



EU-SysFlex

WP5&9 WEBINAR

Demonstrations of easy access to data and easy access to flexibility market

25th of May, 2021

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 773505.



Agenda

10.00-10.10 Welcome and introduction

10.10-10.30 Improved access to data and market through interoperability of data and services – Kalle Kukk (Elering)

10.30-10.50 Data exchange use cases and “CIMification” – Eric Suignard (EDF)

10.50-11.10 Flexibility Platform demonstration – Philippe Szczech (AKKA), Simon Lilleeng (Enoco), Mandimby Ranaivo (AKKA)

11.10-11.30 Data Exchange Platform demonstrations – Aivo Olev (Cybernetica)

11.30-11.55 Q&A

11.55-12.00 Wrap-up

What is EU-SysFlex?

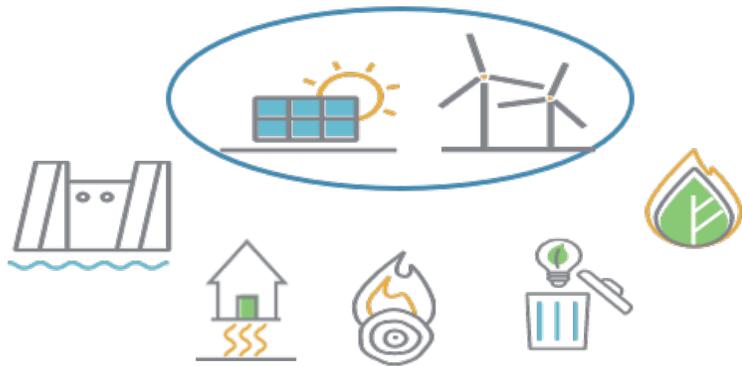
EU-SysFlex stands for pan-European system with an **efficient coordinated use of flexibilities** for the integration of a large share of **renewable energy sources**.

The overall objective is to ensure an **efficient and sufficient level of system services** are provided to facilitate meeting world-leading levels of renewables in electricity, while maintaining the level of **resilience** that consumers and society have come to expect from the **European electricity system**.

The project received **€20.3 M from EU's Horizon 2020**, the total budget is €26.5 M.

EU-SysFlex was launched in November 2017 and lasts **four years**.

Overall increase in system complexity



GREATER RELIANCE ON VARIABLE SOURCES OF ELECTRICITY

System Structure



BECOMING MORE DECENTRALISED AND DISTRIBUTED

ELECTRIFICATION OF HEAT, COOLING & TRANSPORT



LARGE SCALE DEPLOYMENT OF BATTERY STORAGE



SMARTER LIVING



CREATING A ROADMAP TO ADDRESS FUTURE SYSTEM OPERATION COMPLEXITIES

... 2050 >>> ELECTRICITY USE IS ESTIMATED TO INCREASE FROM 20% OF THE OVERALL EUROPEAN ENERGY USE TODAY TO 40% OF ENERGY NEEDS.

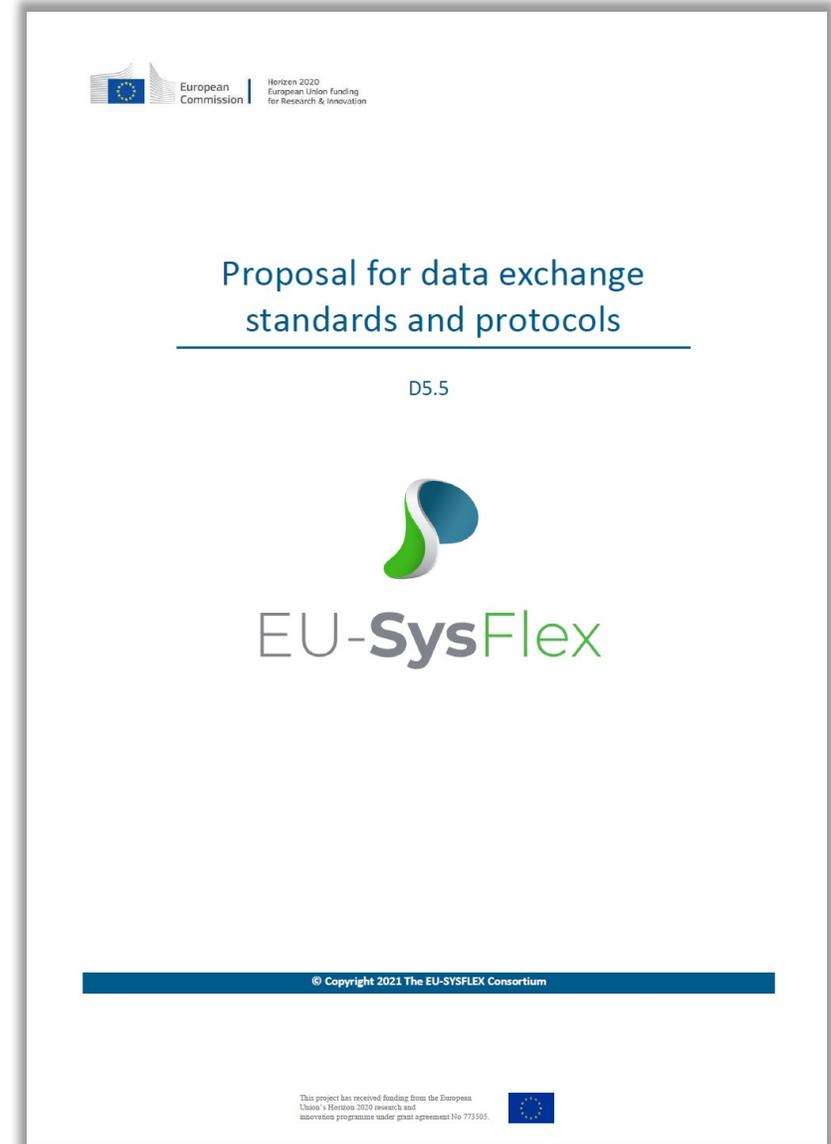
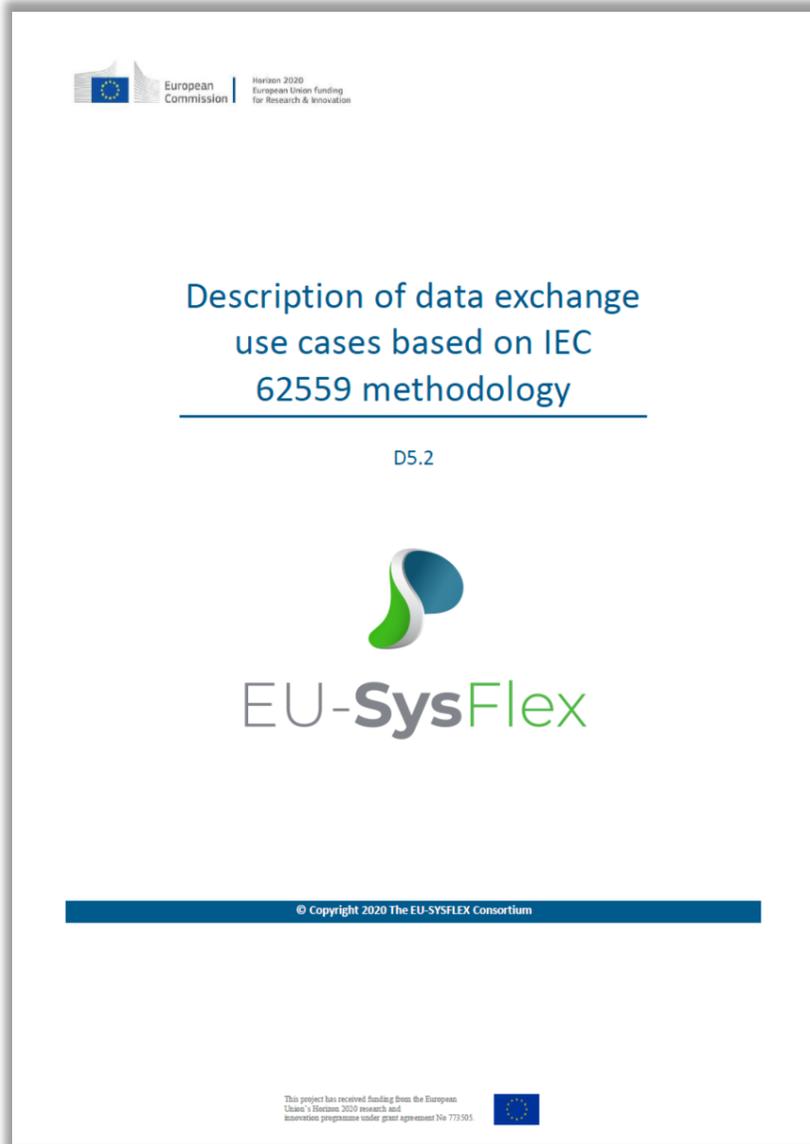


Scope of the webinar

- Two groups of demonstrators were implemented:
 - ❖ First, data arrangements needed for **flexibility market operation**, affordable access by flexibility end-providers through aggregator to market as well as single Flexibility Platform concept are demonstrated.
 - ❖ Second, the benefits of using **Data Exchange Platform** for any data exchanges are proven.
- These demonstrators are based on **data exchange System Use Cases** – 16 use cases were identified and described in the project. Some are fully independent of any business process (e.g. data access permission, data user authentication), some are specifically needed for flexibility market functioning (e.g. baseline calculation, flexibility provider prequalification).
- While system use cases describe the interoperability on the Function Layer, **standardisation** is more relevant on Information Layer and Communication Layer. Relevant initiatives, standards and specification were reviewed, gap analysis per each use case performed and proposals for further standardisation made. EU-SysFlex introduces the concept of “**CIMification**”.

Relevant deliverables:

<https://eu-sysflex.com/documents/>





EU-SysFlex

**Improved access to data and market through
interoperability of data and services**

Kalle Kukk (*Elering*)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 773505.



Customer-centric cross-border data exchange model for flexible market design serving all stakeholders (TSOs, DSOs, suppliers, flexibility providers, ESCOs, etc.).

The aim is NOT a single data exchange platform but ensure the **interoperability** of different solutions.

