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Interoperability Network for the Energy Transition

Integrating cross-cutting standards with vertical standards

Antonio Kung, CEO, Trialog

3rd Expert Workshop on Design and Operation of Digitalized Sector-Coupled Energy Systems (DigiSect 2024) on 16-17 May 2024, Stockholm

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101070086

Outline

- Introduction
  - Speaker
  - Intnet
- Cross-cutting standards
  - AI, Trustworthiness, IoT and digital twin
  - Ecosystem - Data space perspective
  - Privacy – AI perspective
- Integration of verticals
  - Architecture vision
  - Integration of data spaces

Speaker

- CEO Trialog
  - IoT systems: Smart meters, Vehicle charging, Connected vehicles
- Standardisation
  - ISO/IEC, ISO, ITU-T, CEN-CENELEC, ETSI
  - Architecture, IoT, Digital twin, AI, Security and Privacy
- AIOTI (Alliance for IoT and Edge Computing Innovation)
  - Chair AIOTI WG3 Standardisation
  - Liaison officer AIOTI to JTC 1/SC 41
- BDVA (Big data value association)
  - Participation TF6.SG6 standards, TF10 data spaces,
  - Participation Standards AI, Data and Robotics,
- Horizon Europe
  - Energy data space: Int:Net, Enershare
  - Connected collaborative automated mobility: Connect
  - Standards: INSTAR
  - Privacy: LICORICE
  - Digital twins for agriculture: SPADE

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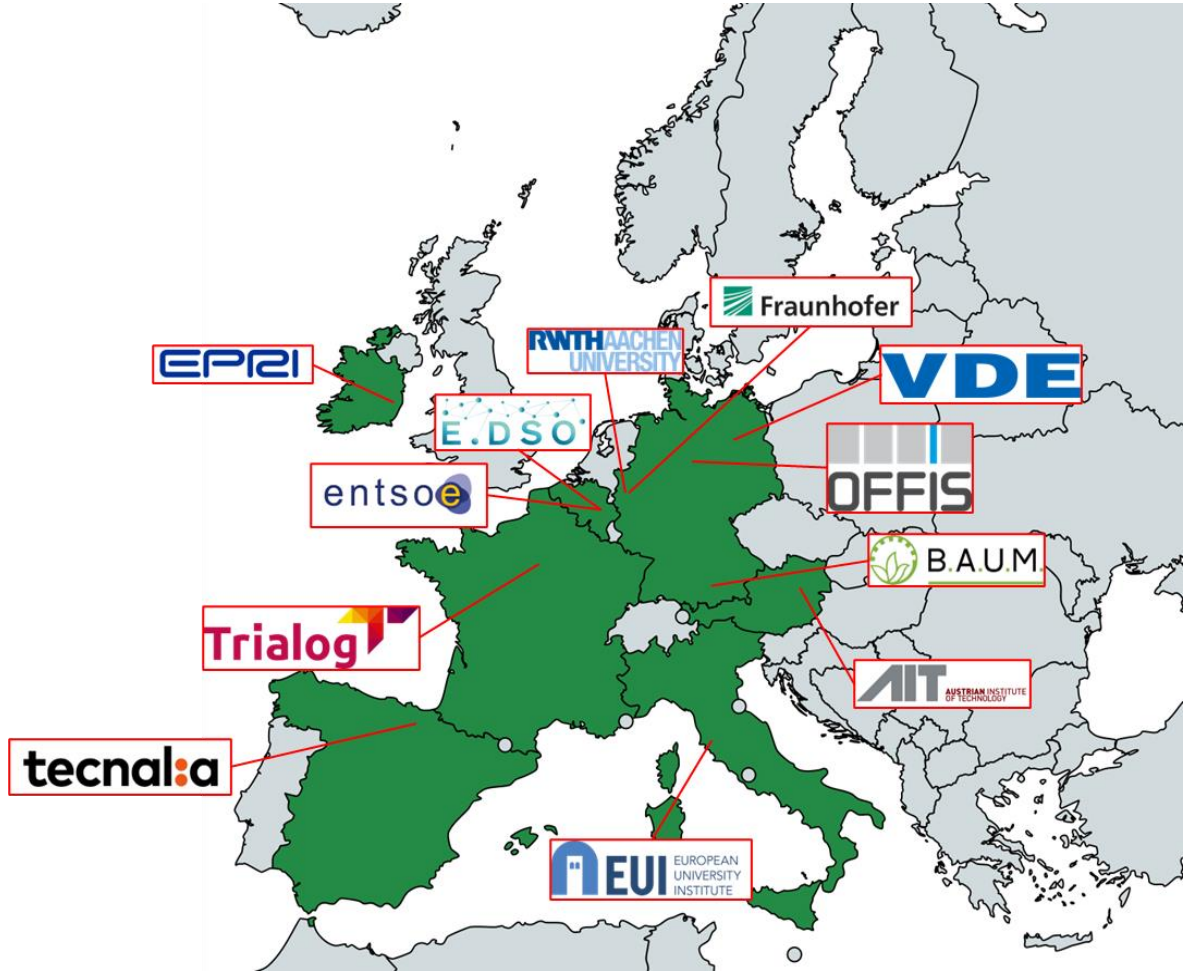
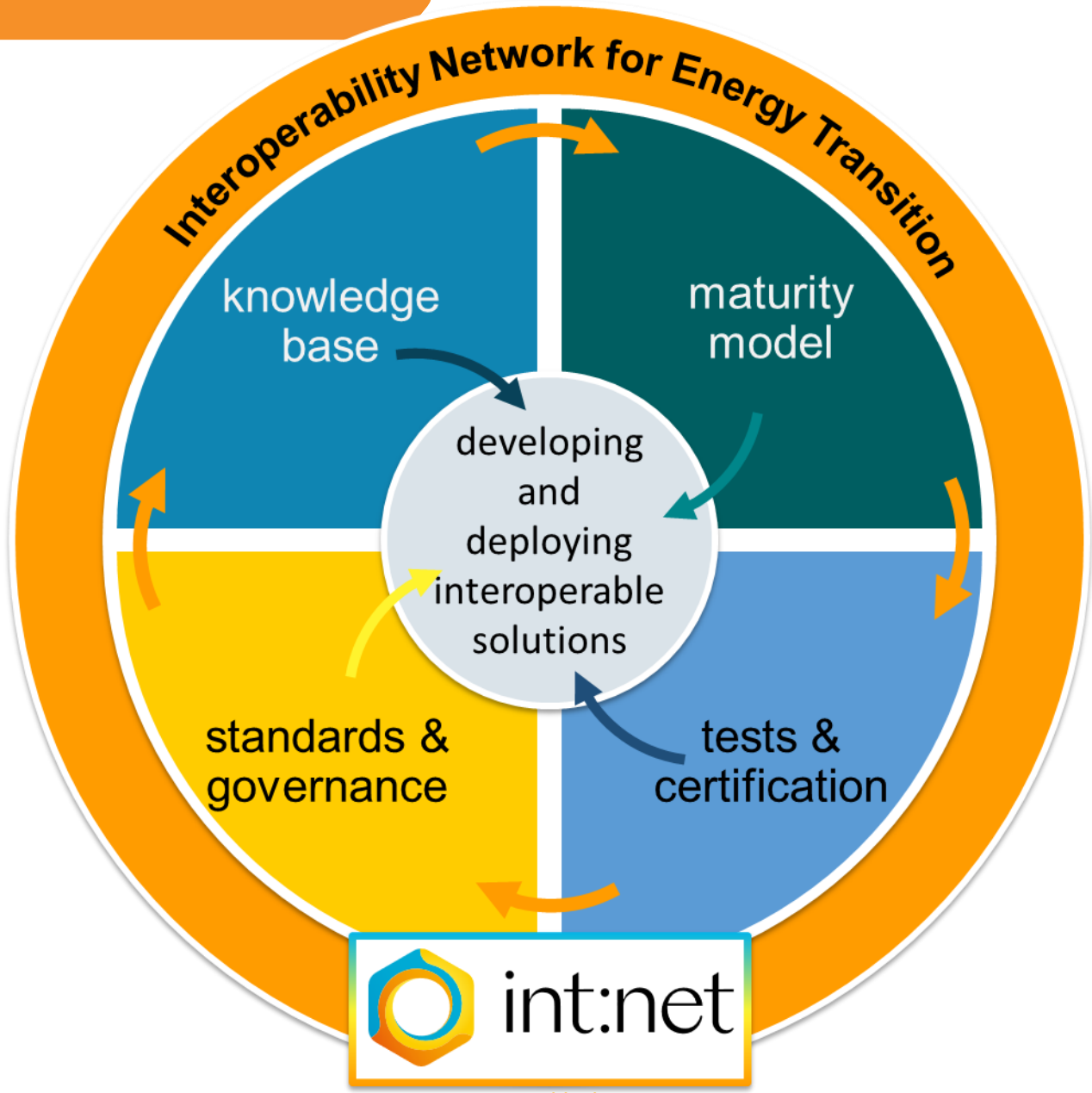
Interoperability Network for the Energy Transition

Horizon Europe call HORIZON-CL5-2021-D3-01-03

- 01.05.2022 – 30.04.2025
- Consortium:
  - 12 Partners
  - 1 Associated Partner
  - 7 Countries



Project Objectives



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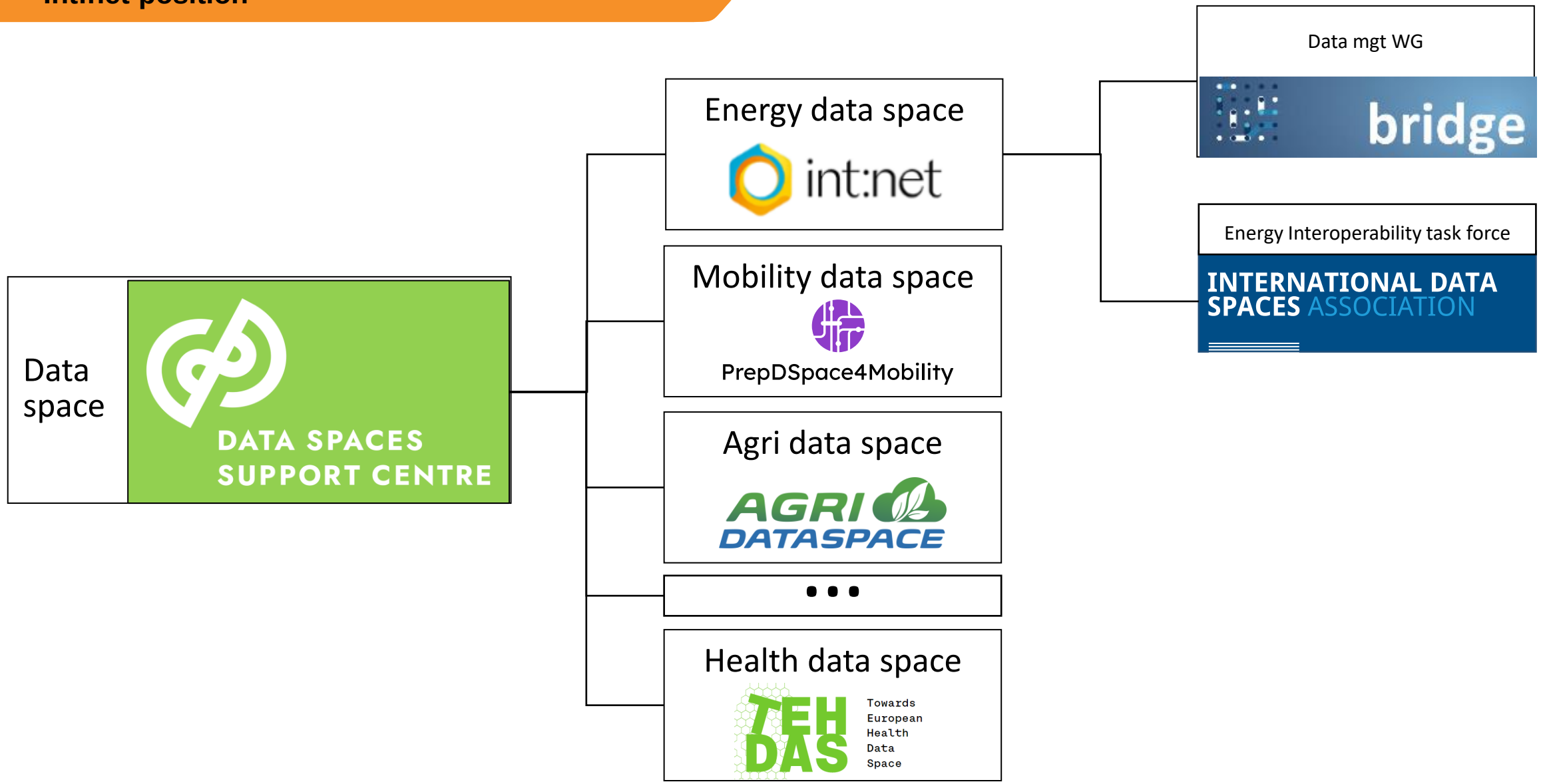

