Report on decentralized edge-level middleware for scalable platform agnostic data management and exchange

D6.1

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About OneNet

The project OneNet (One Network for Europe) will provide a seamless integration of all the actors in the electricity network across Europe to create the conditions for a synergistic operation that optimizes the overall energy system while creating an open and fair market structure.

OneNet is funded through the EU's eighth Framework Programme Horizon 2020, "TSO – DSO Consumer: Large-scale demonstrations of innovative grid services through demand response, storage and small-scale (RES) generation" and responds to the call "Building a low-carbon, climate resilient future (LC)".

As the electrical grid moves from being a fully centralized to a highly decentralized system, grid operators have to adapt to this changing environment and adjust their current business model to accommodate faster reactions and adaptive flexibility. This is an unprecedented challenge requiring an unprecedented solution. The project brings together a consortium of over 70 partners, including key IT players, leading research institutions and the two most relevant associations for grid operators.

The key elements of the project are:

1. Definition of a common market design for Europe: this means standardized products and key parameters for grid services which aim at the coordination of all actors, from grid operators to customers;
2. Definition of a Common IT Architecture and Common IT Interfaces: this means not trying to create a single IT platform for all the products but enabling an open architecture of interactions among several platforms so that anybody can join any market across Europe; and
3. Large-scale demonstrators to implement and showcase the scalable solutions developed throughout the project. These demonstrators are organized in four clusters coming to include countries in every region of Europe and testing innovative use cases never validated before.

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List of Abbreviations and Acronyms

Acronym	Meaning
AI	Artificial Intelligence
API	Application Programming interface
CIM	Common Information Model
DB	Database
DDEP	DSO Data Exchange Platform
DEP	Data Exchange Platform
DoA	Description of Action
DSO	Distribution System Operator
ECC	Execution Core Container
FTC	FIWARE TRUE (TRUsted Engineering) Connector
GUI	Graphical User Interface
IDS	International Data Spaces
IDSA	International Data Space Association
IoT	Internet of Things
JSON	JavaScript Object Notation
LD	Linked Data
NGSI-LD	Next Generation Service Interfaces Linked Data
OAUTH	Open Authorisation
OIDC	OpenID Connect
RBAC	Role Based Access Control
REST API	Representational State Transfer API
RTM	Requirements Traceability Matrix
SO	System Operator
SSL	Secure Sockets Layer
SSO	Single Sign-on
SUC	System Use Case
TDEP	TSO Data Exchange Platform
TSO	Transmission System Operator
UC	Use Case
UI	User Interface
URL	Uniform Resource Locator
XML	Extensible Markup Language
URN	Uniform Resource Name

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Executive Summary

One of the most important aspects of the OneNet network of platforms is to present how specific concepts developed and involved through WP5 and WP6 can help to define a Reference Architecture; assuring a decentralised system that can easily connect any flexibility platform, enabling various energy stakeholders to exchange data in a secure and reliable way. The basic parameters of this design are:

- A consideration of requirements, functional and technical specifications, together with interoperable and standardized interfaces for the creation of an open scalable decentralized interconnection of platforms, in a technology-agnostic way.
- An adaptable and flexible Reference Architecture, with specific quality attributes and capabilities that combines IDS and FIWARE design concepts.
- A categorisation of Services ("Cross-Platform Services") and Data ("Business Objects") that can serve the standardisable (yet configurable) transactions among stakeholders served by frameworks and tools which ensure compliance with legal, regulatory, and cyber-security requirements of the system.
- The support of the OneNet concept by developing a series of components/tools which are fully integrated, adhere to the Reference Architecture and all together constitute the OneNet data sovereignty-preserving framework.
- Semantics layer interface able to support the definition of data sharing requirements and how these will be implemented in the components of the system.

Based on the above parameters, the first release of the OneNet Reference Platform implementation was delivered in July 2022 providing its basic communication capabilities; an easy-to-install Connector, common for any stakeholder, deployed in each platform/stakeholder's environment that identifies each participant and enables the exchange of data between them. The present report aims to present in a clear and concise manner the technical characteristics of the next version of the OneNet Connector, as required by the basic objectives of Task 6.1. It also aims to showcase the development of a decentralized edge-level middleware which will be used as a middleware layer on top of the common IT infrastructure, enabling the exchange of information between all assets and various components fully integrated in the OneNet Interoperable Network of Platforms.

1 Introduction

1.1 OneNet scope

The OneNet system creates a fully replicable, open, flexible, and scalable architecture that enables the whole European electrical system to operate as a single efficient platform in which a variety of markets allow the universal participation of stakeholders regardless of their physical location, at every level from small consumer to large producers. Also, by clearly defining stakeholder interactions and bringing all possible data exchanges to a European level of harmonization, it will fully unlock energy markets at every level and expand the possibilities for a real commercial exploitation. Tangible results presented in D6.5 “OneNet Reference Platform First Release” (August 2022) [7] are:

- A secure and reliable way for the energy stakeholders to exchange data and information;
- A data management framework able to support flexibility markets, but also monitor and optimize the overall European electrical infrastructure, supported by a new set of customer-centric business models;
- A clear and open architecture based on IDS and FIWARE technology enablers that enables any player to participate in innovative market structures which also integrate the grid and market operation for TSO and DSO.

According to OneNet Description of Action (DoA), WP6 contributes to the development of the OneNet system, starting from the design of the OneNet Reference Architecture described in D5.2 and all the necessary requirements and specification provided in the other WP5 tasks. In addition, the WP6 also performs monitoring and evaluation activities during the integration and execution phase, specifically focused on the compliance with the OneNet Reference Architecture and the Cybersecurity aspects.[1][2].

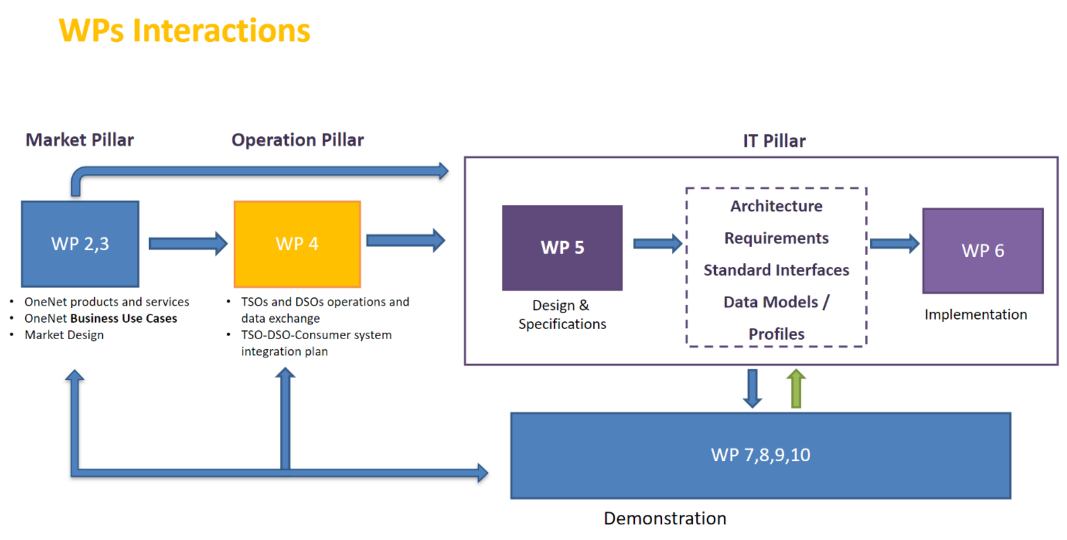

Figure 1 WPs interdependencies

1.2 Report Outline

This report has the following structure:

- **Chapter 2** presents the information sharing management framework as part of the OneNet Connector implementation, focusing on the interaction of the Connector and the other components. It also presents the semantic interoperability orchestration guidelines – taking into consideration the IDS and FIWARE design – as they are visualised by the Cross-Platform Services and business objects.
- **Chapter 3** presents the generic technical characteristics and architecture of the current version of the OneNet Connector focusing on the updates from the previous version.
- **Chapter 4** presents the deployment guide of the OneNet Connector.
- **Chapter 5** is listing the predicted updates which will be included in the final version of the middleware.
- **Chapter 6** concludes the report

The **ANNEX** chapter presents the current version of the GUI Manual

1.3 Task 6.1 Decentralized edge-level middleware for scalable platform agnostic data management and exchange

The basic objective of Task 6.1 is to create a decentralized edge-level middleware layer to enable the exchange of information between all assets and various components that will be integrated in the OneNet Interoperable Network of Platforms

The edge-level middleware includes the following modules:

- Interfaces between involved actors to enable the handling and management of data;
- Semantics layer interface able to support the definition of data sharing requirements and how these will be implemented in the components of the system;
- Data Quality and harmonisation module with a capability to "tag" exchanged datasets with specific parameters as metadata;
- The Linked Data (LD) Context Broker responsible for information context management;
- The Clearing house and Usage Control modules responsible for the data exchange process logging and exchange process policies (contracts) between data produces and consumer.

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2 OneNet decentralized edge-level middleware on OneNet Reference Architecture

2.1 Introduction

The OneNet decentralized middleware, which is one of the core components of the OneNet Framework, acts as an information-sharing management framework. The OneNet Framework is composed of different components that enable the process of managing and sharing information in a controlled and administrative environment. It is important to remark that this framework does not have access to the data shared by the OneNet participants, nor does it forward or process such data. In this way, the owners of the data can have total control of the sovereignty of their data. The OneNet Decentralized Middleware plays the role of orchestrating certain processes such as the identity management, data catalogue (including the administration of OneNet Cross-Platform Services list), data quality process, logging processes and data access policies (including connector's discoverability based on meta-data information).

To accomplish the objectives of the OneNet platform, a series of components were established as being needed. This chapter explains the different components of the OneNet Framework modelled in the Reference Architecture and the way they have been implemented, from the concepts to the interactions between them.

OneNet Decentralized Middleware

A goal of the OneNet project is to provide a fully decentralized P2P architecture that can be applicable to build a distributed system for interoperability. The latter is achieved with the local deployment of OneNet Connector in conjunction with the OneNet decentralized Middleware as an orchestrator of the evolving OneNet ecosystem. This approach allows the local deployment of OneNet Connector in third party platforms enabling their participation into the OneNet ecosystem. Figure 2 presents the first result of OneNet fully decentralised architecture, where the OneNet Connector opens a channel to an interoperable network for data providers and consumers. The OneNet middleware was implemented considering the main principles of the IDSA Reference Architecture Model [12]. Its implementation was done by providing a GUI with authentication and defined data access policies to enable the different actors to access the services and available data catalogues, to act as subscribers or providers according to the necessity of each participant.

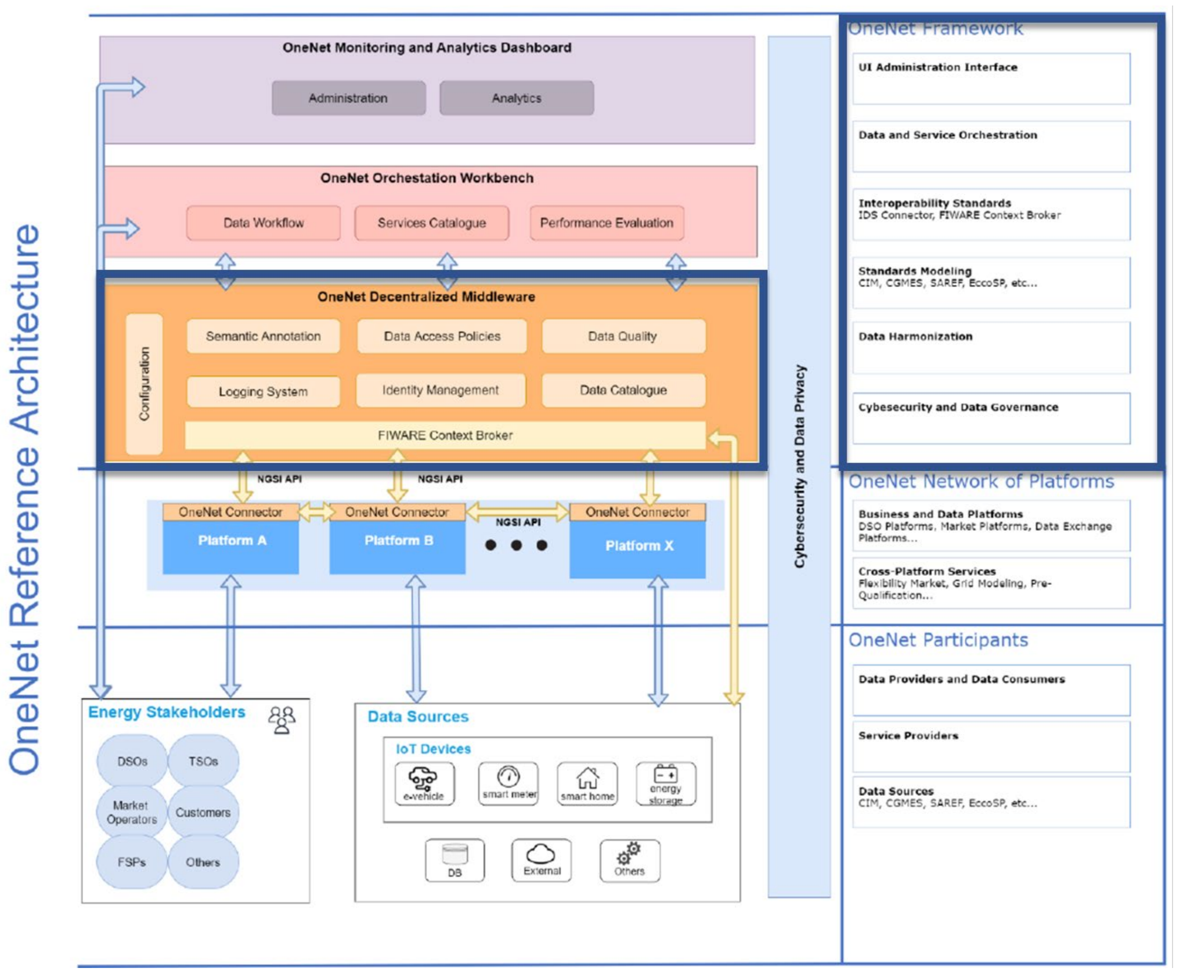
OneNet Reference Architecture
OneNet Monitoring and Analytics Dashboard
Administration
Analytics
OneNet Orchestation Workbench
Data Workflow
Services Catalogue
Performance Evaluation
OneNet Decentralized Middleware
Configuration
Semantic Annotation
Data Access Policies
Data Quality
Logging System
Identity Management
Data Catalogue
FIWARE Context Broker
NGSI API
NGSI API
NGSI API
OneNet Connector
OneNet Connector
OneNet Connector
Platform A
Platform B
Platform X
Cybersecurity and Data Privacy
Energy Stakeholders
DSOs
TSOs
Market Operators
Customers
FSPs
Others
Data Sources
IoT Devices
e-vehicle
smart meter
smart home
energy storage
DB
External
Others
OneNet Framework
UI Administration Interface
Data and Service Orchestration
Interoperability Standards
IDS Connector, FIWARE Context Broker
Standards Modeling
CIM, CGMES, SAREF, EccoSP, etc...
Data Harmonization
Cybesecurity and Data Governance
OneNet Network of Platforms
Business and Data Platforms
DSO Platforms, Market Platforms, Data Exchange Platforms...
Cross-Platform Services
Flexibility Market, Grid Modeling, Pre-Qualification...
OneNet Participants
Data Providers and Data Consumers
Service Providers
Data Sources
CIM, CGMES, SAREF, EccoSP, etc...

Figure 2 OneNet Reference Architecture

A second important aspect that needed to be covered during this interoperability is the suggestion to standardise a set of services (i.e., Cross-Platform Services) and then, assign harmonized data profiles to such services to ease OneNet participants communication (as per Appendix of D5.6 [6]). For this aspect, another interface was implemented to show the different participants the form that the data has and how it can be translated or matched to their own requirements and, in this way, also incorporated into their normal business operations. Within this, there was created a semantic interface layer inside the services catalogue in which the best practices to use the data are shown and the providers can define or adapt their data to these descriptions. In other words, and from another perspective, with this layer defining the data schema and the instances of data, the user, when consuming the data will be able to understand what kind of harmonized data can be provided among each specific Cross-Platform Service. Proper rules for data quality can be assigned for each service, yet those are not qualified at the Connector but rather it is up to the consumer to examine the context of the data source retrieved. Figure 3 below visualises the OneNet Interoperable Network Concept.

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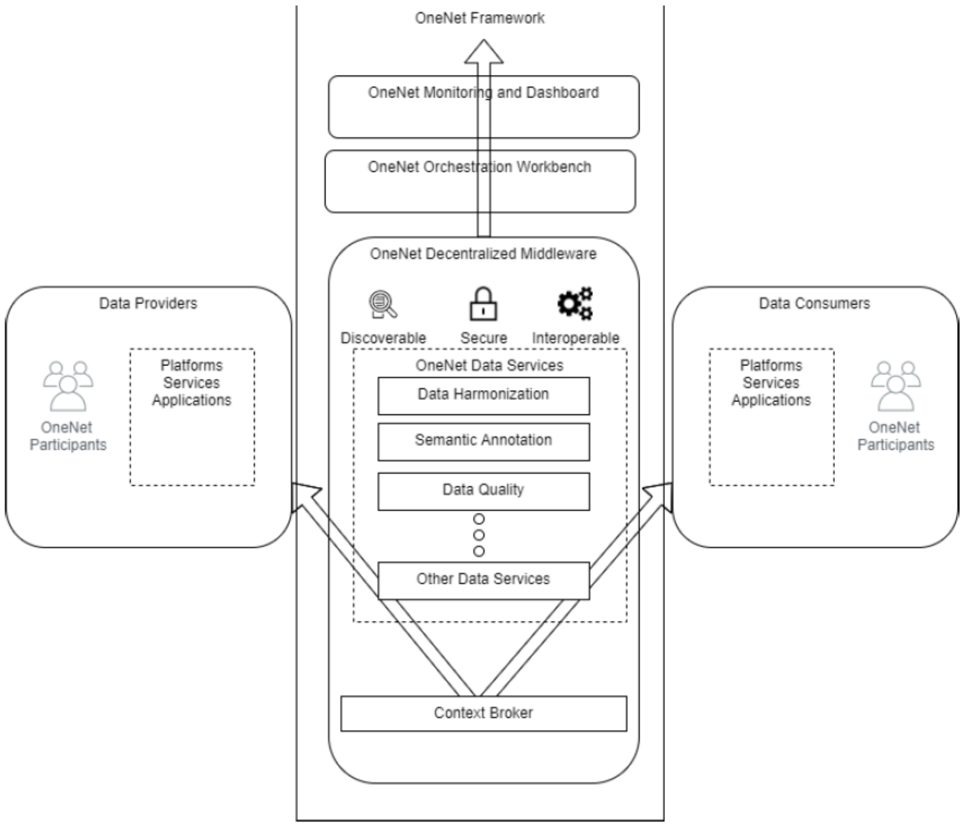

Figure 3 OneNet Interoperable network concept [2]

OneNet Orchestration workbench

This component is defined by Deliverable 5.3 [3] as mandatory, and certainly, it is a very important element to support the integration and evaluation of the shared services. Its importance lies in providing a way for the participants to share their services according to the processes and data they have. The implementation of this component was done by providing an interface where the participants can find specific services that can be provided contained in an already established catalogue. After the identification of this service, the participant can define the data schema or even an instance of the data that will be provided. Another important functionality of this component is the evaluation of these shared services by providing indicators of the entities that the user is consuming and providing, and about the services, categorized in offered, subscribed, or pending subscription requests. These indicators are important to evaluate the use and to be able to scale or identify possible extensions of modules or new requirements of the system functionalities

OneNet Monitoring and Analytics Dashboard

The function of this component is to provide an interface to analyse and monitor the health and status of the OneNet Network of Platforms and all its Participants and Components. The implementation considered Big

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Data and AI techniques and functionalities with focus on the provision of scalable near real-time big data-enabled services wherever applicable.

2.2 Semantic Interoperability orchestration

Semantic interoperability refers to the capability of different platforms (i.e. systems, devices, or software applications) to interpret and exchange data in a meaningful and consistent way. This capacity to understand the exchanged data regardless of their underlying architecture or design is important, since it allows different platforms to work together seamlessly and effectively, enabling the data to flow freely between them without manual intervention. A key factor to achieve semantic interoperability is through orchestration, which refers to the process of coordinating and managing the interactions between the different platforms to achieve a specific goal, which in this case is the transfer of data accurately within a defined context.

This section explains the approach that OneNet is using to implement these management tools to exchange resources more effectively and with this allowing the increase of productivity, cost saving and improvement of the decision-making capabilities. Standardization of the process, as described before, is an important component that was retrieved from Task 5.3 with the categorization and individualization of 58 Cross-Platform Services grouped into 10 categories, which are incorporated in the services-catalogue tool.

Chapter three of the Deliverable 5.3 [3] identified the Cross-Platform interoperability Services to be enabled by the OneNet System. This identification was based on the inputs from WP4 and Task 5.1 and Task 5.2. At the system level implementation, these defined Cross-Platform Services are contained in an interface with the Cross-Platform Services catalogue implemented as a starting point for the OneNet participants to provide a service. This previous statement means that the rule to start providing a new service is based on this definition of the Cross-Platform Services catalogue already established in the OneNet Framework.

As stated in the analysis reported in D5.2 [2] and then again remarked in D5.4 [4], the International Data Space (IDS) provided an adequate Reference Architecture model to base the development of OneNet Services. In the information layer, the conceptual representation of a digital resource can describe the model utilized for the implementation in the OneNet Semantic Interoperability Orchestration. Following the conceptual Representation of the Information Model with the help of the concerned hexagon (C-hexagon) important aspects to reach semantic interoperability can be implemented. This design follows the separation of concern principle, where each corner of the hexagon represents a distinguished concern contributing to the concept of the Digital Resource in the context of the International Data Spaces. In OneNet, some considerations of each concern to define the digital resources can be seen below:

- **The Content concern:** In the implementation, the resource is defined in a Business Object as data with specific types and formats and a sample is provided. In addition, the size and creation date are shown.

- **The Context concern:** Within the temporal and spatial aspects, the framework allows to know the timestamp and the sources of the data.

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- **The Concept concern:** This element is covered and implemented by defining the data schema and a description of it through an interface.

- **The Communication concern:** To face this concern, the User interface provides an intuitive way to subscribe to new services and provide them. In addition, a RESTful API with different endpoints can be accessed with defined operations and messages.

