

13.09.2023

OneNet Architecture – Decentralised Middleware and Connector

Ferdinando Bosco



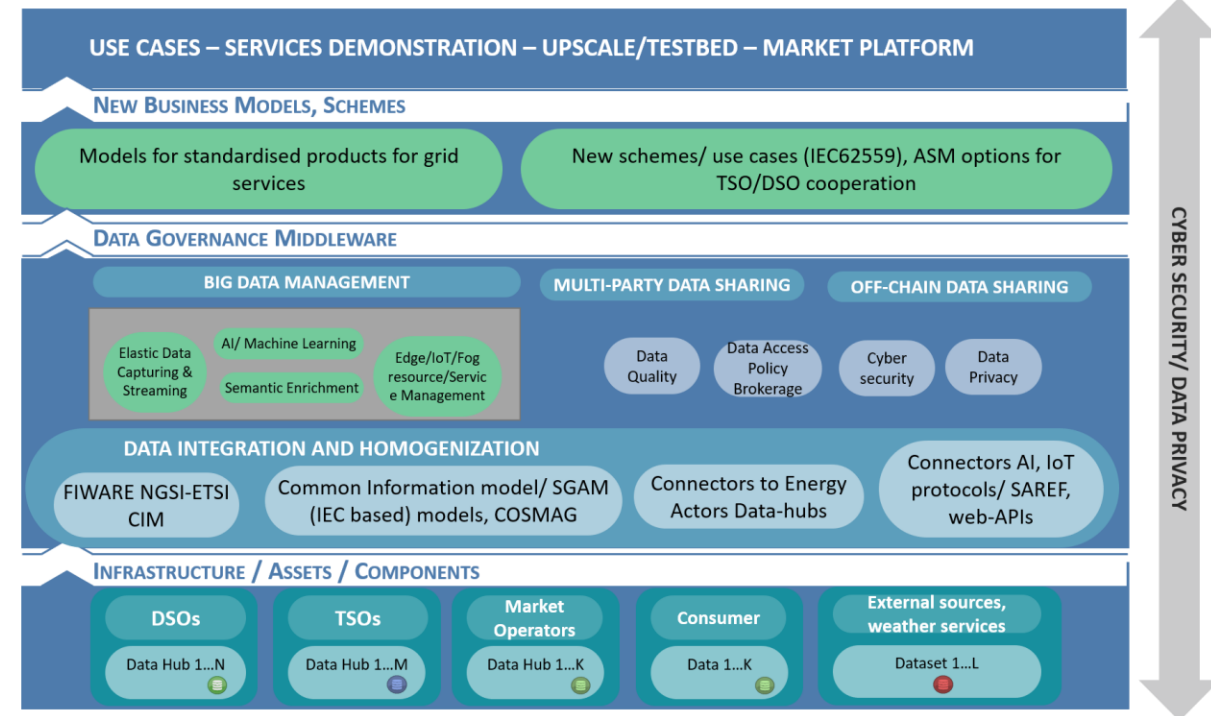
Antonello Monti



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 957739

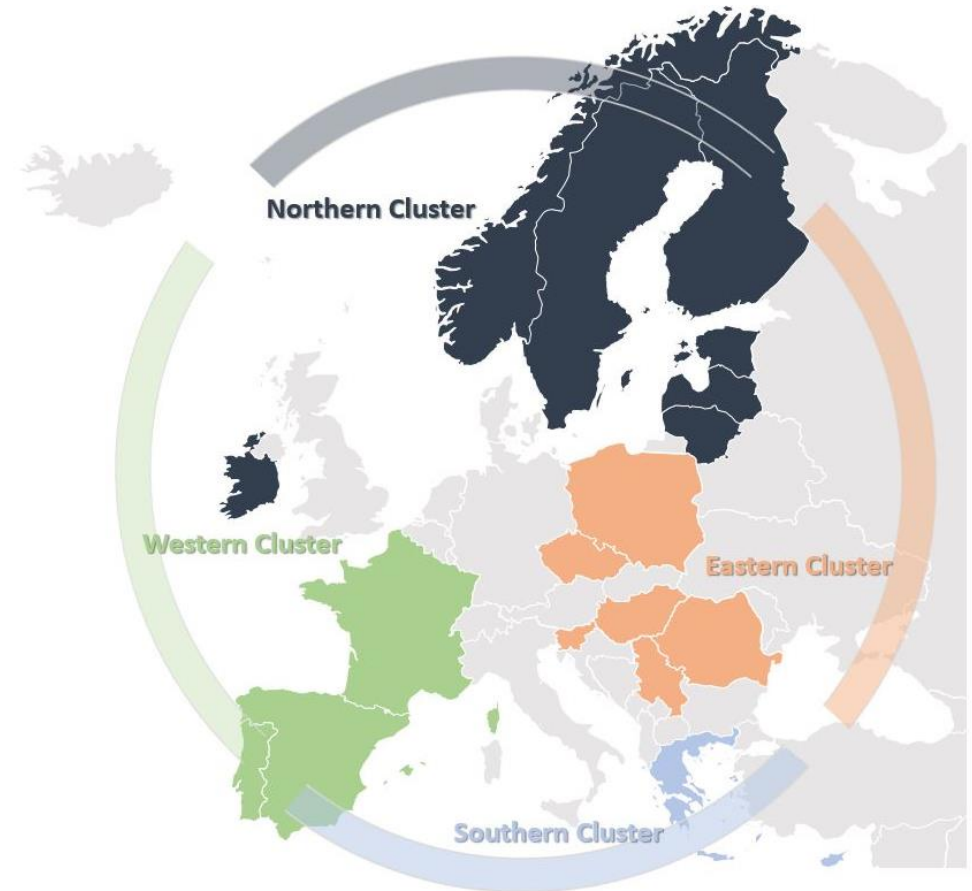
OneNet Vision

- To create a **fully replicable and scalable architecture** that enables
- the whole European electrical system to **operate as a single system** in which
- a **variety of markets** allows
- the **universal participation of stakeholders** regardless of their physical location – at every level from small consumer to large producers

