Interconnect Semantic Interoperability Framework in support of CERF for energy in data exchange and aggregation in semantic interoperable manner towards alignment with European Energy Data Spaces

Workshop: Semantic Interoperability in Data Spaces

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interconnect

Overview

- About CERF and how it fits into data spaces domain
  - European data spaces for energy
- About InterConnect SIF as enabler for semantic interoperability
- SIF based CERF for energy domain and contribution towards data spaces
- Sustainability and scalability of the approach

Common European Reference Framework

- CERF demonstrates that EU is ready to capitalize on innovative technologies to mitigate the impact of energy crisis.
  - ETRA – extensive landscape study on energy platforms and consumer applications
  - Expert Group 3 of the Smart Grid Task Force report “Towards a Common European Reference Framework for Consumer Applications.”

Support the EU and its member states to be better prepared for the energy crisis

Foster the participation of end consumers as active players in solving challenges in the energy supply

Make use of:

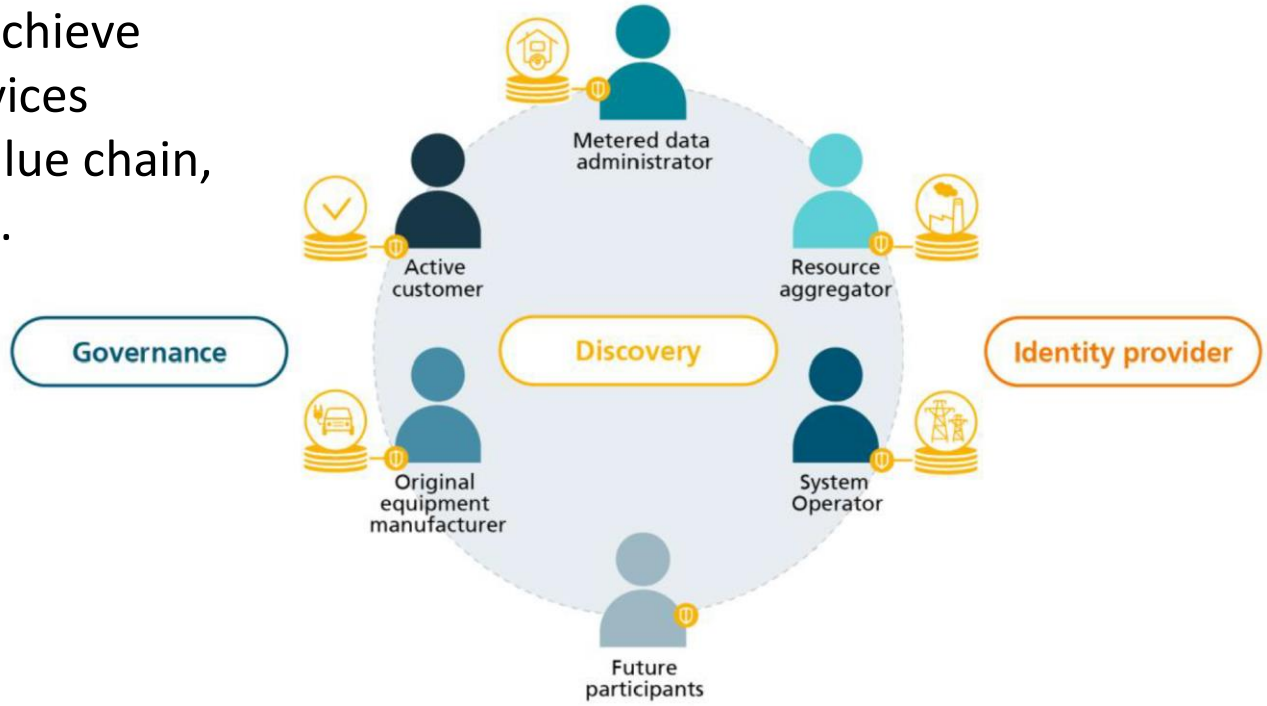
The InterConnect experience in deploying interoperable services for consumers.

Semantic interoperability tools developed by the project (SIF and DSOi) to:

- Facilitate the access and sharing of information in interoperable manner.
- Support the creation of energy applications with common enablers.

