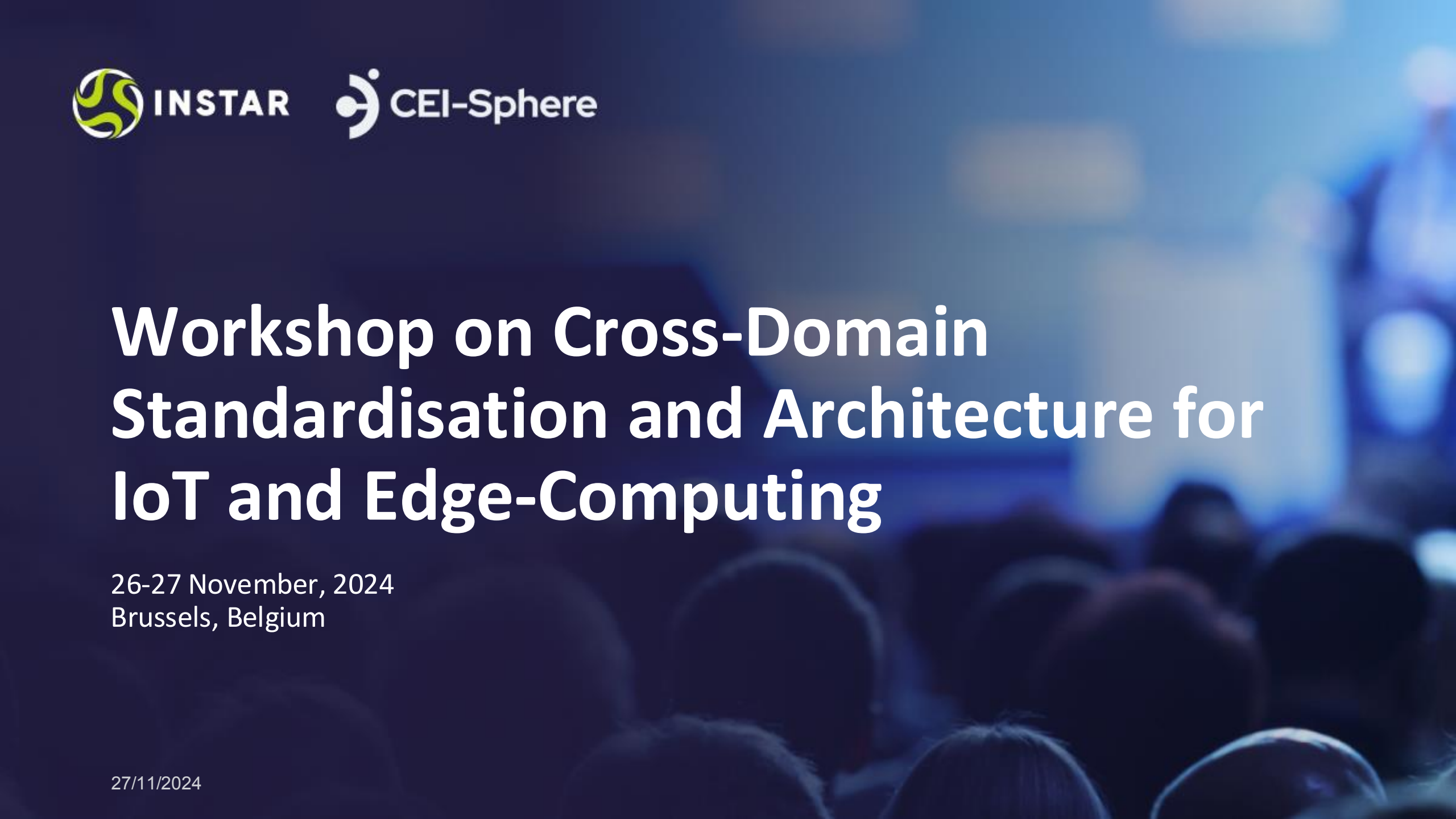


Workshop on Cross-Domain Standardisation and Architecture for IoT and Edge-Computing

26-27 November, 2024
Brussels, Belgium

27/11/2024

27th November Agenda

9:30 - 9:45 | Opening

9:45 - 10:00 | Large Scale Pilots - OCEI Overview

10:00 - 11:00 | Panel: Standardisation strategies from the EU Cloud-Edge-IoT

11:00 - 11:20 | COFFEE BREAK

11:20 - 12:30 | Strategy development session: Pilots and standards plans

12:30 - 13:00 | Summary of Actions

13:00 | CLOSE

Opening

Workshop on Cross-Domain Standardisation and Architecture for IoT and Edge-Computing

27/11/2024

Rolf Riemenschneider

Policy Officer for the European Commission | DG CNECT, E4

EUCloudEdgeIoT.eu

The European Cloud, Edge & IoT Continuum

Standardisation Directions for Large-scale pilots & Open Source

Rolf Riemenschneider

European Commission
Head of Sector IoT
DG CONNECT/E4

Funded by the European Union

Platforms for the Edge

- **Challenges of System Integration**
- Embedded Systems & Control
- Internet of Things – Connected Objects
- Cloud – Digital Twins - Orchestration

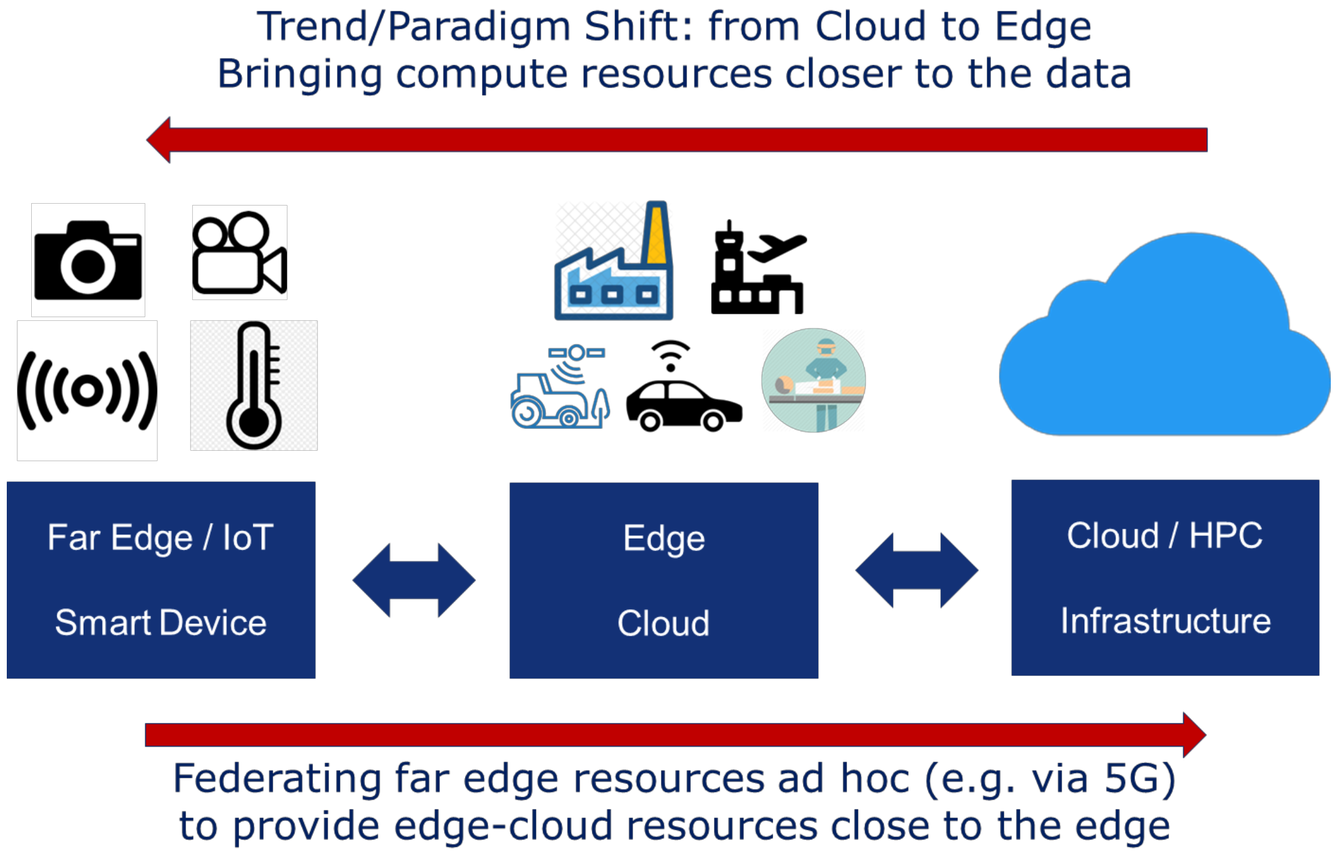
- **A Platform Economy @theEdge**
  - **taking a system-level approach**
    * from hardware of smart devices
    * to operating systems at device and at system level,
    * to middleware and to application software
  - ***Software-defined systems:*** *Functions/Apps over the Air up-dates*
  - *Avoid Vendor Lock-in - Open, vibrant ecosystem*

European Commission

Pilots to explore new IoT Paradigms and their Impact of EU Markets

- **Trends like edge technologies and decentralised Intelligence** will reshape the industrial landscape,
  - **spurring innovation** towards the edges of the IoT network (edge clouds and edge computing)
  - **accelerate the pick-up of novel advanced edge technology** in most important sectors for Europe’s economy, and competitiveness

- **An open framework for a vibrant Edge-IoT ecosystem** is key for up-scaling and to leverage economies of scale
  - **Standardisation & Open Source**
  - compliance, **security** as well as synergies across sectors.
  - Underpinning an emerging **open edge ecosystem** including midcaps, SMEs and start-ups,



WHAT NEXT?

- EU-US Collaboration – DISCOVER US
  - → Open for expression of interest https://discover-us.eu/#/
- International Standardisation
  - → INSTAR – dialogue with US, Korea, Japan, Australia, Canada, etc.
- Pilots for IoT Platforms and Decentralised Intelligence
  - → Calls under WP2024, launched by start of 2025
  - → Ecosytem building supported by CEI-Sphere
  - → Embrace momentum of **Open Source Communities**
  - → Open calls for enterprises, SMES, start-ups

HORIZON-CL4-2024-DATA-01-05: Platform Building, standardisation and Up-scaling of the 'Cloud-Edge-IoT' Solutions (Horizontal Activities - CSA)

Related Background

- **Horizon Europe**:
  → Calls, topics, deadlines WP2023-24

- **Position Papers and Event Reports**
  → Alliance AIOTI Strategic Foresight : IoT and Edge Computing Convergence

- **Cloud-Edge-IoT Portal** – see www.EUCloudEdgeIoT.eu

- HIPEAC Vision https://www.hipeac.net/vision/#/latest/

- Edge-IoT Policy on Europa

➢ **3Cs Strategy**:
→ Calls, topics, deadlines WP2023-24

European Commission

Large Scale Pilots - OCEI Overview

Workshop on Cross-Domain Standardisation and Architecture for IoT and Edge-Computing

26/11/2024

Carlos Palau

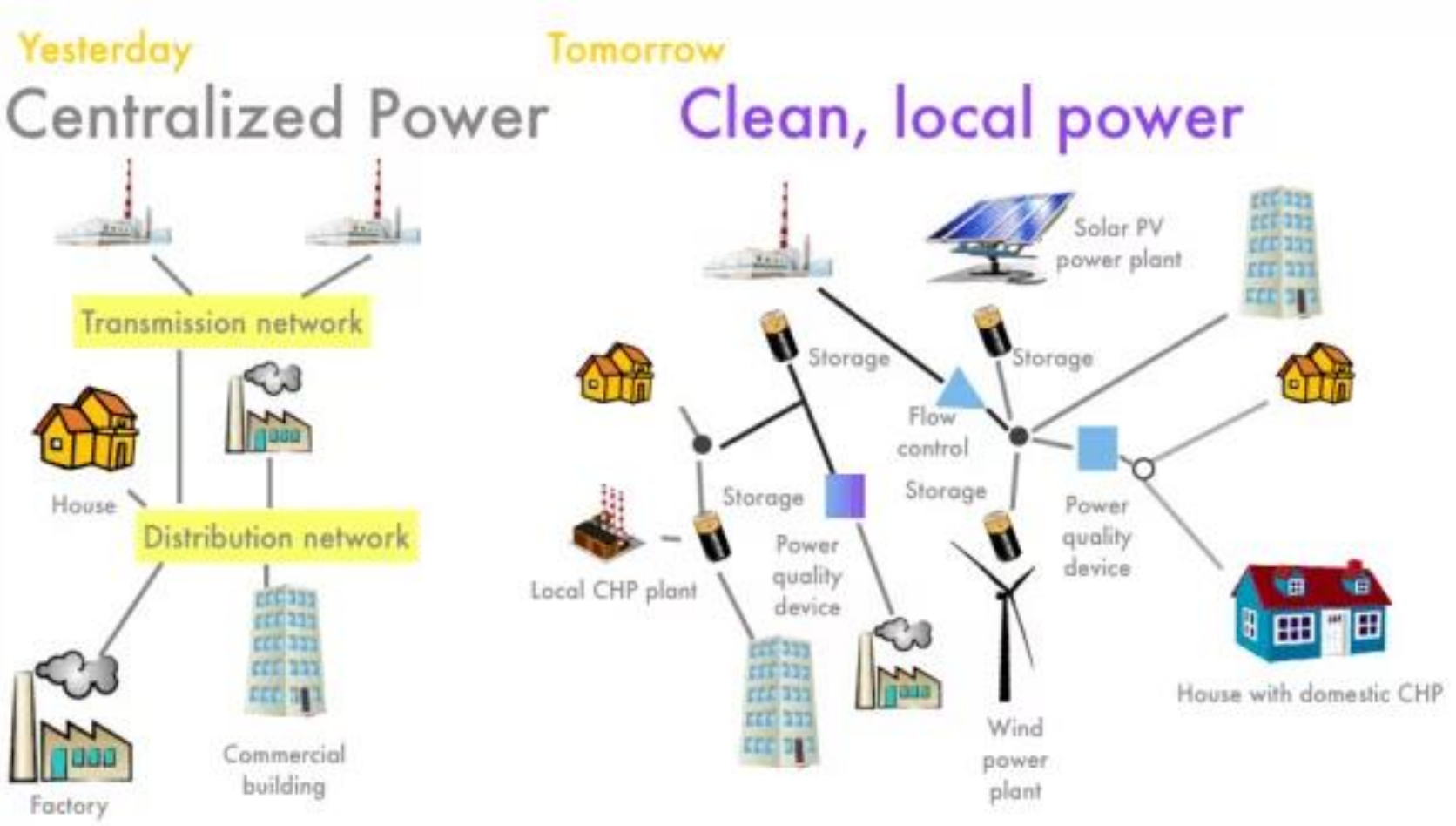
Universitat Politècnica de València (UPV)| O-CEI

Prof. Carlos E. Palau
Universitat Politècnica de València
UNIVERSITAT POLITÈCNICA DE VALÈNCIA

O-CEI
OPEN CLOUDEDGEIOT

O-CEI: Open CloudEdgeIoT Platform Uptake in Large Scale Cross-Domain Pilots

Noticing the paradigm shift

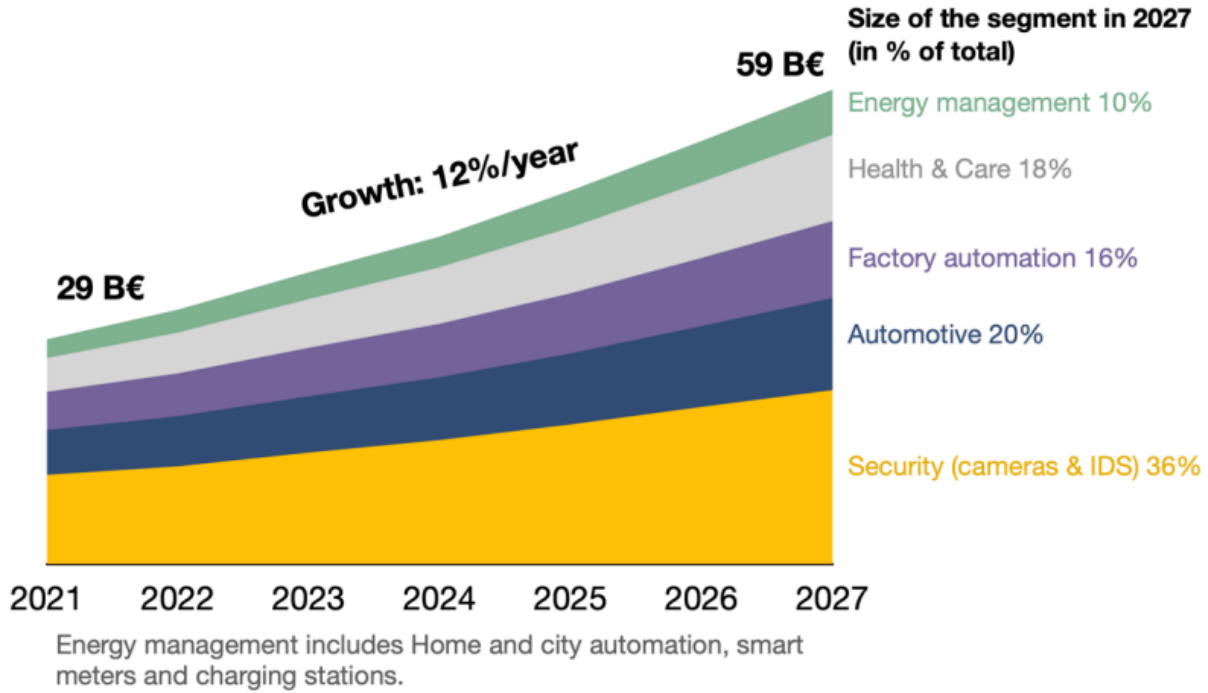


- Distributed Energy Resources (DERs)
- Smart meters by DSOs
- Smart grid - crucial role for prosumers
- Data, AI, analytics for efficiency and flexibility
- New business models

Image credit - Institute for Local Self Reliance

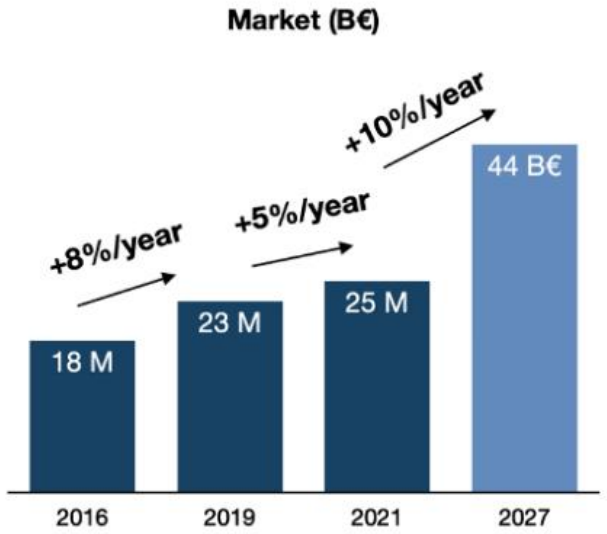
Disclosure - Denis Pombriant is the author of The Age of Sustainability.

… the outstanding opportunity

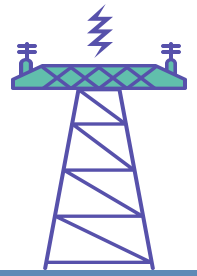


Energy management includes Home and city automation, smart meters and charging stations.