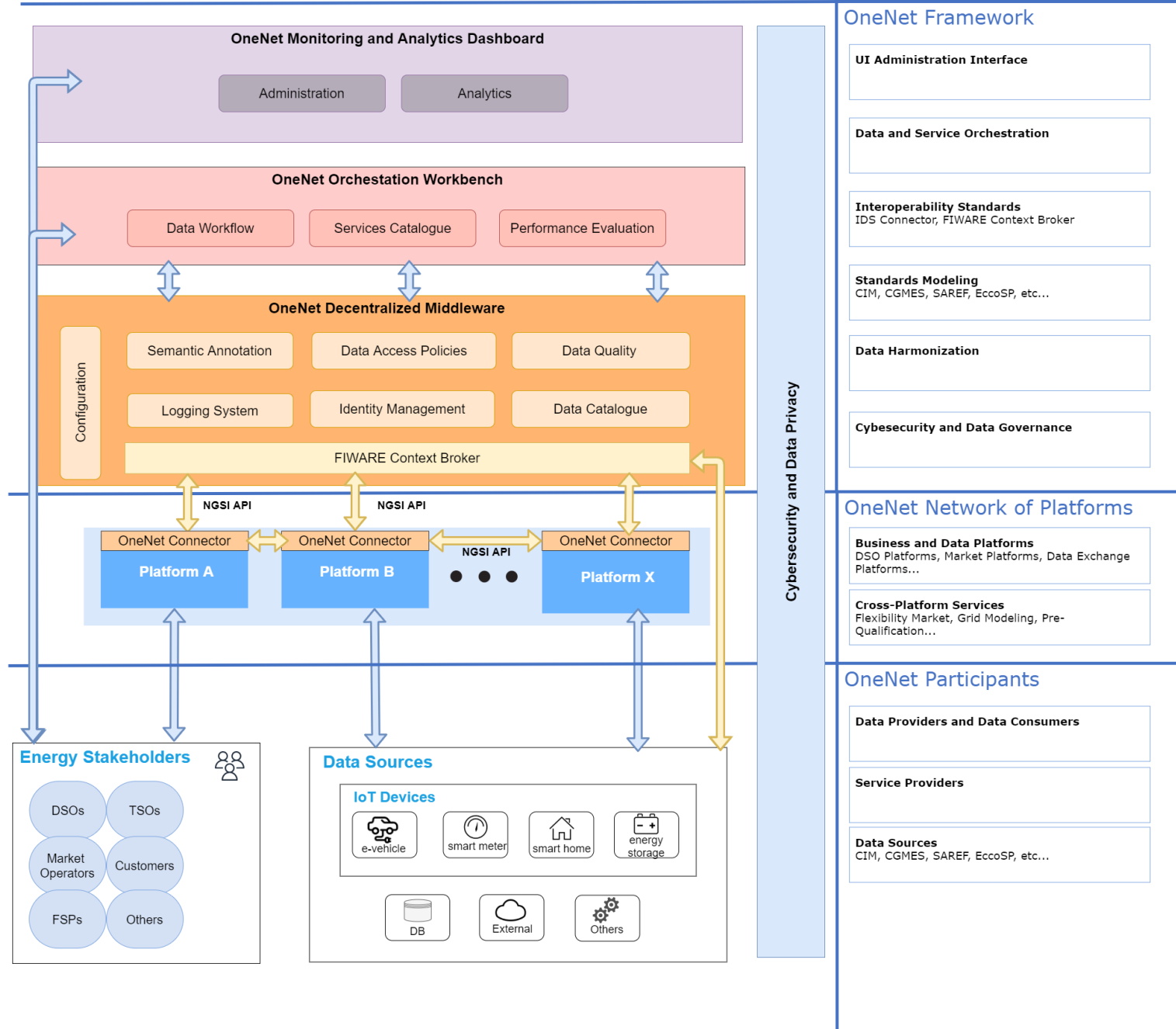


Demo clusters

- Several demos organized in 4 clusters covering the whole Europe
- Each cluster involving multiple DSO and TSO to implement completely new scenarios
- New market concepts tested in real life



OneNet Reference Architecture



- allows **cross-countries participation of stakeholders at all levels**, from TSOs to DSOs, from small consumers to large producers
- facilitates the **platforms integration and cooperation for cross-platform market and network operation services**
- makes **available and accessible data** from different sources (actors) in a **secure and trusted way ensuring data ownership and privacy**

OneNet Architecture – The Three Layers

OneNet Participants

Any kind of actor involved in the OneNet ecosystem. Can be divided into: data source, data provider, data consumer and service provider.

