

OCORA

Open CCS On-Board Reference Architecture
A Collaboration of 5 European Railway Undertakings



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Technical Slide Deck

- OCORA Design Objectives
- OCORA Roadmap
- Modularization Granularity & Roadmap Proposal
- OCORA Scope
- CCS On-Board – Logical Architecture
- CCS On-Board – Physical Architecture
 - Building Blocks
 - Hardware Block Diagrams
 - Train Integration Scenarios
 - Network Topology Scenarios
- Safe Computing Platform (SCP)
- Configuration Management Concept
- Functional Vehicle Adapter (FVA)
- Modular Safety
- Methodology & Tooling
- Operational Concept



OCORA Design Objectives

OCORA-BWS02-030 / v4.00 / 04.07.2023

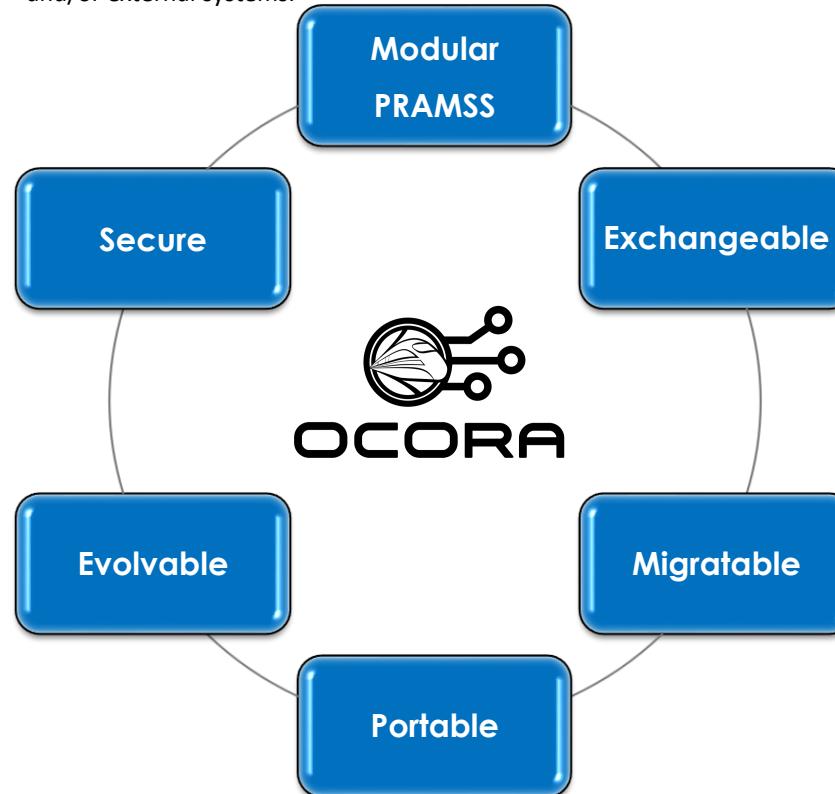
OCORA Design Objectives



Ability to protect the CCS On-Board from attacks. In context of OCORA security means the protection of (especially safety related communication and data used in) CCS on-board systems against threats (in particular cyber-attacks and hacks). To achieve this, all main security functionality like identify, protect, detect, respond and recover are considered.

Ability to easily adapt the CCS On-Board to new technologies and to easily add new Building Blocks. In the context of OCORA evolvability means the ability to easily adopt to new technologies or to extend the functionality of an on-board CCS system without the involvement of the original supplier.

A reasonable number of Building Blocks are defined for CCS On-Board. Each Building Blocks has standardised functionality, standardised PRAMSS requirements (including Tolerable Functional Failure Rate [TFFR], Safety Integrity Level [SIL] and Safety Related Application Conditions [SRAC]), standardised interfaces (on all OSI Layers) towards other building blocks and/or external systems.



Ability to port CCS On-Board Software Building Blocks (software applications) from one computing platform to another. In the context of OCORA portability is achieved when a functional application, based on the generalized abstraction, runs un-changed on different (computing) platform implementations. For this, the functional application shall only use external functions through a defined application programming interface (API).

Ability to replace CCS On-Board Building Block. In the context of OCORA exchangeability means the ability to replace one or multiple OCORA defined building blocks with (a) respective building block(s) of (an)other supplier(s), without affecting other building blocks of the train or the overall CCS on-board system.

Ability to introduce changes to any CCS On-Board Building Block. In the context of OCORA migrateability is the ability to introduce changes (bug-fixes, improvements, new functionality) to one or multiple OCORA defined building blocks, without affecting other building blocks or the overall CCS on-board system.



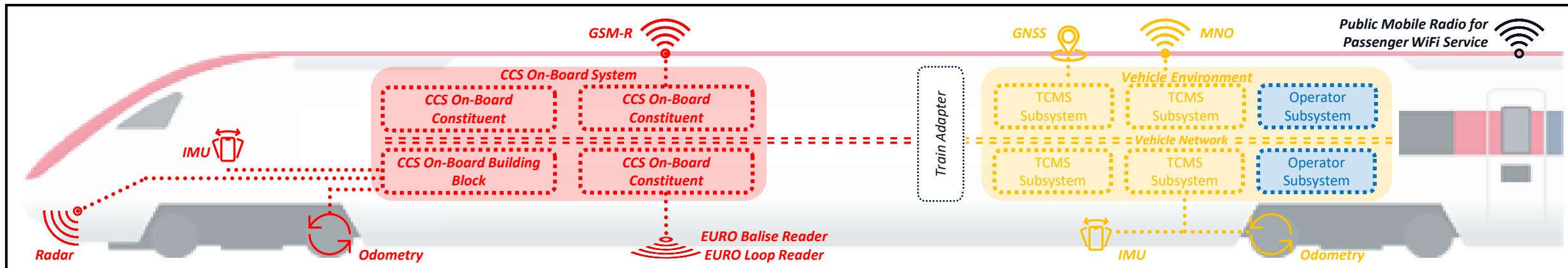
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OCORA Roadmap

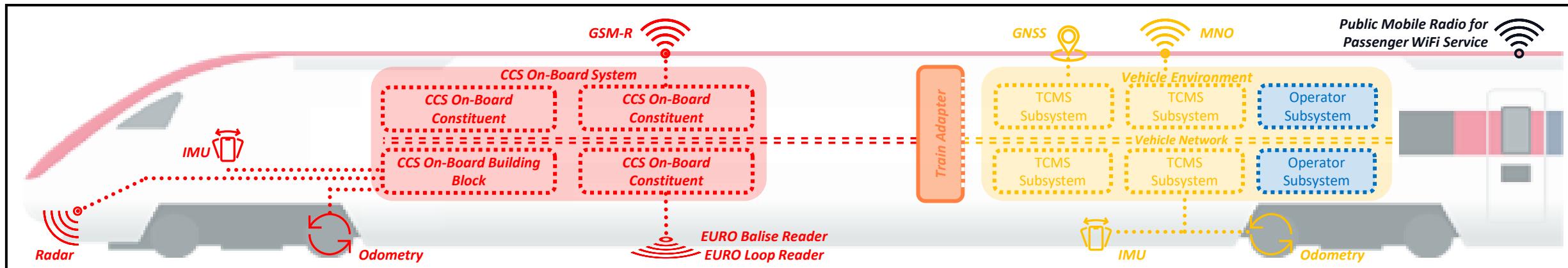
OCORA-BWS02-030 / v4.00 / 04.07.2023

Technical Roadmap – Current Situation



Step 0: Current Situation (TSI 2016)

Today, the proprietary CCS On-Board System (marked in red) is fully integrated in the proprietary Vehicle Environment (marked in yellow), complicating the life-cycle and obsolescence management of the CCS On-Board System.



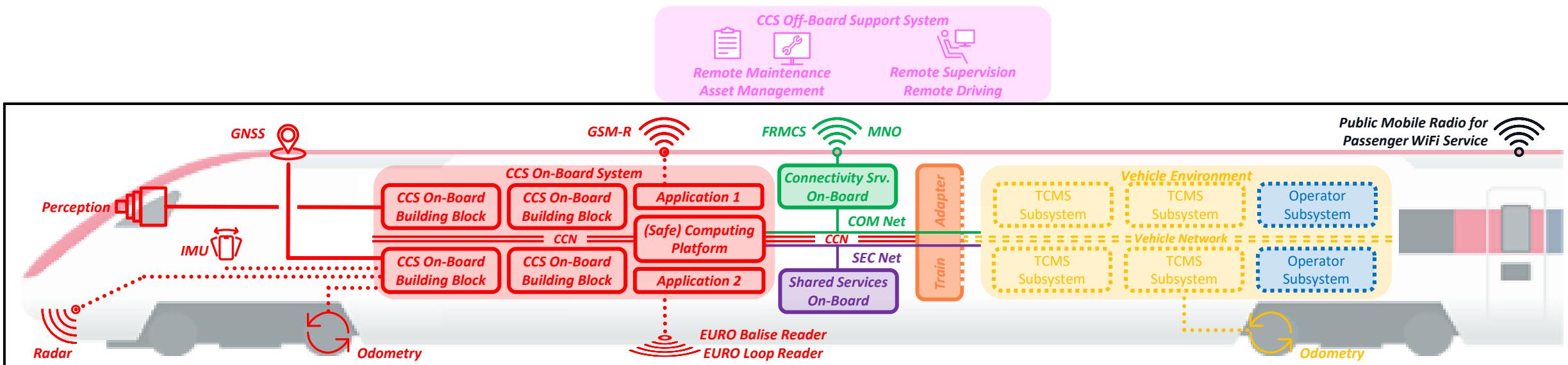
Step 1: Short-Term (TSI 2022/23)

The interface between the proprietary CCS On-Board System and the Vehicle Environment is unambiguously standardised.

Step 1 is enabling exchangeability, supporting migrateability and portability of the CCS On-Board System without affecting the Vehicle Environment.

Step 1 is simplifying life-cycle and obsolescence management for the CCS On-Board System.

Technical Roadmap Step 2 – Mid-Term



Step 2: Mid-Term (e.g. TSI 2025/26)

The CCS On-Board System consists of a reasonable number of Building Blocks. The CCS On-Board Building Blocks communicate with each other, with the Vehicle Subsystems and any Off-Board System via the standardized CCS Communication Network (CCN). The Connectivity Services over FRMCS or MNO are available for all subsystems on a train. Shared Services provide Identity and Access Management (IAM), security patch updates, synchronized time services, and other means to allow secure operations. First applications (e.g. Monitoring, Diagnostics, and Configuration) are running on a computing platform.

Step 2 is enabling exchangeability, migrateability and portability of individual Building Blocks without affecting other Building Blocks, the Vehicle Environment, and any Off-Board Systems. This step is simplifying life-cycle management and is the basis for evolvability. The railways can consider adding new functionality such as:

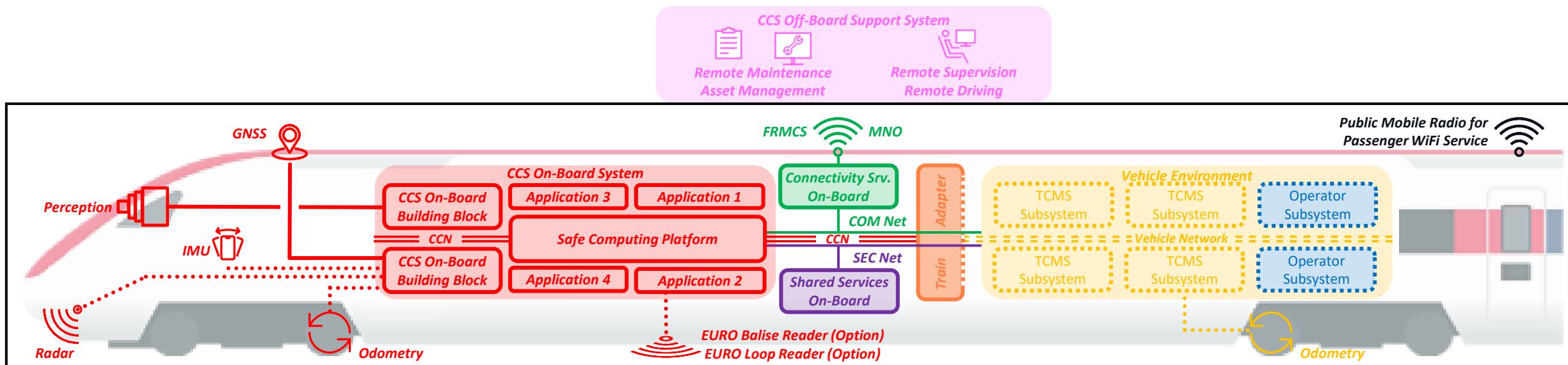
- Remote Maintenance
- Asset Management
- ETCS L2 Moving Block
- ATO GoA 1-4

Step 2 is enabling the sharing of the following services between CCS On-Board and the Vehicle Environment:

- Communication services over FRMCS.
- Communication services over Mobile Network Operators (MNOs)
- Localisation services.



Technical Roadmap Step 3 – Long-Term



Step 3: Long-Term (TSI 2028/29)

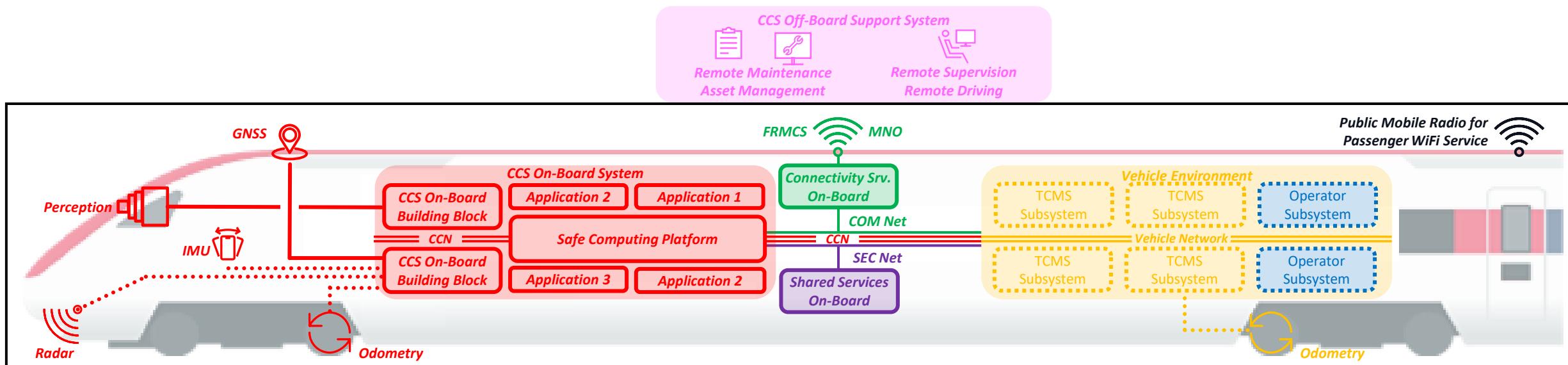
The CCS On-Board System includes a safe computing platform, hosting CCS Building Blocks as applications (SW Building Blocks). They are deployed on an instance of the Generic Safe Computing Platform (SCP) and communicate with each other through the standardised Platform Independent Application Programming Interface (PI-API). Communication with computing platform external building blocks and systems is realised by the Computing Platform (integrating with the CCN).

Due to the increased performance of the CCS On-Board localisation, EURO Balise and EURO Loop readers may not be needed anymore for trains running on certain tracks.

Step 3 is simplifying the portability of the business logic.