- **The Commodity concern:** To address this concern, the resources follow a secure data access and policies, as also some restriction in the definition of services and data to be shared.

- **The Community of trust concern:** Each of the participants is evaluated and certified before being granted access to the trusted OneNet platform. The level of compliance for the evaluation and certification process (according to IDS rules) will be part of the implementation of the final OneNet framework version.

Inside the semantic interoperability implementation, the standardization of processes and data is a key factor, and data models are needed to accomplish it. Common Information Model (CIM) is an open standard which importance relies in the representation of common set of objects and relationships that encapsulate the information of different actors. It allows to give a shape to the data that are being produced in the standalone systems of each interested party. The development of a solution for semantic interoperability can be done using ontologies. SAREF4ENER[1] is an ontology to describe smart energy system and the devices, services and data used by then. SAREF4ENER was proven to be extended to CIM models, and an instance of this was done with the IEC 61850, which is a data standard recognized as a globally accepted solution in the power system automation domain. Furthermore, an extension of SAREF4ENER to include other CIM models can be done by extending it.

The CIM model IEC 62325-451[2] is a standard developed by the International Electrotechnical Commission (IEC) that specifies data models for representing data related to energy market communication. During the assessment by WP5 to understand the standards used by the different platforms, one of the most used CIM standards is identified to be the IEC 62325-451. An extension of SAREF4ENER to include the concepts and data elements defined in IEC 62325-451 can be accomplished by creating new classes and properties to represent the data in a way that conforms to the IEC standard.

However, not all the platforms will be using the standard at an early stage. Whenever CIM models are not applied, a different way to understand the data is needed. A Semantic Definition Layer using appropriate metadata provides better description of the exchanged datasets and helps overall in this area. Moreover, to cover the whole universe of platforms, an interface is implemented in the OneNet Framework to give the participants the possibility to define the data they have so other participants can consume it in a secure and meaningful way. This interface for defining the data of the participants provides the participants with the

[1] https://saref.etsi.org/saref4ener/v1.1.2/

[2] https://webstore.iec.ch/publication/64428

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possibility to define the file schema, a sample of this schema, the profile format, and a description of this profile (e.g. URN). Furthermore, following the guidelines of the IDSA Reference Architecture Model, domain-specific explanations may be required to explain further terms and concepts. This semantic definition interface implemented in OneNet can be considered a tool to extend the core concepts and provide more information on data provided or requested.

Semantic interoperability is verified, for example, within the Portuguese demonstration (Task 9.2), that is focused on information exchange between the DSO and TSO for operational planning, through an approach quite similar to the Universal Market Enabling Interface (UMEI) concept, developed under the EUniversal project[3], that combines different APIs in a standard, agnostic, adaptable and modular way. In the Portuguese demonstration, a DSO Data Exchange Platform (DDEP) and a TSO Data Exchange Platform (TDEP) are developed in a cloud environment, designed to implement easy machine-to-machine communication, bridging DSOs' and TSOs' on-premises data lakes (data layer) and linking them through a set of APIs. These APIs will make the proper link between the services to be developed and the web. For this purpose, a communication middleware is considered to link external entities to the operational layer of each DEP through the usage of REST APIs or the OneNet Connector. The data can be transferred either by JSON or XML depending on the System Use Case (SUC).

The format, fields, and type of data to be exchanged have been previously agreed upon by the two parties, and an automatic format and schema validation is foreseen within the interaction, to verify if the data is readable by the receiver, in accordance with what has been jointly agreed. Following this format and schema validation, if no valid match is found an error message is returned and logged into the database. With a correct validation, an acknowledgement message is sent, and the process continues to the following step.

[3] https://euniversal.eu/project-description/

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3 The OneNet Connector

3.1 Introduction

The OneNet Connector, as described in D5.2 [2], is the core component capable of enabling decentralized data exchanges in the OneNet ecosystem. The OneNet Connector is a deployment instance of the OneNet Decentralized Middleware and, once deployed and integrated within the platforms of each OneNet participant, it allows a trusted pan-European data space, defined as OneNet Network of Platforms, to be created. The development of the first and intermediate version of the OneNet Connector, guided in Task 6.1 meets all functional and non-functional requirements collected starting from the different use cases described in D5.1 [1] and D5.4 [4]. This chapter contains a general technical overview of the OneNet Connector based on the related Connector chapters of D6.5 [7], with the addition of the updates in the intermediate version.

3.2 OneNet Connector Architecture

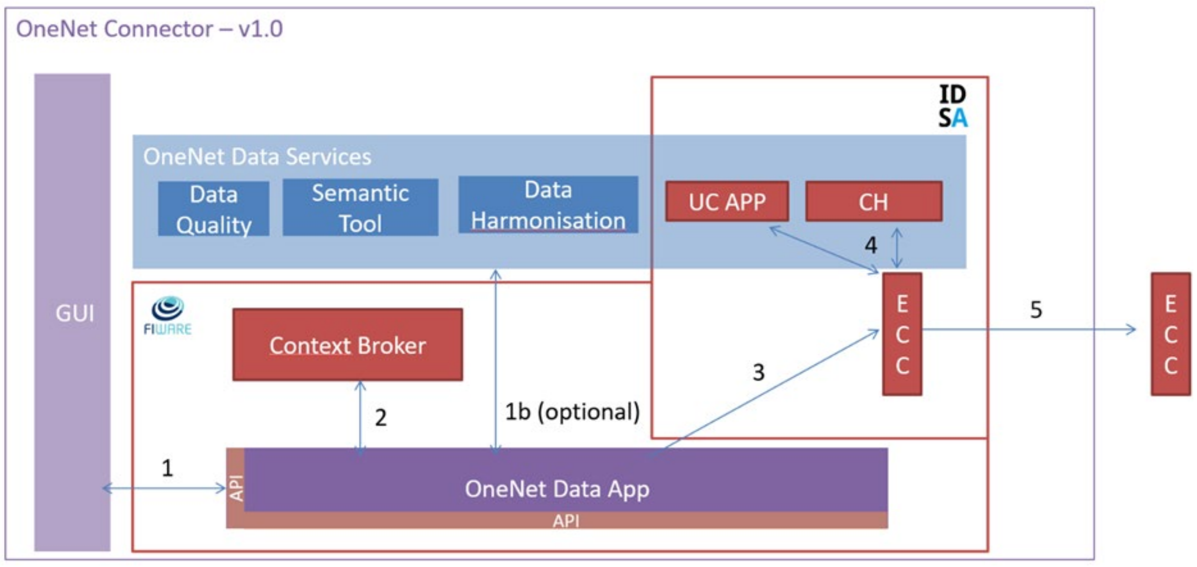

Figure 4: OneNet Connector Architecture

As shown in the Figure 4, which shows the overall OneNet Connector architecture, the Connector is composed of several components:

- GUI: is the graphic interface that allows to configure the OneNet Connector and use the main features. Each OneNet participant can access their own Connector's GUI once installed. The first version of the GUI includes:
  - Registration as data provider / consumer
  - Creation of new data offerings
  - Creation of data entities

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    - Registration / consumption of data offerings and data entities
- OneNet Data App: provides integration APIs for both the GUI and external platforms. It is based on the NGSI standard for the implementation of APIs and for data exchange and in this first version it offers three main services:
    - Entity creation
    - Registration / Subscription
    - Data retrieving
- Context Broker: is the FIWARE component that manages the overall data exchange in the standard NGSI-LD format
- IDS based components: a series of components and tools, extended from the open-source TRUE Connector [10], that enable the IDS processes for the data exchange
    - Execution Core Container (ECC), has the task of implementing IDS-based data exchange processes (authentication, metadata exchange, access control, logging, etc. ...)
    - Clearing House, logging system of all data exchanges (not available in the first version but being integrated)
    - Usage Control App, module for verifying access and use of data (not available in the first version, but being integrated)
- OneNet Data services: additional data services provided by the OneNet Connector (additional information is provided in D5.3 [3]). They are not included in this first version.

3.3 OneNet GUI & Enhancements

The new GUI provided in the intermediate version enables the OneNet users:

- To define certain configuration settings for the user and its OneNet Connector
- To streamline the Service Management (*Cross-Platform Services provision and subscription*) and the data exchange (*provision and consumption*).
- To use the OneNet Connector's APIs

A comprehensive presentation of the GUI in the form of a manual is presented in the Annex. The most recent version of the GUI user manual is accessible online through a dedicated menu item on the GUI. The following text reports a listing of the GUI enhancements in comparison with the first version as is documented in D6.5 [7].

- A new dashboard (entitled Data Exchanges Timeline) has been added which contains a timeline of activities providing useful information about the user data exchange history.
- A new card can be found in the dashboard, which is called Connector Check in the main screen, supporting the user in an automated manner to check if connector's configuration is correct. To this end, direct URL checking has been also added in this regard, as well.
- The OneNet Users has now the capability to send comments to the system administrator on the cross-platform services enabling their continuous update upon request.
- A specific menu for a dedicated account (i.e., for cross-platform services administrator) has been created to receive and manage the user's comments and accordingly make updates or even create new cross-platform services.
- In the Connector settings section, a new tab has been added which show to the data producer all the users who consume their data.
- The User can add a title to an offer service.

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- Service Provider can deactivate a service.
- Pagination functionality has been added for the ‘Provided Data’ & ‘Consumed Data’ lists.
- The error messaging functionality has been enhanced.
- Several UI enhancements in performance, stability and security are part of the new Connector version. The general User Experience has been evolved.
- The User Interface can now be used also locally.

3.4 OneNet Connector Data App

The main goal of the OneNet data app is to be the entry point of the OneNet Connector. In fact, it provides access to all the main features of the OneNet Connector, including those for data exchange, through standard interfaces based on REST API.

From a technical point of view, the OneNet Data App is developed using a Java Architectural Stack, based on Spring Boot [8] framework and a NoSql database, MongoDB [9].

All the services made available by the OneNet Data App can be used both from the GUI of the Connector and directly from the external platforms that need to be integrated with the OneNet Connector.

The new version of the OneNet Connector Data App implements three main interactions, is provided as a standard REST API and available using the GUI (see Annex) or the API interfaces directly.

These three interactions are:

- **Create Entity**: a data provider can create new entities within its own environment and makes them available to all the other OneNet Participants
- **Registration**: a data consumer can register to specific data entities for receiving data in automatic or manual way, after the acceptance of the data provider. The data consumer can register itself to many data providers and many data entities.
- **Get Entity**: the data consumer, after the registration, can retrieve specific data entity from the data provider.

For each interaction a high-level sequence diagram is reported below.

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Create Entity

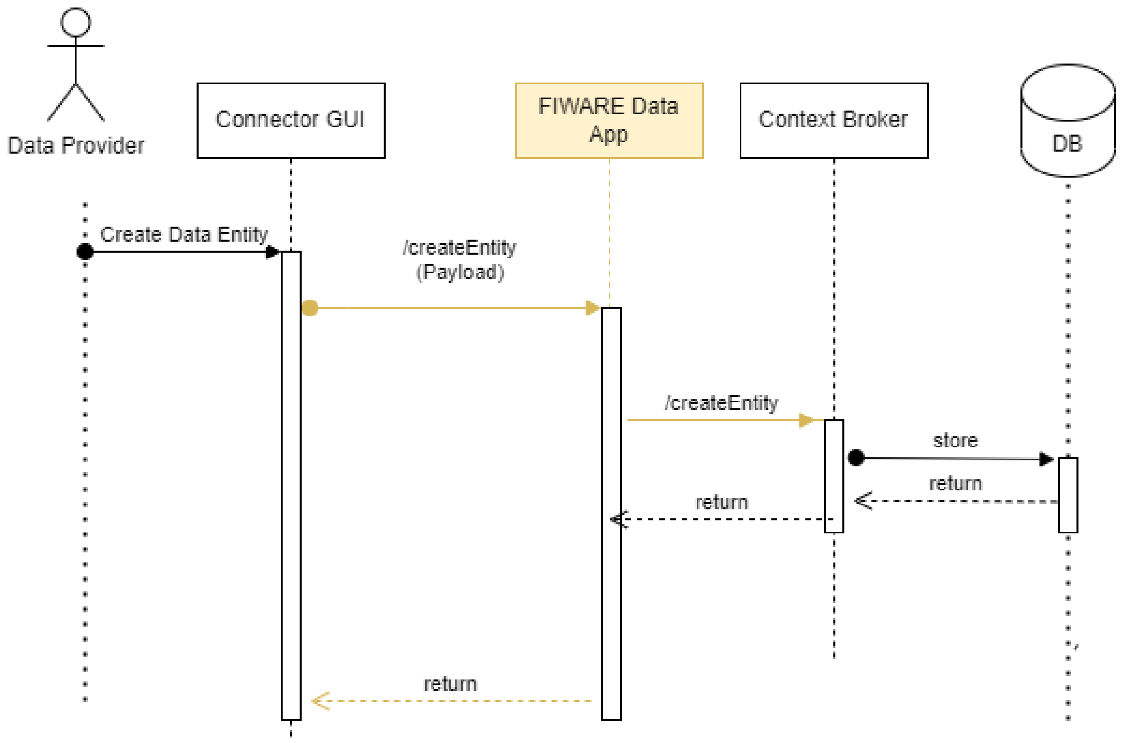
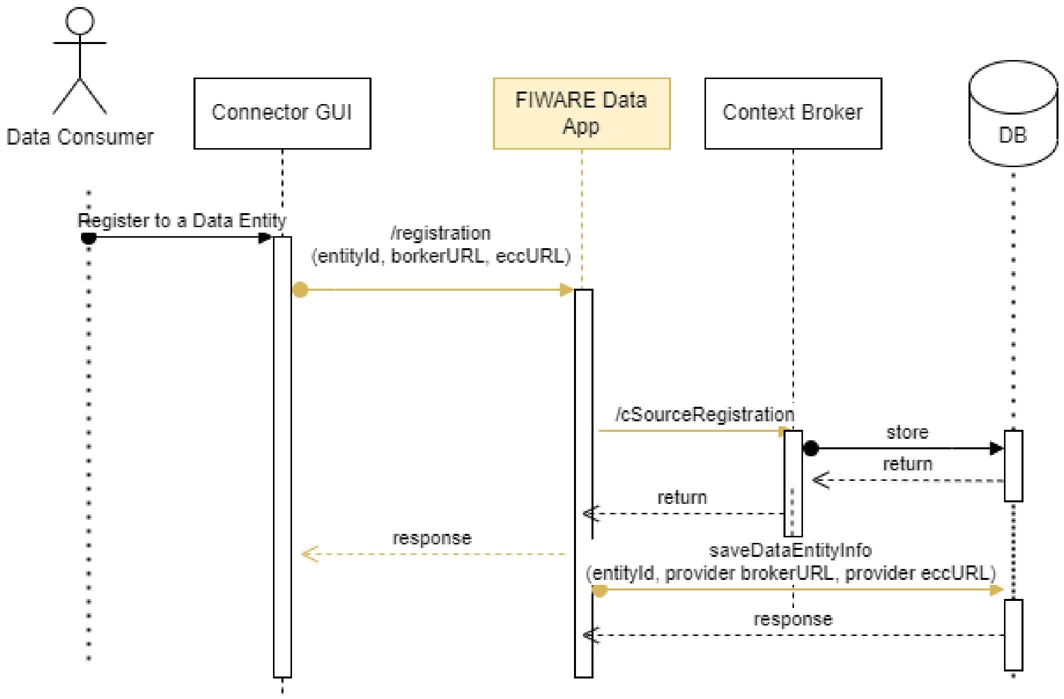


Figure 5: Create Entity - Sequence Diagram

Registration



Data Consumer
Connector GUI
FIWARE Data App
Context Broker
DB
Register to a Data Entity
/registration (entityId, borkerURL, eccURL)
/cSourceRegistration
store
return
return
response
saveDataEntityInfo (entityId, provider brokerURL, provider eccURL)
response

Figure 6: Registration - Sequence Diagram

Get Entity

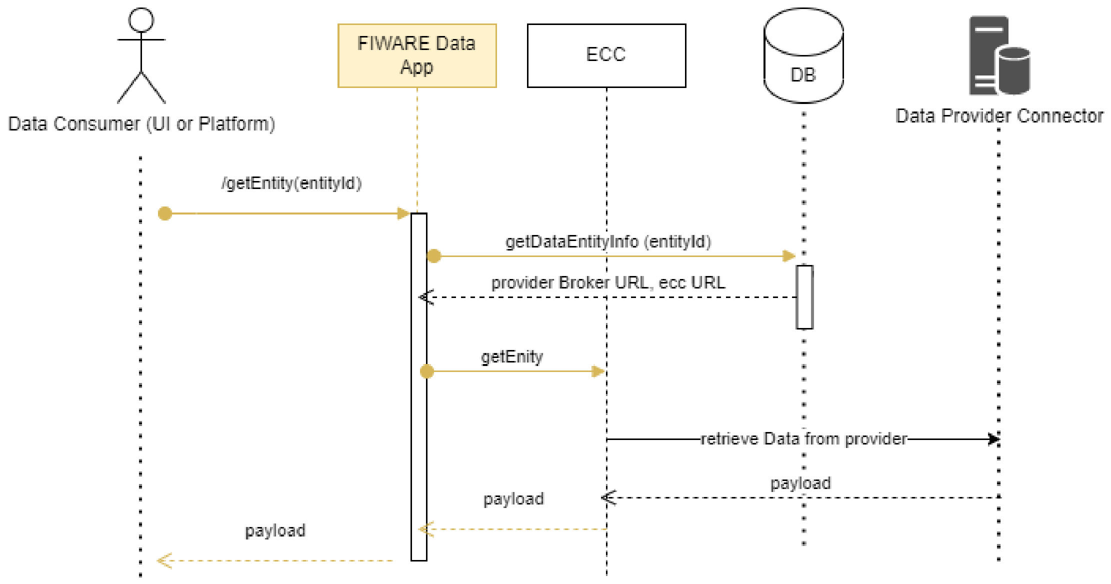

FIWARE Data App
ECC
DB
Data Consumer (UI or Platform)
Data Provider Connector
/getEntity(entityId)
getDataEntityInfo (entityId)
provider Broker URL, ecc URL
getEnity
retrieve Data from provider
payload
payload
payload

Figure 7: Get Entity - Sequence Diagram

3.5 FIWARE and IDS based Components

The core implementation for handling the data exchange in the OneNet Connector leverages on the integration of FIWARE components (FIWARE Orion Context Broker, using NGSI-API) and the IDS Reference Model (IDS based Connector). FIWARE Orion Context Broker, is one of the core components of the FIWARE framework and implements the Next Generation Service Interface (NGSI) standard to implement data exchange mechanisms using standardised data models and interfaces. In the FIWARE framework, Orion Context Broker is a key service to ease the development and provisioning of smart and innovative applications that require context information and data stream management, processing, and exploitation. In the OneNet Connector implementation, the FIWARE Orion Context Broker-LD [11], which supports NGSI-LD and NGSI-v2 API, is in charge of managing all the data exchanges among the OneNet participants in a standardised way. The broker is integrated with the OneNet Data App and with the IDS based components using standardised NGSI APIs and supporting standardised data models based as described in D5.4 [4].

As described in D5.2 [2], the OneNet Architecture follows the IDS reference model for the implementation of a pan European data space, leveraging on existing standards and technologies, as well as governance models to facilitate secure and standardized data exchange and data linkage in a trusted business ecosystem. In the IDS reference model, the IDS Connector is a key component for implementing a European Data Space and the OneNet Connector implements an extended version of the IDS based TRUE (TRUsted Engineering) Connector [10] as shown in Figure 8. In this context the evolution of the TRUE Connector in the OneNet Connector allows

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to implement a FIWARE-based Data Space, integrating the existing FIWARE Ecosystems in a plug-and-play mode enabling the creation and support of IDS ecosystems.

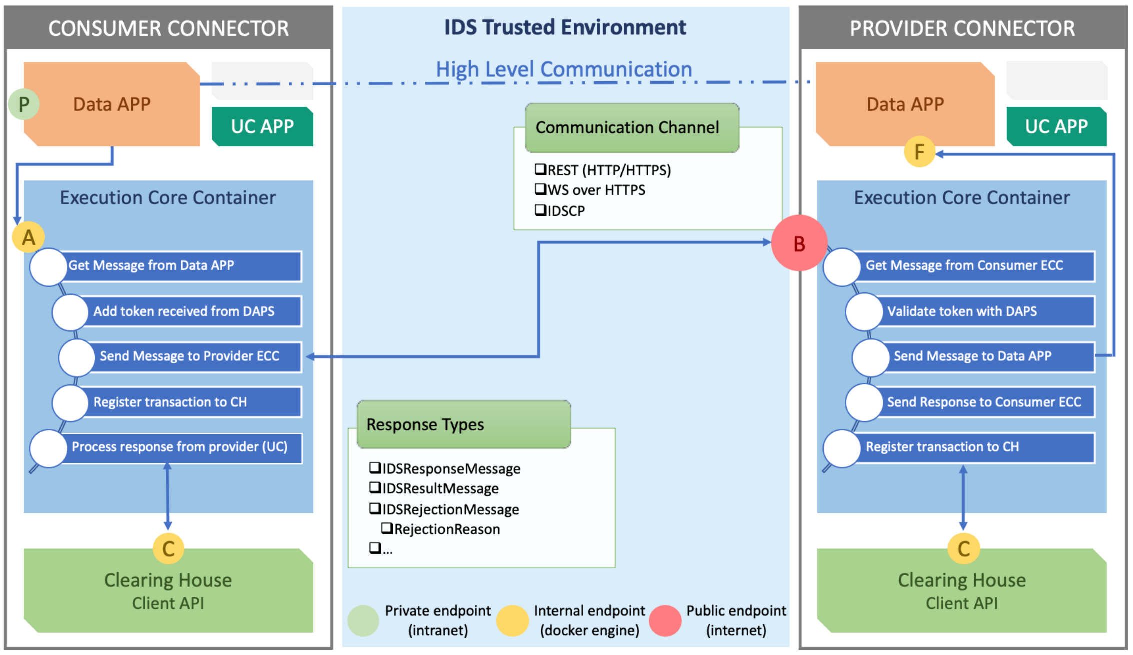

Figure 8: IDS based TRUE Connector [10]

The core of the IDS implementation of the OneNet Connector is the Execution Core container, that is compliant with the latest IDS specifications (IDS Info Model) and can be easily customized to fit a widespread number of scenarios.

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3.6 REST-APIs

All the features made available in the OneNet Data App are provided through standard REST APIs. The APIs are available both for the Graphical User Interface and for the external platforms, to be used for the integration. The table below report a short description of the APIs exposed so far. A detailed and standardised OpenAPI[4] documentation is provided together with the software release.