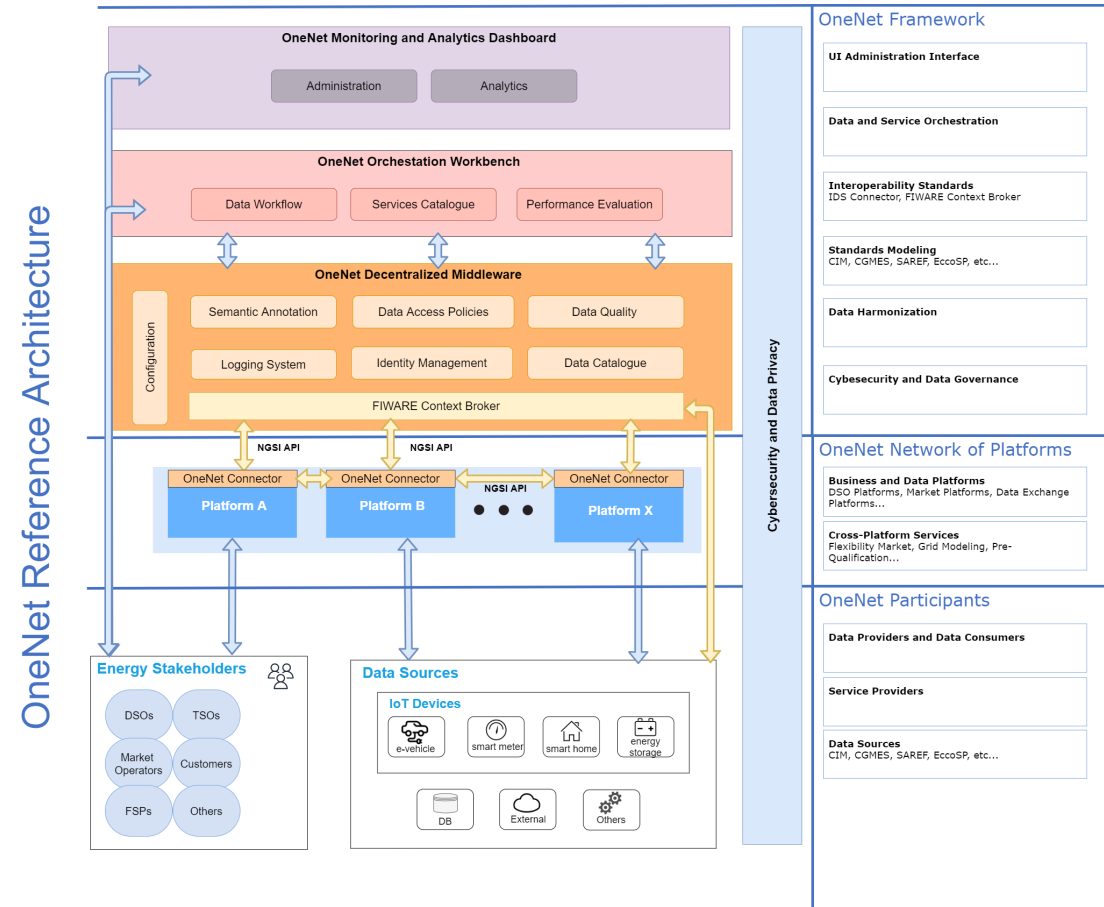
OneNet Network of Platforms

Any Demo Platform (e.g., DSO platforms, Market platforms, DEPs) able to connect with the OneNet Middleware using the OneNet Connector. It aims to be a P2P fully decentralised ecosystem for interoperability. In the OneNet Network of Platforms, two systems (OneNet Participants) can interact directly with each other, without intermediation by a third party.