Step 3 is simplifying the development and deployment of new functionalities by separating the business logic from the hardware. In addition, the Safe Computing Platform is reducing the number of CCS computing units (CCUs) needed, increasing availability and reducing maintenance efforts.

Technical Roadmap Step 4 – Vision



Step 4: Vision (> TSI 2028/29)

The standardised CCS On-Board Communication Network (CCN) is fully integrated with the Vehicle Network, allowing to interface from any CCS On-Board Application directly with any Vehicle Subsystems and vice-versa. The need for a Train Adapter vanishes and certain Applications from the Vehicle Environment may be hosted on the CCS On-Board Safe Computing Platform.

Due to the increased performance of the CCS On-Board localisation through better sensor fusion algorithms, the use of GNSS localisation, digital map data, and augmentation data, the EURO Balise and EURO Loop readers are not needed anymore.

Step 4: integrating the CCS On-Board domain with the Vehicle Environment allows to reuse peripherals and applications throughout the whole train, reducing the level of hardware systems and applications needed on a train. This again will increase availability and will reduce maintenance

Step 4: eliminating the EURO Balise and EURO Loop readers further reduces the maintenance efforts and enables the infrastructure managers to implement changes more quickly.



Modularization Granularity & Roadmap Proposal

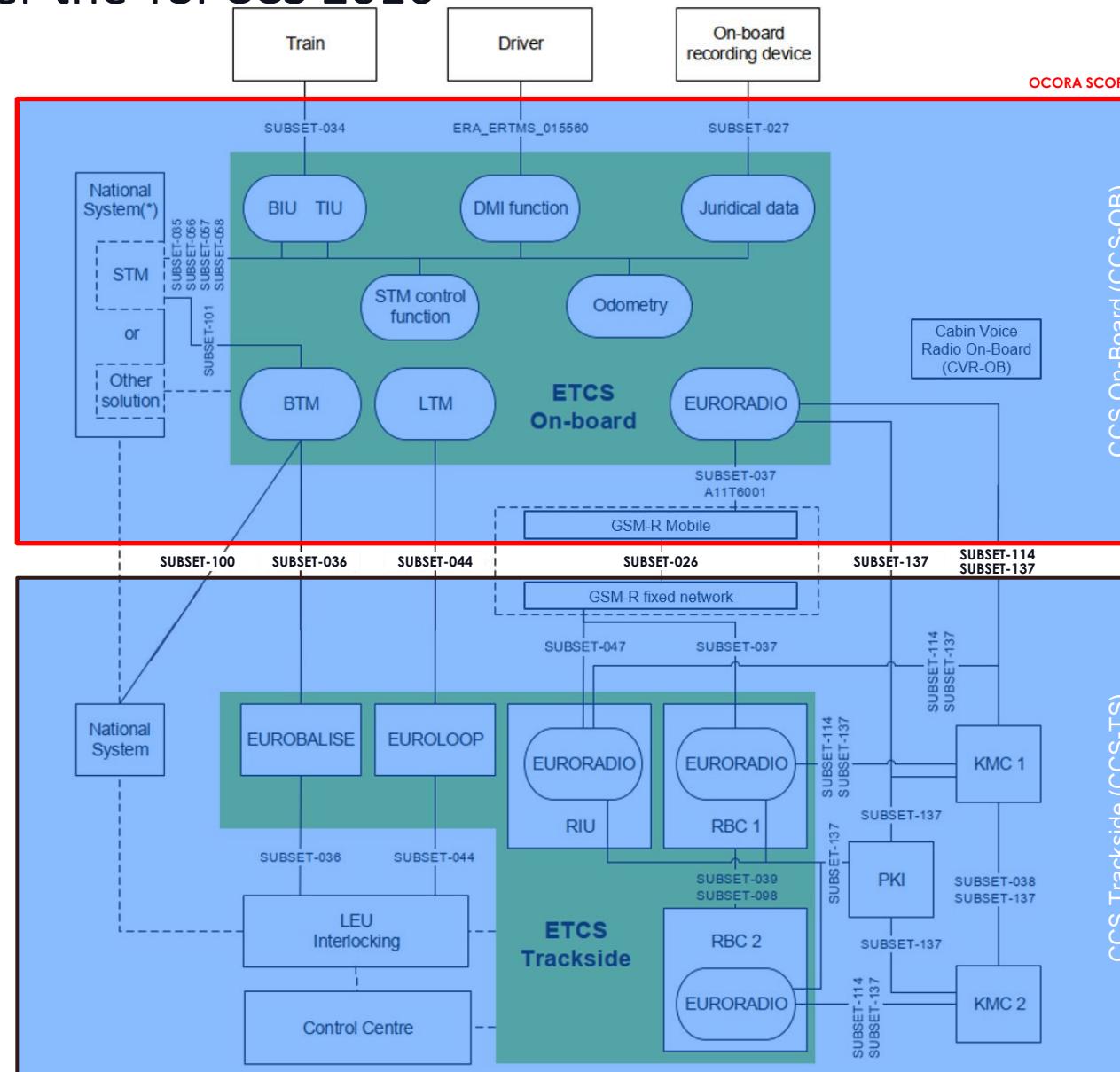
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Modularization as per the TSI

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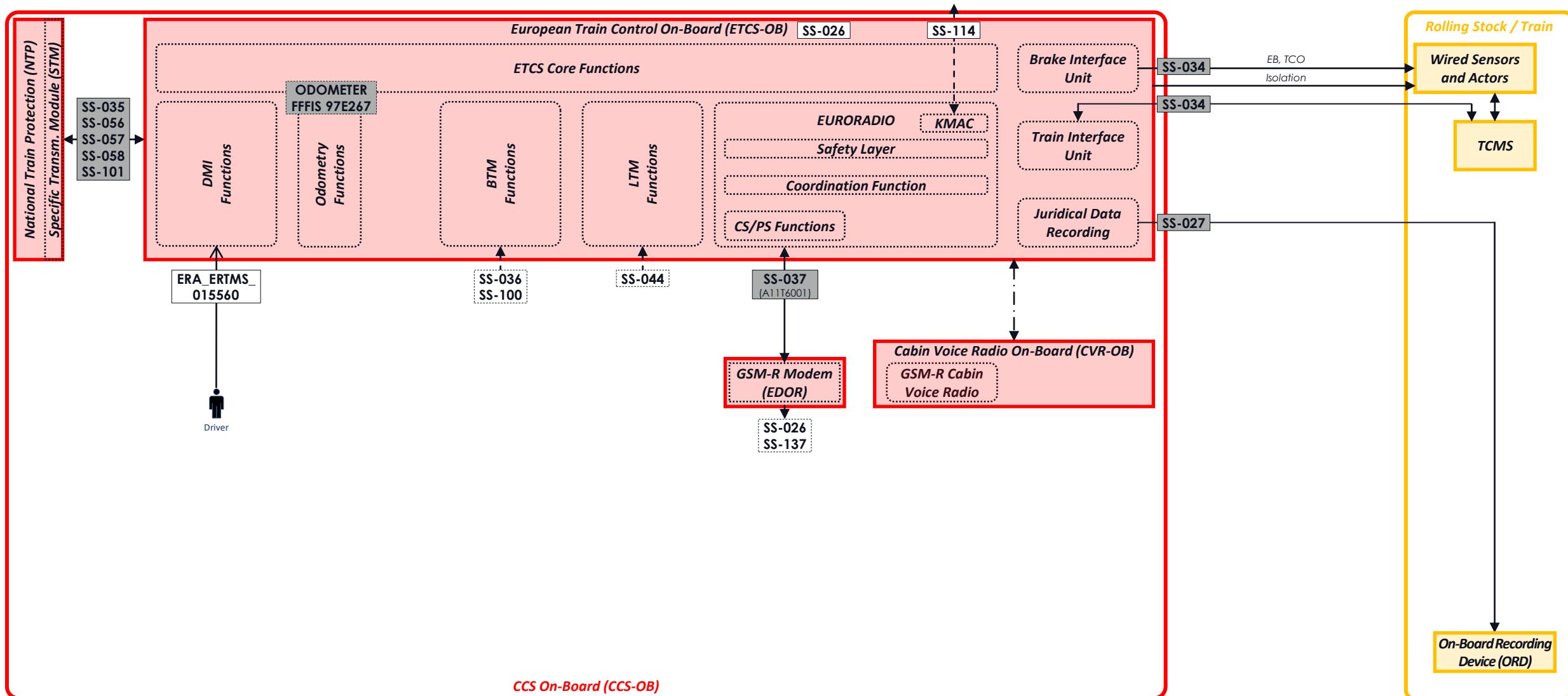
Modularization as per the TSI CCS 2016



Modularization as per TSI 2016 amended in 2019 & 2020



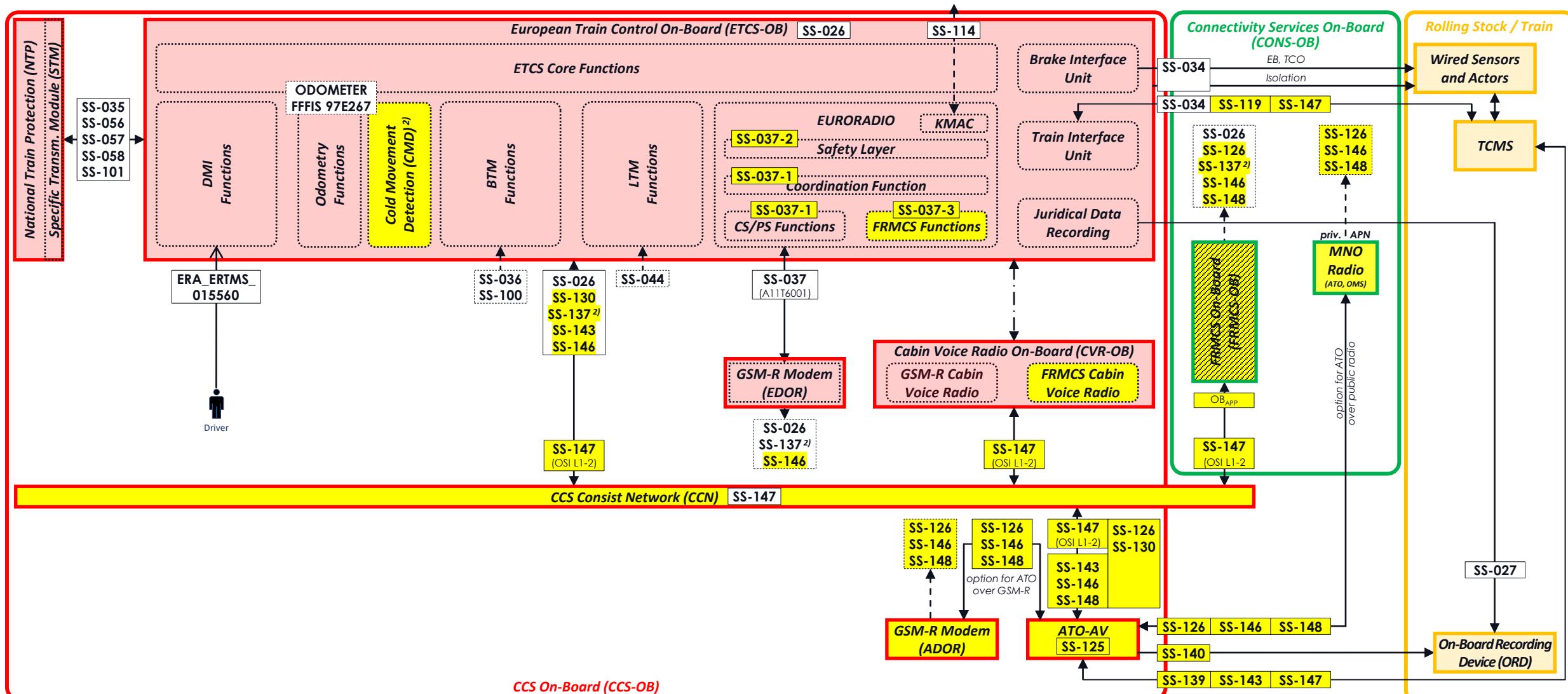
Functionality Level: ETCS and Cab Voice



Modularization as per TSI 2023¹⁾ (newly developed vehicle designs, requiring first authorisation)



Functionality Level: ETCS, Cab Voice, FRMCS (ready), ATO (GoA 1-2)



Yellow marks

changes introduced compared to TSI 2016

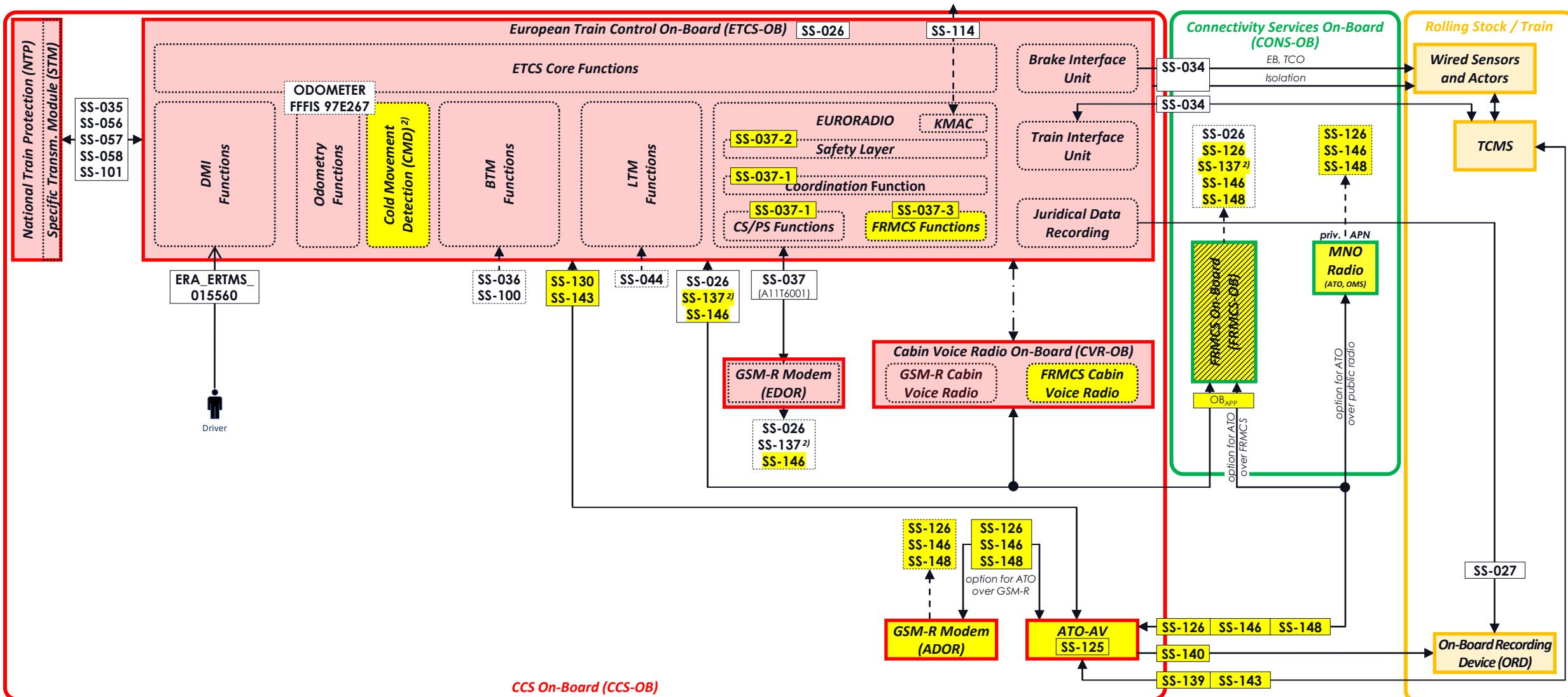
Yellow diagonal stripes

Not fully specified with TSI 2023 / FRMCS BLO

Modularization as per TSI 2023¹⁾ (existing vehicle designs)