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Interoperability Network for the Energy Transition

Cross-cutting standards

Artificial Intelligence Standards (SC42)

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101070086

Artificial Intelligence (ISO JTC1/SC42)

(Green = published, Orange >= CD, Light Red < CD, Red = WD)

Foundational standards WG1

- 22989:2022 AI Concepts and terminology
- 23053:2022 Framework of AI systems using ML
- 42001 2023 AI management System
- 42005 AI system Impact Assessment
- 42006 Req. for bodies providing audit & certification of AIMS
- 42102 Taxonomy of AI system methods and capabilities
- 22989 AMD1 AI Concepts and terminology
- 23053 AMD1 Framework of AI systems using ML
- 24970 AI system logging
- 42xxx Guidelines for AI management system auditing

Data WG2

- 8183:2023 Data life cycle framework
- 20546:2019 Big data vocabulary
- 20547-1,2,3,5 Big data Reference Architecture
- 24668:2022 Process mgt framework for big data analytics
- 5259-1,2,3,4,5 Data quality for analytics and machine learning
- TR 42103 Overview of synthetic data
- 5259-6 Data quality for analytics and ML - Visualization Fwk for data quality
- 42xxx Framework for use of generated data for analytics and ML
- 42559 De-identification of training data for ML

Trustworthiness WG3

- TR 5469:2024 Functional safety and AI systems
- TS 8200:2024 Controllability of automated artificial intelligence systems
- 23894:2023 Guidance on risk management
- TR 24027:2021 Bias in AI systems and AI aided decision making
- TR 24028:2020 Overview of trustworthiness in artificial intelligence
- TR 24029–1,2:21/23 Assessment of robustness of neural networks
- TR 24368:2022 Overview of ethical and societal concerns
- TS 25058:2024 Guidance for quality evaluation of AI systems
- 25059:2023 Quality model for AI systems
- TS 6254 Explainability of ML models and AI systems
- 12791 Treatment of unwanted bias in classification and regression ML tasks
- 12792 Transparency taxonomy of AI systems
- TR 22440 Functional safety and AI systems - Requirements
- TS 22443 guidance societal concerns and ethical considerations
- TR 24029-3 Assessment robustness NN – statistical methods
- 42105 Guidance for human oversight
- TR 42106 Benchmarking of AI system quality characteristics
- PWI 18966 Oversight of AI systems
- PWI 42108 Domain and operating conditions
- NP 25029 Nudging
- 42xxx Reliability of AI systems
- 42xxx Trustworthiness Fact Labels for AI systems
- 24029-5 Assessment of robustness of NN - other AI algorithms

Use cases and apps WG4

- 5338:2023 AI system lifecycle process
- 5339:2024 Guidance for AI applications
- TR 24030 Ed2:2024 AI use cases
- TR 20226 Environmental sustainability aspect os AI
- TR 21221 Beneficial AI systems
- TR 42109 Use cases of human-machine teaming
- PWI 42113 Evaluation metrics for AI use cases and application

Computational approaches WG5

- TS 4213:2022 Assessment of ML classification performance
- TR 24372:2021 Overview of computational approaches
- 5392:2024 Ref. architecture of knowledge engineering
- TR 17903 Overview of machine learning computing devices
- PWI 18966 guidance oversight of AI systems
- PWI 42107 AI lightweight modelling
- NP TS 42110 AI inference framework
- NP 42111 Guidance on AI lightweight modelling
- PWI 42112 ML model training efficiency optimization
- TS 4213 Performance measurement

Joint working groups

- JWG1 38507:2022 Governance implications of the use of AI
- JWG2 TS 17847 Verification and validation of AI systems
- JWG2 TS 29119-11 Testing for AI systems
- JWG3 TR 18988 Application of AI technologies in health informatics
- JWG4 22440-1,2,3 Functional safety and AI systems
- JWG5 TR 23281 Overview AI tasks and functionalities related to NLP
- JWG5 23282 Evaluation methods for accurate NLP
- JWG3 NP 22989-2 Concepts and terminology — Part 2: Healthcare
- JWG4 42xxx Uncertainty quantification

JWG1 Governance implications of AI
JWG2 Testing of AI-based systems
JWG3 AI enabled health informatics
JWG4 Functional Safety and AI
JWG5 Natural language processing

Artificial Intelligence (ISO JTC1/SC42)

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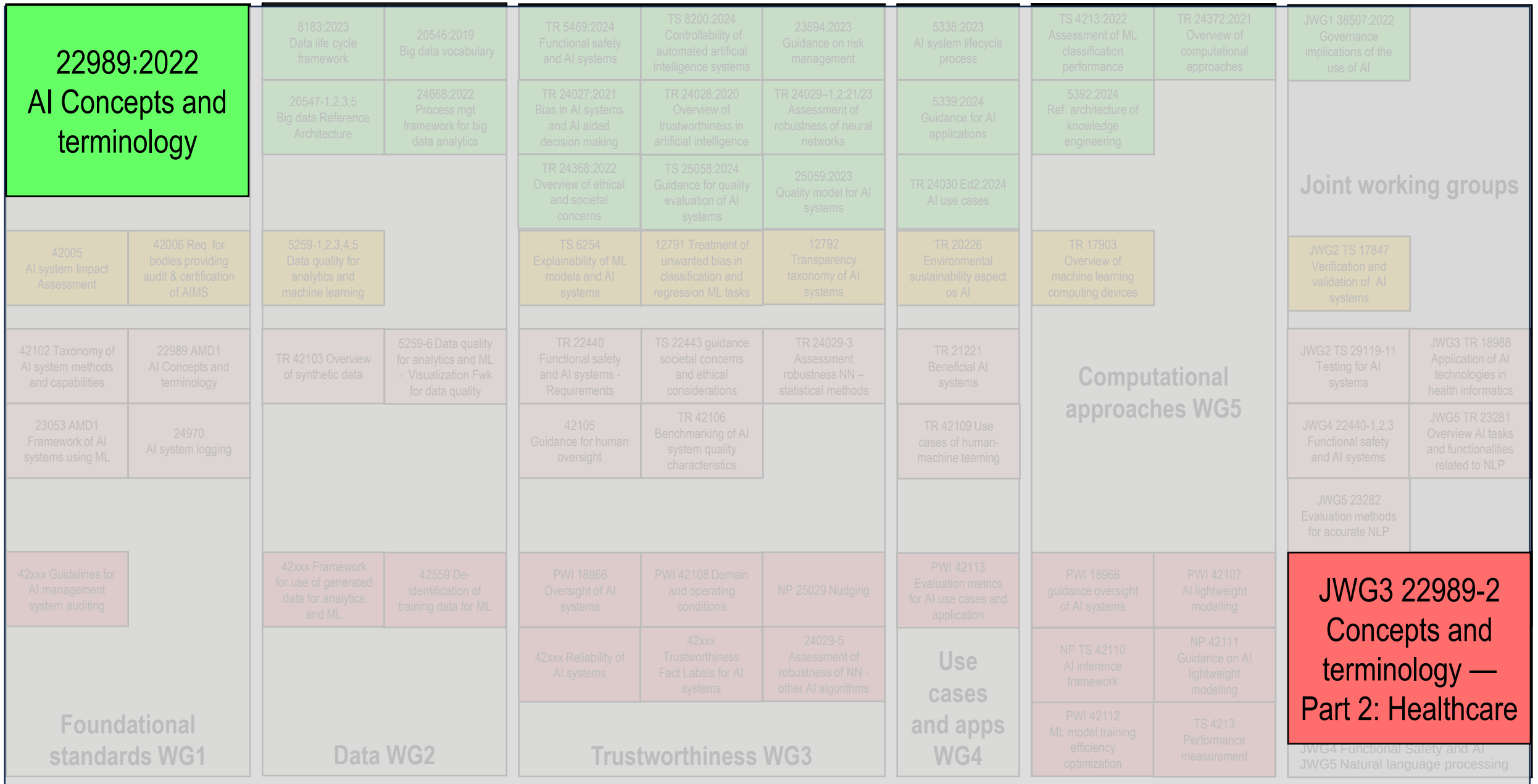

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Interoperability Network for the Energy Transition

Cross-cutting standards

Trustworthiness

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Trustworthiness

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JTC 1/SC 7 System engineering	JTC 1/WG 13 Trustworthiness	JTC 1/SC 41 IoT and digital twin	JTC 1/SC 27 Cybersecurity and privacy		JTC 1/SC 42 Artificial Intelligence				JTC 1/SC 38 Cloud computing	Cen-clc JTC 21 Artificial Intelligence
250xx Systems and software quality requirements and evaluation	**TS 5723:2022** Trustworthiness vocabulary	**30147:2021** Trustworthiness in lifecycle process	**TR 27563:2023** Security and privacy in AI use cases	**TR 6114:2023** Security considerations throughout the product life cycle	**TR 5469:2024** Functional safety and AI systems	**23894:2023** Guidance on risk management	**TR 24027:2021** Bias in AI systems and AI aided decision making	**TR 24028:2020** Overview of trustworthiness in Artificial Intelligence		
					TR 24029 –1, 2: 2021-23 Assessment of robustness of neural networks	**TR 24368:2022** Overview of ethical and societal concerns	**25059:2023** Quality model for AI systems			
9837 System resilience		**30149** IoT Trustworthiness principles	**27090** Security threats and failures in AI systems		**TS 6254** Explainability of ML models and AI systems	**TS 8200** Controllability of automated artificial intelligence systems	**12791** Treatment of unwanted bias in classification and regression ML tasks			
		30187 IoT system indicators			**12792** Transparency taxonomy of AI systems	**TS 25058** Guidance for quality evaluation of AI systems	**42005** AI system impact assessment			
42042 Reference Architecture	**31303** Trustworthiness - Overview and concepts		**5181** Data provenance	**TS 27115** Cybersecurity evaluation of complex systems	**TR 21221** Beneficial AI systems	**TR 22440** Functional safety and AI systems - Requirements	**TS 22443** guidance societal concerns and ethical considerations	**TR 24029-3** Assessment robustness NN - methodology	**TR 11034** Trustworthiness of cloud services	AI Trustworthiness framework
			27091 Artificial intellgence - Privacy protection		**TS 25058** SQuaRE quality evaluation	**TR 42105** Guidance for human oversight	**TR 42106** Benchmarking of AI system quality characteristics			
	PWI 18149 Trustworthiness ontology		**PWI 6109** Guidelines for data security monitoring based on logging	**PWI 7709** Security and privacy for multisourced data processing	**PWI 18966** Oversitght of AI systems	**PWI 42108** Domain and operating conditions				
			PWI 22080 Cybersecurity of UAS							

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Interoperability Network for the Energy Transition

Cross-cutting standards

IoT and Digital Twins (SC41)

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IoT and Digital twins (Yellow tags)

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Foundational

- **20924 Ed2 2024** IoT and digital twin – Vocabulary
- **30141 2018** IoT reference architectures
- **30147 2021** Integration of IoT trustworthiness in ISO/IEC/IEEE 15288
- **30164 2020** IoT Edge computing
- **30165 2021** Real-time IoT
- **30166 TR 2020** Industrial IoT
- **30168:2024 TS** Generic Trust Anchor API for Industrial IoT Devices
- **30173:2023** Digital twin concepts and terminology

Interoperability

- **21823-1 2020** IoT interoperability - framework
- **21823-2 2020** IoT transport interoperability
- **21823-3 2021** IoT semantic interoperability
- **21823-4 2022** IoT syntactic interoperability
- **30161-1 2020** Data exchange platform for IoT - Requirements & architecture
- **30161-2 2023** Data exchange platform for IoT – Transport interoperabiltiy
- **30162 2022** Compatibility requirements within industrial IoT systems

