

# OCORA

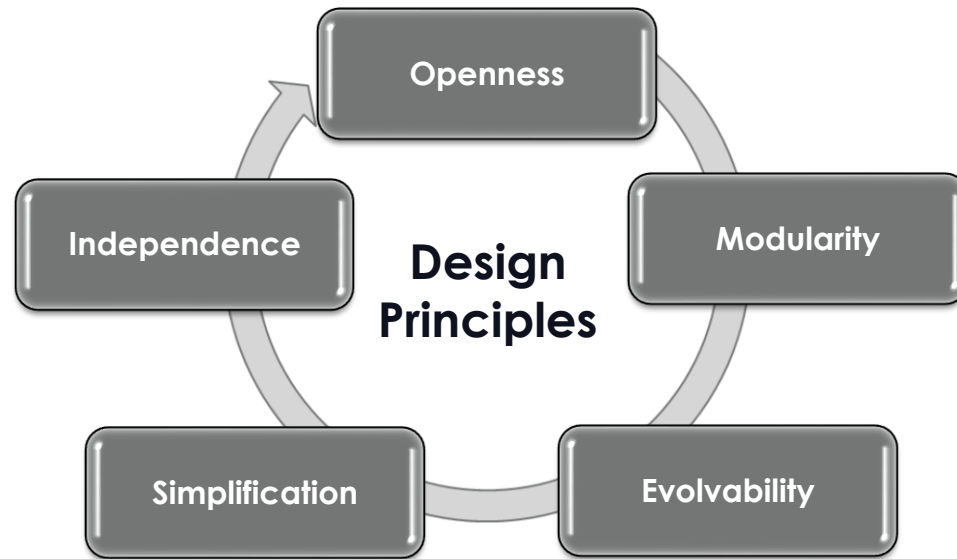
## Program Slide Deck

# OCORA Release R5 - OnePager

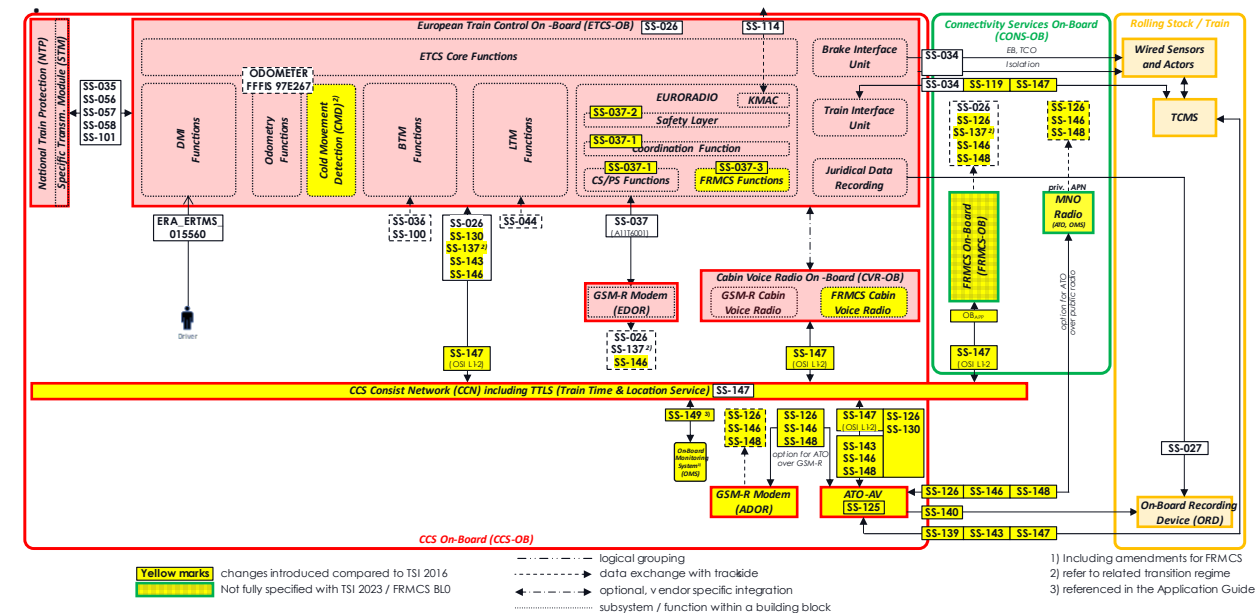
<https://github.com/OCORA-Public/Publication>

**OCORA**, the “**Open CCS On-board Reference Architecture**” initiative, whose signatory founding Members are NS, SNCF, DB, SBB and ÖBB, has reached a next important milestone with the **Release R5** of the specifications of the OCORA architecture.

**OCORA** aims to **reduce life-cycle costs** and **facilitate** the introduction of **innovation** and **digital technologies** beyond the current proprietary interfaces, by establishing a **modular, upgradeable, reliable** and **secure CCS on-board architecture**.



The **OCORA Release R5** describes **CCS On-board** and includes **sector feedback**, especially from the exchange with EU-Rail’s **System Pillar**. It is **defining the OCORA position for System- & Innovation-Pillar** and provides results from **SS-149 Proof of Concept**.



**OCORA deliverables** are published under the **European Union Public License (EUPL)** and are consequently available for all stakeholders. The **OCORA Release R6** is planned for **mid of 2024**. It is expected to be reduced by the already transferred EU-Rail activities.

- Problem Statements
- Key Principles
- OCORA History
- Roadmap
- Migration
- Alliances
- Release Overview
- Methodology & Tooling
- Economic Model
- Sector Dialogue
- EuroSpec Working Group: Control-Command and Signalling