Table 3.1: OneNet Connector REST APIs

Name	URL	Method	Parameters	Responses
Create Entity	/createentity	POST	In Body (JSON format) payload: String	Success (200) Error (500) Error Message - *String*
Registration	/registration	POST	In Body (JSON format) entityId: String eccUrl: String brokerUrl: String	Success (200) Success Message: *String* Error (500) Error Message: *String*
Get Entity	/getentity	GET	In Request: entityId: String	Success (200) entity Error (500) Error Message - *String*

3.7 Updates from the previous version

The updates from the first version (D6.5 [7]) are summarised in the list below:

- Architectural update (inclusion of local APIs & GUI).
- Centralised authentication and identification management.
- Additional features and enhancement of the GUI.
- New APIs for the integration of the external platforms.
- New packaging and installation guidelines.
- List of issues and bugs solved/fixed.

[4] https://swagger.io/specification/

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3.7.1 Updated architecture description

The main update related to the OneNet Connector Architecture was the introduction of an additional layer which is the Local API Layer. In the previous version of the OneNet Connector the APIs exposed to the GUI and the external platforms was embedded in the OneNet FIWARE Data App, to provide an access to the FIWARE based functionalities (creation of an entity, subscription and retrieving of an entity). After a more detailed analysis, it was decided to decouple the API layer from the FIWARE Data App, to provide a more independent a generic access to all the features offered by the OneNet Connector. In fact, the new Local API Layer, which was deployed locally in the OneNet Participant environment, can act as interface for both the central features offered by the middleware (discover of sources and services, vocabularies, etc..) and the data exchange process, implemented in the FIWARE Data App. The specification of OneNet APIs is described in D5.5 [5]. The Figure 9, represents the updated version of the OneNet Connector architecture with the new Local API Layer.

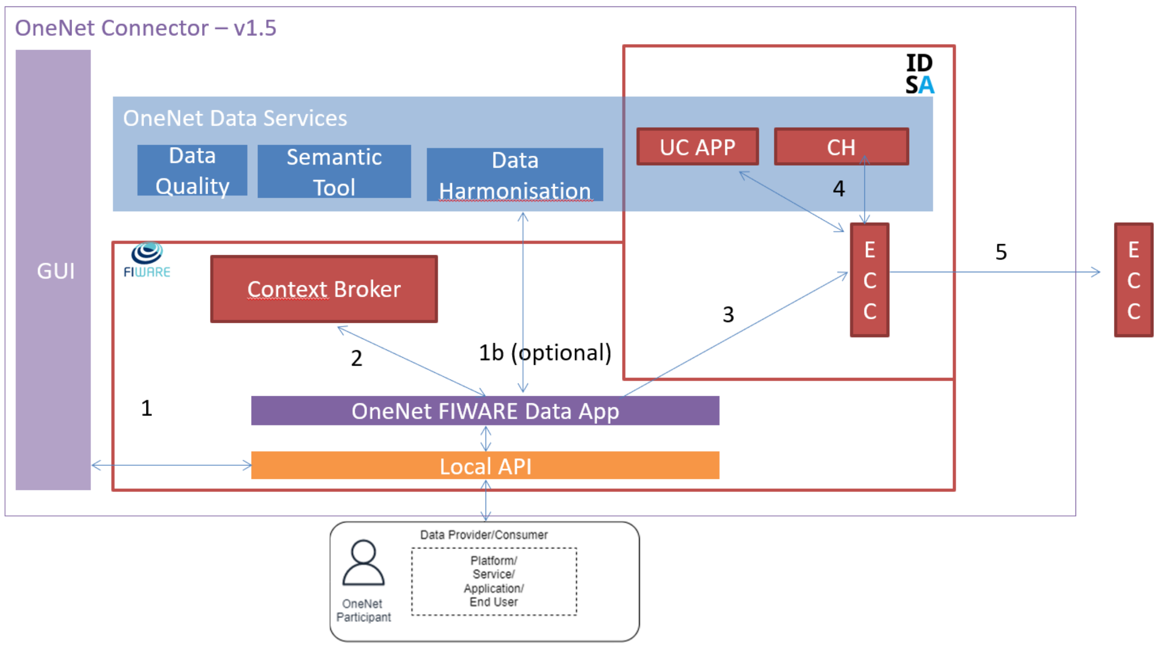

Figure 9: Updated Connector Architecture

3.7.2 Authentication – IDM

KeyCloak[5] will be used as an Authentication/Authorization medium for common login. KeyCloak is an open-source software, widely adopted in EU projects, that enables Single Sign-On (SSO) with Identity and Access Management for modern applications and services. It is written in Java and supports several authentication protocols like: SAML 2.0, OpenID Connect (OIDC) and OAuth2.0. From a conceptual perspective, the purpose of

[5] https://www.keycloak.org/

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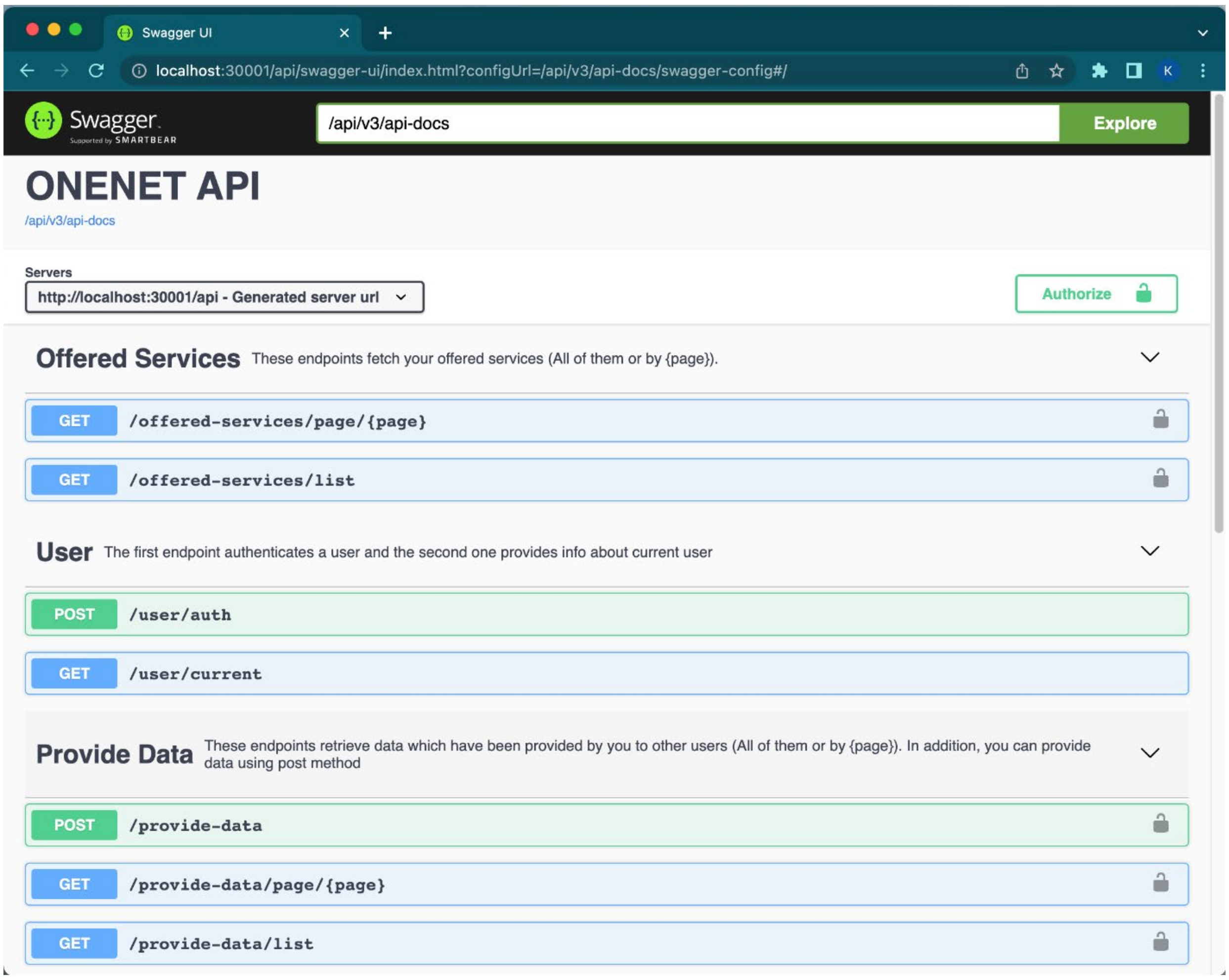
KeyCloak is to facilitate the authentication and authorization flows with applications or services and provide a common login page for users. The authentication of users will be done via KeyCloak, providing a common user base, login and authorization for dashboards and services This is done via OAUTH and OIDC protocols. During the implementation of the final version the focus will be the authorization fine tuning by setting specific roles (RBAC), the authorisation of resources, and the specification of realm access.

3.7.3 Local APIs Implementation

3.7.3.1. Provide & Consume Data through Rest API

The API Endpoints Swagger documentation can be accessed from the OneNet onenet-local-api Docker container on port 30001 using the address:

http://{server address}:30001/api/swagger-ui/index.html?configUrl=/api/v3/api-docs/swagger-config#/
or the localhost if accessed from the server where the docker containers are deployed:
http://localhost:30001/api/swagger-ui/index.html?configUrl=/api/v3/api-docs/swagger-config#/


Swagger UI
localhost:30001/api/swagger-ui/index.html?configUrl=/api/v3/api-docs/swagger-config#/
Swagger
Supported by SMARTBEAR
/api/v3/api-docs
Explore

ONENET API
/api/v3/api-docs

Servers
http://localhost:30001/api - Generated server url

Offered Services These endpoints fetch your offered services (All of them or by {page}).

GET /offered-services/page/{page}
GET /offered-services/list

User The first endpoint authenticates a user and the second one provides info about current user

POST /user/auth
GET /user/current

Provide Data These endpoints retrieve data which have been provided by you to other users (All of them or by {page}). In addition, you can provide data using post method

POST /provide-data
GET /provide-data/page/{page}
GET /provide-data/list

Figure 10: OneNet Swagger

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3.7.3.2. Execution Steps

Authenticate

The first endpoint to Use is the POST /user/auth. On this endpoint the user can set the username & password to authenticate and receive a Jason web token (jwt) that will be used on the headers of all the other endpoints.

The username and password are the same that are used on the website https://onenet-ngsi-ld.eurodyn.com.

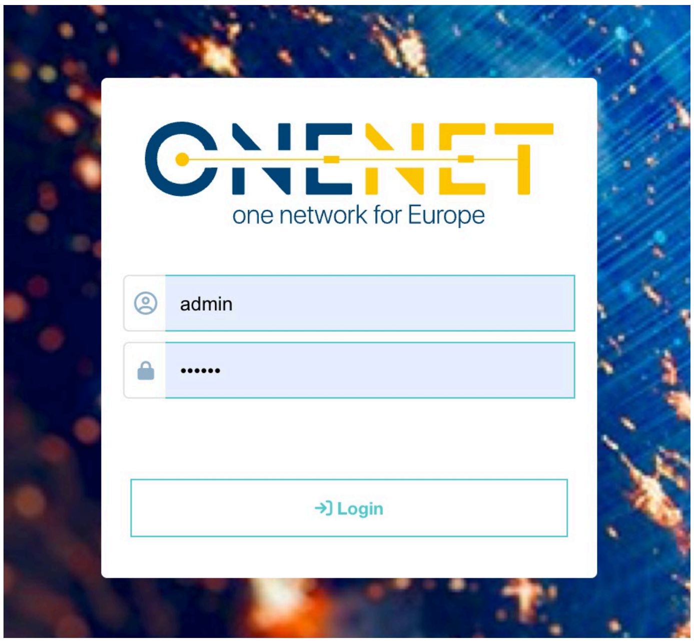

Figure 11: OneNet Login Page

Consume Data

- **Get List of the data registries that you can Consume**
  Using the GET /consume-data/page/{page} endpoint the user can get a list of the registries of the available data to be consumed by the user that was authenticated. It is an endpoint like the Consume Data functionality on the Ui.

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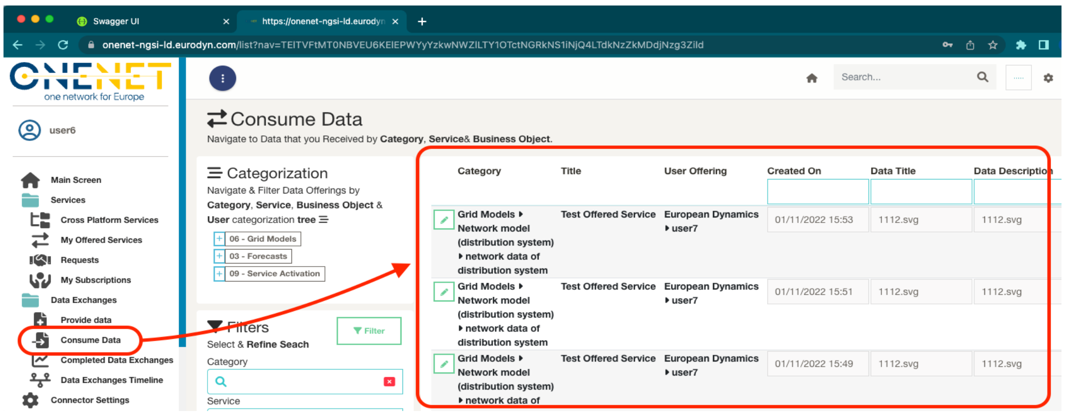


Swagger UI | https://onenet-ngsi-ld.eurodyn

onenet-ngsi-ld.eurodyn.com/list?nav=TEITVFtMT0NBVEU6KEIEPWYyYzkwNWZILTY1OTctNGRkNS1iNjQ4LTdkNzZkMDdjNzg3ZiId

Search...

user6

Main Screen
Services
Cross Platform Services
My Offered Services
Requests
My Subscriptions
Data Exchanges
Provide data
Consume Data
Completed Data Exchanges
Data Exchanges Timeline
Connector Settings

Consume Data

Navigate to Data that you Received by **Category**, **Service**& **Business Object**.

Categorization

Navigate & Filter Data Offerings by **Category**, **Service**, **Business Object** & **User** categorization **tree**

06 - Grid Models
03 - Forecasts
09 - Service Activation

Filters

Select & **Refine Seach**

Filter

Category

Service

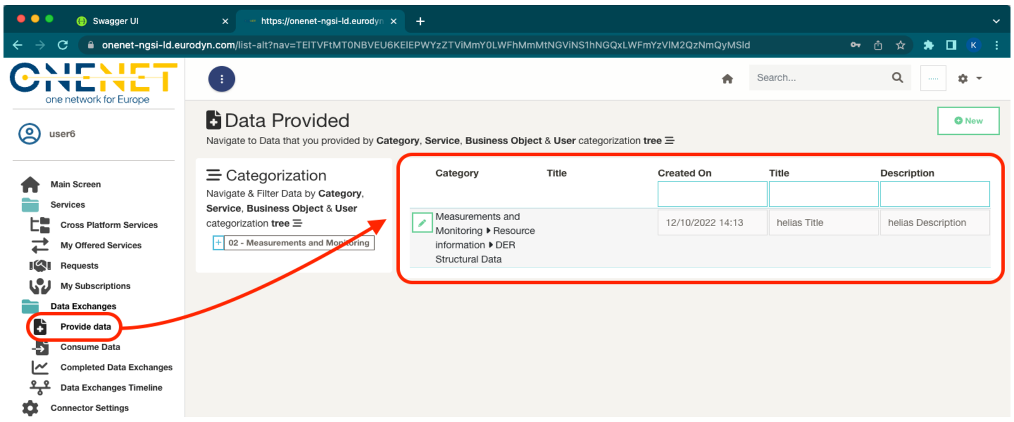
Category	Title	User Offering	Created On	Data Title	Data Descriptio
Grid Models ▸ Network model (distribution system) ▸ network data of distribution system	Test Offered Service	European Dynamics ▸ user7	01/11/2022 15:53	1112.svg	1112.svg
Grid Models ▸ Network model (distribution system) ▸ network data of distribution system	Test Offered Service	European Dynamics ▸ user7	01/11/2022 15:51	1112.svg	1112.svg
Grid Models ▸ Network model (distribution system) ▸ network data of	Test Offered Service	European Dynamics ▸ user7	01/11/2022 15:49	1112.svg	1112.svg

Figure 12: Consume Data

- **Download the file by a registry id**
  Using the GET /consume-data/by-id?id={id} endpoint the user can get the actual file data by a registry id that was on the 2.1 registry's list.

Provide Data

- **Get List of the data registries that you have provided**
  Using the GET /provide-data/page/{page} endpoint the user can get a list of the registries of the available data that he has already provided. It is an endpoint like the Provide Data functionality on the Ui.



Swagger UI | https://onenet-ngsi-ld.eurodyn

onenet-ngsi-ld.eurodyn.com/list-alt?nav=TEITVFtMT0NBVEU6KEIEPWYzZTViMmY0LWFhMmMtNGViNS1hNGQxLWFmYzVlM2QzNmQyMSId

Search...

user6

Main Screen
Services
Cross Platform Services
My Offered Services
Requests
My Subscriptions
Data Exchanges
Provide data
Consume Data
Completed Data Exchanges
Data Exchanges Timeline
Connector Settings

Data Provided

New

Navigate to Data that you provided by **Category**, **Service**, **Business Object** & **User** categorization **tree**

Categorization

Navigate & Filter Data by **Category**, **Service**, **Business Object** & **User** categorization **tree**

02 - Measurements and Monitoring

Category	Title	Created On	Title	Description
Measurements and Monitoring ▸ Resource information ▸ DER Structural Data		12/10/2022 14:13	helias Title	helias Description

Figure 13: Provide Data

- **Provide a File to Other Users**
  Using the POST /provide-data/ endpoint the user can upload a file and provide it to other users. The Json body of that endpoint is as follows

```
{
   "code": "registry entry code"
   "title": "registry entry title",
   "description": "registry entry description",
   "filename": "ex. weather_data.xml",
   "file": " file data in base 64 format",
   "data_offering_id": "eada8855-cc36-4b2e-acf2-e5200a6069ae",
}
```

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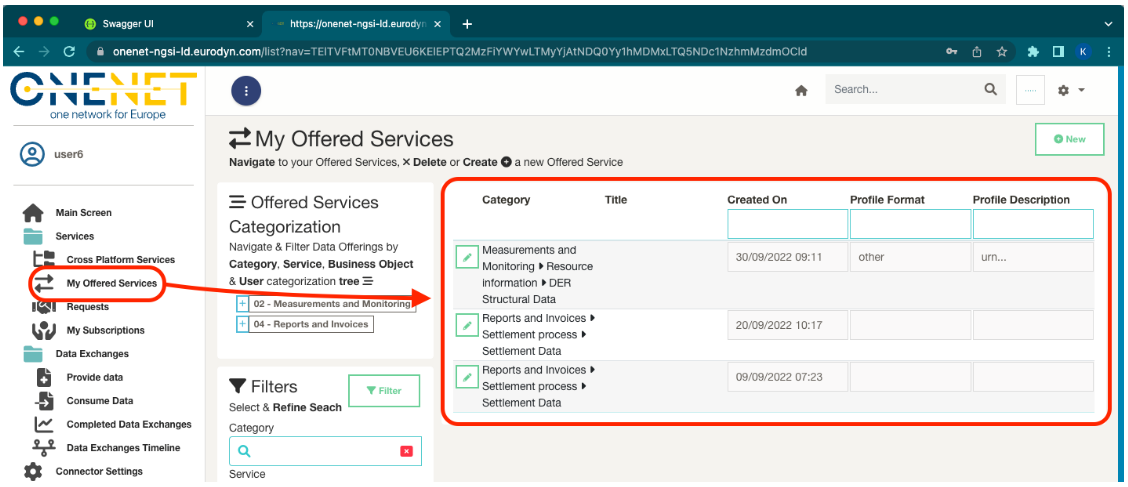
On the file field, the user must write the actual file to be provided. It must be a base64 string containing the contents of the file. The data_offering_id is the field that defines who is going to receive this file. It must be an id of the user's Offered Services. The users that are registered to that Offered Service id are going to receive this file.

- **Offered Services**
  Using the GET offered-services/page/{page} endpoint the user can get a list of the registries of his Offered Services. It is an endpoint like the "My Offered Services" functionality on the UI.



My Offered Services

Navigate to your Offered Services, ✕ **Delete** or **Create** ⊕ a new Offered Service

Offered Services Categorization

Navigate & Filter Data Offerings by **Category**, **Service**, **Business Object** & **User** categorization **tree**

02 - Measurements and Monitoring

04 - Reports and Invoices

Filters

Select & Refine Seach

Category	Title	Created On	Profile Format	Profile Description
Measurements and Monitoring ▸ Resource information ▸ DER Structural Data		30/09/2022 09:11	other	urn...
Reports and Invoices ▸ Settlement process ▸ Settlement Data		20/09/2022 10:17		
Reports and Invoices ▸ Settlement process ▸ Settlement Data		09/09/2022 07:23		

Figure 14: Offered Services

3.7.4 Packaging and deployment

Another relevant update was provided from the packaging and deployment perspective. The updated version of the OneNet Connector is now compliant with the fully decentralized approach described in the OneNet Architecture, which is one of the conceptual pillars of the architecture itself.

In fact, the first version of the OneNet Connector was provided with a centralised Graphical User Interface and API interface, to facilitate the implementation and testing activities of the component itself.