Source: DECISION Etudes & Conseil



Source: DECISION Etudes & Conseil



Green Energy Transition is a top EU priority

AI processed at the edge – DERs is key

Scalability and distributuion in the continuum signalled in DECISION

… and accepting the technical challenge

Data

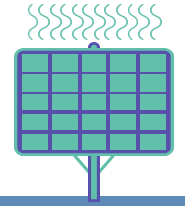
Surveys signal that **harmonization** of data flows, communication networks and cybersecurity are crucial.

Openness

Energy applications tend to work in siloes. Flourishing in the diversity and **reusing open solutions** is in contest.

Success

A lack of **cooperative success stories** is preventing the potential of edge computing in energy from unleashing.

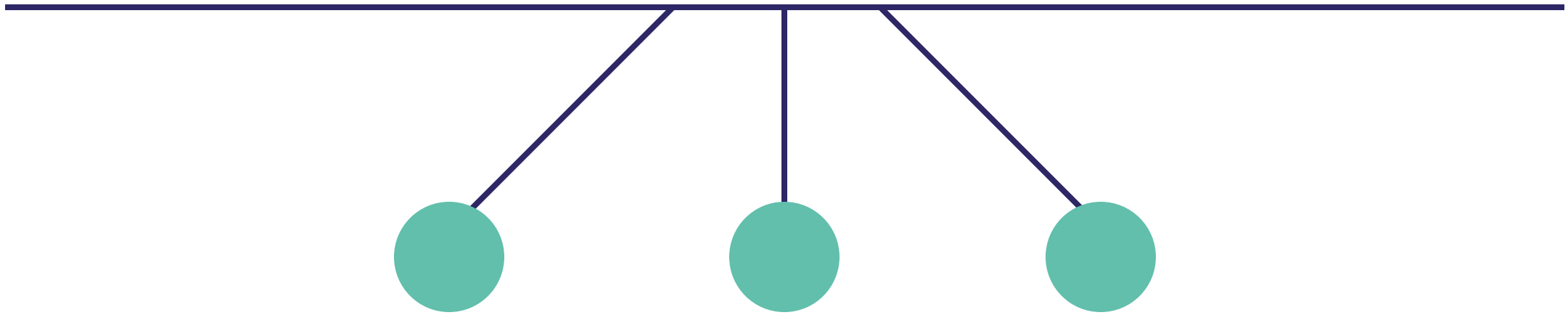


O-CEI factsheet

- Call and Topic: HORIZON-CL4-2024-DATA-01-03 Piloting emerging Smart IoT Platforms and decentralized intelligence
- Type of project: IA
- Total budget: 31,347,300 € - EU Granted amount: 23,140,063.63 €
- Grant Agreement Nº: 101189589
- Duration: **1st Jan 2025**– June 2028 (42 months)
- Project Coordinator: Carlos E. Palau Salvador (UPV)
- Field of action: Energy efficienty, energy flexibility, edge computing, resources orchestration, demand/production, collaboration, cross-domain, marketplaces, virtualization, data sovereignty
- Nº partners: 60 (incl. Two 3LPs)
    - *From 19 countries* : Spain, Greece, Switzerland, France, Malta, Romania, Germany, Austria, Italy, Poland, Cyprus, Ireland, Sweden, Denmark, Slovenia, Portugal, Finland, Belgium and Croatia.
- Cascade funding: 4.000.000€ structured in two rounds
- Work Packages: Project Coordination, Formalization of pilots and Open Platform requirements, O-CEI Open Platform and blueprints development, Execution of O-CEI Large Scale Pilots, Evaluation and Assessment, and Market uptaking, results exploitation and transferability.

Key points

Fostering **collaborations between industries and academia** and demonstrating emerging **edge solutions** in realistic environments

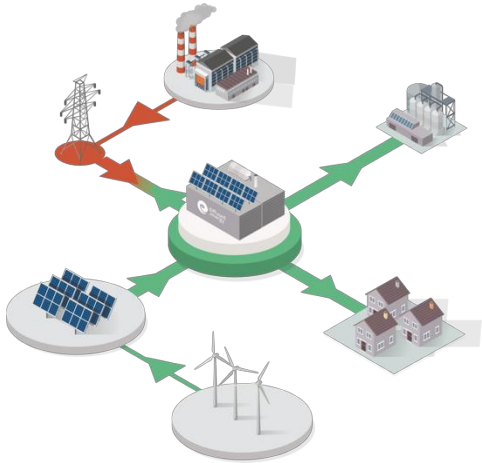


Flexibility

Scalability

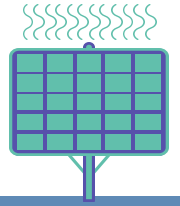
Custom sharing

How will we do it?

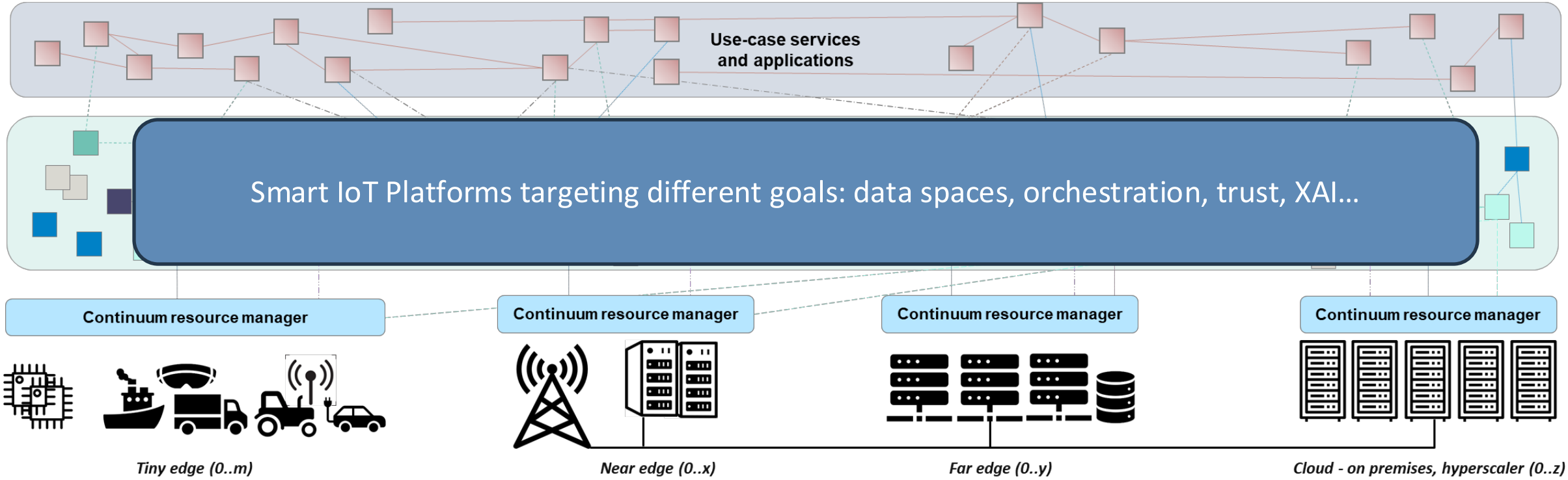


A continuum of computing resources (in edge distributed energy resources) that share **federated data fabric**. Those resources will perform monitoring and actuation based on the requirements of each use case. Success examples will be included in the marketplace, that might be installed and replicated elsewhere.

Every pilot will select a subset of interesting technologies (orchestration, AI, trust…) and will create a **reference blueprint** that will integrate a judiciously picked set of tools. Adoption guidelines, open configuration, and interface-orientation will dominate the process.



How will O-CEI fit in infrastructure?



Background matters

O-CEI carries experience, products and ideas from previous endeavours and long-lasting collaborations, pushing for a **high Return of Investment** of European funding.

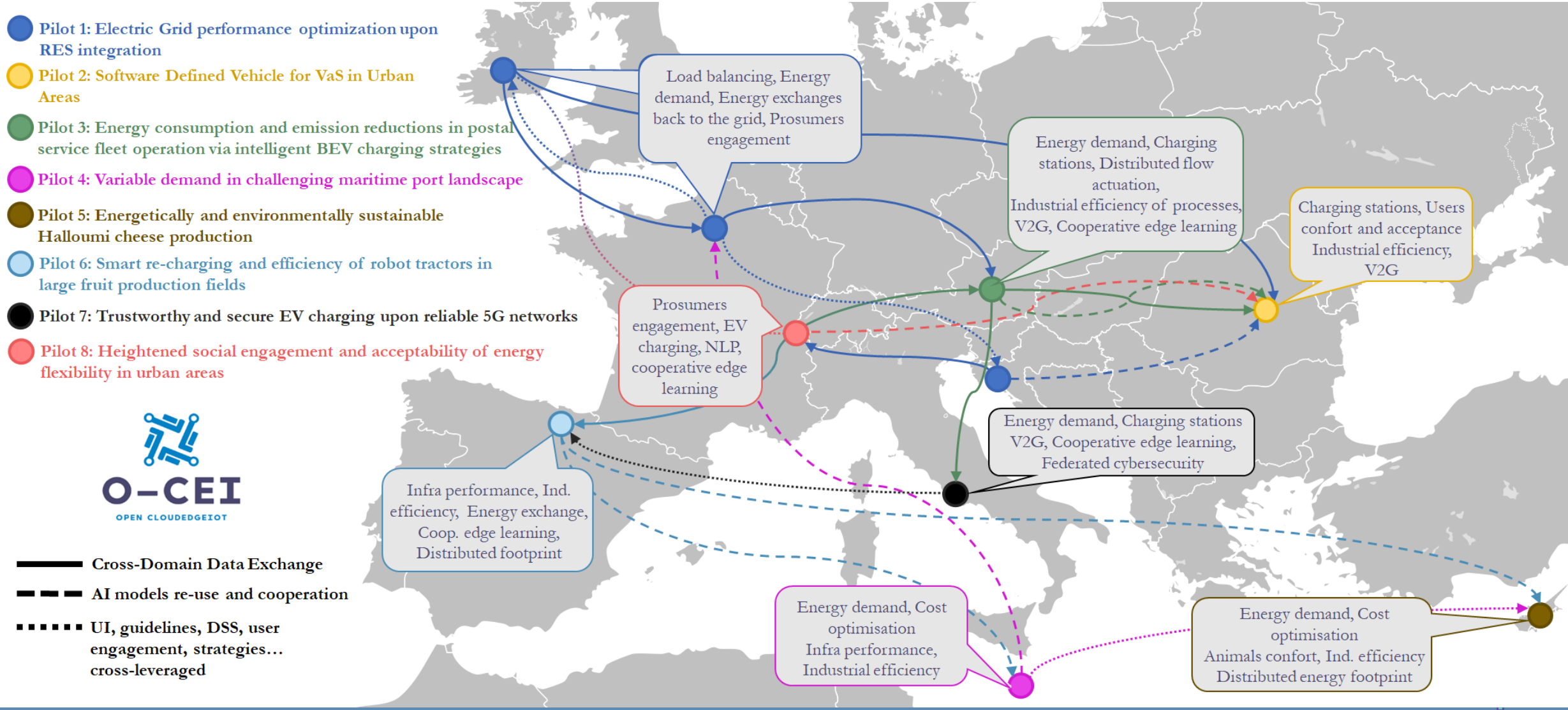
Who will do it?

A heterogeneous and solid mix of partners:

- 18 Large Industrial
- 11 RTOs
- 18 innovative SMEs
- 13 non-for-profit (clusters, public entities…)

All involved in **applied research of new technologies towards energy efficiency**

The core action: validate, uptake and upscale



Expected results

O-CEI Data Sharing Platform

To share metrics and information about prosumers and infrastructure

01

O-CEI Cross-Domain Continuum Ontology

To allow federation of resources

02

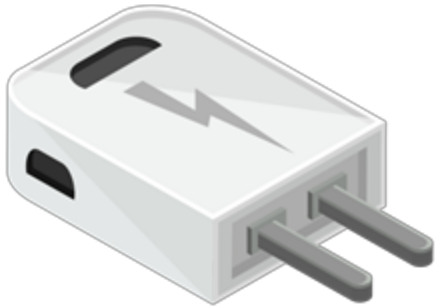
Federated marketplace

To discover, select and allow installation from other examples

03

O-CEI

OPEN CLOUDEDGEIOT



04

Pre-normative

Standardisation on O-CEI deployments

05

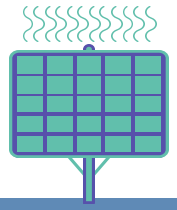
Adoption methodology

Facilitating uptake for other LSPs based on blueprints

06

Business model

Exploitation roadmap of flexible and efficient energy using edge computing



O-CEI

OPEN CLOUDEDGEIOT

The digital backbone for energy flexibility

Source (all rights reserved): https://istormy.eu/5-technology-integration-demonstration-evaluation/

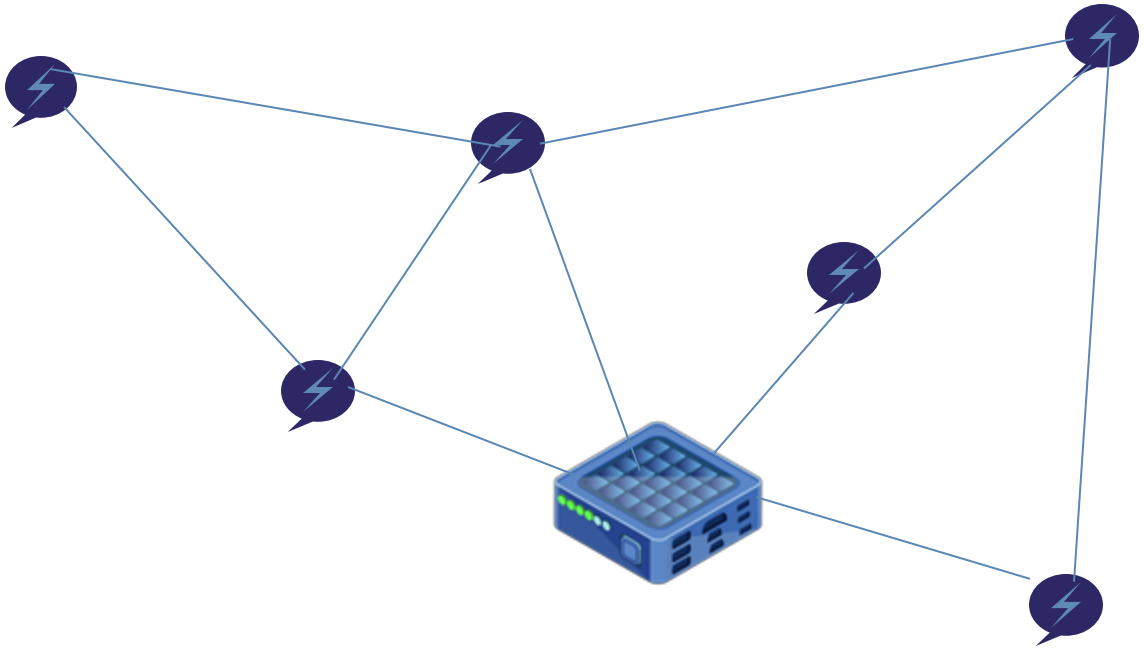
Thanks!

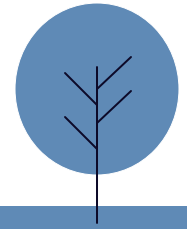
Do you have any questions?

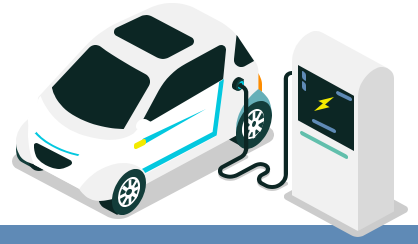
Prof. Carlos E. Palau

cpalau@upv.es

www.satrd.es







Panel: Standardisation strategies from the EU Cloud-Edge-IoT

Workshop on Cross-Domain Standardisation and Architecture for IoT and Edge-Computing

26/11/2024

Panel discussion

slido.com
#3682436

Golboo Pourabdhollian
IDC

Carlos Palau
aerOS

Rute Sofia
CODECO

Anastasios Zafeiropoulos
Nephele

EU-CEI in a nutshell

EUCloudEdgeIoT.eu

A European Commission research and innovation initiative aiming at Realise a pathway for the **understanding and development of the Cloud, Edge and IoT Continuum** through promoting **cooperation** in an extensive ecosystem and support the implementation and **Large Scale Pilots.**

OPEN CONTINUUM
Sep 2022 – Aug 2024
Focus on supply side of the computing continuum landscape

UNLOCK-CEI
Jun 2022- Nov 2024
Focus on demand side of the computing continuum landscape

NexusForum.EU
Boost the consolidation of the European Computing Continuum ecosystem

CEI-Sphere
Support the development of an open and interoperable ecosystem for LSPs

June 2022- Nov 2024

Jan 2024- Mar 2026

EUCEI Community

59 Projects and initiatives are part of EUCEI community

EU-CEI Task Force 3 (led by Open Continuum)

- Standards work
  - June 2024 Preliminary work item in ISO PWI-22 Architecture considerations on IoT Edge Cloud
    - Edited by Lara Lopez and Antonio Kung
    - https://www.iec.ch/dyn/www/f?p=103:38:614053953031768::::FSP_ORG_ID,FSP_APEX_PAGE,FSP_PROJECT_ID:20486,23,126454
  - November 2024 Establishment of AG 25 (pattern repository) convened by Antonio Kung
    - https://www.iec.ch/dyn/www/f?p=103:14:614053953031768::::FSP_ORG_ID,FSP_LANG_ID:52313,25
  - TF3 currently working on pattern contributions
  - Reports
    - Functional View of the Continuum Reference Architecture: Minimum set of expected functionalities (https://zenodo.org/records/11656674)
    - Compositional View of the Continuum Reference Architecture: Graphical representation of common and potential capabilities (https://zenodo.org/records/11656784)
  - OpenContinuum Landscape v2 and recommendations
    - Results of work on taxonomy and architecture
- Further work
  - Contribute use cases, patterns and architecture material to SC41

aerOS path to standardisation impact

Prof. Carlos E. Palau (UPV)

