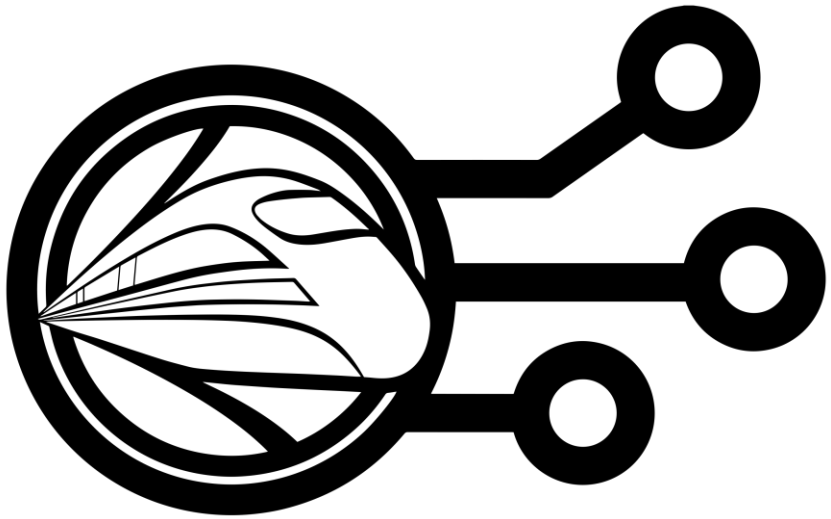


OCORA

Program Slide Deck

OCORA-BWS02-020 / v1.01 / 04.07.23 / Release R4

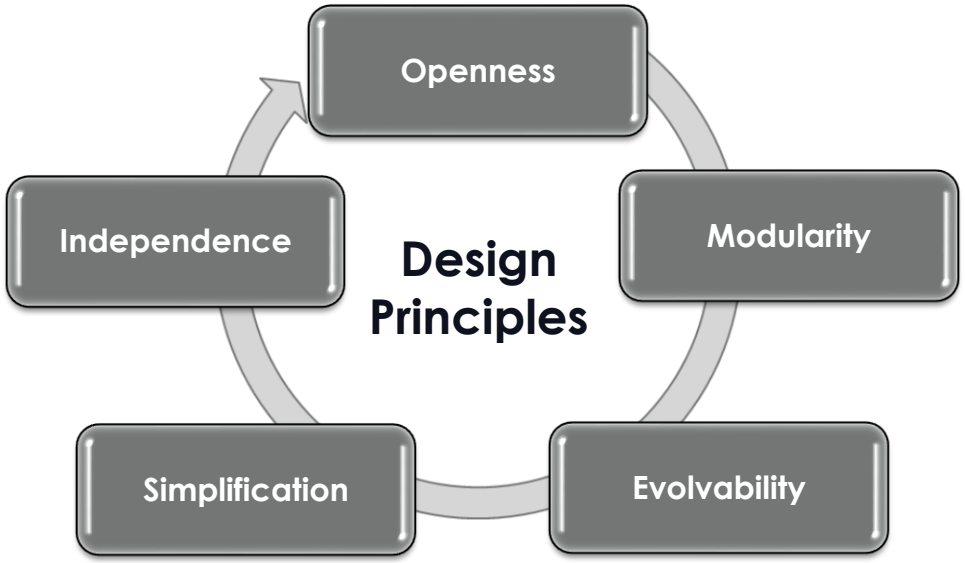
OCORA Release R4 - OnePager

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

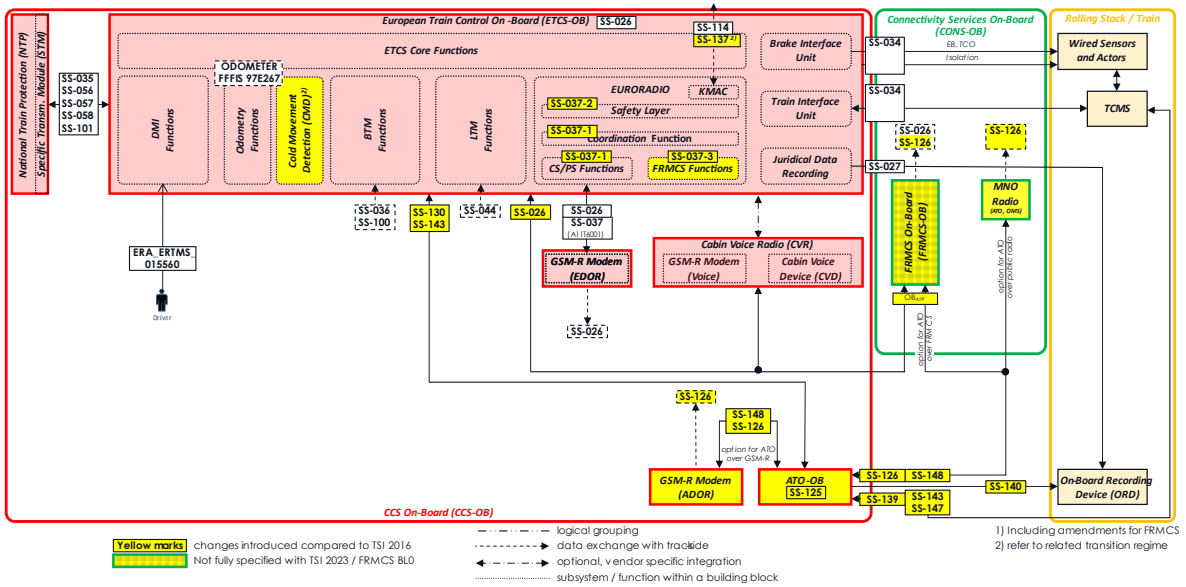
Founding Members

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 R4** 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 R4** descripts **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 the next steps towards **harmonized tender artefacts**.



OCORA deliverables are published under the **European Union Public License** (EUPL) and are consequently available for all stakeholders.