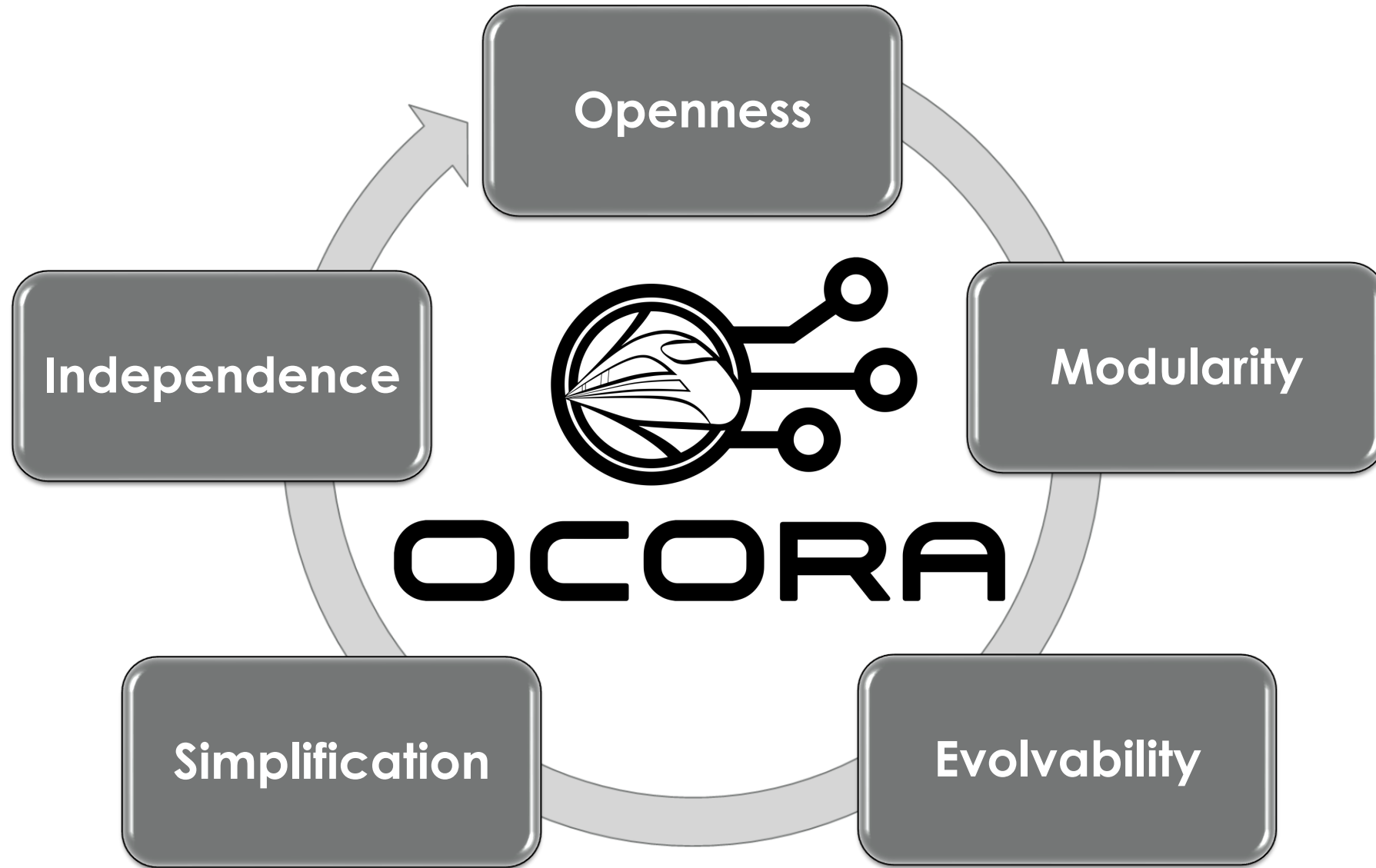
# Problem Statements - Current ETCS On-board solutions...



1. are built on incomplete, not fully standardized, and sometimes ambiguous specifications;
2. do not have a reasonable total cost of ownership;
3. are difficult to be integrated into existing vehicles;
4. are costly and time consuming to adapt/change/update/upgrade:
  - In case of patching and error corrections in non-SIL and SIL areas (e.g. cyber- security patching);
  - In case of baseline upgrades (e.g. ETCS baseline 2 to 3);
  - In case of functional enhancements (e.g. adding ATO);
  - In case of adaptation to new technologies (e.g. upgrade to FRMCS);
5. do not respect different life-cycles profiles of the different vehicle-based constituents (e.g. vehicle vs. ETCS vs. connectivity);
6. are difficult to maintain (e.g. monitoring, diagnosis, configuration, and maintenance possibilities very limited – no remote functionality);
7. are lacking built-in cyber security;
8. are performing below expected quality levels.

In addition:

- The benefit of ETCS On-board only pays off, if the ERTMS rollout progresses in Europe on large scale.
- The ETCS On-board functions as such also need some improvements (e.g. braking curve, odometry accuracy, etc.) to serve current operational needs.
- Difficult, expensive and time consuming ETCS On-board fitments in general, are delaying national deployment plans, impacting trackside investments, and postponing ERTMS rollouts.