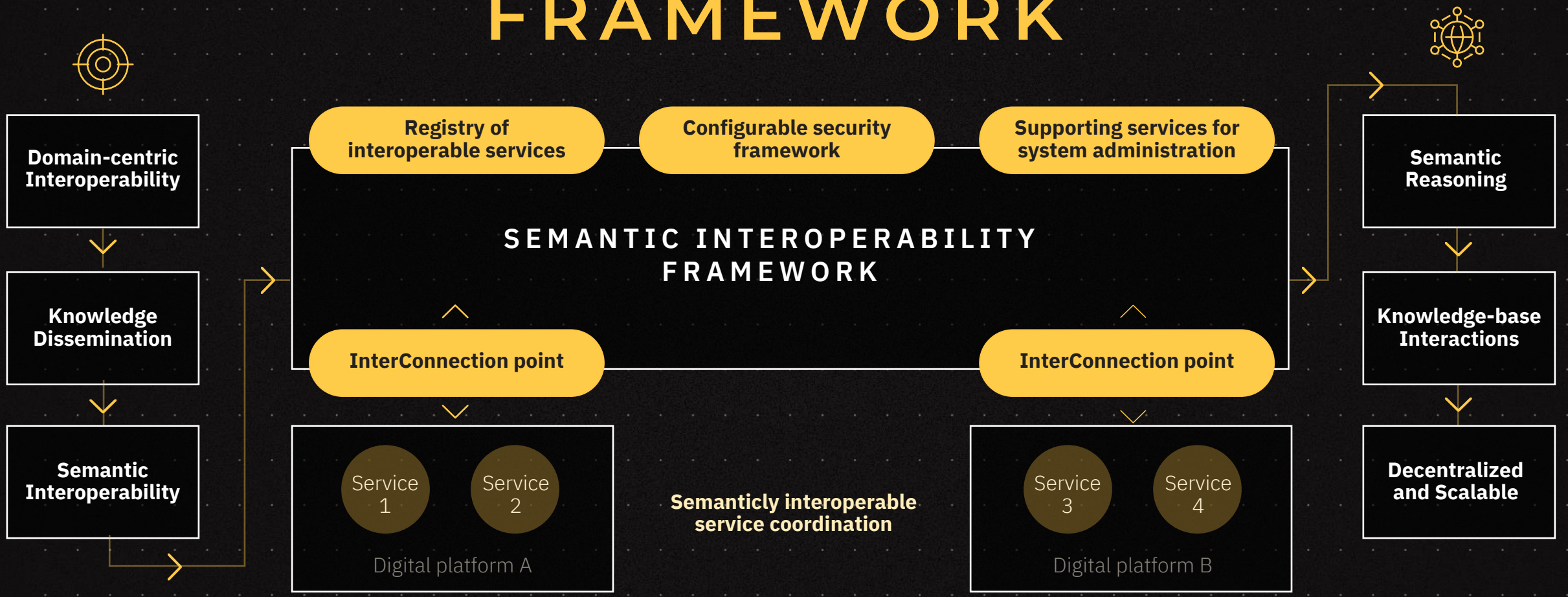
European data spaces for energy

- Access to data to develop innovative energy services.
- Achieve interoperability with other sector data spaces, enabling actors from various sectors to participate in the energy market and deliver services.
- Provide interoperability mechanisms to achieve interoperability of data, systems and services between the key players of the energy value chain, considering semantic standards as SAREF.
- Build on actions from Horizon Europe programme and existing national or regional efforts.



Source – EnTEC - Full Report – Common European Energy Data Space

SEMANTIC INTEROPERABILITY FRAMEWORK



SEMANTIC TOOLKIT FOR DIGITAL PLATFORMS/SERVICES CROSS-DOMAIN INTEROPERABILITY

Publish, React, Query, Data Discovery and Reasoning capabilities across several industry domains.
Domain agnostic framework technology.

Ecosystem Interoperable Services

- ENERGY
- NON-ENERGY
- CROSS-DOMAIN
- CROSS-PILOT

Interconnect Interoperability Framework

STANDARDS

ETSI · CEN CENELEC · W3C

IN LINE WITH

- FIWARE
- GAIA-X
- IDSA
- BDVA

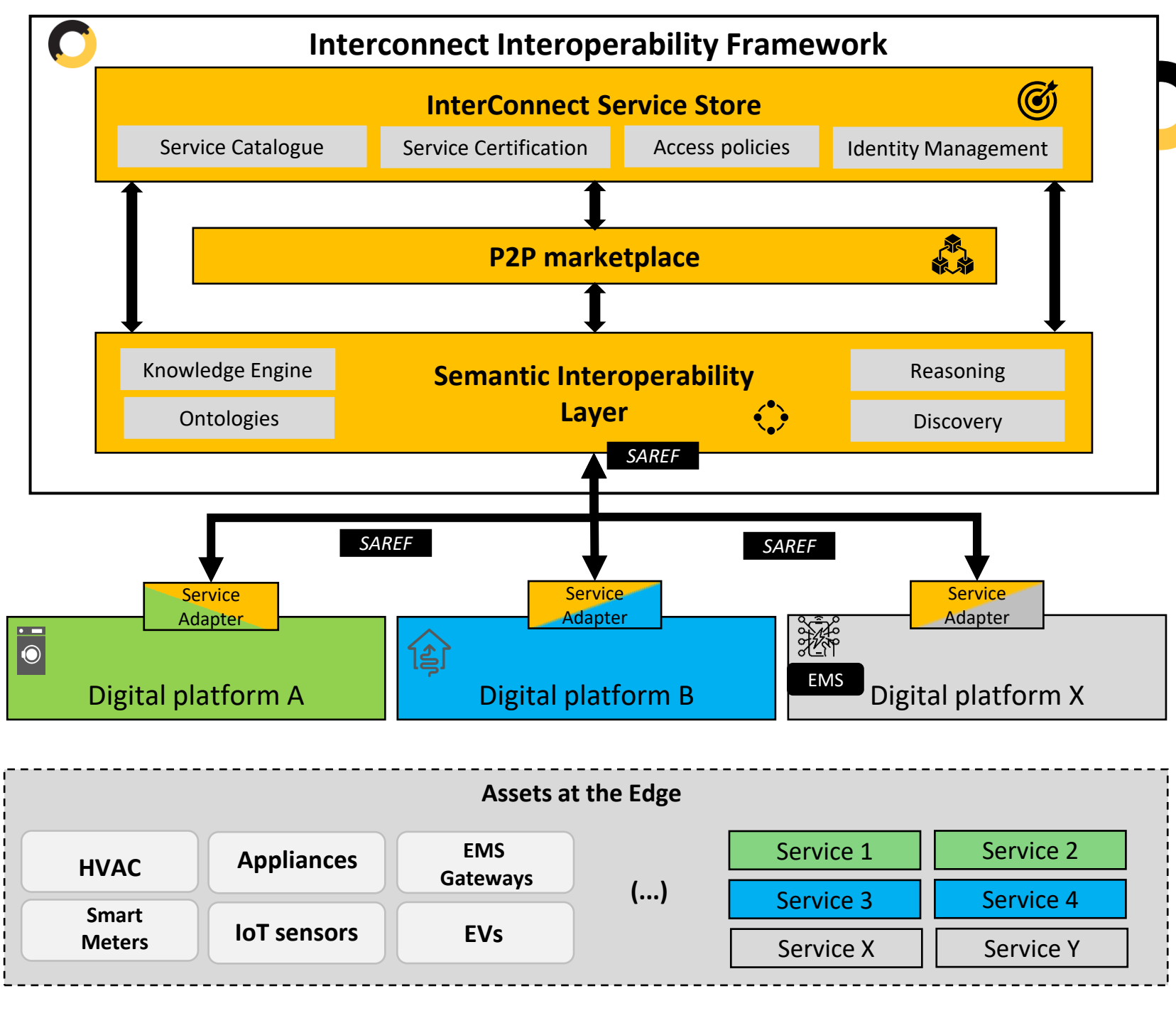
SEMANTIC INTEROPERABILITY BASED ON

- ONTOLOGIES
- GRAPH PATTERNS
- KNOWLEDGE FEDERATION

Interconnect Stakeholders

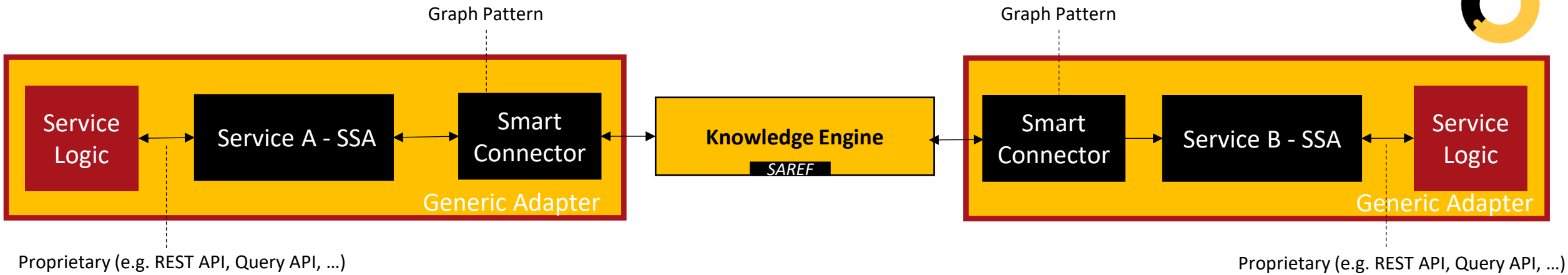
- R&D
- CONSULTANCY
- MANUFACTURERS
- ASSOCIATIONS
- DSOs
- RETAILERS
- END USER