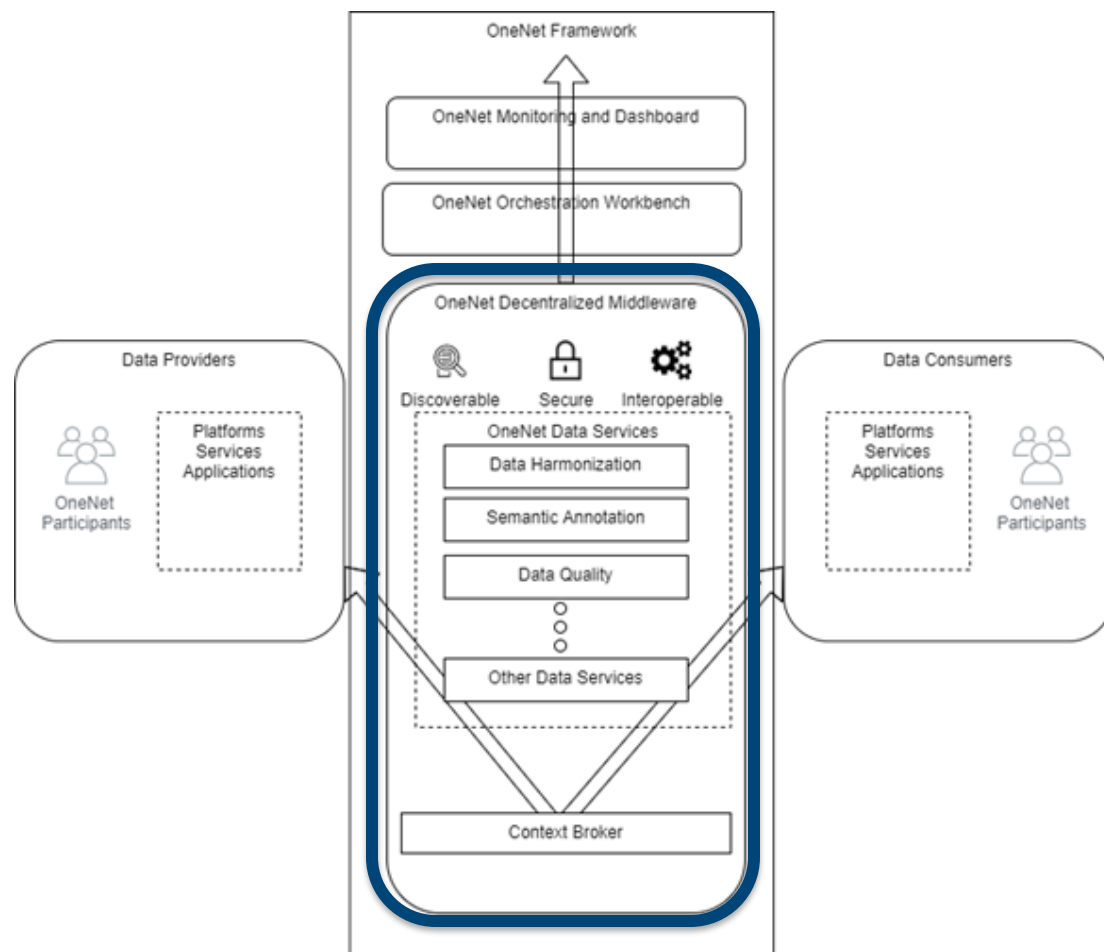
OneNet Framework

The core of the OneNet Architecture. It consists of three main components:

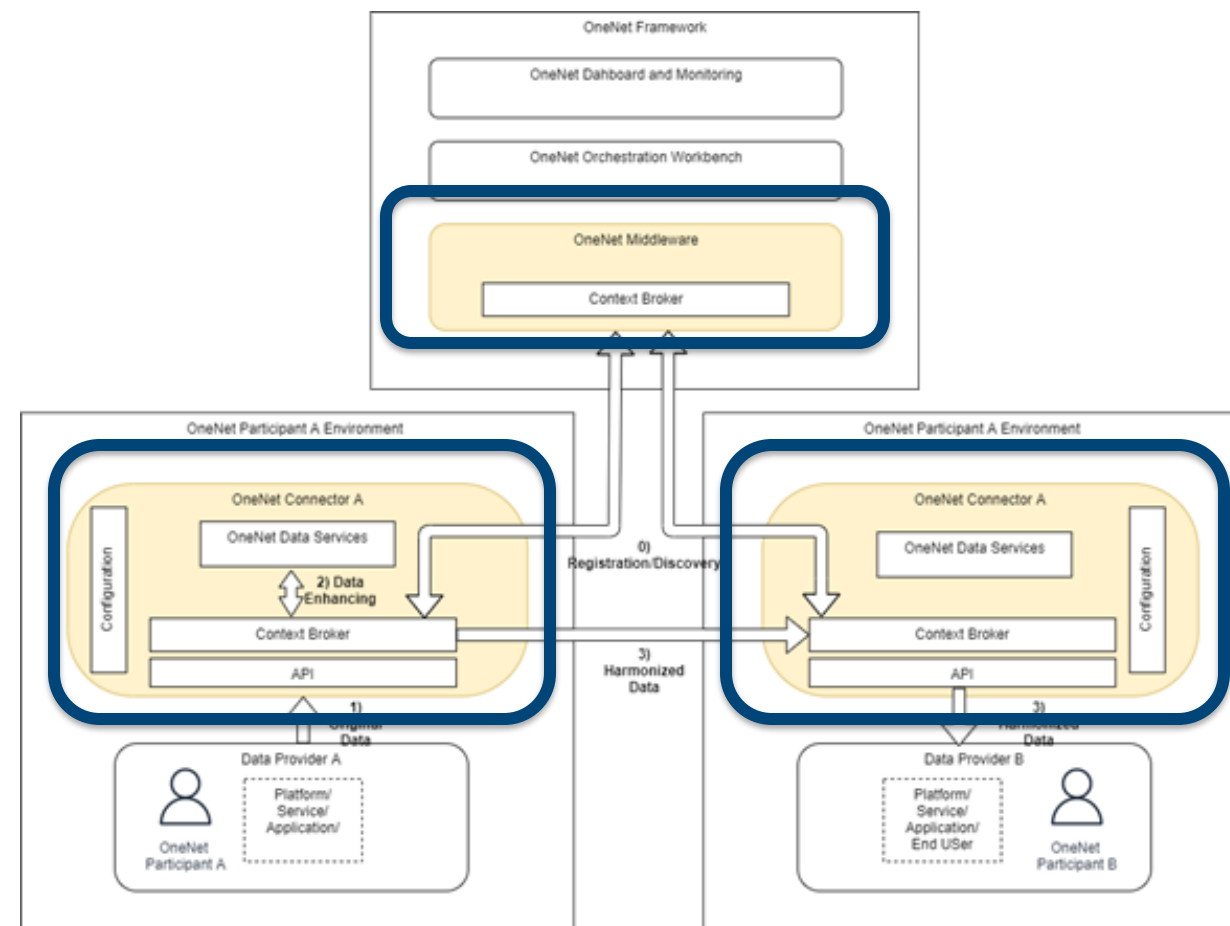
- OneNet Decentralized Middleware
- OneNet Orchestration Workbench
- OneNet Monitoring and Analytics Dashboard