Regulation -> e.g. CEP, GDPR

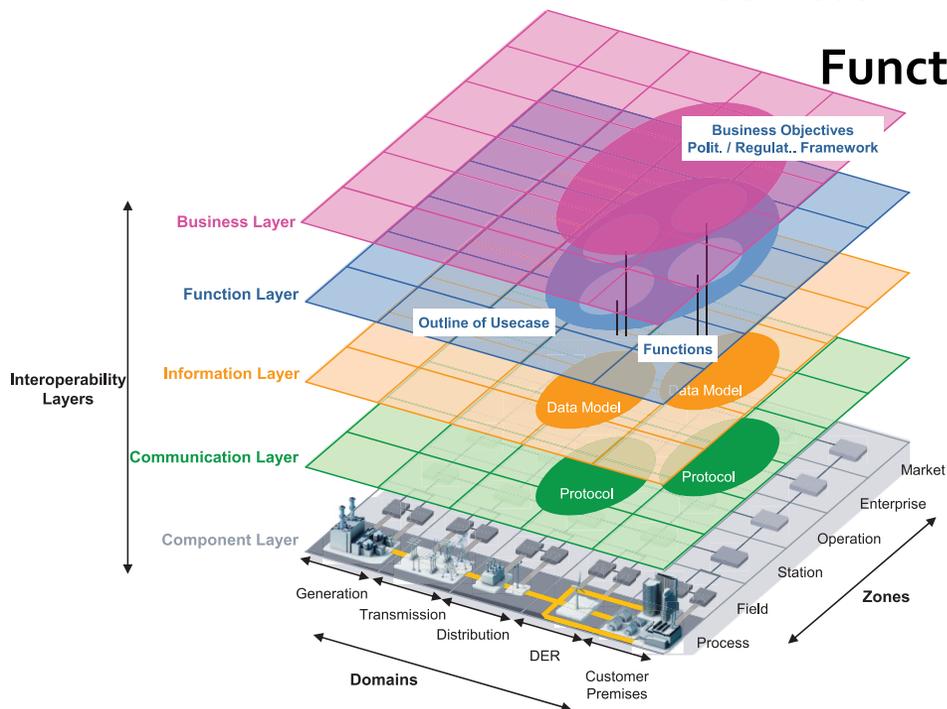
Business -> governance model, business use cases for data exchange demos

Functions -> data exchange system use cases, focus on private data

Information -> data semantics, standards' assessment, focus on CIM

Communication -> standards' assessment

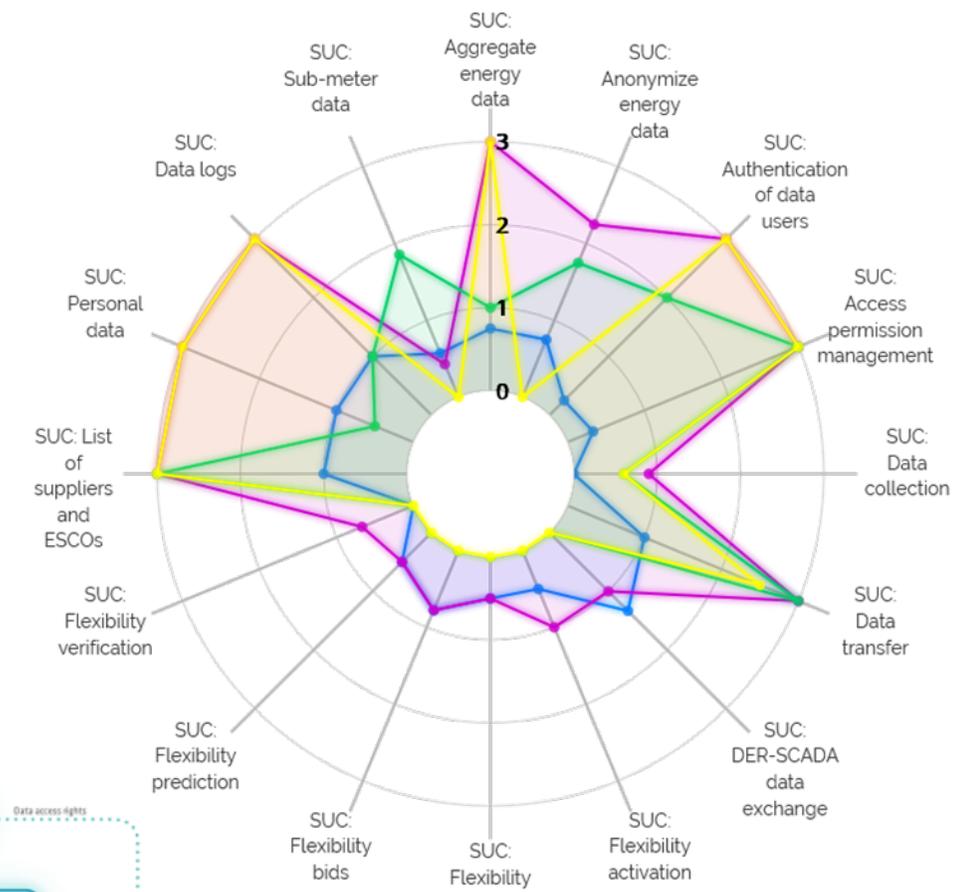
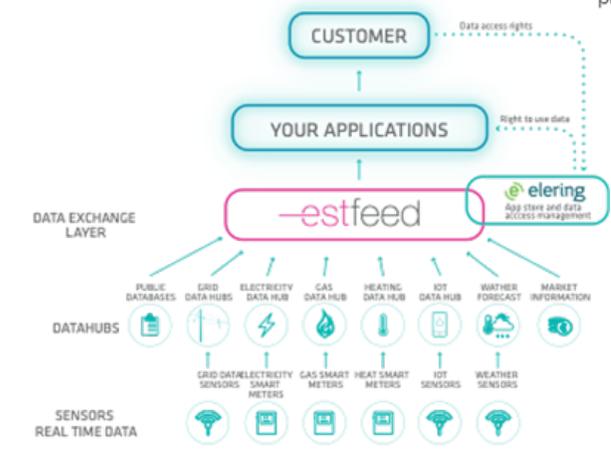
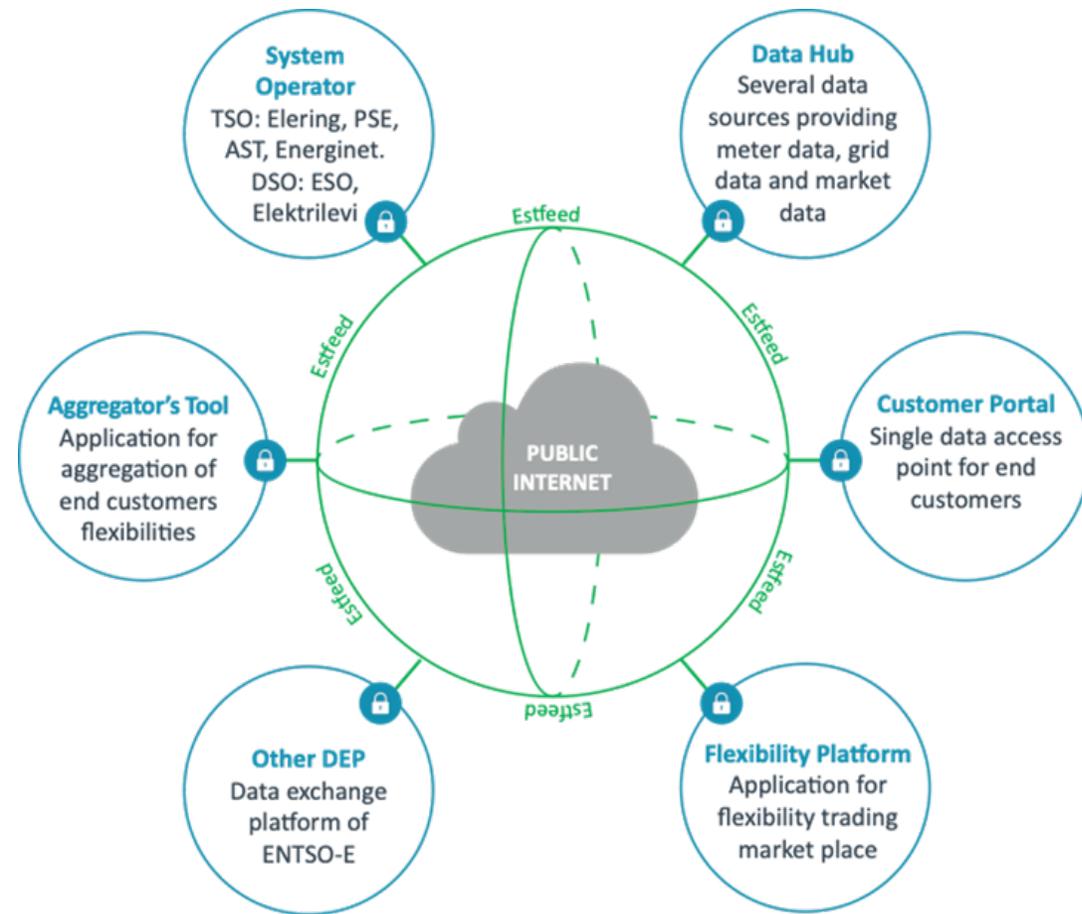
Components -> data platforms

