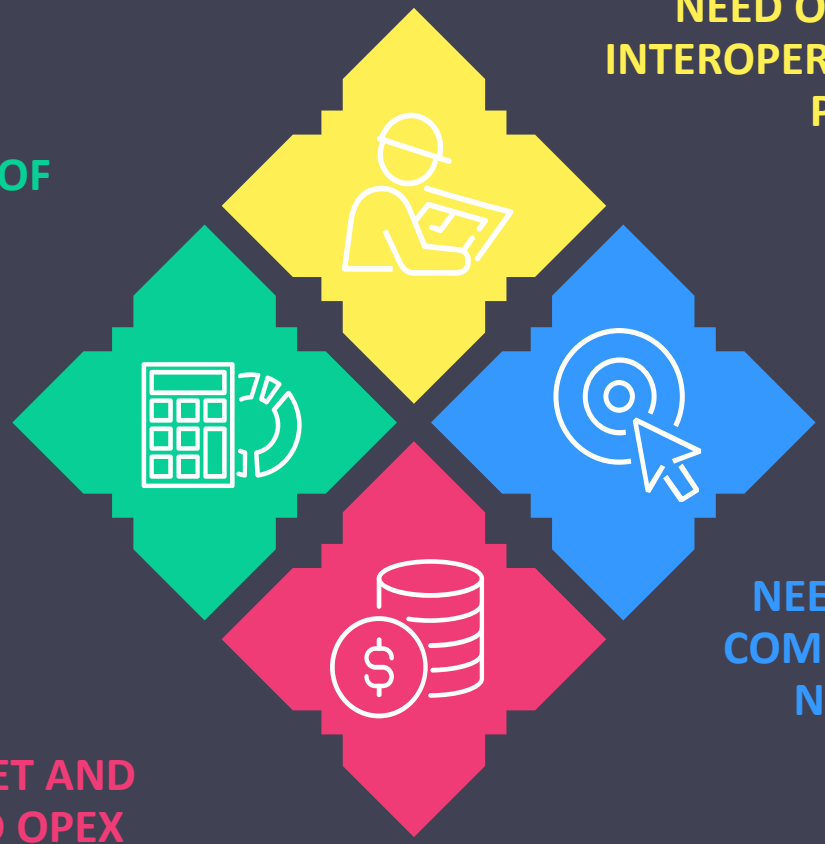
19th Novem[illegible]025

General Presentation
2026 - Public

E4S Alliance

NEED OF MULTIPURPOSE, INTEROPERABLE, AND REUSABLE PLATFORMS

THE INCREASING INTEGRATION OF IT TECHNOLOGIES



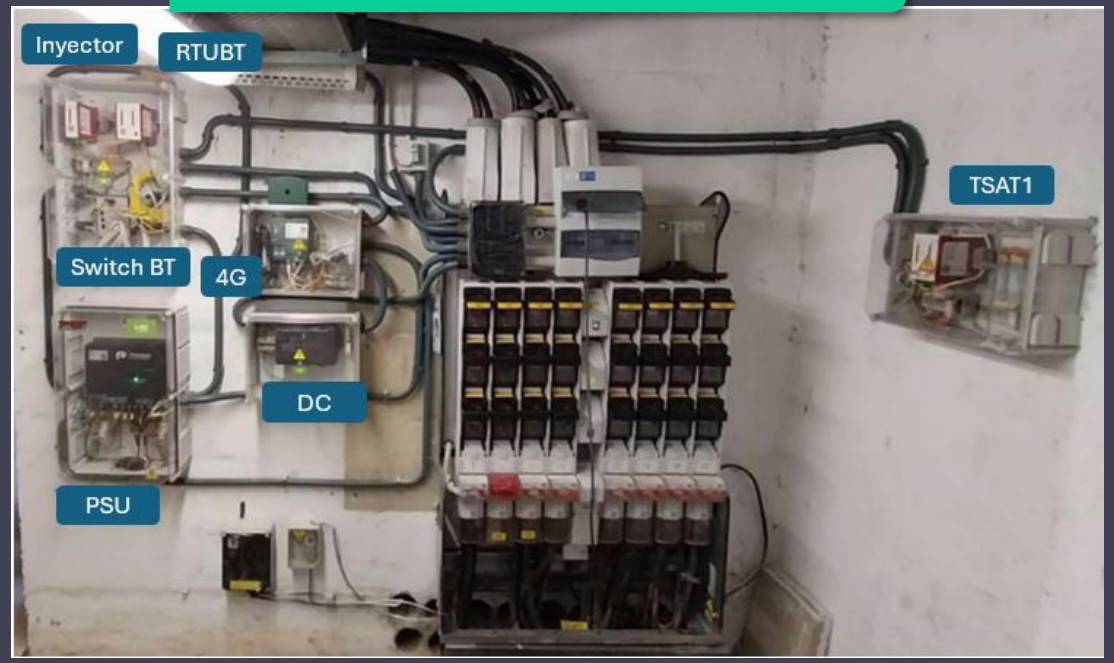