The OCORA **Release R5** is planned for **end of 2023.** It is expected to be reduced by the already transferred EU-Rail activities.

Program Slide Deck

Content

- Introduction into OCORA
- Roadmap
- Alliances
- Release Overview
- Economic Model
- Sector Dialogue

Introduction

Problem Statements - Current ETCS On-board solutions…

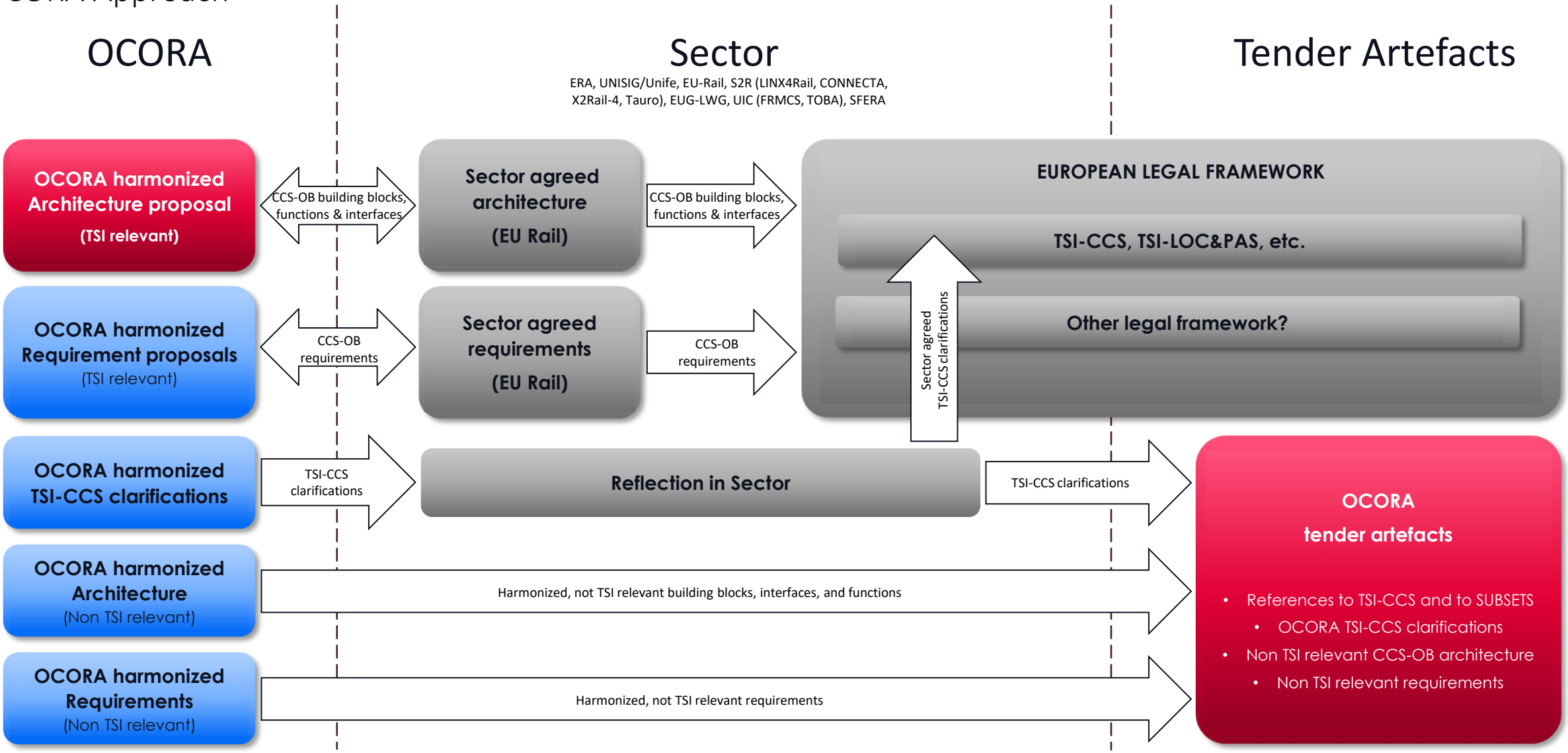
1. are built on incomplete, not fully standardized, and sometimes ambiguous specifications;
2. do not have a reasonable total cost of ownership;
3. are difficult to be integrated into existing vehicles;
4. are costly and time consuming to adapt/change/update/upgrade:
   - In case of patching and error 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.

