

# **IoT Conference 2023**

InterConnect: 4 Years of experience on SAREF-based semantic interoperability

Presented by: David Rua





## InterConnect at a glance



- H2020 Large Scale Pilot (2019-2024)
  - InterConnect gathers 50+ European entities to develop and demonstrate advanced solutions for connecting and converging digital homes and buildings with the electricity sector.
- Cross-domain semantic interoperability based on SAREF over several use-cases.
- Validation in 7 connected large-scale test-sites:
  - PT, BE, DE, NL, IT, EL and FR.









□ R&D

# **InterConnect Project – Mission**



#### 2021-2024

# Open Calls for Innovators



2019-2021



#### **Background**

- Technologies & services in TRL 6
- SAREF, SPINE, FIWARE, S2
- 30 use cases from 11 different projects (InterFlex, Integrid, GIFT, EEBUS, etc.)

2020-2022



#### **Interoperability**

- Semantic data exchange (SAREF)
- Interoperability framework w/ semantic discovery, navigation and reasoning enablers

2019-2021



#### **Use Cases & Services**

- New use cases for existing technologies
- New technologies for existing use cases
- Incremental innovation of existing technologies

2021-2024



#### Core Technologies

- SAREFized services
- AI & ML
- IoT platforms
- Gamification
- P2P marketplace
- DSO interface

- Interoperable-bydesign prototypes
- Energy Applications for Grid Resiliency

2021-2024

**Pilots** 



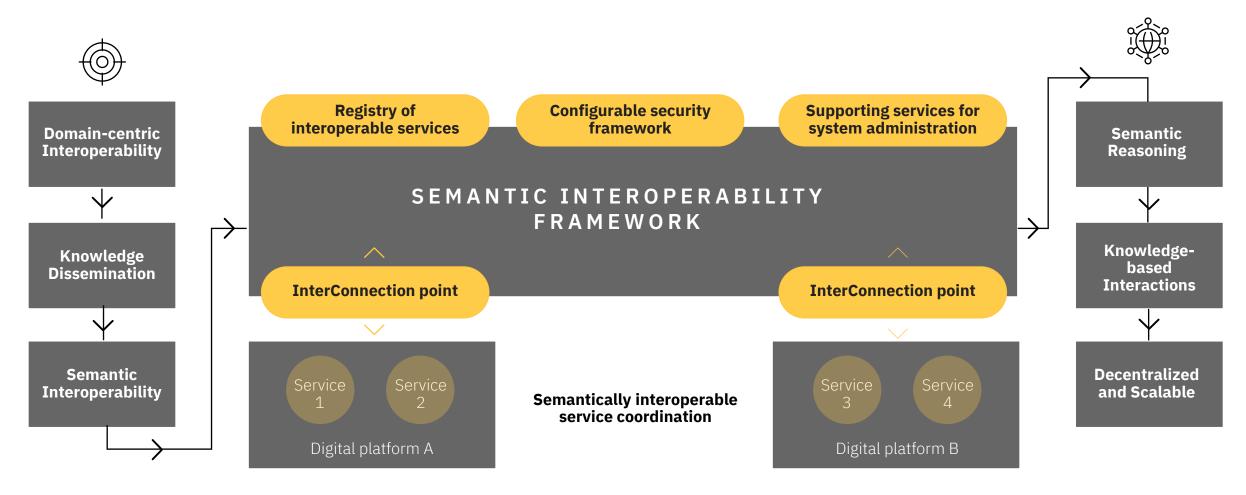
- DSF-centric
- Multi-utility
- Cross-sector

# Interoperable frameworks

Innovative solutions to support data flows

# **Semantic Interoperability Framework**





#### DIGITAL PLATFORMS AND SERVICES BECOME SEMANTICLY INTEROPERABLE

Services use the interoperable tools to publish & discover capabilities and are joint together to enable use case demonstration



## **Semantic Interoperability Framework**





Developed over 3 years and deployed in the 7 large scale pilots (50 integrators) of InterConnect



The SIF utilizes SAREF-based ontologies, and it is offered as a framework so that integrators choose which components to utilize/deploy.