Project Coordinator

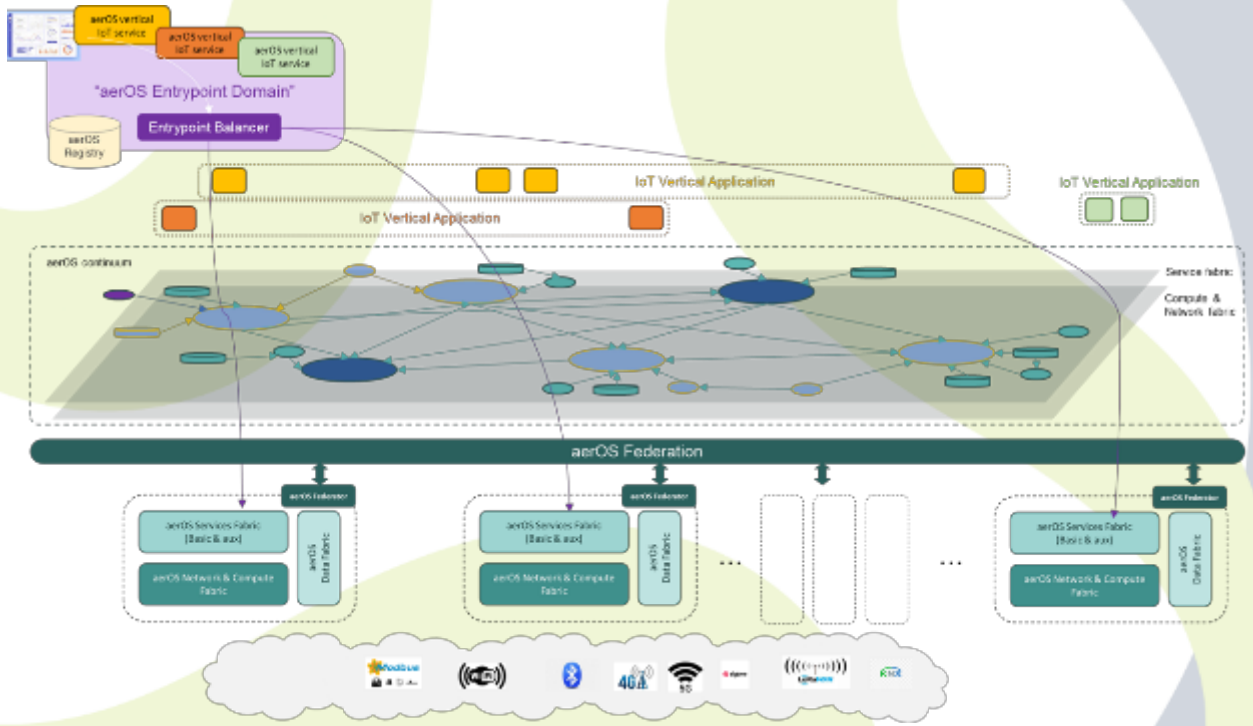
29/11/2024


aerOS partners
aerOS
EUROPEAN IOT-EDGE-CLOUD
UNIVERSITAT POLITÈCNICA DE VALÈNCIA
DEMOKRITOS
innovalia ASSOCIATION
TTControl HYDAC INTERNATIONAL
SIEMENS
FIWARE FOUNDATION
Telefónica
COSMOTE
InQbit The Q-Bit Innovation
FOGUS INNOVATIONS & SERVICES
ERICSSON
IBS PAN
icfficial solutions
INFOLYSIS
prodevelop
EUROGATE Container Terminal Limassol
Cyprus University of Technology
dst.
S21 SEC
JOHN DEERE
CloudFerro
electrum
POLITECNICO MILANO 1863
MADE Competence Center I4.0
SWITZERLAND INNOVATION PARK BIEL/BIENNE
nasertic
This Communication is part of a project that has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101070633/22
aerOS project
6

Our main asset and strategy

- aerOS roots upon well-known standards
  - Network: SDN, NFV, 5G...
  - Protocols: MQTT, HTTP, JSON, gRPC...
  - Industrial: ROS, OPC UA, MODBUS..
  - De-facto: K8s, OAuth2.0...

- aerOS **architecture proposes innovative advances** in workload orchestration, distributed federation of domains, data models and in modern network usage that are **prone to contribute to European and international standards**.



Our target

- Departing from our technology, aerOS has exerted huge efforts in attending WG discussions, participating in different boards, and providing documentation, ideas and concepts with the goals:

aerOS

To achieve 3 contributions to European pre-normatives

aerOS

aerOS concepts in 25 EU and international SDO entrypoints

Our contribution brochure

- SDOs and standardization initiatives in which aerOS partners intervene actively

More relevant granular activities (short list)

Revision of data type definitions in the NGSI-LD API (ETSI CIM 009 v1.7.1)	ETSI CIM
Presentation "Data Management Paradigms: Data Fabric and Data Mesh at IETF 117	IRTF NMRG
OpenAPI specification for NGSI-LD API 1.6.1 release	ETSI CIM
Draft Asset Lifecycle Management and Operations: A Problem Statement	IETF IVY
Draft Data Manifest for Contextualized Telemetry Data	IETF Ops Area
Draft Applying COSE Signatures for YANG Data Provenance	IETF Ops Area
Draft Mounting YANG-Defined Information from Remote Datastores	IETF NETMOD
Presentation “Knowledge Graphs for Network Management” at IETF 118	IRTF NMRG
Extension of NGSI-LD API with filtering based on datasetId: https://portal.etsi.org/webapp/workprogram/Report_WorkItem.asp?WKI_ID=68619	ETSI CIM
Presentation “Use cases for DetNet/5G - Deterministic Programmable Data Planes for the Cloud-Edge- IoT Continuum”	5G-ACIA WI82
Draft "Augmented-by Addition into the IETF-YANG-Library" https://datatracker.ietf.org/doc/draft-lincla-netconf-yang-library-augmentation/	IETF NETCONF
Draft Knowledge Graphs for YANG-based Network Management	IETF NMOP
AIOTI HLA – High Level Architecture	AIOTI
Participation in the webinar “Webinar: IoT, Cloud, Edge Computing Continuum from Research to Deployment”	AIOTI
Initiative by AIOTI via exposing the demand vs. supply side of meta–Operating Systems	AIOTI Business Forum
Participation in the preparatory actions of the “Replicability Initiative” for the creation and assessment of the “Feasibility, Replicability and Scalability Assessment Tool”	AIOTI
Participation in the Semantic Interoperability Expert Group	AIOTI
Following and participating in the issuing of SRIA of AIOTI 2023	AIOTI
Active contribution in the Working Group of Privacy and Security	AIOTI
Continuous participation in the WG of Standardization of AIOTI	AIOTI
SO/IEC JTC 1/SC 41 Plenary Meeting in Helsinki	ISO/IEC JTC 1/SC 41
AIOTI Days 2024 (24-25 Sept 2024, Brussels)	AIOTI
Representation of AI applications and predictions	ETSI TC SmartM2M

Contributions to SDOs

M28

Issues, basic services, architecture, data models → 23 contributions

ETSI CIM, AIOTI HLA, IETF/IRTF

Entry points exploited

M28

Board meetings, Working Groups, position papers → 22 entry points exploited

ISO/IEC, IEEE, Linux Foundation, ETSI…

Contributions to European pre-normatives

M28

aerOS technology included as core part of the documents → 2 contributions

AIOTI Standardization WG, 5G-ACIA WG3

Contributions to data-related clusters and initiatives

M28

New public data sets, models, schemas… → 2 contributions

FIWARE SmartData Models, W3C w3id

Contributions to relevant data spaces

M28

New public data sets, models, schemas… → 2 contributions

IDSA, BDVA, IETF NETMOD/NETCONF

Highlighting impact: ISO/IEC JTC1/SC41

- ISO/IEC JTC 1/SC 41: Arrangement of presentation about aerOS architecture in the **ISO/IEC JTC 1/SC 41 Plenary meeting in Helsinki (27.05.2024)**

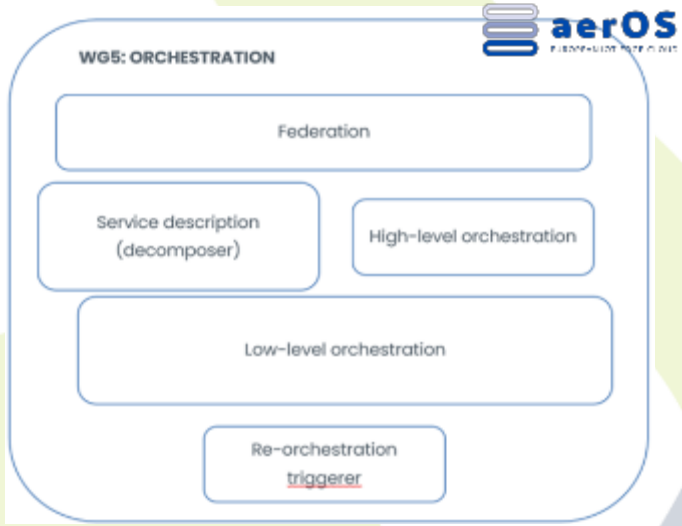
- **Pre-acceptance in ISO/IEC JTC1/SC141** - a preliminary work item (PWI) has been officially accepted at ISO/IEC JTC1/SC41 to develop a taxonomy and patterns for the CEI based on the work already performed at TF3.

Highlighting impact: ISO/IEC JTC1/SC41

- The role and technology of aerOS in the pre-normative
  - EUCEI TF3 initiated activity for commong glossary, taxonomy and architecture by the varioous projects in metaOS cluster.
  - aerOS has led the definition of the WG5: ORCHESTRATION

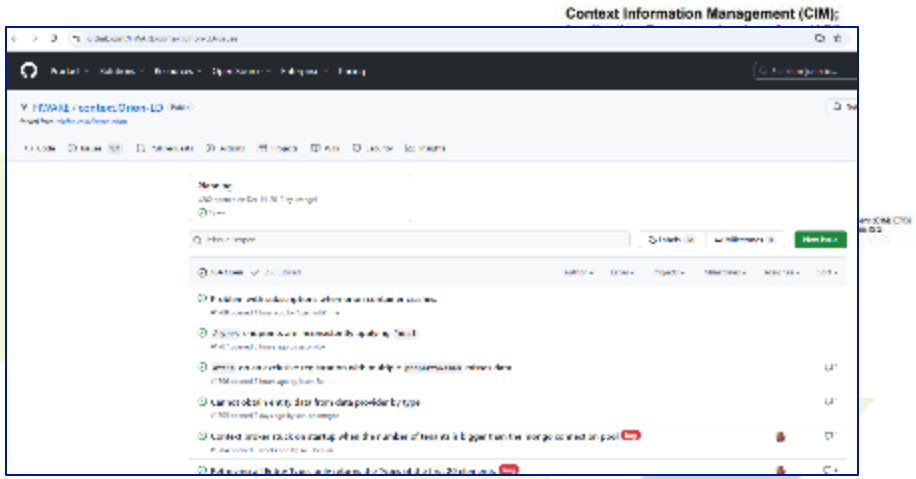
  - The *concepts* from the project have been included:
    - Dual-layer orchestration (HLO and LLO)
    - Re-orchestration triggering
    - De-composition in service components
    - Federation of orchestration domains

  - The *reference implementation technology* accompanies the design:
    - Cloud-native in the edge (KubeEdge, operators)
    - Monitoring and deployment multi-architecture and multi-framework)



Highlighting impact: ETSI ISG CIM

- The protagonism of aerOS in ETSI ISG CIM
  - The two owners and founders of the Context Broker are partners of the project: TID and FIWARE.
  - More than 7 ETSI members in the Consortium.
  - Varied contributions:
    - Inclusion of *datasetId* in new release J2024 from aerOS
    - New type of NGSI-LD attribute: *VocabularyProperty*
    - Direct contribution to functionalities in the core component: *SourceRegistrations, multi-attribute query, Federation Ops*…
    - Local requests without any other specifier (*?local=true*)
    - Usage of the Via HTTP header for loop detection in distributed operations
    - More than 20 issues in the official GitHub of the official CEF component
    - SmartDataModels
    - and more….



Highlighting impact: W3C

- Huge engagement with W3C international:
  - Contribution to the group WoT (Web of Things)
  - Direct participation in KGC Community Group (Knowledge Graph)
  - Issuing and publication of Permanent Identifiers for the Web:
    - Data Model of the Continuum: https://wp4.pages.aeros-project.eu/t4.1/aeros-continuum/
    - Building Ontology: https://wp4.pages.aeros-project.eu/t4.1/pilot-5-building-ontology/index.html
    - and more...

Very relevant! This was really needed and did not exist

- Cross-project joint active collaboration:
  - Joint workshop at AIOTI Days 2024 (aerOS-organised)
  - Morph-KGC tool repository:
    - Kafka support, Helm, containerization, Implement *grel:string_IndexOffunction*, and others...
  - Contribution to other relevant repos

Our next steps:

- Working towards standardization in ISO/IEC JTC1/SC41
- Participation in NexusForum task forces
- Membership in DISCOVER-US
- Creation of a new Standard Discussion Group (SDG) in ETSI focused on Computing Continuum and surrounding technologies.
- Potential co-location of an ISO TC meeting with an aerOS General Assembly (in discussion)

Thanks to INSTAR and CEI-SPHERE for sharing this space

FOLLOW US!

https://aeros-project.eu

@AerosProject

aerOS Project

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/aerosproject

/aerosproject

Coordinator

BluSpecs

Fraunhofer

fortiss

Alliance for IoT and Edge Computing Innovation

Trialog

TU Delft

Trust-IT Services communicating to markets

COMMpla Communication Platforms and Online Solutions

AIT Austrian Institute of Technology

CODECO: Cognitive, Decentralized Edge-Cloud Orchestration

Workshop on Cross-Domain Standardisation and Architecture for IoT and Edge Computing

Rute C. Sofia, fortiss GmbH (Coordinator)

26.11.2024, Sparks Meeting, Brussels

This work has received funding from the European Commission programme Horizon Europe, under grant agreement number: 101092696

Funded by the European Union

CODECO: Flexible Edge-Cloud Continuum

A novel Edge-Cloud orchestration framework, focusing on data-compute-network adaptability

Main Challenges

5G/6G smart services Dense environments	Mobility High portability	Far Edge to Cloud

Vision

Highly adaptive Edge-Cloud management framework (TRL4-5) that integrates a unique, smart, and cross-layer orchestration considering decentralised data flow, computation, and adaptive networking

CODECO
Cognitive Decentralised Edge Cloud Orchestration

CODECO Website

Funded by the European Union

Assets and Use-cases

SCAN ME

A1 Open toolkits and smart Apps

A2 Open-source Eclipse repository

A3 Training Database

A4 Edge-Cloud Use-cases

A5 R&I Engagement Programme

A6 Open Experimental Framework

P1: Smart Monitoring of the Public Infrastructure

Lead: Univ Göttingen/City of Göttingen, DE
VP: Improved QoE
Domain: Smart Cities

P2: Vehicular Digital Twin for safe urban mobility

Lead: I2CAT, SP
VP: Increasing road safety
Domain: Mobility

P3: Decentralized Edge MDS

Lead: Telefonica, SP
VP: cross-layer resource optimization for MDS
Domain: Smart Cities

P4:Decentralized Grids Collective Demand Side Management

Lead: Univ Politecnica de Madrid, SP
VP: Smart monitoring of the energy generation, consumption,availability
Domain: Energy

P5:Decentralised, wireless AGV Control for Flexible Factories

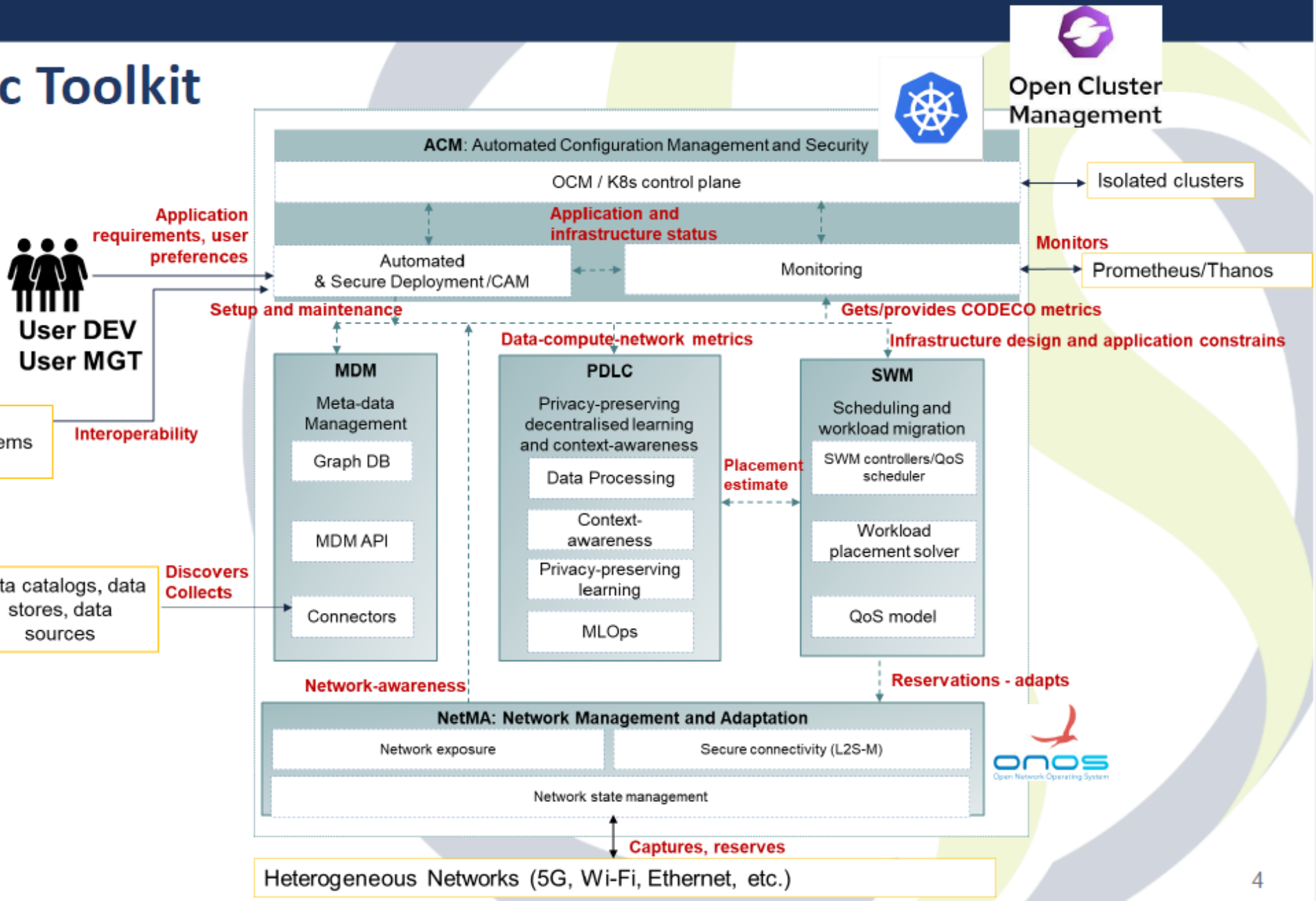
Lead: fortiss, DE
VP: Increased AGV autonomy and scalability via decentralized control
Domain: Manufacturing