Functionality Level: ETCS, Cab Voice, FRMCS (ready), ATO (GoA 1-2)



Yellow marks

changes introduced compared to TSI 2016

Yellow diagonal stripes

Not fully specified with TSI 2023 / FRMCS BLO



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OCORA Modularization & Roadmap Proposal

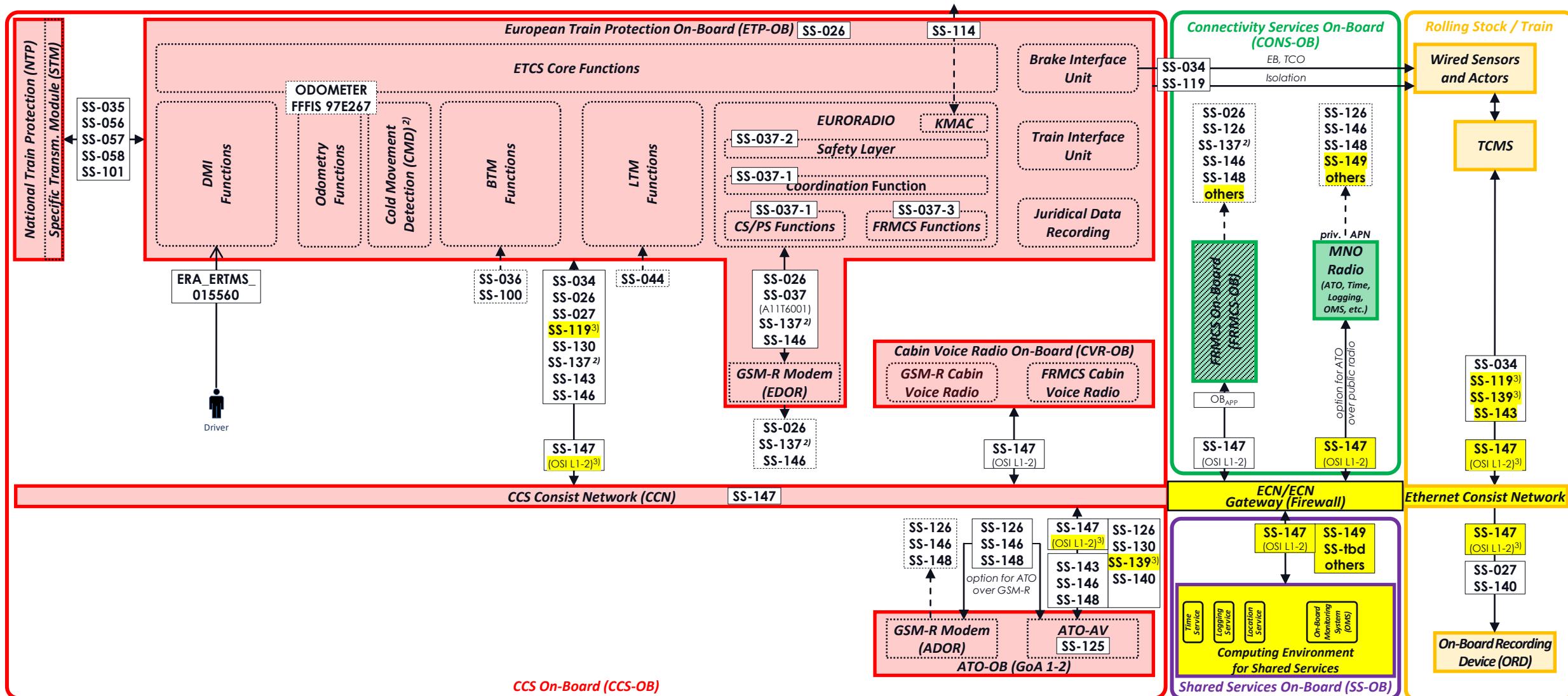
for new vehicles
(based on TSI 2023)

OCORA-BWS02-030 / v4.00 / 04.07.2023

OCORA modularization proposal based on TSI 2023¹⁾ (new vehicles)



Functionality Level: ETCS, Cab Voice, FRMCS ready, ATO (GoA 1-2)



Yellow marks

changes introduced compared to TSI 2023

Not fully specified with TSI 2023 / FRMCS BLO

logical grouping

data exchange with track-side

optional, vendor specific integration

subsystem / function within a building block

1) Including amendments for FRMCS

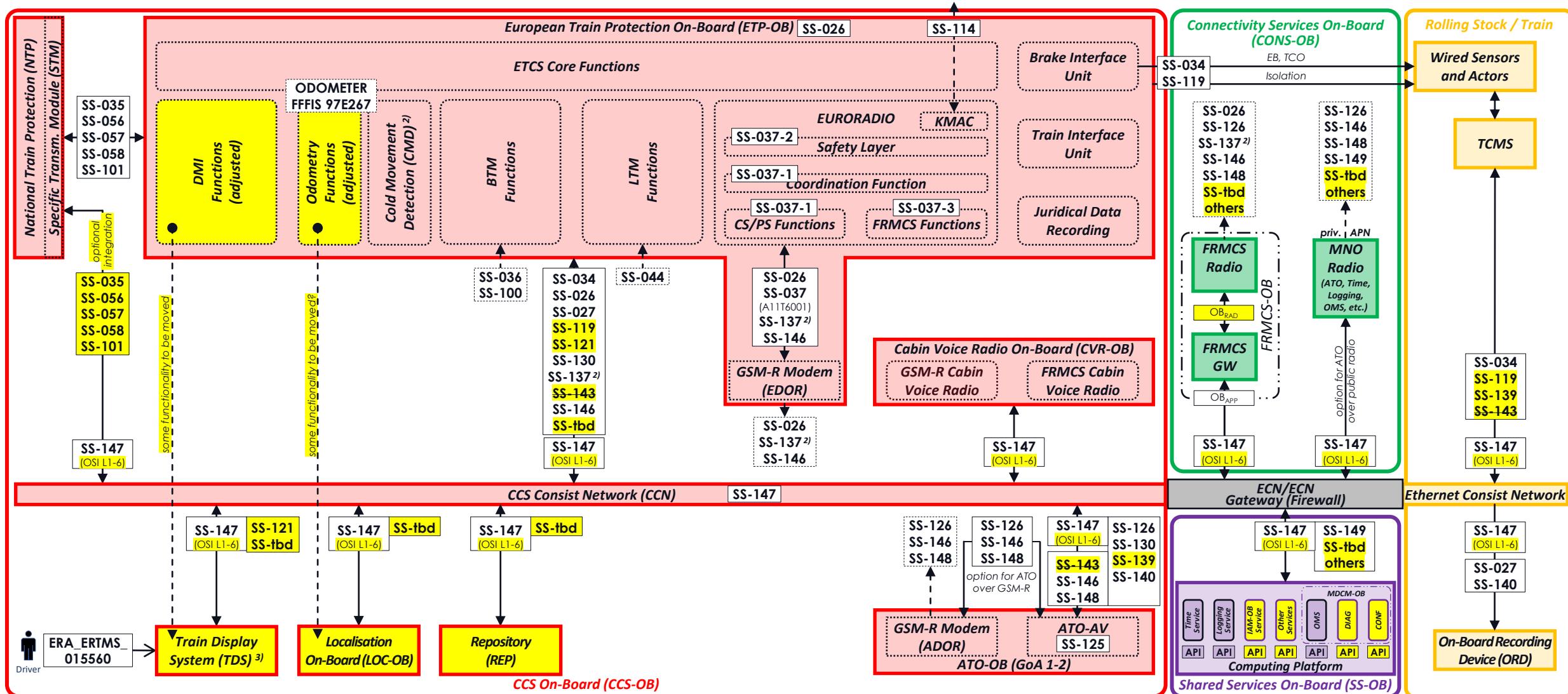
2) refer to related transition regime

3) incl. OCORA addendum

OCORA modularization proposal for TSI 2025/26 (new vehicles)



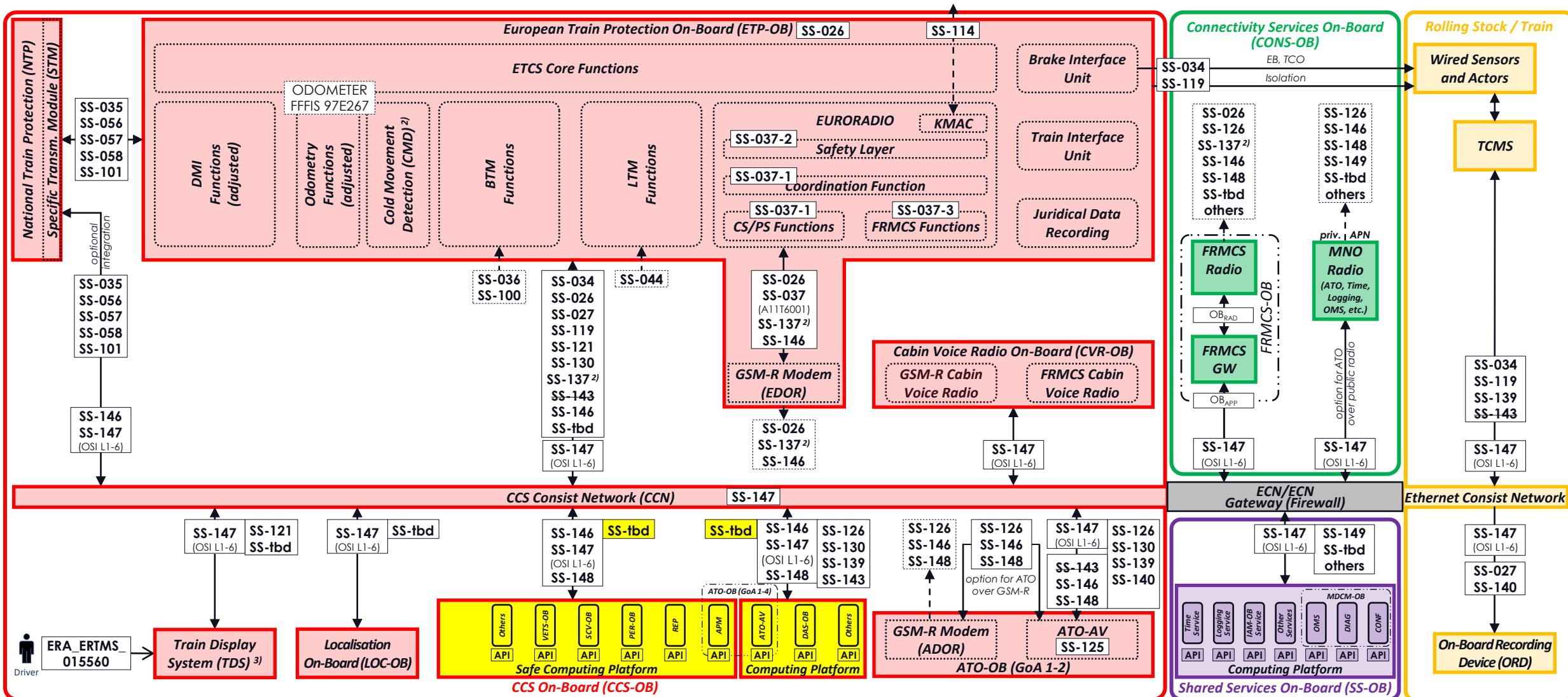
Functionality Level: ETCS, Cab Voice, FRMCS, ATO (GoA 1-2), MDCM, TDS, LOC-OB, Shared Sec. Services, etc.



OCORA modularization proposal for TSI 2028/29 (new vehicles)



Functionality Level: ETCS, Cab Voice, FRMCS, ATO (GoA 1-4), MDCM, TDS, LOC-OB, Shared Sec. Services, DM, etc.



Yellow marks

changes introduced to OCORA proposal, based on TSI 2025/26

OCORA

OCORA-BWS02-030 / v4.00 / 04.07.2023

1) Including amendments for FRMCS

2) refer to related transition regime

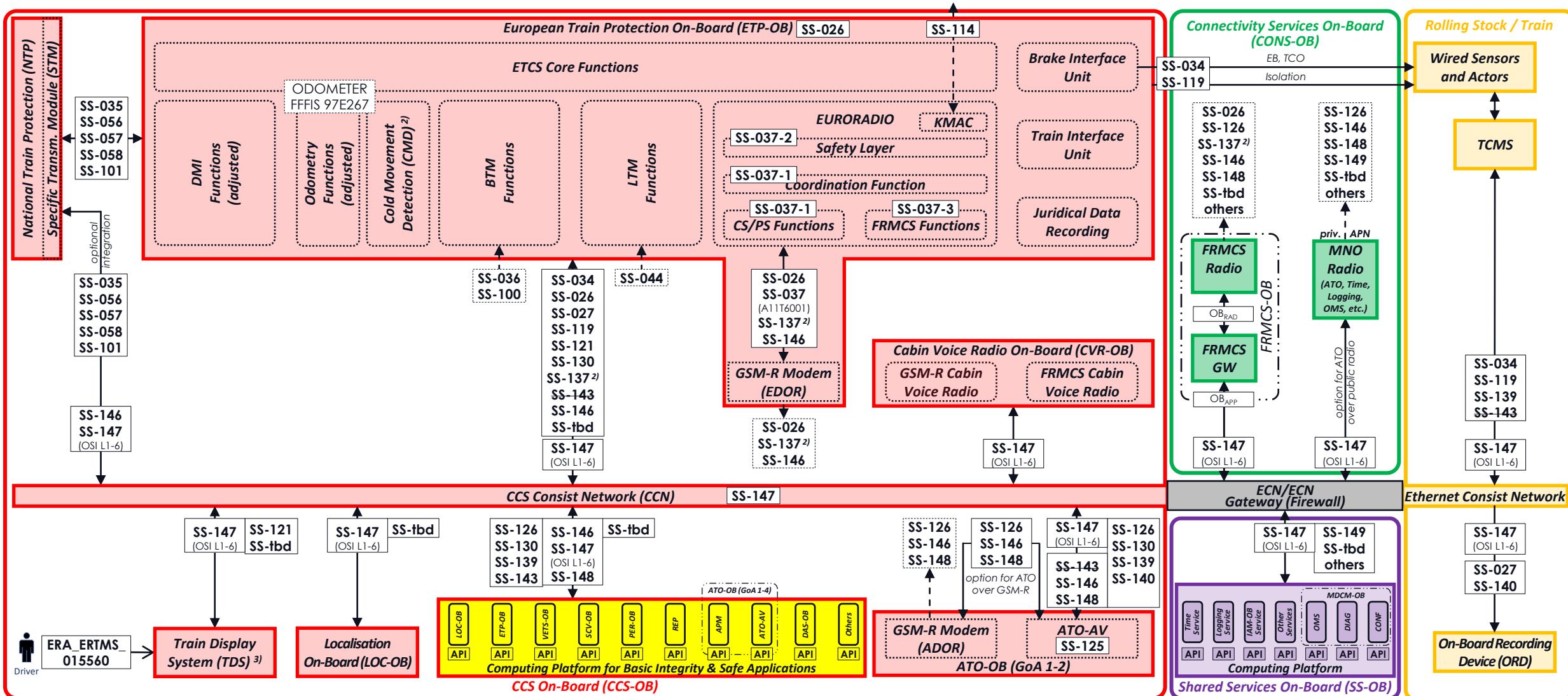
3) May be moved outside of CCS-OB

MDCM-OB: Monitoring, Diagnostics, Configuration, Maintenance On-Board 20

OCORA modularization vision (new vehicles)



Functionality Level: ETCS, Cab Voice, FRMCS, ATO (GoA 1-4), MDCM, TDS, LOC-OB, Shared Sec. Services, DM, etc.