Application

- **22417 TR 2017** IoT use cases
- **30163 2021** SN-based integrated platform for chattel asset monitoring
- **30169 2022** IoT applications for electronic label systems (ELS)
- **30172 TR 2023** Digital twin use cases
- **30176 TR 2021** Integration of IoT and DLT/blockchain: use cases
- **30179 2023** IoT system for ecological environment monitoring

Sensor network

- **29182-1 2017** SNRA General overview and requirements
- **29182-2 2013** SNRA Vocabulary and terminology
- **29182-3 2014** SNRA Reference architecture views
- **29182-4 2013** SNRA Entity models
- **29182-5 2013** SNRA Interface definitions
- **29182-6** 2014 SNRA Applications
- **29182-7 2015** SNRA Interoperabiity guidelines
- **20005 2013** Collaborative information processing in intelligent SN
- **30128 2014** Generic SN Application Interface
- **19637 2016** SN testing framework
- **22560 TR 2017** SN - Aeronautics active air-flow control
- **30101:2014** SN and its interfaces for smart grid system

Underwater acoustic network

- **30140-1 2018** UWASN – Overview and requirements
- **30140-2 2017** UWASN – Reference architecture
- **30140-3 2018** UWASN – Entities and interfaces
- **30140-4 2018** UWASN – Interoperability
- **30142 2020** UWASN – Network mgt system overview & requirements
- **30142-2 2020** UWASN – Network management system u-MIB
- **30143 2020** UWASN – Application profiles
- **30171-1 2022** B-UWAN - Overview and requirements

IoT and Digital twins (Yellow tags)

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Foundational

- **30141 Ed2** IoT reference architecture (WG3)
- **30186** Digital twin maturity model (WG6)
- **30149 TS** IoT trustworthiness principles (WG3)
- **30187** Evaluation indicator for IoT systems (WG5)
- **30188** Digital twin Reference Architecture (WG6)
- **PWI 16** Digital Twin – Extraction and transactions of data components (WG6)
- **PWI 17** Guidance on IoT and digital twin integrations in data spaces (WG6)
- **PWI 19 Digital twin – G**uidelines for digital entity modelling (WG6)

Interoperability

- **30178** IoT Data format, value and coding (WG4)
- **30181** Functional architecture for resource ID interoperability (WG4)
- **30198** Edge computing gateway interoperability framework (WG4)
- **21823-5** Behavioral and policy interoperability (WG4)
- **TR PWI 11** Digital twin correspondence measure of DTw twinning (WG6)

Applications

- **30194 TR** Best practices for use case projects (SC41)
- **30189-1 TR** IoT-based cultural heritage mgt – Framework (WG5)
- **30180** Status of self-quarantine through IoT data interfaces (WG5)
- **30195 TR** IoT Applications for Long-distance Oil and Gas Pipeline
- **30184** Autonomous IoT object identification in connected home (WG5)
- **30196 TR** IoT applications for natural gas distribution system (WG5)
- **30197** IoT for stress management, good health and well-being (WG5)
- **TR PWI 13** IoT Apps for long-distance oil & gas transmission pipeline (WG5)
- **TR PWI 10** IoT-based cultural heritage mgt - Use cases (WG5)
- **PWI 15** System reqs of IoT-based fixed asset seizure management (WG5)
- **TR PWI 12** Environmental effect of underwater acoustic signalling (WG7)
- **TR PWI 18** Guidance on IoT application to home healthcare (WG5)

Underwater

- **30177** Underwater network mgt system (U-NMS) interworking (WG7)
- **63573-1** Multi-modal underwater wireless com. tech – overview & reqs.

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Interoperability Network for the Energy Transition

Cross-cutting standards

Ecosystem - Data space perspective

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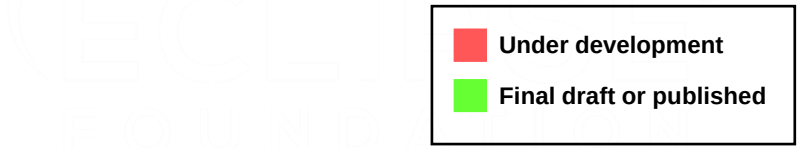
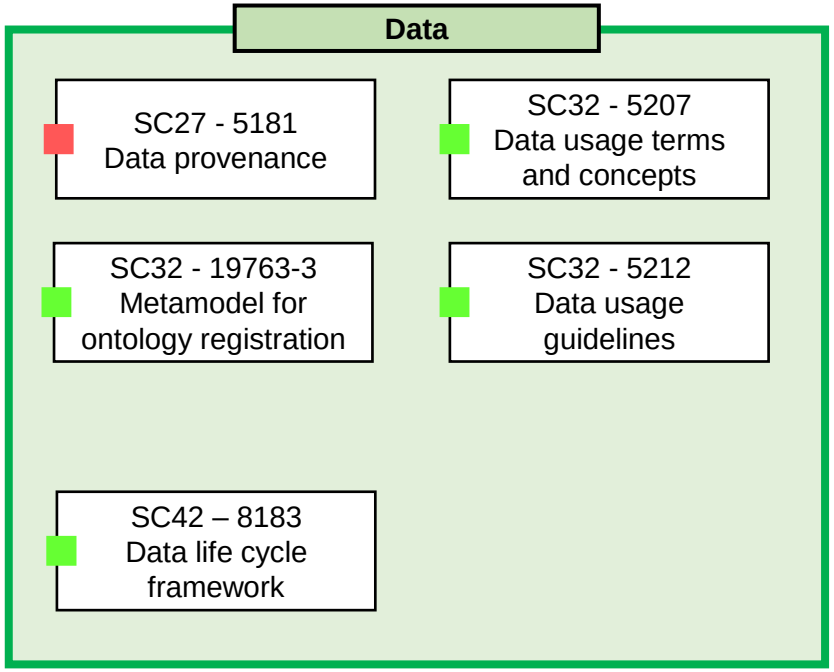
standardization

Perspective

Ecosystem – Data space





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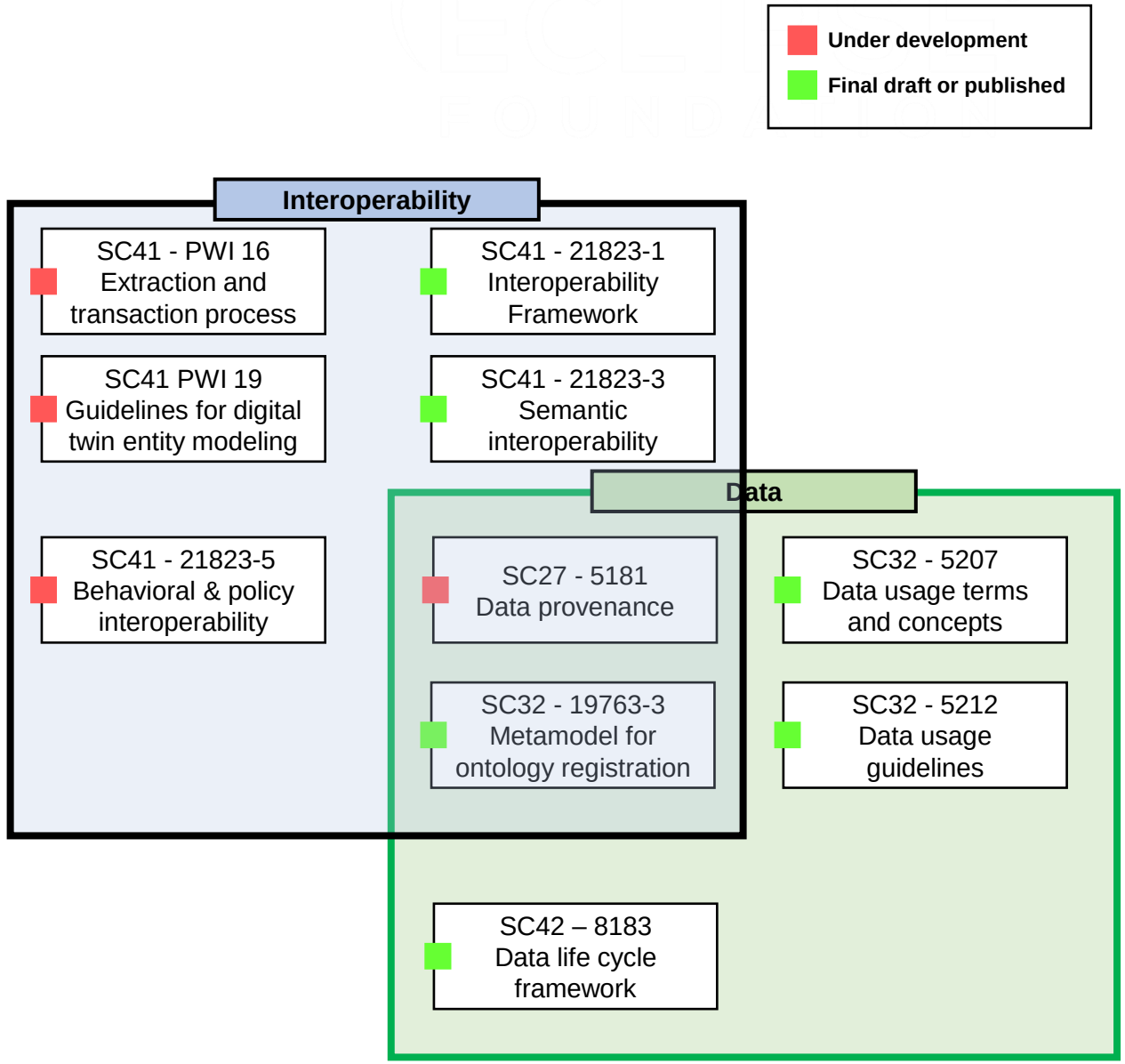
standardization

Perspective

Ecosystem – Data space



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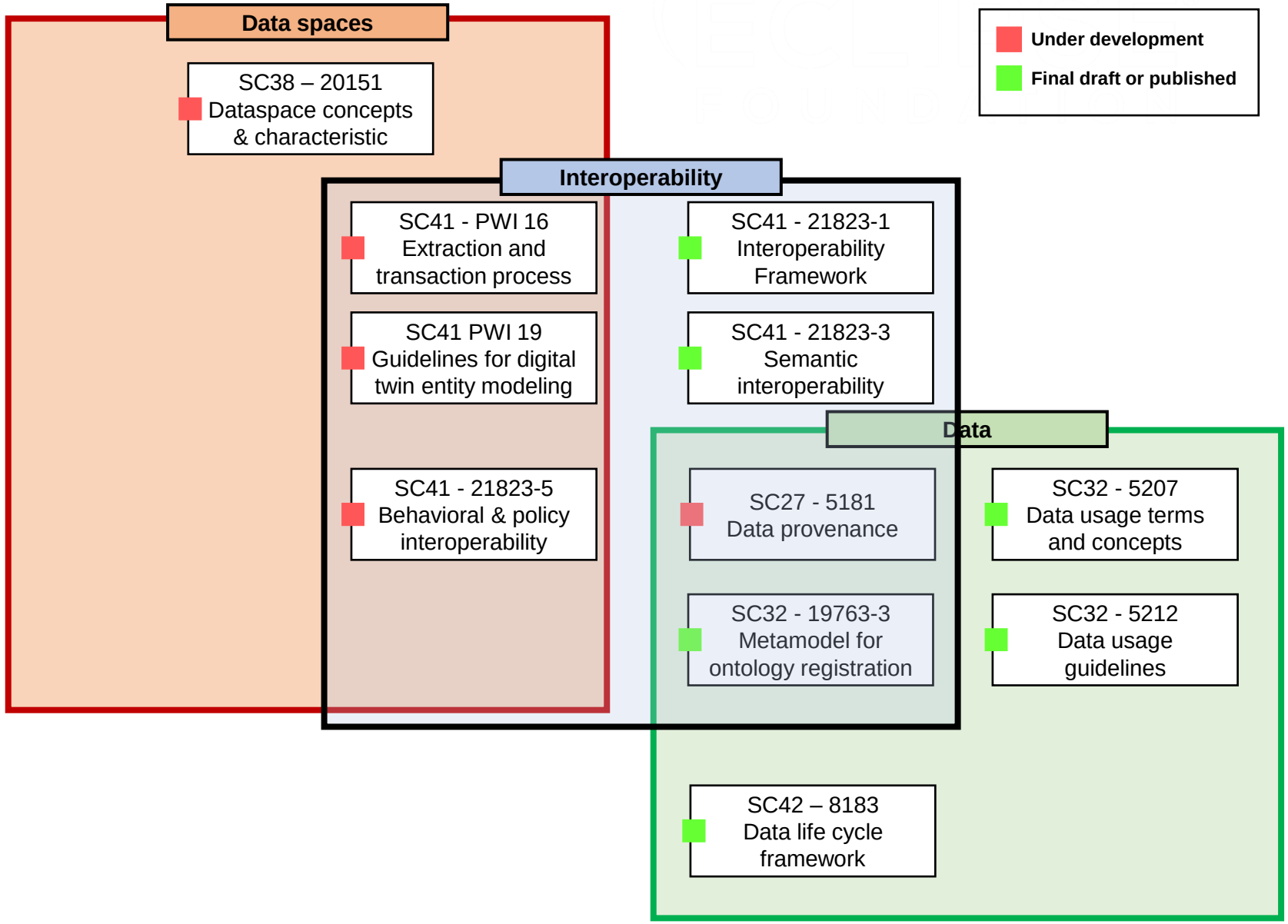
standardization