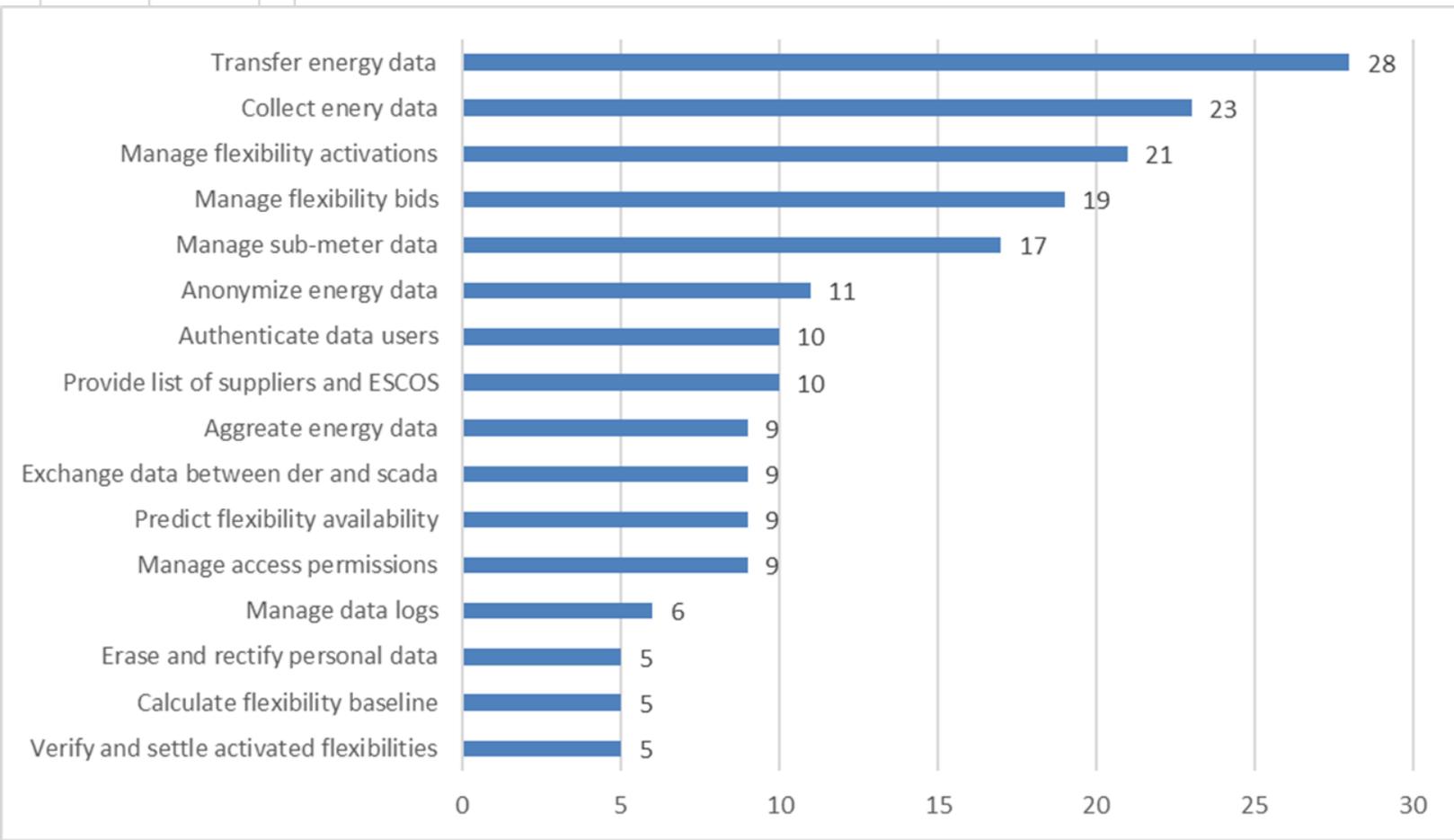
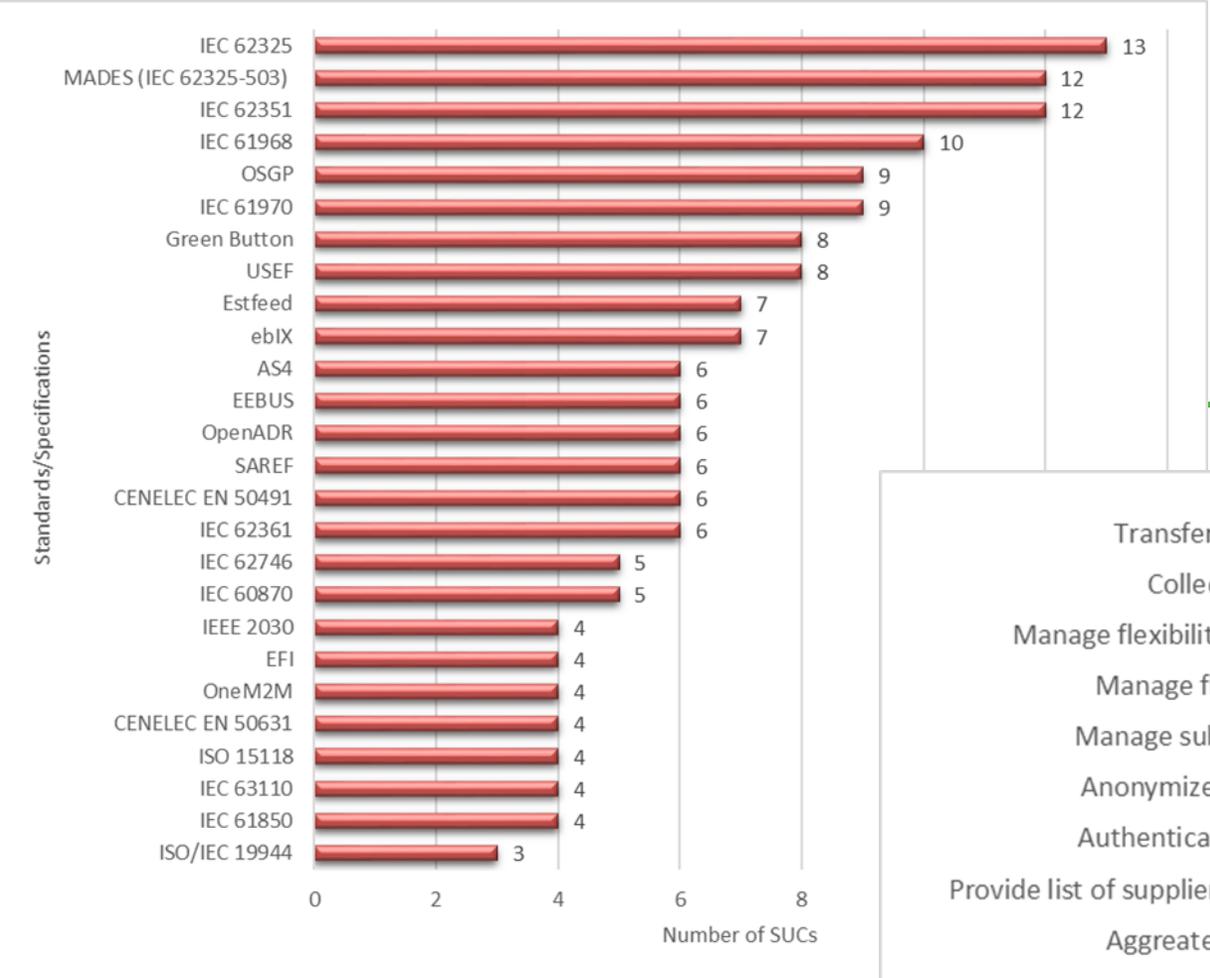


Solutions vs. Standards?

		Governance models			
		Industry-driven standardisation	Government-driven standardisation	Open-source solutions	Proprietary solutions
Data exchange models	Centralised			Data hubs	
	Decentralised	Bilateral data exchange			
	Distributed	Blockchain		Data exchange platforms	
	Hybrid				

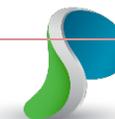
Country (name)	Data platform ownership	Data platform operator	Operational since (planned)	Connection points 2017
Netherlands (EDSN)	TSO and 7 DSOs	Private company owned by grid operators	2013/2018	15.7 Mil (inc. gas)
Estonia (Estfeed)	TSO	TSO	2012	0.75 Mil
Italy (SII)	The State	Third party	2016	37 Mil
Belgium (Atrias)	5 DSOs	Atrias*	2018	-
Denmark (DataHub)	TSO	TSO	2013/2016	3.3 Mil
Sweden (Data hub)	TSO	TSO	(2023)	5,3 Mil**
Finland (Datahub Oy)	TSO	TSO	(2021)	3.6 Mil**
Norway (ElHub)	TSO	Subsidiary of TSO	2019	3 Mil**

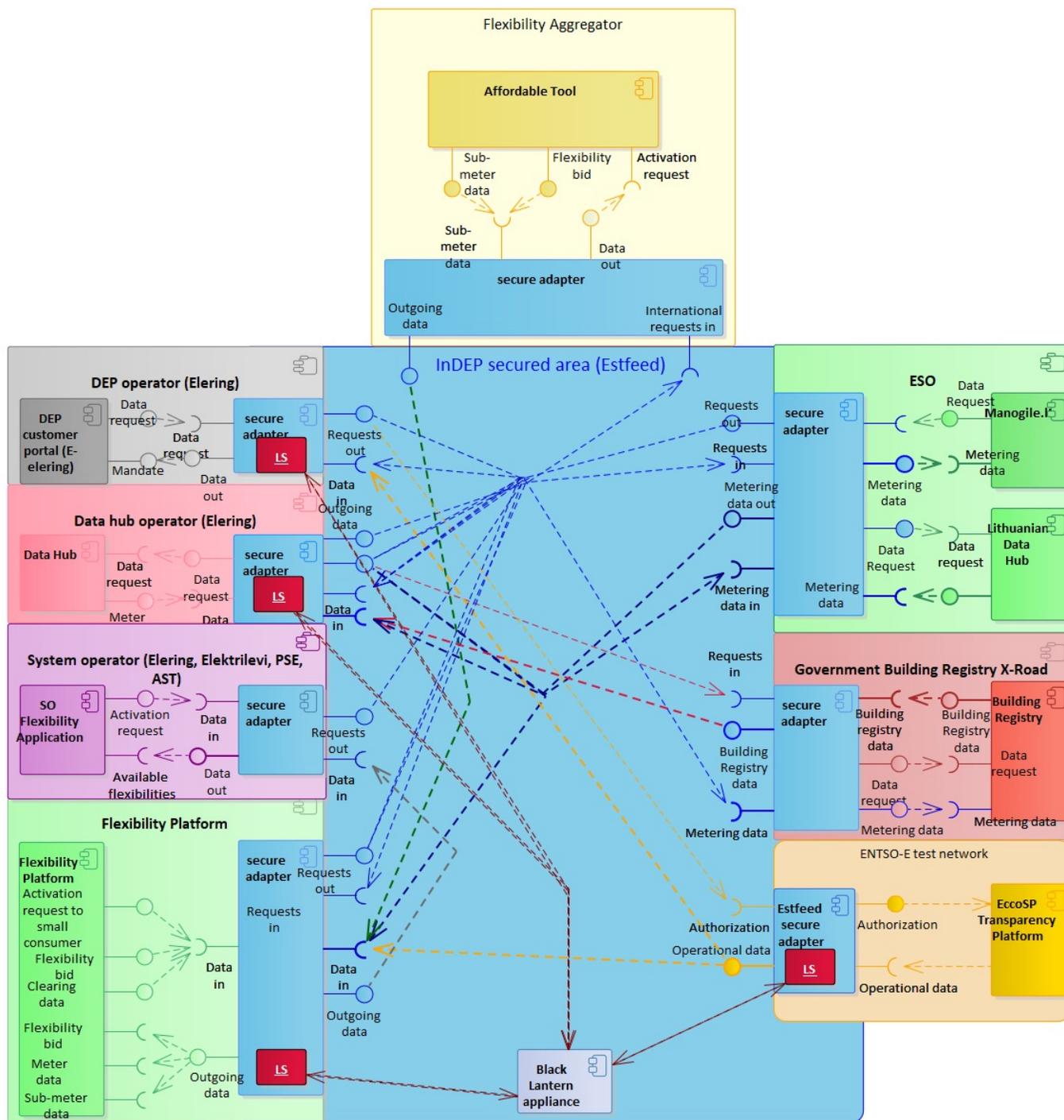




Coverage of data exchange SUCs by existing standards and specifications

USE CASE	Covered in existing standards and specifications?	Further CIM coverage needed?
Collect energy data	Green	May be needed
Transfer energy data	Yellow	Recommended
Provide a list of suppliers and ESCOs	Green	Not needed
Manage flexibility bids	Orange	May be needed
Manage flexibility activations	Yellow	May be needed
Verify and settle activated flexibilities	Yellow	May be needed
Manage access permissions	Orange	Recommended
Authenticate data users	Orange	Recommended
Manage data logs	Red	Recommended
Calculate flexibility baseline	Yellow	Recommended
Predict flexibility availability	Yellow	May be needed
Manage sub-meter data	Yellow	Recommended
Exchange data between DER and SCADA	Orange	Recommended
Anonymize energy data	Yellow	May be needed
Aggregate energy data	Yellow	May be needed
Erase, restrict and rectify personal data	Red	Recommended





Takeaways from demonstrators (1/3)

1. To ensure **interoperability of flexibility services** one needs to focus on data interoperability next to harmonising regulatory/business processes. “Flexibility Platform” addresses the issue of homogeneous and secure data management through DEP contributing to the participation of stakeholders across the geographical borders and of any asset.
2. “Affordable Tool” in the role of FSP enables to **bring smaller customers actively to the energy market** willing to sell flexibility by aggregating such customers, consuming data services provided by DEP, and using market services (e.g. bid submission, asset activation) provided by the Flexibility Platform.
3. Residents of one country are able to access their meter data and share the data with other stakeholders using services (e.g. consent management) provided by DEP located in another country. The biggest obstacle of **cross-border data exchange** is differing level of authentication available in different countries.

Takeaways from demonstrators (2/3)

4. Data providers and data users connected to different DEPs (ECCo SP, Estfeed) can exchange data by ensuring **interoperability of DEPs**. This was demonstrated for private data sharing use case whereby on platform benefitted from consent services provided by another platform.
5. Using dedicated **privacy-preserving technologies** (Sharemind in this case) it is possible to preserve data owner's privacy while allowing a third party application to receive a calculated result based on some private data (e.g. baseline calculation). Use of DEP (Estfeed) ensures that the data owner is aware that the data is used for just given (baseline calculation) purposes but in a privacy-preserving way.
6. **Cross-sector data exchange** was demonstrated which proposed a way to add value to users of one system (meter data hub) with data enrichment from another system (building register).