NEED OF THE CREATION OF A COMMON, OPEN, AND VENDOR NEUTRAL ARCHITECTURE

FASTER TIME TO MARKET AND OPTIMIZED CAPEX AND OPEX SOLUTIONS

FULL Digitalization of SS

Secondary Substations as the CORE of Distribution Grid Digitalization

Complete SS Architecture

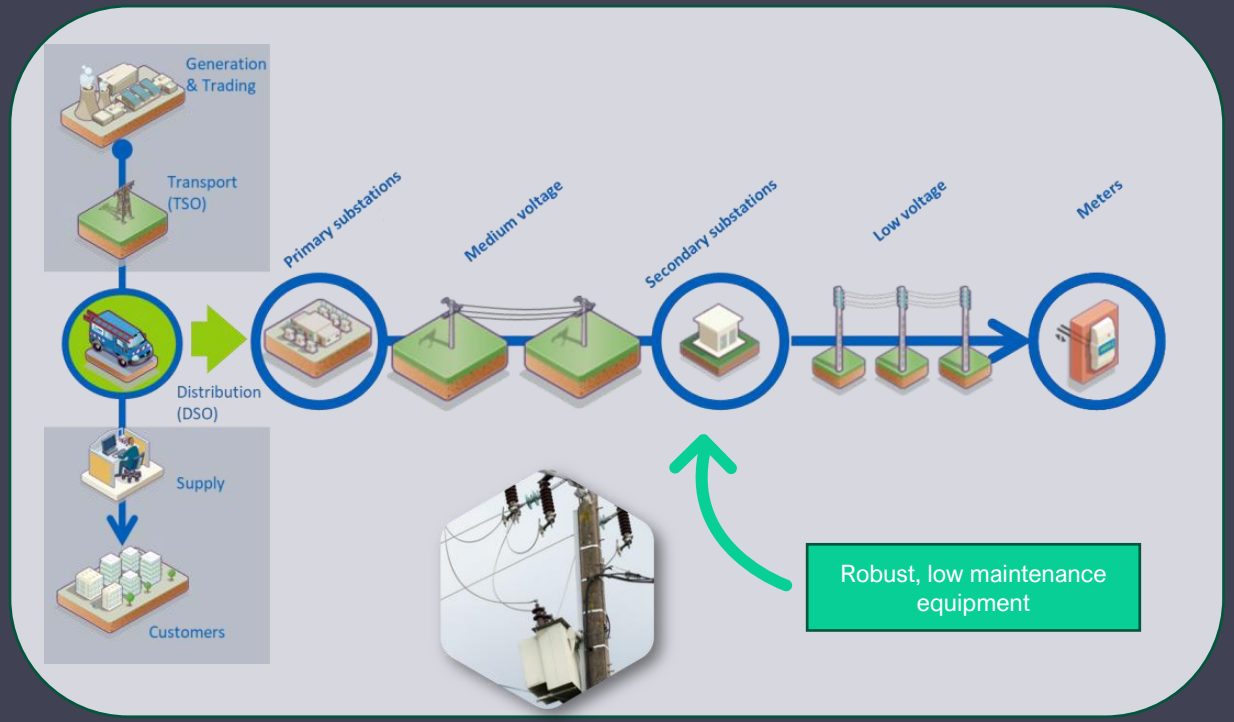