Perspective

Ecosystem – Data space



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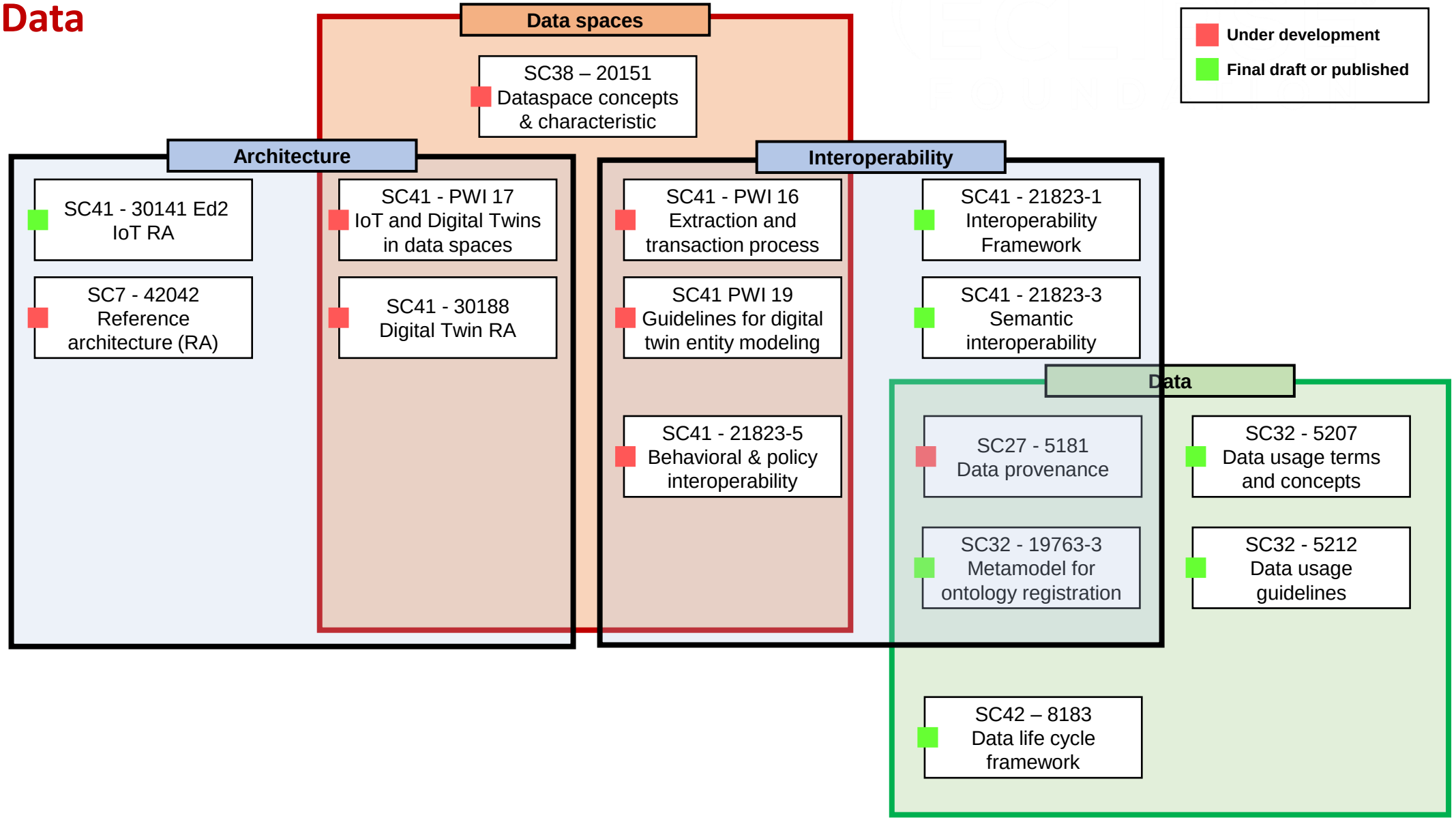
standardization

Perspective

Ecosystem – Data space



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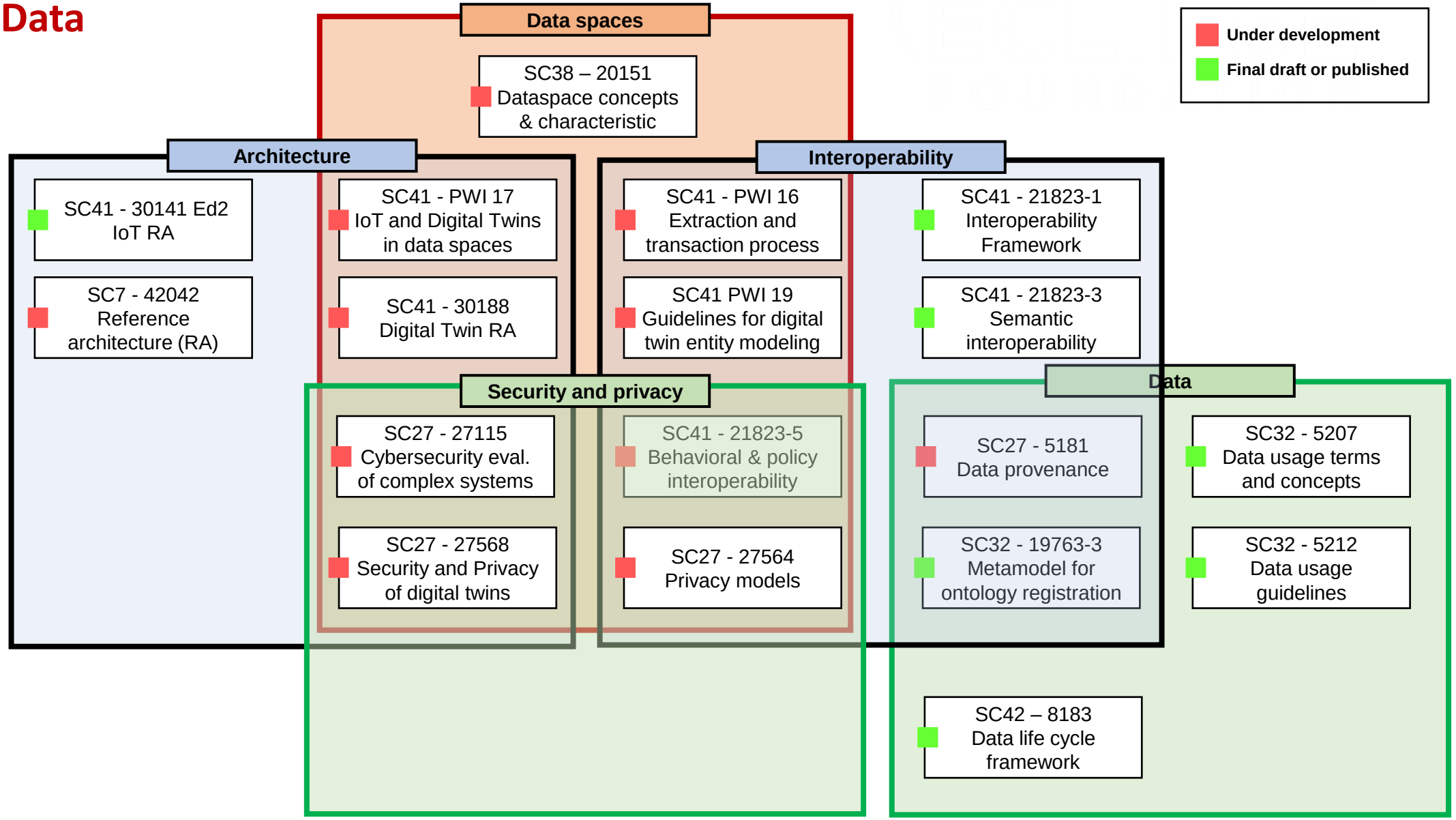
standardization

Perspective

Ecosystem – Data space



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Perspective

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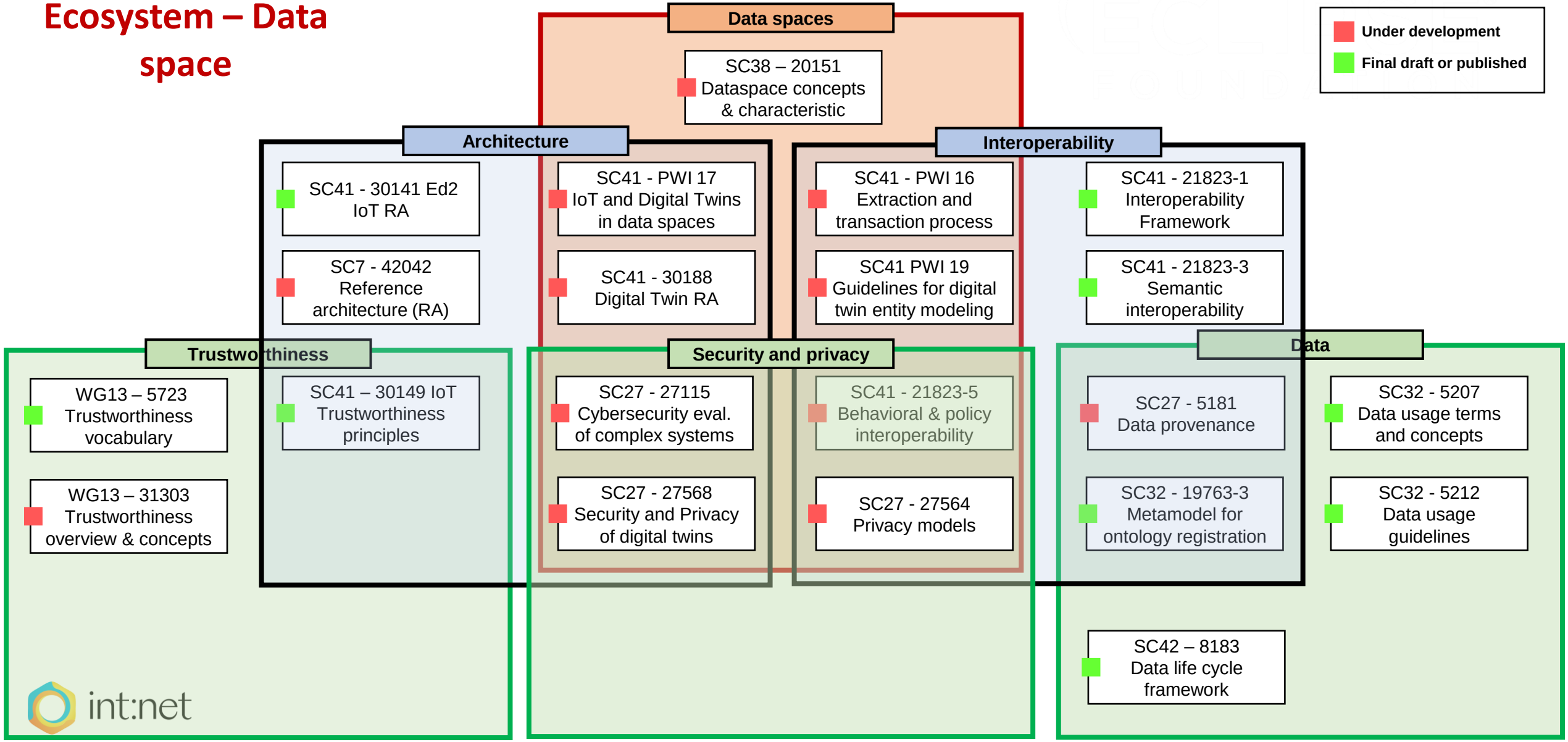