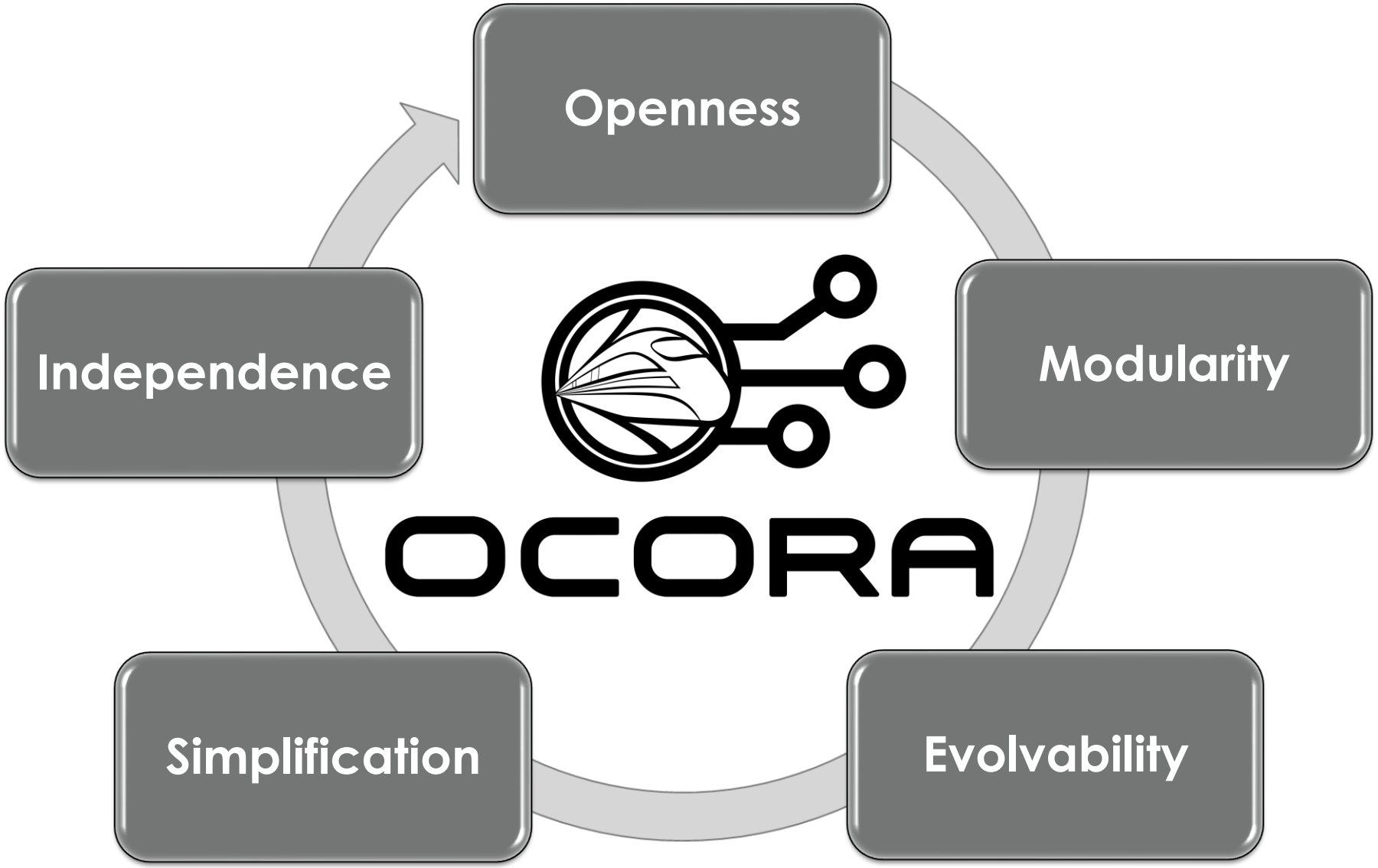
Introduction

OCORA Approach



Introduction

Key Principles



Introduction

OCORA - History

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

March 2019
- **Memorandum of Understanding - 5 founding members (NS, SNCF, SBB, ÖBB, DB)**
- OCORA is a **collaborative platform gathering engineering resources** working on **ERTMS and beyond**

October 2019
- **OCORA Governance** in place, with an active Steering Committee
- Open to railway companies willing to contribute to the collaboration

November 2019
- **OCORA Alpha Release**, first publication
- Alpha outlines the Who, the How and the Why

July 2020
- **OCORA Beta Release**, first comprehensive CCS On-board description
- Based on Beta OCORA starts Sector / Industry Dialogue

December 2020
- **OCORA Gamma Release**, updated CCS On-board description, including Sector / Industry feedback
- Gamma is feeding TSI-2022 and S2R-2 with qualified technical input

July 2021
- **OCORA Delta Release**, updated CCS On-board description, including Sector / Industry feedback
- Delta is again feeding TSI-2022 and prepares for Europe's Rail Joint Undertakings System- & Innovation-Pillar