P6:Smart Buildings

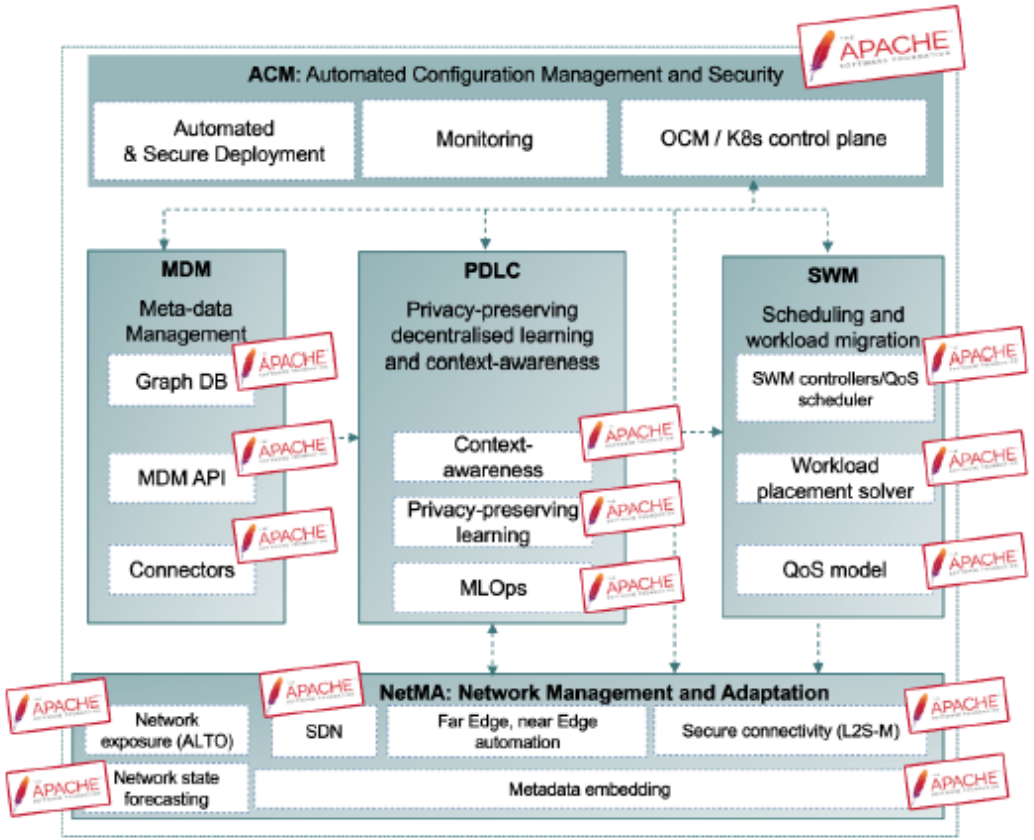
Lead: Almende, NL
VP: far Edge management of Crownstone meshes and their appliances
Domain: Energy

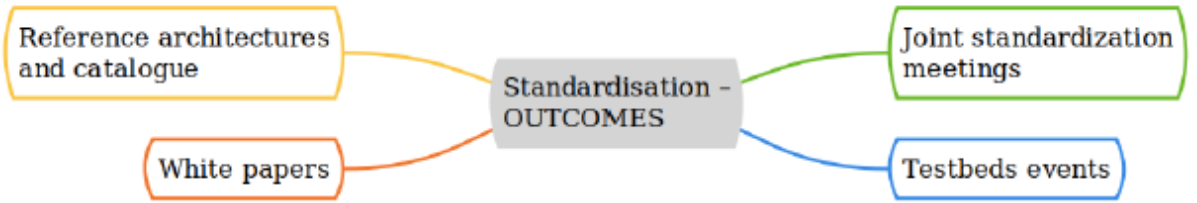
CODECO OSS Basic Toolkit

- **ACM:** Entrypoint to user; lifecycle management
- **PDLC:** AI/ML and metadata aggregation – energy-awareness and resilience estimations
- **NetMA:** Network awareness, secure connectivity
- **MDM:** Data status and awareness
- **SWM:** New scheduler informed re-scheduling (weighing estimations)



CODECO Standardisation Strategy



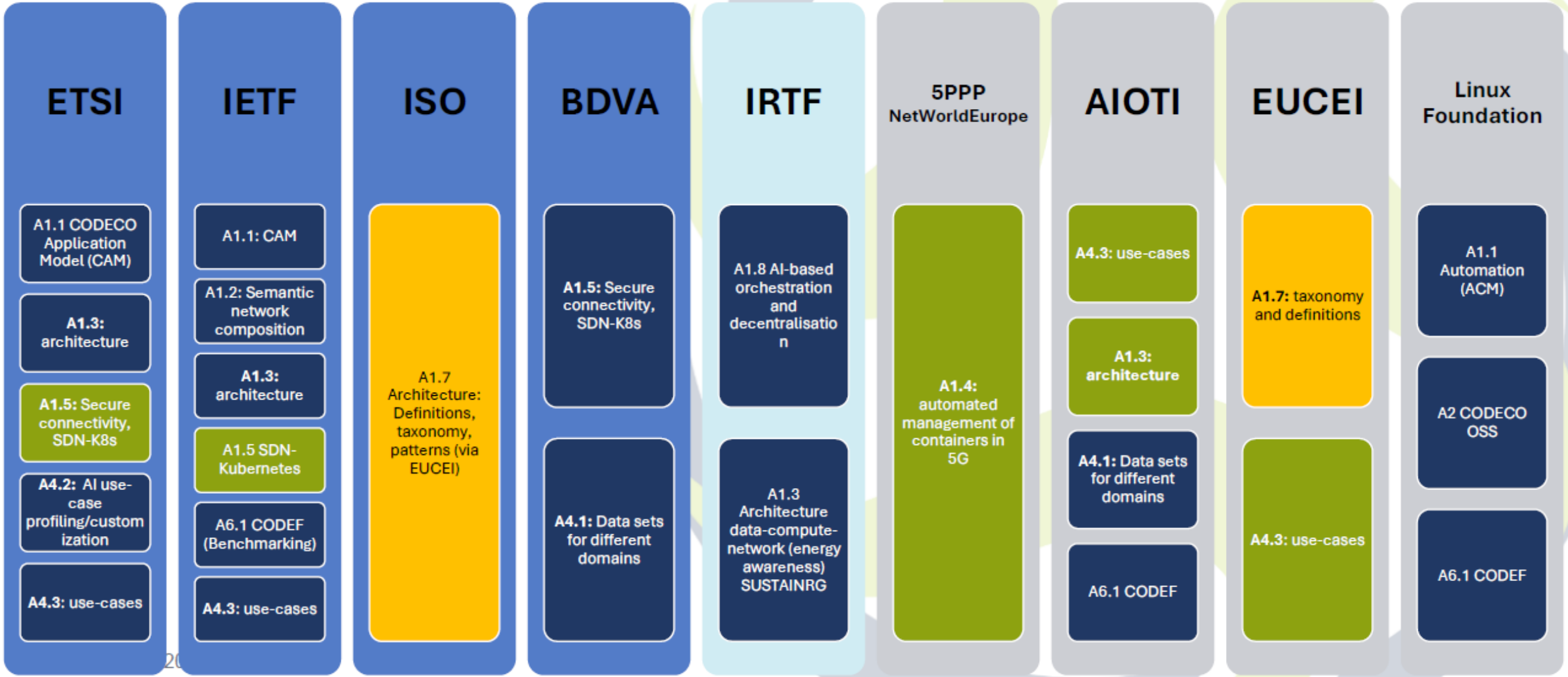


Standardization Process Breakdown

What	Where	How	Who
Identify Standardization assets	Partner to SDO links	Periodic checks on selected SDOs/groups	Task-force (partners)
Identify SDOs	Direct and indirect contributions	Survey and activities to partners	SDOs
Analyze standards in the CODECO framework		HSBooster (2025)	Related entities, e.g., EUCEI, AIOTI, etc
Identify gaps and contributions			

Zenodo: Deliverable D22

CODECO Standardisation, Asset to SDO Mapping (M23)



M23: Lessons learned, Challenges

- **Large industry and standardization**: standardization department not always involved
  - Business unit involvement is relevant
- **Asset identification**: start from low TRL (papers, TRL2) – start earlier, M1-M6
- Role of CSAs: **extremely important, major help**
  - Aggregator role; guiding role; best practices exchange
- **Research Staff** not trained to understand a need for standardisation
- **Resource constrains and standards lifecycles:** limited representation of partners in SDOs prevents efficient participation (e.g., ISO, IEEE) and reduces impact of contributions
  - Engage early

Suggestions, Joint Work to Strenthen RIA presence in SDOs?

- **Guidelines:** Via CSAs, Joint white papers (mapping of projects to SDOs), joint research to standardisation events, exchange of best practices
- **Exchange of best practices:** Establish a task-force (via CSAs) among all projects to regularly meet and discuss standardisation efforts and views
- **Develop expertise:** Provide regular training to researchers
- **Provide Grants:** specific support for standardisation in digital technologies

CODECO | Get Engaged!

Engagement: Innovation and Research Community Engagement Programme

- Engagement events
- Possibilities to extend and re-use CODECO
- **Awards**!

Play with the CODECO early code release – Eclipse Gitlab

- Sub-components of CODECO
- Examples
- Synthetic Data Generator

SCAN ME

Follow Us!

LinkedIN @CODECO Project

Twitter @CODECOProject

Zenodo Community

NEPHELE - A lightweight software stack and synergetic meta-orchestration framework for the next generation compute continuum (https://nephele-project.eu/)

Workshop on Cross-Domain Standardisation and Architecture for IoT and Edge Computing

Dr. Anastasios Zafeiropoulos

National Technical University of Athens

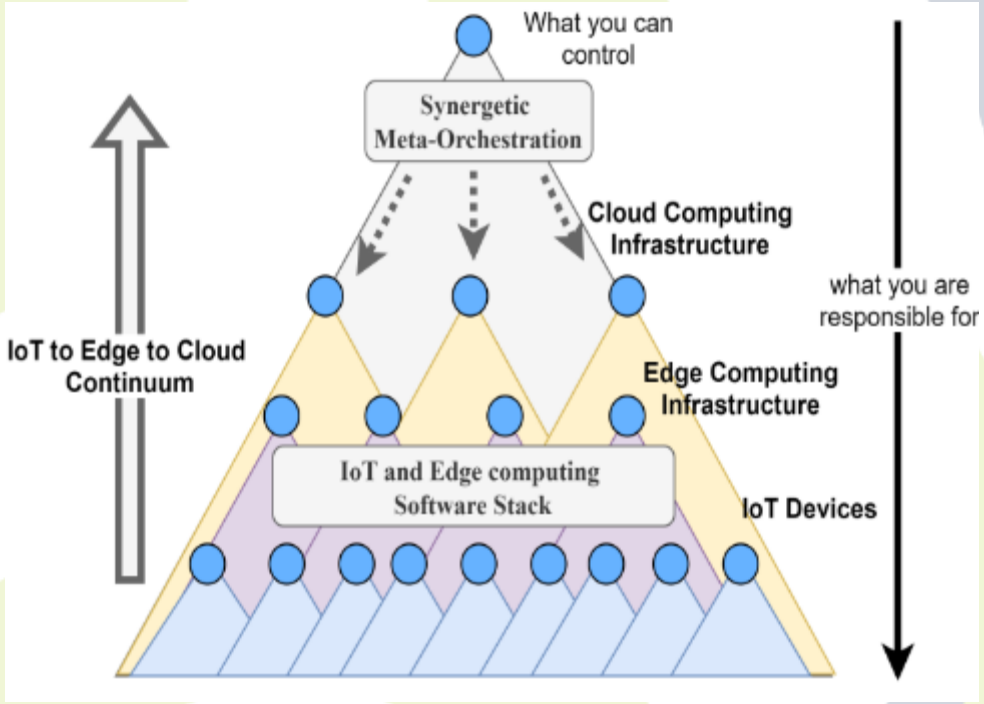
Contact: tzafeir@cn.ntua.gr

https://www.netmode.ntua.gr/

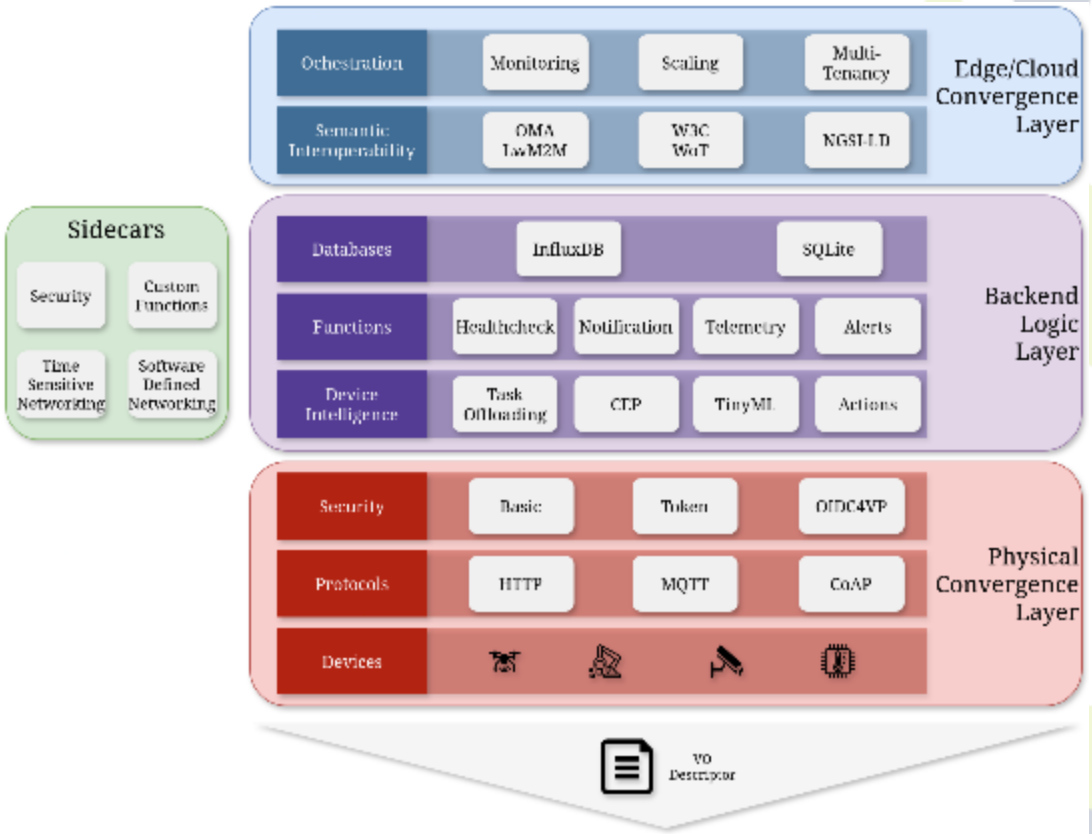
29/11/2024

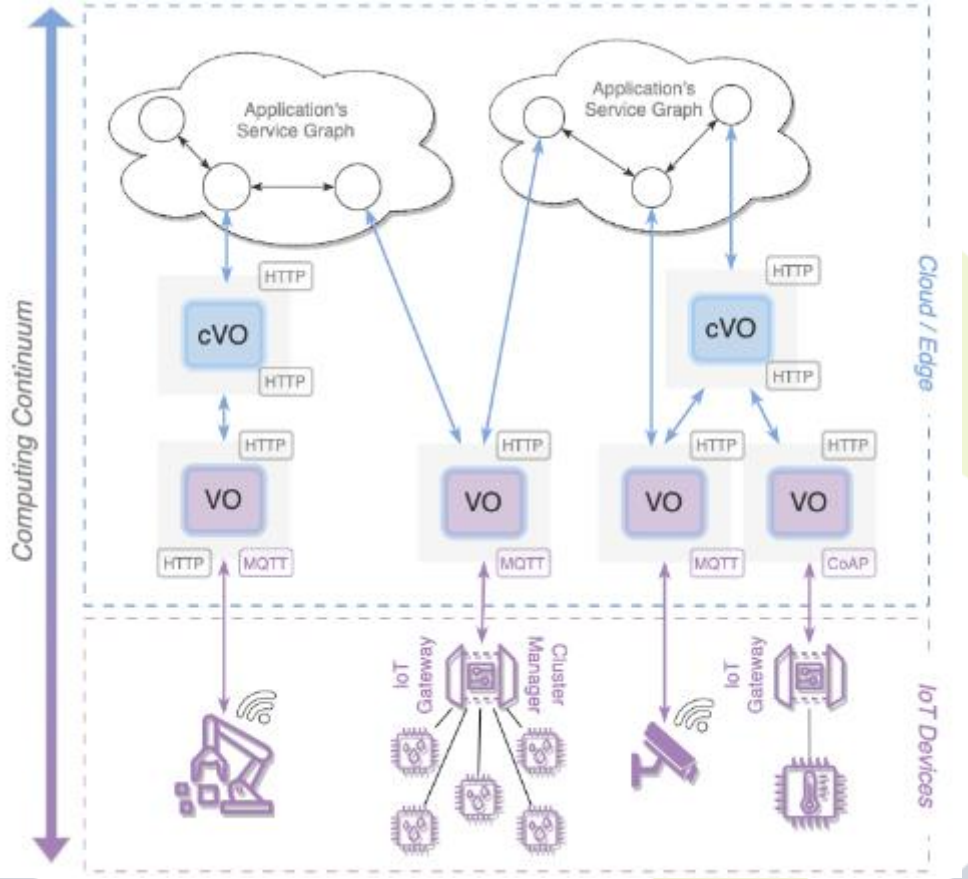
Main Innovations in NEPHELE

- an **IoT and edge computing software stack** for leveraging **virtualization of IoT devices** at the edge part of the infrastructure and supporting openness and interoperability aspects in a device-independent way.
- a **synergetic meta-orchestration framework** for managing the coordination between cloud and edge computing orchestration platforms, through high-level scheduling supervision and definition, based on the adoption of a "**system of systems**" approach.