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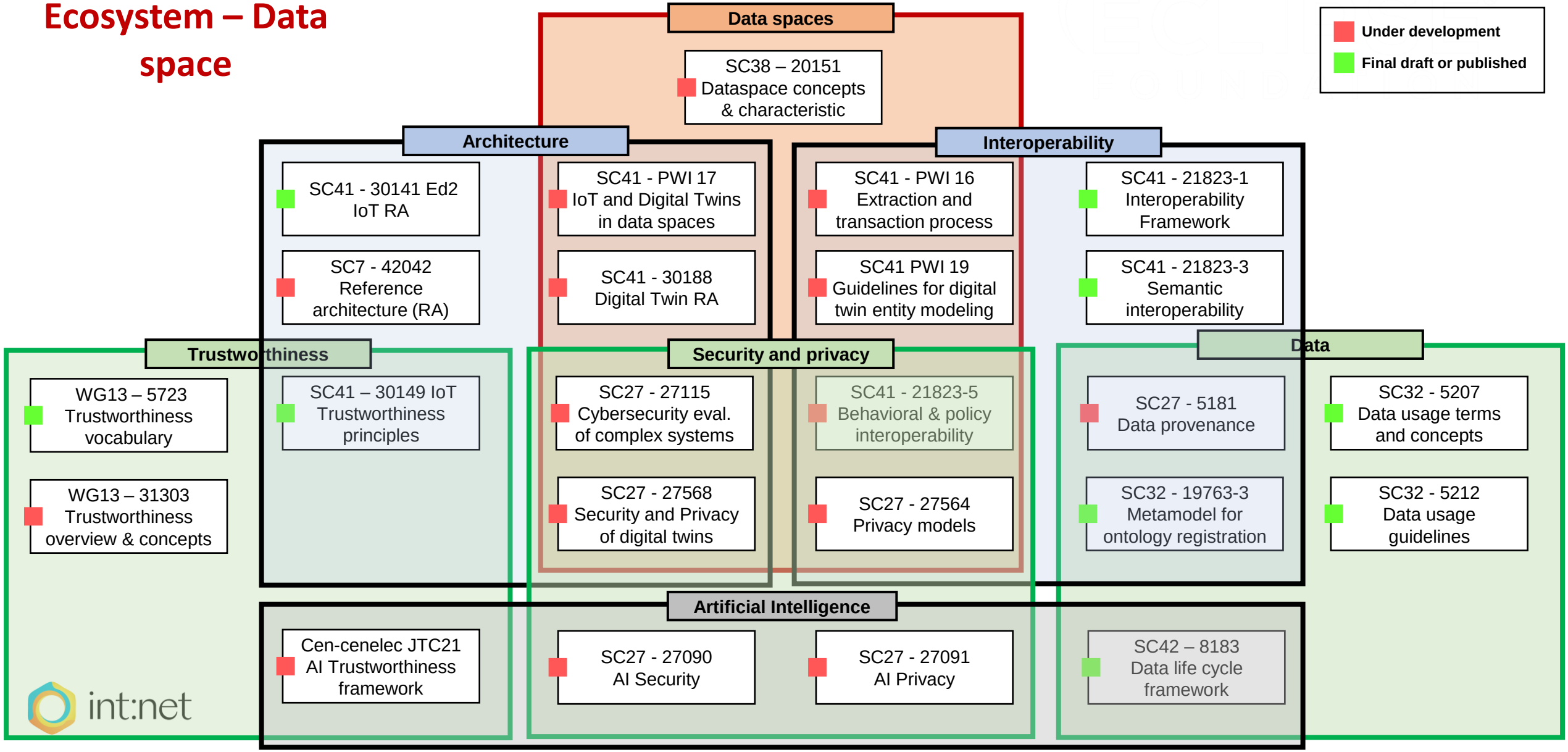

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Cross-cutting standards

Privacy – AI perspective

OECD Expert Workshop on PETS and AI

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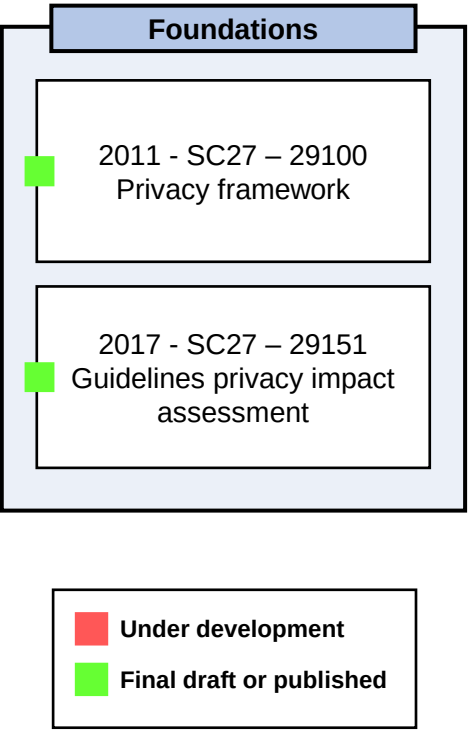
Standardization

Perspective

PETS - AI



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Standardization Perspective

PETS - AI

Privacy engineering

- 2019 - SC27 – 27550 Privacy engineering for system lifecycle processes
- 2023- PC317 – 31700-1,2 Privacy-by-design for consumer goods and services
- 2024 -SC27 – 27566 POMME Privacy operationalization for engineering
- SC27 – 27564 Privacy models

Foundations

- 2011 - SC27 – 29100 Privacy framework
- 2017 - SC27 – 29151 Guidelines privacy impact assessment

Under development

Final draft or published

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Standardization Perspective

PETS - AI

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Foundations

- 2011 - SC27 – 29100 Privacy framework
- 2017 - SC27 – 29151 Guidelines privacy impact assessment

De-identification

- 2018 - SC27 – 20889 Privacy enhancing de-identification terminology and classification of techniques
- 2022 - SC27 – 27559 Privacy-enhancing data de-identification framework
- SC27 – 27565 Guidance on privacy preservation based on zero-knowledge proofs

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Final draft or published

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Standardization Perspective

PETS - AI

Foundations

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Privacy engineering

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- 2018 - SC27 – 20889 Privacy enhancing de-identification terminology and classification of techniques
- 2022 - SC27 – 27559 Privacy-enhancing data de-identification framework
- SC27 – 27565 Guidance on privacy preservation based on zero-knowledge proofs

Other domains

- 2024 - SC27 – 27561 Privacy guidelines for fintech
- SC27 – 27566-1,2,3 Age assurance
- SC27 – 27568 Security and privacy of digital twins
- SC27 – 27573? Privacy protection of avatars

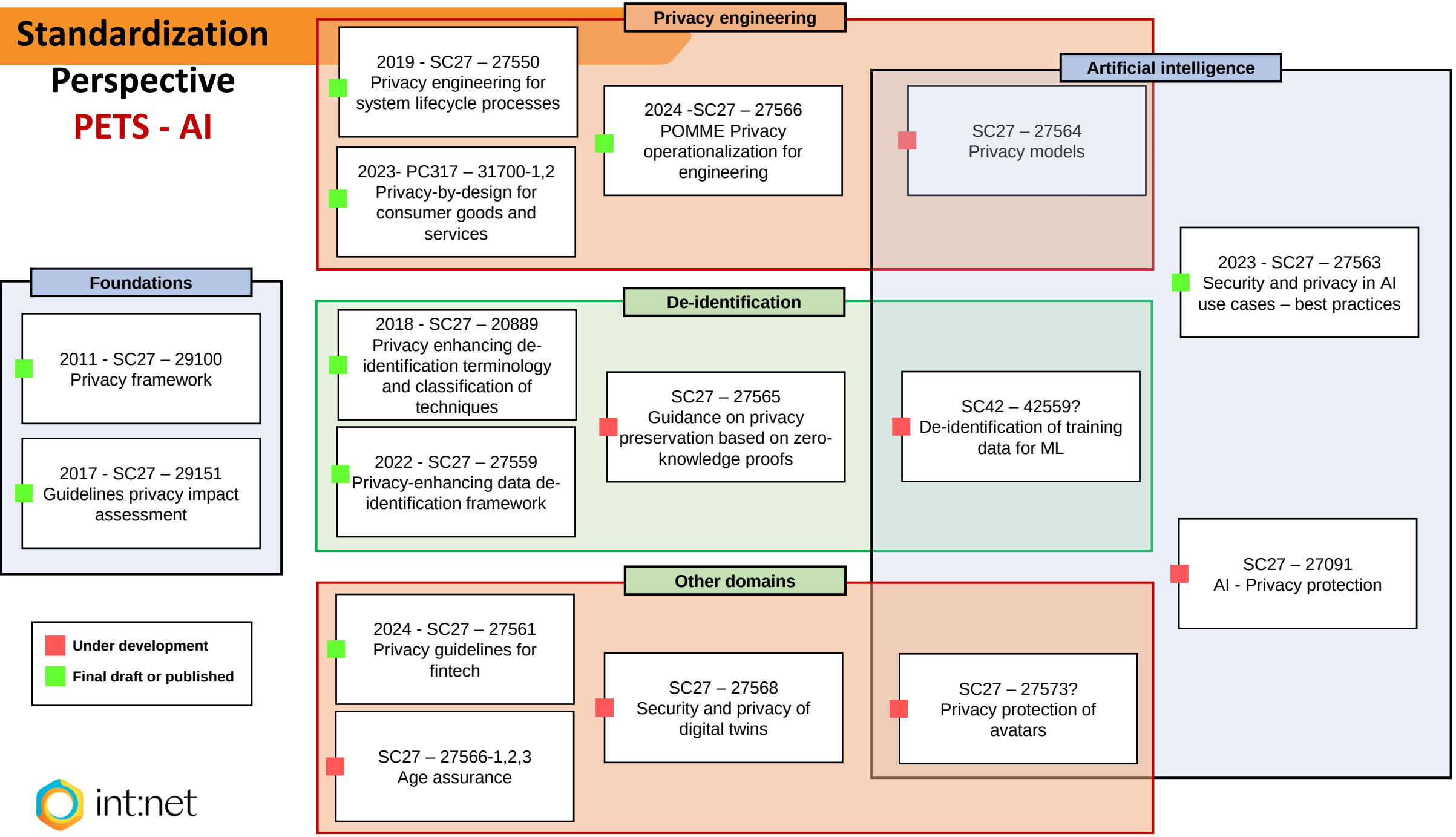
Under development

Final draft or published

int:net

Standardization Perspective

PETS - AI



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Interest Group: Models for Privacy

Enershare

ECLIPSE FOUNDATION

Established early 2024

Purpose:
- practices for privacy engineering based on models
- create synergies to foster development of an ecosystem of privacy models
- promote the creation, use and sharing of privacy models

https://models4privacy.org/
- join as a member of the interest group
- join mail list
- stay updated on the interest group activities/events

Michelle Chibba - Antonio Kung - Ann Cavoukian

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Interoperability Network for the Energy Transition