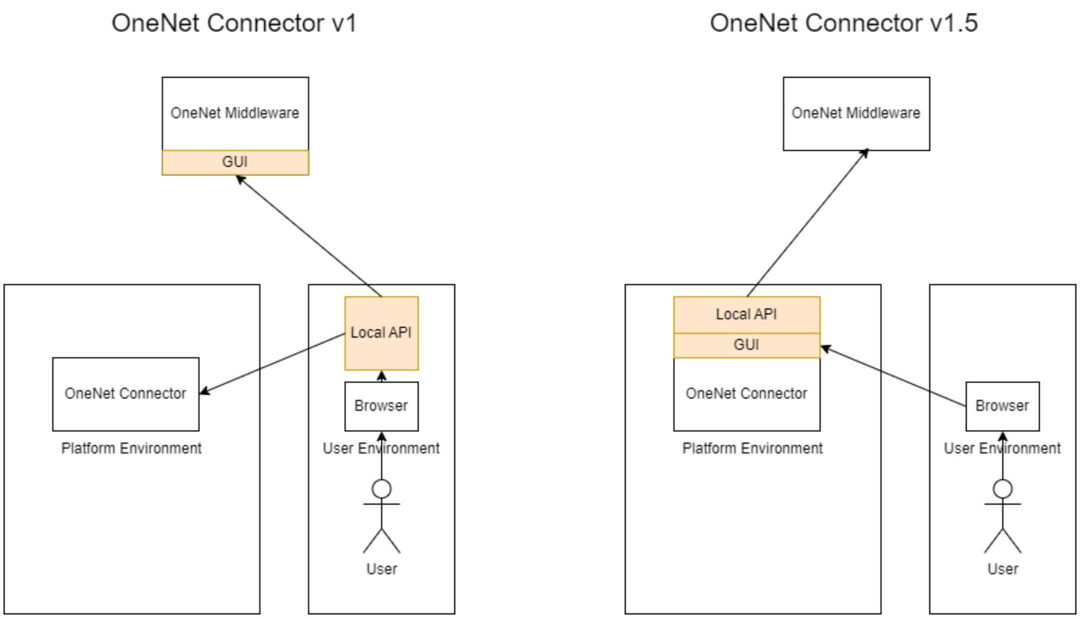


Figure 15: OneNet Connector packaging and deployment approach

In the updated version of the OneNet Connector, the GUI is provided as a local instance of the Connector itself and packaged together the other local components. The GUI can contact both the OneNet Middleware for integrating some "centralised" feature (e.g., Data Catalogue, Identity Manager, etc..) and the local components deployed in the OneNet Participant local environment.

Figure 15 describes the different packaging and deployment approached used in the two versions of the OneNet Connector.

4 OneNet Connector Deployment

4.1 Introduction

The deployment of the OneNet Connector is possible through the software and the instructions that are available under https://github.com/european-dynamics-rnd/OneNet/tree/master.

The instructions for Deployment are available under

https://github.com/european-dynamics-rnd/OneNet/blob/master/README.md

As the development of the OneNet Connector is an ongoing process, deployment instructions might be updated. The above link will always lead to the latest version, indicating possible alterations/additions in comparison with previous versions. The Connector's S/W is being deployed through containerisation in a Docker environment. It can be deployed either under a Windows or a Linux server. Thus, the basic steps towards deployment (as they are in detail documented in the deployment guide) are:

- Install the Docker environment on a Windows or Linux Server
- OneNet Containers installation on Docker
- Central User Interface registration/configuration
- Network configuration

4.2 Prerequisites and Installation

The hardware and operating system prerequisites are:

- A 2-core processor
- 4GB RAM Memory
- 50GB of disk space or more.

The software prerequisites include:

- Centos 7 or Windows Server Operative System (OS)
- docker and docker-compose.

OneNet software and its components will be delivered utilizing the Docker containers functionalities. Firstly, the Docker platform must be downloaded and installed accordingly to the OS of the server to host the deployment, as described in the following paragraphs.

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4.2.1 For Windows server

1. Install Docker from https://hub.docker.com/?overlay=onboarding (The user needs to create first an account on the same page)
2. After the installation if Docker has not started automatically open start Menu, the user shall type Docker and select the Docker icon that appears.

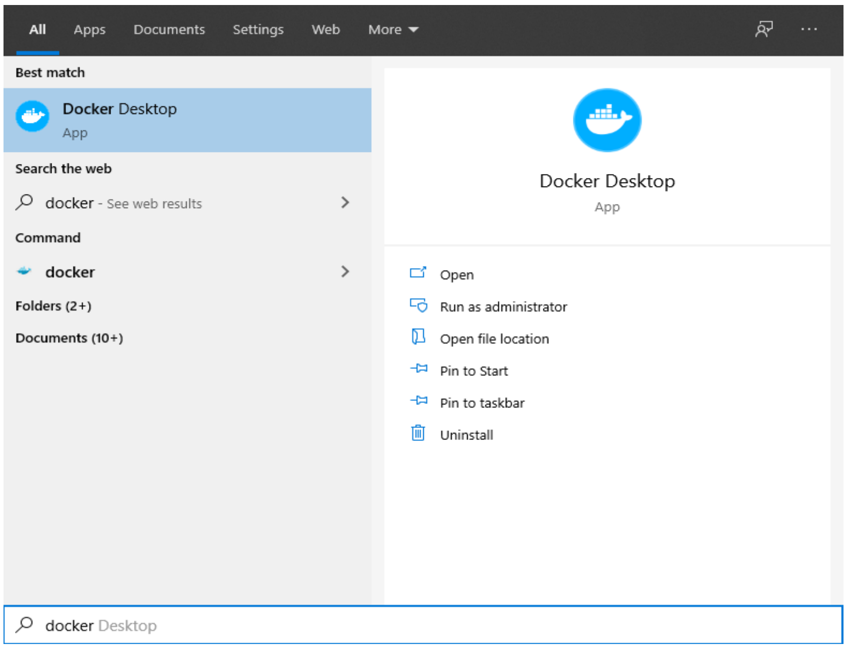

Figure 16 Launching Docker (Windows Server)

3. Docker may take some time to start. When it has successfully started the user should be able to see the icon on the bottom right of the screen

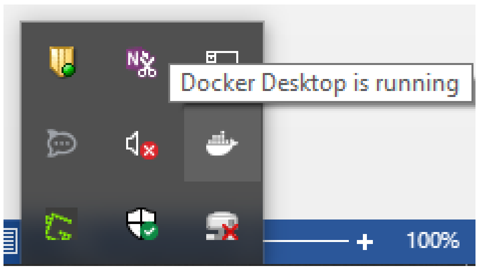

Figure 17 Docker Successfully Started (Windows Server)

Troubleshooting

- Docker: it requires specific support from the CPU, but most recent PCs should support it.
- Hyper-V should be installed and enabled in windows and Virtualization should be enabled in the BIOS. Please also consult the following page https://docs.docker.com/docker-for-windows/troubleshoot/#virtualization/ .

4.2.2 For Linux server

1. Update the apt package index and install packages to allow apt to use a repository over HTTPS

For 64-bit version of CentOS type:

```
$ sudo yum update
$ sudo yum install \
 apt-transport-https \
 ca-certificates \
 curl \
 gnupg-agent \
 software-properties-common
```

For 64-bit version of one of Ubuntu versions (Groovy 20.10, Focal 20.04 (LTS), Bionic 18.04 (LTS), Xenial 16.04 (LTS)) type:

```
$ sudo apt-get update
$ sudo apt-get install \
apt-transport-https \
ca-certificates \
curl \
gnupg-agent \
software-properties-common
```

2. Add Docker's official GPG key

```
$ curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo apt-key add –
```

3. Verify the key by searching for the last 8 characters of the fingerprint.

```
sudo apt-key fingerprint <last 8 characters of the fingerprint >
```

4. Install Docker. According to the Docker installation the user should:

- Set up the Docker repository

For 64-bit version of CentOS type:

```
$sudo yum install -y yum-utils
$sudo yum-config-manager \
  --add-repo \
  https://download.docker.com/linux/centos/docker-ce.repo
```

For 64-bit version of Ubuntu use the following command to set up the stable repository:

```
$ sudo add-apt-repository \
   "deb [arch=amd64] https://download.docker.com/linux/ubuntu \
$(lsb_release -cs) \
   stable"
```

- Install the latest version of Docker Engine and container.

For 64-bit version of CentOS type:

```
$sudo yum install docker-ce docker-ce-cli containerd.io
```

For 64-bit versions of Ubuntu type:

```
$ sudo apt-get install docker-ce docker-ce-cli containerd.io
```

- Start and enable docker by typing:

```
$sudo systemctl start docker
$sudo systemctl enable docker
```

- Verify that Docker Engine is installed correctly by running the hello-world image:

```
$ sudo docker run hello-world
```

This command downloads a test image and runs it in a container. When the container runs, it prints an informational message and exits.

5. Install Docker compose. Docker Compose is a tool for defining and running multi-container Docker applications. With Compose, we use a YAML Ain't Markup Language (YAML) file to configure our application's services. Then, with a single command, we create and start all the services from our configuration. According to the docker compose installation we should:

- Download the current stable release of Docker Compose, by typing:

```
$ curl -L "https://github.com/docker/compose/releases/download/1.28.2/docker-compose-$(uname -s)-
$(uname -m)" -o /usr/local/bin/docker-compose
```

- Apply executable permissions to the binary, by typing:

```
$sudo chmod +x /usr/local/bin/docker-compose
```

4.3 OneNet Container's Installation on Docker

To proceed with the installation of OneNet, the user must use the *docker* folder that contains all the necessary configuration.

6. Next step is to deploy OneNet using Docker Compose. First step is to clone the https://github.com/european-dynamics-rnd/OneNet repository, by typing:

   ```
   cd /opt/onenet-true-connector/
   git clone https://github.com/european-dynamics-rnd/OneNet.git
   ```

7. Use the yml file (docker-compose.yml), located under */opt/onenet/onenet-true-connector/docker to configure all aspects of the OneNet FIWARE true Connector container
8. Finally execute:

   ```
   $docker-compose up –d
   $docker-compose logs -f
   ```

9. If no errors are seen, this means that OneNet FIWARE TRUE CONNECTOR was successfully deployed.

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4.4 OneNet Local Application installation

4.4.1 Installation instructions

On every client computer that will run OneNet the user must also install the OneNet Local Application by following the steps below:

1. Login to the Ui Application from https://onenet-ngsi-ld.eurodyn.com using the username & password that he received from the OneNet administrator.

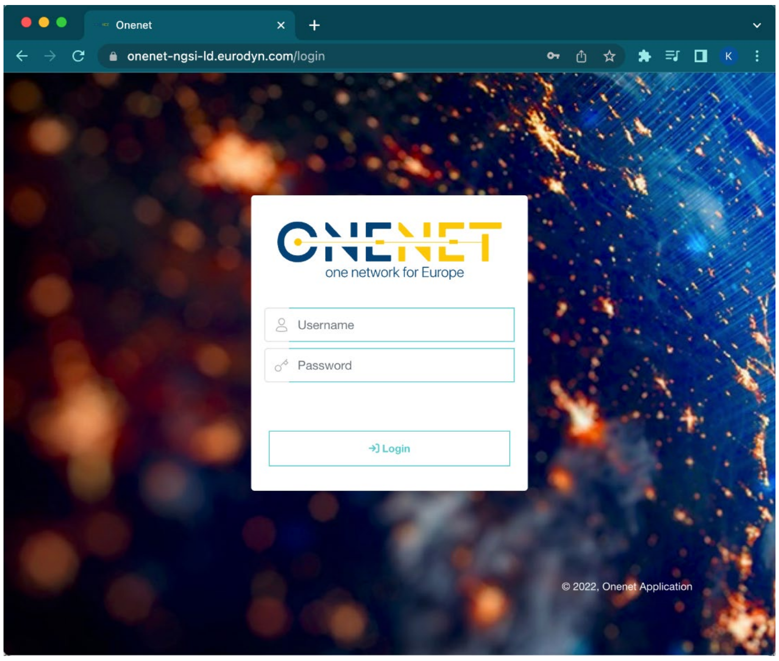
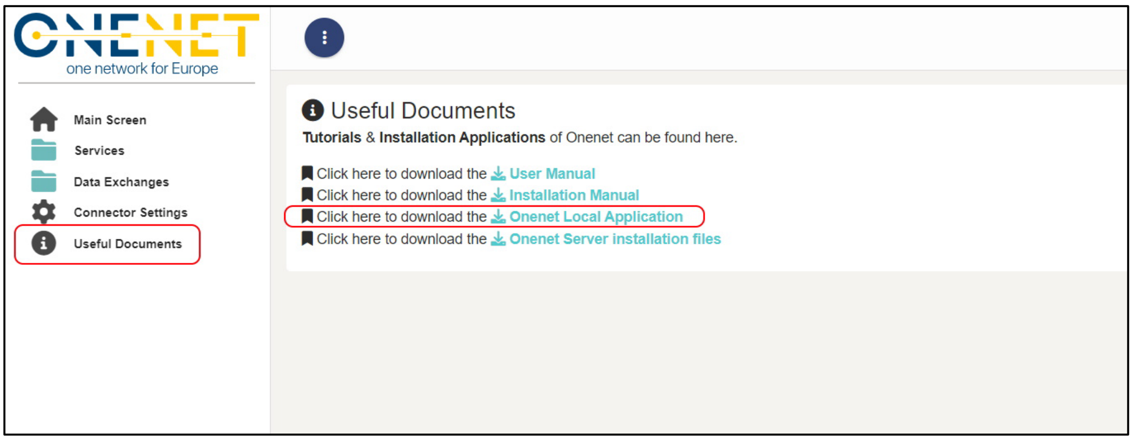


Figure 18 OneNet Login Screen

2. Download the OneNet Local Application installer from the "Useful Documents" menu.



Useful Documents

Tutorials & **Installation Applications** of Onenet can be found here.

Click here to download the **User Manual**
Click here to download the **Installation Manual**
Click here to download the **Onenet Local Application**
Click here to download the **Onenet Server installation files**

Figure 19 Useful Documents

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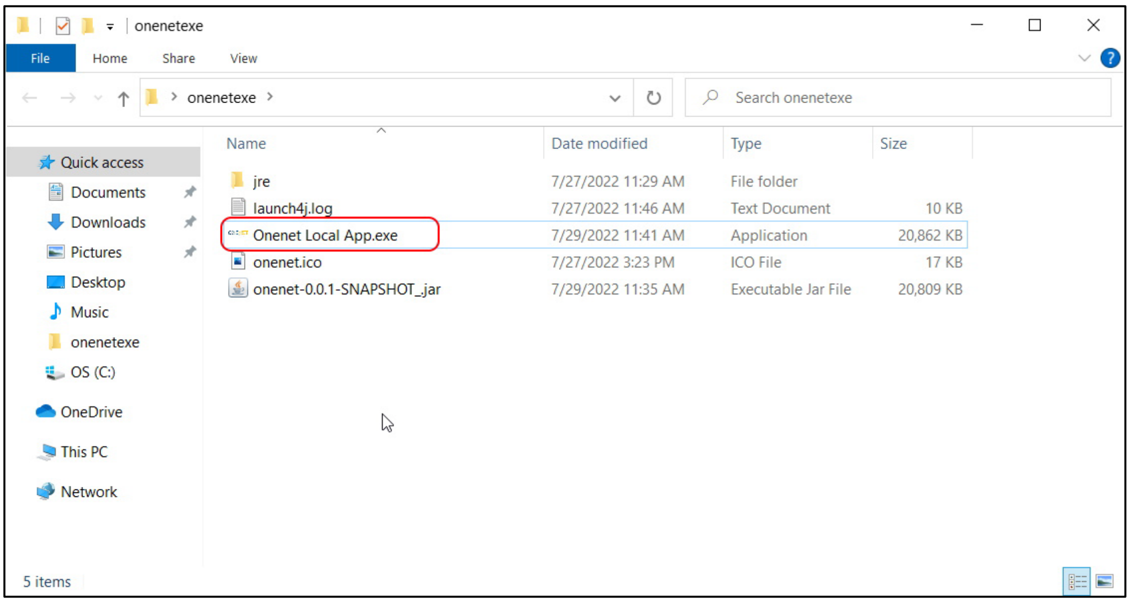
3. Double click & run the Application

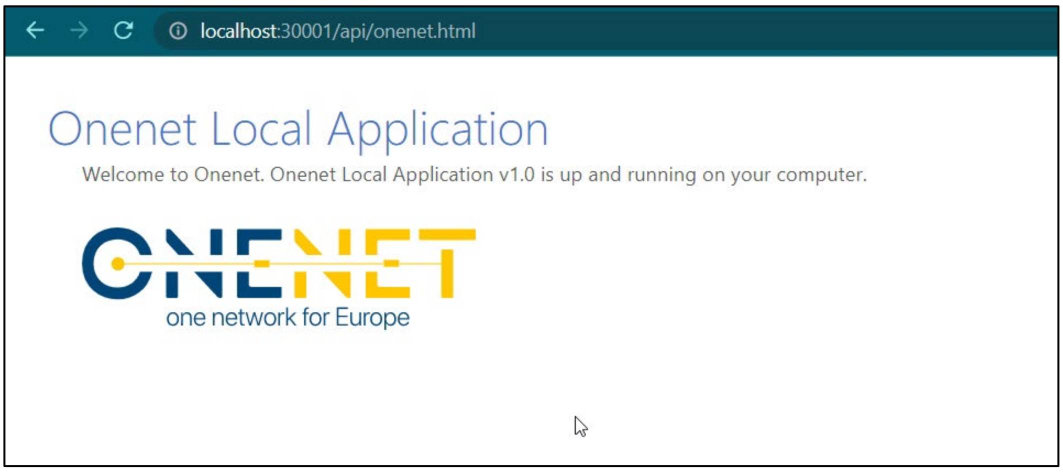


onenetexe

Name	Date modified	Type	Size
jre	7/27/2022 11:29 AM	File folder	
launch4j.log	7/27/2022 11:46 AM	Text Document	10 KB
Onenet Local App.exe	7/29/2022 11:41 AM	Application	20,862 KB
onenet.ico	7/27/2022 3:23 PM	ICO File	17 KB
onenet-0.0.1-SNAPSHOT_.jar	7/29/2022 11:35 AM	Executable Jar File	20,809 KB

Figure 20 Click & Run

3. After running the web browser should popup and show the page below indicating that the application is running.



localhost:30001/api/onenet.html

Onenet Local Application

Welcome to Onenet. Onenet Local Application v1.0 is up and running on your computer.

Figure 21 Application running

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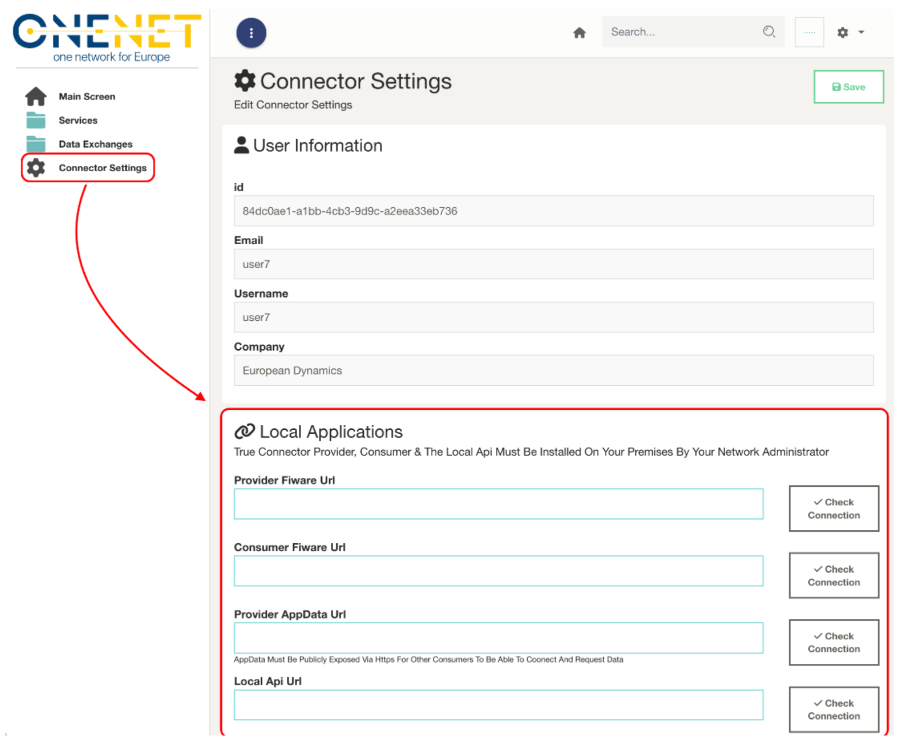
4.4.2 Local Applications subscription To the Central Registry

1. Login to the Ui Central Registry from https://onenet-ngsi-ld.eurodyn.com using the username & password that the user received from the OneNet administrator.
2. Navigate to the Connector settings by the sidebar menu & define the local installation URLs of the user's Local API, FIWARE URL & Data App.



Connector Settings
Edit Connector Settings

User Information

id
84dc0ae1-a1bb-4cb3-9d9c-a2eea33eb736

Email
user7

Username
user7

Company
European Dynamics

Local Applications
True Connector Provider, Consumer & The Local Api Must Be Installed On Your Premises By Your Network Administrator

Provider Fiware Url

Consumer Fiware Url

Provider AppData Url
AppData Must Be Publicly Exposed Via Https For Other Consumers To Be Able To Coonect And Request Data

Local Api Url

Figure 22 Local Applications subscription

5 Current and Future development

As mentioned in D6.5 “OneNet Reference Platform First Release” [7], the functional requirements of the edge-level middleware are based on:

- Demo business and system use cases
- OneNet Reference Architecture
- IDS Reference Architecture and Data processes
- FIWARE True Connector inherent functionality
- OneNet Cross-Platform Services
- OneNet Interfaces sub-layer
- OneNet domain agnostic data model (information model)/Semantic Models

All these thematic areas were analysed to provide a clear and specific set of technical specifications which formed the implementation basis for both the first and the current (intermediate) release of the OneNet Connector.

In the Table below, these functional requirements are presented, sorted by implementation status, showing those already implemented in the current version and those which will be part of the final middleware release. For every functional requirement we also present in which Governance aspect it belongs to, based on the work of Task 6.2.