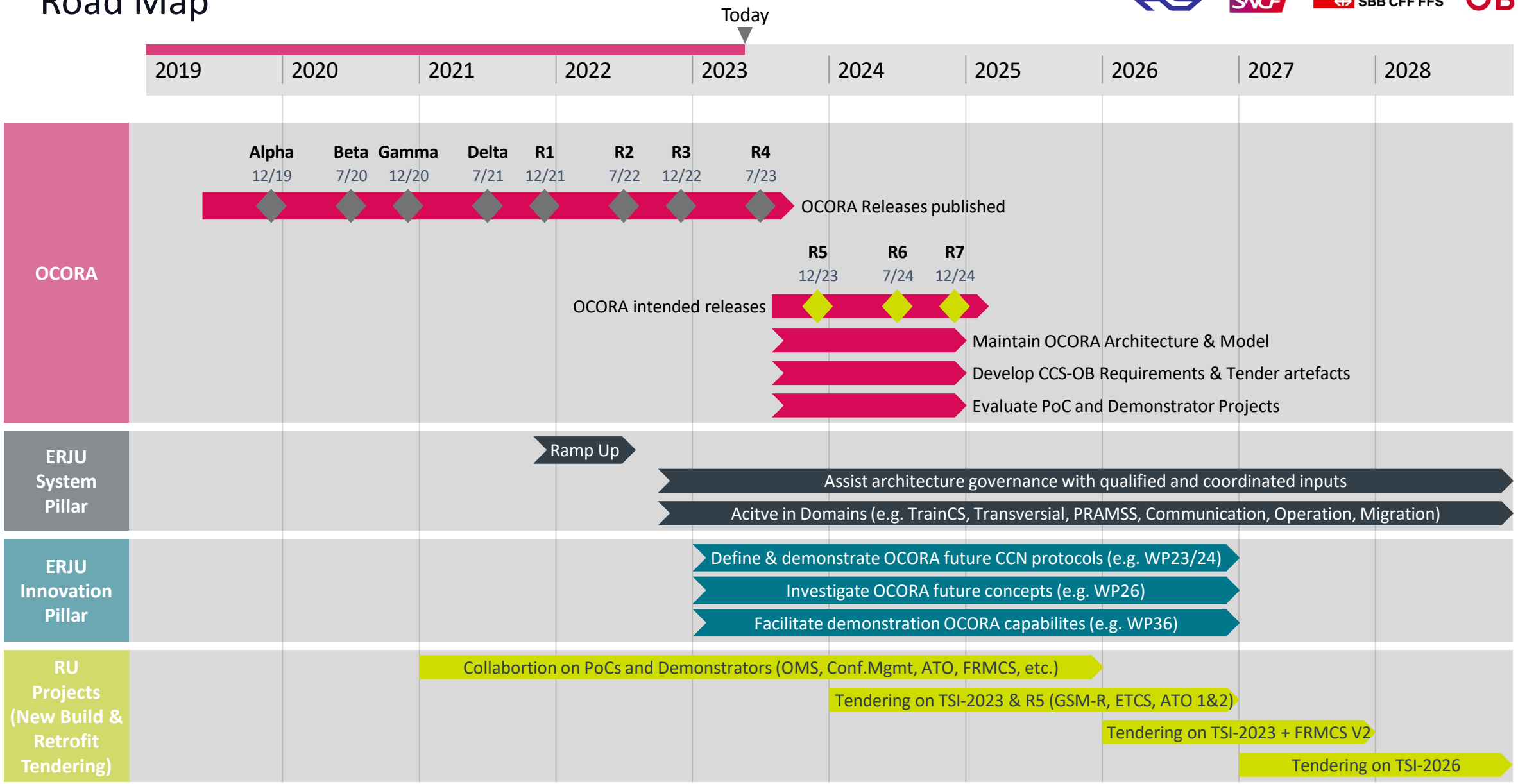
December 2021
- **OCORA Release R1**, updated CCS On-board description, including Sector / Industry feedback
- Prepares for Europe's Rail Joint Undertakings System- & Innovation-Pillar.

July 2022
- **OCORA Release R2**, updated CCS On-board description, including industry feedback from System-Pillar Ramp Up
- Serves as further input for EU-Rail System- & Innovation-Pillar.

December 2022
- **OCORA Release R3**, updated CCS On-board description
- Serves with operational input for EU-Rail and provided the concept on Configuration Management

July 2023
- **OCORA Release R4**, updated CCS On-board description
- defining the OCORA position for System- & Innovation-Pillar and the next steps towards harmonized tender artefacts