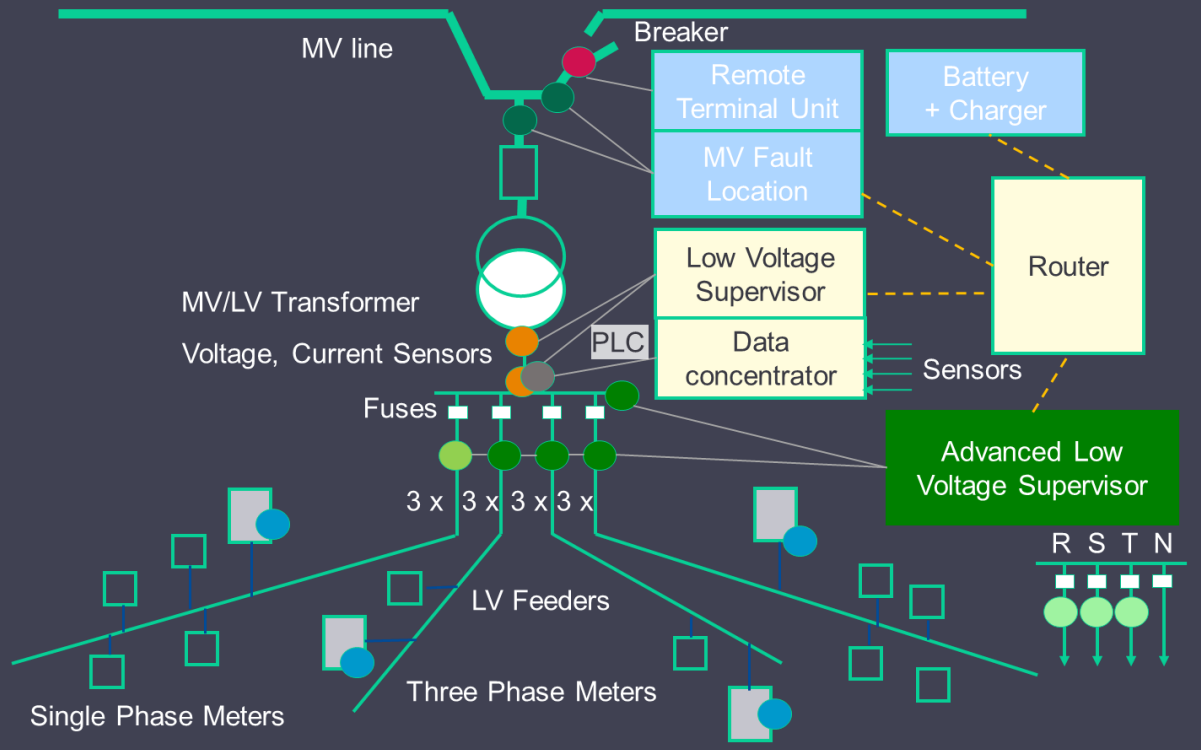
Smart SS System

Since 2019, E4S has evolved from validating Edge Computing to virtualizing critical network functions—and is now leading their standardization. We're not focused on building faster networks, but on creating networks that can evolve MUCH faster