#### SIF components:

Knowledge Engine (as interoperability layer)

Generic and Service Adapters (for mapping legacy interface logic)

Service Store (as catalogue of all interoperable services)

P2P marketplace enablers

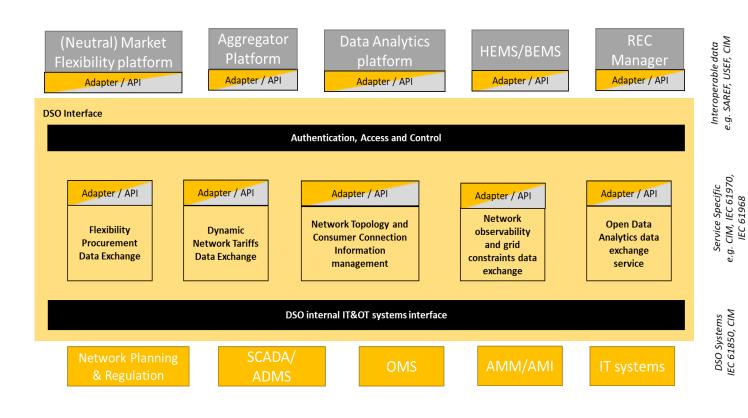
Set of support tools for streamlining the integration process.



#### **DSO** Interface



#### **DSO Interface High-Level Architecture**



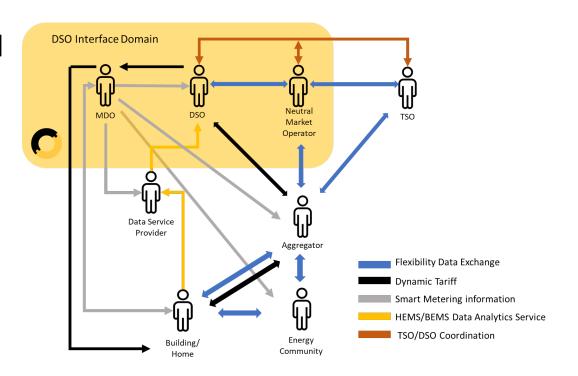
#### **DSO Interface is composed**

- InterConnect generic adapter(s), providing the interface between DSO's core-services and external stakeholders within IFA.
- DSO Interface data exchange and management services platform, responsible for the data management, aggregation and the necessary data translations between interoperable data and specific data formats e.g., CIM, IEC 61850.
- Interface towards internal IT and OT systems and authentication and access control mechanisms.

#### **DSO** Interface



- Based on the SIF
- Semantic GW between DSO systems and market entities, with the primary objective of
  - defining communication models between
     DSO's and market parties for the purposes
     of enabling demand side flexibility services
  - open data sharing
  - enhanced network observability



# Contributions

Experience from applying semantics to actual applications

## **Contributions over 4 years**



<b>Interoperability framework</b>
operational

**DSO interface concept** for standardized DSF products & **DSO data-centric services** 

Centralized pool for optimal local energy sharing

66 SAREF-ized services (flex, config, forecast, measurements & control)

112 Use Cases 166 APIs 864 parameters Social innovation strategies & consumer behavior-centric deep learning

Semantic-based interaction to handle heterogeneous data from equipment and services

Contribution to standardization activities in ISO/IEC, AIOTI, etc.

User-centric approach for market uptake of services, enabled by interoperability

Reference architecture with technology and device-agnostic ecosystem

SAREF contributions to ETSI
SmartM2M

Cross-sector services, e.g., e-mobility in supermarkets (PT), municipality (FR), multi-utility (BE)

# Flow for Integration

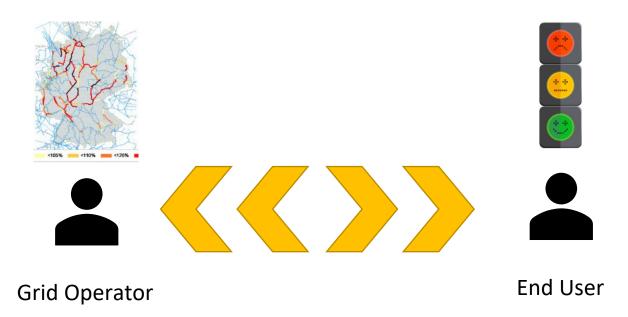


Understand the SIF		SAREFization Process		SIF Deployment		Field Integration	
	Familiarity with the SIF and ontology using public documentation		SAREFization process		Deployment of SIF according to specific needs	*	Establish the different data connections
	Repository with code and examples	O	Graph patterns and knowledge interactions	o o	Establish knowledge interactions and binding sets		Support the demonstration / field architecture
	Security and privacy protection assessment		SSA building process		Use existing examples from project implementations		Instantiate the SIF components
	Workshops and other documented material		Examples from the service catalogue	Q	Explore other implementations		Collection of relevant indicators