Yellow marks

changes introduced to OCORA proposal, based on TSI 2025/26



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OCORA Modularization

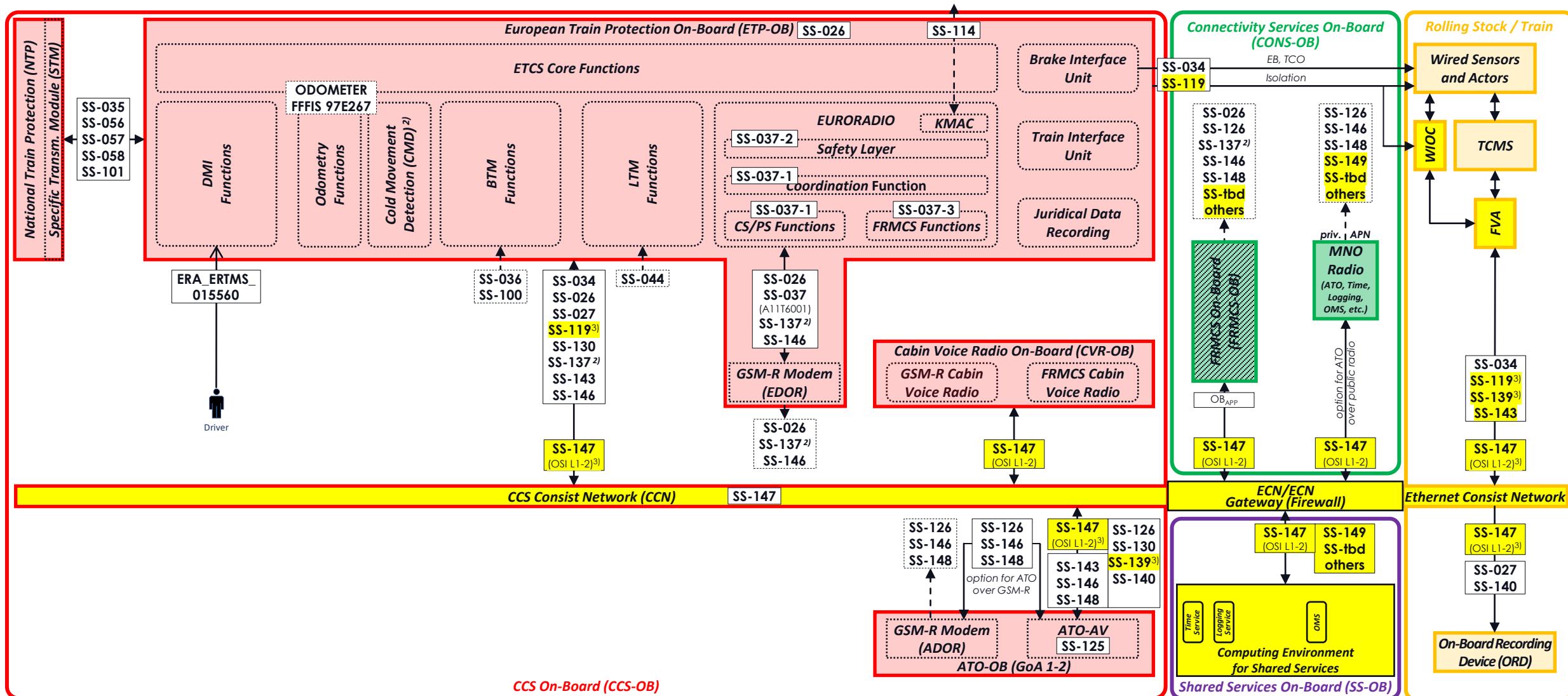
for ETCS upgrades & updates of vehicles in operation
(based on TSI 2023)

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OCORA modularization proposal based on TSI 2023¹⁾ (vehicles in operations)



Functionality Level: ETCS, Cab Voice, FRMCS (ready), ATO (GoA 1-2)



Yellow marks

changes introduced compared to TSI 2023

Green hatched

Not fully specified with TSI 2023 / FRMCS BLO

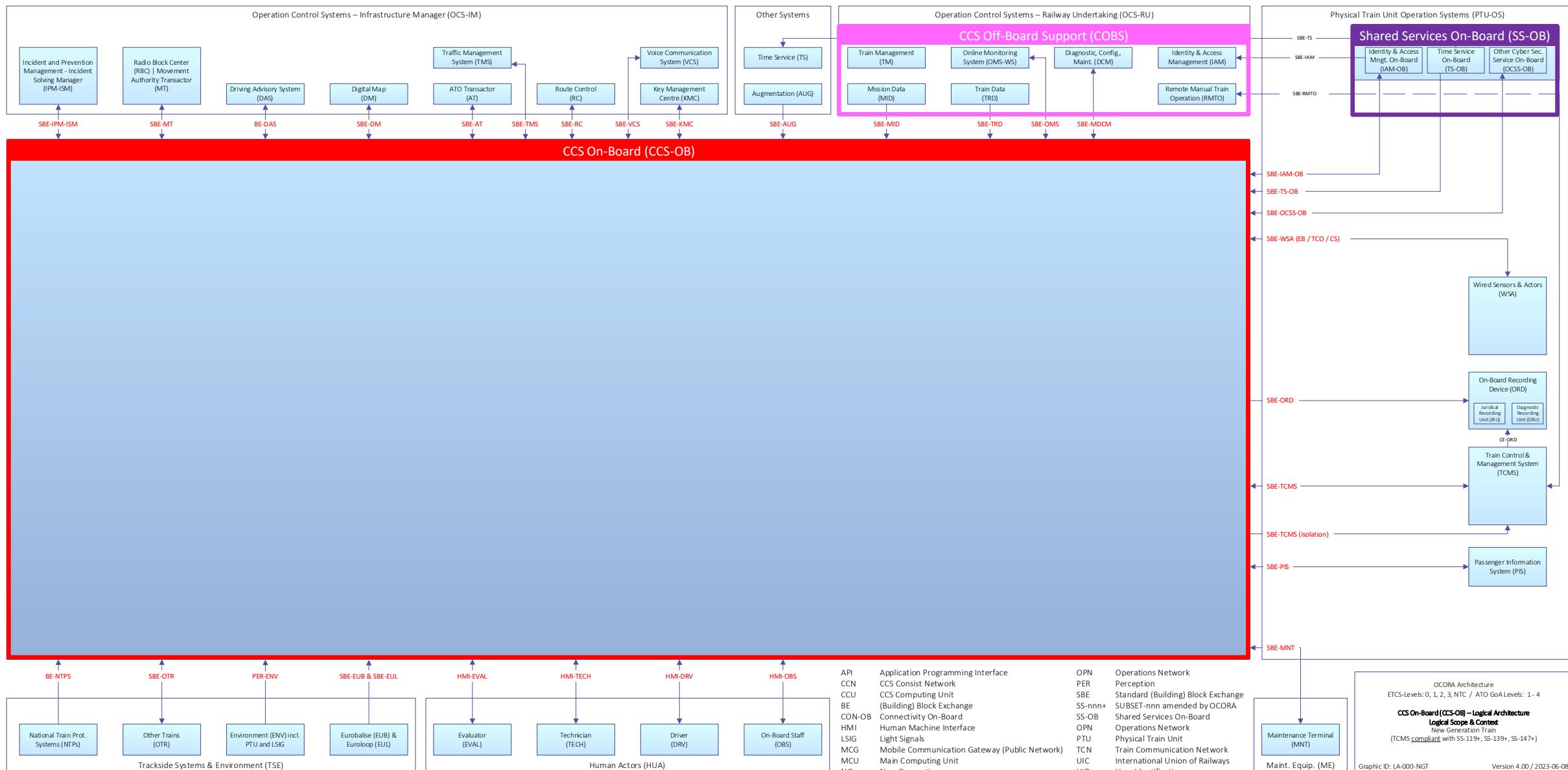


OCORA Scope

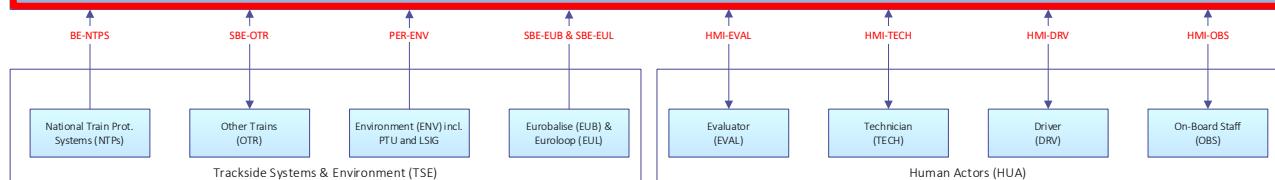
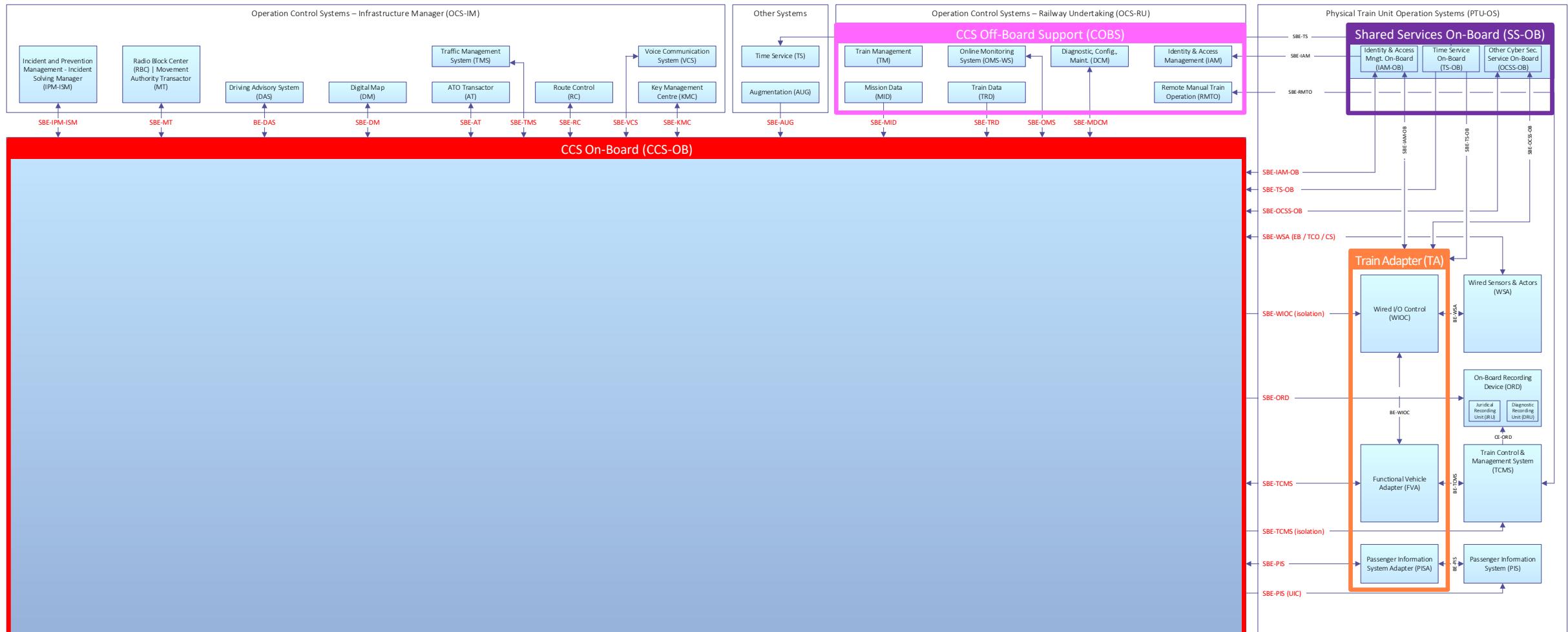
Logical & Physical Architecture

OCORA-BWS02-030 / v4.00 / 04.07.2023

Logical Architecture – Scope & Context (New Generation Train)



Logical Architecture – Scope & Context (Legacy Train Example)



API	Application Programming Interface
CCN	CCS Consist Network
CCU	CCS Computing Unit
BE	(Building) Block Exchange
CON-OB	Connectivity On-Board
HMI	Human Machine Interface
LSIG	Light Signals
MCG	Mobile Communication Gateway (Public Network)
MCU	Main Computing Unit
NG	New Generation

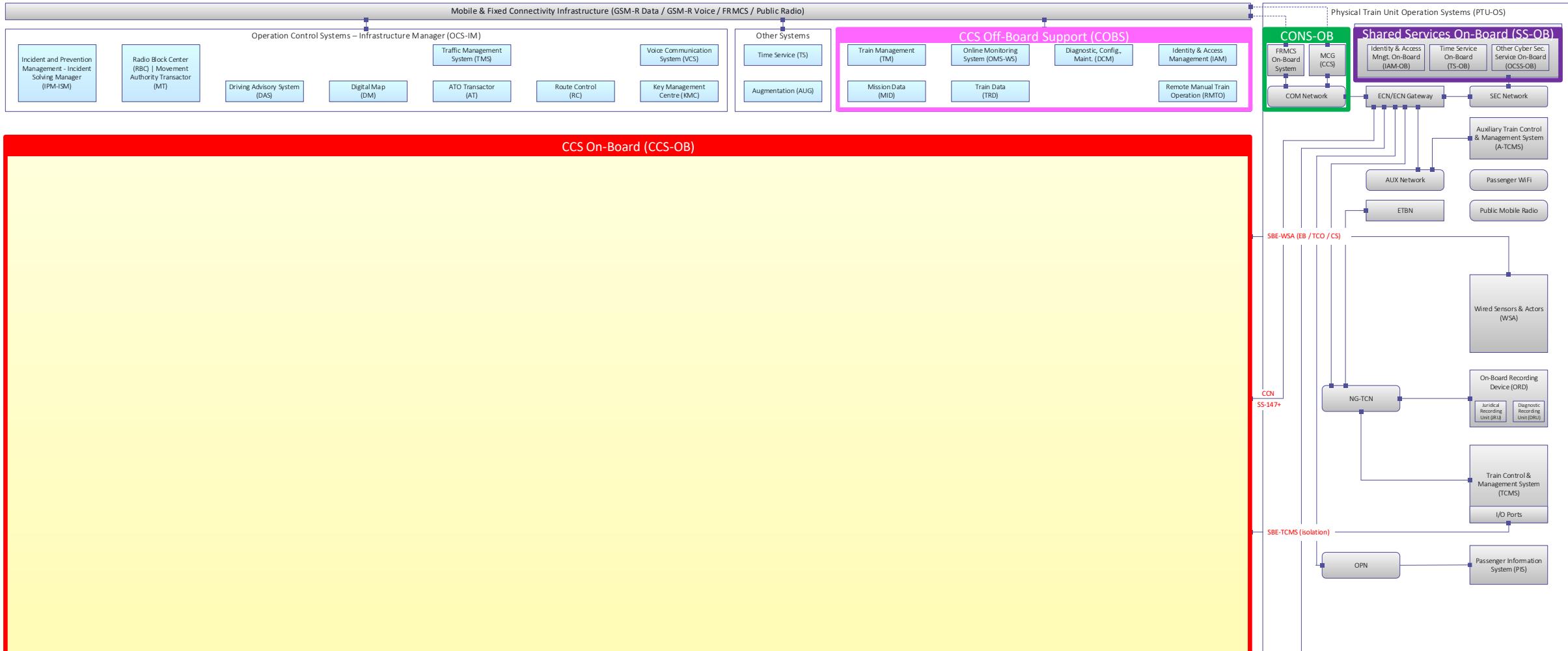
OPN	Operations Network
PER	Perception
SBE	Standard (Building) Block Exchange
SS-nnn+	SUBSET-nnn amended by OCORA
SS-OB	Shared Services On-Board
OPN	Operations Network
PTU	Physical Train Unit
TCN	Train Communication Network
UIC	International Union of Railways
UID	User Identification