Decentralized Approach



Logical View

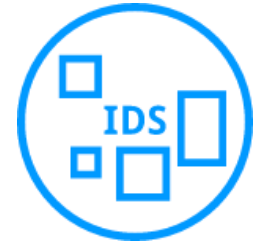


Deployment View

OneNet Middleware and Connector

OneNet Middleware

- enables a **secure and trust end-to-end data exchange** between OneNet Participants
- offers central features to all the OneNet participants like *identity management, sources discovery, semantic annotation, vocabularies and ontologies*



OneNet Connector

- follow the standards **IDS specifications**
- is a **decentralised instance of the OneNet Middleware**
- is **responsible for the execution of the complete data exchange process**
- each OneNet Participant is able to **deploy and configure its own connector**
- Context Broker in the OneNet connector is based on **FIWARE Orion Context Broker and NGSI-API**
- It also includes
 - **Configuration tool**
 - Set of **interoperable API** for the connection with already existing Platform/Application/Services
 - **OneNet Data Harmonization services**



OneNet Connector

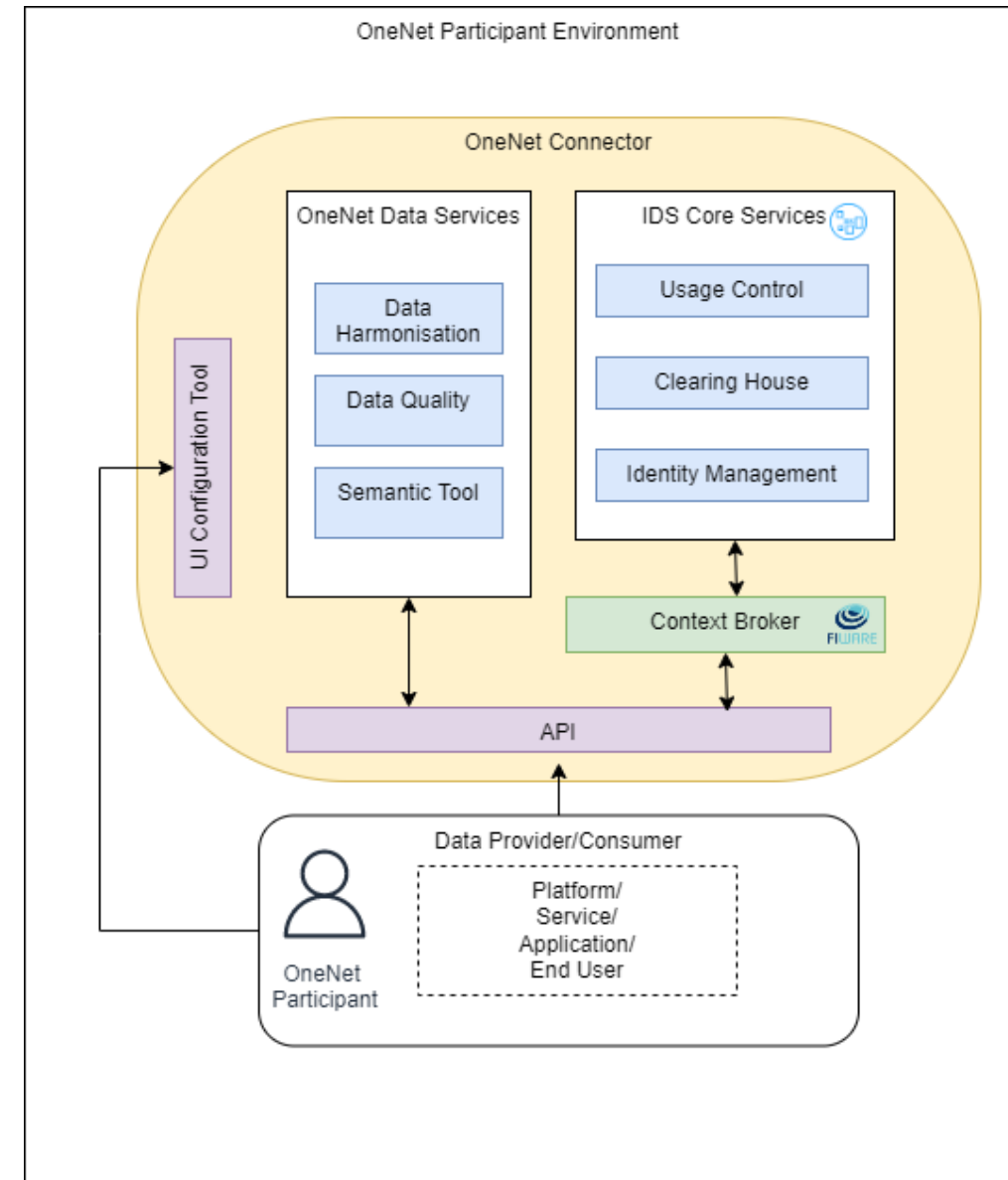
API for OneNet Participants

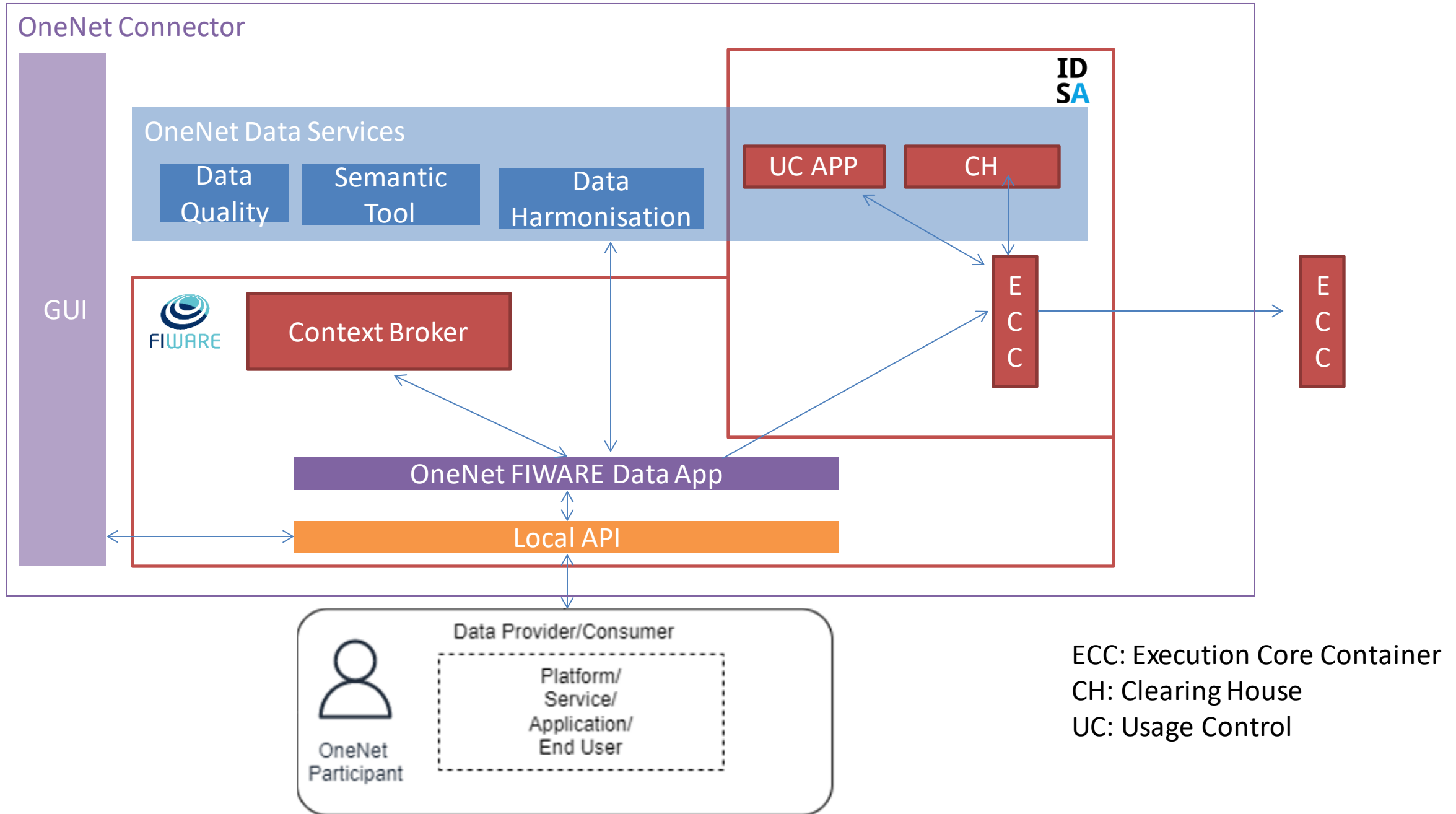
GUI for Connector Configuration and Usage

FIWARE Context Broker and NGSI-LD data exchange

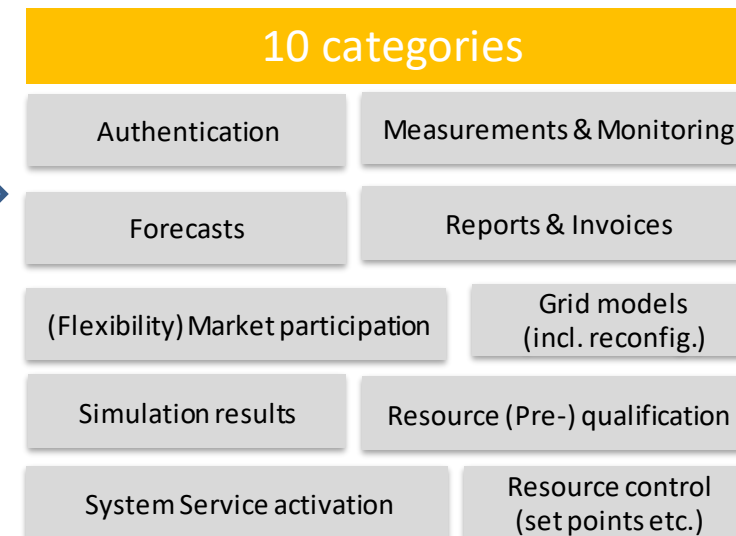
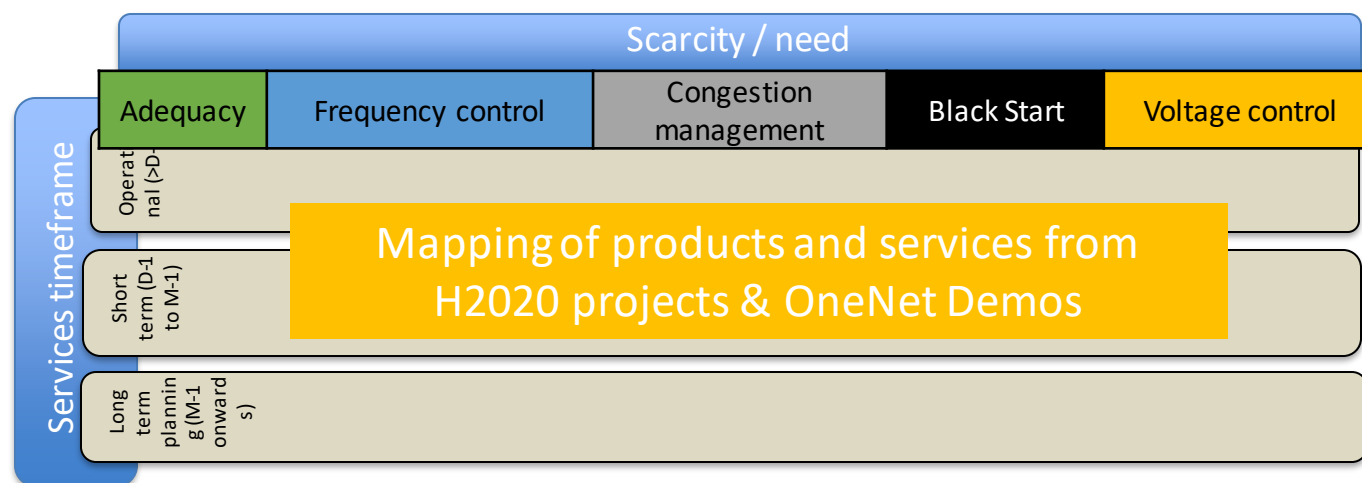
IDS Core services for IDS Trusted Environment