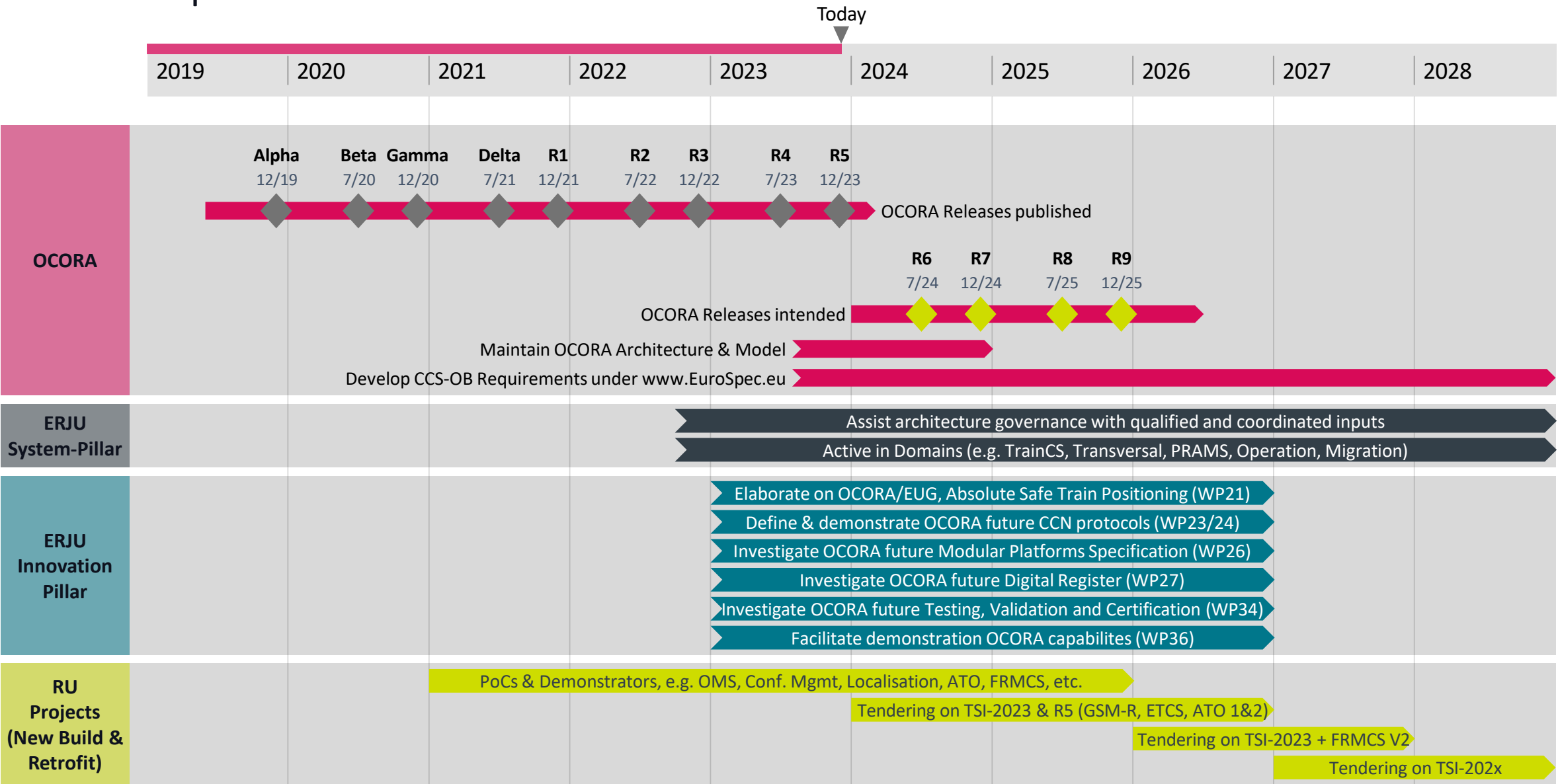


OCORA IS...
... open cooperation
... a set of public specifications
.. for the On-Board CCS

OCORA IS NOT...
... a representative Body/Organisation
... a product
... for trackside CCS

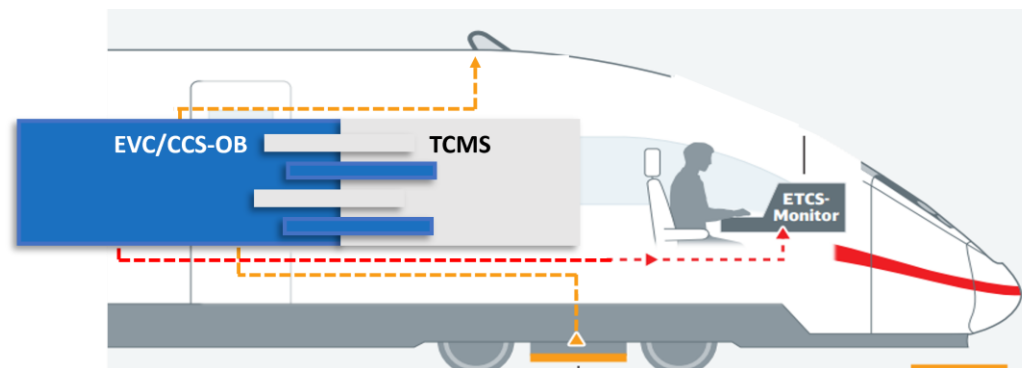


# Road Map



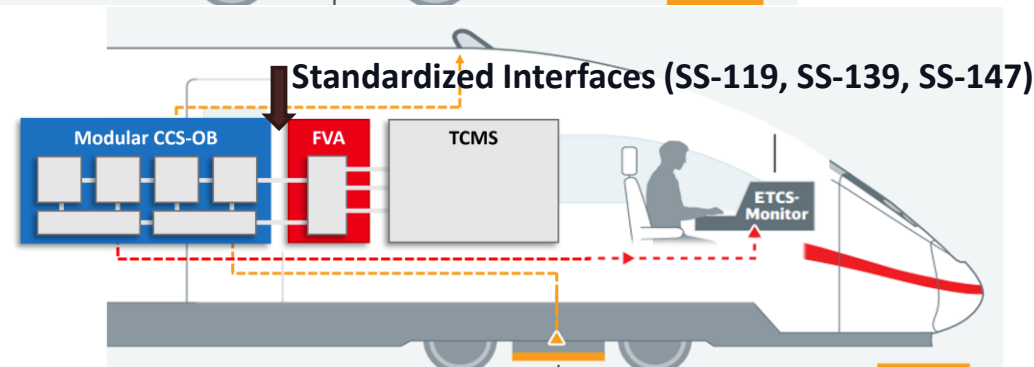
### 1. Current situation

- Monolithic CCS (Command, Control & Signalling).
- EVC/CCS-OB tightly integrated with TCMS.
- CCS-OB replacements requires understanding of individual, manufacturer specific TCMS.



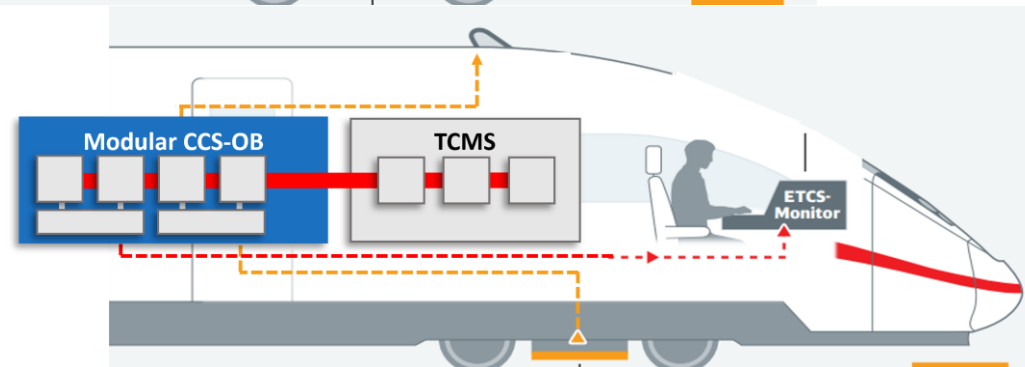
### 2. OCORA Functional Vehicle Adapter

- Modular, upgradeable CCS-OB architecture.
- CCS-OB communicates with TCMS via standardized interfaces (SS-119, SS-139, SS-147). Non-compliant TCMSs are adapted to the standardized interfaces through a Functional Vehicle Adapter (FVA).
- CCS-OB upgrades/replacements do not require a detailed understanding of the TCMS systems anymore.



### 3. OCORA Long Term perspective

- Comprehensive next-gen Communication Network for connecting all train control and safety systems (TCMS and CCS). TCMSs are compliant with the standardized interfaces. The need for an FVA vanishes.
- Separation of HW and SW via Computing Platform.





## Ongoing OCORA liaisons

Sector interest group	Collaboration area	Liaison in place
<b>CCS SG (CER)</b>	Preparing TSI revisions Setting sector governance for CCS architecture	OCORA experts sharing achievements for endorsement
<b>TWG Train Modular Architecture (ERA)</b>	Sounding TSI-CCS On-board preparation	OCORA experts present as CER speakers
<b>FRMCS (UIC)</b>	On-board telecommunication architecture Safe and secure communication capabilities Migration from GSM-R	Coordination done through experts involved in both initiatives.
<b>Localisation WG (EUG)</b>	Mission requirement for onboard localisation Interface for localisation peripherals	Coordination done through experts involved in both initiatives.
<b>X2Rail-4 (Shift2Rail)</b>	ATO Architecture	Alignment and collaboration ongoing

- ▶ OCORA assumes that a frequent, well-structured and open, unbiased exchange of views and ideas with its suppliers is fundamental to initiate customer oriented product and service development. Formalised liaisons with suppliers and industry interest groups (e.g. UNIFE/UNISIG) are therefore a sensible objective for OCORA collaboration.