OCORA Architecture
ETCS-Levels: 0, 1, 2, 3, NTC / ATO GoA Levels: 1 - 4
CCS On-Board (CCS-OB) – Logical Architecture
Logical Scope & Context Legacy Train Example (TCMS not compliant with SS-119+, SS-139+, SS-147+)

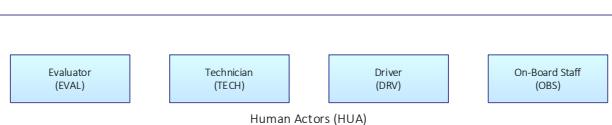
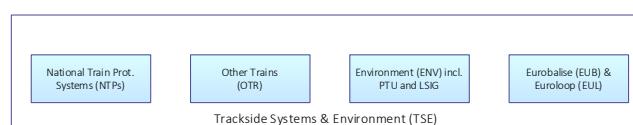
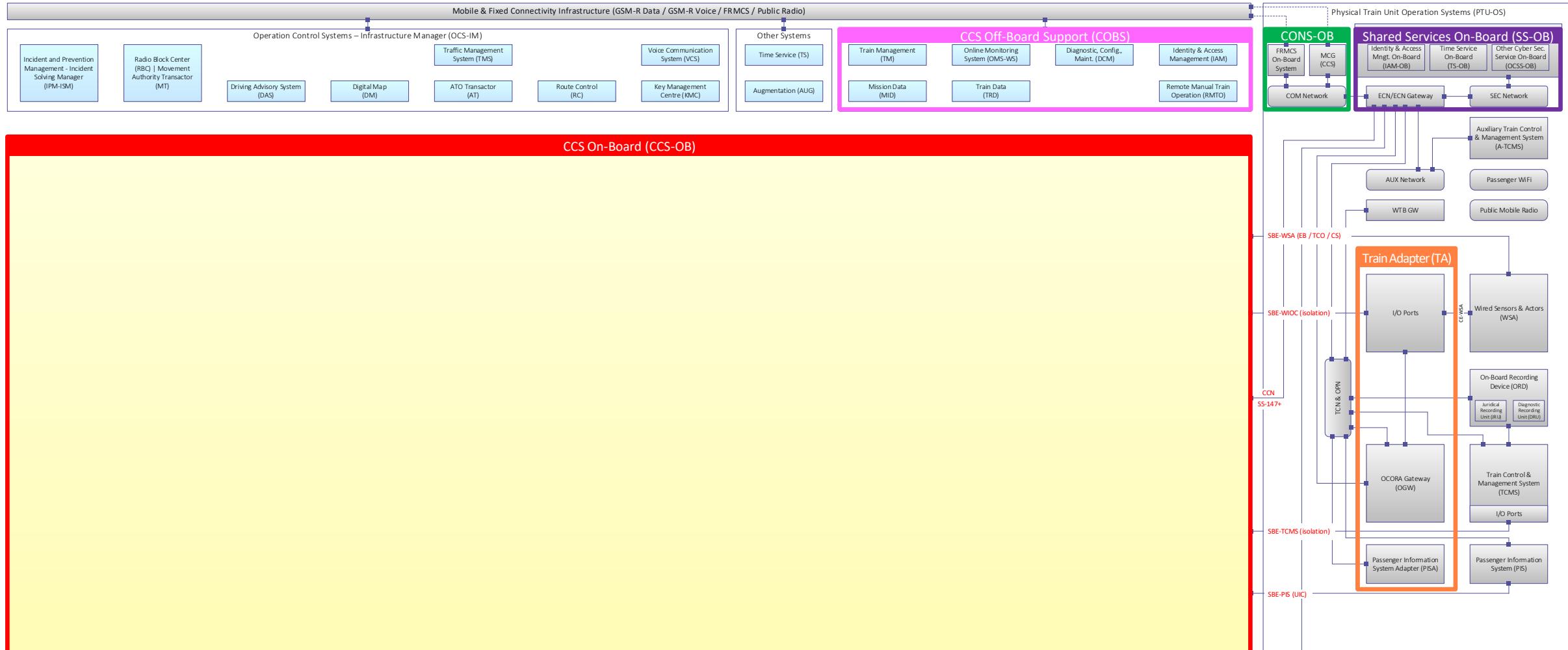
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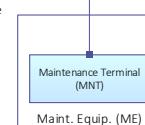
Physical Architecture – Scope & Context (New Generation Train)



Physical Architecture – Scope & Context (Legacy Train Example)



API	Application Programming Interface
CCN	CCS Consist Network
CCU	CCS Computing Unit
BE	(Building) Block Exchange
CON-OB	Connectivity On-Board
HMI	Human Machine Interface
LSIG	Light Signals
MCG	Mobile Communication Gateway (Public Network)
MCU	Main Computing Unit
NG	New Generation
OPN	Operations Network
PER	Perception
SBE	Standard (Building) Block Exchange
SS-nnn+	SUBSET-nnn amended by OCORA
SS-OB	Shared Services On-Board
OPN	Operations Network
PTU	Operations Train Unit
TCN	Train Communication Network
UIC	International Union of Railways
UID	User Identification



OCORA Architecture
ETCS-Levels: 0, 1, 2, 3, NTC / ATO GoA Levels: 1 - 4
CCS On-Board (CCS-OB – Physical Architecture)
Physical Scope & Context
Legacy Train Example
(TCMS not compliant with SS-119+, SS-139+, SS-147+)
Graphic ID: PA-000-LTE
Version 4.00 / 2023-06-08



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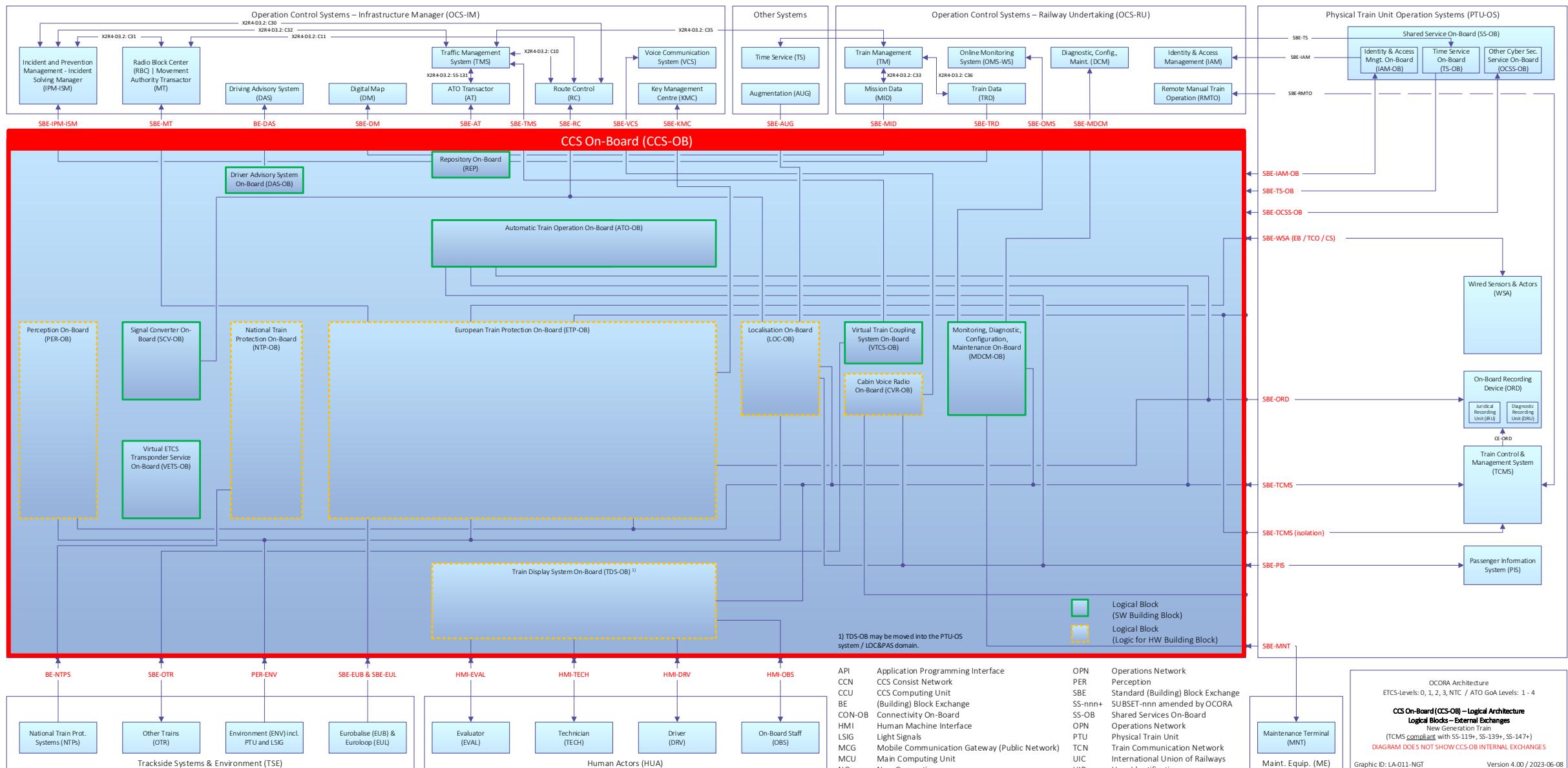


CCS On-Board (CCS-OB)

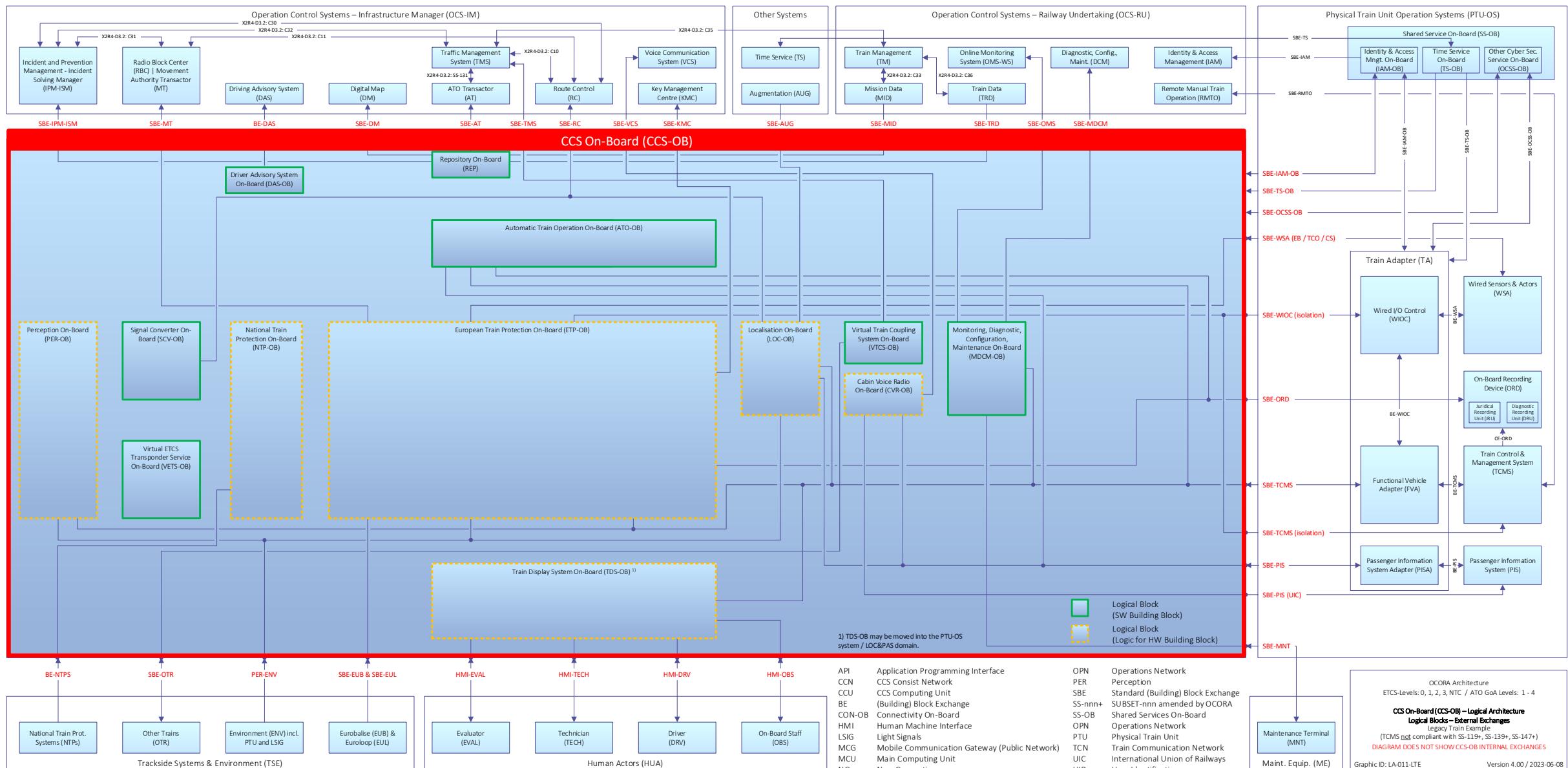
Logical Architecture

OCORA-BWS02-030 / v4.00 / 04.07.2023

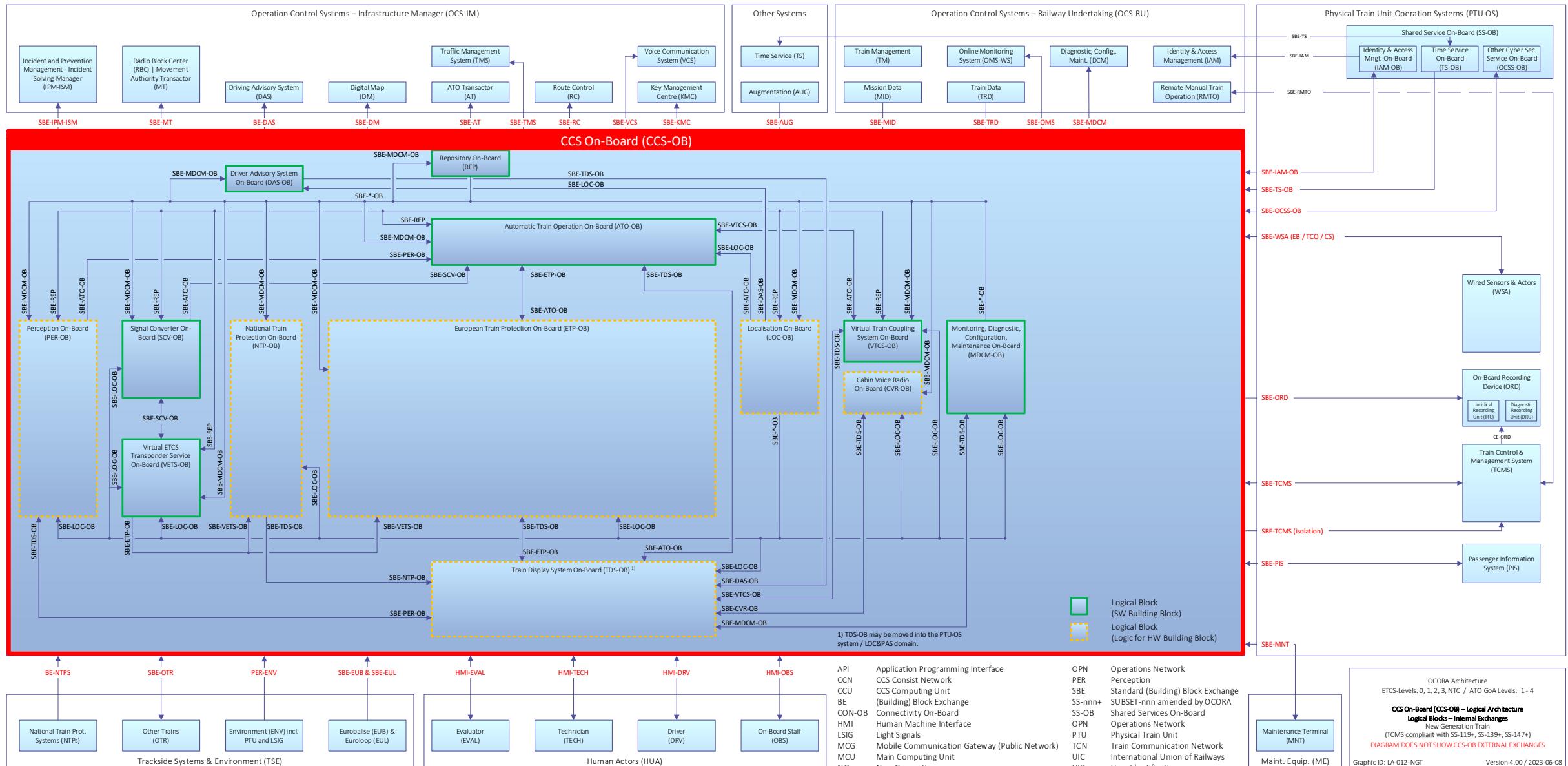
Logical Blocks – External Exchanges (New Generation Train)