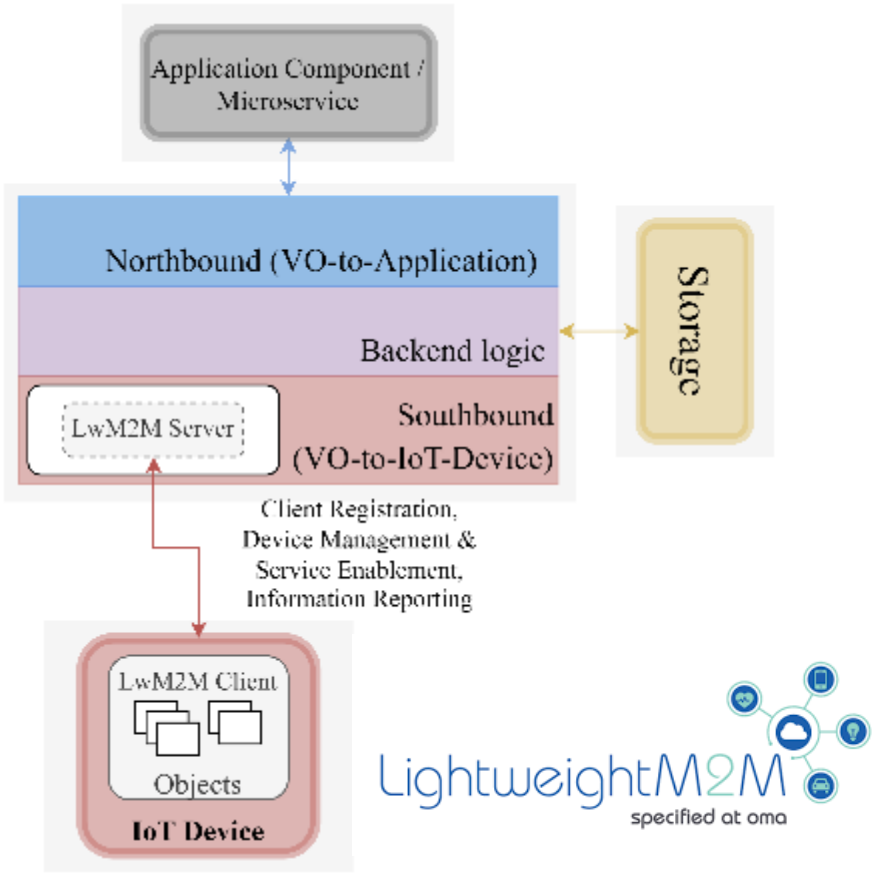


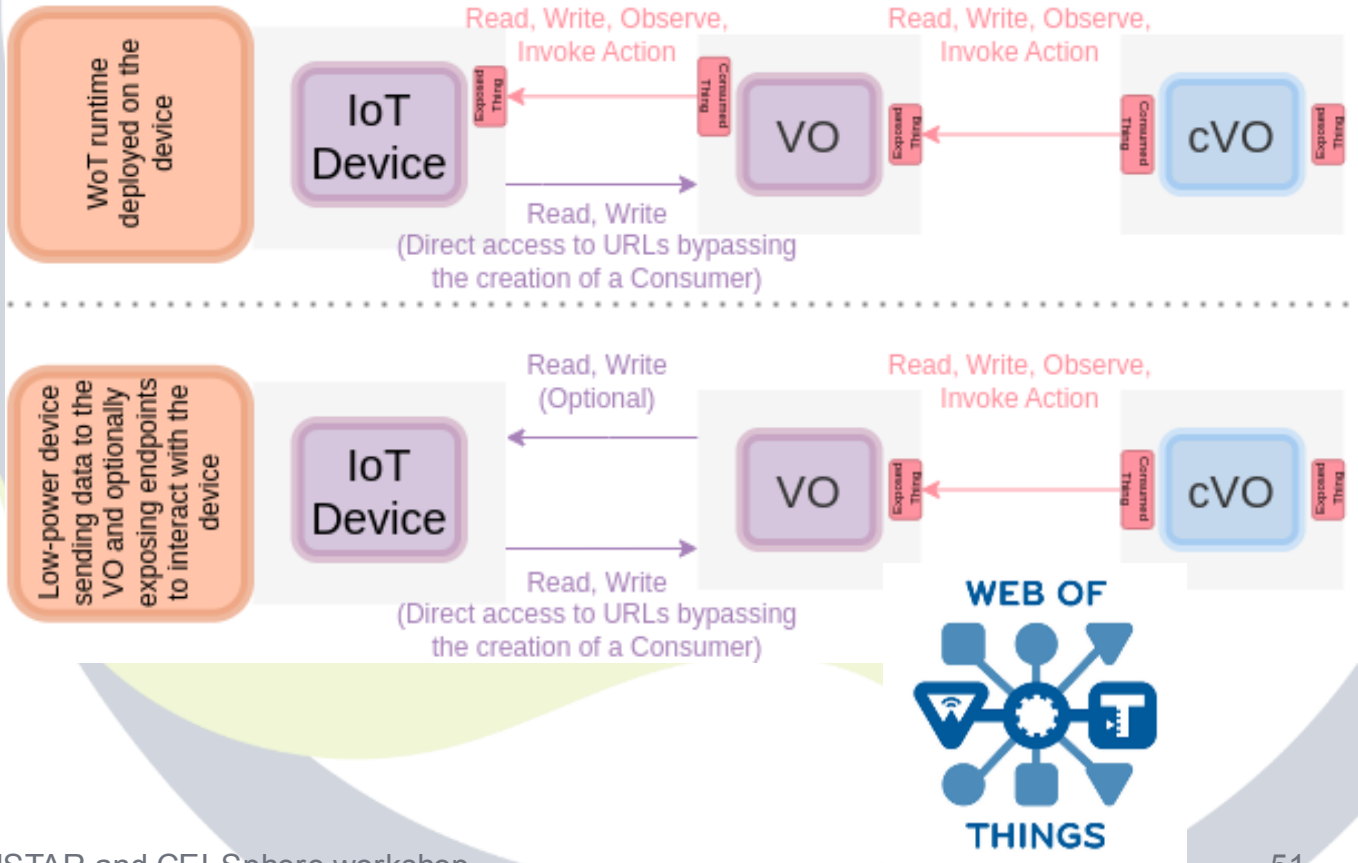
Virtual Object Stack





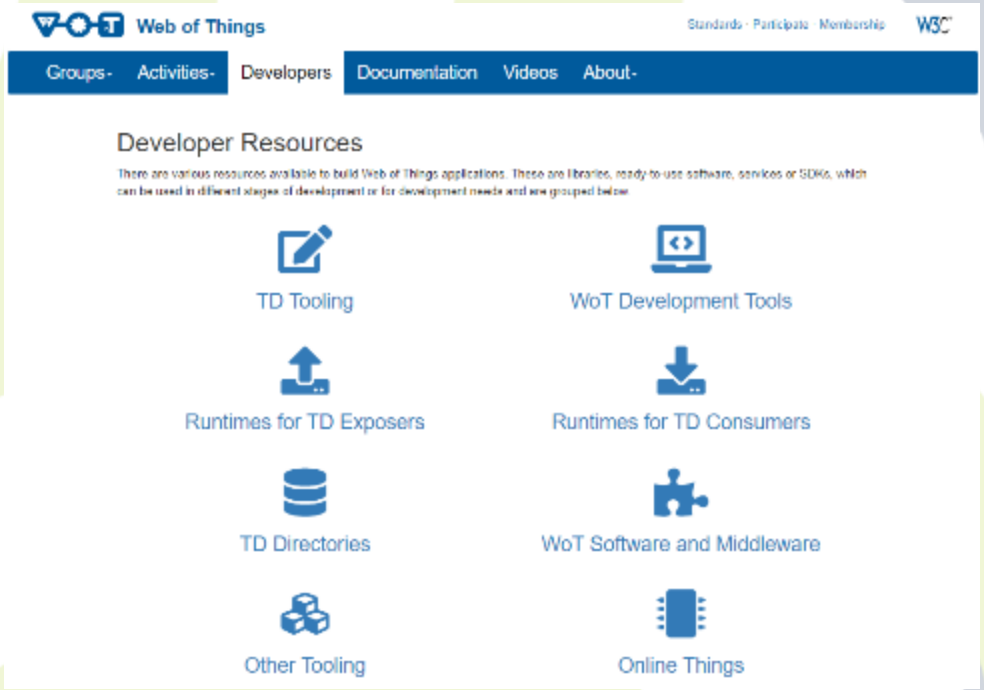
Standardization Activities Related to VOStack





VOStack alignment with the W3C Web of Things (WoT)

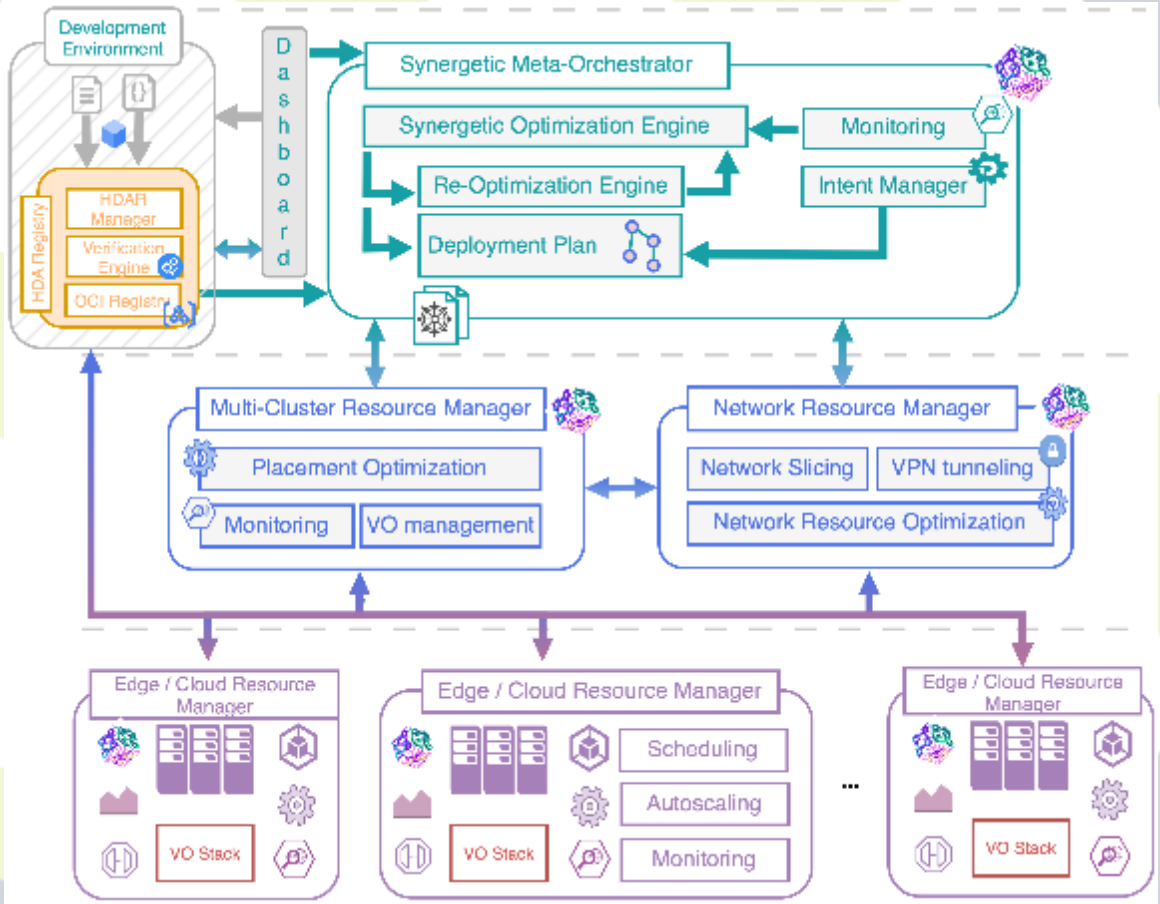
- Implementation based on the Web of Things Python implementation WoTPy
- Extensions provided for:
  - Interfaces for orchestration of VOs/cVOs, Convergence with edge/cloud computing platforms
  - The concept of Virtual Functions
  - Task offloading between edge and IoT resources
  - Semantic interoperability (W3C WoT, NGSI-LD, OMA LwM2M)
  - Security, Time Sensitive Networking, Software Defined Networking
  - Video support
  - Pool of VOs and cVOs for various verticals
- Documentation available at https://netmode.gitlab.io/vo-wot/
- Online events with the community
- Participation in ETSI IoT Conference 2023
- Upcoming event: AIOTI Workshop on Semantic Interoperability and Digital Twins



https://www.w3.org/WoT/developers/

Standardization Activities related to the Meta-Orchestration Platform

- Participation and contribution into the OpenContinuum TF3 activities (emerging draft to be presented during next SC41 meeting in November)
- NEPHELE architectural approach based on the ISO/IEC/IEEE 42010 specifications
- Continuous interaction with AIOTI
- Presentation at the "A Glimpse of Europe" workshop, co-organised by AIOTI and the OpenContinuum CSA (alongside with the international committee meeting of ISO/IEC JTC 1 SC 41)
- Contribution to ETSI Open-source MANO (Management and Orchestration) Framework



The role of an open-source strategy

NEPHELE Adopts a SoS Approach to Deliver an OSS Stack for IoT Virtualisation and a Meta-Orchestration Framework

Share this article

The Internet of Things (IoT), and in particular the Industrial Internet of Things (IIoT), is a powerful, flexible technology being used and adopted by numerous industries. But effective deployment and integration of sensors and devices, particularly alongside other complex technologies such as edge computing and cloud computing, has proven challenging.

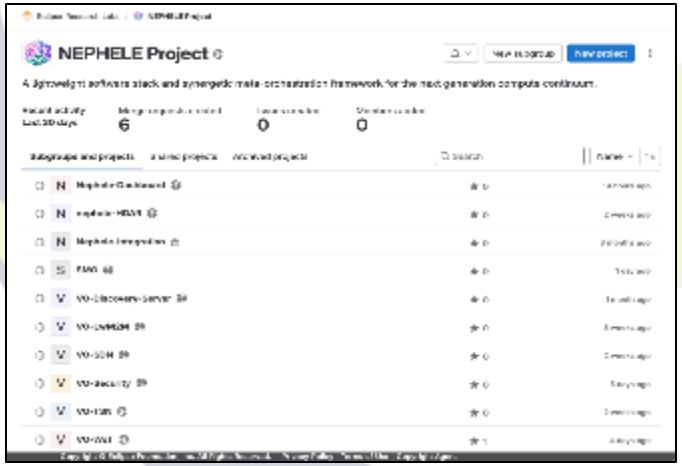
Many companies and organisations have tackled these challenges, with varying degrees of success. As a result, there has been a rapid and widespread proliferation of methodologies. New challenges have emerged from this abundance of methodologies, particularly when it comes to taking edge data, feeding it to IoT and IIoT devices, and synchronising communication and coordination via the cloud. Interoperability and convergence have proven difficult issues to resolve.

This is the issue the NEPHELE Research Project is tackling with:

- An IoT and edge computing software stack
- A synergetic meta-orchestration framework

https://newsroom.eclipse.org/eclipse-newsletter/2024/september/nephele-adopts-sos-approach-deliver-oss-stack-iot-virtualisation

Research Meets Open Source



EUCEI Award for Open Source and Standardisation

Eclipse ResearchLabs GitLab

https://gitlab.eclipse.org/eclipse-research-labs/nephele-project

Key insights

- Openness (open specifications, open APIs, open-source software) is key for standardization
- Continuous effort required for communication, interaction with members in standardization groups, dissemination of added value
- Continuous software development effort to keep updated with the various contributions in the provided tools by working groups
- Joint events (both in-person and online) are very helpful
- Participation of industrial partners is critical
- Collaboration across EU projects is important to increase the adoption rate and the impact of the proposed solutions

COFFEE BREAK
11:00 - 11:20

Next Session at 11:20
Strategy development session: Pilots and standards plans

Workshop on Cross-Domain Standardisation and Architecture for IoT and Edge-Computing

27/11/2024

Strategy development session: Pilots and standards plans

Workshop on Cross-Domain Standardisation and Architecture for IoT and Edge-Computing

27/11/2024

Panel discussion

slido.com
#3682436

Brendan Rowan
BluSpecs

Tim Valbert
Pionix

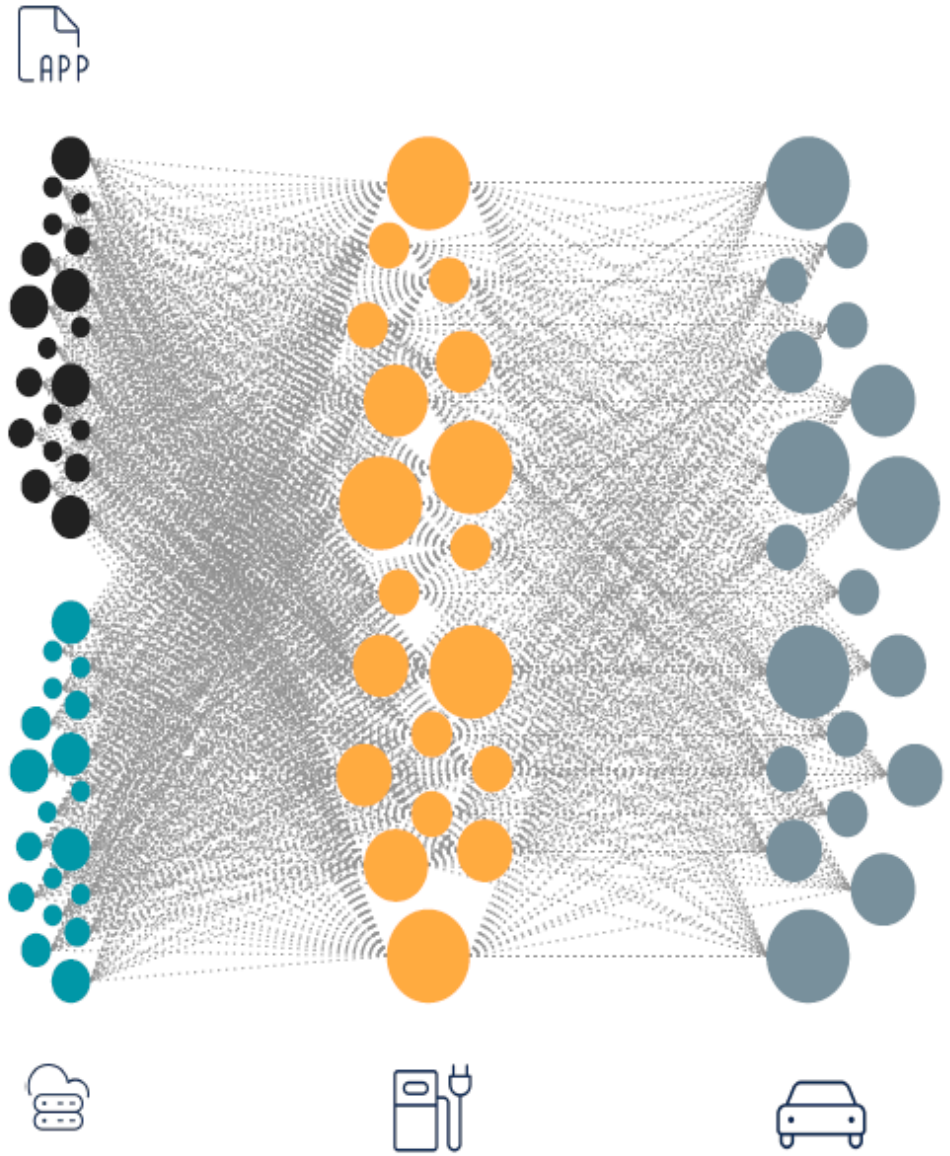
Gael Blondelle
ECLIPSE Foundation


LF ENERGY
EVerest
ONE STACK TO CHARGE THEM ALL!

THE PROBLEM

The reason many charging sessions fail is a combinatorial explosion:

Make **every EV charger** work
with **every EV variant** and
all connected apps and **cloud software**
via **every standard**.