Table 5.1: Functional Requirements

OneNet Connector Functional Requirements			
Thematic Area			**Governance Aspect**
Configuration			
Configuration of OneNet Connector: Configure data format/ semantic annotation	OneNet Participants must be able to select the data formats and configure semantic annotation to be applied by the OneNet Connector so that data is harmonized (via OneNet Connector GUI)	Implemented	Standardization, Integrity
The requirement has been addressed in the GUI: For the final version we will investigate about the possibility to enhance the existing functionality			
Configuration of OneNet Connector: Configure data quality	OneNet Participants must be able to select and configure data quality requirements and data quality checks to be applied by the OneNet Connector on outgoing data (via OneNet Connector dashboard)	Final Release	Integrity
This is a supportive requirement as the OneNet Connector provide data quality guidelines and not specific software components. The user will be able to check through a list of generic data quality parameters and fill in appropriate metadata.			
Configuration of OneNet Connector: Configuration of transaction logging	OneNet Participants must be able to configure transaction logging (activate/ deactivate, logging intensity and details	Final Release	Access

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	etc.) of the OneNet Connector (via OneNet Connector dashboard)		
To be investigated (connected to the logging information which will be part of the final version)			
Configuration of OneNet Connector: Configuration of data reception endpoints	OneNet Participants must be able to configure data reception endpoints in their systems/ platforms to subscribe themselves to the OneNet Connector context broker and receive incoming data in their systems	Implemented	Access
GUI functionality			
ONBOARDING_Connector Configuration and Provisioning: Define connector configuration model- General information	Service provider to define general information including connector type, version, timestamp of last change made to the configuration, configuration, name of contact person	Final Release	Access
To be investigated as we already provide partially information about the connector through GUI configuration			
ONBOARDING_Connector Configuration and Provisioning: Define connector configuration model- Lifecycle- Data Flow	Service provider to define the configuration of tasks and connections established by the Data Router between the Data Services and the Data Bus (i.e., Networking: ports/IPs, for internal and external connections, Security: SSL certificates or publics keys, Compliance/Data Sovereignty: rules before connector deployment (preventing incorrect configuration)	Final Release	Access
To be investigated			
ONBOARDING_Connector Configuration and Provisioning: Define connector configuration model- Service Configuration	App service provider to define how configuration parameters for Data services or other connector components must be set, i.e., metadata describing datatypes for input/output among different components.	Final Release	
To be investigated since currently we do not have a specific demo use case			
Data Catalogue			
Middleware Features: Available services and data sources discovery	The middleware must allow to discovery for data sources	Implemented	Access
OneNet Connector functionality			
Identity Management			
Middleware Features: Registration of the OneNet Connector	The middleware must allow to uniquely identify each OneNet connector	Partially implemented	Access
Has been implemented partially through the GUI. Towards the final release the IDSA Certification process will be investigated for the possibility of integration with our solution			
Cybersecurity: Ensuring that all the processes can be uniquely identified and related to a specific user		Partially implemented	Access
Part of generic Authentication and Authorization functionality			
IDS-based Service: Identity Management	OneNet Connector can verify the identity of the participants	Partially implemented	

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Full implementation in final release			
ONBOARDING_Connector Configuration and Provisioning: Define connector configuration model- Publishing: Identity Management	Proper identity management interface closely to integrated with the connector defining the Identity Provider	Partially implemented	
Full implementation in final release			
REST APIs			
Data exchange through REST APIs: Exchange harmonized payload data	OneNet Participants must be able to exchange harmonized payload data between OneNet Connectors using OneNet REST APIs	Implemented	Structure
OneNet Connector functionality			
Data exchange through REST APIs: Authentication in OneNet System	OneNet Participants must be able to authenticate themselves/ their platform/ system for exchanges through the OneNet Middleware	Partially implemented	Access
Full implementation in final release			
Data exchange through REST APIs: Data Retrieval	OneNet Participants can retrieve data from a specific data source and filter it (e.g., time window)	Final release	Access
To be investigated how it will be implemented through GUI			
Platforms integration: Platforms can connect with the OneNet Framework	OneNet Connector must be able to connect any kind of Platforms using REST APIs	Implemented	Access
OneNet Connector functionality			
Middleware Features: Any Data sources is integrable with OneNet Middleware		Implemented	Structure Standardization
OneNet Connector functionality			
Middleware Features: Interfaces for reading/writing data	The middleware must provide standard interfaces for reading/writing data	Implemented	Access
OneNet Connector functionality			
Data Exchange: Publish Data	Publish new data using the Connector	Implemented	Access
OneNet Connector functionality			
Data Exchange: Subscribe as service consumer	Register as data consumer to a specific service through the GUI	Implemented	Access
OneNet Connector functionality			
Data Exchange: Subscribe to a data source	Register a data consumer or as a subscriber (publish/subscribe mechanism) through the GUI	Implemented	Access
OneNet Connector functionality			
Data Exchange: Retrieve data	Retrieve data from a specific data source	Implemented	Access
OneNet Connector functionality			
User Interface			

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Monitor OneNet Connector status: Monitor network traffic	OneNet Participants must be able to monitor the network traffic between their own OneNet Connector and other OneNet Connectors and must be notified about potential security breaches (metrics to be defined) through the OneNet Connector dashboard.	Final release	Data security governance
Part of the Cybersecurity functionality components integrated with Context Broker			
Monitor OneNet Connector status: Monitor known data sources	OneNet Participants must be able to monitor the connected data sources (other OneNet Participants and their Connectors) and the current authentication and authorization status through the OneNet Connector dashboard; sensitive information should only be exposed if a OneNet Participant agrees	Implemented	--
OneNet Connector functionality integrated with OneNet workbench/dashboard – intermediate release			
Monitor OneNet Connector status: Monitor health status	OneNet Participants must be able to monitor the health status of their OneNet Connector and the included active data services through the OneNet Connector dashboard.	Implemented	--
OneNet Connector functionality integrated with OneNet workbench/dashboard – intermediate release			
Monitor OneNet Connector status: Monitor transaction logs	OneNet Participants must be able to monitor the transaction logs through the OneNet Connector dashboard	Final release	Access Data security governance
Full implementation in final release			
Monitor OneNet Connector status: Monitor results from data quality checks	OneNet Participants must be able to monitor results from data quality checks through the OneNet Connector dashboard.	Final release	Integrity Data governance performance measurement
This is a supportive requirement as the OneNet Connector provide data quality guidelines and not specific software components. The user will be able to check through a list of generic data quality parameters and fill in appropriate metadata.			
Software update	OneNet Participants must be able to update the software of the OneNet Connector or any of these modules.	--	
OneNet Connector functionality			
Browse and test REST API endpoints	OneNet Participants must be able to browse and test REST API endpoints of the OneNet APIs through the OneNet Connector dashboard.	Implemented	
OneNet Connector functionality			
Registration and Configuration: Registering as OneNet Participant		Implemented	Access
OneNet Connector functionality			
Registration and Configuration: Discovery/search data sources		Implemented	Access

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OneNet Connector functionality			
Registration and Configuration: Change configuration settings		Implemented	
OneNet Connector functionality			
Registration and Configuration: Register new data source	Register an endpoint for making available a set of data.	Implemented	
OneNet Connector functionality			
IDS-based Service: Usage Control - Policy definition	Data Provider can define policies for a specific data source	Final release	Usage
Activation of Usage Control functionality			
File Upload	OneNet Participant can upload files and use them as data sources using the Connector GUI.	Implemented	Structure
OneNet Connector/GUI functionality			
ONBOARDING_Security Setup: IDS Consumer/Provider configures data access restrictions	The Connector provides appropriate functionality for Data Provider or Data Consumer to configure custom access restrictions for bilateral communications; The Data Provider may serve the same data using different representations or pricing options, so the Data Consumer may select a suitable offer from the Data Provider's Connector description.	Partially implemented	Usage Access
Implemented through GUI publish/subscribe handshake. To be finalized with Usage Control activation			
PUBLISHING AND USING DATA APPS_Use Data App: App User UI to search for available Data Apps	App User UI to search for available Data Apps	Final release	
To be investigated			
Clearing House			
IDS-based Service: Clearing House	All the data transactions are logged in	Final release	Access
Activation of Clearing House functionality towards the final release			
ONBOARDING_Connector Configuration and Provisioning: Define connector configuration model- Publishing: Clearing	Connector to provide interface to describe which Clearing House should be informed regarding a certain data exchange transaction	--	
ONBOARDING_Connector Configuration and Provisioning: Define connector configuration model	Connector communicates configuration to broker and/ or clearing house	Partially implemented	Access
Activation of Clearing House functionality towards the final release			
EXCHANGE OF DATA_Invoke Data Operation: Notification	Upon data consumer request for data a notification is sent at clearing house for logging data operation request	Final release	Access

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of data operation call at clearing House			
Activation of Clearing House functionality towards the final release			
EXCHANGE OF DATA_Invoke Data Operation: Notification of data operation call reception at clearing House	Upon data providers reception of data consumer's request, a notification is sent at clearing house for logging reception	Final release	Access
Activation of Clearing House functionality towards the final release			
EXCHANGE OF DATA_Invoke Data Operation: Clearing house logs in a persistence database all transactions	Clearing house logs in a persistence database all transactions ensuring data provenance tracking infrastructure	Final release	Access
Activation of Clearing House functionality towards the final release			
EXCHANGE OF DATA_Invoke Data Operation: Notification of data operation result sent at clearing House	Notification of data operation result sent at clearing House from data provider	Final release	Access
Activation of Clearing House functionality towards the final release			
EXCHANGE OF DATA_Invoke Data Operation: Notification of data operation result received at clearing House	Notification of data operation result received at clearing House	Final release	Access
Activation of Clearing House functionality towards the final release			
Context Broker			
Platforms integration: Platforms can exchange data each other	OneNet Connector must be able to exchange data with other OneNet Connector	Implemented	
OneNet Connector functionality			
Middleware Features: Categorization of services and data	The middleware should support the categorization of data in unstructured (text data), semi-structured (e.g., XML/JSON formalized data) and structured	Implemented	
OneNet Connector functionality			
Middleware Features: Data Exchange	The Middleware must support data exchange	Implemented	
OneNet Connector functionality			
ONBOARDING_Availability Setup: Broker provider functions for searching	Broker provides functions for searching/browsing/querying for and retrieving registered Connector self-descriptions, including data sources, interfaces, security profiles, and current levels of trustworthiness.	Partially implemented	
To be enhanced towards the final version			

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EXCHANGE OF DATA_Find Data Provider: Connector provides proper interface to find data provider	Connector offers functionality to Data Consumer to be able to send a query to a Broker Service Provider upon selection of a suitable Broker (e.g., based on thematic coverage) and determine the query capabilities (e.g., a graphical search interface or a domain-specific query language)	Implemented	
GUI functionality			
EXCHANGE OF DATA_Find Data Provider: Broker communicates to data consumer the queried result	The Broker then returns the query result to the Data Consumer (via Connector), who needs to interpret the result to find out about the different data sources available in the IDS for providing the data specified in the query	Implemented	
GUI functionality			
EXCHANGE OF DATA_Find Data Provider: Connector provide a human readable and technical interpretation of result from Broker	Each query result must provide information about each IDS Connector capable of providing the desired data, so that the Data Consumer can retrieve each Connector's self-description to learn more about how to receive the desired dataset from a technical point of view (e.g., endpoint addresses, protocol).	Implemented	
GUI functionality			
EXCHANGE OF DATA_Find Data Provider: Data consumer direct contact with data provider	Data Consumer may already know a suitable Data Provider. In this case, the Data Consumer can contact the Data Provider directly (i.e., without invoking a broker).	Implemented	
OneNet Connector functionality			
EXCHANGE OF DATA_Invoke Data Operation: Data consumer -via connector- retrieve usage policies from data provider	Data consumer -via connector- retrieve usage policies based on data provider's self-description	Final release	
Activation of Usage Control functionality towards the final release			
Data Access Policies			
Access OneNet Framework: Register or change data access consents	OneNet Participants must be able to register and change data access consents through accessing the OneNet Framework dashboard	Final release	
Activation of Usage Control functionality towards the final release			
IDS-based Service: Usage Control - Access Control and Enforcement	Usage Control App verify all the polices during data exchange	Final release	
Activation of Usage Control functionality towards the final release			
Data Quality			

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Middleware Features: Data Quality Checking	The middleware should include tool for data quality check	Final release	
This is a supportive requirement as the OneNet Connector provide data quality guidelines and not specific software components. The user will be able to check through a list of generic data quality parameters and fill in appropriate metadata.			
OneNet Additional Services: Data Quality		Final release	
This is a supportive requirement as the OneNet Connector provide data quality guidelines and not specific software components. The user will be able to check through a list of generic data quality parameters and fill in appropriate metadata.			
Semantic Annotation			
Middleware Features: Development of semantic models	The Middleware should provide a semantic tool for the development of semantic models	Implemented	
The OneNet Connector provides semantic guidelines accessible to the user as choices in GUI			
OneNet Additional Services: Data Harmonization	OneNet Connector can map CIM Data models	Partially Implemented	
The OneNet Connector provides semantic guidelines accessible to the user as choices in GUI. To be enhanced towards final release			
OneNet Additional Services: Semantic Annotation		Implemented	
The OneNet Connector provides semantic guidelines accessible to the user as choices in GUI			
UC Data App			
Onboarding_Connector Configuration and Provisioning: Define connector configuration model- Publishing: Accounting	Connector interface to define information for a data exchange transaction between participants, it is necessary to record additional information, such as contract specifications, pricing models, or billing details.	Final release	
The need for this will be investigated			
Onboarding_Availability Setup: Connector option to select a set of available Broker services	Connector provider proper interface for Data Provider/Consumer to select a Broker from a set of available Broker services (i.e., a registry for Connector self-descriptions) to publish the self-description of their Connector	--	
Exchange of Data_Invoke Data Operation: Data consumer negotiate policy with data provider	Data consumer to be able to negotiate with data providers sending counter offers for data usage policy	Final release	
The need for this will be investigated			
Exchange of Data_Invoke Data Operation: IDS participants reach agreement on policy	Accept policies to be deployed in both sides and send in policy persistence	Final release	
The need for this will be investigated			
Exchange of Data_Invoke Data Operation: Policies locally deployed at IDS,	Negotiated polices are deployed at connectors' level	Final release	

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informing policy persistence			
The need for this will be investigated			
Exchange of Data_Invoke Data Operation: Data consumer conducts data operation call		Implemented	
OneNet Connector functionality			
Publishing and Using Data APPs_Use Data App: App User selects Data App compatible format	App User selects Data App compatible format being compatible with user's connector specifications packaging format	--	
Publishing and Using Data APPs_Use Data App: IDS user retrieves Data App	IDS user retrieves Data App (same as 2b. process)	--	

6 References

[1] D5.1 – OneNet concept and requirements, Sep. 2021 (https://onenet-project.eu/wp-content/uploads/2022/10/D51-OneNet-Concept-and-Requirements.pdf)

[2] D5.2 – OneNet Reference Architecture, Sep 2021 https://onenet-project.eu/wp-content/uploads/2022/12/OneNet_D5.2_v1.0.pdf)

[3] D5.3 - Data and Platform Assets Functional Specs and Data Quality Compliance, Nov. 2021 (https://onenet-project.eu/wp-content/uploads/2022/12/OneNet-D5.3-v1.0.pdf)

[4] D5.4 - AI, Big Data, IoT Enablers and FIWARE compliant interoperable interfaces for grid services, Jan 2022 (https://onenet-project.eu/wp-content/uploads/2022/12/OneNet_D5.4_v1.0.pdf)

[5] D5.5 - Report on Technical specifications for data models/platform agnostic middleware, Jan. 2022 (https://onenet-project.eu/wp-content/uploads/2022/12/OneNet_D5.5_v1.0.pdf)

[6] D5.6 - Report on Extended Data, Platform and Service Interoperability, Mar. 2022 (https://onenet-project.eu/wp-content/uploads/2022/12/OneNet_D5.6_v1.0.pdf)

[7] D6.5 - OneNet Reference Platform First Release (https://onenet-project.eu/wp-content/uploads/2022/10/OneNet_D6.5_final_v1.1.pdf)

[8] Spring Boot (https://spring.io/projects/spring-boot)

[9] MongoDB (https://www.mongodb.com/docs/)

[10] IDS based TRUE (TRUsted Engineering) Connector (https://github.com/Engineering-Research-and-Development/true-connector)

[11] FIWARE Orion Context Broker-LD (https://github.com/FIWARE/context.Orion-LD)

[12] International Data Spaces Association Reference Architecture Model (https://internationaldataspaces.org/wp-content/uploads/IDS-Reference-Architecture-Model-3.0-2019.pdf)

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7 ANNEX – Graphical User Interface (GUI) Manual – v2.0

7.1 Guide for admin roles

The system administrator is essentially responsible for the administering the operation of the OneNet central Middleware. Accordingly, the creation/registration of new OneNet users takes place solely through the system administrator's environment. The administrator menus are illustrated in Figure 23.

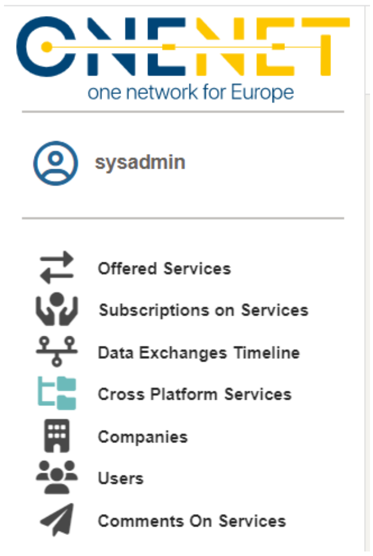
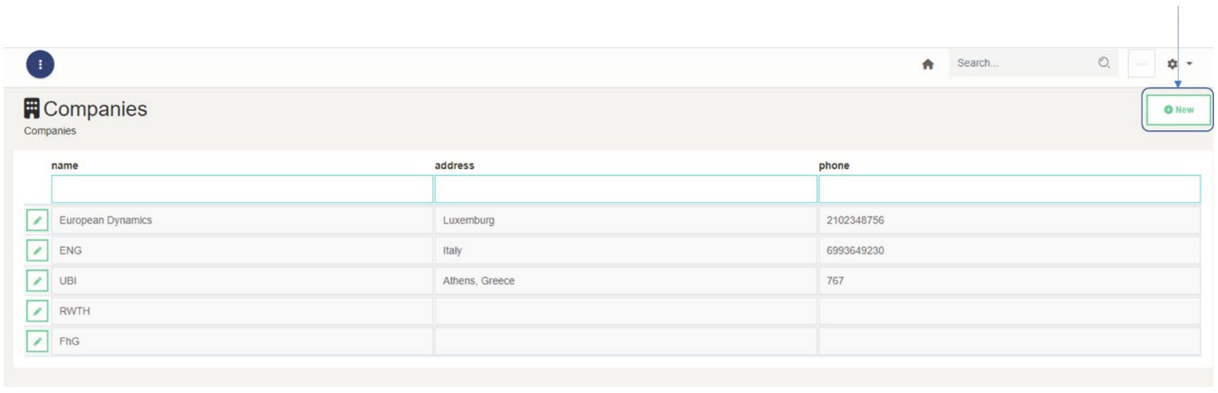


Figure 23 Administrator's menu

Therefore, the admin can have an overview on the different processes for all OneNet users, observing only meta-data which are stored in the OneNet middleware and not the actual data that are exchanged directly between Producer and Consumer. For instance, offered services details (meta-data here refers to the service specification and the service provider etc.), all the offered services that they are available in the ecosystem; subscription on services that details all the registered subscriptions; cross-platform services which contain the open and configurable (by admin user and the following to be explained in Section 8.2) list of OneNet cross-platform services; the Companies and the Users registered on the Middleware upon request.

A system administrator might create new user profiles which always have to be assigned with an affiliated Company. Screen 1, illustrates the respective dashboard in which the system administrator might add or edit companies in the ecosystem.

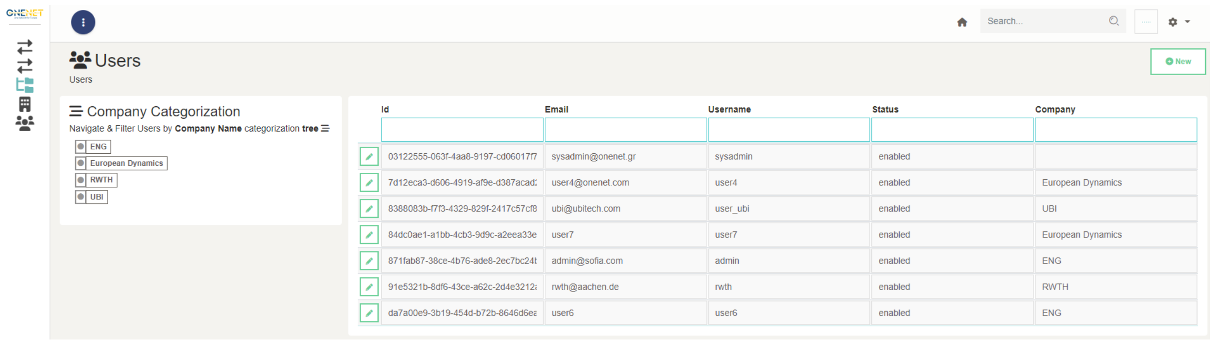


Companies
Companies

	name	address	phone
	European Dynamics	Luxemburg	2102348756
	ENG	Italy	6993649230
	UBI	Athens, Greece	767
	RWTH		
	FhG		

Screen 1: Companies registry.

The corresponding dashboard for user management (configuration of existing and creation of new users) is presented in Screen 2. Multiple users might be assigned with a company.



Users
Users

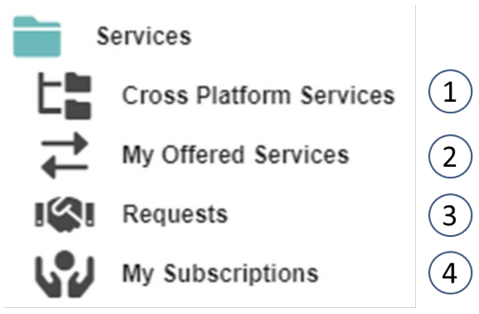
Company Categorization
Navigate & Filter Users by **Company Name** categorization **tree**
- ENG
- European Dynamics
- RWTH
- UBI

	Id	Email	Username	Status	Company
	03122555-063f-4aa8-9197-cd06017f7	sysadmin@onenet.gr	sysadmin	enabled	
	7d12eca3-d606-4919-af9e-d387acad:	user4@onenet.com	user4	enabled	European Dynamics
	8388083b-f7f3-4329-829f-2417c57cf8	ubi@ubitech.com	user_ubi	enabled	UBI
	84dc0ae1-a1bb-4cb3-9d9c-a2eea33e	user7	user7	enabled	European Dynamics
	871fab87-38ce-4b76-ade8-2ec7bc24t	admin@sofia.com	admin	enabled	ENG
	91e5321b-8df6-43ce-a62c-2d4e3212:	rwth@aachen.de	rwth	enabled	RWTH
	da7a00e9-3b19-454d-b72b-8646d6ea	user6	user6	enabled	ENG

Screen 2: User Management.

The system administrator might view from Services tab (Screen 3):

1. any information related cross-platform services and update this information. It is the system administrator's sole responsibility to add or update a new cross-platform service. For instance, a system administrator might wish to update the semantic definition of a cross-platform service,
2. all offered services from all users,
3. all requests sent to services providers to accept/reject a service subscription,
4. any service subscriptions to any cross-platform service.