Additional OneNet Data Services (Data Quality, Data Harmonisation...)





Cross-platform Services



64 Cross-platform services

- | | |
|---------------------------------------|---------------|
| 1. Authentication and Authorization | (12 services) |
| 2. Measurements and Monitoring | (4 services) |
| 3. Forecasts | (6 services) |
| 4. Reports and Invoices | (6 services) |
| 5. (Flexibility) Market Participation | (12 services) |
| 6. Grid Models | (5 services) |
| 7. Simulation Results | (3 services) |
| 8. Resource (Pre-) Qualification | (3 services) |
| 9. System Service Activation | (2 services) |
| 10. Resource Control | (3 services) |

Cross-platform services (2)

For each Cross Platform Service identified:

- Description
- Method
- Data Producer and Consumers (mapped in “Harmonised Energy Role Model”)
- Business Objects exchanged
- Data quality Requirements
- Data format and standard data models

Category 03: Forecasts					
ID	Name	Methods	Description	Data Sender/ Producer	Data Receiver/ Consumer
OneNet_03FORC_0001	Forecast data (general)	Create (Post) Read (Get) Update (Put)	Communicate forecast data for environmental parameters, load, generation or storage upon request (Read) or by initiative (Create, Update). Power forecasts can be both related with the FSPs baseline or aggregated Load and RES forecast.	Data Exchange Platform (DEP) Operator (B), System Operator, Flexibility Services Provider	Data Exchange Platform (DEP) Operator (B), System Operator, Market Operator