Security and privacy framework , Admin and Governance



Use cases, Interoperable Services, Standardization

SIF - under the hood



ASK

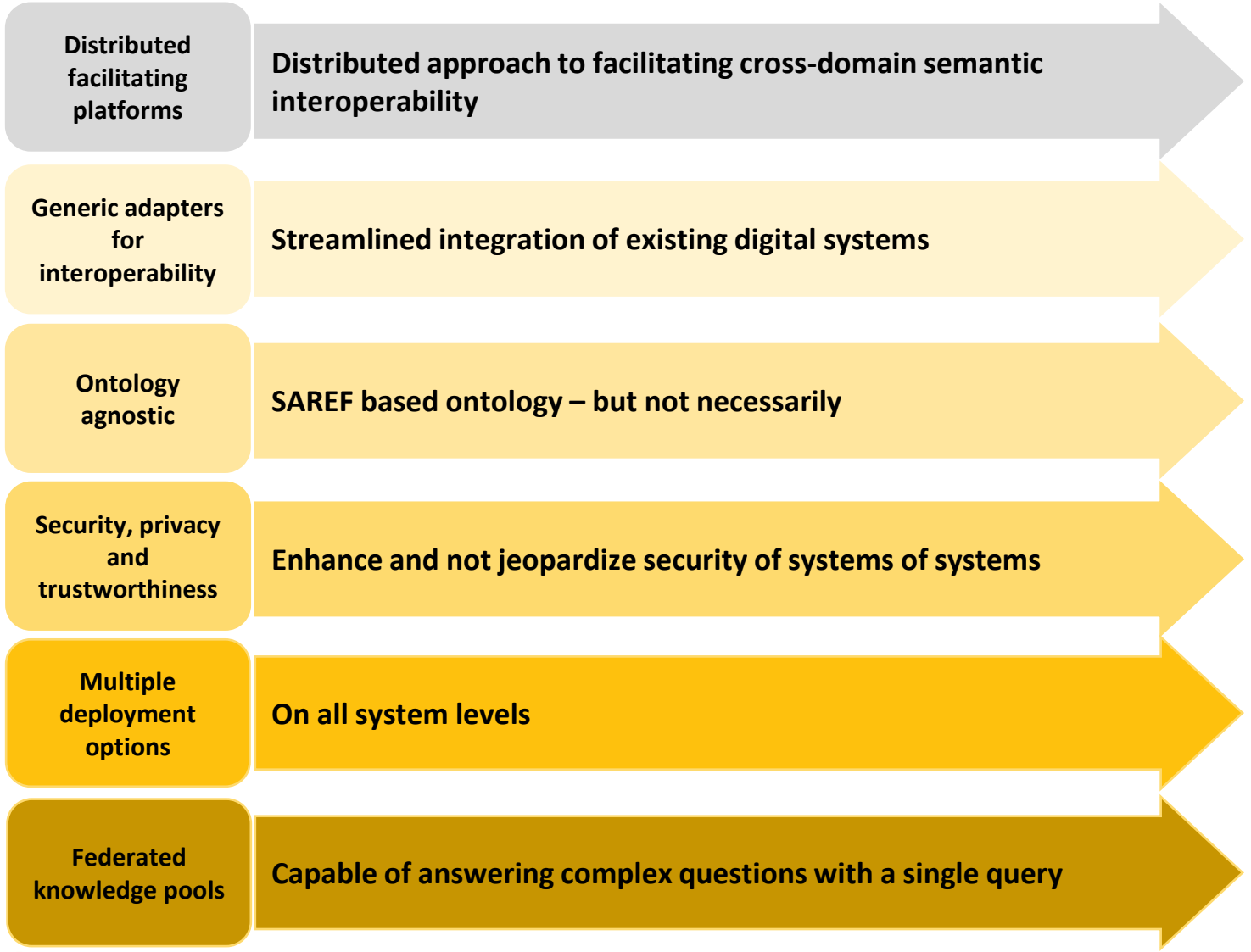
POST

```
?meterData ic-tplg:hasTopologicalAssociation ?tpl .
?tpl rdf:type ic-tplg:TopologicalLocation .
?tpl ic-tplg:hasTopologicalLocationDescription ?locationId .
?locationId rdf:type xsd:string .
?meterData ic-data:hasEffectivePeriod ?ts .
?ts rdf:type time:Interval .
?ts ic-data:hasBeginning ?beg .
?ts ic-data:hasEnd ?end .
?beg time:inXSDdatetimestamp ?startTime .
?end time:inXSDdatetimestamp ?endTime .
?meterData ic-data:hasTemporalResolution ?tr .
?tr rdf:type time:TemporalDuration .
?tr time:minutes ?resolution .
```

ANSWER

REACT

How InterConnect addresses the challenges for decentralized semantic interoperability