Screen 3: Services dashboard and sub-menus

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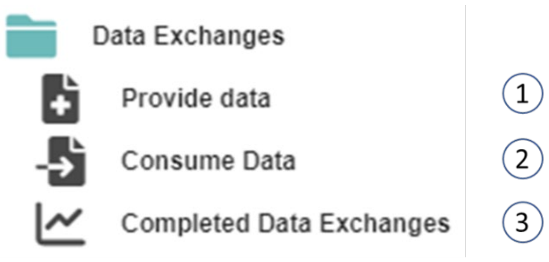
The system administrator has also the capability to view meta-data information about OneNet data exchanges (Screen 4):

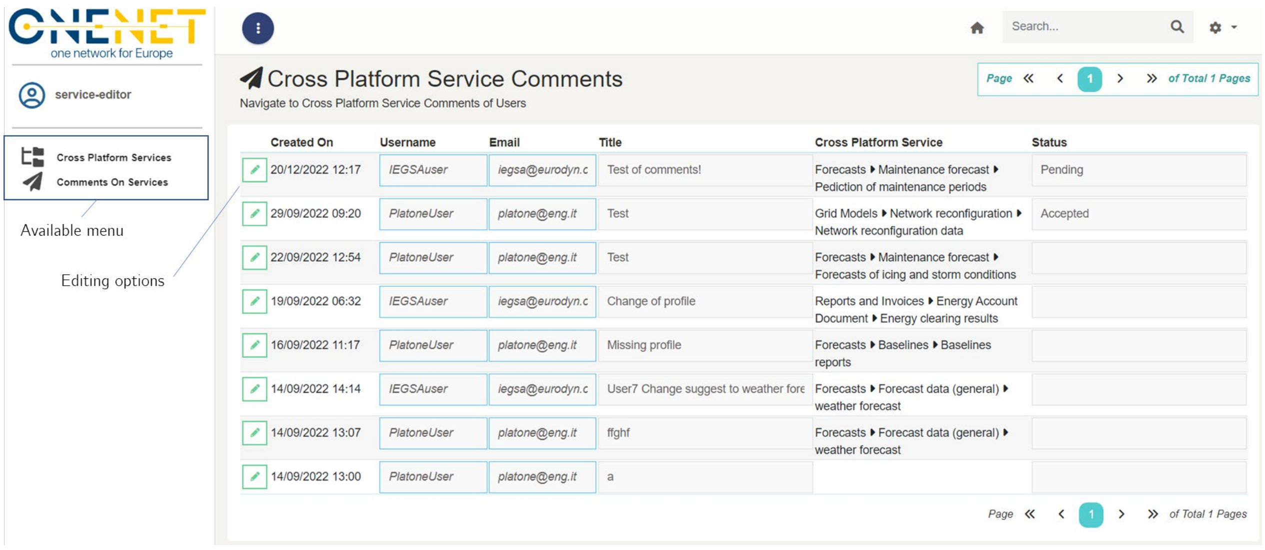
1. any data provisions from OneNet data providers,
2. any **meta-data** information for data available for consumption,
3. a dashboard with a list of completed data exchanges.



Screen 4: Data exchanges dashboard and sub-menus.

7.2 Data profile manager

The data profile manager is an essentially one additional administration menu which is dedicated to the configuration and maintenance of the cross-platform services list. As the cross-platform services list is an evolving directory, in the sense that new entries might need to be registered or existing services might need updates either to their functional description or to their semantic definition. The data profile manager's menu is presented in Figure 24.



Cross Platform Service Comments

Navigate to Cross Platform Service Comments of Users

Created On	Username	Email	Title	Cross Platform Service	Status
20/12/2022 12:17	IEGSAuser	iegsa@eurodyn.c	Test of comments!	Forecasts ▸ Maintenance forecast ▸ Pediction of maintenance periods	Pending
29/09/2022 09:20	PlatoneUser	platone@eng.it	Test	Grid Models ▸ Network reconfiguration ▸ Network reconfiguration data	Accepted
22/09/2022 12:54	PlatoneUser	platone@eng.it	Test	Forecasts ▸ Maintenance forecast ▸ Forecasts of icing and storm conditions	
19/09/2022 06:32	IEGSAuser	iegsa@eurodyn.c	Change of profile	Reports and Invoices ▸ Energy Account Document ▸ Energy clearing results	
16/09/2022 11:17	PlatoneUser	platone@eng.it	Missing profile	Forecasts ▸ Baselines ▸ Baselines reports	
14/09/2022 14:14	IEGSAuser	iegsa@eurodyn.c	User7 Change suggest to weather fore	Forecasts ▸ Forecast data (general) ▸ weather forecast	
14/09/2022 13:07	PlatoneUser	platone@eng.it	ffghf	Forecasts ▸ Forecast data (general) ▸ weather forecast	
14/09/2022 13:00	PlatoneUser	platone@eng.it	a		

Figure 24 Data profile manager menu

The data profile manager essentially gives access to the comments received from users. Accordingly, the data profile manager can access the comment with the edit button and change status (Pending, Accepted, Rejected) on the comments when this is properly addressed. On the corresponding cross platform services tab

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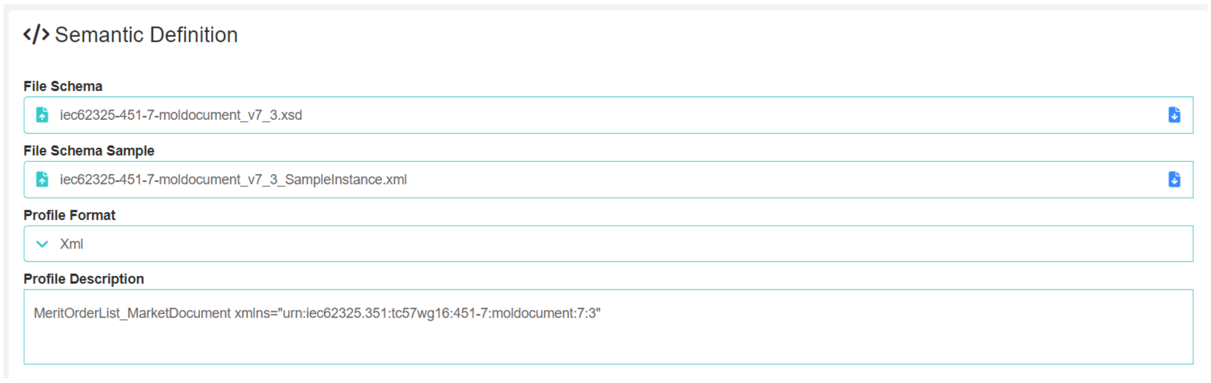
this admin role can edit a specific service to provide any kind of updates. Particularly on the semantic definition of a service the profile manager can upload the harmonized semantic schemas as in Figure 25.


</> Semantic Definition

File Schema
iec62325-451-7-moldocument_v7_3.xsd

File Schema Sample
iec62325-451-7-moldocument_v7_3_SampleInstance.xml

Profile Format
Xml

Profile Description
MeritOrderList_MarketDocument xmlns="urn:iec62325.351:tc57wg16:451-7:moldocument:7:3"

Figure 25 Semantic definition of a cross-platform service.

7.3 OneNet users

Prior to the description of the OneNet Connector's GUI, it is vital to highlight the key concept/workflow that is designed to provide seamless and secure data exchange among platforms. As illustrated in Figure 26, there are certain preconditions for new OneNet entrants, to provide or consume data:

- **Data provision**: OneNet user that wishes to act as a data provider, needs primarily, to register (i.e. in the OneNet Middleware) what type of services will be offered. This is performed in centralized manner, to inform all the potentially interested parties about this new service offering. The service offering is assigned with cross-platform service type, as defined in OneNet, so that there is common understanding (description, syntactics/semantics). Once this new service offering is registered, then a service provider can make available data items in the OneNet ecosystem. In fact, only meta-data information will be made available (for this new data item) to all OneNet users that have an active subscription for this service.
- **Data consumption**: OneNet user that wishes to consume data, needs firstly, to express the interest for a specific cross-platform services, by making a service subscription, accordingly. Once the subscription is marked accepted by the service provider, then the data consumer will be able to get updates (i.e., given proper meta-data descriptions) on new data items assigned with this service. For new data items, the data consumer can make a GET request to the provider by clicking the respective button as it is explained in the forthcoming sections.

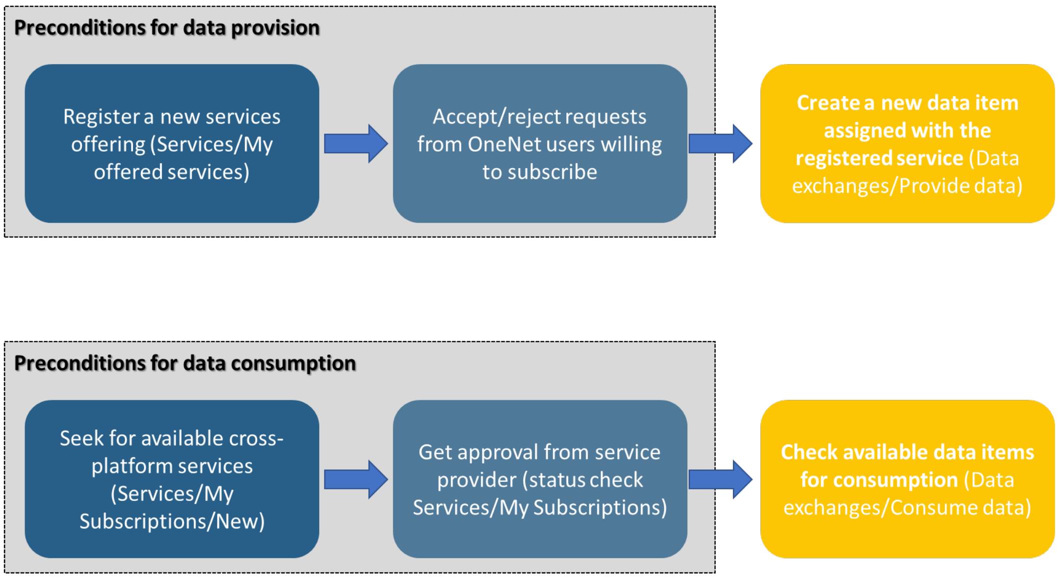
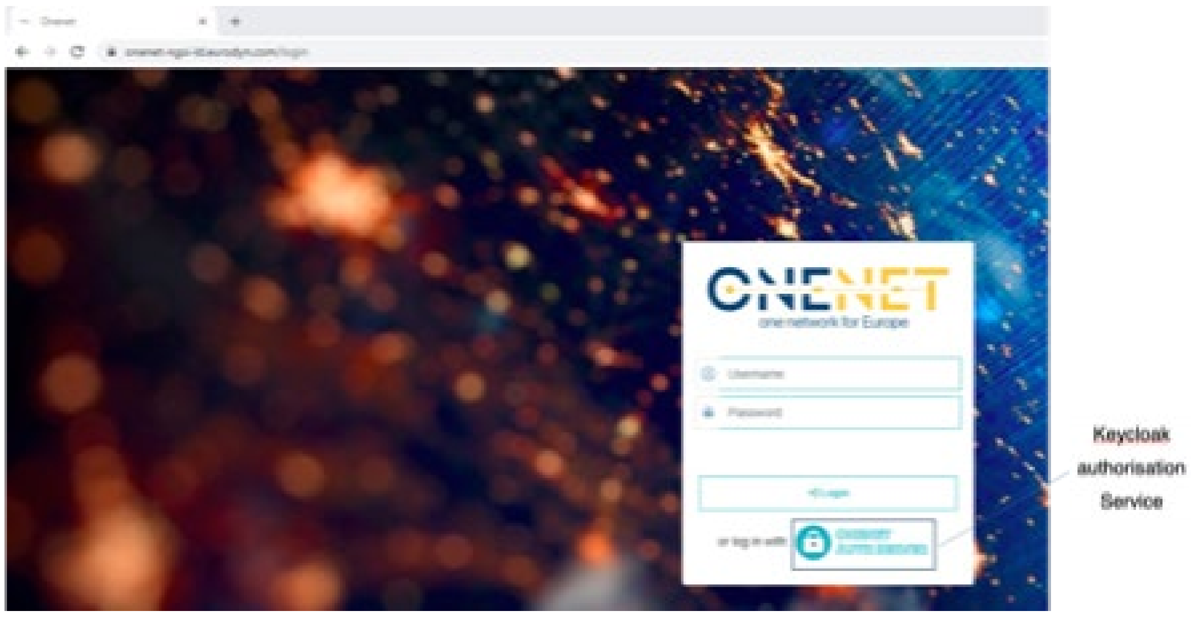

Preconditions for data provision
Register a new services offering (Services/My offered services)
Accept/reject requests from OneNet users willing to subscribe
Create a new data item assigned with the registered service (Data exchanges/Provide data)
Preconditions for data consumption
Seek for available cross-platform services (Services/My Subscriptions/New)
Get approval from service provider (status check Services/My Subscriptions)
Check available data items for consumption (Data exchanges/Consume data)

Figure 26: Key concept for exchanging data through OneNet Connector.

7.3.1 Accessing OneNet GUI

For companies/users that are willing to deploy the OneNet connector proper user profiles will be created and shared with them, which will be used to get access to the GUI of OneNet (https://onenet-ngsi-ld.eurodyn.com/login). The Log-in screen appears in Screen 5. A user will notice the Keycloak authorization service which enables a common authorization mechanism along the OneNet solutions.



Screen 5: OneNet Connector's GUI log-in screen.

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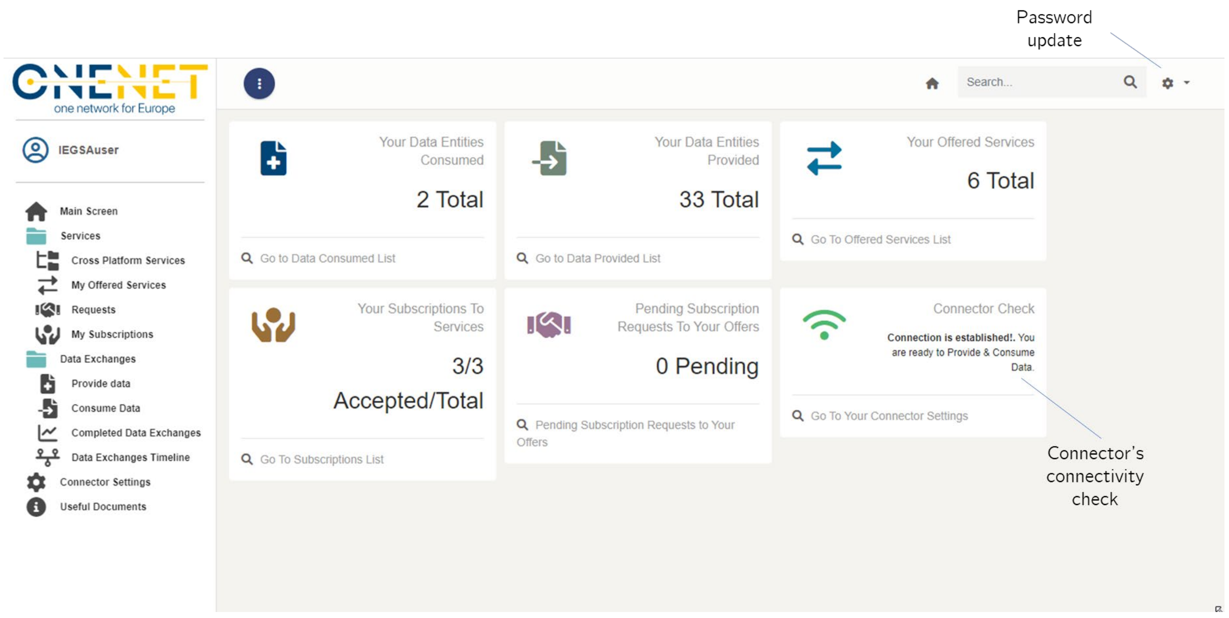
7.3.2 Main screen

The main screen that the user will be redirected to is presented in Screen 6, which essentially provides an overview of KPIs calculated at the OneNet connector's level. Such information might refer to data items consumed/provided, offered services, active subscriptions, along with the connector's connectivity check. All the presented analytics provide a go to button that shift the user to the corresponding menu.



Connection is established!. You are ready to Provide & Consume Data.

Screen 6: Main screen.

A user can update the pre-set password by clicking on settings as illustrated in Screen 6.

7.3.3 Services

In general, the services framework is designed to provide all the necessary details about the definition of OneNet cross platform services (i.e. business objects, functional description, semantic definition), the offering of a cross-platform service into the OneNet ecosystem as well as the subscription in a cross-platform service.

7.3.3.1 Cross-Platform Services

The cross-platform services tab is essentially a view-only environment which provides a directory on cross-platform services as they are proposed and categorized in OneNet project (see Screen 7). It should be noted that if an OneNet user cannot find a matching cross-platform service, then it is indicated that the 00- Generic- Non-existing shall be used providing analytical descriptions for this cross-platform service. The latter will ease the evolution of cross-platform services and proceed with updates on the catalogue.

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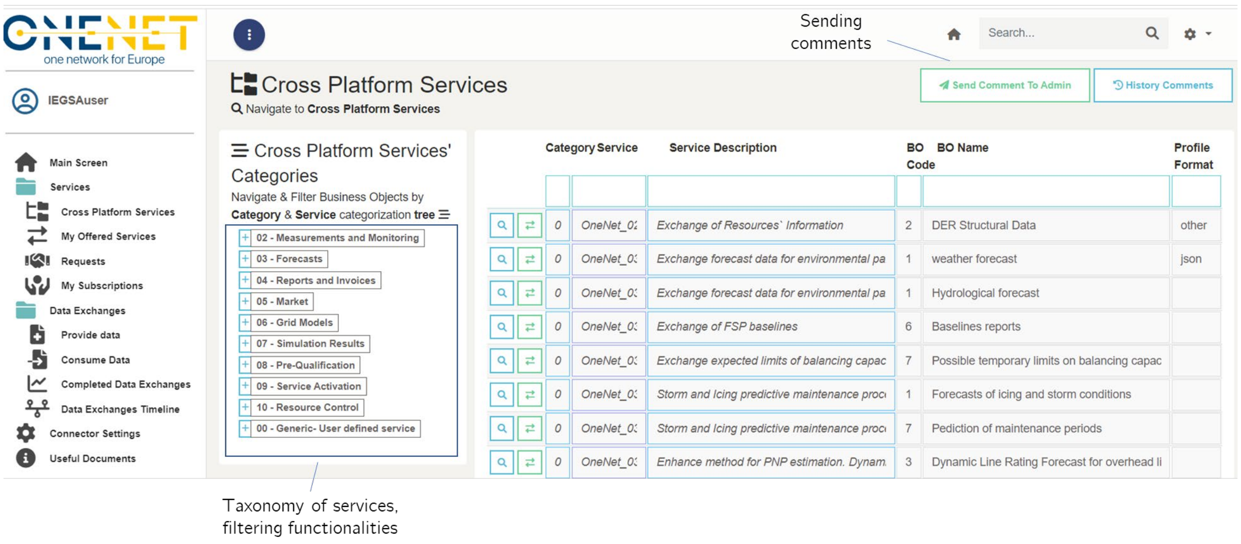


ONENET one network for Europe

IEGSAuser

Main Screen
Services
Cross Platform Services
My Offered Services
Requests
My Subscriptions
Data Exchanges
Provide data
Consume Data
Completed Data Exchanges
Data Exchanges Timeline
Connector Settings
Useful Documents

Search...

Cross Platform Services
Navigate to **Cross Platform Services**

Send Comment To Admin | History Comments

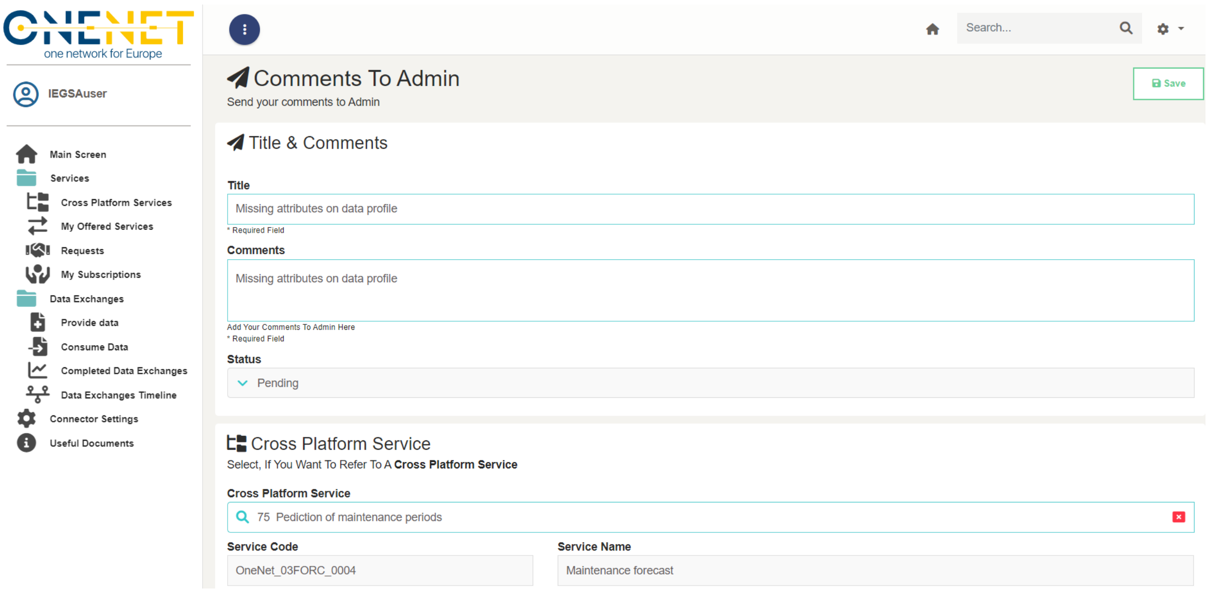
Cross Platform Services' Categories
Navigate & Filter Business Objects by **Category** & **Service** categorization **tree**

- 02 - Measurements and Monitoring
- 03 - Forecasts
- 04 - Reports and Invoices
- 05 - Market
- 06 - Grid Models
- 07 - Simulation Results
- 08 - Pre-Qualification
- 09 - Service Activation
- 10 - Resource Control
- 00 - Generic- User defined service

Category	Service	Service Description	BO Code	BO Name	Profile Format
0	OneNet_0:	Exchange of Resources` Information	2	DER Structural Data	other
0	OneNet_0:	Exchange forecast data for environmental pa	1	weather forecast	json
0	OneNet_0:	Exchange forecast data for environmental pa	1	Hydrological forecast	
0	OneNet_0:	Exchange of FSP baselines	6	Baselines reports	
0	OneNet_0:	Exchange expected limits of balancing capac	7	Possible temporary limits on balancing capac	
0	OneNet_0:	Storm and Icing predictive maintenance proc	1	Forecasts of icing and storm conditions	
0	OneNet_0:	Storm and Icing predictive maintenance proc	7	Pediction of maintenance periods	
0	OneNet_0:	Enhance method for PNP estimation. Dynam	3	Dynamic Line Rating Forecast for overhead li	

Screen 7: Cross-platform services tab.