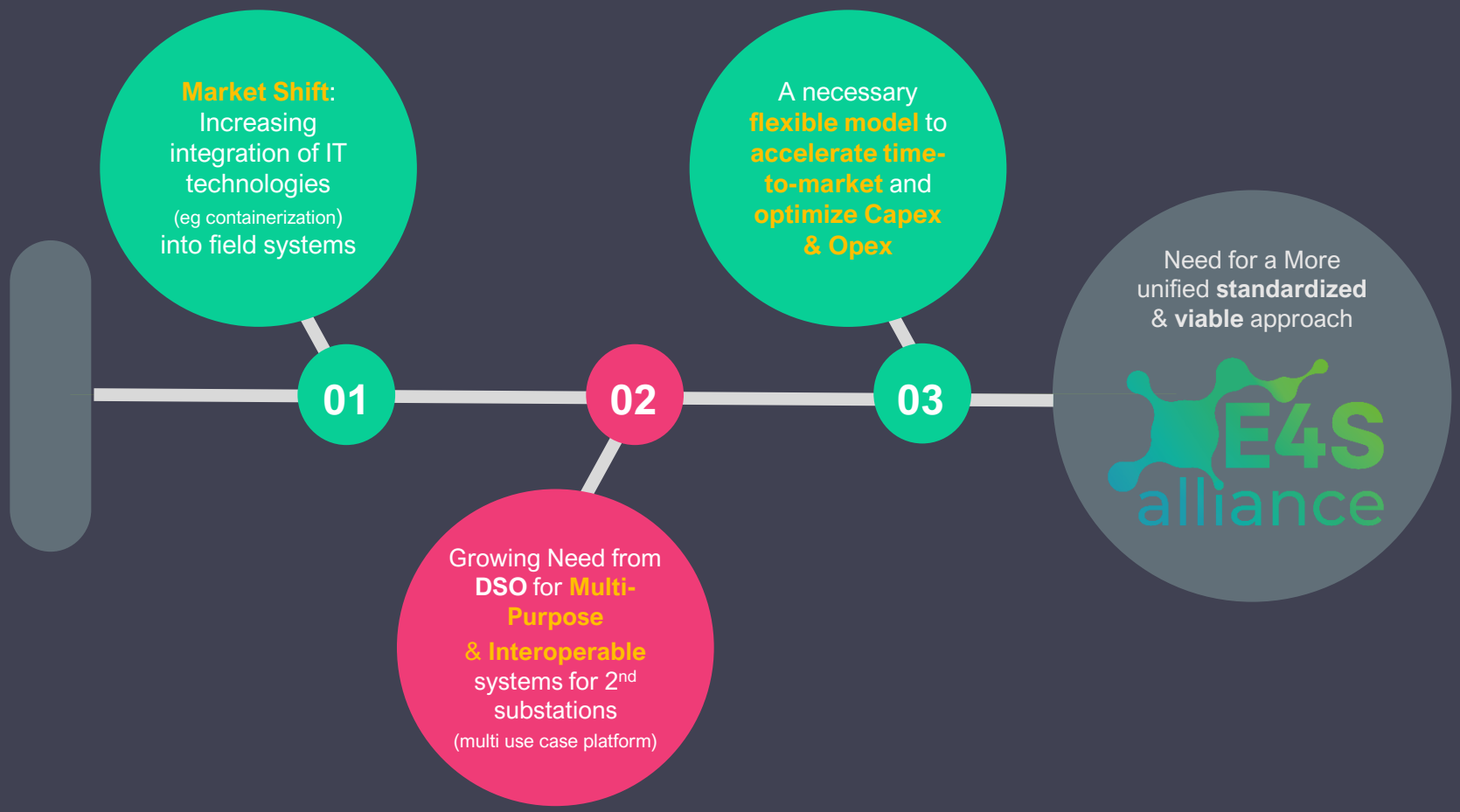
The scope …

Secondary Substation refers to the utility premises where **distribution Transformers (MV to LV)** directly **feeding final customers** are located.





Drivers for Establishing the E4S Alliance



- Several DSOs agreed on working together with manufacturers and other entities, in order to define a standardized solution
- Work started by a set of companies forming the E4S Consortium
- To guarantee a stronger commitment and working context, the consortium evolved to the E4S Alliance, a non-profit Association based in Brussels

Vision: Shaping the Next Generation of SS

Flexible platform

Community of DSO & partners

Vision Statement of the E4S alliance

E4S is a **DSO-driven alliance** committed to defining and maintaining a secure, open, public, **vendor-neutral,** and **interoperable edge computing architecture** for Smart Secondary Substations. It establishes recognized **standard specifications** to address major **DSO challenges** in the ongoing transformation of grids