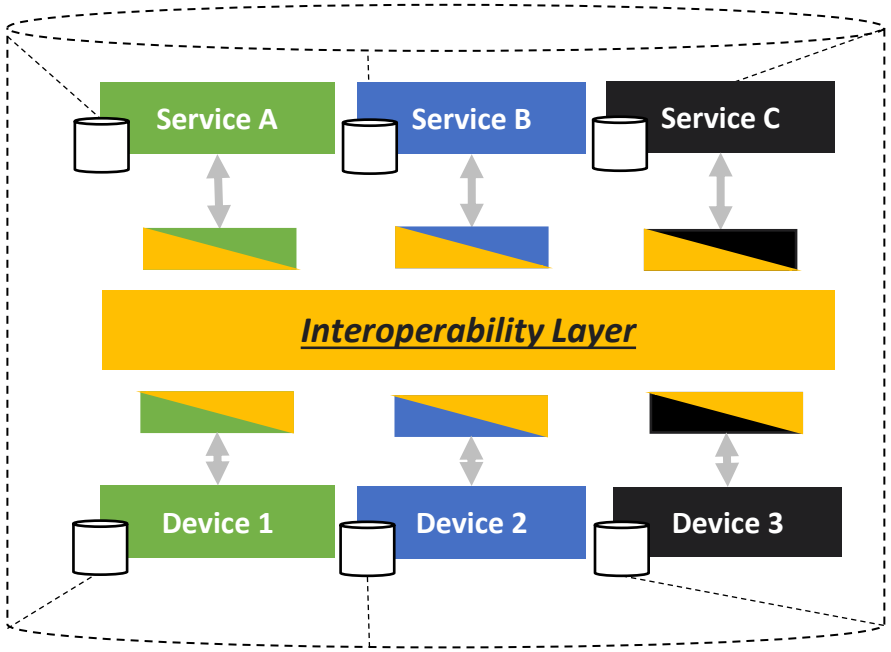


How is the Semantic Interoperability Layer used to build interoperable data space?

Local Knowledge base

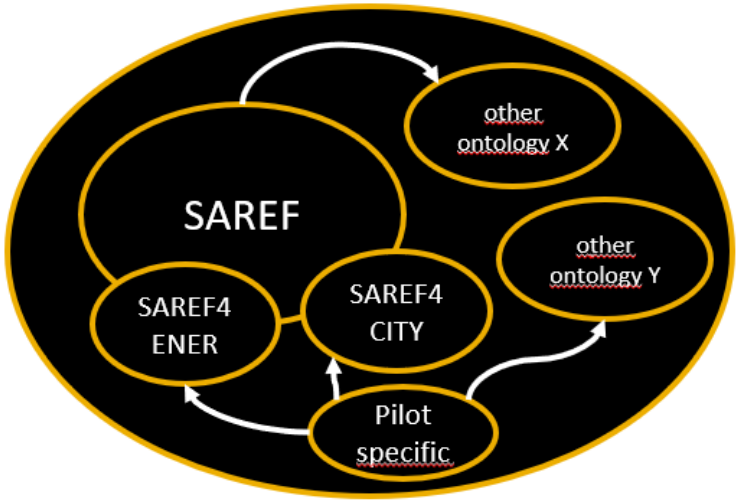
Semantically Interoperable Ecosystems establish Data Space

Adapter

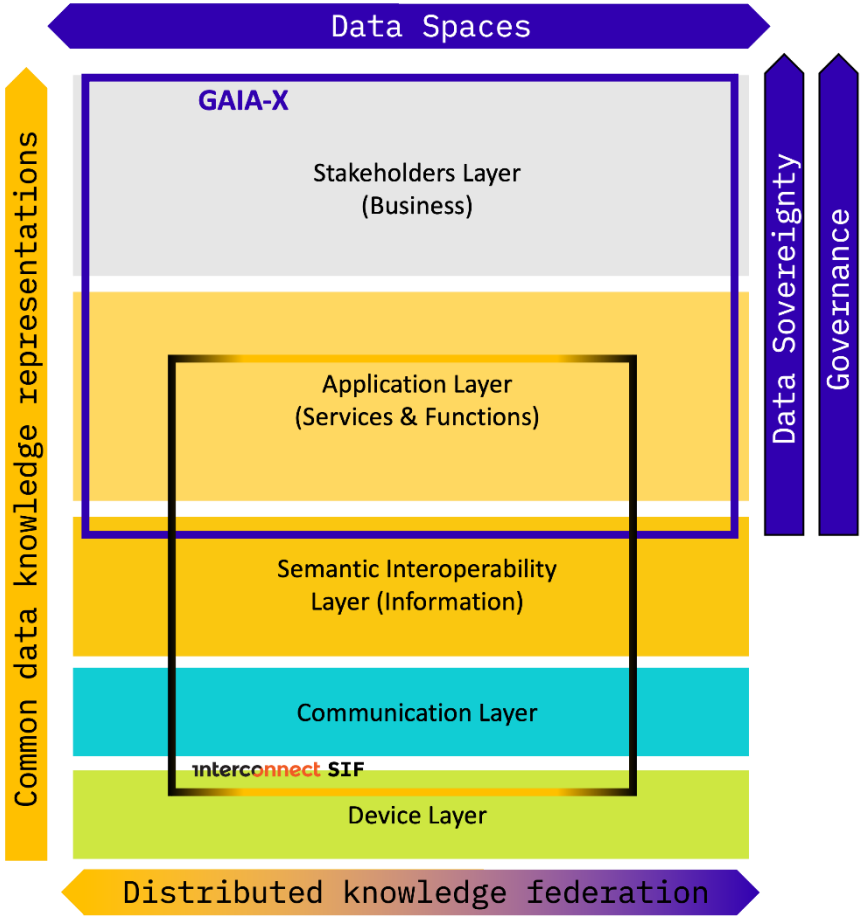


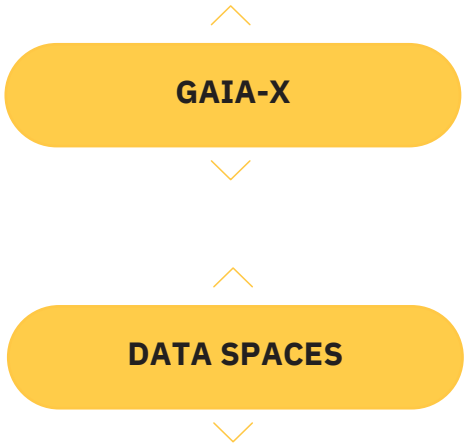
(distributed)