Takeaways from demonstrators (3/3)

7. DEP can transport to any third-party application results from **big data framework**, an end-to-end big data process was demonstrated: raw data are collected from external APIs, processed in batch and near-real time with AI algorithms, results are stored in a serving layer and are available through request/response API.
8. It is possible to integrate alternative **signing mechanisms to the critical logs** that provide the information about the data exchange and participants. The risk of losing critical data logs was reduced from the three aspects: a) signing with different technology; b) adding additional log storage; c) including anti-tamper infrastructure to an existing solution.
9. It would not take much effort to translate the original API of an implementation (e.g. "Flexibility Platform") into **CIM compliant API**, and to replace already implemented original API by CIM compliant API.

Types of interfaces defined and implemented

- Data management services
 - for consumers/prosumers – e-Elering (graphical user interface) (“ESO”, “Building Registry”, “Affordable Tool”)
 - for B2B (Business-to-Business) customers – Estfeed API (“Affordable Tool”, “Flexibility Platform”, “SO Application”, “ENTSO-E”, “Big Data Tool” “Baseline Application”)
- Energy market services (e.g. flexibility services) – Flexibility Platform interfaces for System Operators and Flexibility Service Providers, aggregator’s interface for end customers (“Affordable Tool”), interfaces of applications providing specific services (e.g. “Baseline Application”)

Questions & answers, discussion



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EU-SysFlex

DATA EXCHANGE SYSTEM USE CASES & CIM PROFILING

EU-SysFlex webinar – May 25th 2021

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 773505.



Agenda

- Data exchange System Use Cases
- CIM profiling



Agenda

- Data exchange System Use Cases
- CIM profiling



Data exchange System Use Cases

- Context
 - Given flexibility data exchanged in EU-SysFlex demonstrators, provide recommendations for **data management** in flexibility services when applied in a large scale (on an IT perspective), estimate the volume of data exchanges, work on the guidelines and requirements (cybersecurity, privacy, time constraints, handling massive flows of data, etc.) and provide recommendations at each level in order to ensure the **scalability of flexibility services**
- Objectives for Data exchange System Use Cases
 - Identification, description and analysis of **data exchange system use cases** necessary for business processes
 - Focus on System Use Cases that could impact the feasibility of **scaling up** flexibility services (on an IT perspective) and useful for demonstrations
 - System use cases will be applied and tested in a **cross-border** data exchange demonstrator

A few definitions

- **System Use Cases** describe how System and/or Business Roles of a given system interact to perform a Smart Grid Function required to enable / facilitate the business processes described in Business Use Cases. Their purpose is to detail the execution of those processes from an Information System perspective (source: IEC/TS62913-1)

E.g. Access to metering data, Data exchange between DER/aggregators and SCADA

- A **System Role** describes a finite set of functionalities that is assumed by an entity (devices, information system, equipment) (source: IEC/TS62913-1)

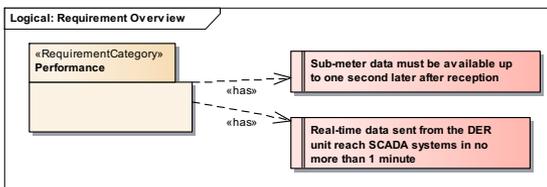
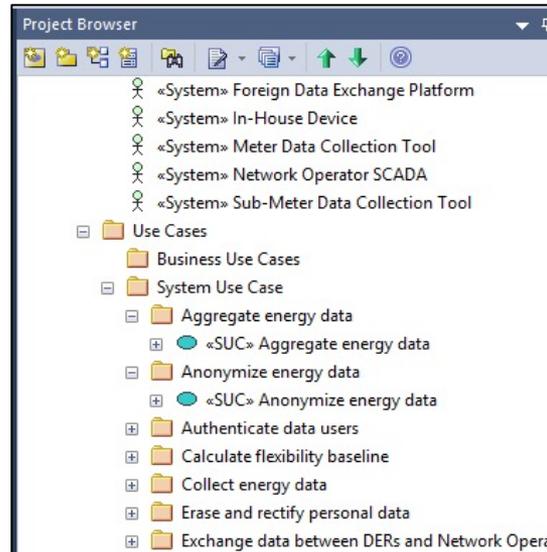
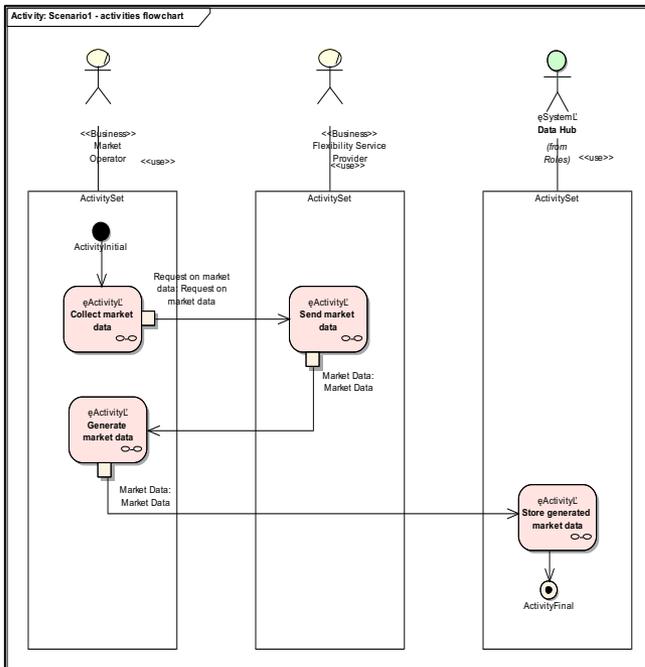
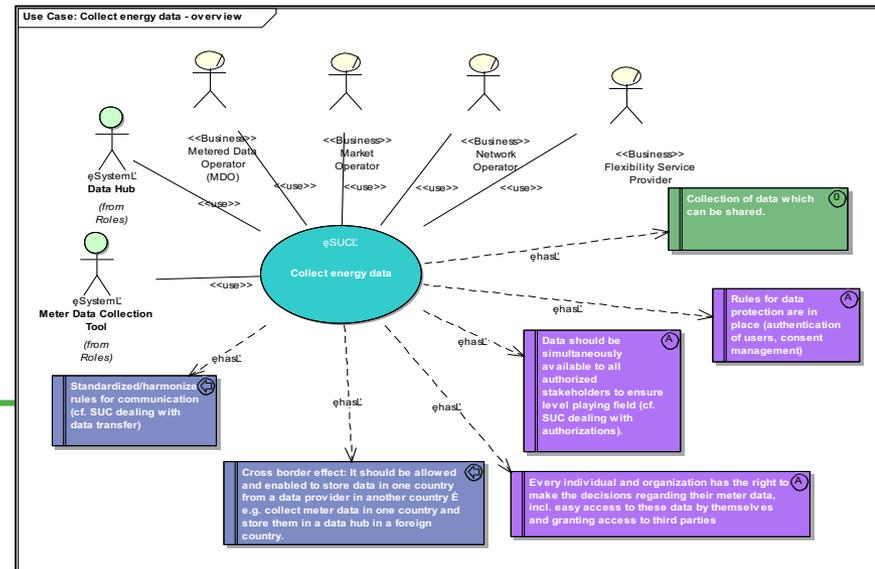
E.g. Data Exchange Platform, Geographic Information System, SCADA

→ SUCs consist in **functional specifications** for systems to be implemented and tested

An example of an IEC 62559 compliant SUC written with Modсарus

Scope and objectives of use case

Scope	Collection of different types of energy related data from data providers to data hubs
Objective(s)	Collection of data which can be shared.



Collect energy data

Based on IEC 62559-2 edition 1
Generated from UML Use Case Repository with Modсарus® (EDF R&D Tool)

- Description of the use case**
 - Name of use case**

Use case identification	
ID Area(s)/Domain(s)/Zone(s)	Name of use case
Access to data, Market for flexibilities, Operational planning and forecasting, Services related to end customers	Collect energy data
- Version management**
- Scope and objectives of use case**

Scope and objectives of use case	
Scope	Collection of different types of energy related data from data providers to data hubs
Objective(s)	Collection of data which can be shared.
Related business case(s)	

- Narrative of Use Case**

Narrative of use case	
Short description	

Data exchange activity tested like explained in data exchange SUCs
 Data exchange activity tested in the demo but with a different approach
 Data exchange activity not in scope of the demo

Data exchange System Use Cases and EU-SysFlex demonstrators

T5.2 SUCs vs demos	WP6 Germany	WP6 Italy	WP6 Finland	WP7 Portugal VPP	WP7 Portugal FlexHub	WP8 France	WP9
Aggregate energy data							
Anonymize energy data							
Authenticate data users							
Calculate flexibility baseline							
Collect energy data							
Erase and rectify personal data							
Exchange data between DERs and System Operators							
Manage access permissions							
Manage flexibility activations	Alt 2						Alt 1
Manage flexibility bids / Prequalification process	Alt 2						Alt 1
Manage flexibility bids / Bidding process	Alt 2						Alt 1
Manage data logs							
Manage sub-meter data							
Predict flexibility availability							
Provide list of suppliers and ESCOs							
Transfer energy data							
Verify and settle activated flexibilities							

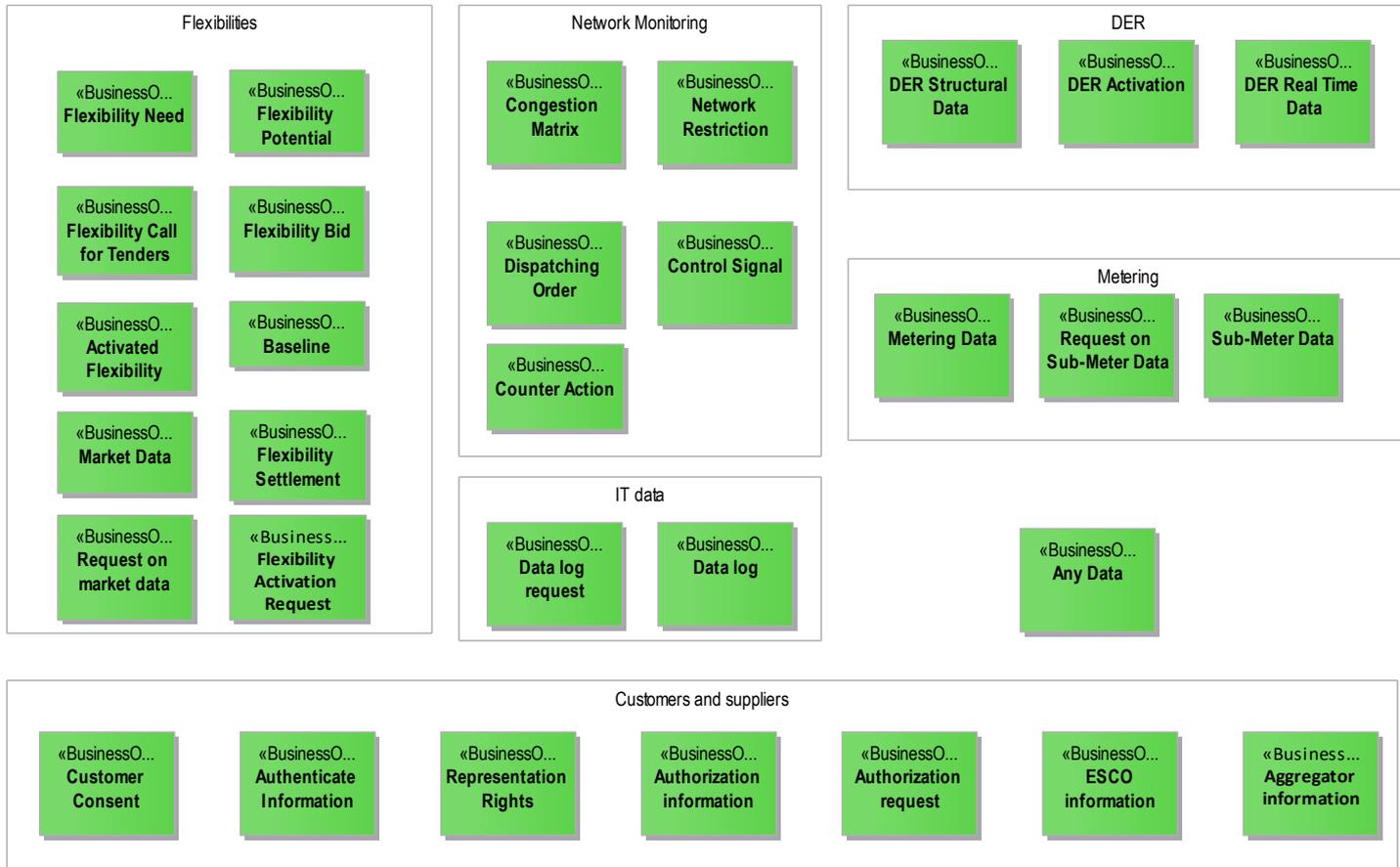
Data exchange activity tested like explained in data exchange SUCs
 Data exchange activity not in scope of the demo