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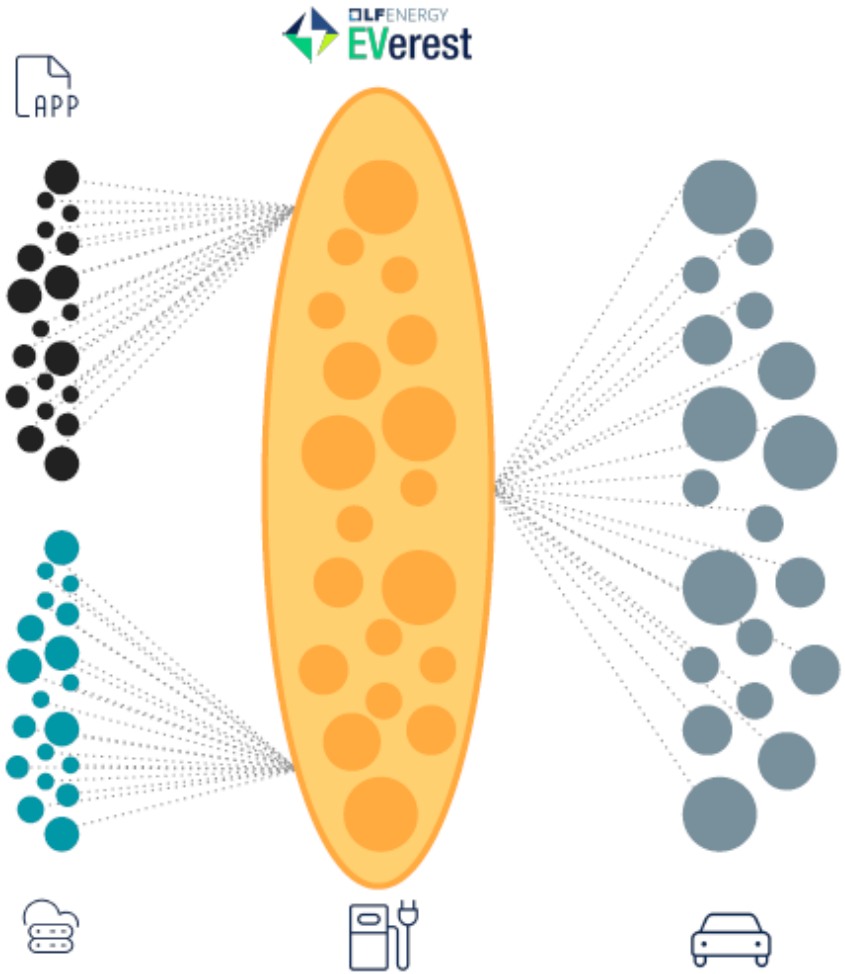
THE SOLUTION

- One Single implementation on one end of the wire
- Not a new SW monopoly, but cooperation
- Flexibility for everyone to innovate

The only solution to the future of EV charging software is an Open Source Model



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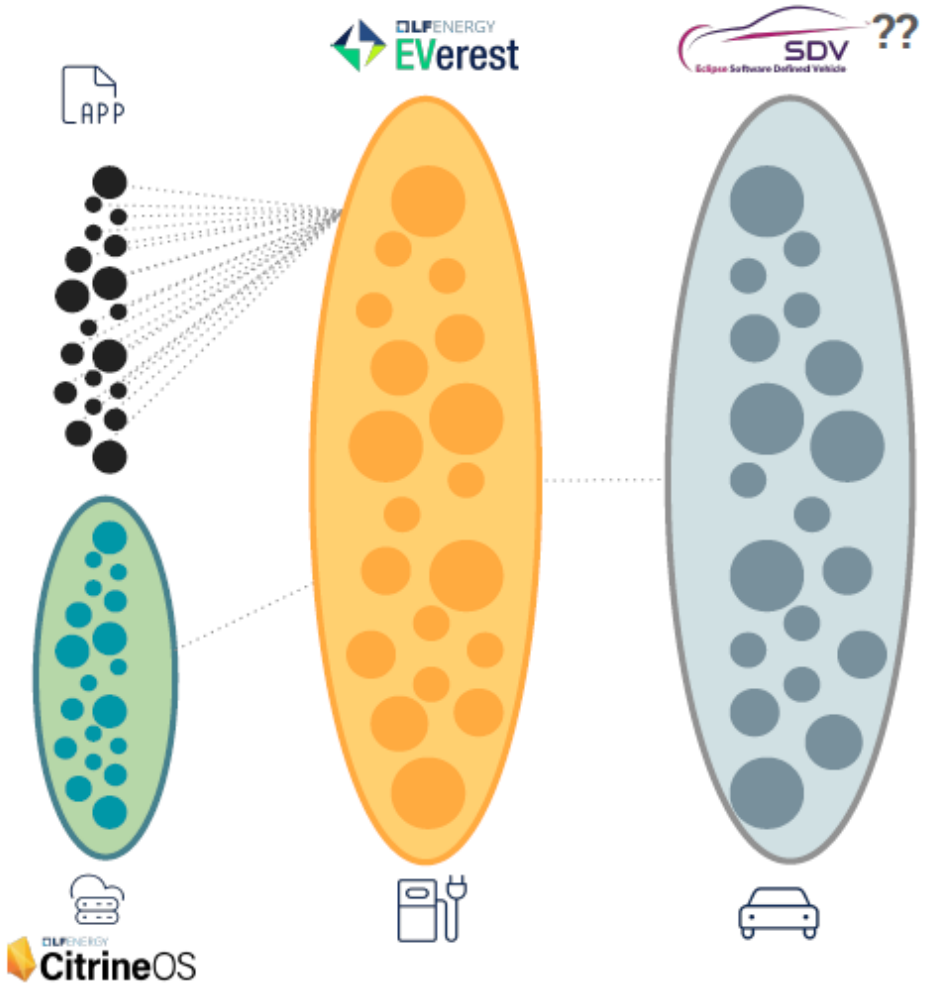
THE DREAM

- Make EV charging protocols commodity
- One Single implementation for all systems

The only solution to the future of EV charging software is an Open Source Model



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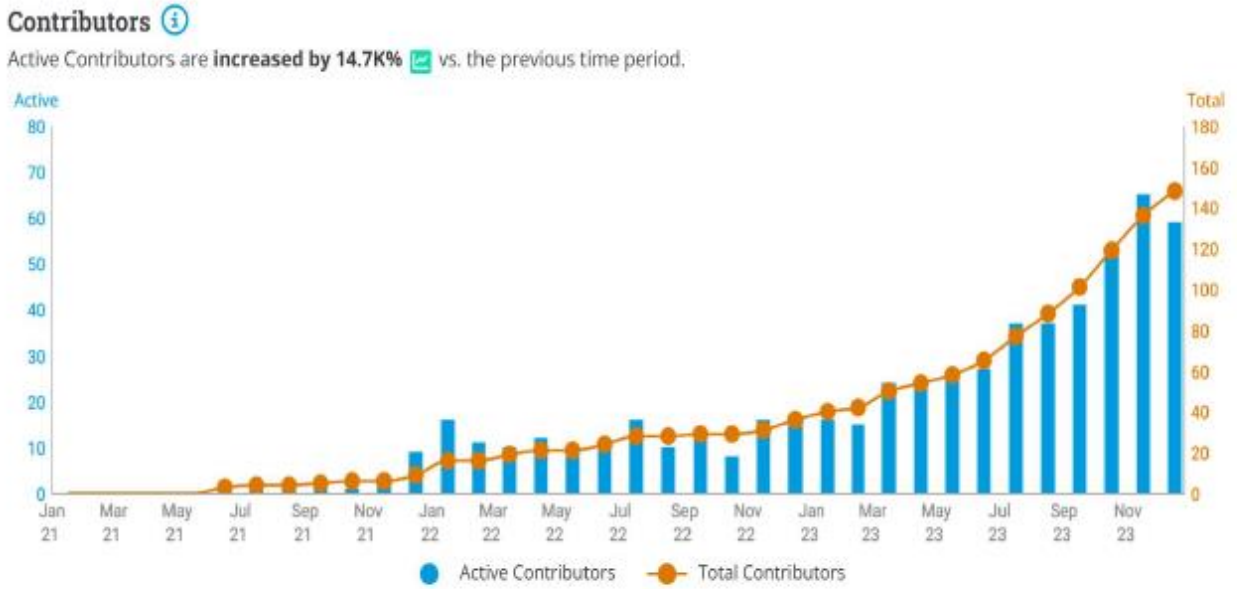
EVerest community

- The foundation of OSS lies in its vibrant and active community.
- The collective offers invaluable support, acting as an extended team
- For organisations with limited resources, this community becomes an indispensable asset

Technical Steering Committee:

- PIONIX
- Chargebyte
- Qwello
- JOET*

~ **380+** members on the mailing list
~ **330+** Active Zulip members
~ **150** contributors
6 regular working group meetings



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** US Joint Office of Energy and Transport*

PIONIX

EVerest is the Leading Open Source EV Charger Stack

Under the umbrella of Linux Foundation Energy, we quickly attracted the global EV charging industry to form a booming community.

- 5-10x growth year-over-year
- > 50 contributing organizations
  - Leading Car OEMs
  - Charging Station Makers
  - Standardization Bodies
  - Governments & Universities
  - Operators (CPOs)
  - Component Manufacturers
- Every ~ 10 min new commits
- Most active project in Linux Foundation Energy

THE LINUX FOUNDATION LFENERGY

EVEREST ECOSYSTEM - CONTRIBUTORS & CUSTOMERS

LFENERGY EVerest

EVerest - Standards & Implementation

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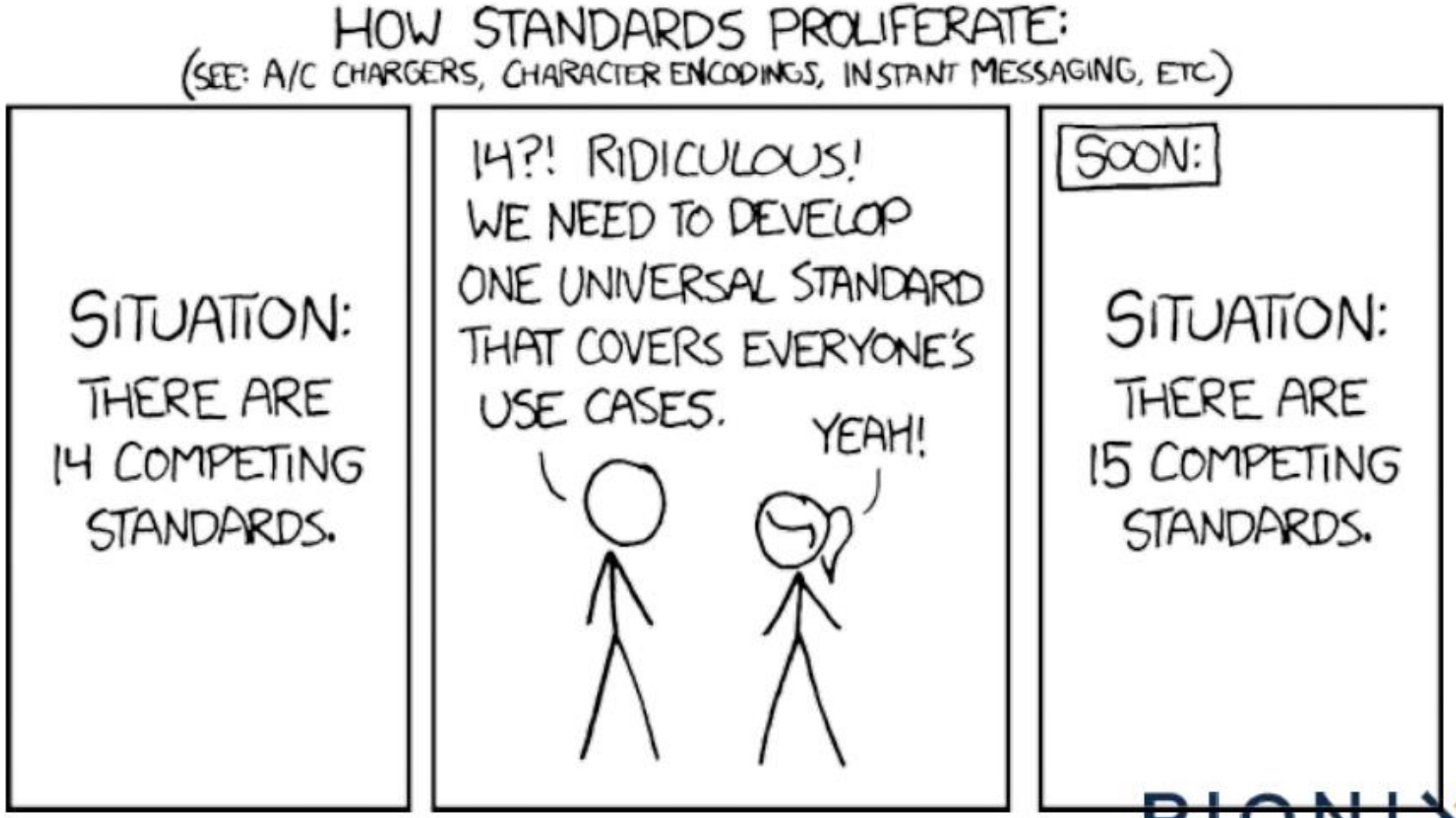
New standards are not the solution, but an common open source stack is!



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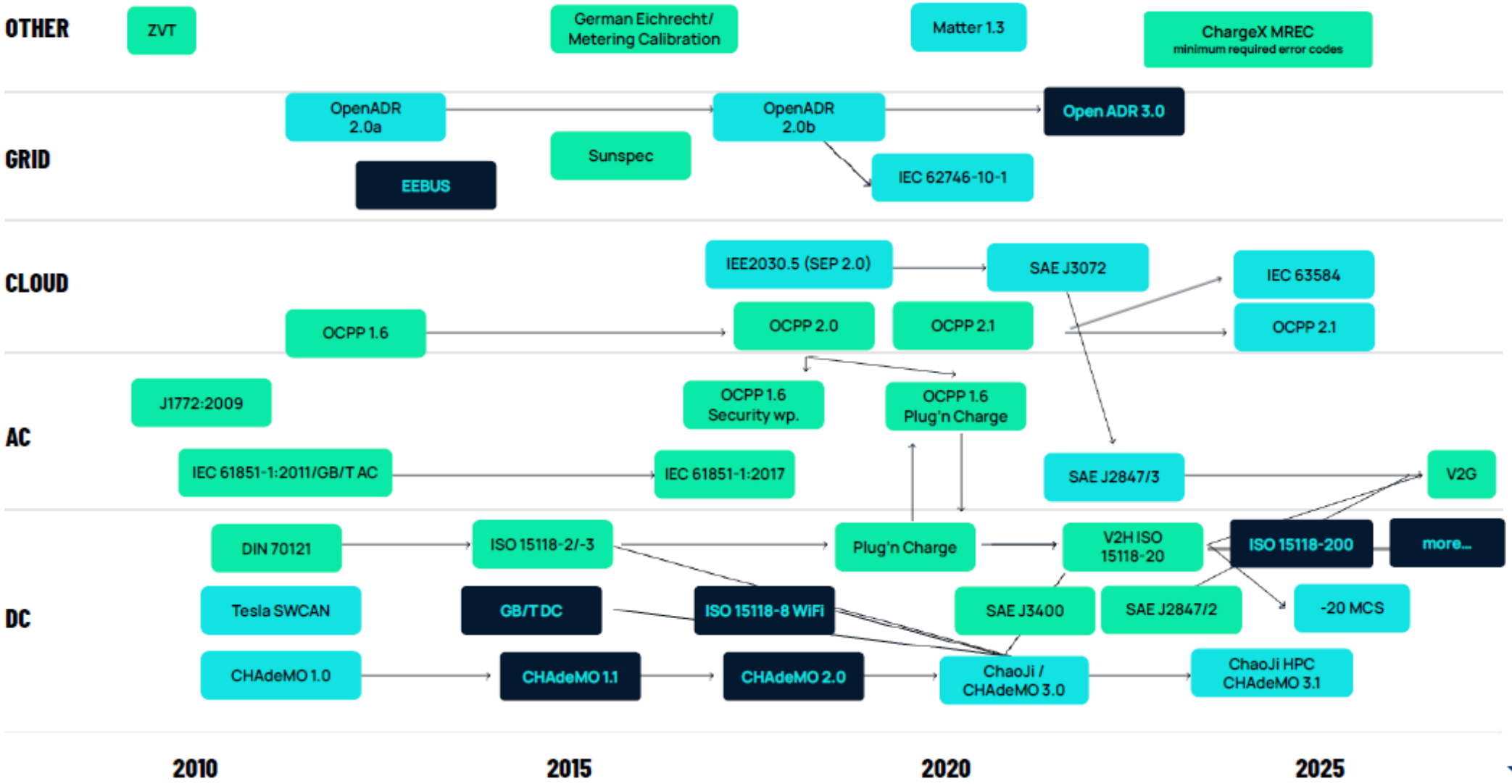
https://xkcd.com/927/

Evolving standards



TO BE CONTINUED ...

Roadmap

WIP

Done

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Security & Reliability

ensitive
lata

PIONIX

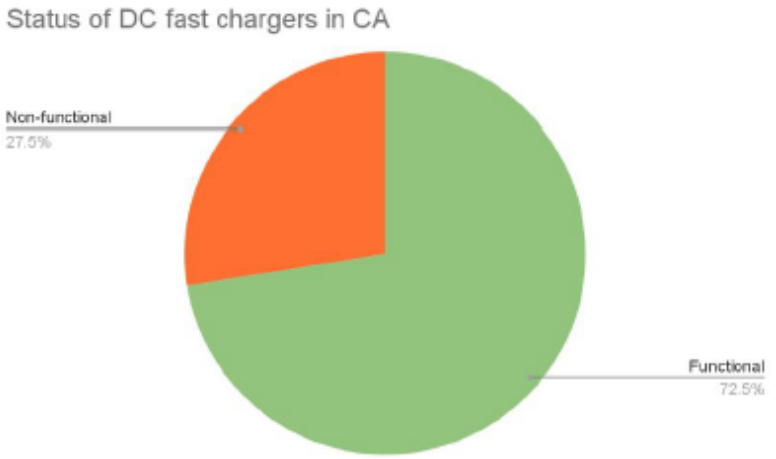
Security advantages of OSS

“Hackers with access to a large network of charging stations could cause power outages and potentially even damage power grid infrastructure”
Security architecture for electric vehicle charging infrastructure., ELaadNL

- Developers and Security experts can inspect, validate, and fortify code
- LFE security scans

Reliability Advantages

Reliability needs to improve:
72.5% is really bad
99% uptime is not good enough: 3,5 day/year



- The strength of OSS often lies in its community-driven approach.
- Solutions are birthed from the collective expertise of a diverse group of contributors.
- Rigorous testing, vetting, and refinement from multiple perspectives, culminating in a product that boasts of heightened reliability.

Cost-Efficiency: don't implement commodity code

75% companies have reported: not using OSS would have cost more.

Would you implement TCP/IP?

Don't invest in software that does not bring added value:
Lets make OCPP, ISO 15118, CHAdeMO etc commodity.

No need to develop & maintain commodity code:
Focus on unique features and faster time-to-market.
15 - 25% of the development cost is yearly spend on maintenance.

JOET Collaboration

PIONIX

Joint Office of Energy and Transportation

Joined the EVerest project Jan 2024 - help the industry to adopt communication protocol requirements set forth in NEVI (e.g. OCPP, Plug n Charge, etc.)

- Active code contributions (via Accenture development)
- Public endorsement
- Hosting and Organisation of Events - EVerest US summit
- Participation on “Testivals”
- Providing use cases and demos for industry
- Pilot program for early adopters

“By providing a unified framework and fostering collaboration, the EVerest project empowers industry stakeholders to accelerate the transition to zero-emission transportation," emphasized Sarah Hipel, Standards and Reliability Program Manager at the Joint Office. “EVerest simplifies compliance while providing a scalable, interoperable foundation for innovation in EV charging.”

https://driveelectric.gov/news/everest-open-source-platform

Joint Office of Energy and Transportation and Linux Foundation Energy to Advance Electric Vehicle Charging Interoperability with EVerest Open-Source Platform

June 11, 2024

In January 2024, the Joint Office of Energy and Transportation (Joint Office) announced a partnership with Linux Foundation (LF) Energy to build open-source software tools to support communications between electric vehicle (EV) charging infrastructure and other systems through LF Energy's EVerest project. Today, the Joint Office announced that the March release of EVerest includes support for the communication protocol requirements defined in the National Electric Vehicle Infrastructure Standards and Requirements and enables Plug

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Licensing

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All starts with correct IP Strategy

Licence Options

Commercial Licence:
- ❌ No community

GPL only:
- ❌ No proprietary IP / USPs protection
- ✅ Community

Dual license: GPL + commercial
- ❌ No proprietary IP / USPs protection
- ❌ No community

MIT / BSD
(entirely, or only for core components):
- ✅ Community
- ✅ No limitation to commercial usage
- ❌ 3rd party contributors threaten by patent trolls

Apache 2.0
- ✅ Community could contribute
- ✅ No limitation to commercial usage
- ✅ Protection against patent trolls

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Structure & Governance

PIONIX

LFE governance structure

LFENERGY

Governing Board

Budgets

Marketing

Strategy

Technical Advisory Council

Promotes and supports projects

Facilitate communication and collaboration among the Technical Projects

Defines projects states and processes

EV Charging SIG

Reviews and supports projects in the EV charging space

com. and collaboration

Onboard new Projects

LFENERGY EVerest

LFENERGY CitrineOS

+ more!