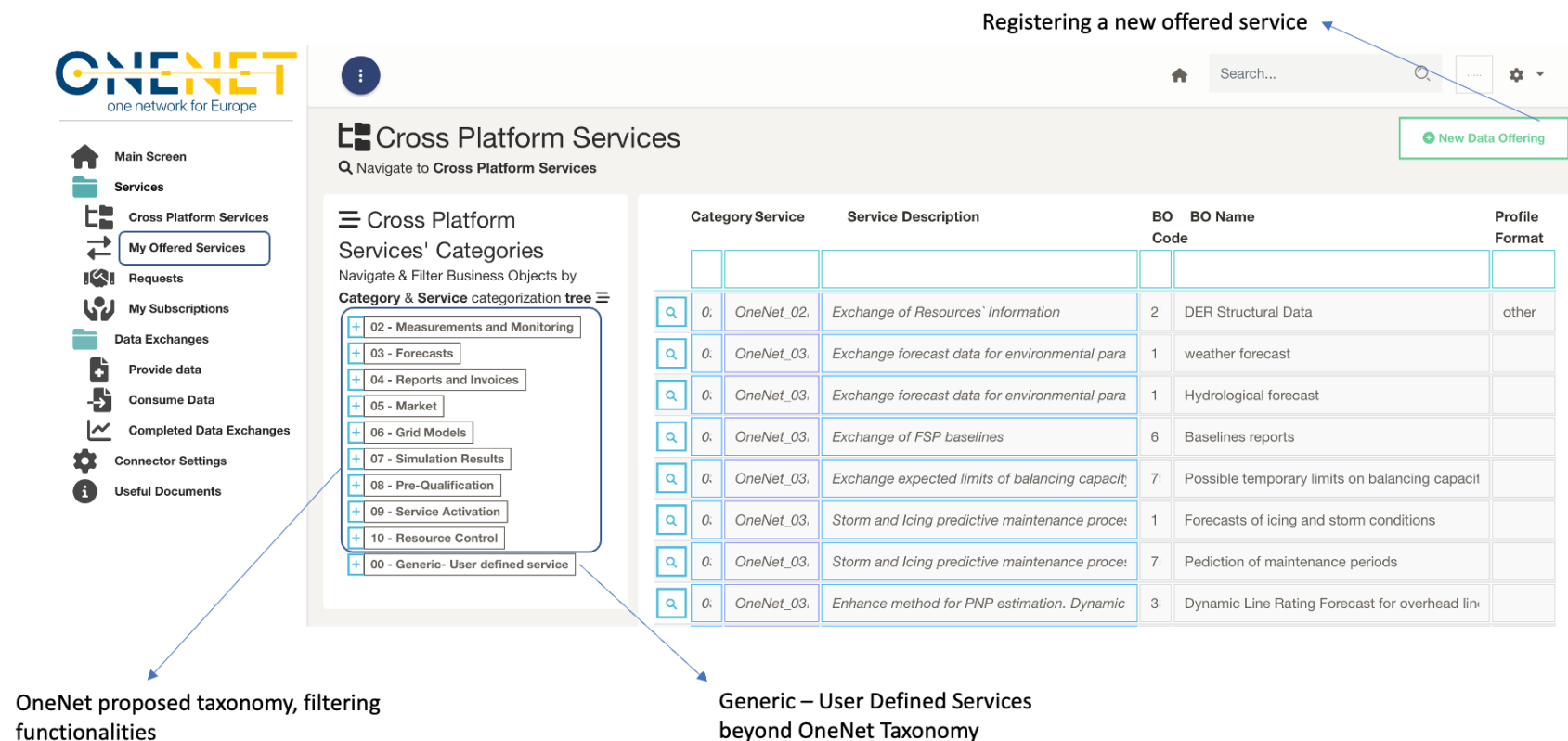
OneNet Service ID	Service Category	Business Object	Accuracy	Completeness	Consistency	Credibility	Currentness	Accessibility	Confidentiality	Efficiency	Compliance	Precision	Traceability	Understandability	Availability	Portability	Recoverability
OneNet_01AUTH_0005	Authentication and Authorization	Consent request	X	X					X			X			X		
OneNet_01AUTH_0007		Data rectification request	X	X	X								X				
OneNet_01AUTH_0008		Data deletion request	X	X	X								X				
OneNet_01AUTH_0009		Data usage information logs	X	X		X							X				
OneNet_01AUTH_0003		Delegated representation rights	X	X	X									X			
OneNet_01AUTH_0003		Details about representing party	X	X	X									X			
OneNet_01AUTH_0002		Identity information of data owner or delegated party	X	X					X			X					
OneNet_01AUTH_0002		Identity verification	X	X					X			X					
OneNet_01AUTH_0004		Consent/Refusal to data access	X	X	X									X			
OneNet_01AUTH_0006		Consent/Refusal to data access	X	X	X									X			
OneNet_01AUTH_0001		Authentication information report	X	X					X			X					
OneNet_02MEMO_0001	Measurements and Monitoring	DER Structural Data	X	X	X				X		X				X		
OneNet_02MEMO_0001		DER structural Data	X	X	X				X		X						
OneNet_02MEMO_0001		Flexibility needs (i.e., balancing,	X	X	X				X		X						

Business objects	OneNet ID (T5.3)	Service Name (T5.3)	Related BUC(s) (T5.3)	Short description of cross-platform data exchange/attributes incorporated (T5.3)	Data format (T5.6)
(Day ahead and Intra Day) Market Results	OneNet_04REIN_0003	Market results	Congestion Management and voltage violation elimination	Report: Day Ahead & Intra Day Results	IEC 62325-451-‘X’ standards, “publish auction results” & “publish trade results” covered in X=3. IEC 62325-451-7, provides contextual and assembly models.Includes MOL. IEC 62325-451-6 covers publishing of market information (e.g. related to the transparency platform).

OneNet Connector APIs and GUI

- Identified *Cross Platform Services*
- Categorised in 10 categories
- Offered through APIs and/or GUI
- Open for custom services
- Identified Data Profiles (CIM, other or custom) for each Cross Platform Service

Registering a new offered service



OneNet proposed taxonomy, filtering functionalities

Generic – User Defined Services beyond OneNet Taxonomy

Category	Service	Service Description	BO Code	BO Name	Profile Format
02	OneNet_02	Exchange of Resources' Information	2	DER Structural Data	other
03	OneNet_03	Exchange forecast data for environmental para	1	weather forecast	
04	OneNet_03	Exchange forecast data for environmental para	1	Hydrological forecast	
05	OneNet_03	Exchange of FSP baselines	6	Baselines reports	
06	OneNet_03	Exchange expected limits of balancing capacity	7	Possible temporary limits on balancing capacity	
07	OneNet_03	Storm and Icing predictive maintenance process	1	Forecasts of icing and storm conditions	
08	OneNet_03	Storm and Icing predictive maintenance process	7	Prediction of maintenance periods	
09	OneNet_03	Enhance method for PNP estimation. Dynamic	3	Dynamic Line Rating Forecast for overhead line	

OneNet advantages

- Open to all stakeholders
- “Standardised” processes & data
- Authorisation and Authentication of participants
- One-to-One secure data exchange
- Easy to use (Connector, open APIs)
- Scalable



Thank You

Uni.-Prof. Antonello Monti

Contact Information

Affiliation: Fraunhofer FIT

antonello.monti@fit.fraunhofer.de

Ferdinando Bosco

Contact Information

Affiliation: Engineering SpA

ferdinando.bosco@eng.it