Integration of verticals

Architecture

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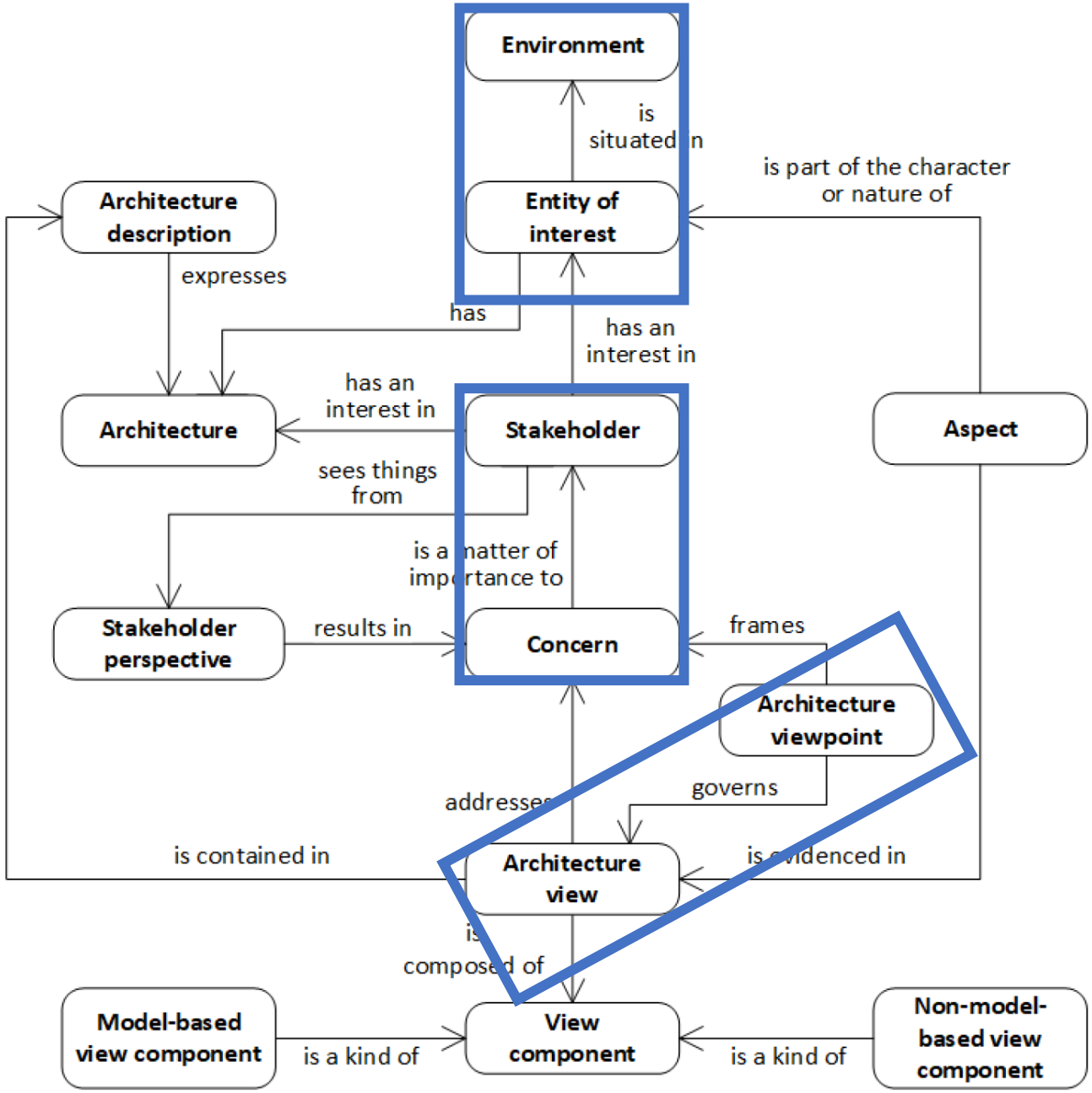
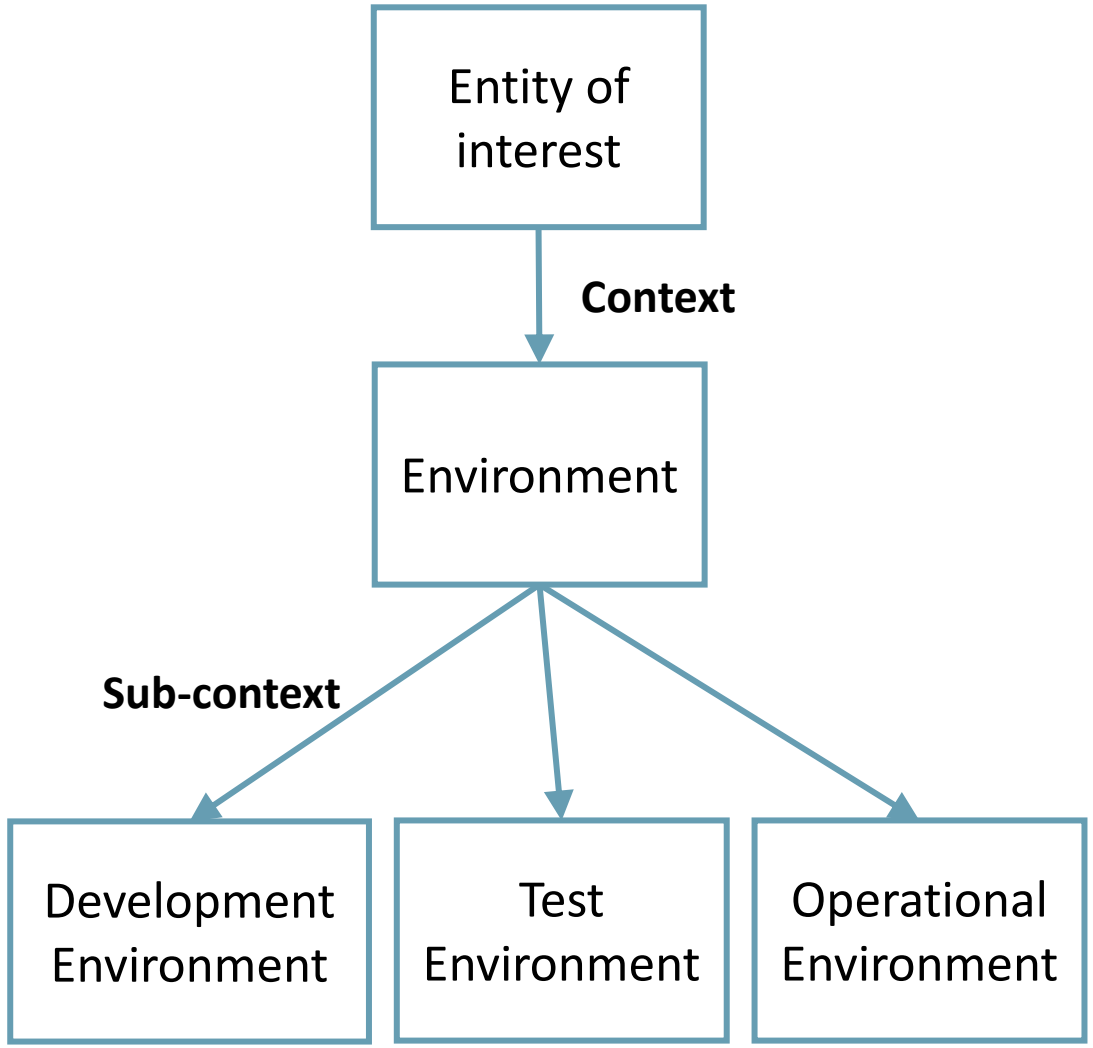
- Architecture Description
  - Environment+Entity of interest
  - Stakeholder+Concerns
  - Viewpoints+View

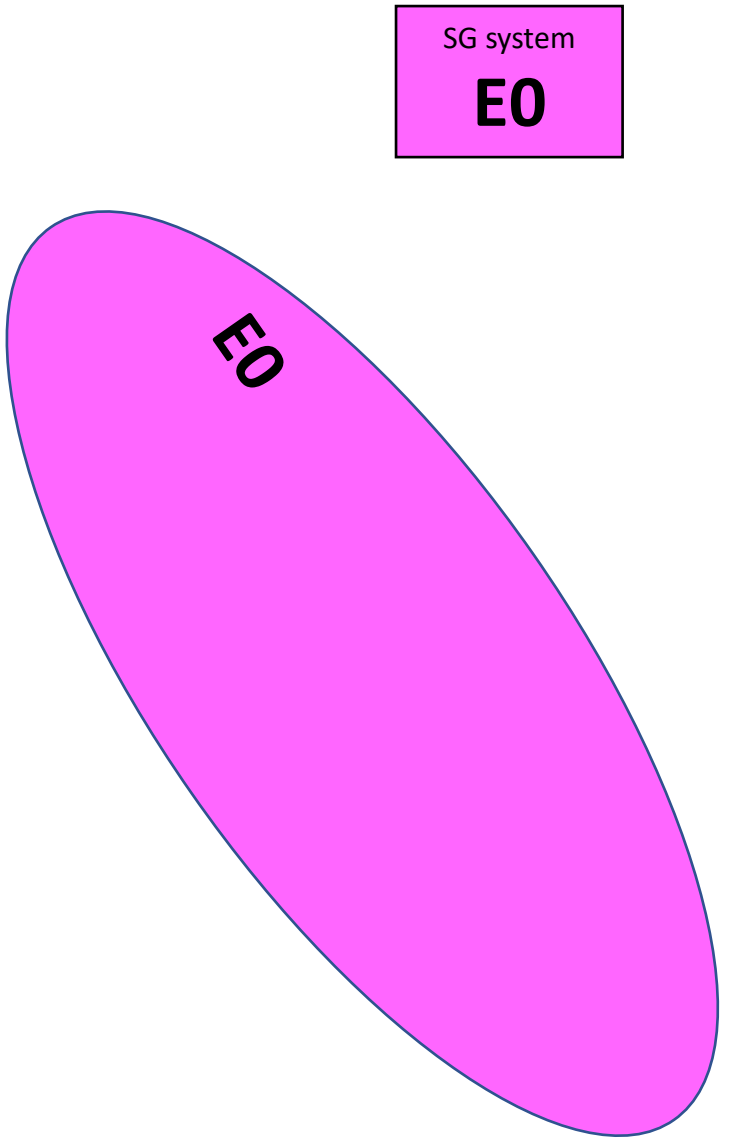


- Environment
  - Context of surrounding things, conditions, or influences upon an entity
    - Environment of an entity of interest includes external entities that have influences upon an entity
      - Developmental, Technological,
      - Business, Operational,
      - Organizational, Political,
      - Economic, Legal,
      - Regulatory, Ecological,
      - Social, …
    - Qualifier to the word environment identifies a particular sub-context
      - Development environment
      - Test environment
      - Operational environment….



Multiple entities of interest

- Entity of interest
  - Smart Grid (SG) system
  - Artificial Intelligence (AI) system
  - Knowledge Engineering (KE) system



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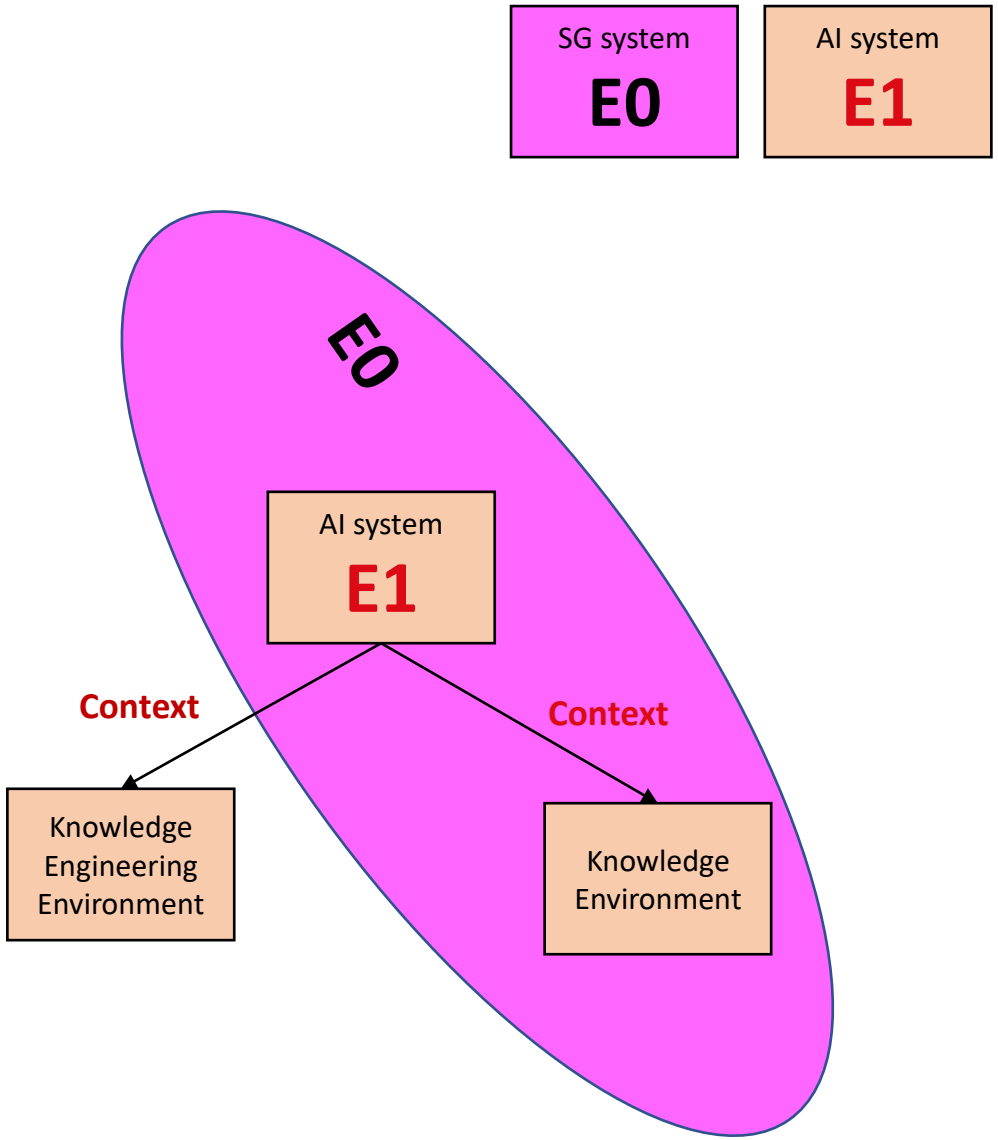