Data exchange System Use Cases and EU-SysFlex demonstrators

System Roles	Task 9.1 Affordable Tool for smaller DSR units	Task 9.2 Application for TSO-DSO flexibility data exchange	Task 9.3 Cross-border data exchange
Data Exchange Platform	Elering's Esfeed	Elering's Esfeed	Elering's Esfeed / ENTSO-E's ECCo SP
Data Hub	Affordable Tool	Elering's data hub	Elering's Data Hub
Grid Validation System			
Flexibility Platform		Flexibility Platform	
System Operator SCADA		TSO/DSO IT System (SO Simulator)	
Aggregator SCADA	Affordable tool	Affordable tool (FSP Simulator)	
Automation Controller	Affordable Tool		
Customer Portal	Customer interface of Affordable Tool		e-Elering
Foreign Customer Portal			
In-House Device	In-house devices used by Affordable Tool		
Meter Data Collection Tool	Affordable Tool		
Sub-Meter Data Collection Tool	Affordable Tool		
External Data Source			Estonian Building Registry /Cybernetica's Sharemind (providing baselines)

Identified exchanged Business Objects

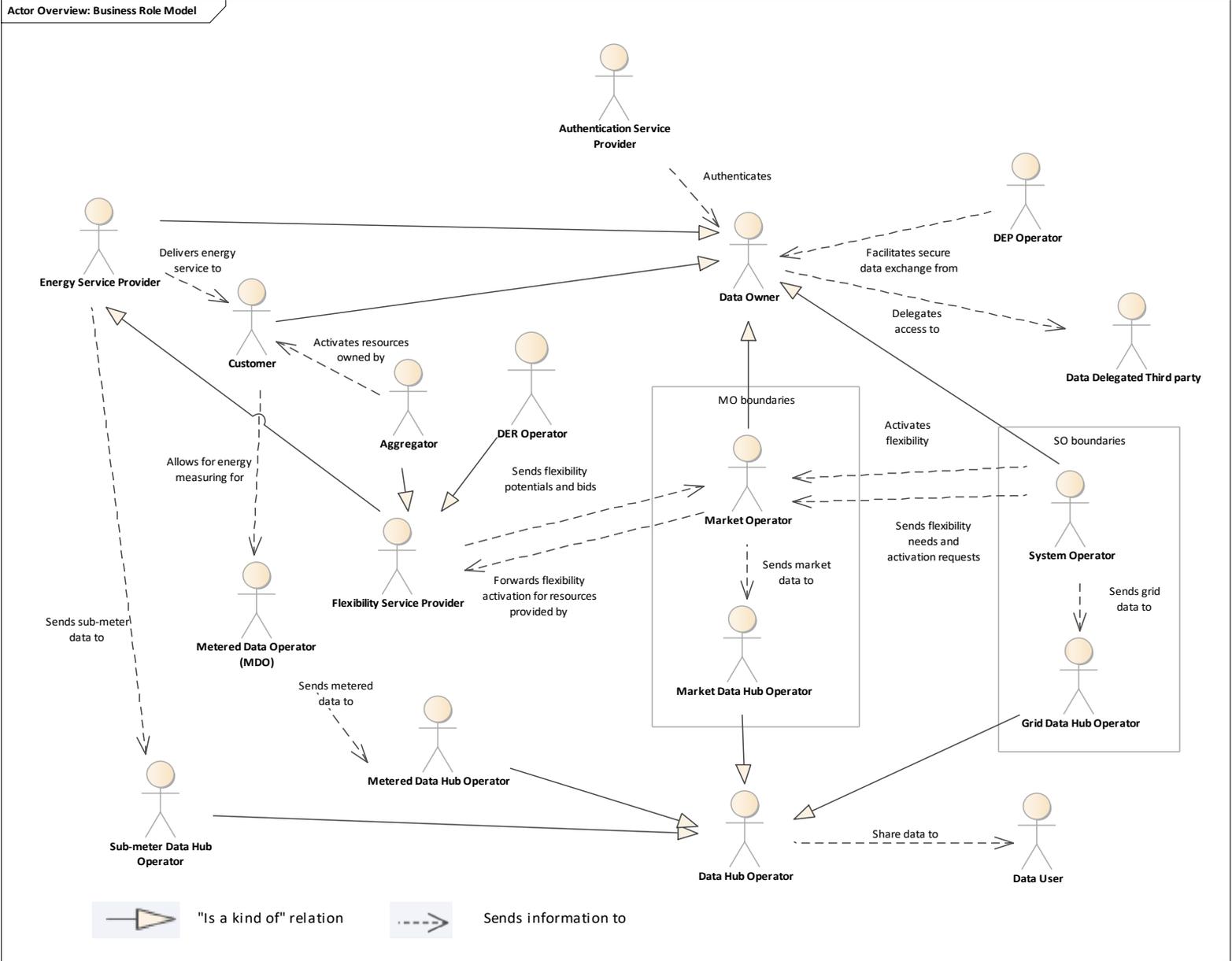
Logical: Information Exchanged



Key systems for exchanging data

Roles	Descriptions
Data Exchange Platform	Data exchange platform (DEP) is a communication platform the basic functionality of which is to secure data transfer (routing) from data providers (e.g. data hubs, flexibility service providers, TSOs, DSOs) to the data users (e.g. TSOs, DSOs, consumers, suppliers, energy service providers). DEP stores data related to its services (e.g. cryptographic hash of the data requested). The DEP does not store core energy data (e.g. meter data, grid data, market data) while these data can be stored by data hubs. Several DEPs may exist in different countries and inside one country.
Data Hub	Data Hub is an information system which main functionality is to store and make available measurements (e.g. meter data, operational data) and associated master data. Data Hubs are not necessarily centralized in a country or in a region.
Flexibility Platform	<p>Flexibility Platform (FP) for System Operators and Flexibility Service Providers that enables the trading of different flexibility products and services. A FP is operated by a Market Operator.</p> <p>Available to System Operators and Flexibility Services Providers. It is used to support the prequalification, the bidding, the activation and the verification processes, ensuring coordination between activities undertaken by several operators using the same flexible resources. Several national and regional FPs may exist.</p>
Customer Portal	Customer Portal manages data users' authentication, access permissions and data logs. Customer Portals store data related to its services (e.g. authentication information, representation rights, access permissions, data logs).

Da



Actor Overview: Busi

Energy Service

Sends sub-me data to

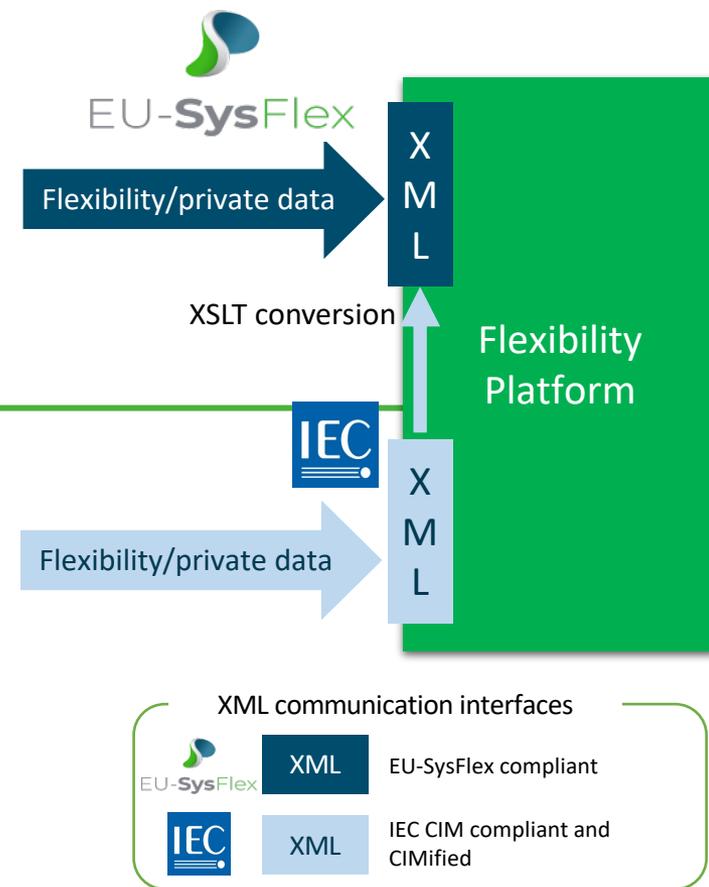
Agenda

- Data exchange System Use Cases
- CIM profiling



CIM profiling

- “CIMification” of APIs
- Context
 - Several demonstrators APIs developed for the exchange of flexibility or private data were custom-made and did not rely on CIM data models, thus did not allow **interoperability** nor **reuse**
- Objectives
 - Standardization of custom-made APIs
 - Enhancement to XSDs correct syntactically speaking but leaving out precisions: units for measures, currency units for prices, strongly typed values (instead of just strings) or enumerated values
 - Definition of CIM profiles based on CIM standards whenever it was possible and production of XSDs based on them
 - In case of gaps in CIM standards, definition of extensions to be proposed to IEC



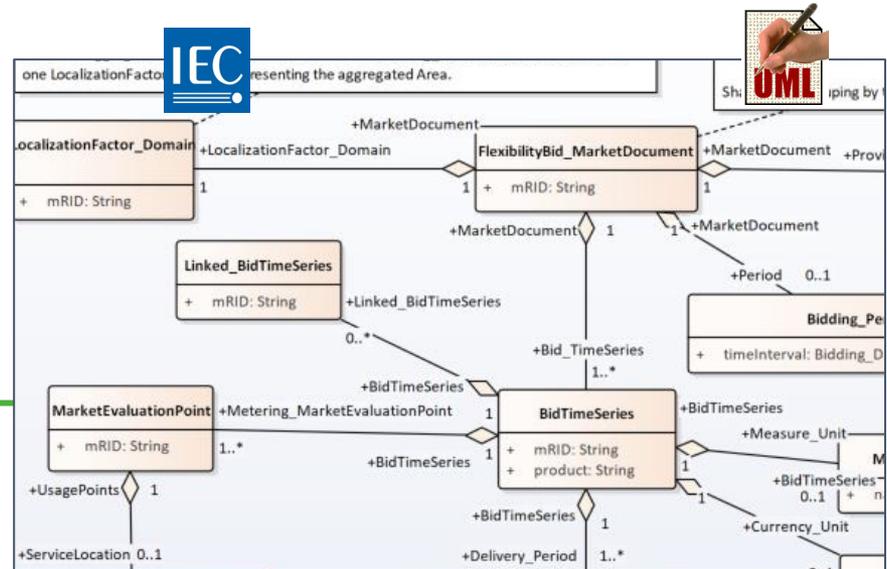
CIM profiling

- Modсарus (EDF R&D modelling tool based on UML standards) for:

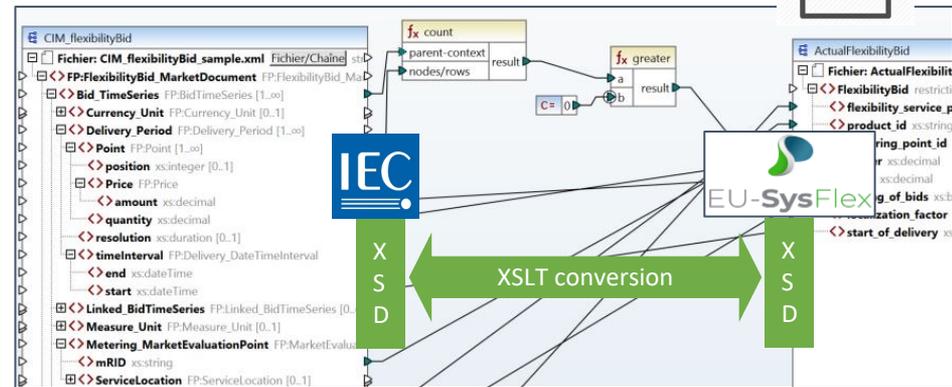
- Definition of UML data models based on CIM data models
- Generation of CIMified XSDs

- Altova MapForce tool for:

- Mapping between XSDs
- Generation of XSLT codes converting XML data exchanges compliant with CIMified XSDs into XML data exchanges compliant with EU-SysFlex XSDs



UML data models for CIMified data exchanges



EU-SysFlex

CIM profiling

- Flexibility Bids
 - Actual XSD



The screenshot shows a window titled "ActualFlexibilityBid.xsd" with a tree view on the left and XML code on the right. The code defines a schema for FlexibilityBid with the following structure:

```
1 <xs:schema xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
2   xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="
3   qualified" attributeFormDefault="unqualified">
4   <xs:element name="FlexibilityBid">
5     <xs:complexType>
6       <xs:sequence>
7         <xs:element name="flexibility_service_provider" type="xs:string"/>
8         <xs:element name="product_id" type="xs:string"/>
9         <xs:element name="metering_point_id" type="xs:string"/>
10        <xs:element name="power" type="xs:decimal"/>
11        <xs:element name="price" type="xs:decimal"/>
12        <xs:element name="linking_of_bids" type="xs:boolean"/>
13        <xs:element name="localization_factor" type="xs:string"/>
14        <xs:element name="start_of_delivery" type="xs:dateTime"/>
15      </xs:sequence>
16    </xs:complexType>
17  </xs:element>
18 </xs:schema>
```

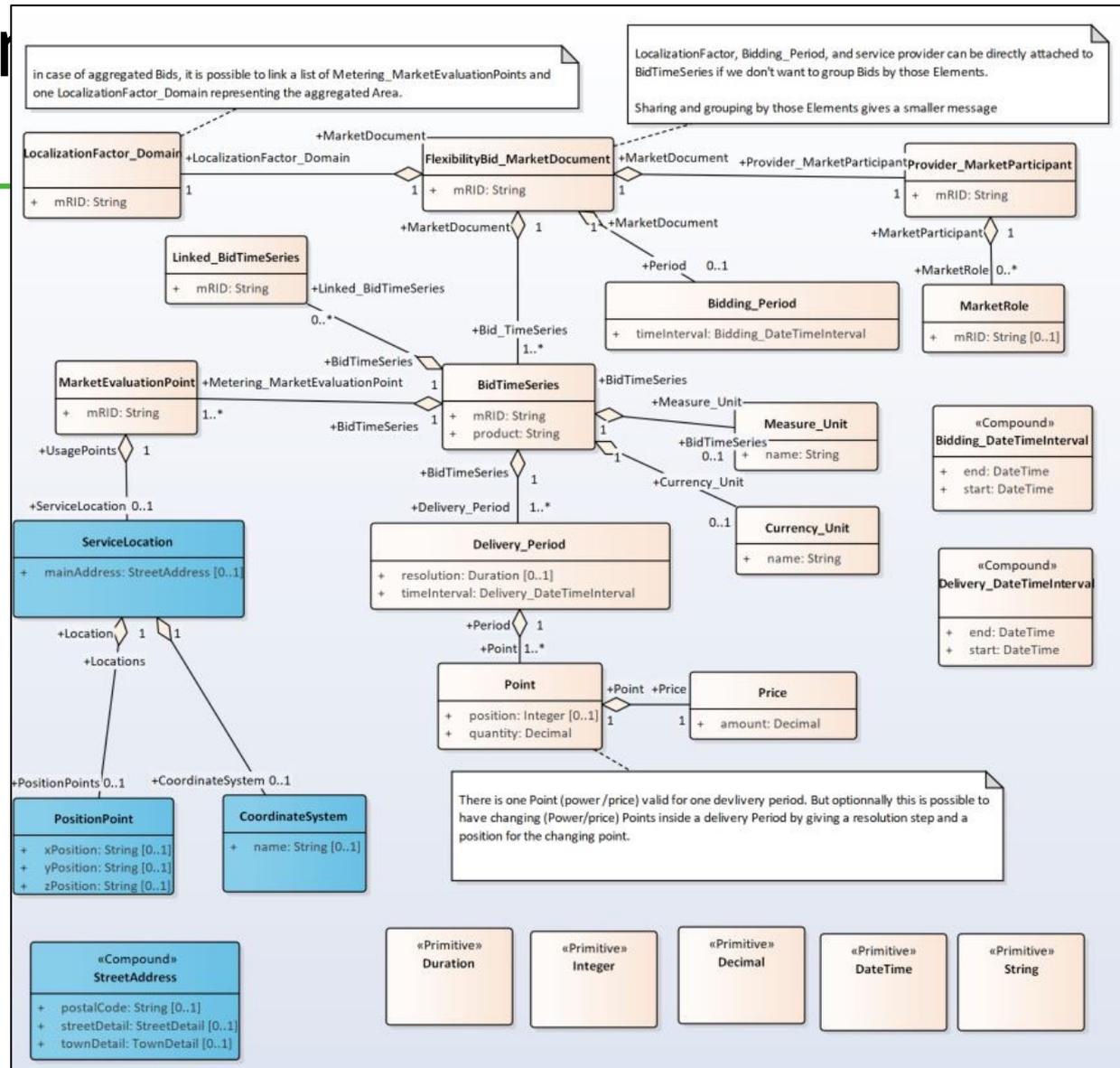
The editor interface includes a toolbar at the top right with minimize, maximize, and close buttons. At the bottom, there is a tabbed interface with "Text" selected, and other tabs for "Grid", "Schema/WSDL", "Authentic", and "Browser".