# Release Overview



## OCORA Business and Technical Workstreams, Work Packages and RU Projects

### Business Workstreams

BWS01 Core Team

BWS02 Stakeholder Management

BWS03-4 Introduction and Problem Statements

BWS05-6 Procurements, Roadmap and Planning

BWS06 Business Objectives, Economic Model

### Technical Workstreams

TWS01 System Architecture

TWS02 CCS Communication Network

TWS04 Functional Vehicle Adapter

EuroSpec Requirements CCS Onboard

TWS07 Modular Safety, CENELEC, RAM

TWS08 MDCM

TWS15 Prototyping

### Architecture Work Packages

WP00 CCS-OB Architecture

WP01 ATP-OB Architecture

WP02 LOC-OB Architecture

WP03 ATO-OB Architecture

WP10 MBSE Preparation

WP11 System Capabilities

WP12 Connectivity

### RU Projects

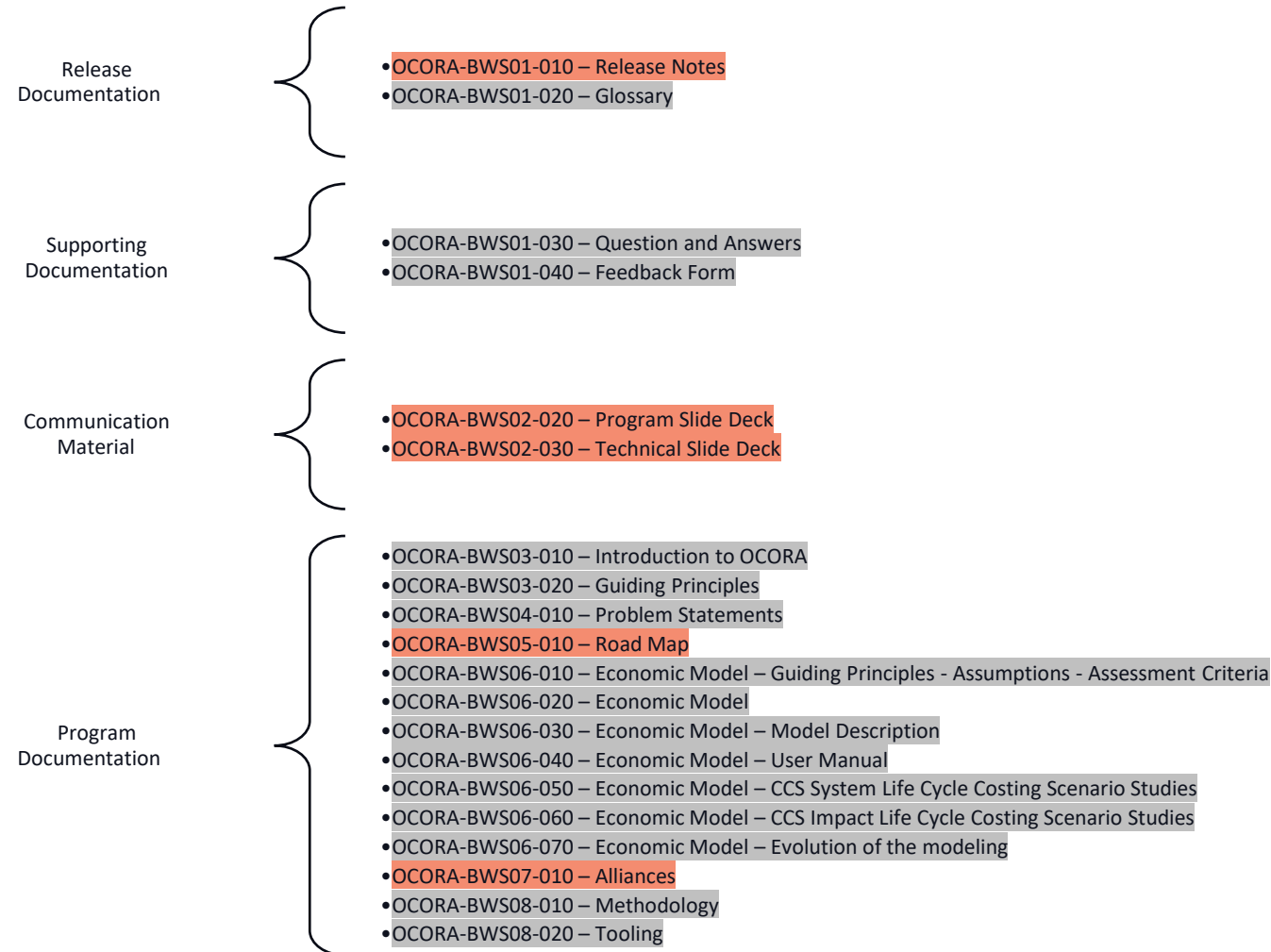
SNCF Modelling SS-121

SBB PoC OMS SS-149

SBB PoC Config Management

# Release Overview

## Program Content



### Release Highlights Program Documents are:

- Updated Communication Material
- Updated Road Map
- Updated Alliances document

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New document or document with significantly new/additional content.