Standard based

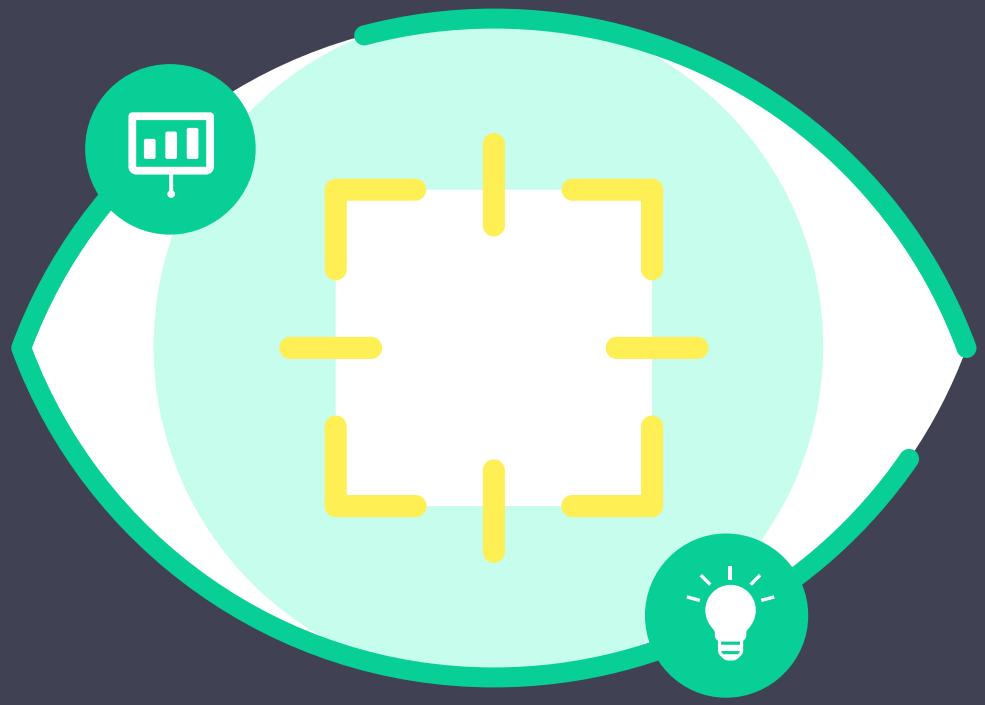
Grid modernization

E4S mission

Standardizing Edge & Virtualization in Secondary Substations

Leverage on **DSO and Industry collaboration** to promote the development and usage of a **standard based approach**, utility and industry wide, for an edge computing platform in secondary substations:

- Identifying all **relevant use cases**
- Creating/maintaining a solution **specification**
- Creating/maintaining a **certification process**
- **Driving ecosystem development** and market adoption, while **empowering vendors** to actively contribute and provide their solutions



E4S Specification: A Foundation for Standardization

E4S is committed to **exploring the potential for our specifications** to become recognized as official standards. The E4S specification shall provide a **cohesive framework** :

- Fulfilling the **DSO requirements**
- Providing the **flexibility to develop optimal components**
- Promoting fair competition and eliminating barriers to entry