CIM profilin

- Flexibility Bids

- Actual XSD
- Standardized data model

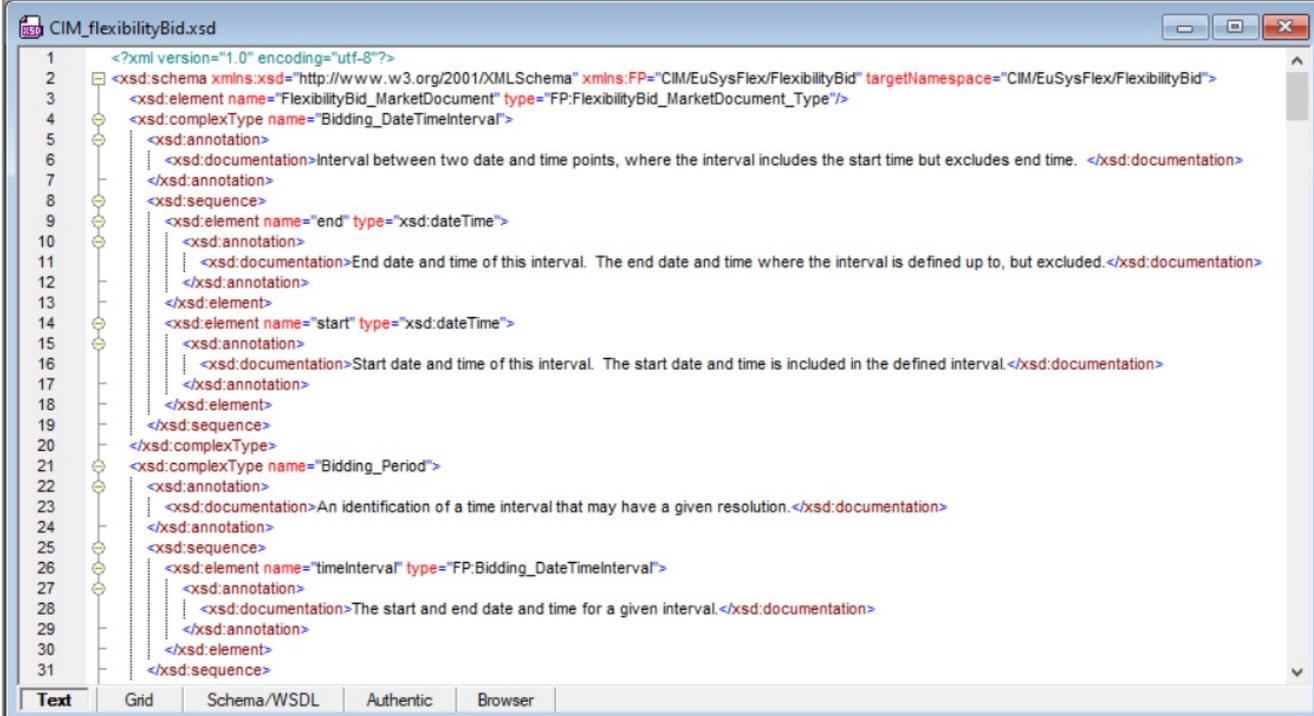
➔ Based on CIM data models



CIM profiling

- Flexibility Bids

- Actual XSD
- Standardized data model
- Standardized XSD

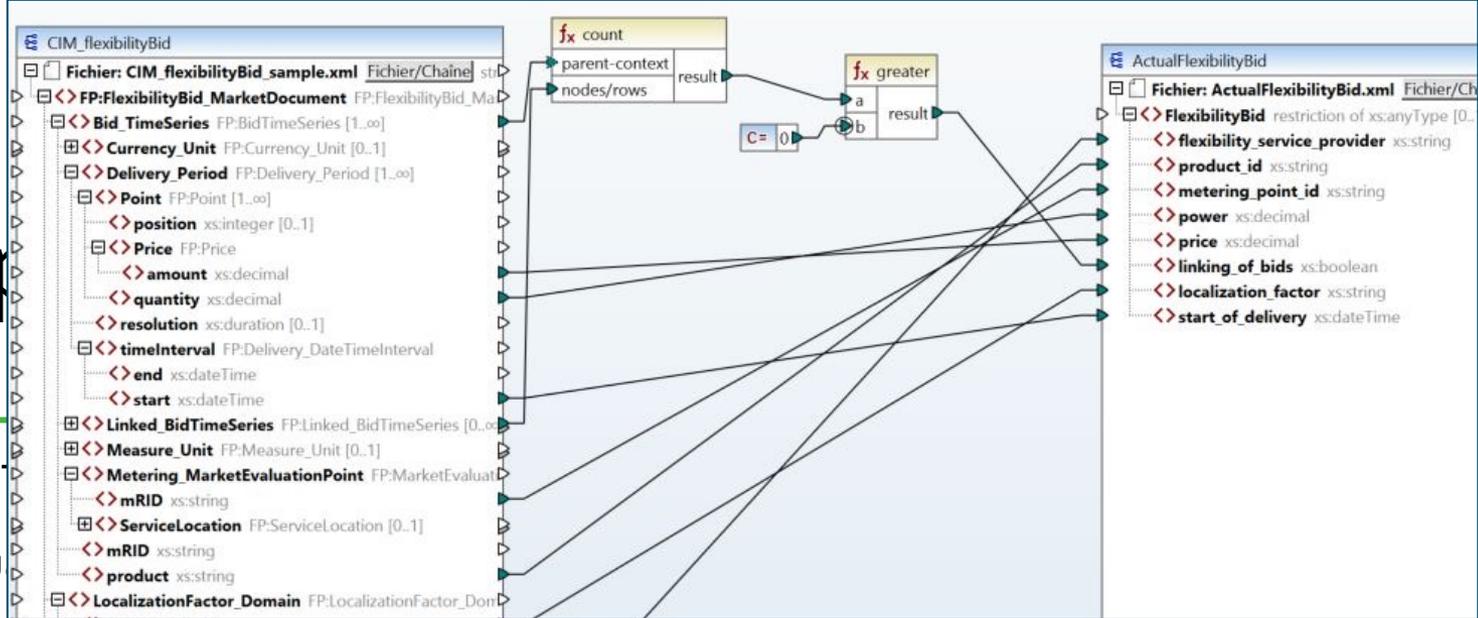


```
1 <?xml version="1.0" encoding="utf-8"?>
2 <xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:FP="CIM/EuSysFlex/FlexibilityBid" targetNamespace="CIM/EuSysFlex/FlexibilityBid">
3 <xsd:element name="FlexibilityBid_MarketDocument" type="FP:FlexibilityBid_MarketDocument_Type"/>
4 <xsd:complexType name="Bidding_DateTimeInterval">
5 <xsd:annotation>
6 <xsd:documentation>Interval between two date and time points, where the interval includes the start time but excludes end time. </xsd:documentation>
7 </xsd:annotation>
8 <xsd:sequence>
9 <xsd:element name="end" type="xsd:dateTime">
10 <xsd:annotation>
11 <xsd:documentation>End date and time of this interval. The end date and time where the interval is defined up to, but excluded.</xsd:documentation>
12 </xsd:annotation>
13 </xsd:element>
14 <xsd:element name="start" type="xsd:dateTime">
15 <xsd:annotation>
16 <xsd:documentation>Start date and time of this interval. The start date and time is included in the defined interval.</xsd:documentation>
17 </xsd:annotation>
18 </xsd:element>
19 </xsd:sequence>
20 </xsd:complexType>
21 <xsd:complexType name="Bidding_Period">
22 <xsd:annotation>
23 <xsd:documentation>An identification of a time interval that may have a given resolution.</xsd:documentation>
24 </xsd:annotation>
25 <xsd:sequence>
26 <xsd:element name="timeInterval" type="FP:Bidding_DateTimeInterval">
27 <xsd:annotation>
28 <xsd:documentation>The start and end date and time for a given interval.</xsd:documentation>
29 </xsd:annotation>
30 </xsd:element>
31 </xsd:sequence>
```

CIM

- Flexibility

- Actual
- Standardized data model
- Standardized XSD
- Mapping between XSDs
 - ➔ With Altova MapForce



CIM

- Flexibility

- Actual

- Standardiz

- Standardiz

- Mapping be

- Automated generation of XSLT codes

- ➔ With Altova MapForce

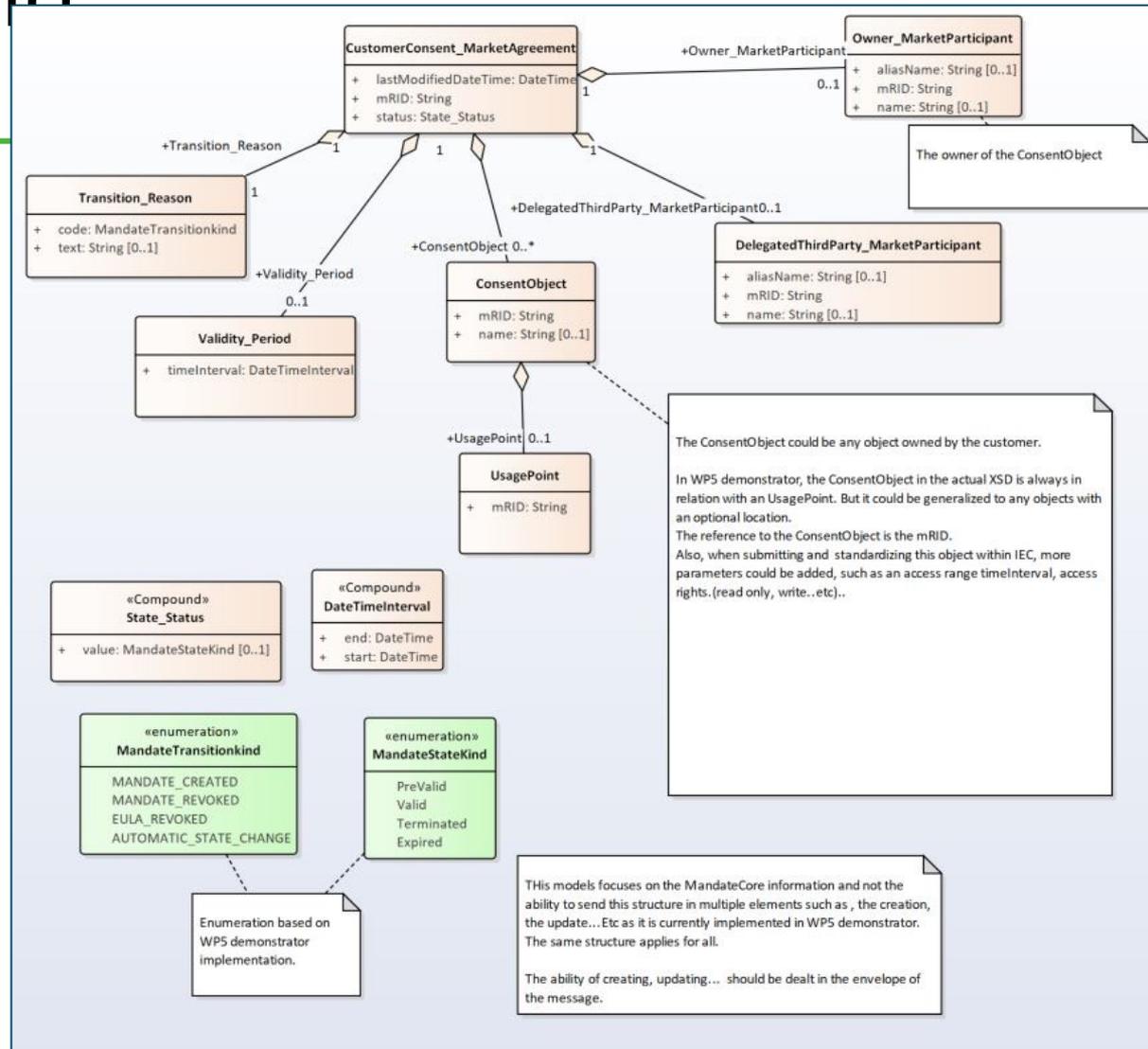
- Integration of XSLT codes in the Flexibility Platform, by means of a Saxon library, without any other inner changes

The screenshot displays the Altova MapForce interface. On the left, a tree view shows the source XML structure: CIM_flexibilityBid, Fichier: CIM_flexibilityBid_sample.xml, FP:FlexibilityBid_MarketDocument, Bid_TimeSeries, Currency_Unit, and Del... FlexibilityBid CIM2Sys.xslt*. The main window shows the generated XSLT code, which includes various XPath expressions and XSLT elements like <xsl:variable>, <xsl:attribute>, <xsl:for-each>, <xsl:sequence>, <xsl:product-id>, <xsl:sequence>, <xsl:for-each>, <xsl:sequence>, <xsl:for-each>, <xsl:sequence>, <xsl:for-each>, <xsl:sequence>, <xsl:for-each>, <xsl:sequence>, <xsl:for-each>, and <xsl:sequence>. The code is designed to transform the source XML into an ActualFlexibilityBid format. The bottom of the window shows a tabbed interface with 'Text' selected, and other tabs for 'Grid', 'Schema/WSDL', 'Authentic', and 'Browser'.

CIM profiling

- Customer Consent

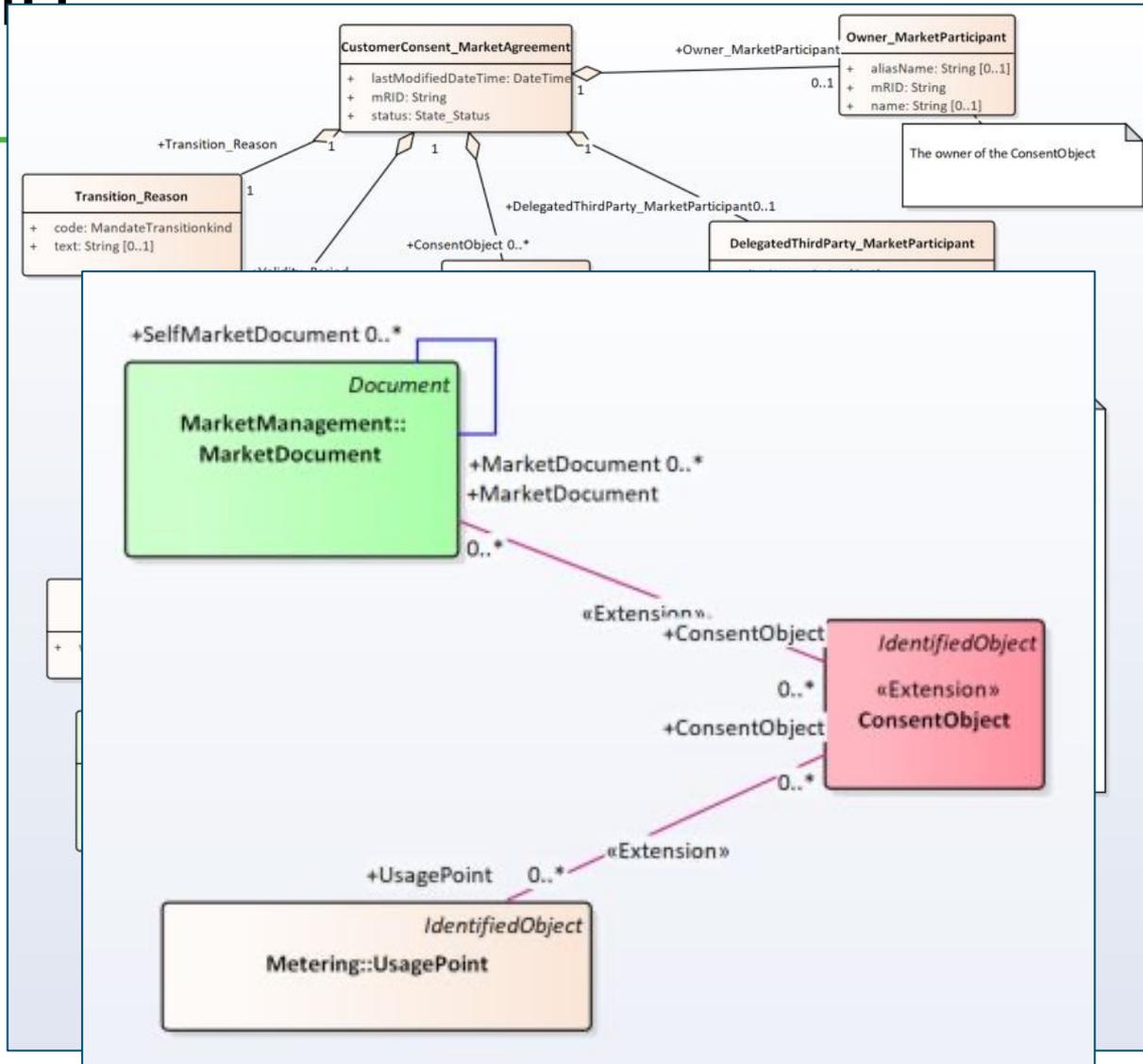
- Actual XSD
- Standardized data model
- ➔ Based on CIM data models