Technical Steering Committee

Steer the project, takes decisions on architecture, roadmap etc.

Working Group A/B/C...

On big projects like EVerest, you need further breakdown

LFENERGY

EVerest Project Governance:
LF Energy reviews and supports EVerest

LF ENERGY

Technical Advisory Council

Reviews and supports projects

communication and collaboration among Projects

processes

LF ENERGY EVerest

Technical Steering Committee

Steers project, decisions, architecture, roadmap etc.

- PIONIX
- Chargebyte
- Qwello
- JOET (US Joint Office of Energy and Transport)

Working Groups

Discuss/work on specific topics related to EVerest

- Car Communication
- Cloud Communication
- CI/CD & Testing
- EVerest Framework & Tools
- General / Q&A
- Energy Mgmt

How to get involved

everest.github.io

- CODE!
- Hardware designs
- EVerest Mailing list
- Quick start guide
- Meeting schedules
- Webinars & Updates Videos
- Developer chat

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Open Hardware: YETI & YAK

You wouldn't download an EV charger, or would you?

- https://github.com/PionixPublic/reference-hardware
- CERN Open Hardware Licence Version 2 - Permissive
- Developer friendly
- Designed with KiCAD 6 https://www.kicad.org
- Case design files for 3D printing available

Yeti: power board

Yak: High level board

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Open Standards and Open Source
The Winning Formula for Interoperability

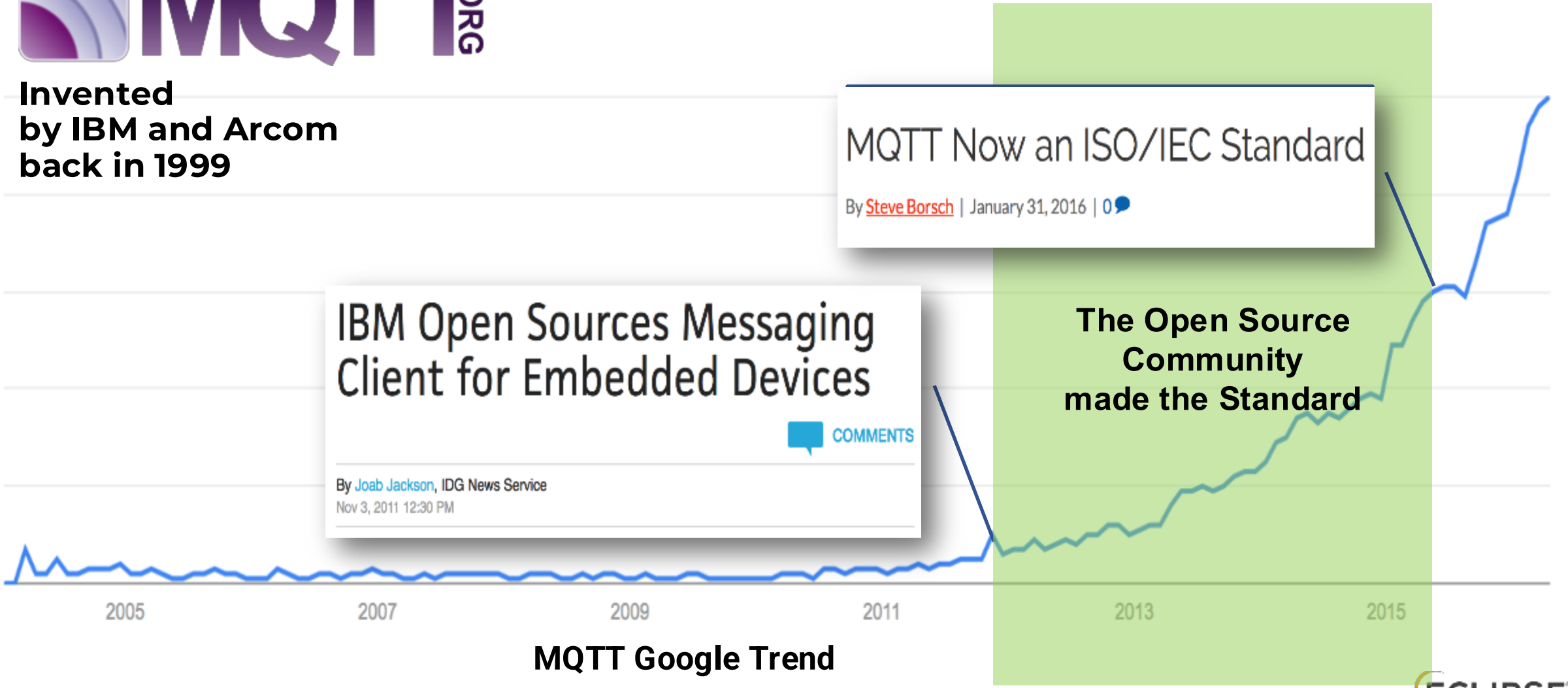
Gaël Blondelle

ECLIPSE FOUNDATION

27/11/2024

MQTT, a success story!

Invented by IBM and Arcom back in 1999



MQTT Google Trend

Open Source is a flavor of Intellectual Property management

Royalty Free is the only compatible option

Eclipse Foundation Services

Collaboration Platform

Governance Platform

Infrastructure for Open Collaboration

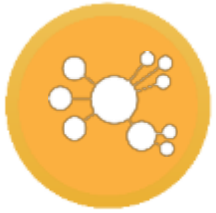
Ecosystem Development

Community Governance & Processes

IP Management & Licensing

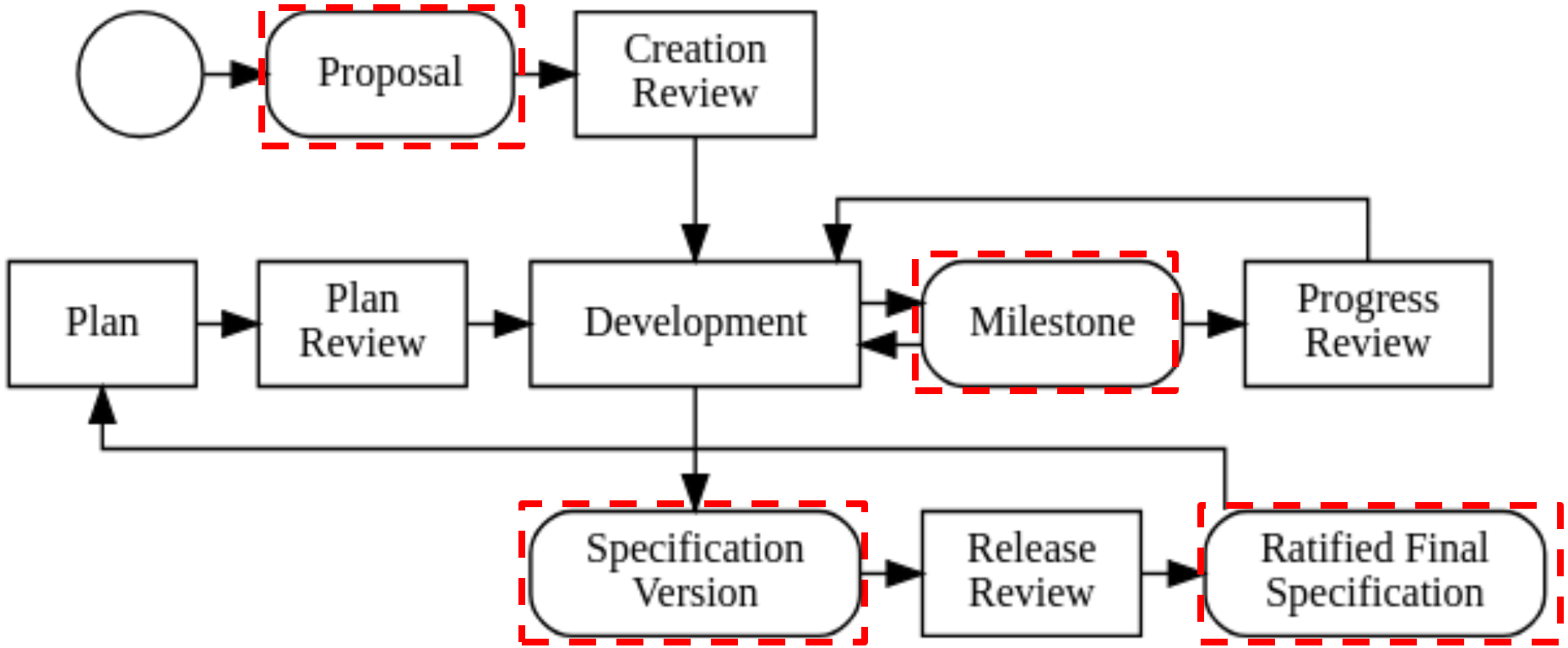
Supply Chain Security

Public Policy

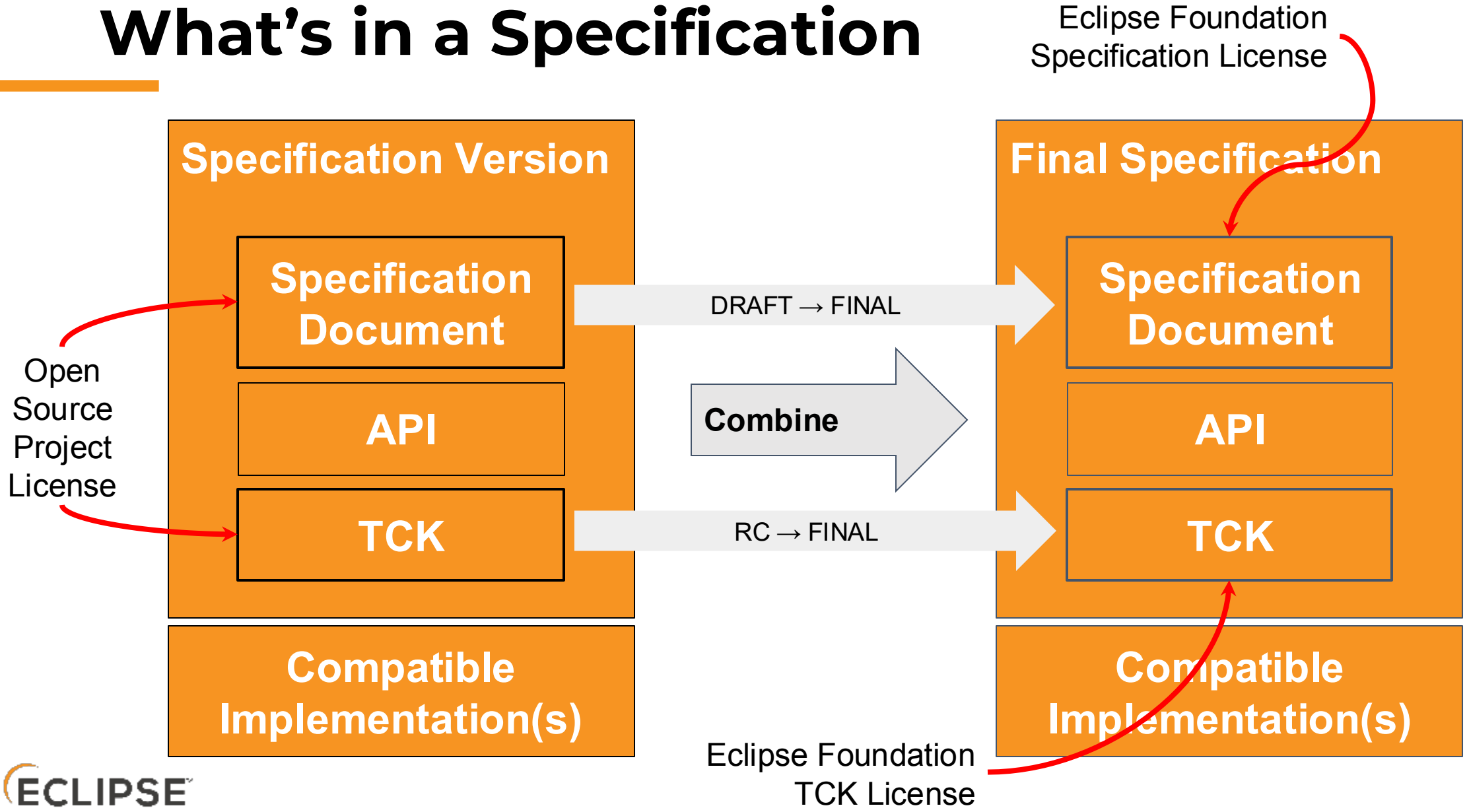


ECLIPSE FOUNDATION

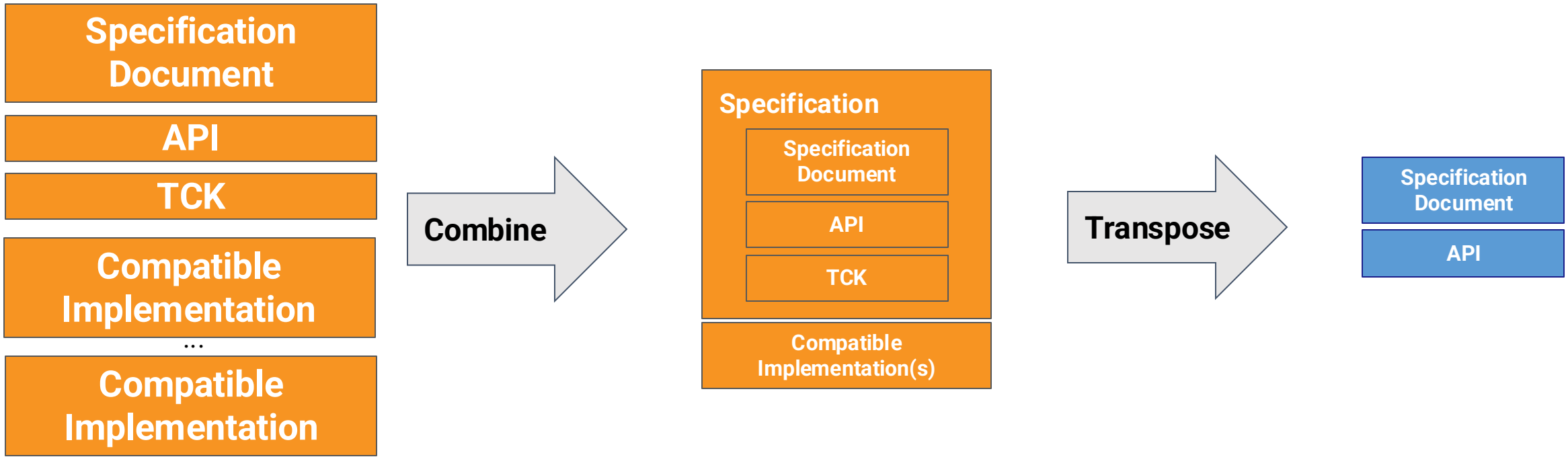
Specification Lifecycle
As close as possible to project lifecycle



What's in a Specification



Standards at Eclipse and Beyond



The Eclipse Foundation is recognized by ISO/IEC JTC1 as a submitter of Publicly Available Specifications (PAS). Eclipse specifications can thus become international standards. Sparkplug has been submitted for transposition in November 2022. The ballot concluded successfully in May 2023. Sparkplug was published as ISO/IEC 20237 in October 2023.

Standards Participation

The Eclipse Foundation possesses category A liaisons with the following ISO/IEC JTC 1 subcommittees

- ISO/IEC JTC 1/SC 38 Cloud computing and distributed platforms (latest liaison report)
  - SC 38/AG 5 Long-term strategy
  - SC 38/WG 3 Cloud Computing Fundamentals (CCF)
  - SC 38/WG 5 Data in cloud computing and related technologies
- ISO/IEC JTC 1/SC 41 Internet of things and digital twin (latest liaison report)
  - SC 41/WG 3 IoT Architecture
  - SC 41/WG 6 Digital twin

We intend to request a liaison with ISO/IEC JTC 1/SC 27 Information security, cybersecurity and privacy protection in the upcoming months

- Liaison status established with CEN/CENELEC
  - Participation in JTC13/SC9 to contribute to standards for the CRA

Our first success story: Sparkplug®

- **Sparkplug:** First specification submitted for PAS transposition
  - Relies on ISO/IEC 20922:2016 (MQTT) as a transport
  - Focused on interoperability (payloads, topic structures)
- Created in 2016 by Cirrus Link Solutions
- Contributed in 2019 to the Eclipse Foundation
- Eclipse Tahu: Open Source Implementation
- **V3.0 Transposed as ISO/IEC 20237 (Publication: Oct 2023)**

Summary of Actions

Workshop on Cross-Domain Standardisation and Architecture for IoT and Edge-Computing

27/11/2024

slido.com
#3682436

Antonio Kung
O-CEI

Rolf Riemenschneider
DG CNECT

Carlos López-Rodríguez
DG CNECT

Takeaways – Antonio Kung, O-CEI

- Cross-sector standardization
- International Dimension
- Cross-Fertilization
- Roadmap Development.
- Impact Enhancement

Cross-sector standardization takeaways

Energy as a « horizontal » domain

Flexibility as a priority-flagship vector

Integration of ETSI MEC

Leveraging IEC need for digital twin and semantic interoperability

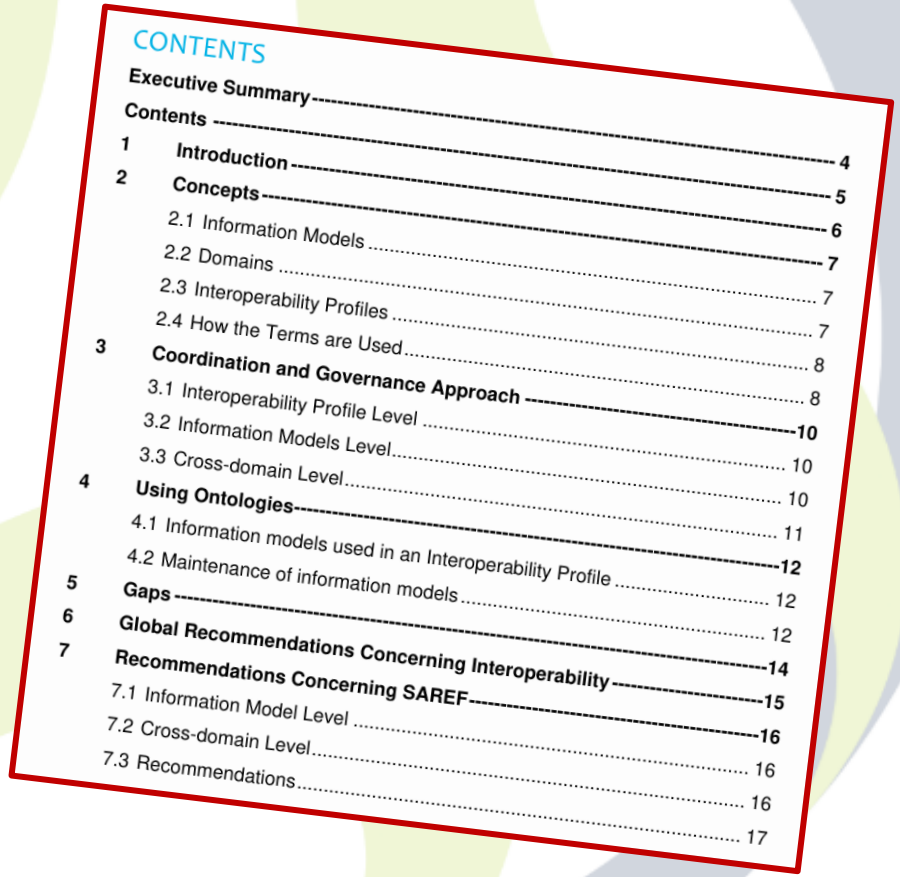
Cross-sector standardization takeaways

Higher level coordination on
data model - information model

Concern	Recommendation
Information models	**R**: Standardisation committees should engage in coordination and governance activities on information models selected as relevant.
Cross-domain	**R**: Standardisation committees should set up cross-domain coordination.
SDO	**R:** SDOs should adapt their ecosystem to better handle standardised information models across their whole life cycle (from their creation, to their publication including their maintenance)