**Doc. Title**

Updated document with major enhancements

**Doc. Title**

Unchanged content only with minor improvements

# Release Overview

## Technical Content

Technical  
Documentation

- OCORA-TWS01-010 – Design Requirements
- OCORA-TWS01-020 – Operational & System Analysis
- OCORA-TWS01-025 – Modularisation Roadmap Proposal
- OCORA-TWS01-030 – System Architecture
- OCORA-TWS01-035 – CCS On-Board (CCS-OB) – Architecture
- OCORA-TWS01-040 – Capella Modelling
- OCORA-TWS01-041 – MBSE Modelling Guidelines
- OCORA-TWS01-050 – Capella Model Export
- OCORA-TWS01-100 – Localisation On-Board (LOC-OB) – Introduction
- OCORA-TWS01-101 – Localisation On-Board (LOC-OB) – Requirements (incl. EUG 22E126 – LOC-OB System Definition & Operational Context and EUG 22E135 – LOC-OB Risk Analysis)
- OCORA-TWS01-112 – Automated Train Protection On-Board (ATP-OB) - MLM Interface Analysis
- OCORA-TWS01-201 – Train Display System – Discussion Paper
- OCORA-TWS01-210 – Train Display System – SS-121 Modelling Report
- OCORA-TWS02-010 – CCS Communication Network – Evaluation
- OCORA-TWS02-020 – CCS Communication Network – Proof of Concept (PoC)
- OCORA-TWS02-030 – Addendum to SUBSET-147
- OCORA-TWS03-010 – SCP – Whitepaper Computing Platform for Railway Applications
- OCORA-TWS03-020 – SCP – High-Level Requirements
- OCORA-TWS03-030 – SCP – Specification of the PI API between Application and Platform
- OCORA-TWS04-010 – Functional Vehicle Adapter – Introduction
- OCORA-TWS04-011 – Functional Vehicle Adapter – Requirements
- OCORA-TWS04-012 – TCMS – Standard Communication Interface Specification
- OCORA-TWS04-015 – OCORA Addendum to SUBSET-119
- OCORA-TWS04-016 – OCORA Addendum to SUBSET-139
- OCORA-TWS05-010 – Requirements – Management Guideline
- OCORA-TWS05-020 – Stakeholder Requirements
- OCORA-TWS05-021 – Program Requirements
- OCORA-TWS07-010 – RAMS – Modular Safety Strategy
- OCORA-TWS07-020 – RAMS – Evolution Management
- OCORA-TWS07-030 – RAMS – SRAC/AC Management
- OCORA-TWS07-040 – RAMS – Optimised Approval Process
- OCORA-TWS07-050 – RAMS – RAM Strategy
- OCORA-TWS07-060 – Configuration Management – Concept
- OCORA-TWS07-100 – CENELEC Phase 1 – Concept
- OCORA-TWS07-202 – QRAMSS – Plan
- OCORA-TWS07-203 – RAMSS – Policy
- OCORA-TWS08-010 – MDCM-OB – Introduction
- OCORA-TWS08-030 – MDCM-OB – SRS
- OCORA-TWS09-010 – Testing – Strategy
- OCORA-TWS09-011 – Testing – Requirements
- OCORA-TWS09-050 – Testing – Cybersecurity Testing Strategy
- OCORA-TWS09-110 – Train Adapter Block Integration Plan
- OCORA-TWS09-111 – Testing - Testplan Functional Vehicle Adapter
- OCORA-TWS15-040 – CCS-OB Retrofit - Guideline for Projects
- OCORA-TWS15-050 – PoC OMS SS-149 - Concept
- OCORA-TWS15-051 – PoC OMS SS-149 - Results
- OCORA-TWS15-060 – PoC Configuration Management – Concept

### Release Highlights Technical Documents are:

- Updated Modularisation Roadmap Proposal
- Updated Architecture Documentation
- Addendum SS-147, incl. Time Synchronization
- New Addendums for SS-119 and SS-139. based on TSI-2023 incl. recommendations for a product approach
- Results of PoC OMS SS-149
- Updated Specification for Configuration Management

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## Methodology:

- OCORA is developing based on topical workstreams
- OCORA is releasing continuously
- OCORA makes a use of Best Practice
- OCORA uses the OSI model for interface specifications
- OCORA is using Model Based System Engineering based on Arcadia methodology
- OCORA deliverables are in compliance with the CENELEC phases
- OCORA deliverables are following the V cycle

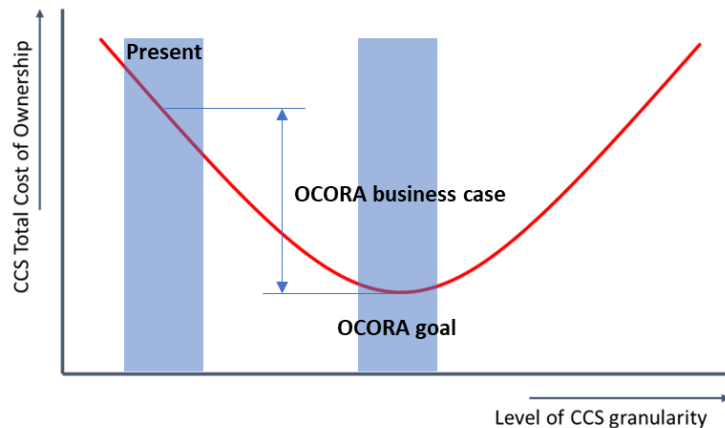
## Tooling:

- ▶ OCORA uses MsTeams for telcos
- ▶ OCORA uses a public repository for publications:  
<https://github.com/OCORA-Public>
- ▶ OCORA uses an internal repository for work in progress
- ▶ OCORA uses Polarion for requirements engineering and management
- ▶ OCORA uses Capella for Model Based System Engineering