Data Space – Knowledge Federation



SIF and data spaces





Sovereignty control/enforcement

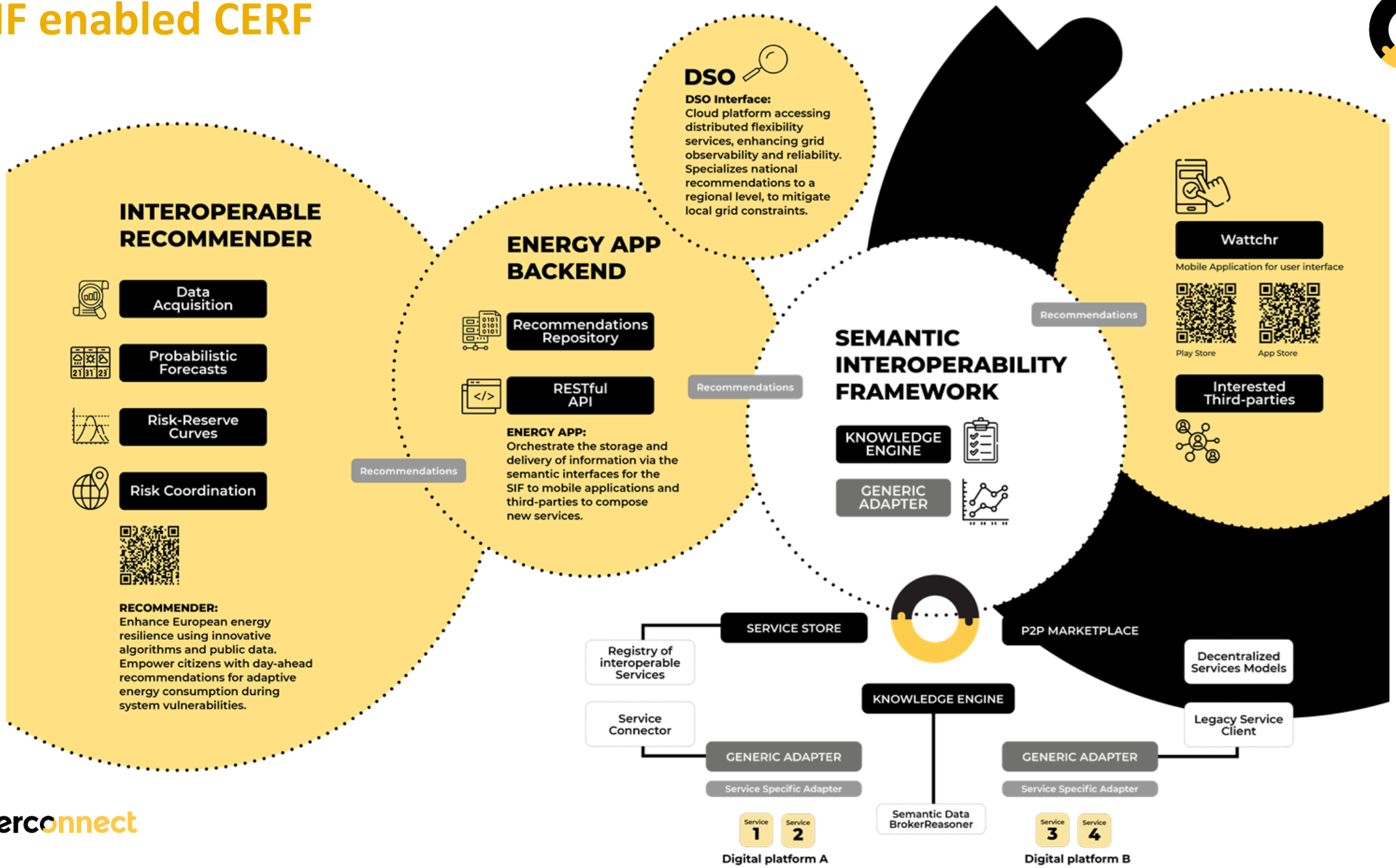
Cross-domain services
Identity Centric

INTERCONNECT

SEMANTIC
INTEROPERABILITY
FRAMEWORK

Enabling semantic data exchange with agnostic toolset
Domain bounded by an ontology (SAREF for Interconnect)
Federation of distributed knowledge

SIF enabled CERF



interconnect

SIF: an open ecosystem, deployed on scale already

- The Interconnect Semantic Interoperability Framework (SIF) was developed and is used by 50+ partners across Europe and is entirely based on open standards.
- Two additional waves of companies using SIF for innovative interoperable demonstrators have onboarded in two Open Calls, showing that our open digital ecosystem works for new parties without investing large amounts of time first.
- InterConnect partners have successfully deployed SIF in 7 large scale pilots, reaching thousands of end users in Greece, France, Portugal, Netherlands, Germany, Belgium and Italy.

- Use cases demonstrated: commercial and residential, in both the energy and non-energy domain.
- Overview of our achievements and pilots on https://interconnectproject.eu

Key figures:

- more than **50** integrators involved and committed
- **26** interoperable digital platforms connected
- more than **60** interoperable services (and growing..)
- more than **8** SIF instances currently
- established interworking between SIF instances

interconnect

interoperable solutions connecting smart homes, buildings and grids

FINANCING

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant agreement No 857237

PROJECT CONTACT

interconnect_project@inesctec.pt

DURATION

01.10.2019 / 30.09.2023

Security and privacy framework , Admin and Governance

Interconnect Interoperability Framework

InterConnect Service Store

Service Catalogue | Service Certification | Access policies | Identity Management

P2P marketplace

Semantic Interoperability Layer

Knowledge Engine | Ontologies | Reasoning | Discovery

SAREF

SAREF *SAREF* *SAREF*

Service Adapter

Digital platform A

SPINE IoT Json representation

```
# Alternatives of Powersequences
        sequenceId: 1
        state: scheduled
        activeSlotNumber: 0
        sequenceRemoteControllable: true
        startTime: "2021-06-24T12:00:00Z"
        endTime: "2021-06-24T13:40:00Z"
        earliestStartTime: "2021-06-24T06:20:00Z"
        latestEndTime: "2021-06-24T19:00:00Z"
        isPausable: false
        isStoppable: false
        valueSource: "empiricalValue"
        powerTimeSlots
        slotId: 1
```