To send comments for updates or omissions for a specific cross-platform service, a user needs to click the button "Send Comments To Admin", which will redirect to a new dashboard where the user needs to select the referencing service along with the comments as in Figure 27.



ONENET one network for Europe

IEGSAuser

Main Screen
Services
Cross Platform Services
My Offered Services
Requests
My Subscriptions
Data Exchanges
Provide data
Consume Data
Completed Data Exchanges
Data Exchanges Timeline
Connector Settings
Useful Documents

Search...

Comments To Admin
Send your comments to Admin

Save

Title & Comments

Title
Missing attributes on data profile
* Required Field

Comments
Missing attributes on data profile
Add Your Comments To Admin Here
* Required Field

Status
Pending

Cross Platform Service
Select, If You Want To Refer To A **Cross Platform Service**

Cross Platform Service
75 Pediction of maintenance periods

Service Code
OneNet_03FORC_0004

Service Name
Maintenance forecast

Figure 27 Comments to admin screen.

7.3.3.2 My offered Services

This tab is when a user wishes to provide/deliver a new cross-platform service. By clicking this tab, see Screen 8, the user can preview existing offered services by the same user, to which one sort based on the filters. The

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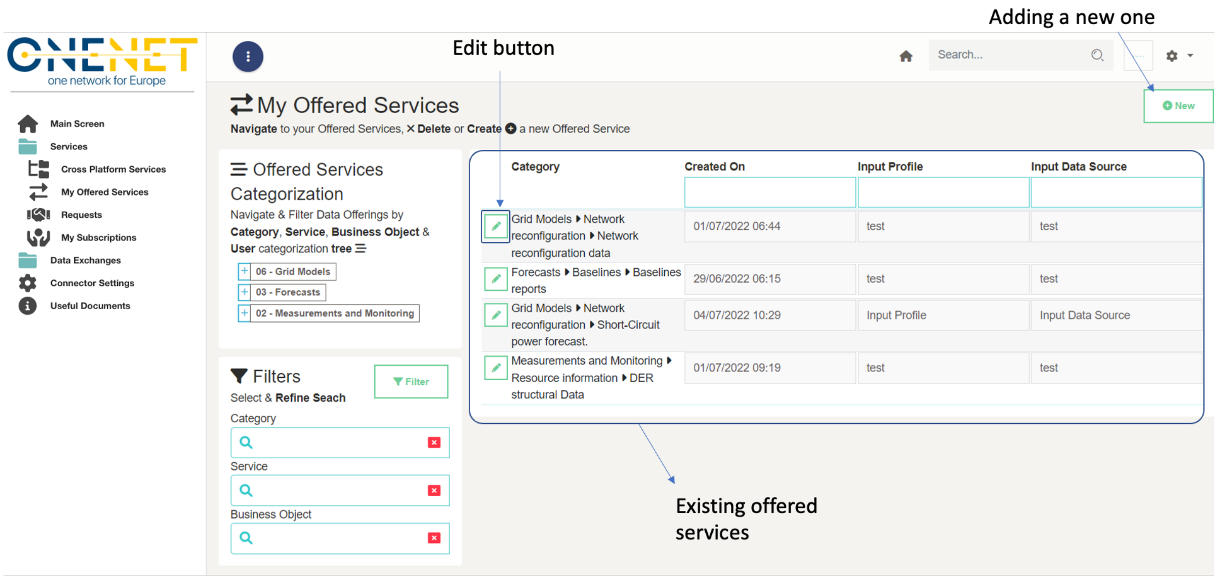
user has the option to edit an existing service and proceed with updates on the offering, by clicking on the edit Button. For a new offering, the user needs to click New.



My Offered Services

Navigate to your Offered Services, ✕ **Delete** or **Create** ⊕ a new Offered Service

Offered Services Categorization

Navigate & Filter Data Offerings by **Category**, **Service**, **Business Object** & **User** categorization **tree**

- 06 - Grid Models
- 03 - Forecasts
- 02 - Measurements and Monitoring

Filters

Select & **Refine Seach**

Category

Service

Business Object

Category	Created On	Input Profile	Input Data Source
Grid Models ▸ Network reconfiguration ▸ Network reconfiguration data	01/07/2022 06:44	test	test
Forecasts ▸ Baselines ▸ Baselines reports	29/06/2022 06:15	test	test
Grid Models ▸ Network reconfiguration ▸ Short-Circuit power forecast.	04/07/2022 10:29	Input Profile	Input Data Source
Measurements and Monitoring ▸ Resource information ▸ DER structural Data	01/07/2022 09:19	test	test

Screen 8: My offered services tab.

By clicking New, the user will view a pop window as in Screen 9. The user must assign this new service with a business object that is in turn under a cross-platform service. By clicking in the Business Object, the list that is presented in the Cross-platform Services tab will again appear. The user has also to claim whether service delivery will occur using OneNet harmonized data profiles, else to define the data profile of information to be shared. In the OneNet info there is information regarding the service provider timestamp, the assigned by the system unique user-ID as well the information of the service provider as in Screen 10. The semantic definition area is the one where the service provider states details on how the data to entities (assigned with this service) will be formatted. For this reason, once a user selects a specific cross-platform service then the harmonized -if any- will be loaded automatically. In case the services provider wishes to set custom profile, then, needs to check the box “Custom Semantics”.

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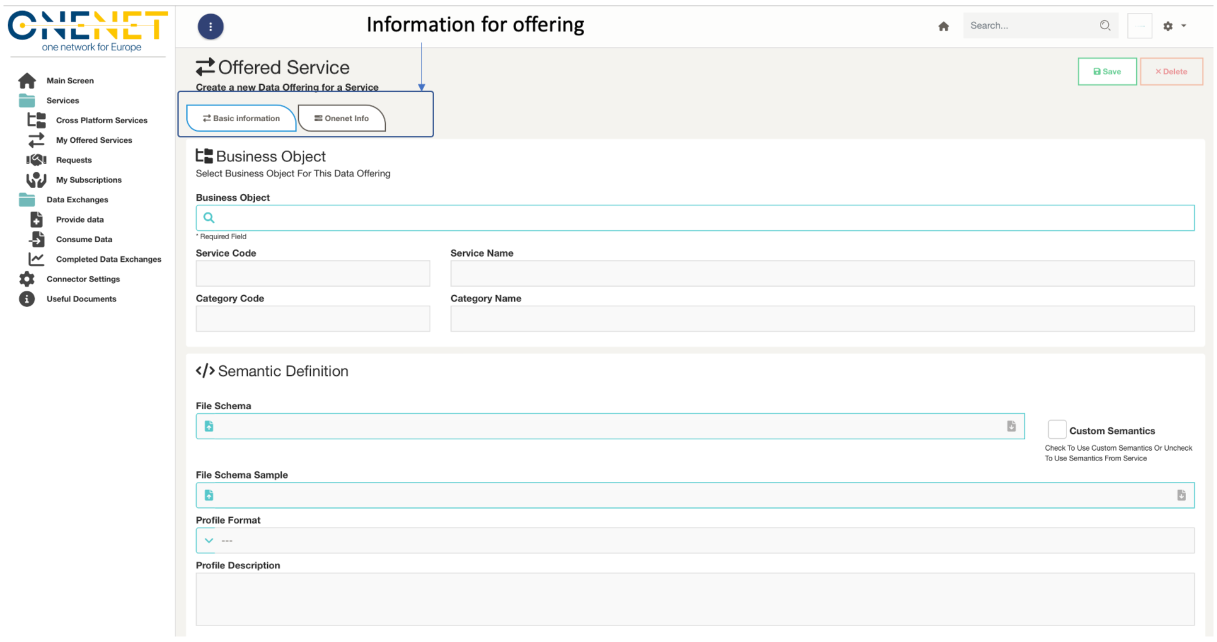


Offered Service
Create a new Data Offering for a Service

Business Object
Select Business Object For This Data Offering

Business Object

* Required Field

Service Code

Service Name

Category Code

Category Name

Semantic Definition

File Schema

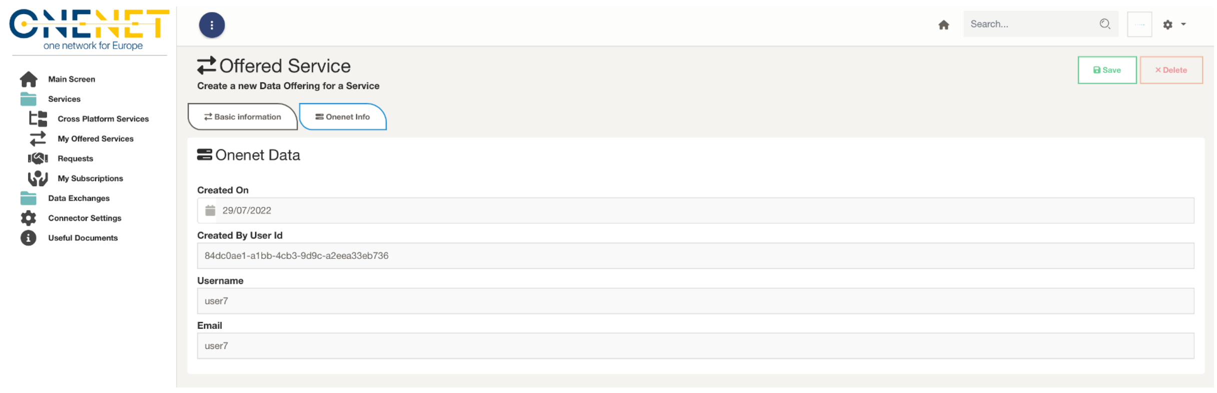
Custom Semantics
Check To Use Custom Semantics Or Uncheck To Use Semantics From Service

File Schema Sample

Profile Format

Profile Description

Screen 9: Adding a new cross-platform service offering.



Offered Service
Create a new Data Offering for a Service

Onenet Data

Created On
29/07/2022

Created By User Id
84dc0ae1-a1bb-4cb3-9d9c-a2eea33eb736

Username
user7

Email
user7

Screen 10: OneNet Info on my offered services.

7.3.4 Requests

This tab provides a listed summary of incoming requests from other OneNet users for the Offered services, as in Screen 11. The service can view the list of pending or already responded requests. The requests can be addressed by clicking the Edit button. The window that appears accordingly is on Screen 12, which, essentially, provides information about requesting user and company. From this tab, a service can even change the status of a service from “Accept” to “Reject.” Note that, once a request is accepted or rejected then it cannot change again.

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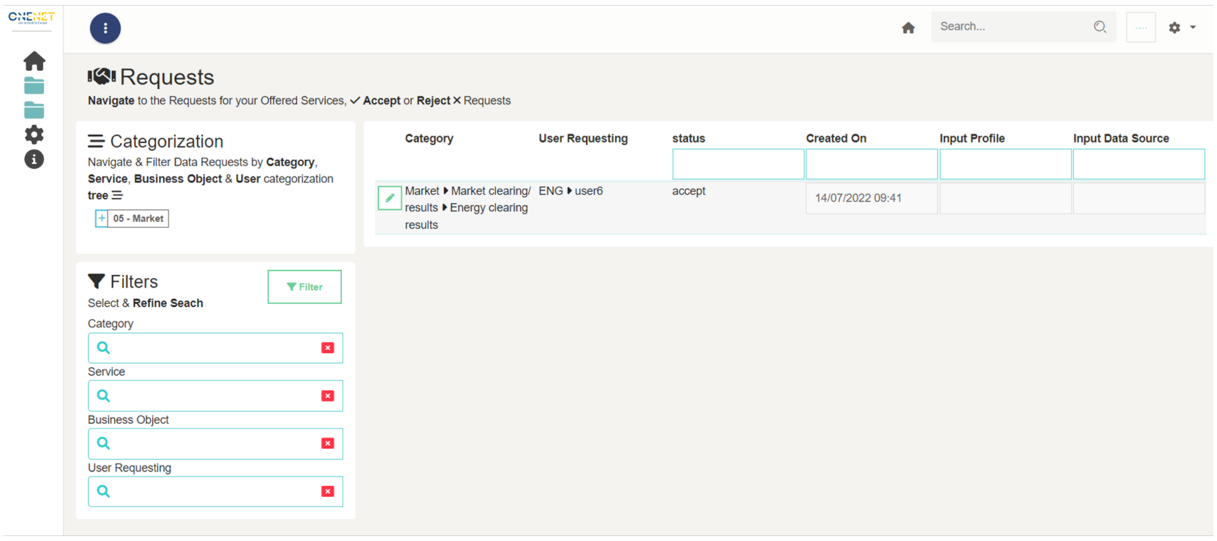

Requests

Navigate to the Requests for your Offered Services, ✓ **Accept** or **Reject** ✕ Requests

Categorization

Navigate & Filter Data Requests by **Category**, **Service**, **Business Object** & **User** categorization **tree**

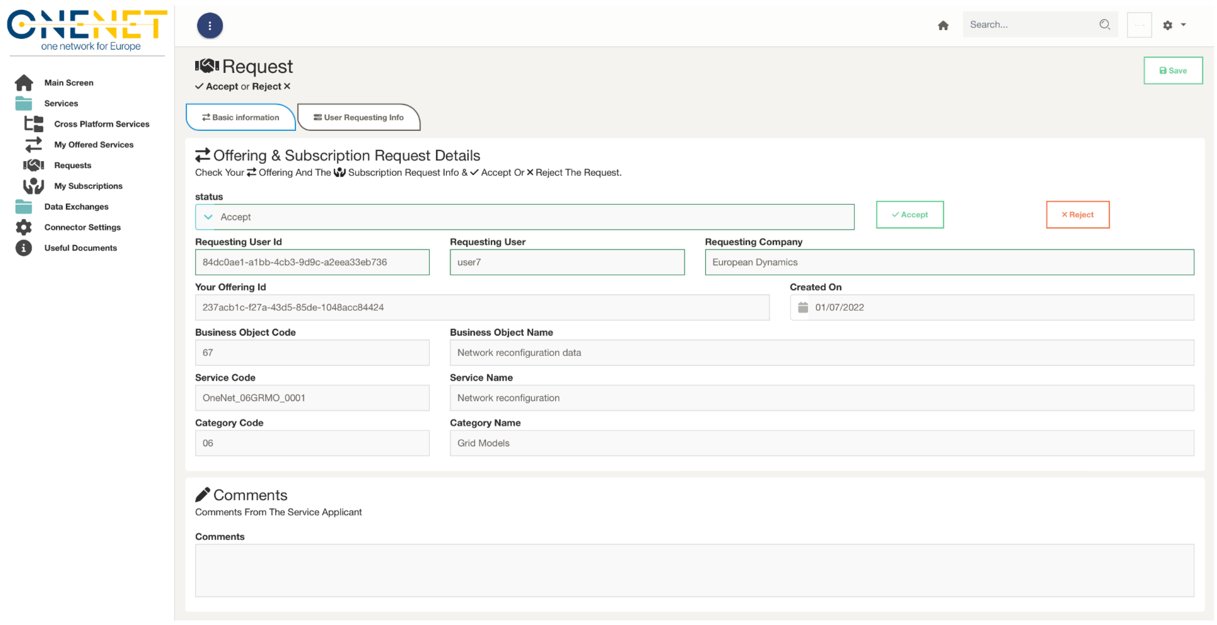
05 - Market

Filters

Select & **Refine Seach**

Category	User Requesting	status	Created On	Input Profile	Input Data Source
Market ▸ Market clearing/ results ▸ Energy clearing results	ENG ▸ user6	accept	14/07/2022 09:41		

Screen 11: Requests, incoming request for offered services.



Request

✓ **Accept** or **Reject** ✕

Offering & Subscription Request Details

Check Your Offering And The Subscription Request Info & ✓ Accept Or ✕ Reject The Request.

status	Accept
Requesting User Id	84dc0ae1-a1bb-4cb3-9d9c-a2eea33eb736
Requesting User	user7
Requesting Company	European Dynamics
Your Offering Id	237acb1c-f27a-43d5-85de-1048acc84424
Created On	01/07/2022
Business Object Code	67
Business Object Name	Network reconfiguration data
Service Code	OneNet_06GRMO_0001
Service Name	Network reconfiguration
Category Code	06
Category Name	Grid Models

Comments

Comments From The Service Applicant

Comments

Screen 12: Responding a request on offered service.

7.3.5 My subscriptions

Accordingly, the “My subscriptions” tab is for a user to make subscription to available services. The main screen on this tab is a listed summary of current subscriptions as in Screen 13.

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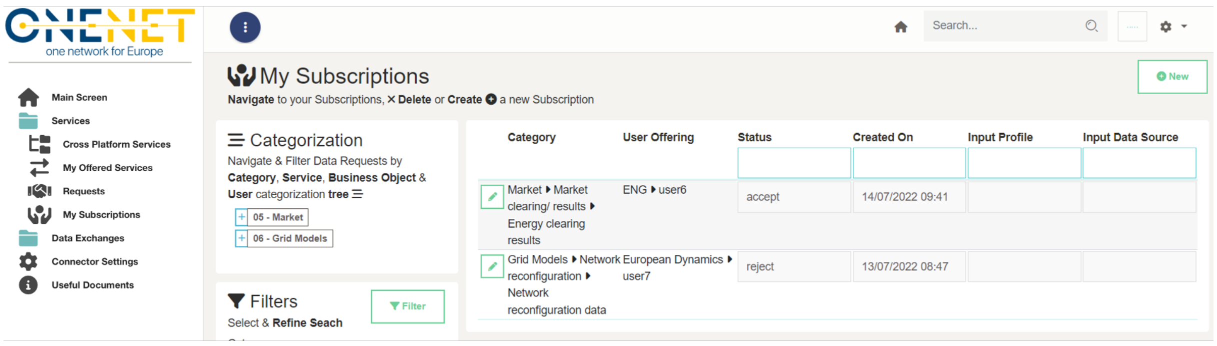

Main Screen
Services
Cross Platform Services
My Offered Services
Requests
My Subscriptions
Data Exchanges
Connector Settings
Useful Documents

Search...

My Subscriptions
Navigate to your Subscriptions, ✕ **Delete** or **Create** ⊕ a new Subscription

New

Categorization
Navigate & Filter Data Requests by **Category**, **Service**, **Business Object** & **User** categorization **tree**
05 - Market
06 - Grid Models

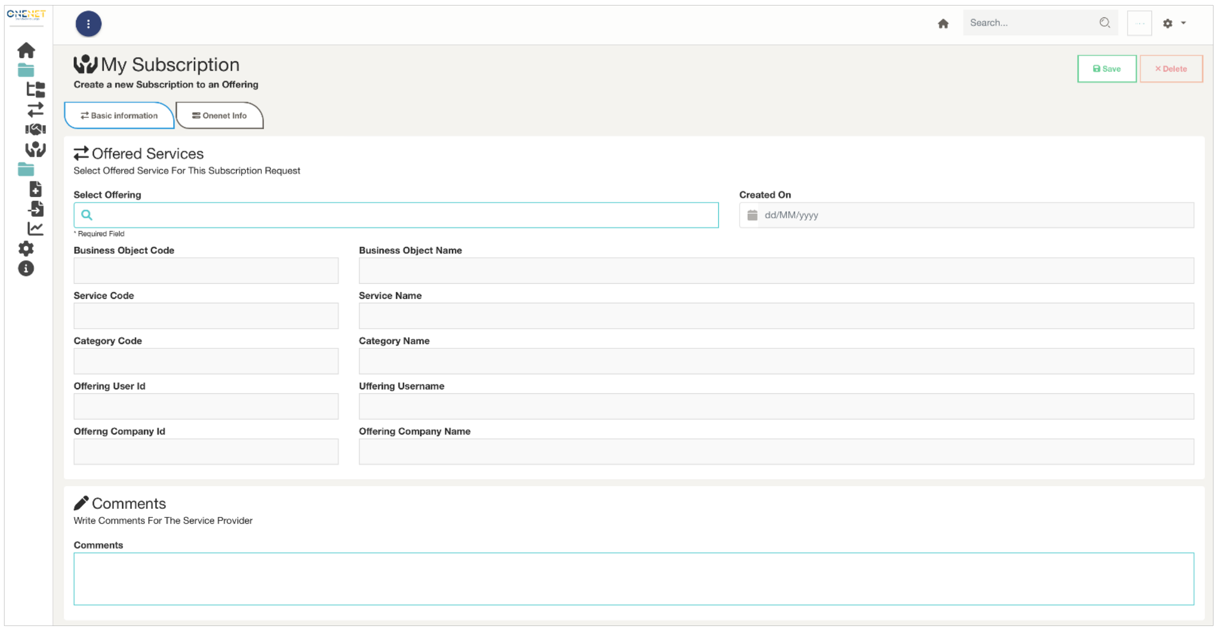
Filters
Select & **Refine Seach**

Filter

Category	User Offering	Status	Created On	Input Profile	Input Data Source
Market ▸ Market clearing/ results ▸ Energy clearing results	ENG ▸ user6	accept	14/07/2022 09:41		
Grid Models ▸ Network reconfiguration ▸ Network reconfiguration data	European Dynamics ▸ user7	reject	13/07/2022 08:47		

Screen 13: My subscriptions.

A user can make a new request to service providers by clicking the "New" button, where the tab that appear is on Screen 14.


Search...

My Subscription
Create a new Subscription to an Offering

Save
✕ Delete

Basic information
Onenet Info

Offered Services
Select Offered Service For This Subscription Request

Select Offering
* Required Field

Created On
dd/MM/yyyy

Business Object Code
Business Object Name
Service Code
Service Name
Category Code
Category Name
Offering User Id
Uffering Username
Offerng Company Id
Offering Company Name

Comments
Write Comments For The Service Provider
Comments

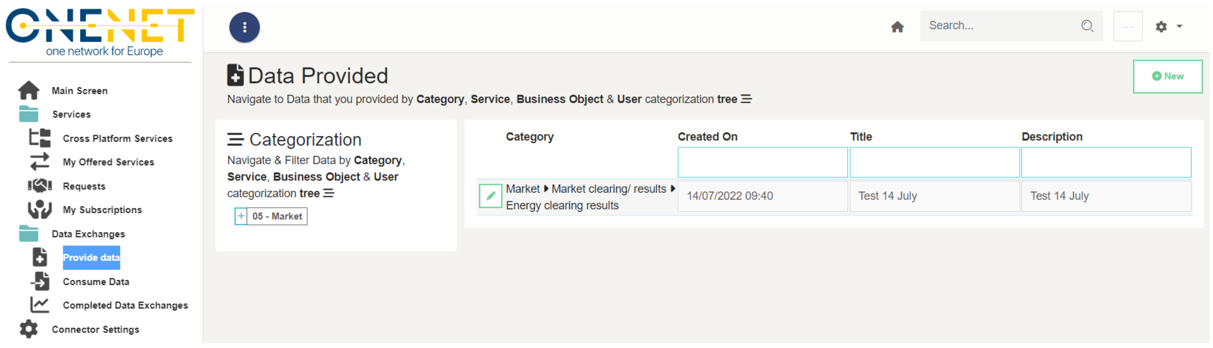
Screen 14: New subscription.