# Economic Model

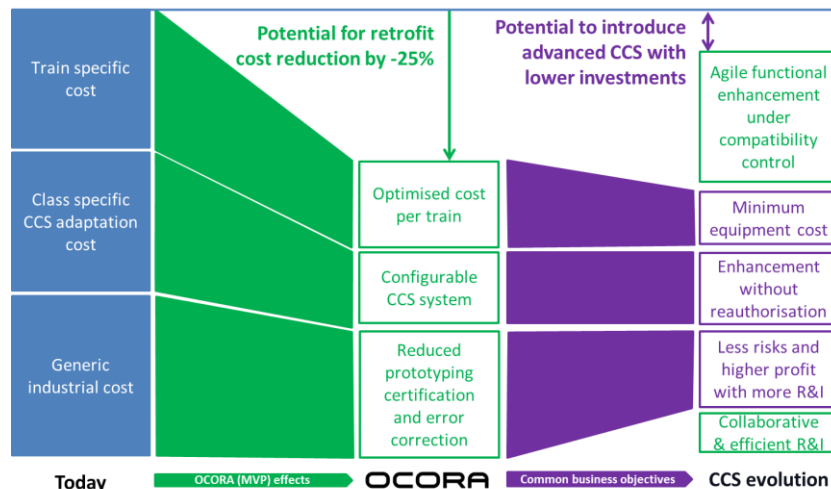


An economic model to discuss the optimal level of granularity



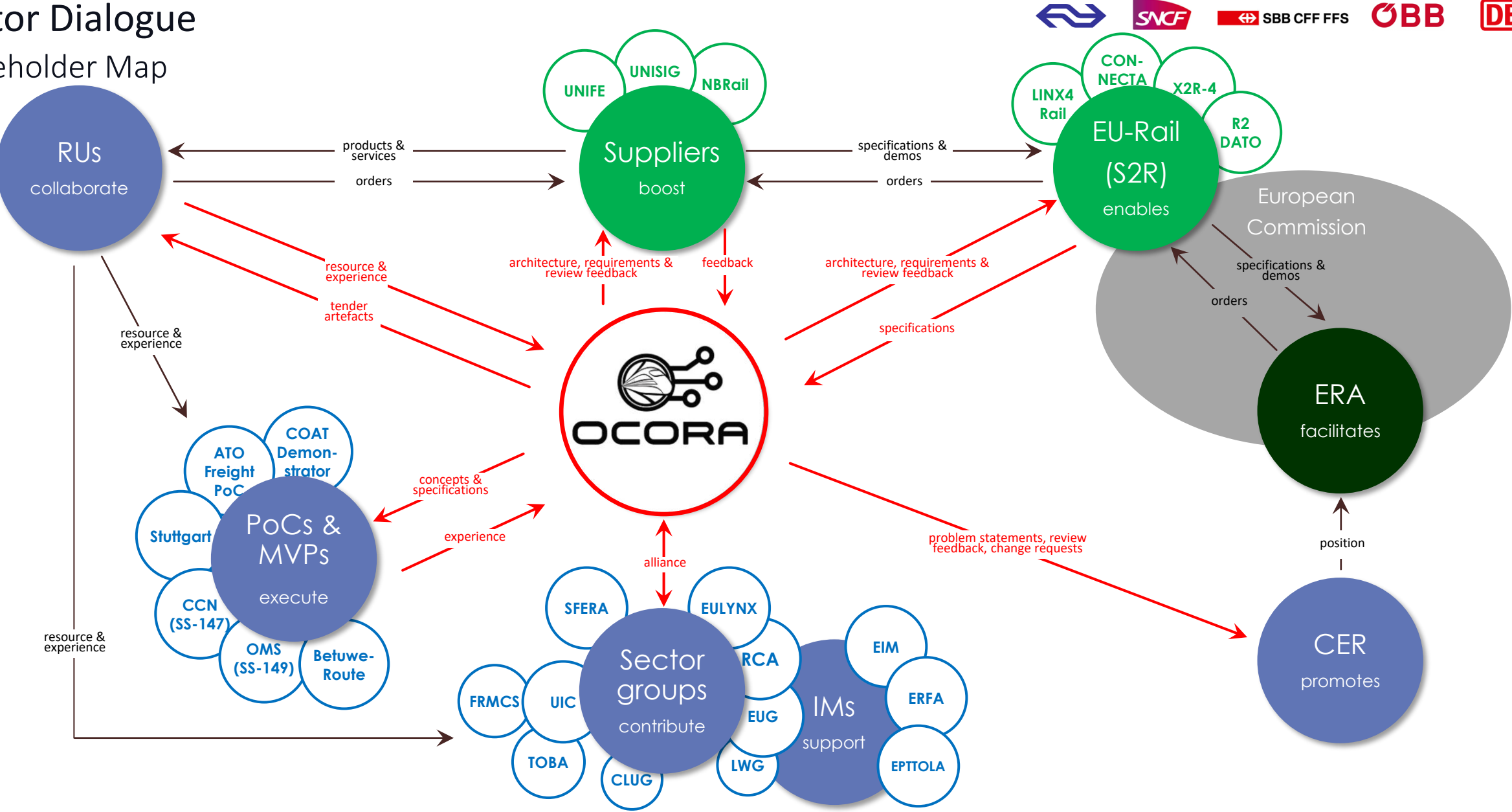
The development of the OCORA economic model, intends to provide tools for:

- Getting a clear view on the economic driver for the modularization of the on-board. To this end the model focus on 3 cost categories:
  - Generic industrial cost for developing certified CCS onboard sub systems
  - Cost for authorising operation with a new CCS configuration in a class of vehicle
  - Train specific cost for fitting or upgrading CCS building blocks
- Studying the impact of technology life cycle on the total cost of ownership. To this end scenario are defined for comparison purpose:
  - Today's situation with slow deployment and small project size, based on reference values derived from EC studies on ERTMS.
  - OCORA MVP scenario to model the economic impact of the modularisation of CCS onboard architecture
  - CCS evolution scenarios allowing to investigate impact of larger market, enhanced functionalities and accelerated upgrade scheme
- Optimising the contribution of OCORA breakthrough to common business objectives. An open dialogue with the industry creates mutual benefit.



# Sector Dialogue

## Stakeholder Map



# Introduction

## OCORA Approach

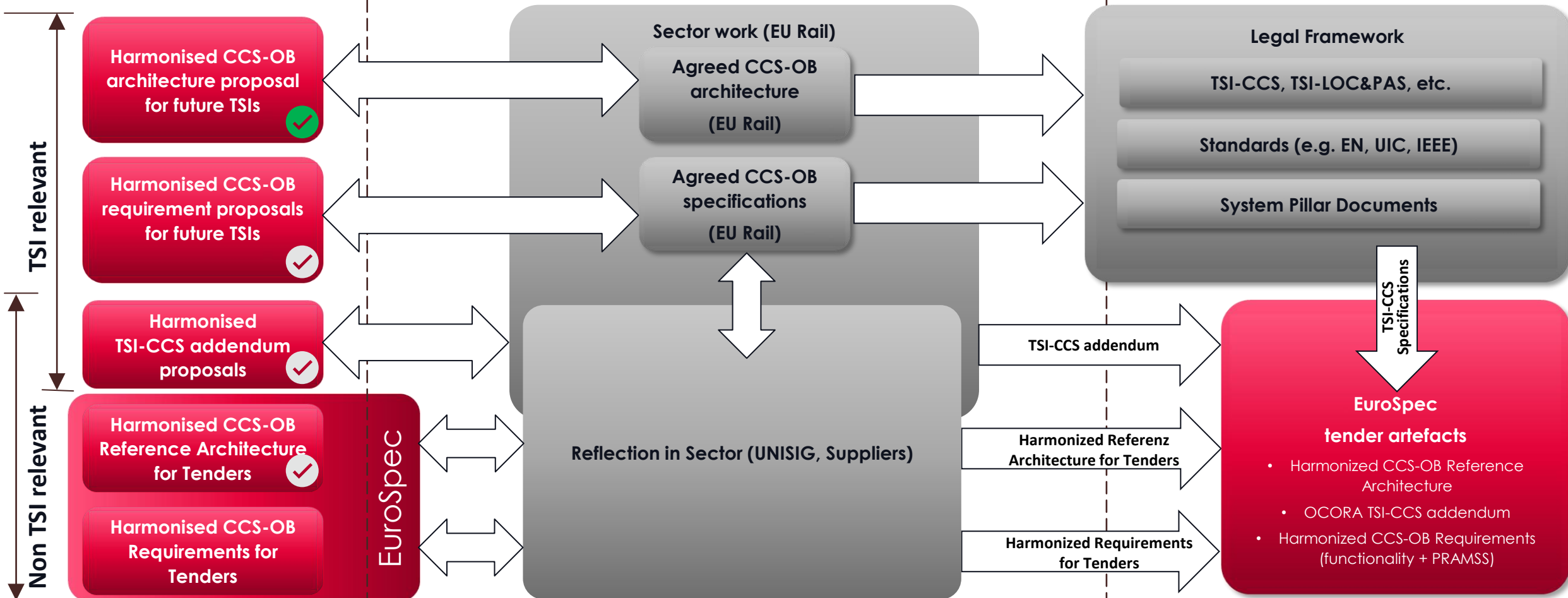


### OCORA

### Sector

ERA, UNISIG/Unife, EU-Rail, S2R (LINX4Rail, CONNECTA, X2Rail-4, Tauro), EUG-LWG, UIC (FRMCS, TOBA), SFERA