Targeted Use Cases

Measurement, data collection & control command

1. Data Concentrator for Smart Metering
2. Remote Terminal Unit (MV)
3. Remote Terminal Unit (LV)

Voltage & power Quality management

1. Advanced Low Voltage Supervisor
2. Voltage Regulation
3. Load Balancing & Energy Management

Operation & grid monitoring

1. Outage Management
2. Secondary Substation & Transformer Monitoring
3. Grid Topology Identification

Distributed & smart energy system

1. Distributed Energy Resource Management
2. Street Light Control

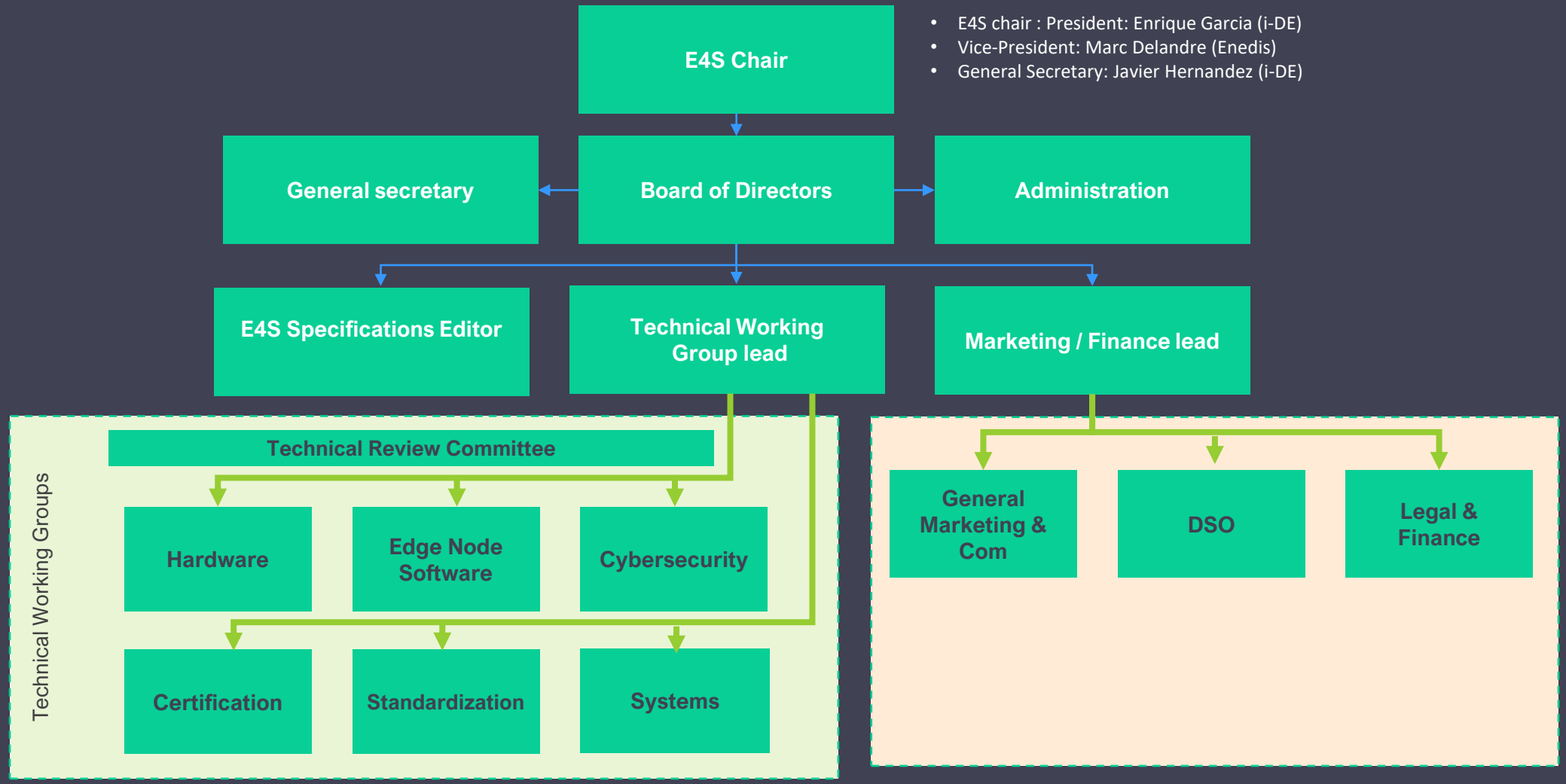
E4S Articles of Association highlights

Theme	Key Provisions / Highlights
Form & Name	International non-profit (AISBL) under Belgian law (BCCA), based in Brussels
Purpose	• Promote open, standards-based edge-computing for secondary substations • Develop and certify interoperable specifications • Liaise with industry and academia.
Membership	• **Executive Members** (full rights, voting, Board eligibility), • **Observer Members** (participation without voting). • Admission approved by Board • Membership non-transferable.
Fees*	• Annual membership fees set by General Meeting. * Fees can be adapted • Executive : 3500 euros • Observer : 2000 euros
Board & Officers	• Board (5–15 Directors; **majority DSO reps**) manages operations. • Officers: President/CEO, Vice Presidents, Treasurer, Secretary, and General Secretary.

Info@e4salliance.com

The E4S alliance Structure & Organization

- E4S chair : President: Enrique Garcia (i-DE)
- Vice-President: Marc Delandre (Enedis)
- General Secretary: Javier Hernandez (i-DE)