7.3.6 Data exchanges

The data exchanges framework is the one to perform actual data exchanges (data provision or consumption) among OneNet users serving offered services and subscriptions, accordingly. This framework is organized in three self-explanatory tabs: "Provide data", "Consume data" and "Completed Data Exchanges".

7.3.6.1. Provide data

In Screen 15, it is the main Provide data tab, where it presents a list of the current user's data item provisions. It is essential to note that for an existing data provision the file cannot be changed; due to issues related the operation of OneNet Connector. Therefore, the user might create a new entry for the data provision. To do so, the user must click on "New", where a window will pop up as in Screen 16.



Data Provided

Navigate to Data that you provided by **Category**, **Service**, **Business Object** & **User** categorization **tree**

Categorization

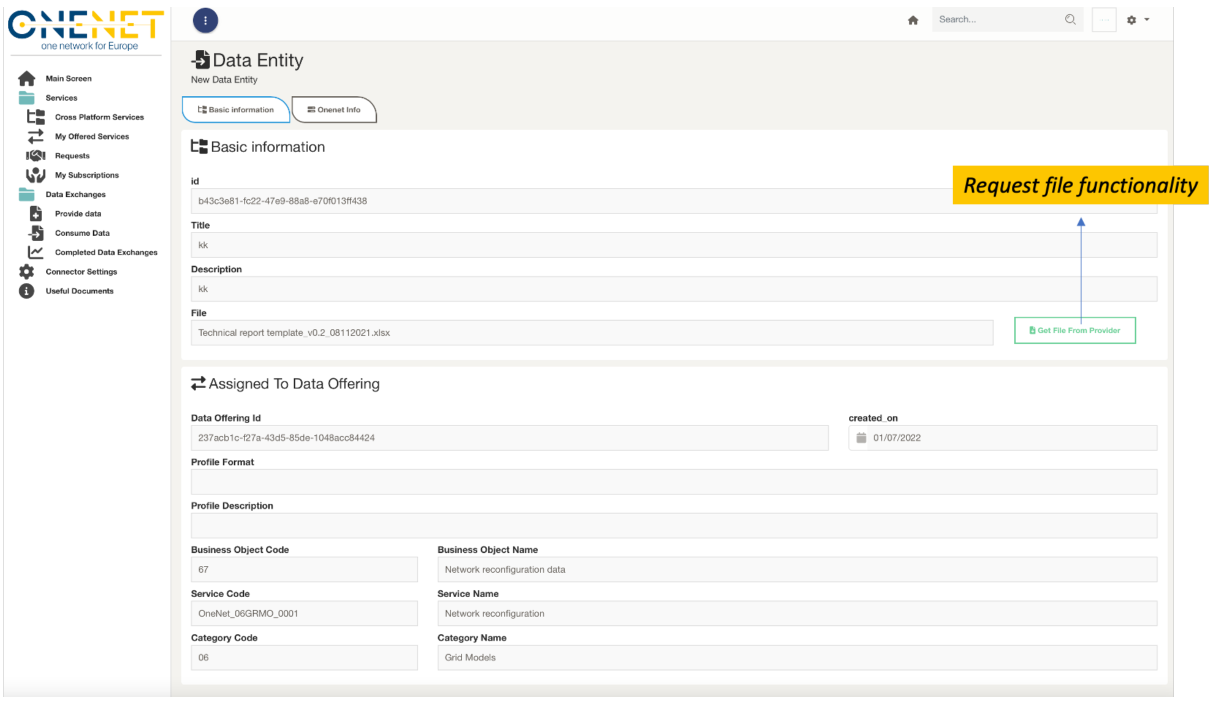
Navigate & Filter Data by **Category**, **Service**, **Business Object** & **User** categorization **tree**

05 - Market

Category	Created On	Title	Description
Market ▸ Market clearing/ results ▸ Energy clearing results	14/07/2022 09:40	Test 14 July	Test 14 July

Screen 15: Provide data tab

The user will have to assign the new data item with an existing offering and then upload a file through the upload file functionality. The input shall be aligned with the definition of the offered service in order the potential data consumer can utilize it.



Data Entity

New Data Entity

Basic information

id: b43c3e81-fc22-47e9-88a8-e70f013ff438

Title: kk

Description: kk

File: Technical report template_v0.2_08112021.xlsx

Assigned To Data Offering

Data Offering Id: 237acb1c-f27a-43d5-85de-1048acc84424

created_on: 01/07/2022

Profile Format:

Profile Description:

Business Object Code: 67

Business Object Name: Network reconfiguration data

Service Code: OneNet_06GRMO_0001

Service Name: Network reconfiguration

Category Code: 06

Category Name: Grid Models

Screen 16: Adding a new data item.

7.3.6.2. Consume data

This tab for consuming data provides listed information for available data items (related to My subscriptions services) -see Screen 17-. To consume any of these data items, a user needs to click on the data entity and a new pop-up will appear as in Screen 18, which provides multiple meta-data information about provided data. There

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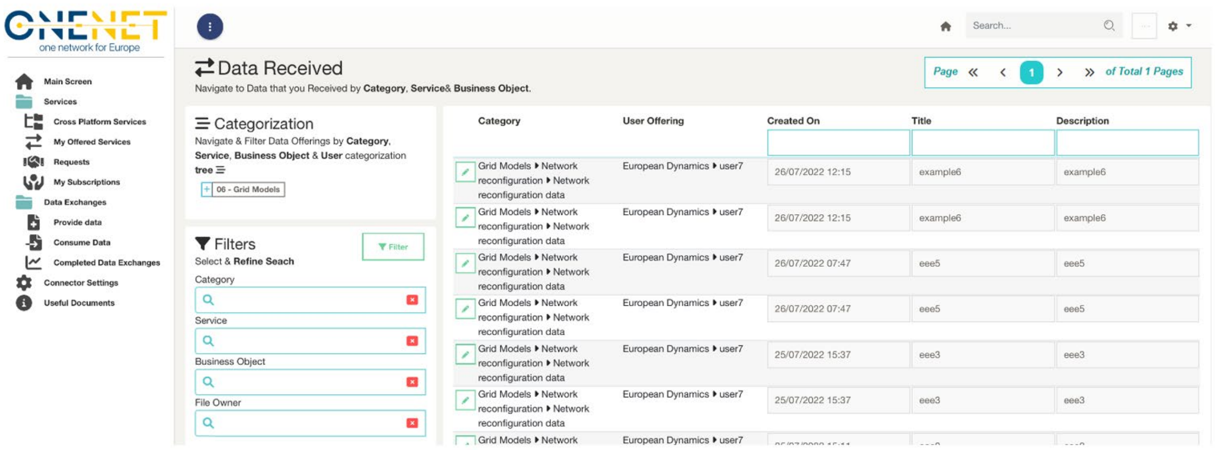
is this streamlined process of requesting the data by clicking a button as a download functionality, yet the UI deals in the backend to trigger the necessary processes related to IDSA and FTCs.



Data Received

Navigate to Data that you Received by **Category**, **Service**& **Business Object**.

Categorization

Navigate & Filter Data Offerings by **Category**, **Service**, **Business Object** & **User** categorization **tree**

06 - Grid Models

Filters

Select & **Refine Seach**

Category

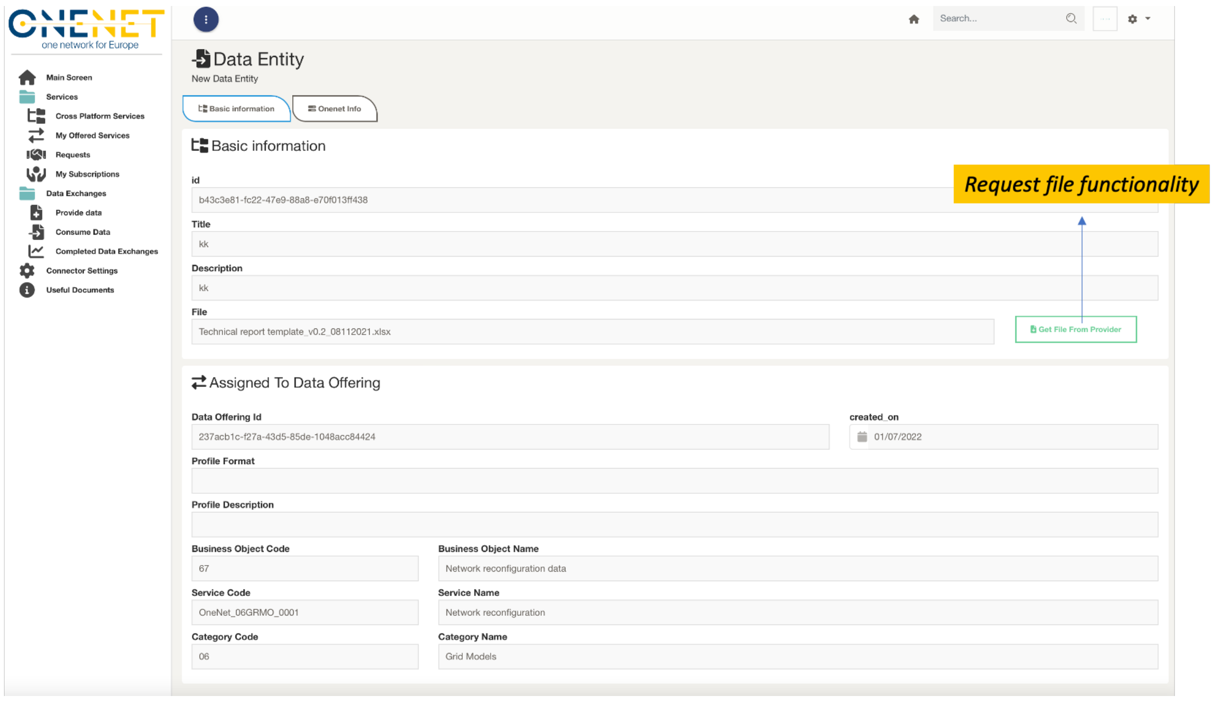
Service

Business Object

File Owner

Category	User Offering	Created On	Title	Description
Grid Models ▸ Network reconfiguration ▸ Network reconfiguration data	European Dynamics ▸ user7	26/07/2022 12:15	example6	example6
Grid Models ▸ Network reconfiguration ▸ Network reconfiguration data	European Dynamics ▸ user7	26/07/2022 12:15	example6	example6
Grid Models ▸ Network reconfiguration ▸ Network reconfiguration data	European Dynamics ▸ user7	26/07/2022 07:47	eee5	eee5
Grid Models ▸ Network reconfiguration ▸ Network reconfiguration data	European Dynamics ▸ user7	26/07/2022 07:47	eee5	eee5
Grid Models ▸ Network reconfiguration ▸ Network reconfiguration data	European Dynamics ▸ user7	25/07/2022 15:37	eee3	eee3
Grid Models ▸ Network reconfiguration ▸ Network reconfiguration data	European Dynamics ▸ user7	25/07/2022 15:37	eee3	eee3
Grid Models ▸ Network	European Dynamics ▸ user7	[illegible]	[illegible]	[illegible]

Screen 17: Consumer data tab.



Data Entity

New Data Entity

Basic information

id	b43c3e81-fc22-47e9-88a8-e70f013ff438
Title	kk
Description	kk
File	Technical report template_v0.2_08112021.xlsx

Assigned To Data Offering

Data Offering Id	237acb1c-f27a-43d5-85de-1048acc84424
created_on	01/07/2022
Profile Format	
Profile Description	
Business Object Code	67
Business Object Name	Network reconfiguration data
Service Code	OneNet_06GRMO_0001
Service Name	Network reconfiguration
Category Code	06
Category Name	Grid Models

Screen 18: Data entity information and get functionality.

7.3.6.3. Completed data exchanges

This tab provides an overview/history (see Screen 19) of completed data exchanges (data provided/consumed), where a user can check analytical information by clicking in any of those.

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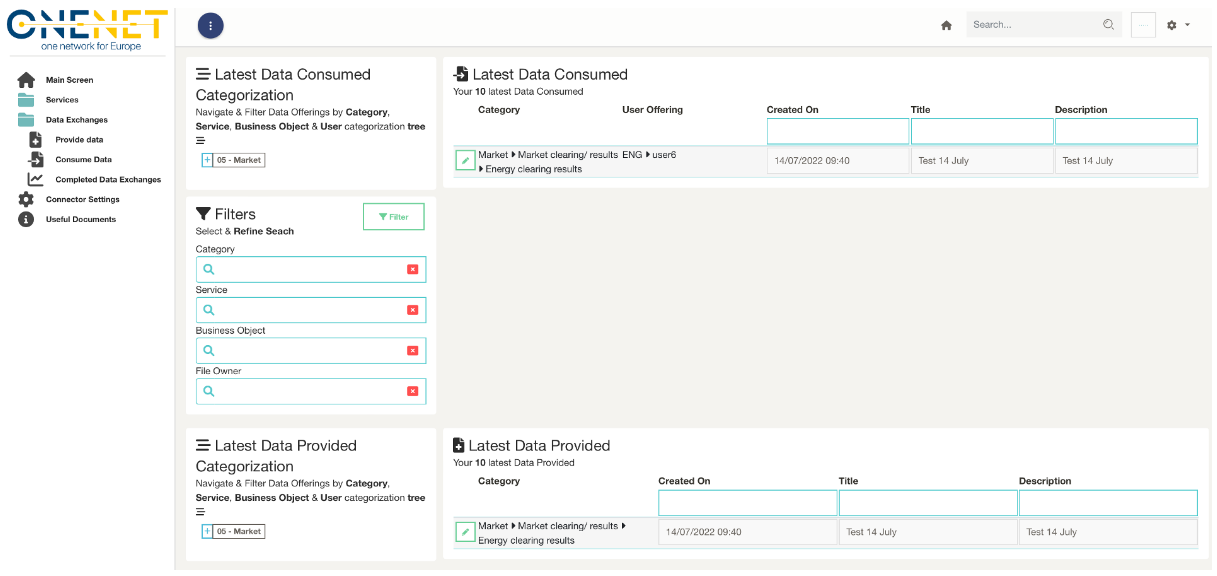


Latest Data Consumed Categorization

Navigate & Filter Data Offerings by **Category**, **Service**, **Business Object** & **User** categorization **tree**

05 - Market

Latest Data Consumed

Your **10** latest Data Consumed

Category	User Offering	Created On	Title	Description
Market ▸ Market clearing/ results ENG ▸ user6 ▸ Energy clearing results		14/07/2022 09:40	Test 14 July	Test 14 July

Filters

Select & **Refine Seach**

Filter

Category

Service

Business Object

File Owner

Latest Data Provided Categorization

Navigate & Filter Data Offerings by **Category**, **Service**, **Business Object** & **User** categorization **tree**

05 - Market

Latest Data Provided

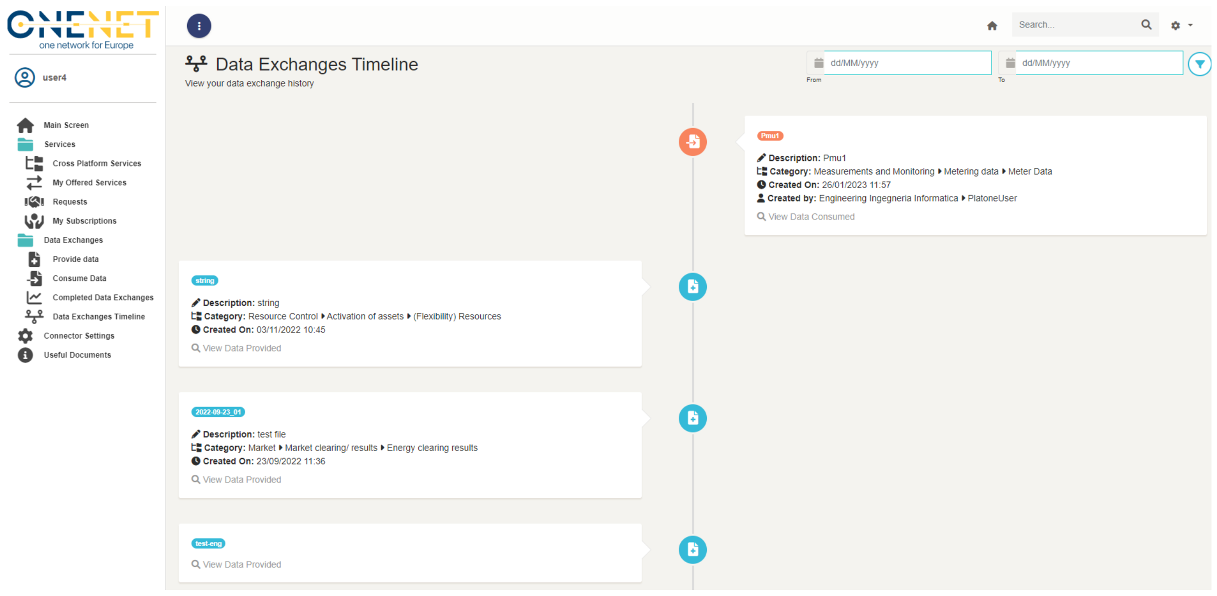
Your **10** latest Data Provided

Category	Created On	Title	Description
Market ▸ Market clearing/ results ▸ Energy clearing results	14/07/2022 09:40	Test 14 July	Test 14 July

Screen 19: Completed data exchanges tab.

7.3.7 Data Exchanges Timeline

This dashboard is a rather a visualized Timeline (see Figure 28) that contains all the completed data exchanges for the user. Essentially is a supportive dashboard to improve user’s experience, as multiple data exchanges are performed.



Data Exchanges Timeline

View your data exchange history

Pmu1

Description: Pmu1

Category: Measurements and Monitoring ▸ Metering data ▸ Meter Data

Created On: 26/01/2023 11:57

Created by: Engineering Ingegneria Informatica ▸ PlatoneUser

View Data Consumed

string

Description: string

Category: Resource Control ▸ Activation of assets ▸ (Flexibility) Resources

Created On: 03/11/2022 10:45

View Data Provided

2022-09-23_01

Description: test file

Category: Market ▸ Market clearing/ results ▸ Energy clearing results

Created On: 23/09/2022 11:36

View Data Provided

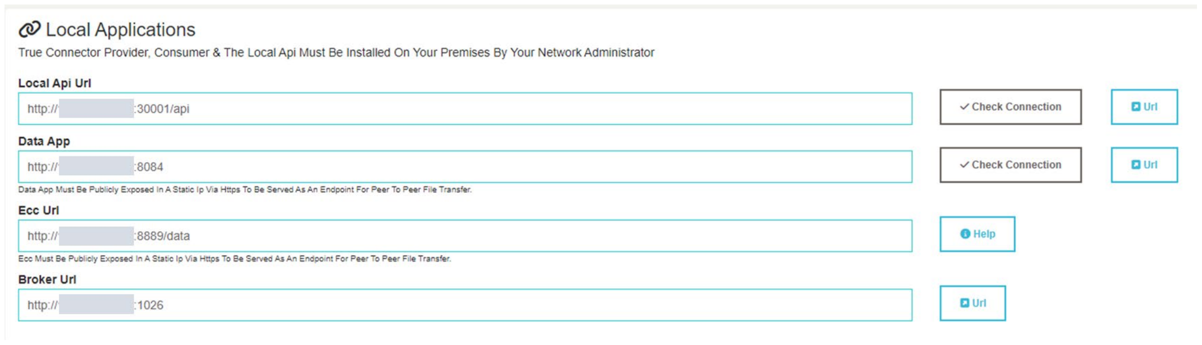
test-eng

View Data Provided

Figure 28 Data Exchanges Timeline.

7.3.8 Connector Settings

This tab is rather a configuration/setting one which provides the option to user to change the configuration files of the OneNet connector. Obviously, this can harm the connectivity and operation of the OneNet connector, therefore it is not suggested for typical (i.e., non-IT users) to test it. A user can have an overview of the actual endpoints configuration and test their connectivity (see Screen 20).



Local Applications

True Connector Provider, Consumer & The Local Api Must Be Installed On Your Premises By Your Network Administrator

Local Api Url: http:// [redacted] :30001/api

Data App: http:// [redacted] :8084

Data App Must Be Publicly Exposed In A Static Ip Via Https To Be Served As An Endpoint For Peer To Peer File Transfer.

Ecc Url: http:// [redacted] :8889/data

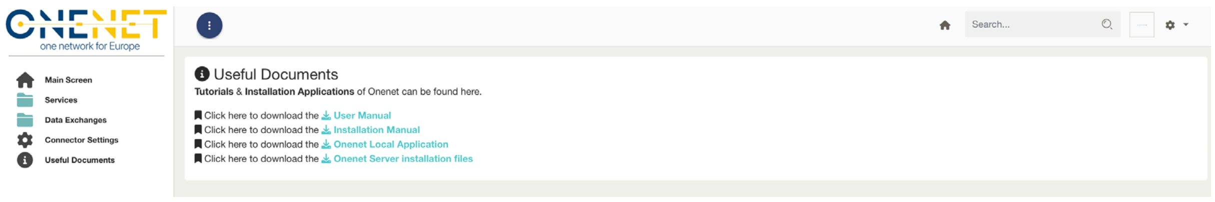
Ecc Must Be Publicly Exposed In A Static Ip Via Https To Be Served As An Endpoint For Peer To Peer File Transfer.

Broker Url: http:// [redacted] :1026

Screen 20: Connector settings.

7.3.9 Documents & Downloads

This tab provides useful documents (like the latest versions of the Manual and Deployment Guide) as well as for the latest S/W packages of OneNet (see Screen 21).



Useful Documents

Tutorials & Installation Applications of Onenet can be found here.

Click here to download the User Manual
Click here to download the Installation Manual
Click here to download the Onenet Local Application
Click here to download the Onenet Server installation files

Screen 21: Documents & Downloads

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