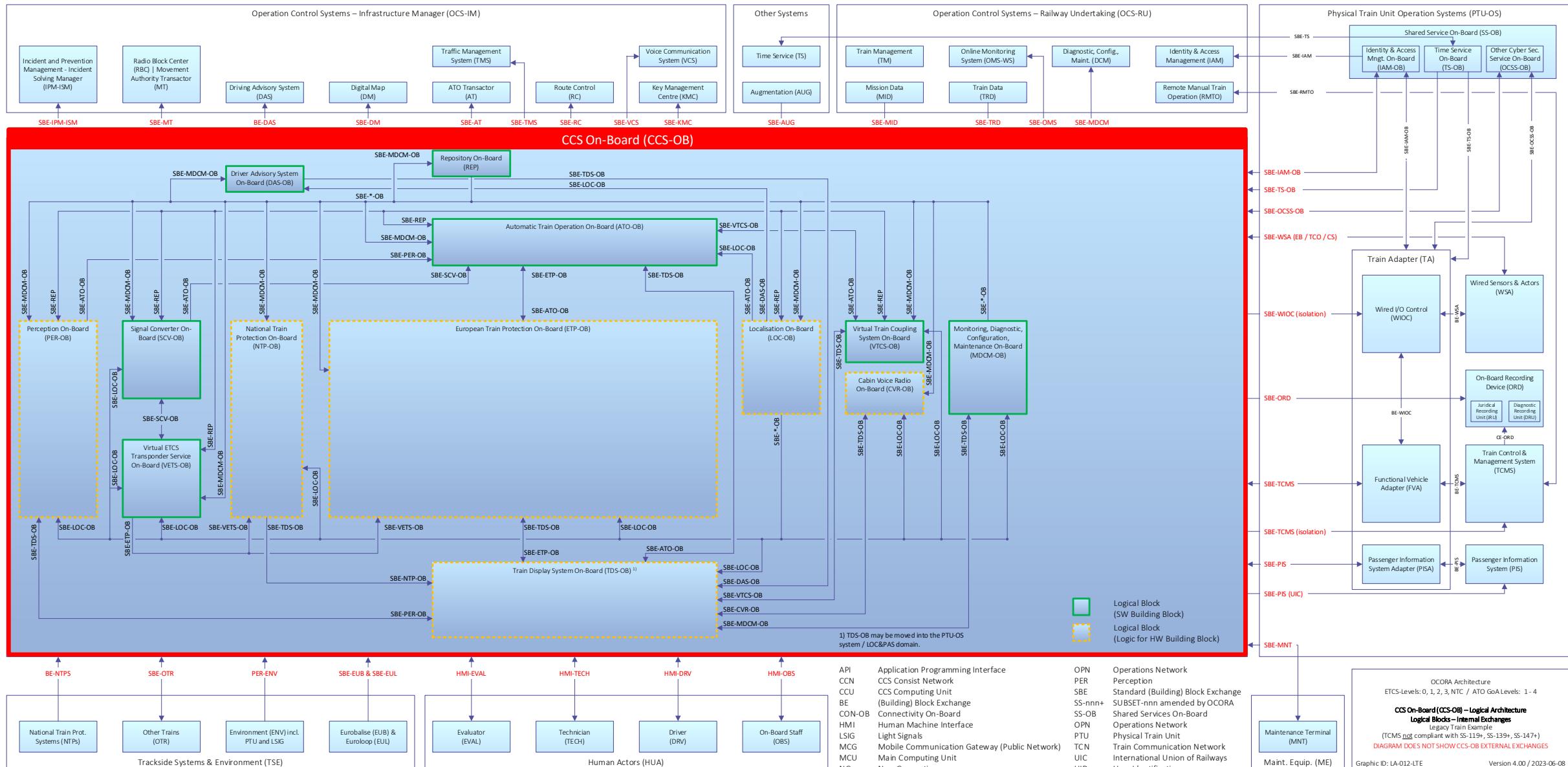
Logical Blocks – External Exchanges (Legacy Train Example)



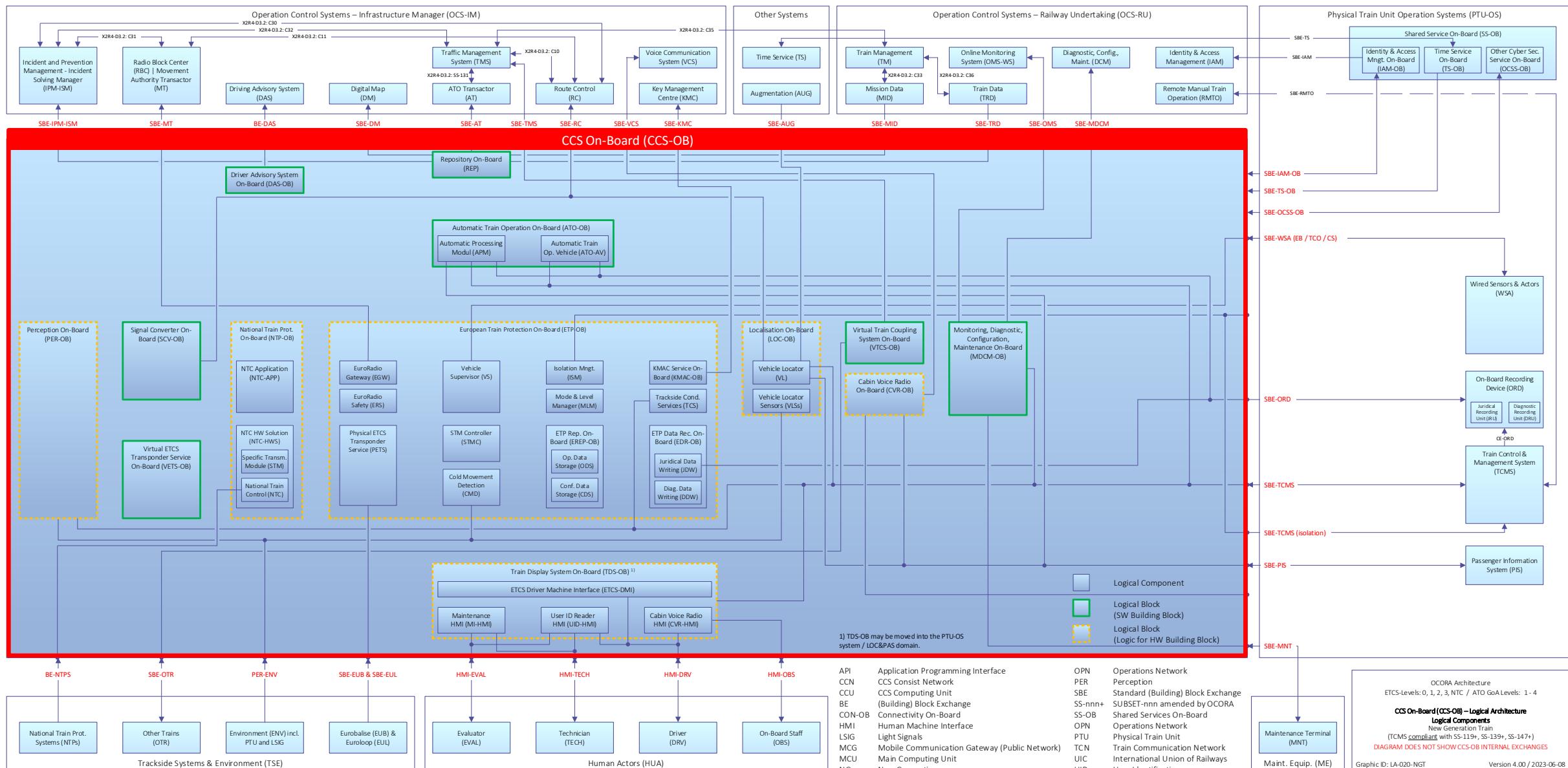
Logical Blocks – Internal Exchanges (New Generation Train)



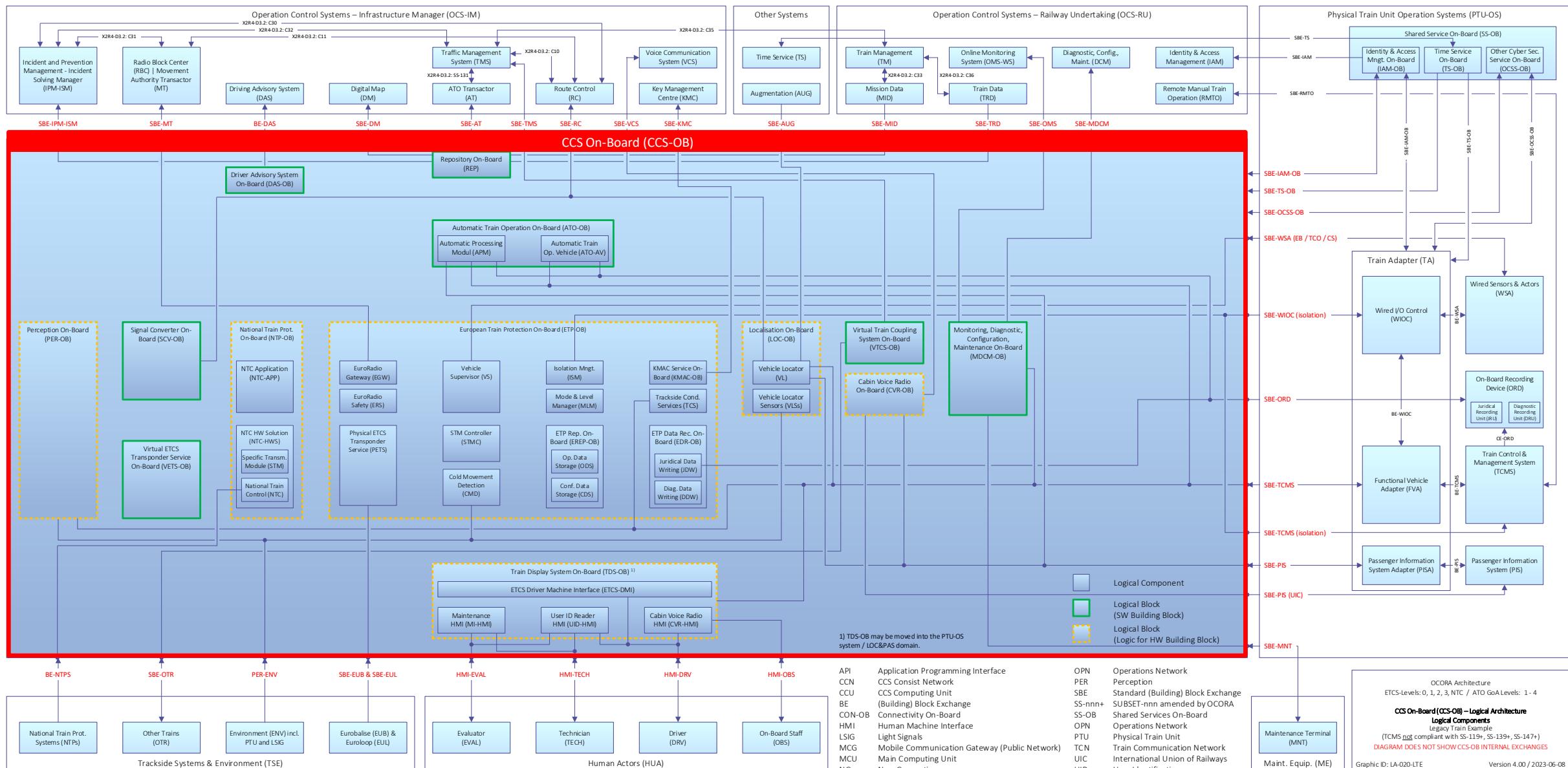
Logical Blocks – Internal Exchanges (Legacy Train Example)