Board of Directors

President

Enrique Garcia
i-DE

Vice President

Marc Delandre
Enedis

General Secretary

Javier Hernandez
i-DE

Director

Paulo Libano
E-Redes

Director

Mariano Gaudó
UFD

Director

Davide Della Giustina
Unareti

WG Leaders

Edge Node Software

Erwann Roussy
Savoir-faire Linux

Marketing & Communication

Ionut Deaconeasa
ASUS

Sensors & IoT

Aitor Amezua
Minsait

Hardware

Daniel Sun
Advantech

Systems

David Puron
Barbara IoT

Certification & Cybersecurity

Libertad Moro
Tecnalia

Standardization

Gilles Nativel
Enedis

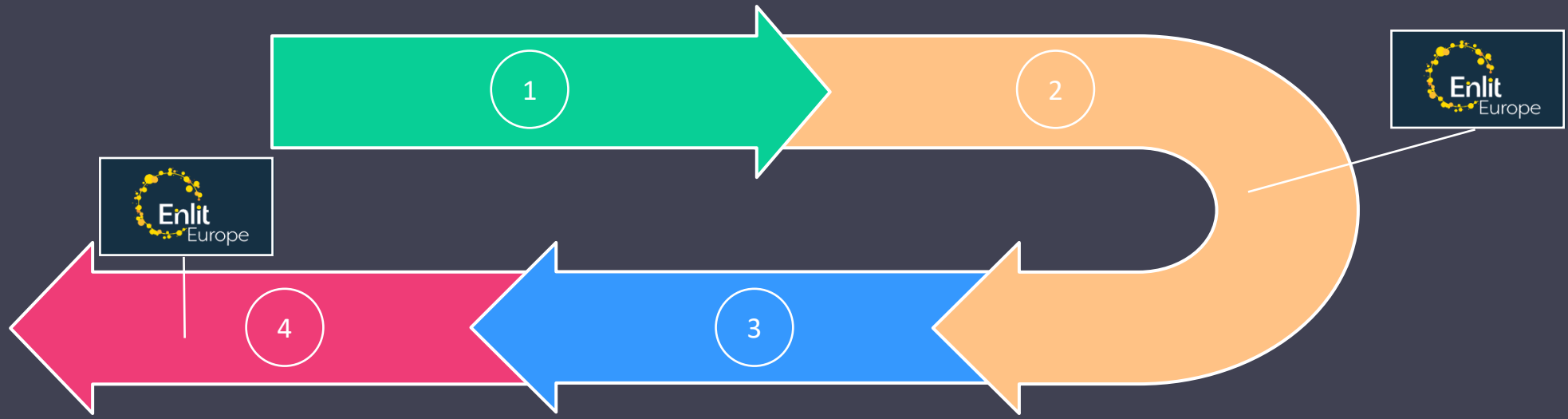
E4S Roadmap

1

2025
Definition of requirements (by DSOs)
First Iteration of Technical Specification

2

Q4 2025
Incorporation of Association
Onboarding of Consortium & new members



4

2026+
Onboarding of Consortium & new members
Expansion of Technical Working Groups
Iteration of Technical Specifications
Building of certification process

3

Q1 2026
Onboarding of Consortium & new members
Expansion of Technical Working Groups
Appointment of the permanent Board

The E4S Alliance: A DSO-Led Initiative

Defining open, secure, and shared Edge standards for Smart Secondary Substations.

A United Front for the Grid Edge

A shared DSOs view proving the minimal technical requirements needed to move the industry away from fragmented, proprietary silos toward interoperable open edge computing.

The Mission: A Shared Baseline

Rather than dictating a single commercial product, this document serves as an architectural blueprint. It provides the essential framework that the WGs will use to draft each specific technical specifications.

Core Strategic Objectives

Open

Breaking traditional vendor lock-in and fostering market competition.

Shared

Ensuring seamless integration of technology across each DSOs grid.

Secure

Building a resilient, cyber-secure architecture for the grid of tomorrow.

Hardware & Resilience Baseline

Minimum physical standards agreed upon by DSOs to ensure interoperability and longevity.

Standardized Durability & Resilience Guaranteed operational lifecycle of 15 years for continuous operation. Built for extreme resilience: operational from -25°C to +70°C and altitudes up to 2,000m.

Power Supply Flexibility Support for multiple internal output voltages (12Vdc, 24Vdc, 48Vdc) with a built-in backup energy reserve to manage micro-interruptions and maintain autonomy.

Interchangeability (Anti Vendor Lock-in) Standardized physical interfaces for seamless component swapping. Ensures backward compatibility for legacy sensors and includes a mandatory PLC modem baseline.

Standardized Connectivity Minimum 4× RJ45 Gigabit Ethernet. Built-in RS485/RS232, 4 DI/DO, modular WAN, and baseline PLC modem.

Example of a modular EDGE NODE application

Software Ecosystem & Orchestration

Common principles to ensure operational efficiency and scalability

Open Infrastructure

Adoption of a common OS (Linux-based) to eliminate reliance on closed-box proprietary solutions. The Abstraction Layer allows software and physical components to evolve entirely independently.

Dynamic APP Management

Core functions (RTU, LV Supervision) coexist within secure, virtualized environments. Shared prioritization rules ensure mission-critical grid apps always have the resources they need.