### Results for Tenders





# Control-Command and Signalling Working Group

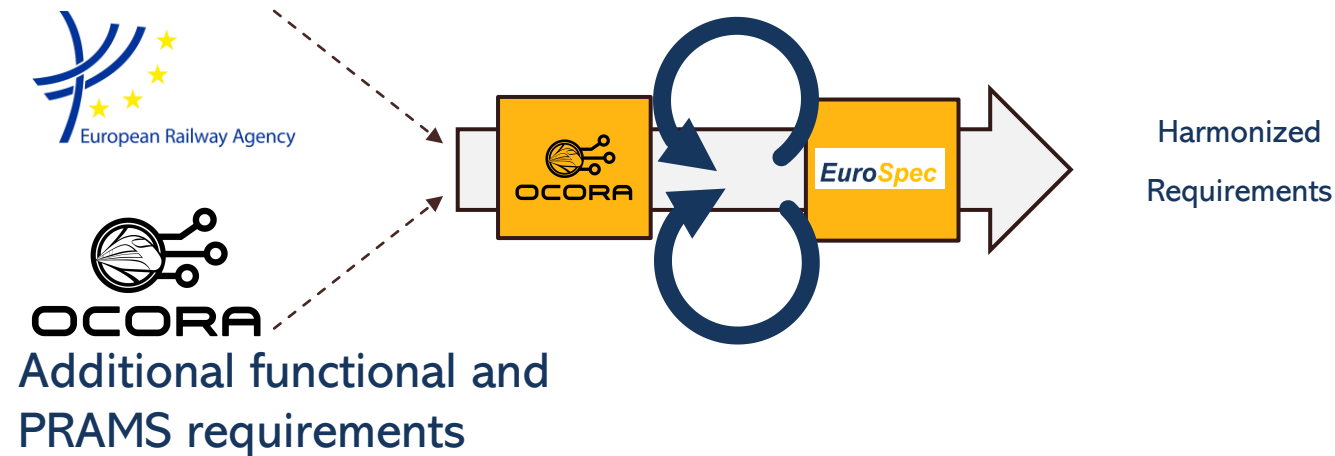
Introduction

Motivation – Benefits – Scope

# OCORA and EuroSpec have joint their forces for CCS-OB Requirements

Harmonised CCS-OB Procurement Requirements :

TSI 2023 & other Standards



**EuroSpec publications category**

<b>CCS On-board</b> Contains just the project brief, no specifications yet.	<b>Exterior hatches&amp;panels</b> Contains just the project brief, no specifications yet.	<b>Maintenance Software</b> Contains just the project brief, no specifications yet.	<b>On board Data Availability</b> All versions, pdf and xls documents.
<b>Software Updates</b> All versions, pdf and xls documents.	<b>Life Cycle Cost</b> Contains just the project brief, no specifications yet.	<b>Contains for project brief</b> All versions, pdf and xls documents.	<b>Common IDs</b> All versions, pdf and xls documents.
<b>Watertightness</b> All versions, pdf and xls documents.	<b>Circularity</b> All versions, pdf and xls documents.	<b>Upgradeability</b> All versions, pdf and xls documents.	<b>Alt. Traction Energy Supply</b> All versions, pdf and xls documents.
<b>Seat Comfort</b> All versions, pdf and xls documents.	<b>Pantograph strip</b> All versions, pdf and xls documents.	<b>Wheel Brake Disc</b> All versions, pdf and xls documents.	<b>Parking Noise</b> All versions, pdf and xls documents.
<b>Automatic coupler</b> All versions, pdf and xls documents.	<b>Sliding Steps</b> All versions, pdf and xls documents.	<b>TCMS Data Service</b> All versions, pdf and xls documents.	<b>Door Systems</b> All versions, pdf and xls documents.
<b>Requirement Management</b> All versions, pdf and xls documents.	<b>Documentation</b> All versions, pdf and xls documents.	<b>HVAC systems</b> All versions, pdf and xls documents.	<b>Toilet systems</b> All versions, pdf and xls documents.

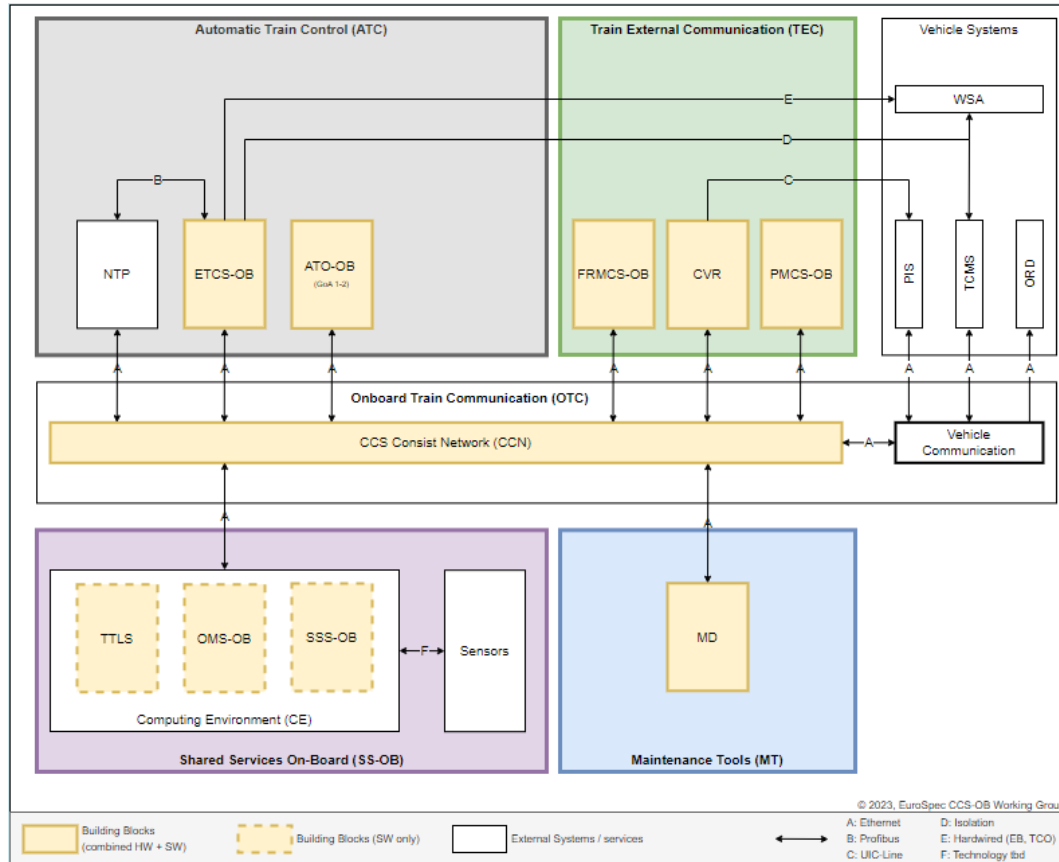
# Reason for Cooperation of OCORA & EuroSpec