Road Map

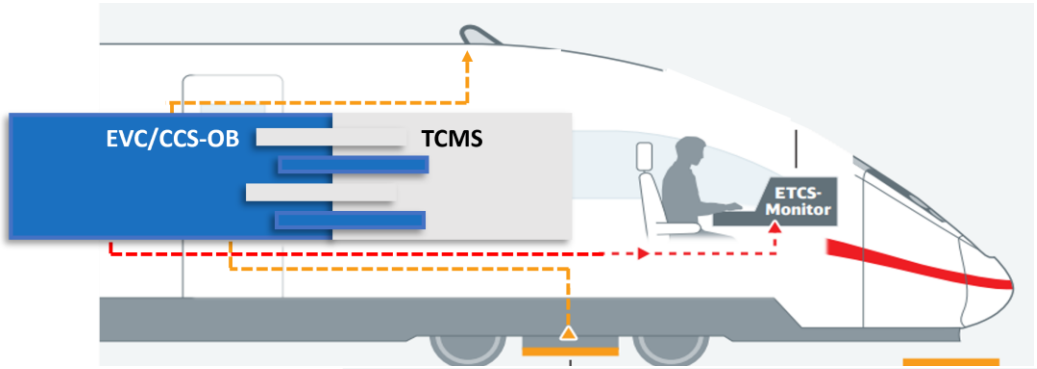

Today
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
OCORA
Alpha 12/19
Beta 7/20
Gamma 12/20
Delta 7/21
R1 12/21
R2 7/22
R3 12/22
R4 7/23
OCORA Releases published
R5 12/23
R6 7/24
R7 12/24
OCORA intended releases
Maintain OCORA Architecture & Model
Develop CCS-OB Requirements & Tender artefacts
Evaluate PoC and Demonstrator Projects
ERJU System Pillar
Ramp Up
Assist architecture governance with qualified and coordinated inputs
Acitve in Domains (e.g. TrainCS, Transversial, PRAMSS, Communication, Operation, Migration)
ERJU Innovation Pillar
Define & demonstrate OCORA future CCN protocols (e.g. WP23/24)
Investigate OCORA future concepts (e.g. WP26)
Facilitate demonstration OCORA capabilites (e.g. WP36)
RU Projects (New Build & Retrofit Tendering)
Collabortion on PoCs and Demonstrators (OMS, Conf.Mgmt, ATO, FRMCS, etc.)
Tendering on TSI-2023 & R5 (GSM-R, ETCS, ATO 1&2)
Tendering on TSI-2023 + FRMCS V2
Tendering on TSI-2026

Migration

Stepwise Approach

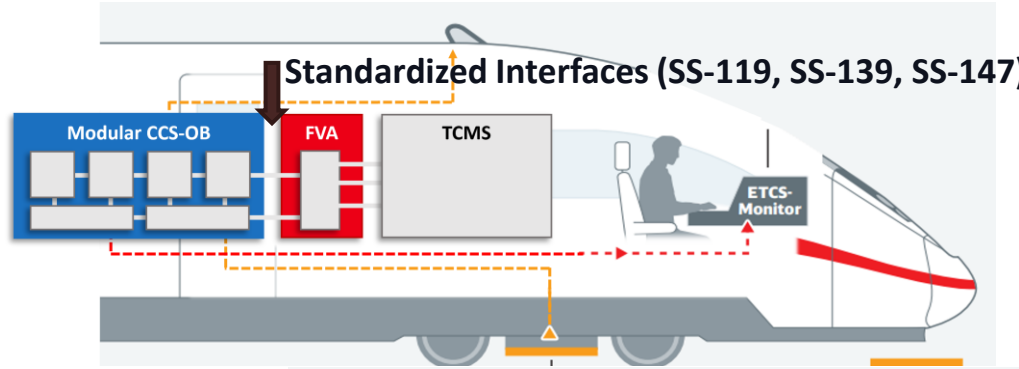