E4S Manager

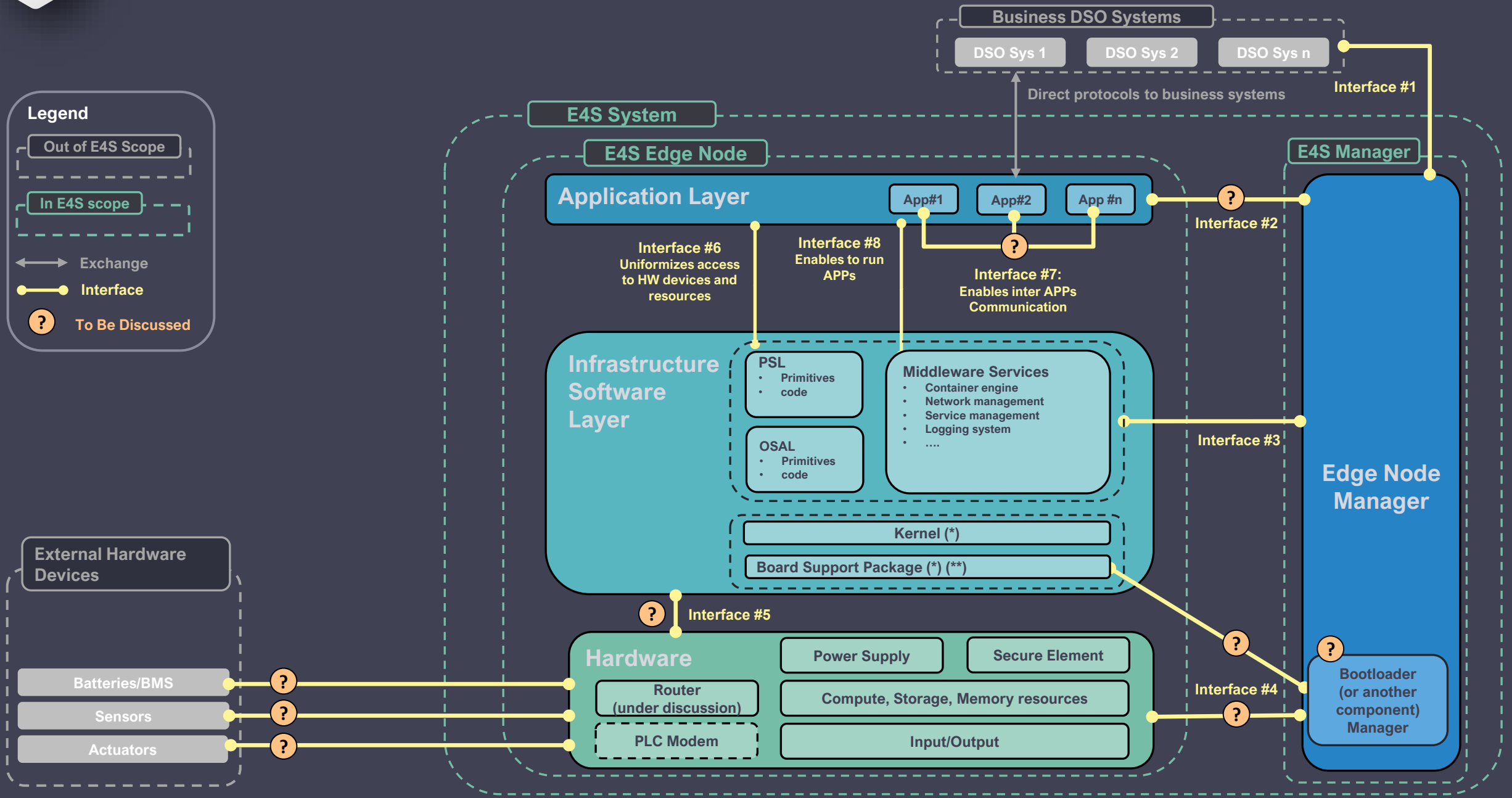
Centralized Edge Nodes platform featuring automated node registration, unified fleet telemetry and streamline over-the-air updates with built-in rollback safeguards to instantly revert failures and guarantee grid continuity.

E4S Technical Requirement Principles

> The architecture shall enable flexible procurement, governance, and operating models by allowing each layer—Hardware, Infrastructure Software, System Management, and Applications—to be sourced either as a single integrated offering or as disaggregated components.

Key Technical Requirements

- Layered Architecture with standardized interface principles
- Unified System Management
- Hardware–Software Agnosticism and Component Interchangeability within the Architecture
- Vendor-neutral approach regarding procurement and maintenance models
- Linux / Open Source / Standards-based solutions
- Encourage vendor innovation by imposing minimal technical constraints
- Clear process of certification


Business DSO Systems
DSO Sys 1
DSO Sys 2
DSO Sys n
Interface #1
Direct protocols to business systems
Legend
Out of E4S Scope
In E4S scope
Exchange
Interface
To Be Discussed
E4S System
E4S Edge Node
E4S Manager
Application Layer
App#1
App#2
App #n
Interface #2
Interface #6
Uniformizes access to HW devices and resources
Interface #8
Enables to run APPs
Interface #7:
Enables inter APPs Communication
Infrastructure Software Layer
PSL
Primitives
code
OSAL
Primitives
code
Middleware Services
Container engine
Network management
Service management
Logging system
....
Interface #3
Edge Node Manager
Kernel (*)
Board Support Package (*) (**)
Interface #5
External Hardware Devices
Batteries/BMS
Sensors
Actuators
Hardware
Power Supply
Secure Element
Router (under discussion)
Compute, Storage, Memory resources
PLC Modem
Input/Output
Interface #4
Bootloader (or another component) Manager

E4S alliance

Join Us!

E4S ALLIANCE

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