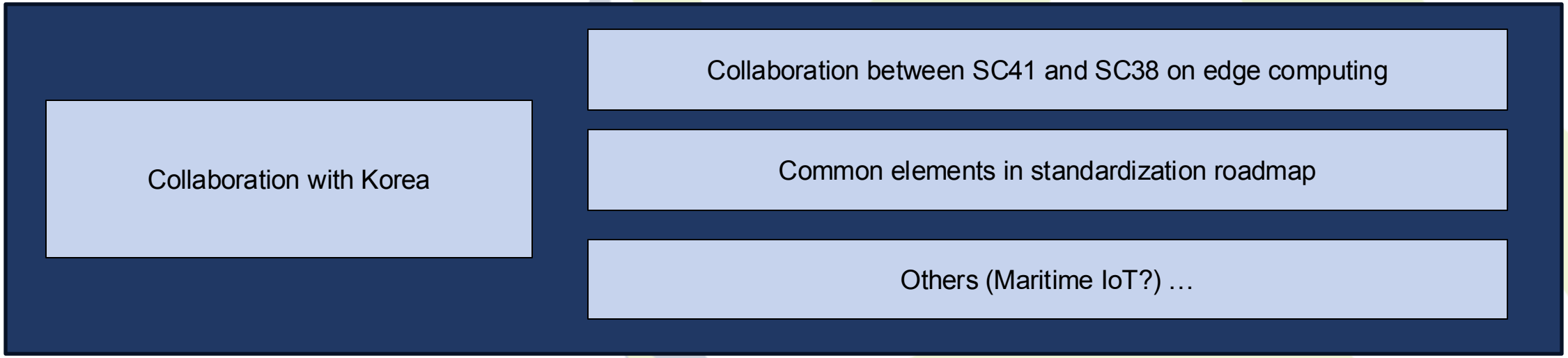
Concern	Recommendation
SAREF	**R**: Create a SAREF information model coordination and governance.
SAREF	**R**: Host the SAREF information model coordination by an existing structure, e.g. AIOTI

Paper on interoperability to be published by AIOTI - Information models coordination and governance: standardisation recommendations. *Submitted to SC41*



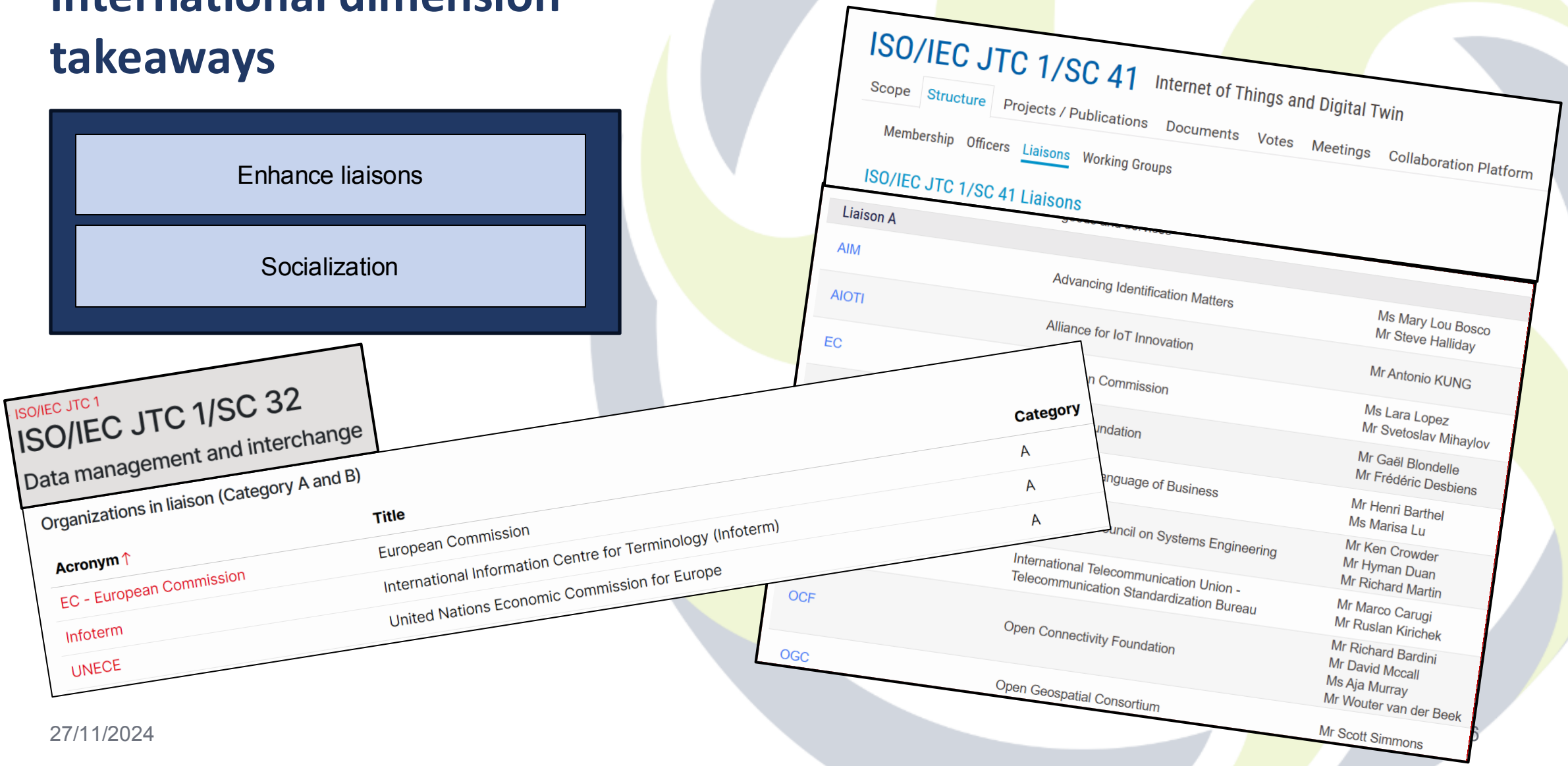
CONTENTS

International dimension takeaways



International dimension takeaways

- Enhance liaisons
- Socialization



ISO/IEC JTC 1

ISO/IEC JTC 1/SC 32

Data management and interchange

Organizations in liaison (Category A and B)

Acronym ↑	Title	Category
EC - European Commission	European Commission	A
Infoterm	International Information Centre for Terminology (Infoterm)	A
UNECE	United Nations Economic Commission for Europe	A

ISO/IEC JTC 1/SC 41 Internet of Things and Digital Twin

Scope | Structure | Projects / Publications | Documents | Votes | Meetings | Collaboration Platform

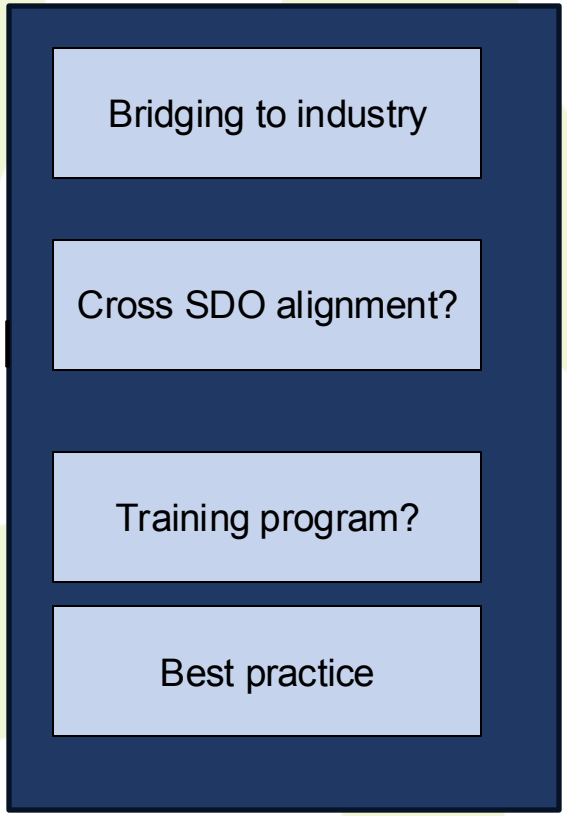
Membership | Officers | Liaisons | Working Groups

ISO/IEC JTC 1/SC 41 Liaisons

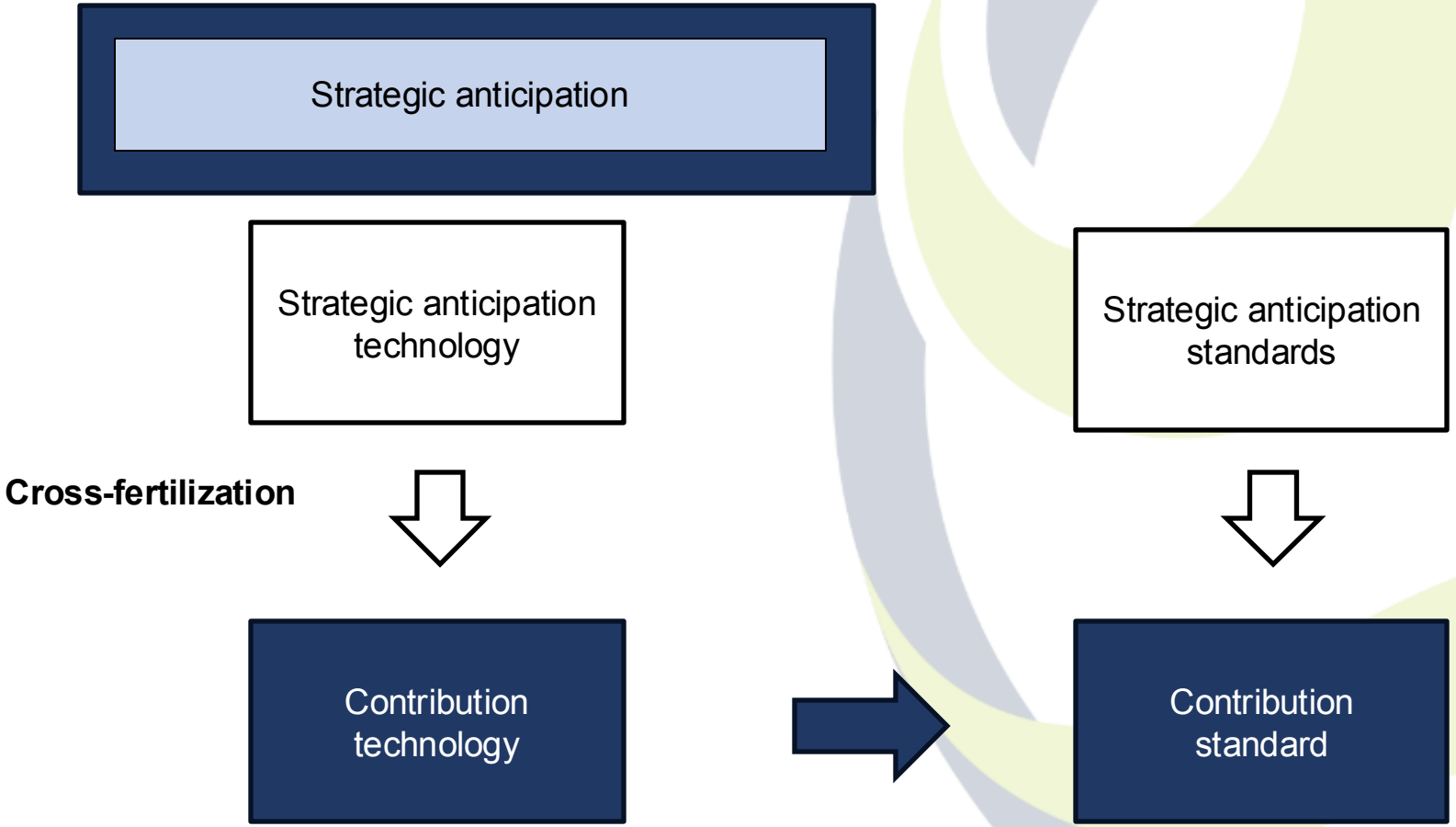
Liaison A		
AIM	Advancing Identification Matters	Ms Mary Lou Bosco Mr Steve Halliday
AIOTI	Alliance for IoT Innovation	Mr Antonio KUNG
EC	n Commission	Ms Lara Lopez Mr Svetoslav Mihaylov
	ndation	Mr Gaël Blondelle Mr Frédéric Desbiens
	nguage of Business	Mr Henri Barthel Ms Marisa Lu
	uncil on Systems Engineering	Mr Ken Crowder Mr Hyman Duan Mr Richard Martin
OCF	International Telecommunication Union - Telecommunication Standardization Bureau	Mr Marco Carugi Mr Ruslan Kirichek
OGC	Open Connectivity Foundation	Mr Richard Bardini Mr David Mccall Ms Aja Murray Mr Wouter van der Beek
	Open Geospatial Consortium	Mr Scott Simmons

Cross fertilization takeaways

- NEPHELE
  - Participation of industrial partners critical
- AEROS
  - Contributions in different SDOs : SC41, ETSI
- CODECO
  - Training researchers on standardisation
  - Meet regularly to exchange best practices



Cross fertilization takeaways



Cross fertilization on Architecture (Platform)

Contribute patterns

EUCloudEdgeIoT.eu
Architecture
Task Force 3

Taxonomy

Patterns

Alliance for AI, IoT and Edge Continuum Innovation

ISO/IEC JTC1/SC41 IoT and digital twin

AG 35 Pattern Repository

Standards in the making

PWI-22 Architecture considerations IoT Edge Cloud

Cross fertilization on Digital twin (platform) to Data Spaces

?

Use case
Enablers (concepts, architecture)

Contribution ??

Socialisation

ISO/IEC JTC1/ SC38 Cloud computing

ISO/IEC JTC1/ SC41 IoT and digital twin

AG 35 Pattern Repository

CEN-CLC JTC25 DDCE

ISO/IEC 20151 Dataspace concepts and characteristics

ISO/IEC 30152 Guidance on connection to data spaces

ISO/IEC 30151 Extraction and transaction of data products

Standards in the making

Cross fertilization on Energy flexibility (application) interoperability

?

Data models
Ontologies
Patterns
MIM

Contribution ??

Socialisation

WG11
Smart cities

IEC TC57
Power systems management

WG21
Interfaces and protocol profiles

SC41
IoT and digital twin

AG 35
Pattern Repository

5087 Smart city data model

IEC 61970 CIM

21823-1 Interoperability framework

21823-5 Behavioral and policy interoperability

Standards in the making

Existing standard

Standards in the making

Cross fertilization on real-time interoperability

?

Data models
Ontologies
patterns

Contribution ??

Socialisation

WG11
Smart cities

5087 Smart city data model

Standards in the making

SC41
IoT and digital twin

AG 35
Pattern Repository

30165 (2021) Real-time IoT framework

Existing standard

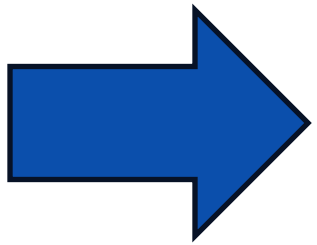
PWI 28 Distributed processing framework for massive data interoperability of Real-Time IoT systems

Standards in the making

Impact enhancement takeaways

Set of projects

Standardisation facilitation (CSA)



Standards Use cases	Flexiblity profile	
Standards Concepts and architecture	Ontologies, patterns	
Standards interoperability profiles	Guidance on creating profiles	
Standards conformity assessment	Assurance	Trust label as enabler to enter market

Open source facilitation

Takeaways - Carlos López-Rodríguez (EC)

- Offer the rolling plan as a guidance document to standardisation
  - Agree on volontary actions
  - Please contribute to the rolling plan
- Cooperation between standards and open source
  - Challenging but lots of potential
  - SDOs and open source communities to collaborate
  - Impact of regulation
- Pilots
  - Cooperation is key (with CSA – CEI-sphere) and standardisation (INSTAR)
  - Support from StandICT, HSBooster (mentoring…)

The Challenge of Cross-sector standardisation

Take aways

Rolf Riemenschneider
Internet of Things
European Commission - DG CONNECT/E4

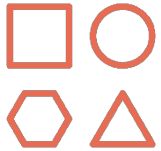
HORIZON 2020

Challenges for X-Sector Standards

Industrial evidence:

reinforce market pressure

* standardisation of assets
  - Involve SMEs, start-ups
  - Feedback through an ecosystem (training ☺)



Diverse approaches

Across different domains

→ Level playing field

→ Abstraction, Virtual Objects

Avoid asymmetric regulation

→ align with parallel regulatory developments

Interoperability

* Of infrastructures and of technical requirements

Open source to benefit from enhanced collaboration with SDOs.

Global adoption

requires an international dialogue / benchmark

→ *Follow up with US stakeholders on energy flexibility*

European Commission

Key Take Aways of 1st day

- Adapt to geopolitical changes and threats
- Embrace opportunities in TEC, e.g. GenAI
- Market actors to get their acts together (zoom in to key markets)
- Need for a dialog across domains
- Be stronger if aligning with international initiatives

- Fight for focused ecosystems
  - Around non-differentiating (edge) functions,
    e.g. core edge SW / HAL / cloud –edge management
  - Exploit momentum by OSS communities

HORIZON-CL4-2024-DATA-01-05: Platform Building, standardisation and Up-scaling of the 'Cloud-Edge-IoT' Solutions (Horizontal Activities - CSA)

Related Background

- **Horizon Europe**:
  → Calls, topics, deadlines WP2023-24

- **Position Papers and Event Reports**
  → Alliance AIOTI Strategic Foresight : IoT and Edge Computing Convergence

- **Cloud-Edge-IoT Portal** – see www.EUCloudEdgeIoT.eu

- HIPEAC Vision https://www.hipeac.net/vision/#/latest/

- Edge-IoT Policy on Europa

➢ **3Cs Strategy**:
→ Calls, topics, deadlines WP2023-24

European Commission