CIM profiling

- Customer Consent

- Actual XSD
- Standardized data model
 - ➔ Based on CIM data models
 - ➔ Need of CIM extensions



CIM profiling

- Conclusion

- CIMified XSDs and XSLT codes easily integrated without specific software development
- A few CIM extensions needed for the exchange of customer consents and representation rights
- “CIMification” could have been similarly carried out for other core business objects: Flexibility Product, Flexibility Potential, Flexibility Call for Tenders, Flexibility Activation Request/Order, Flexibility Settlement, Flexibility Baseline, Flexibility Need, Usage Point, Metering Data, Electricity Price
- Standardization of XSDs for other business objects (i.e. Weather Forecast, Weather Observation) could have been carried on the basis of ENTSO-E documents (e.g. [URL](#))

THANK YOU!



EU-SysFlex

DATA EXCHANGE PLATFORM DEMONSTRATIONS

25. May 2020

Aivo Olev, Cybernetica AS

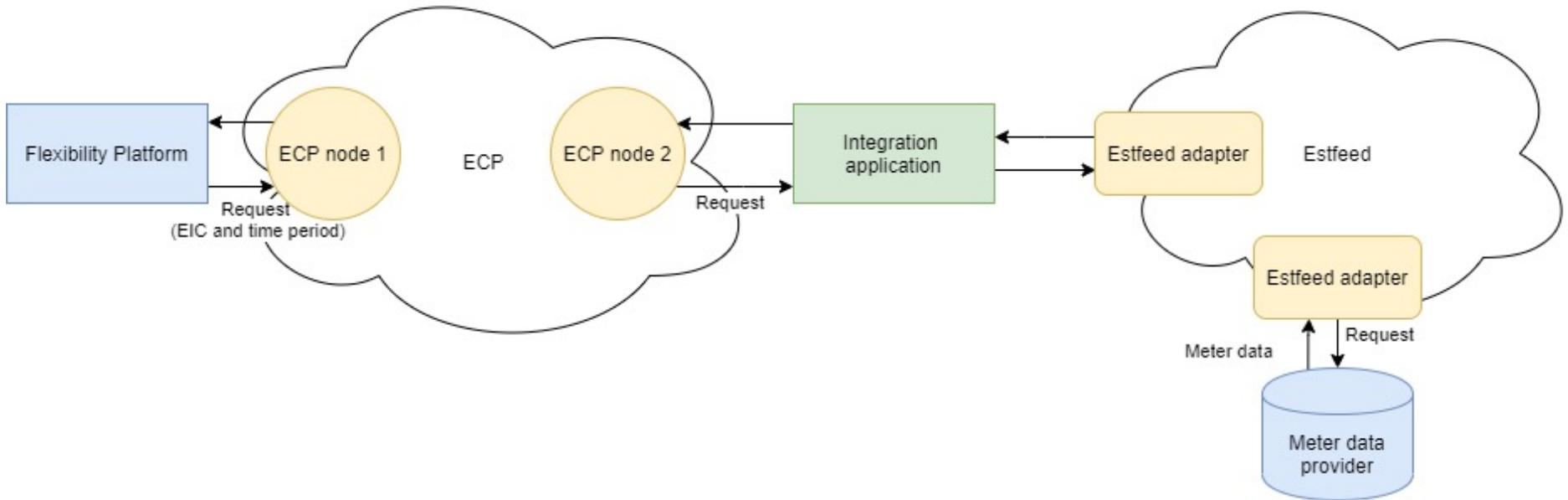
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Data Exchange Between ENTSO-E and Elering Platforms

- ENTSO-E has operational data available in their ECCoSP platform.
- This was integrated with Estfeed data exchange platform to enable data exchange with Elering data hub.
- Enables third parties (e.g. aggregator) can have access to both types of data through a single access point – either integrating their applications with Elering’s Estfeed platform or ENTSO-E’s ECCoSP platform
- Third party can have access to data assuming the data is either public or it has received authorization:
 - from the consumer (in case of meter data)
 - or from the network operator (in case of operational data).
- Secure adapters relay requests and data to either party over secured channels and according to given authorization or ownership.

ECP – Estfeed Interoperation Demonstration



Demonstrated capabilities

- An application connected to ECP can request data from an Estfeed data source.
- Estfeed can still ensure that data owner has given consent to the receiving application behind ECP.

Limitations:

- Integrations requires a simple integration application.
- When exchanging private data, the integration application must send a direct message to the requesting ECP application, so that private data does not leak in ECP.

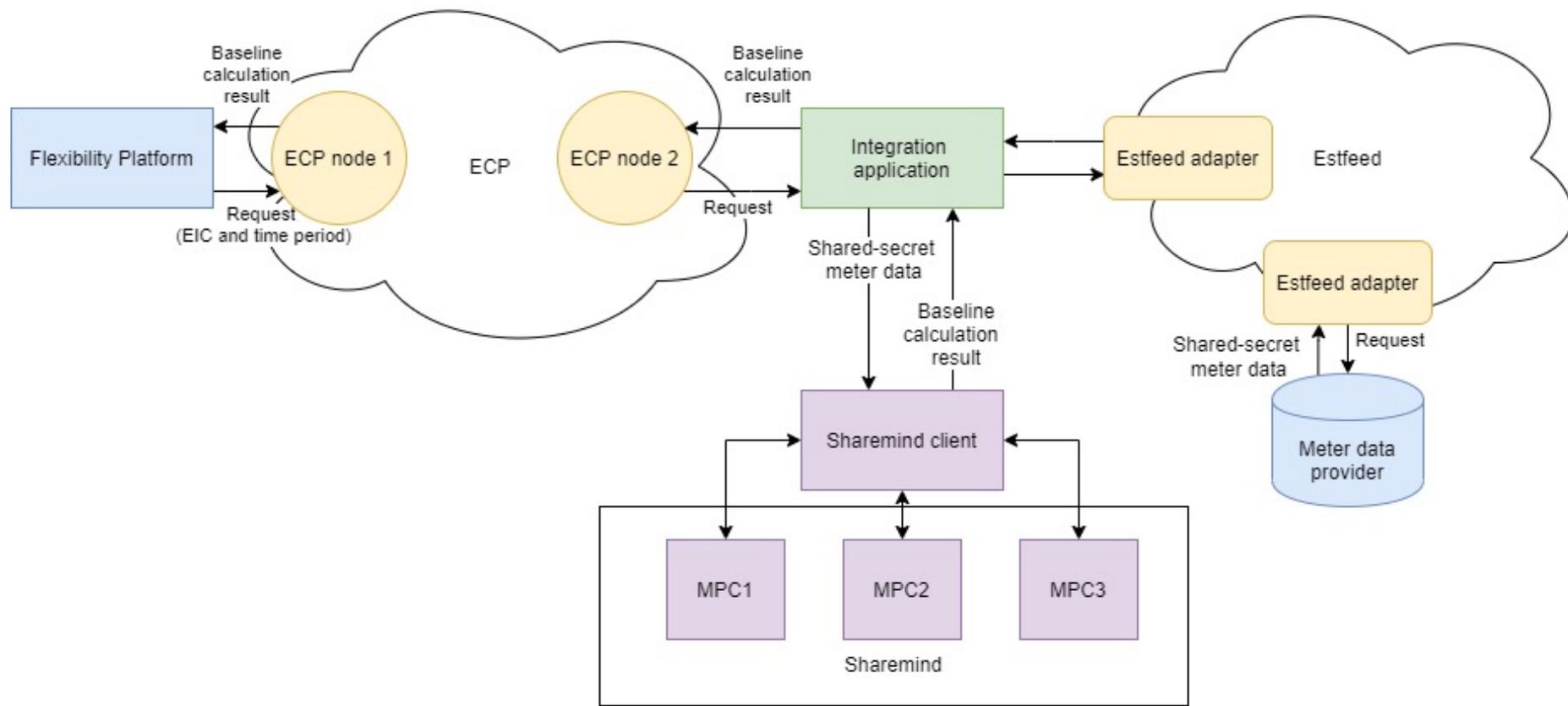
Data Exchange Between ESO and Elering Platforms

- The demonstration removed restrictions of Lithuanian nationals from accessing the Estonian data exchange platform Estfeed.
- Enabled private persons and organizations to access private meter data from another country with the data owner's consent.

Integration of an Application Enabling Flexibility Baseline Calculation

- Demonstrates a intermediate processing between ECP – Estfeed data exchange.
- Using Cybernetica’s Sharemind technology allowed to demonstrate:
 - How to share only as little as necessary (only baseline result, not meter data)
 - Meter data was first encrypted and obfuscated.
 - It could only be read in Sharemind, where the data was used to calculate baseline.
 - The application behind ECP only received calculation results, not meter data which it did not need.
 - Would be especially useful when there are multiple data sources with private data that have to be used in the calculations.

Integration of an Application Enabling Flexibility Baseline Calculation



Main results

- The goal of the demo was to demonstrate how privacy-preserving data exchange can protect private data while allowing systems to calculate results from that data.
- Estfeed ensured that the owner of the data was aware that the data was used for just baseline calculation purposes and in a privacy-preserving way.
- The demonstration proposed an architecture that could make every service of the Estfeed DEP preserve user privacy by first encrypting and obfuscating data and only using it in a secure environment for only the intended purposes.
- Privacy is ensured by the Sharemind MPC technology if the parties hosting the MPC servers are independent and do not collude to break the privacy of individual consumers. No Sharemind MPC server can individually break the privacy.

Cross-Sector Data Exchange Between Building Registry and Elering Platform

- Demonstrated data exchange between different sectors
- The target groups (e.g. building designers, energy labelers, authorities responsible for issuing permissions, building developers, building owners) of Building Registry can use energy meter data to make their processes smoother.
- On the other hand, if energy data accessible via a DEP is enriched with information about the size of the rooms and buildings, energy labels, materials used for building, heating and ventilation systems, then it would be valuable information for energy service providers like, for example, flexibility aggregators.