Service Adapter

Digital platform B

Service Adapter

European Commission
DG-ENER
Code of Conduct
Test application

Native SAREF platform

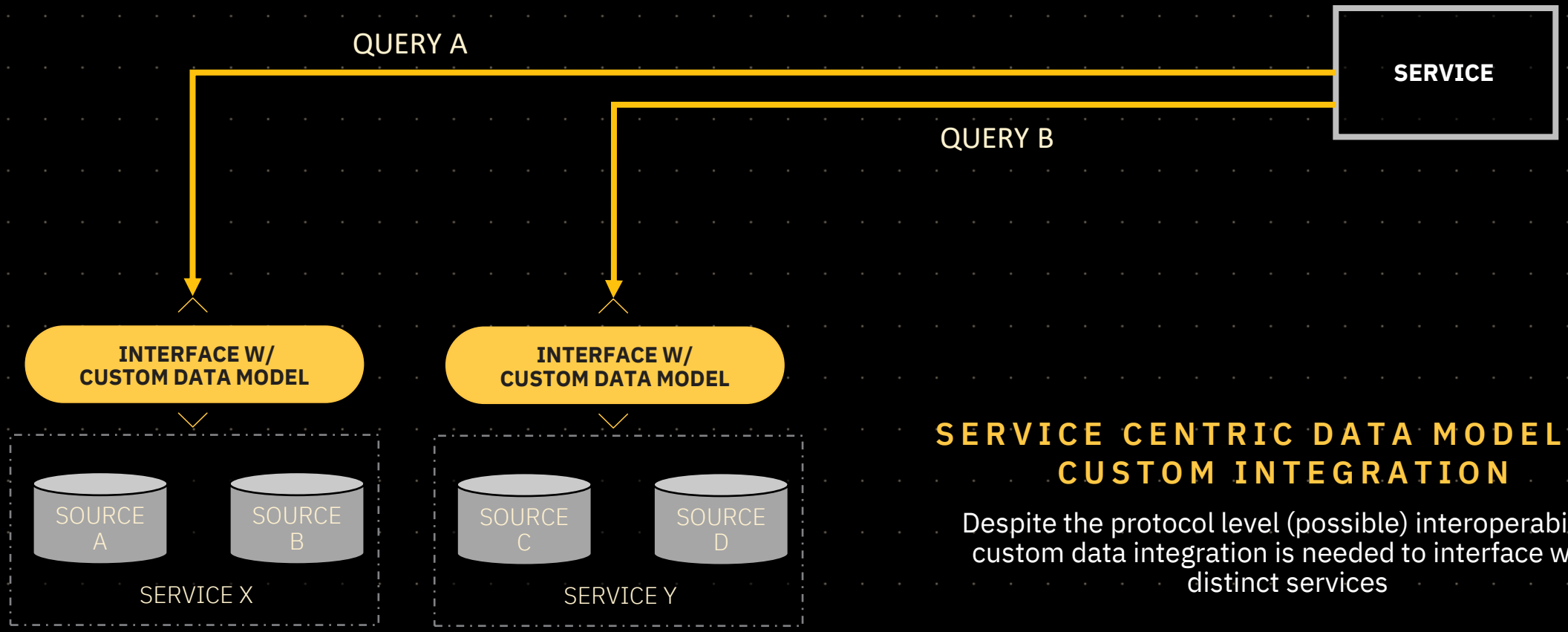
SAREF triple representation

```
?powerSequence rdf:type s4ener:PowerSequence .
?powerSequence s4ener:sequenceID "1"^^xsd:string .
?powerSequence saref:hasState s4ener:Scheduled .
?powerSequence s4ener:activeSlotNumber "0"^^xsd:unsignedInt .
?powerSequence s4ener:sequenceRemoteControllable "true"^^xsd:boolean .
?powerSequence s4ener:hasStartTime "2021-06-24T12:00:00Z"^^xsd:dateTime .
?powerSequence s4ener:hasEndTime "2021-06-24T13:40:00Z"^^xsd:dateTime .
?powerSequence s4ener:hasEarliestStartTime "2021-06-24T06:20:00Z"^^xsd:dateTime .
?powerSequence s4ener:hasLatestEndTime "2021-06-24T19:00:00Z"^^xsd:dateTime .
?powerSequence s4ener:isPausable "false"^^xsd:boolean .
?powerSequence s4ener:isStoppable "false"^^xsd:boolean .
```

Use cases, Interoperable Services, Standardization

DATASPACE

BOFORE
DATASPACES



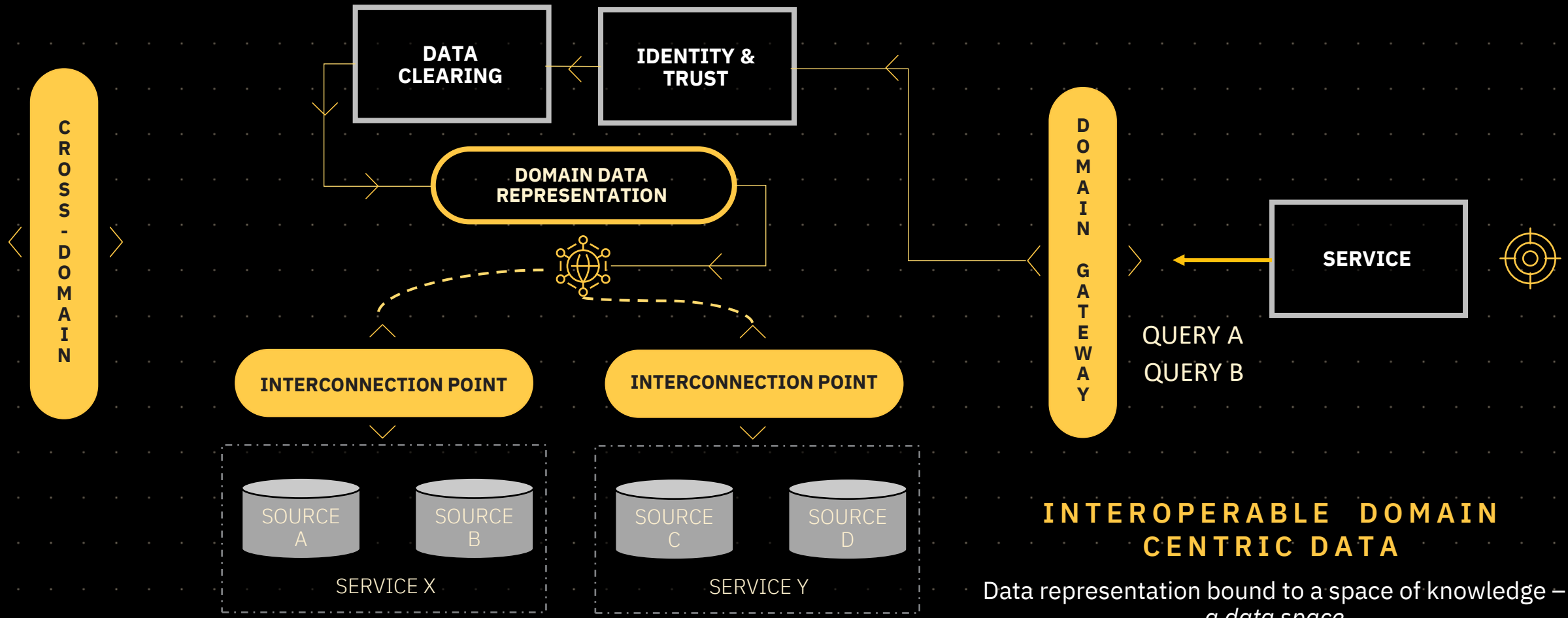
SERVICE CENTRIC DATA MODEL W/ CUSTOM INTEGRATION