Multiple entities of interest

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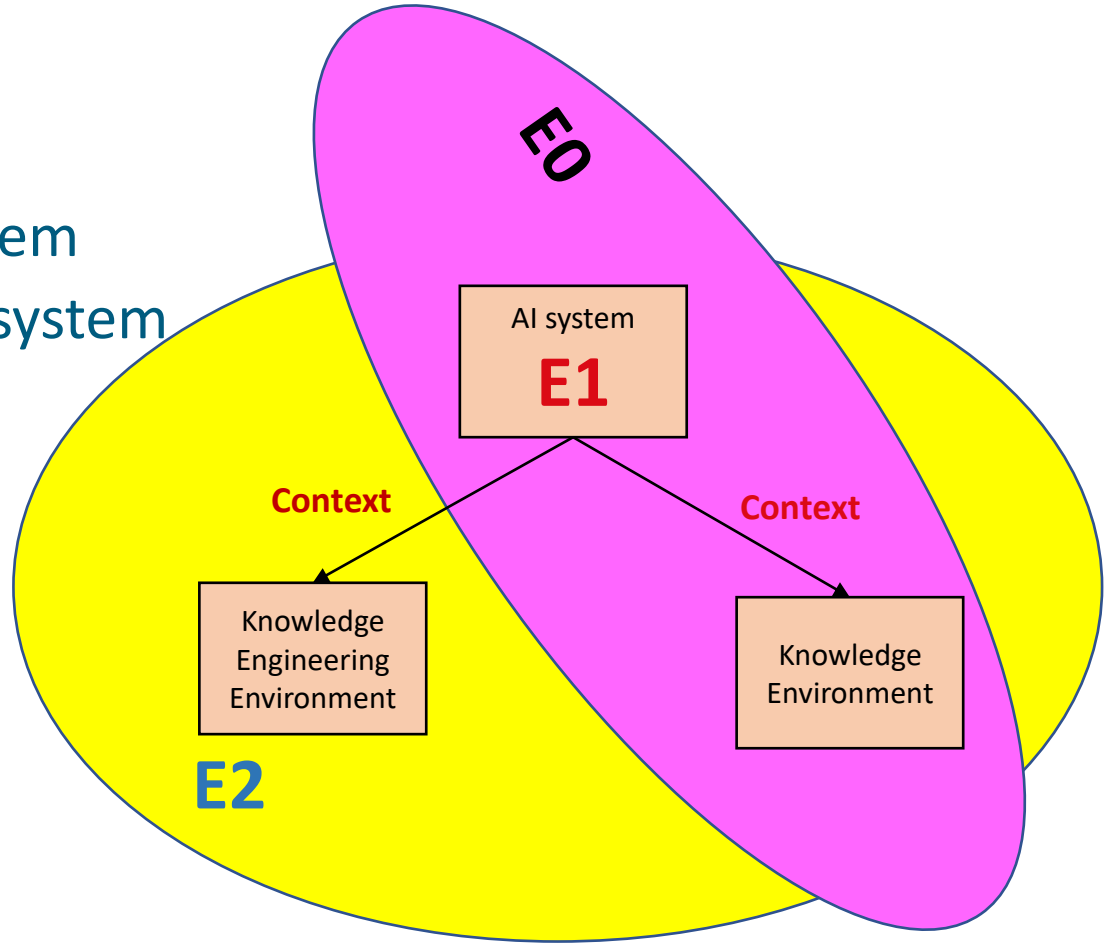

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Interoperability Network for the Energy Transition

Integration of verticals

Integration of data spaces

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Integration Issue: Horizontal/Vertical Interplay

Data space

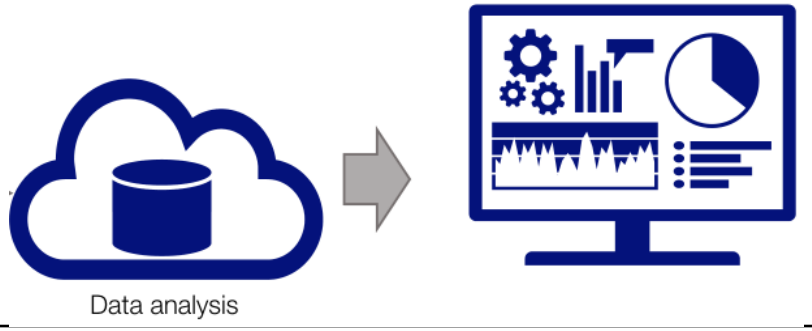
Data sources
Domain 1
(e.g. Energy)

Data sources
Domain 2
(e.g. Smart
manufacturing)

Data sources
Domain N
(e.g. Health)