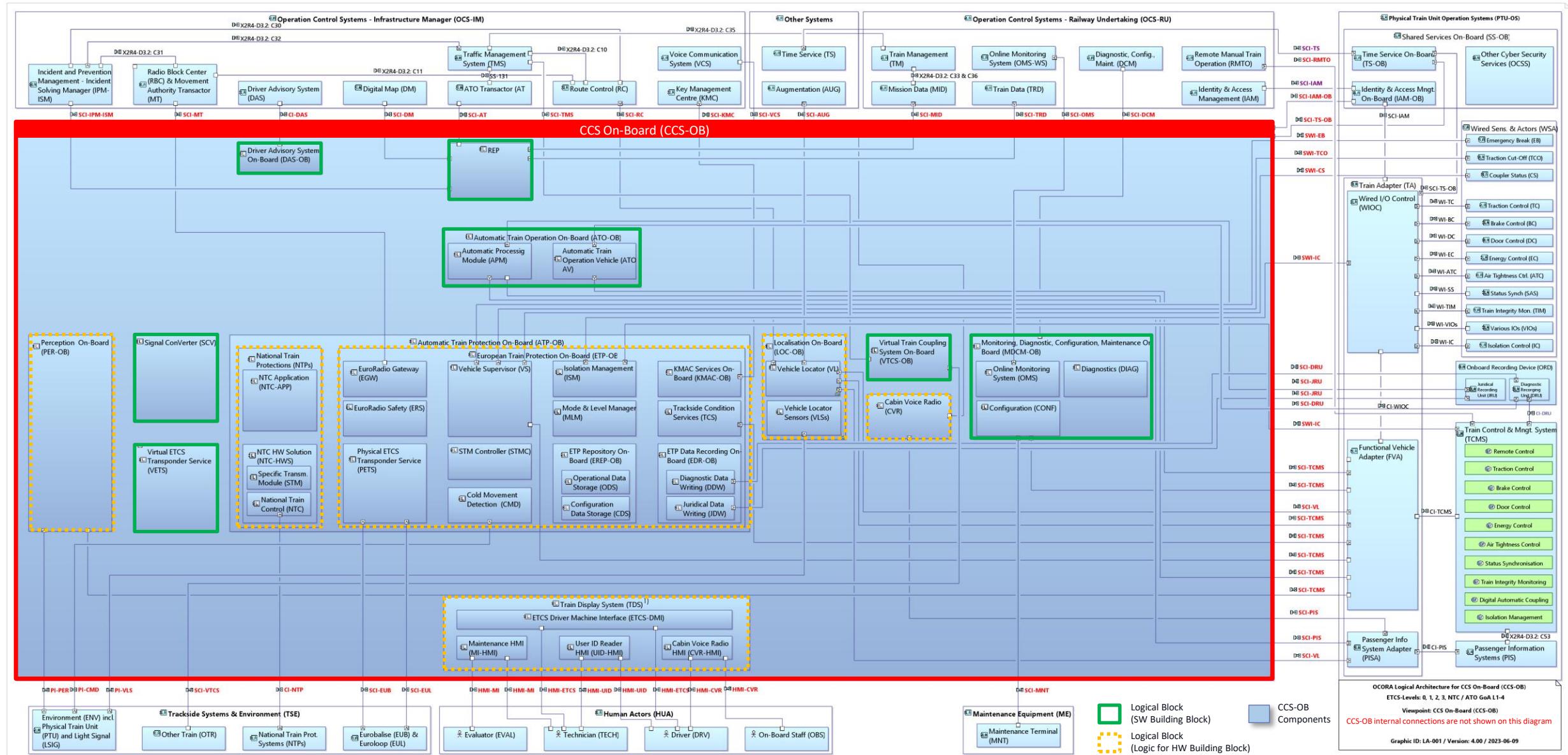
Logical Components (New Generation Train)



Logical Components (Legacy Train Example)



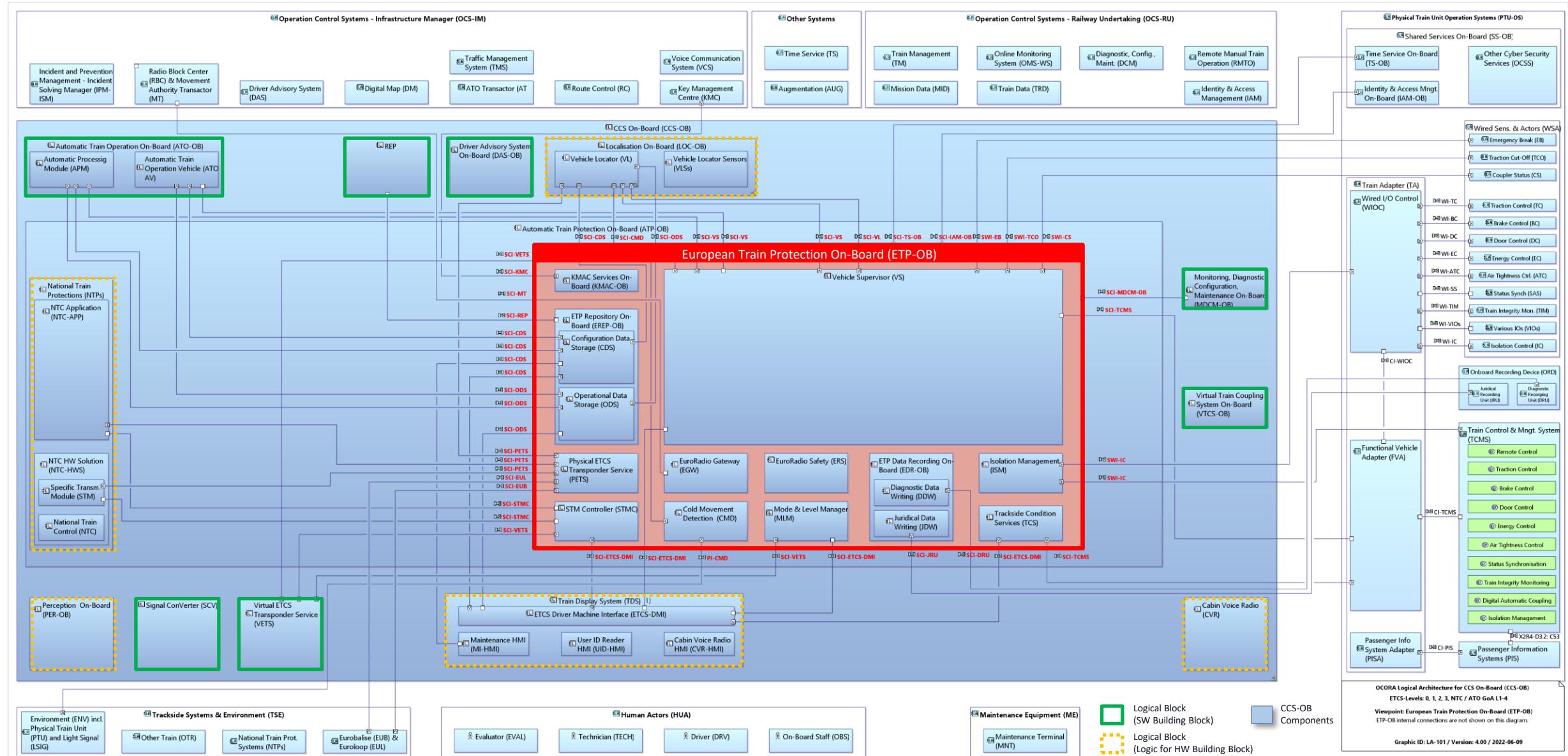
External Logical Interfaces (Legacy Train Example)



1) TDS-OB may be moved into the PTU-OS / LOC&PAS domain.



External Logical Interfaces – ETP-OB (Legacy Train Example)

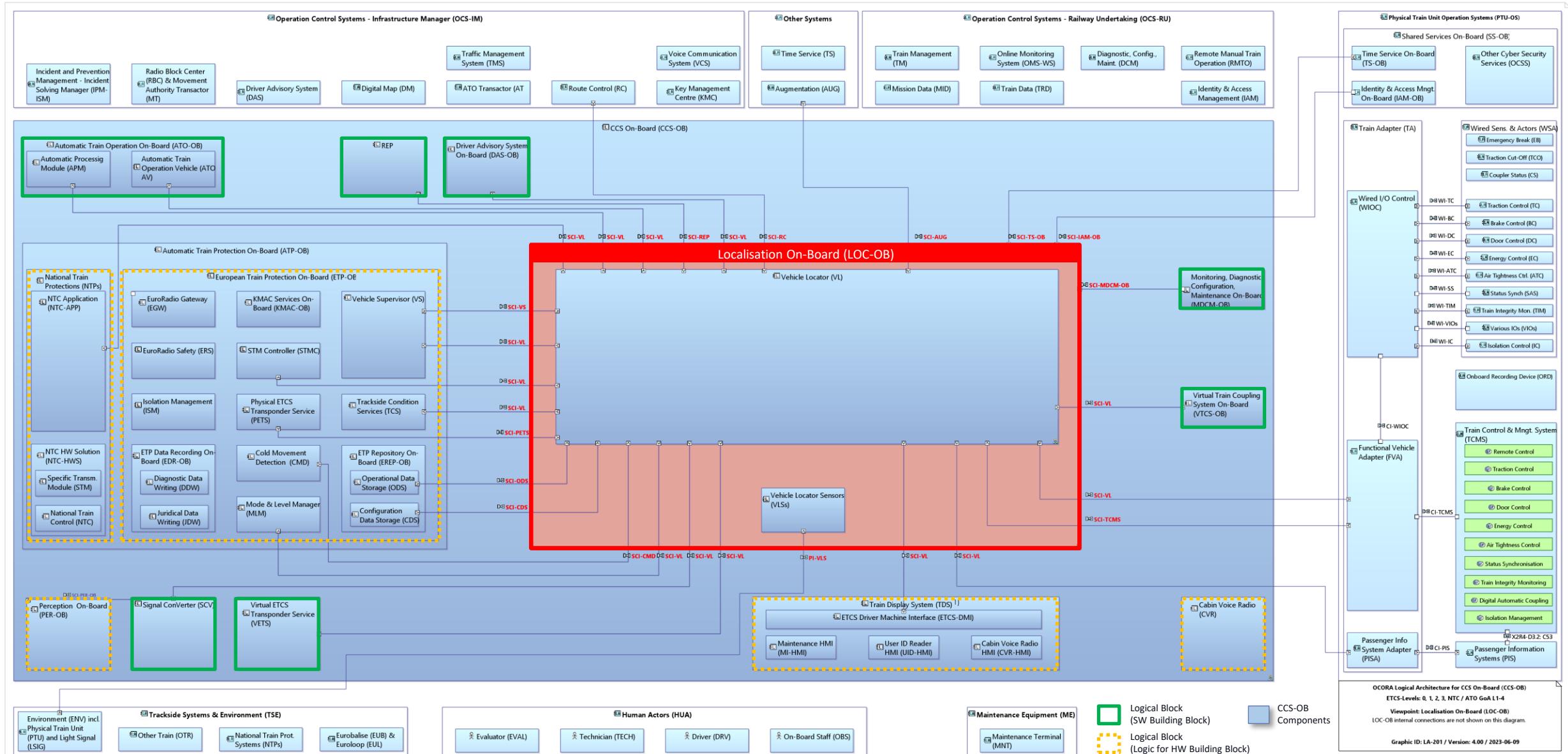


1) TDS-OB may be moved into the PTU-OS / LOC&PAS domain.



External Logical Interfaces – LOC-OB

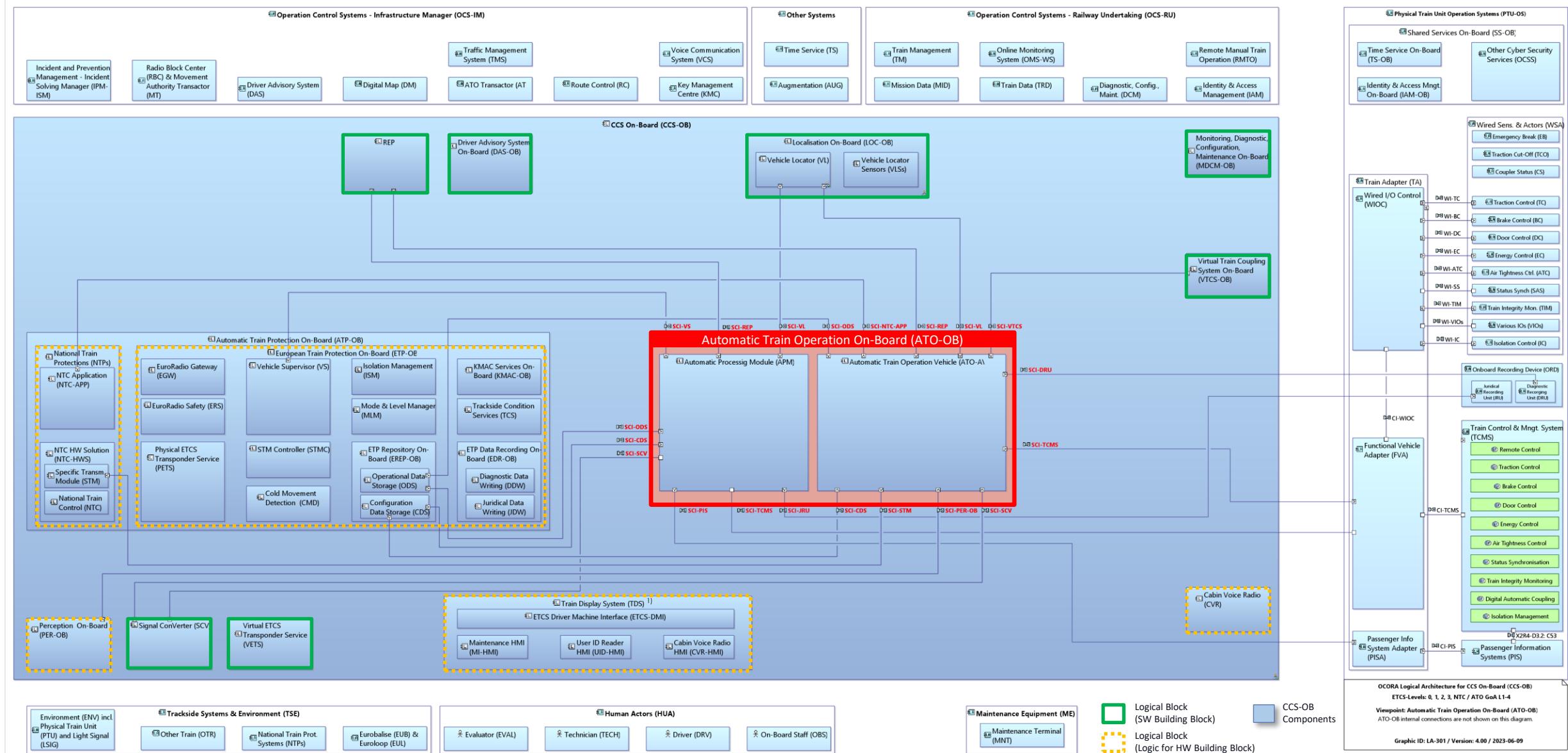
(Legacy Train Example)



1) TDS-OB may be moved into the PTU-OS / LOC&PAS domain.



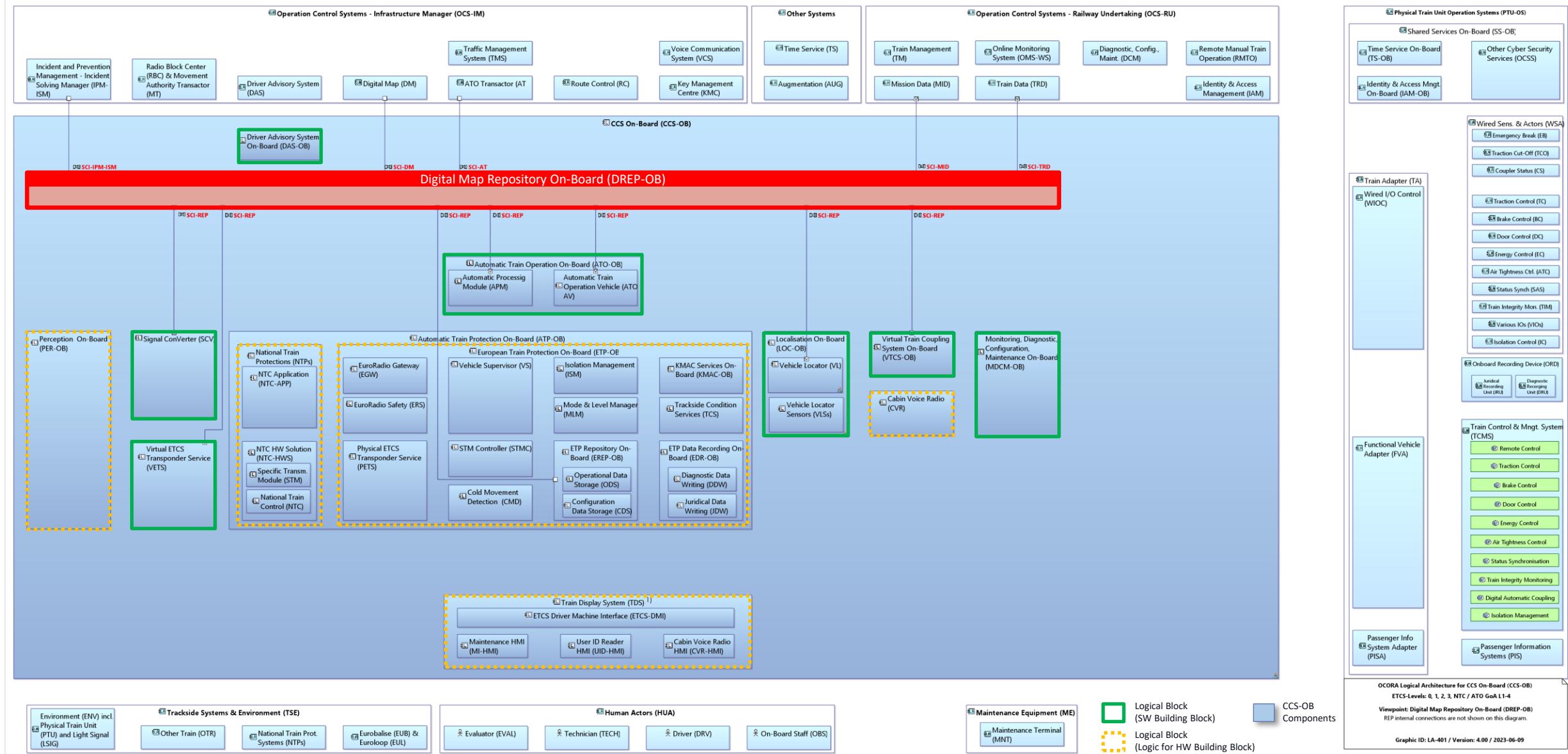
External Logical Interfaces – ATO-OB (Legacy Train Example)



1) TDS-OB may be moved into the PTU-OS / LOC&PAS domain.