# **Interoperability for Energy Applications**

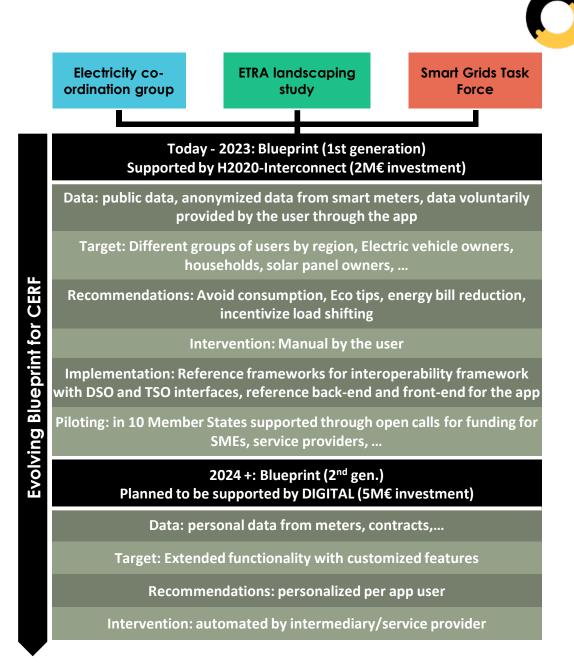


- Demonstrate that EU is ready to use technologies to help mitigate the impacts of the energy crisis
  - Potential savings to one's energy bill
  - Empower consumers to make measurable impact
  - Help maintaining grid stability (shave peaks)
- Interoperability as a key factor in connecting services and stakeholders
- Pass signals from the grid side to consumers:
  - When is it the best time to consume?
  - How to use available flexibility?



# From a blueprint to the next generation of Common Energy Reference Framework

- Digitalising the energy system EU action plan.
- ETRA landscape study on energy platforms and consumer applications.
- Smart Grids Task Force EG3 Towards a Common European Reference Framework for Consumer Applications.

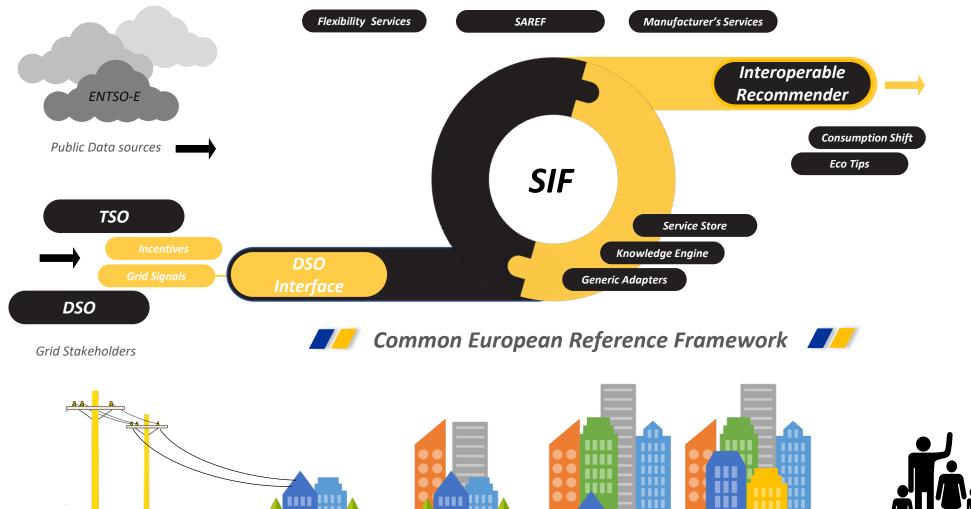




# A new use-case for interoperability: Energy applications for grid resiliency

**interconnect** 







# Interconnect

This project has received funding from

the European Union's Horizon 2020

research and innovation programme

under Grant Agreement No 857237

interoperable solutions connecting smart homes, buildings and grids

DISCLAIMER: The sole responsibility for the content lies with

the authors. It does not necessarily reflect the opinion of the

CNECT or the European Commission (EC). CNECT or the EC

are not responsible for any use that may be made of the

information contained therein



**DURATION** 

interconnect project@inesctec.pt

01/10/2019 to 31/03/2024