1. Current situation

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



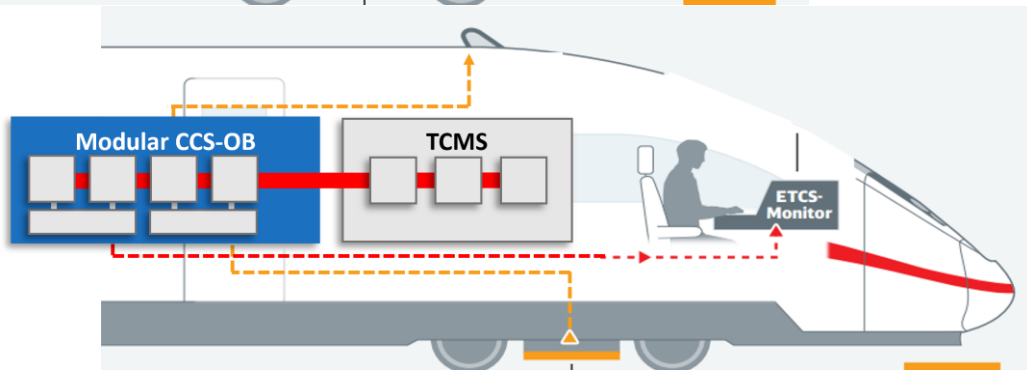
2. OCORA Functional Vehicle Adapter

- 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.



Alliances

Ongoing OCORA liaisons

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

Technical Workstreams

TWS01	System Architecture
TWS02	CCS Communication Network
TWS04	Functional Vehicle Adapter
TWS05	RMG and Requirements
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

DB Cargo	ATO Freight GoA2+4+RCS
SBB	PoC OMS SS-149
SBB	PoC Config Management

Release Overview

Program Content

Release Documentation
- OCORA-BWS01-010 – Release Notes
- OCORA-BWS01-020 – Glossary

Supporting Documentation
- OCORA-BWS01-030 – Question and Answers
- OCORA-BWS01-040 – Feedback Form

Communication Material
- OCORA-BWS02-010 – Executive Summary Slide Deck
- OCORA-BWS02-020 – Program Slide Deck
- OCORA-BWS02-030 – Technical Slide Deck
- OCORA-BWS02-040 – Program Posters
- OCORA-BWS02-050 – Technical Posters