Despite the protocol level (possible) interoperability, custom data integration is needed to interface with distinct services

MULTIPLE MODELLING AND INTEGRATION IN THE SAME DOMAIN

DATASPACE

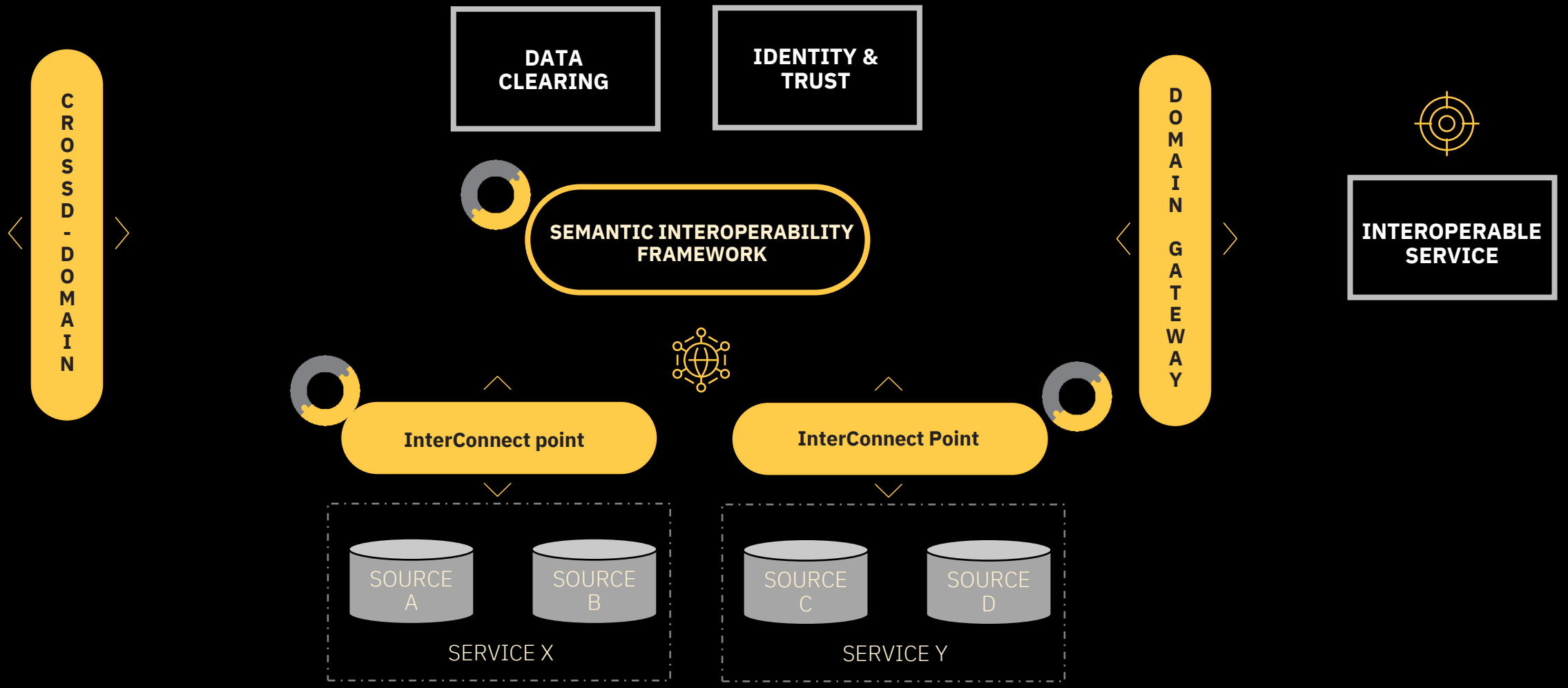
AFTER DATASPACES



INTEROPERABLE DOMAIN CENTRIC DATA

Data representation bound to a space of knowledge – *a data space*

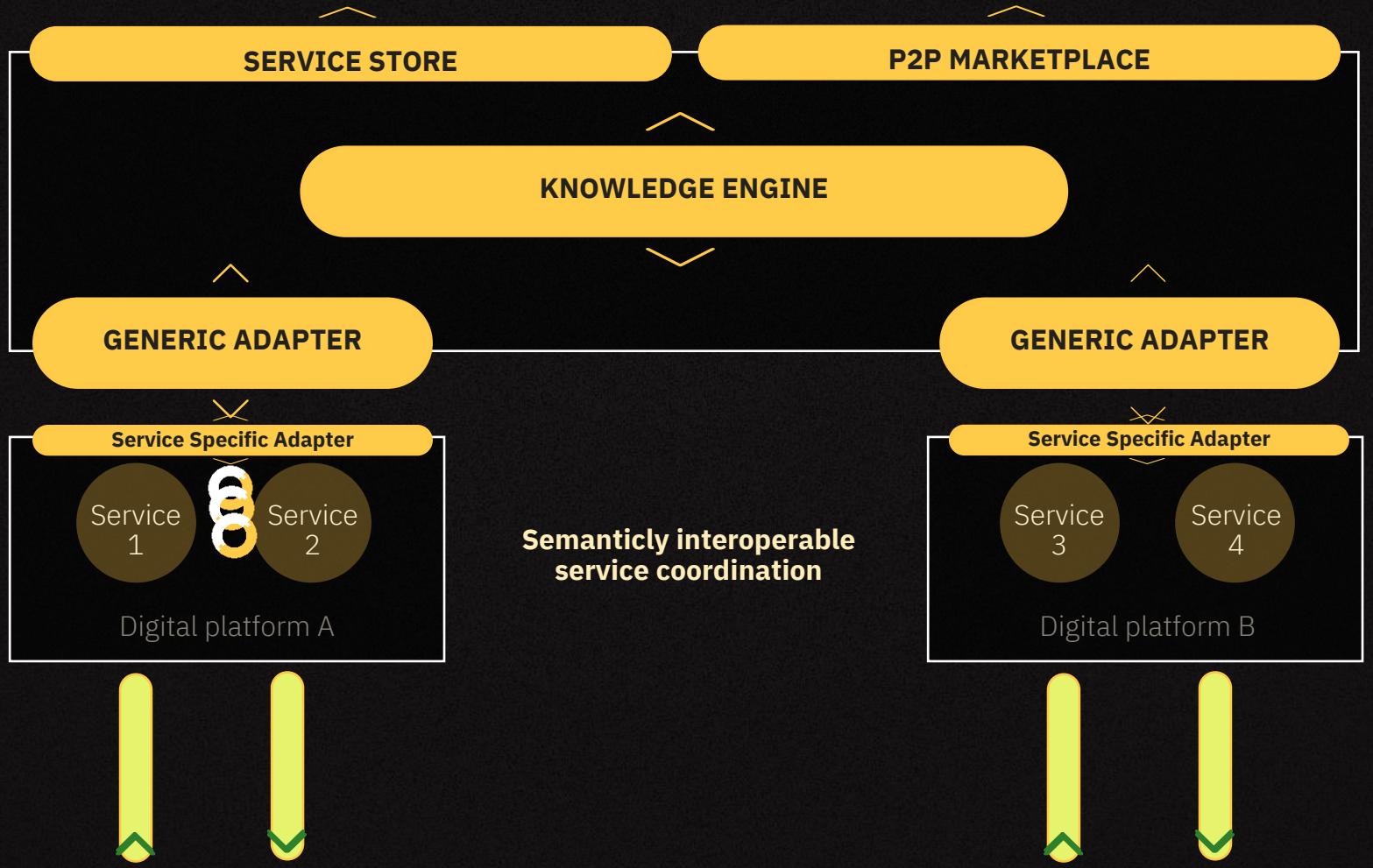
INTERCONNECT enabled DATASPACE



INTERCONNECT PROVIDES SEMANTIC INTEROPERABILITY

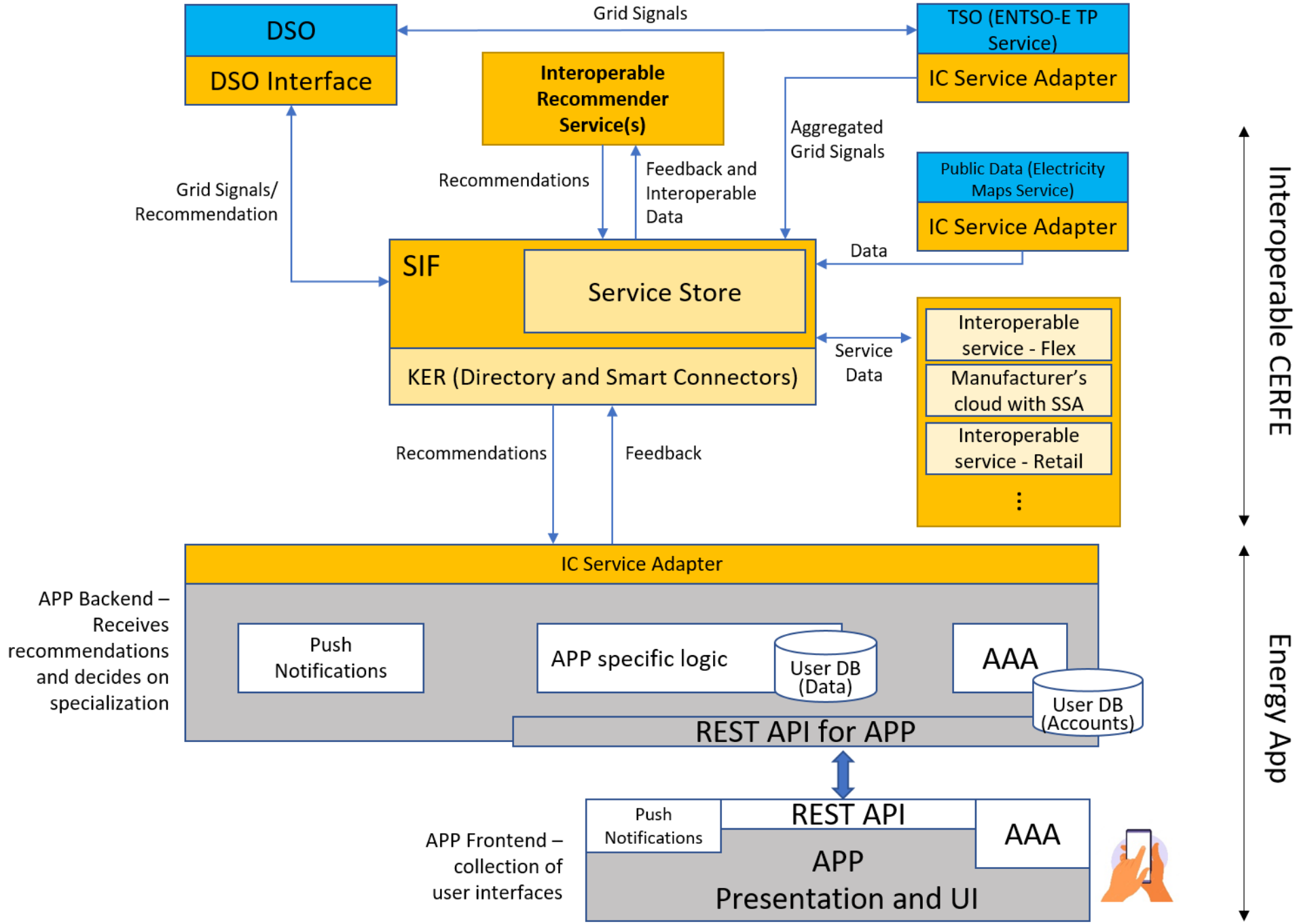
From the IoT /Energy domain with domain agnostic data sharing technology

SEMANTIC INTEROPERABILITY FRAMEWORK



SAREF
GRAPH PATTERN DATA

LEGACY SERVICE DATA


DSO
DSO Interface
Grid Signals
TSO (ENTSO-E TP Service)
IC Service Adapter
Interoperable Recommender Service(s)
Aggregated Grid Signals
Public Data (Electricity Maps Service)
IC Service Adapter
Grid Signals/ Recommendation
Recommendations
Feedback and Interoperable Data
Data
SIF
Service Store
KER (Directory and Smart Connectors)
Service Data
Interoperable service - Flex
Manufacturer's cloud with SSA
Interoperable service - Retail
Recommendations
Feedback
Interoperable CERFE
IC Service Adapter
APP Backend – Receives recommendations and decides on specialization
Push Notifications
APP specific logic
User DB (Data)
AAA
User DB (Accounts)
REST API for APP
Energy App
APP Frontend – collection of user interfaces
Push Notifications
REST API
AAA
APP
Presentation and UI