IoT Integration

Data space

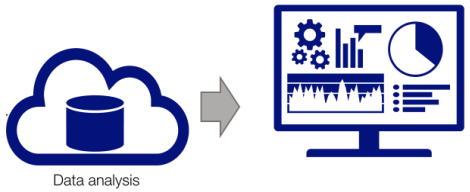


Data sources
Energy consumption

Digital Twin Integration

Data space

Consumption profiles



Digital Twin

Consumption prediction

IoT System

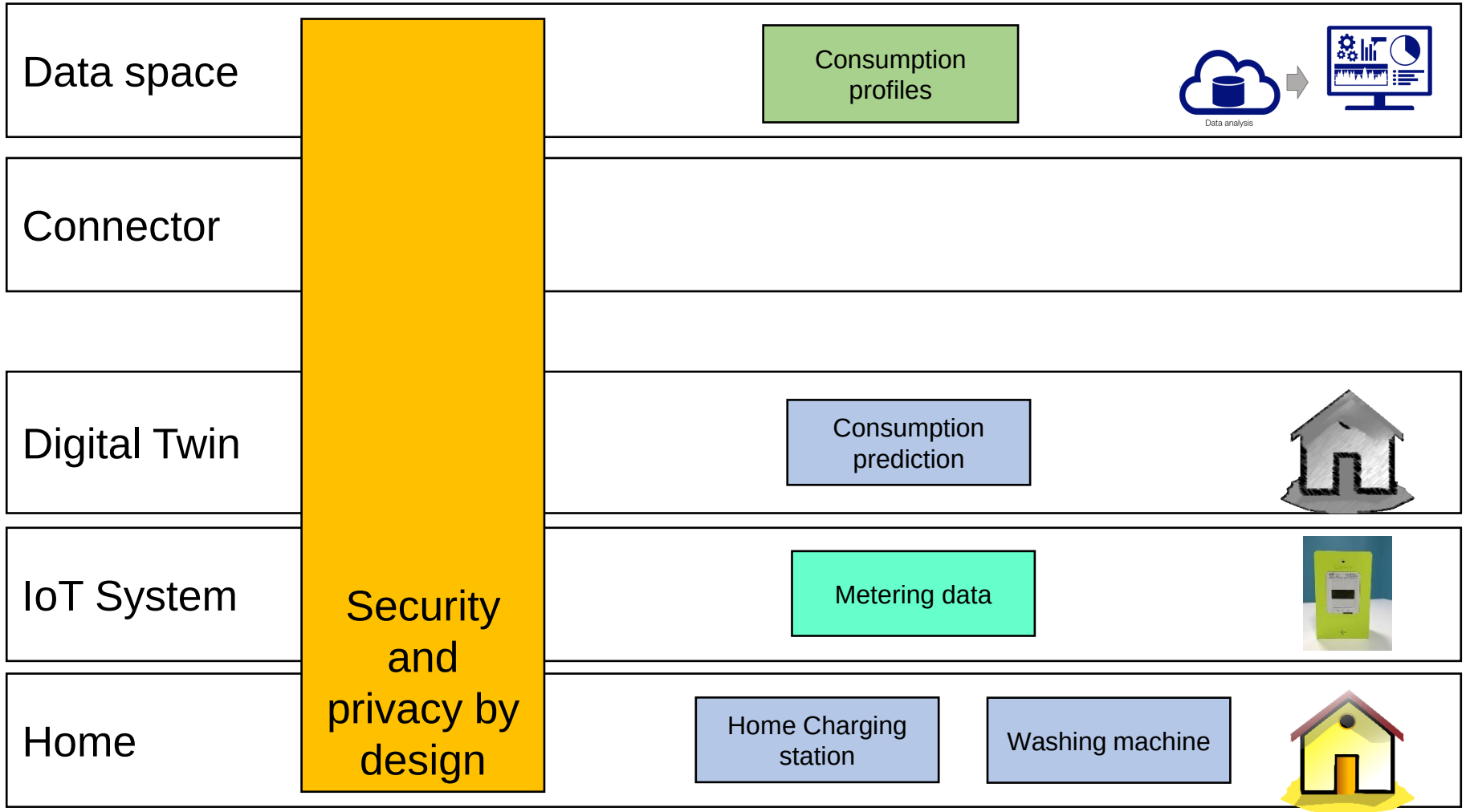
Metering data

Home

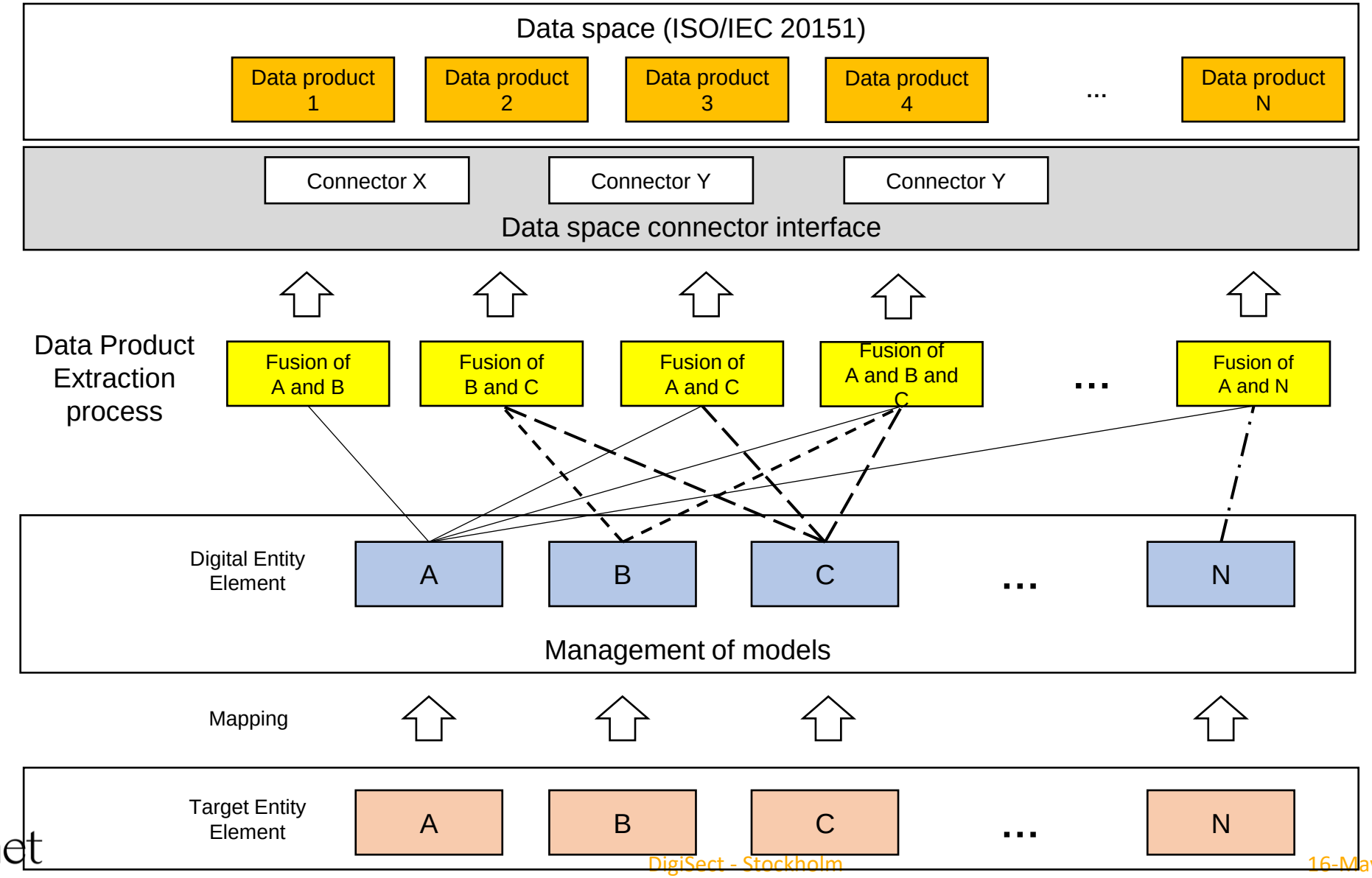
Home Charging station

Washing machine

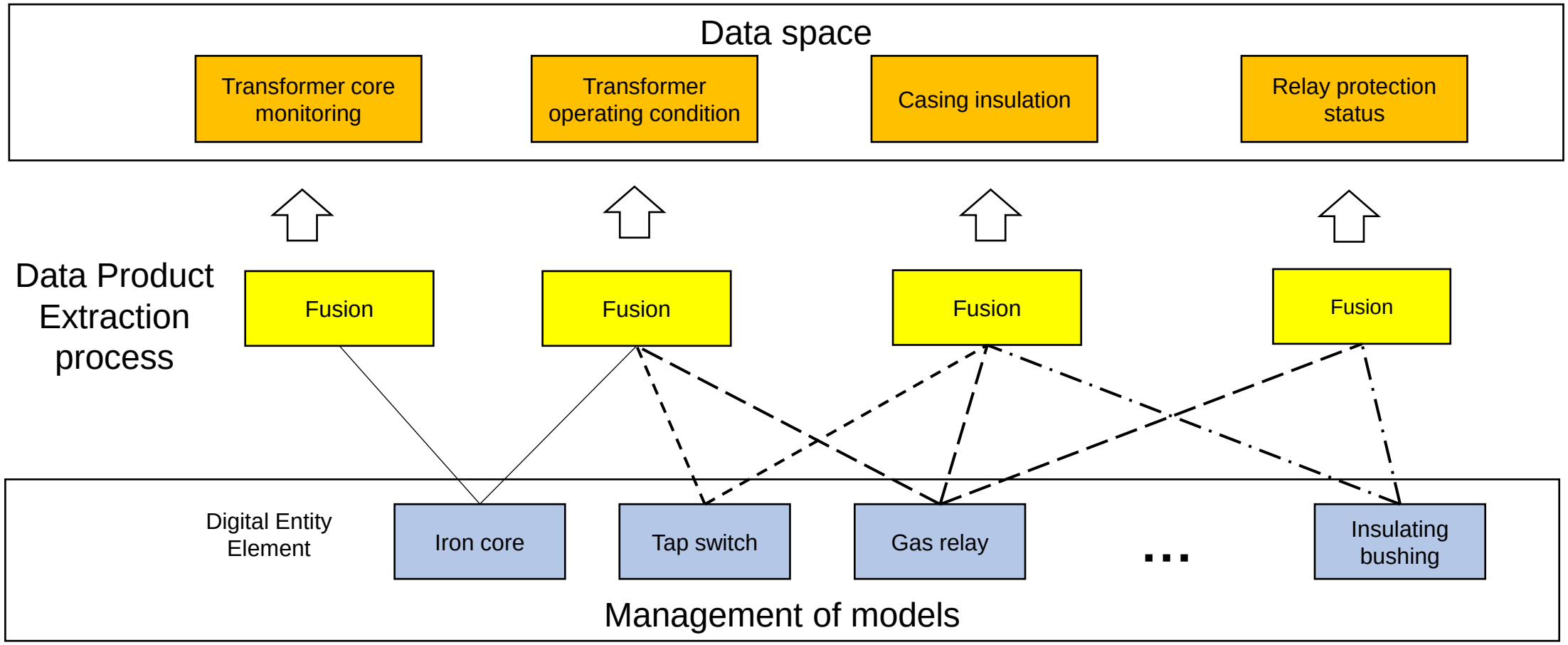
Security and Privacy Integration



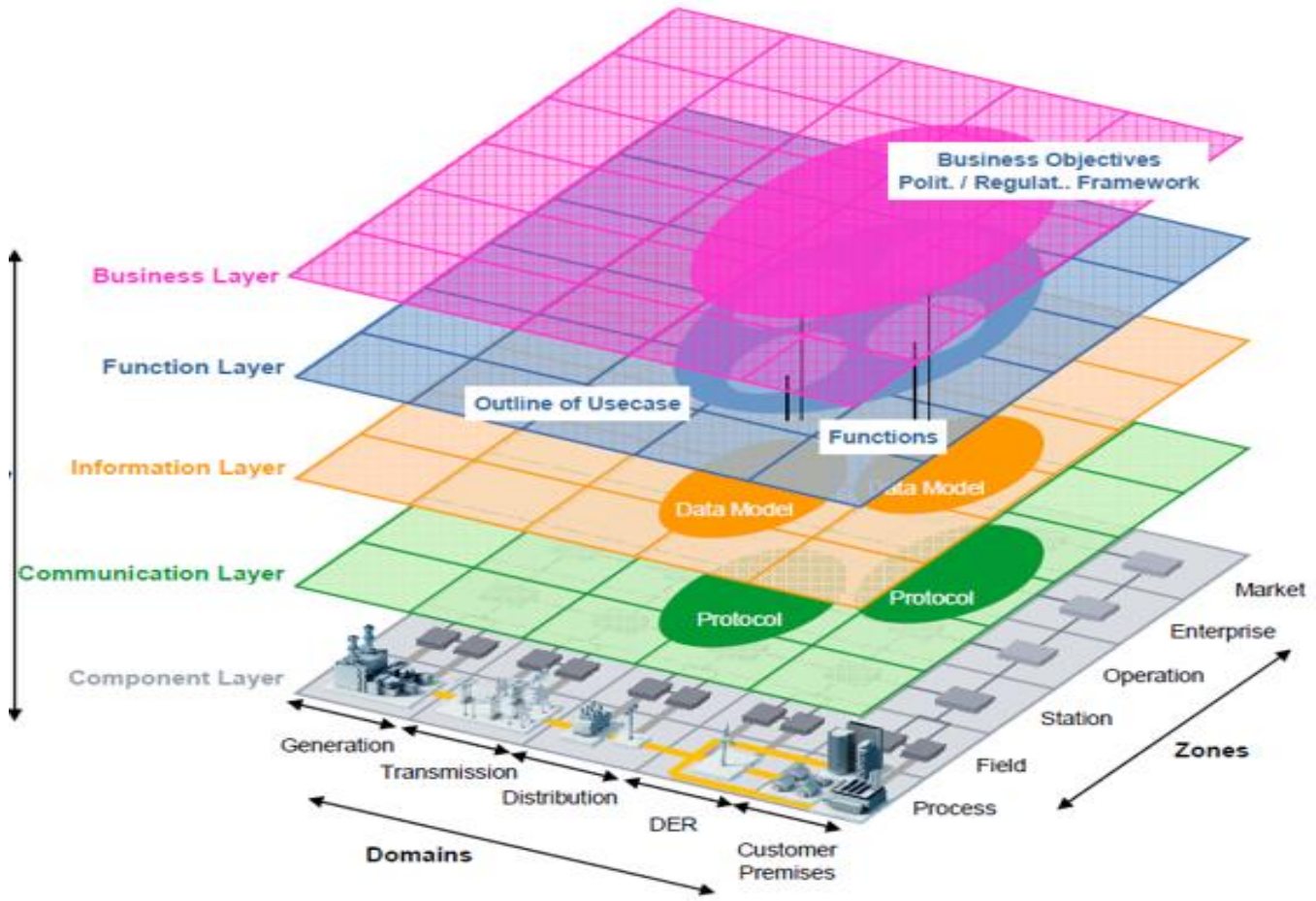
Standard on interoperability Data product extraction



Standard on interoperability Data product extraction



Integration issue



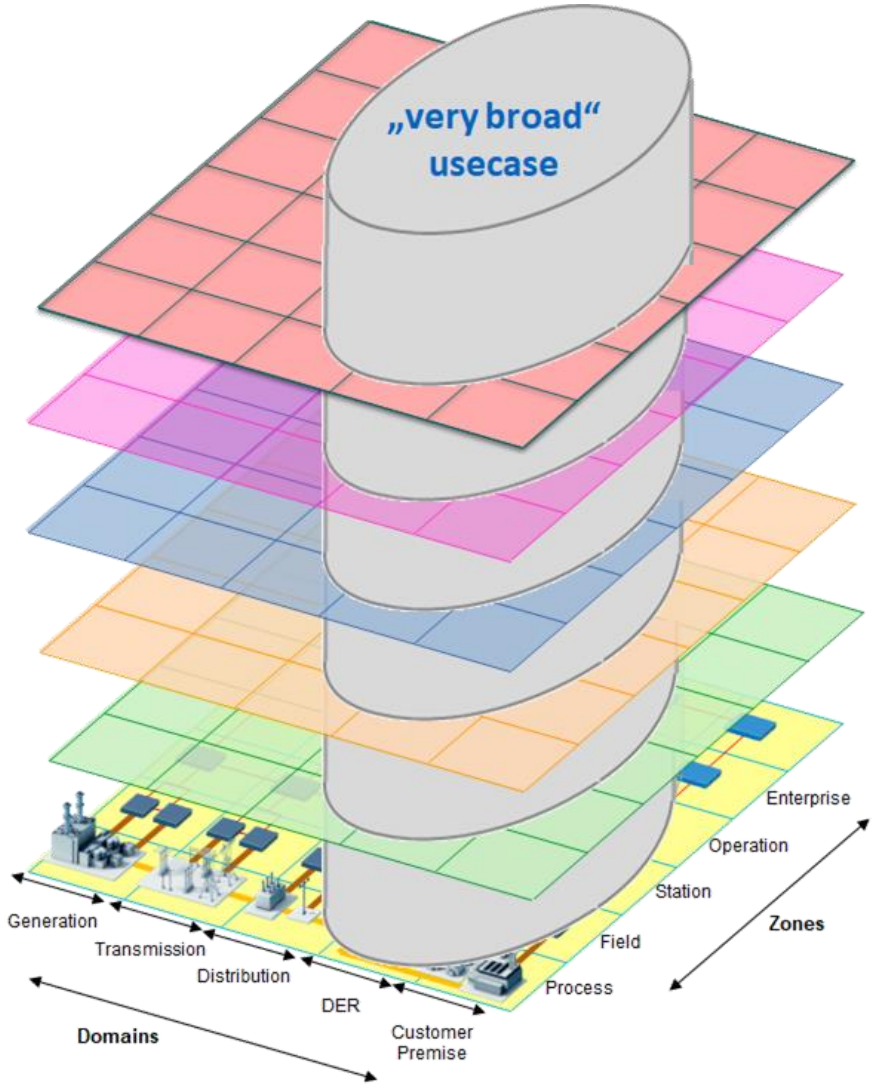
Security and privacy,
Trustworthiness, Resilience,..

GDPR, AI act, Data act,
Cyberesilience act,..

AI, digital twins, DLT XR/VR

Tube in a Cube

- A data space is associated with a tube in the cube
- Guiding principles (upcoming IDSA white paper on standards)
  - Self-determined control of data use (Data Sovereignty),
    - Participants have autonomy
    - Participants have agency over their data assets
  - Dataspace creates a context of trust
  - Logical function for governance (Dataspace Governance Authority - DGA)



int:net

Interoperability Network for the Energy Transition

Thanks

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