Program Documentation
- OCORA-BWS03-010 – Introduction to OCORA
- OCORA-BWS03-020 – Guiding Principles
- OCORA-BWS04-010 – Problem Statements
- OCORA-BWS05-010 – Road Map
- OCORA-BWS06-010 – Economic Model – Guiding Principles - Assumptions - Assessment Criteria
- OCORA-BWS06-020 – Economic Model
- OCORA-BWS06-030 – Economic Model – Model Description
- OCORA-BWS06-040 – Economic Model – User Manual
- OCORA-BWS06-050 – Economic Model – CCS System Life Cycle Costing Scenario Studies
- OCORA-BWS06-060 – Economic Model – CCS Impact Life Cycle Costing Scenario Studies
- OCORA-BWS06-070 – Economic Model – Evolution of the modeling
- OCORA-BWS07-010 – Alliances
- OCORA-BWS08-010 – Methodology
- OCORA-BWS08-020 – Tooling

Release Highlights Program Documents are:

- Updated Communication Material
- Updated Problem Statement
- Updated Road Map
- Updated Economic Model and new impact analysis

Color Legend:

Doc. Title
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
- EUG 22E126 – LOC-OB System Definition & Operational Context
- 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-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-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:

- New document on Modularisation Roadmap Proposal
- Significantly enriched Operational & System Analysis
- Updated Architecture Documentation
- Further elaboration for PRAMSS- in particular for future modularity
- Results of PoC OMS SS-149

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Doc. Title
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

Methodology & Tooling

Methodology:

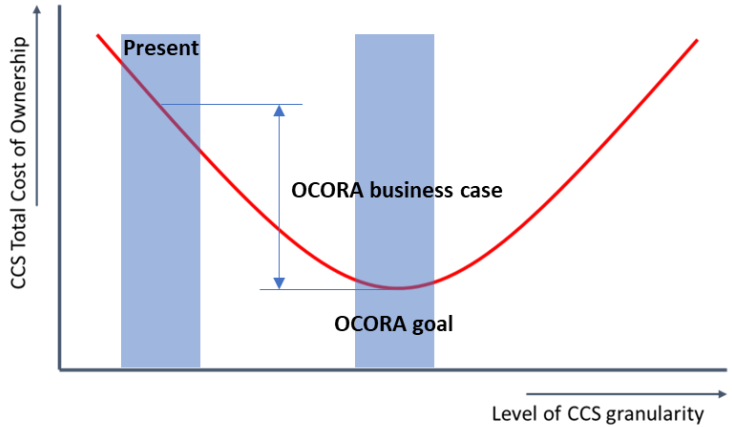
- OCORA is developing based on topical workstreams
- OCORA is releasing contiguously
- OCORA makes a use of Best Practice
- OCORA uses the OSI model for interface specifications
- OCORA is using Model Based System Engineering based on Arcadia methodology
- OCORA deliverables are in compliance with the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

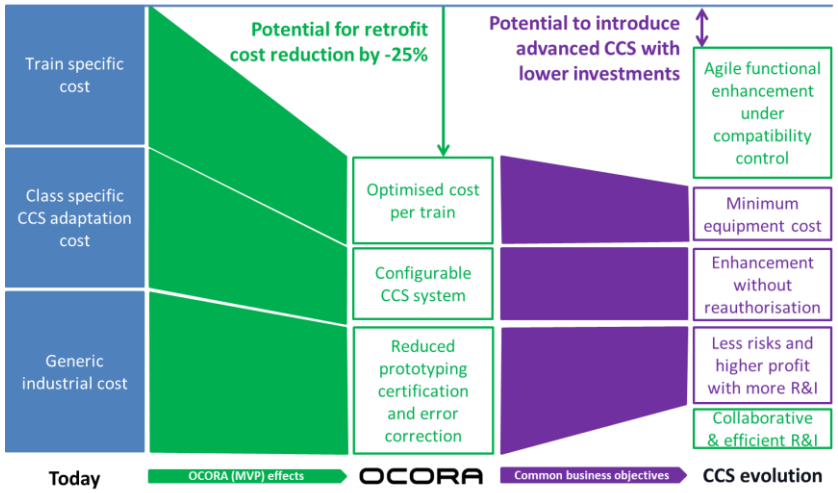
Tooling:

- 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



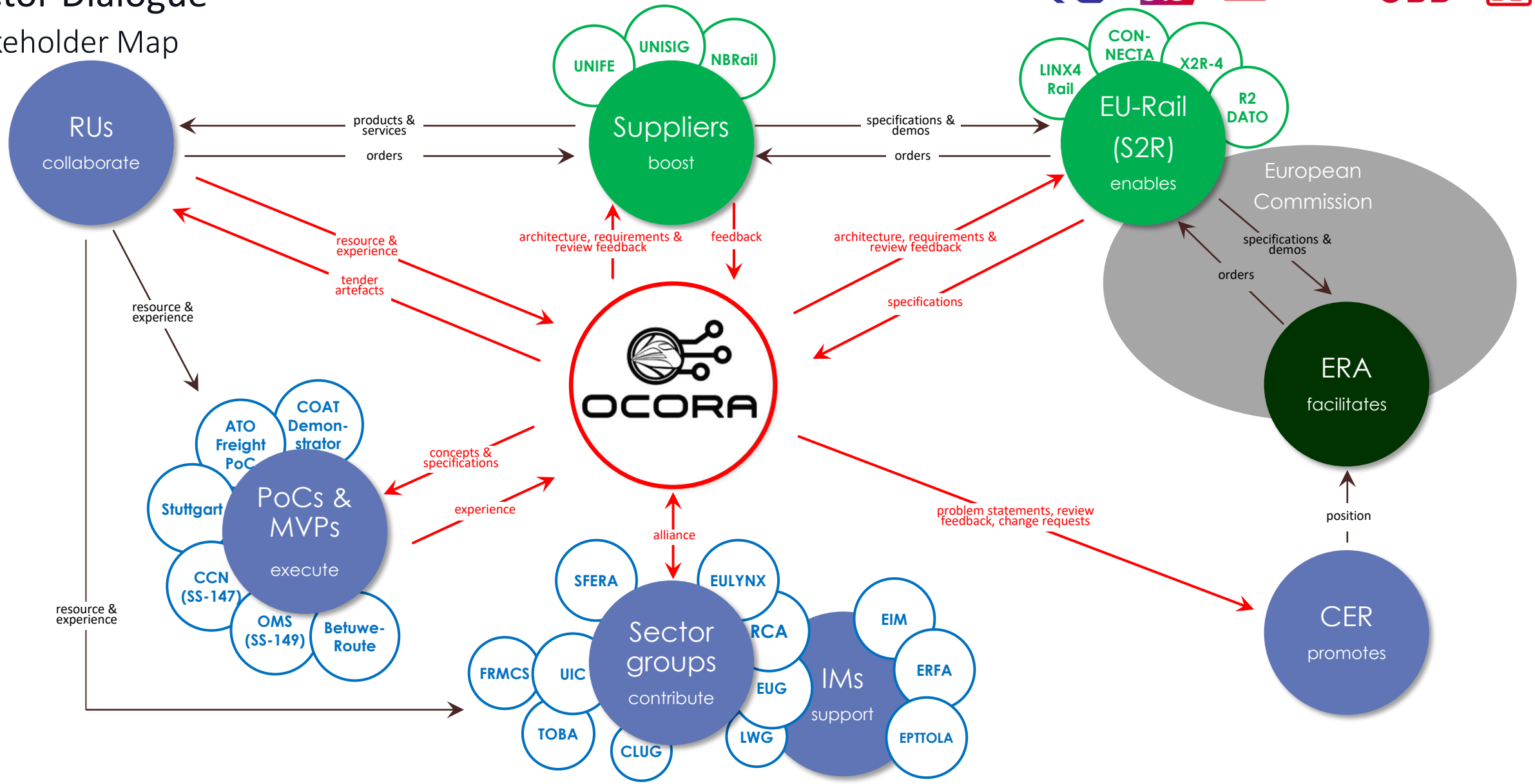


The development of the OCORA economic model, intends to provide tools for:

- 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:
  - Todays 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



Sector Dialogue

OCORA Release Imprint

- Publisher: OCORA Cooperation
- Channel: OCORA publishes exclusively over https://github.com/OCORA-Public/Publication
- Any feedback for OCORA is welcome!
  If you would like to attend a workshop or give a feedback, please contact rolf.muehlemann2@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 rolf.muehlemann2@sbb.ch.
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