- **Same vision and objectives**
  - *To align train operator's needs to reduce the whole life cycle cost of the train, shorten the delivery time and speed up the innovation cycle and the deployment of innovations.*
- **Use of already existing framework**
  - *Established platform for discussion of requirements with Industry.*
  - *EuroSpec requirements already used in procurements.*
- **Fill a gap in EuroSpec publication category**
  - *EuroSpec is currently not covering CCS On-Board requirements.*

# Harmonized requirements increase the attractiveness of railways

- **Harmonized requirements help the industry to reduce product variety**  
*This leads to less development and maintenance efforts*
- **Harmonized requirements help the RUs to operate more standardised vehicles**  
*This leads in a long term to less operational costs (documentation, training, maintenance, etc.)*
- **Harmonized requirements help the industry to simplify the offering**  
*Harmonized requirements catalogues help the industry to answer requests for tenders with less effort*
- **Harmonized requirements help the RUs to simplify the procurement**  
*Formalised requirements help the RU to compile their requirements catalogue. This is especially helpful for smaller RUs with limited resources/knowledge*
- **The EuroSpec CCS-OB requirements are aligned with respective specifications**  
*Requirements are built on or extend already existing standards (e.g. TSI, UIC, EN) and are updated regularly*

# EuroSpec CCS-OB Scope & Document Structure



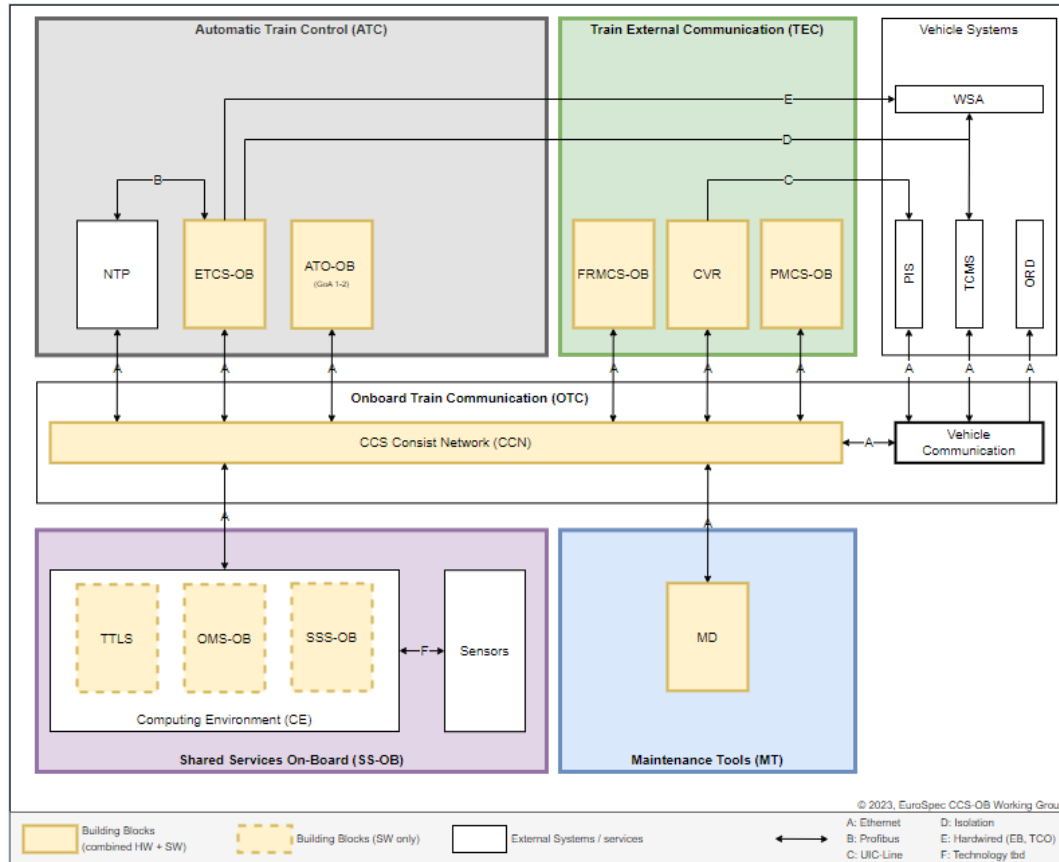
## Scope

- CCS On-Board building blocks as per the graphic to the left (yellow marked blocks)
  - Yellow marked blocks with solid outline: combined hardware/software building blocks
  - Yellow marked blocks with dashed outline: Software building blocks/services
- Focus on functional and RAMSS requirements
- Building on or extending already existing standards (TSI, UIC, EN, etc.)
- Eventually extending the scope to RU centralised systems needed for CCS-OB operations (e.g. Online Monitoring System, Remote Maintenance System, etc.)

## Structure

- The CCS-OB EuroSpec requirements structure allows for procuring every building block separately

# 1<sup>st</sup> Release CCS-OB Euro Spec in Q1/2024



- First version of the requirements for ETCS-OB, ATO-OB, FRMCS-OB, CCN, and TTLS can be expected in Q1/2024.
- Based on TSI-CCS:2023
- Requirements to include FRMCS in the procurements
- Requirements to overwrite the transition regime in some cases (SS-147, SS-119, etc.)
- Requirements to close gaps in the TSI-CCS:2023
  - SUBSET-147 (CCS Consist Network - Communication Layers): closing gaps in communication layer and train time and location service specifications. See also OCORA addendum to SS-147, v2.0\*
  - SUBSET-119 (ETCS-TCMS Interface): refer to OCORA addendum to SS-119, v1.0\*
  - SUBSET-139 (ATO-TCMS Interface): refer to OCORA addendum to SS-119, v1.0\*

\* publication expected in December 2023

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- Any feedback for OCORA is welcome!  
If you would like to attend a workshop or give a feedback, please contact [luca.de\\_libero@sbb.ch](mailto:luca.de_libero@sbb.ch).  
For specific feedback the OCORA-BWS01-040 Feedback Form shall be used.
- For active collaboration (within the OCORA framework) the OCORA Code of Conduct must be accepted and signed.  
In case of interest for active collaboration and you are eligible to become a partner according to the OCORA Code of conduct, please drop a "interest of becoming a OCORA member by mail" to [luca.de\\_libero@sbb.ch](mailto:luca.de_libero@sbb.ch).
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