External Logical Interfaces – REP (Legacy Train Example)



1) TDS-OB may be moved into the PTU-OS / LOC&PAS domain.





CCS On-Board (CCS-OB)

Physical Architecture – Building Blocks

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Definition

- A **Building Block** is a sourceable unit of the CCS on-board system (hardware and/or software), having standardised functionality, standardised PRAMSS requirements (including Tolerable Functional Failure Rate [TFFR], Safety Integrity Level [SIL] and Safety Related Application Conditions [SRAC]), standardised interfaces (on all OSI Layers) towards other building blocks and/or external systems.

Building Blocks are separately sourceable from different suppliers and capable of being integrated by a third party.

There are 2 types of building blocks: a) Hardware Building Blocks and b) Software Building Blocks.

- **Hardware Building Blocks** consist of hardware and typically software that provide the building block's functionality. They exclusively communicate with each other and with external systems through the CCS Communication Network (CCN) using standardised interfaces.
- **Software Building Blocks** consist of software that provide the building block's functionality. They are deployed on an instance of the Generic Safe Computing Platform (SCP) and shall communicate with each other through the standardised Platform Independent Application Programming Interface (PI-API). Communication with computing platform external building blocks and systems is realised by the Computing Platform (integrating with the CCN).

Software Building Blocks are portable i.e., they may be deployed on different Computing Platform implementations.

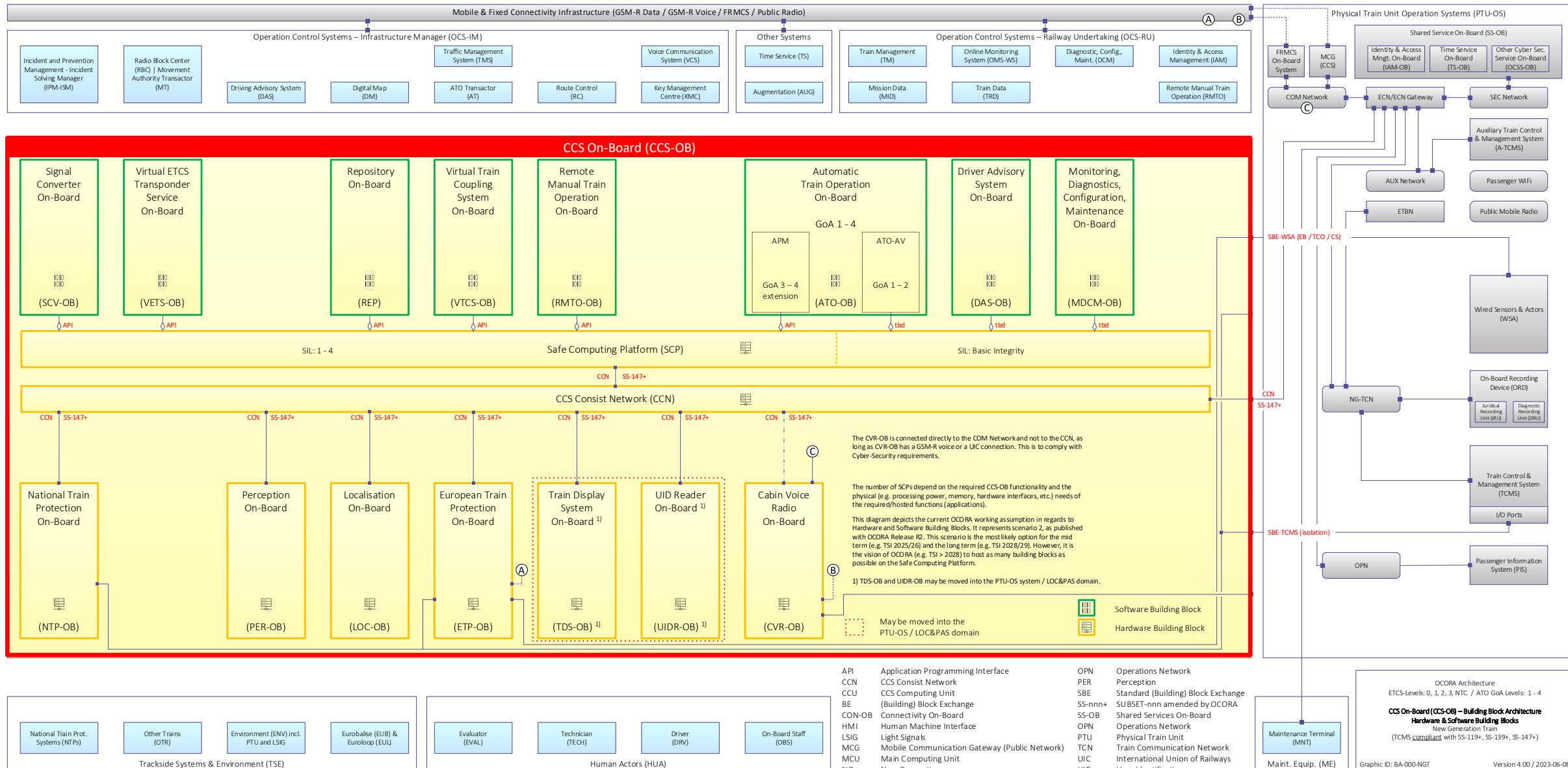


Building Blocks support the following OCORA design objectives:

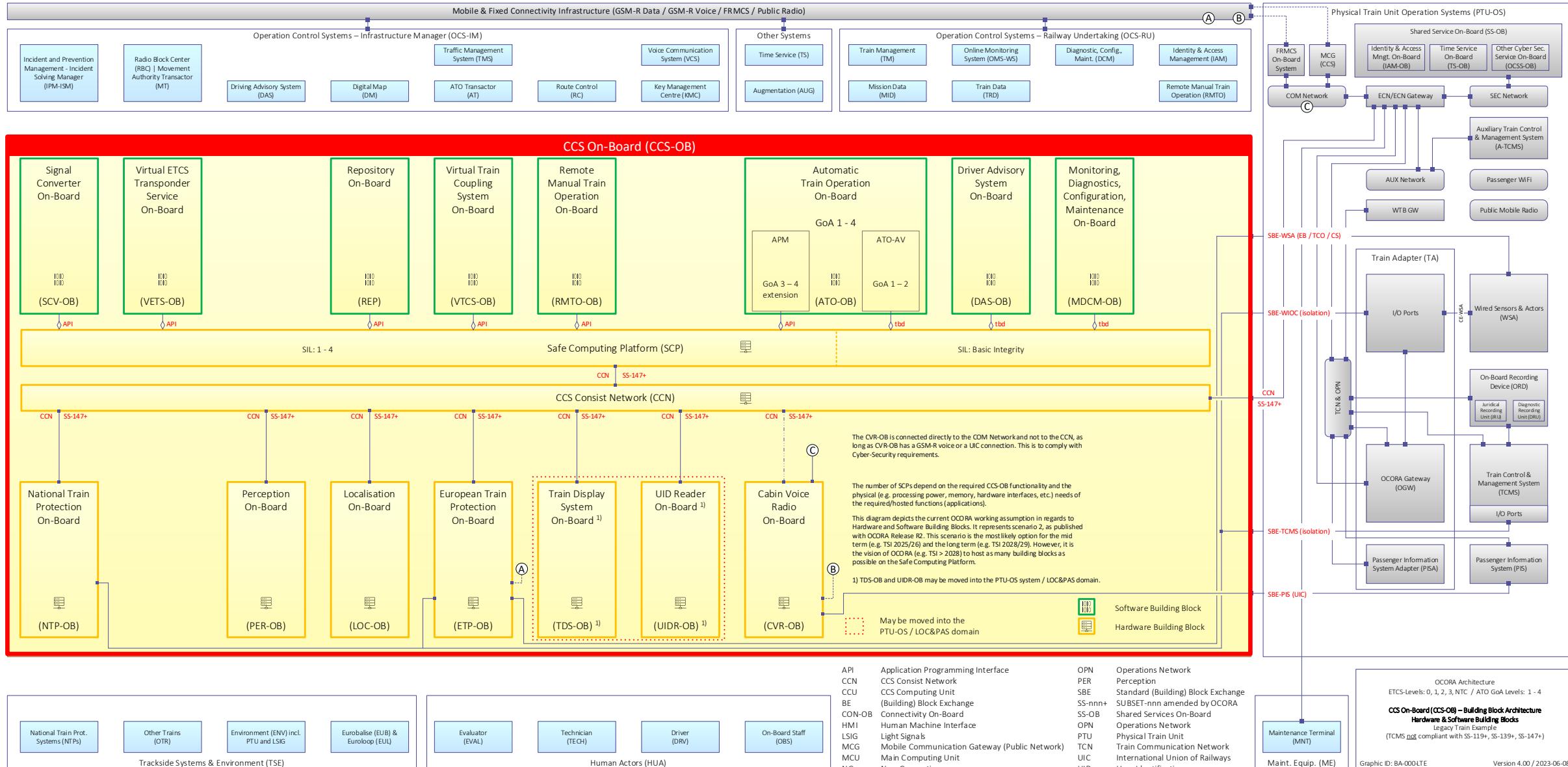
- **Exchangeability:** Building Blocks are individually exchangeable, by a third party integrator, with a building blocks of the same or of a different supplier without the involvement of any other building block supplier.
- **Migrateability:** Building blocks are individually migratable (introducing bug-fixes, improvements, new functionality), without affecting the other building blocks, unless changes on external interfaces are needed that are not backward compatible (note: backward in-compatible changes must be avoided, if possible).
- **Portability:** Software Building Blocks are portable. This means, that they runs un-changed, based on the generalized abstraction, on different (computing) platform implementations.
- **Evolvability:** Building blocks support the evolvement of the overall CCS.

Building Blocks also support the OOCRA vision for simplicity (reduced complexity) and for improved maintainability.

CCS-OB Building Blocks (New Generation Train)



CCS-OB Building Blocks (Legacy Train Example)





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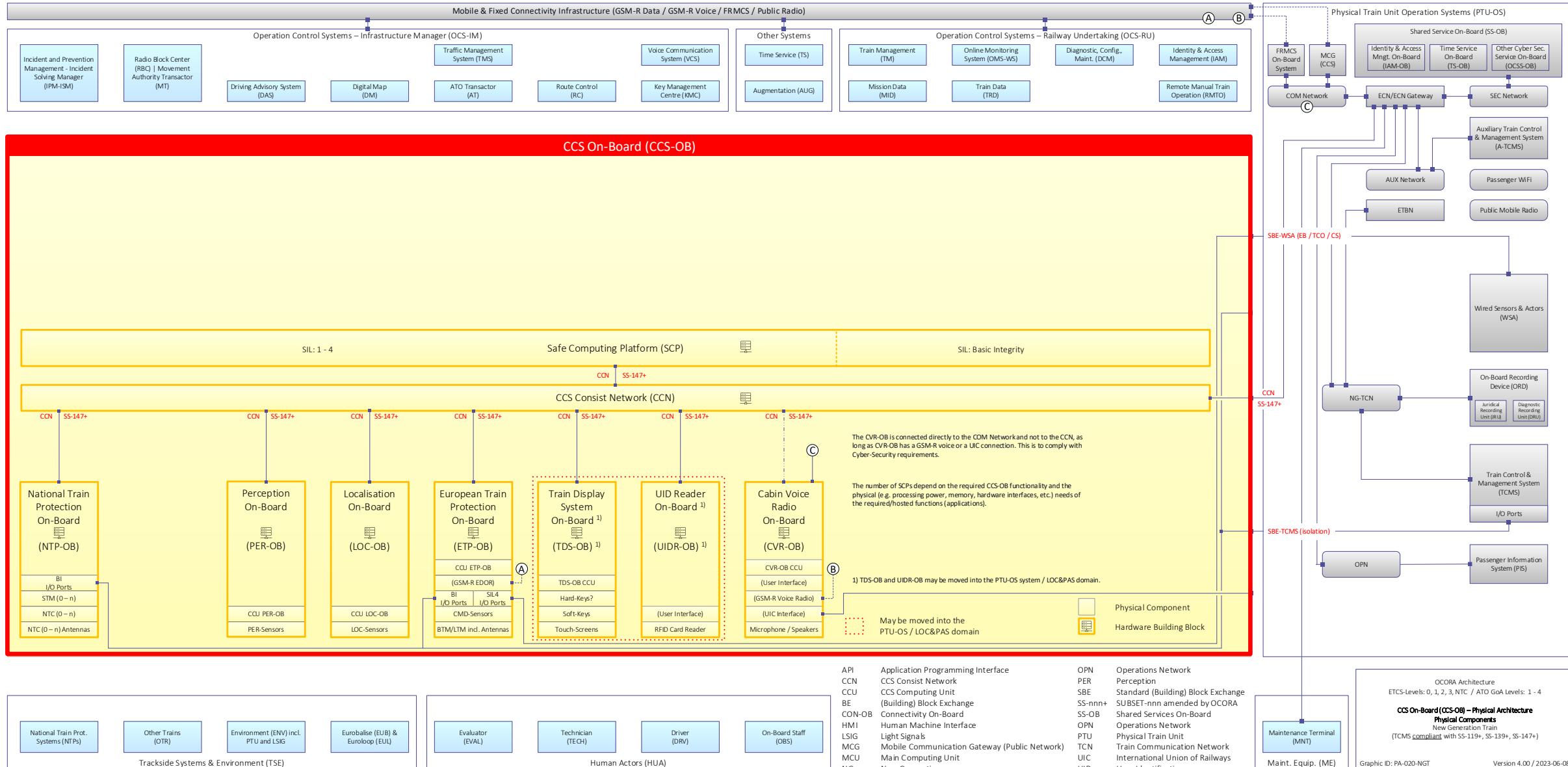


CCS On-Board (CCS-OB)

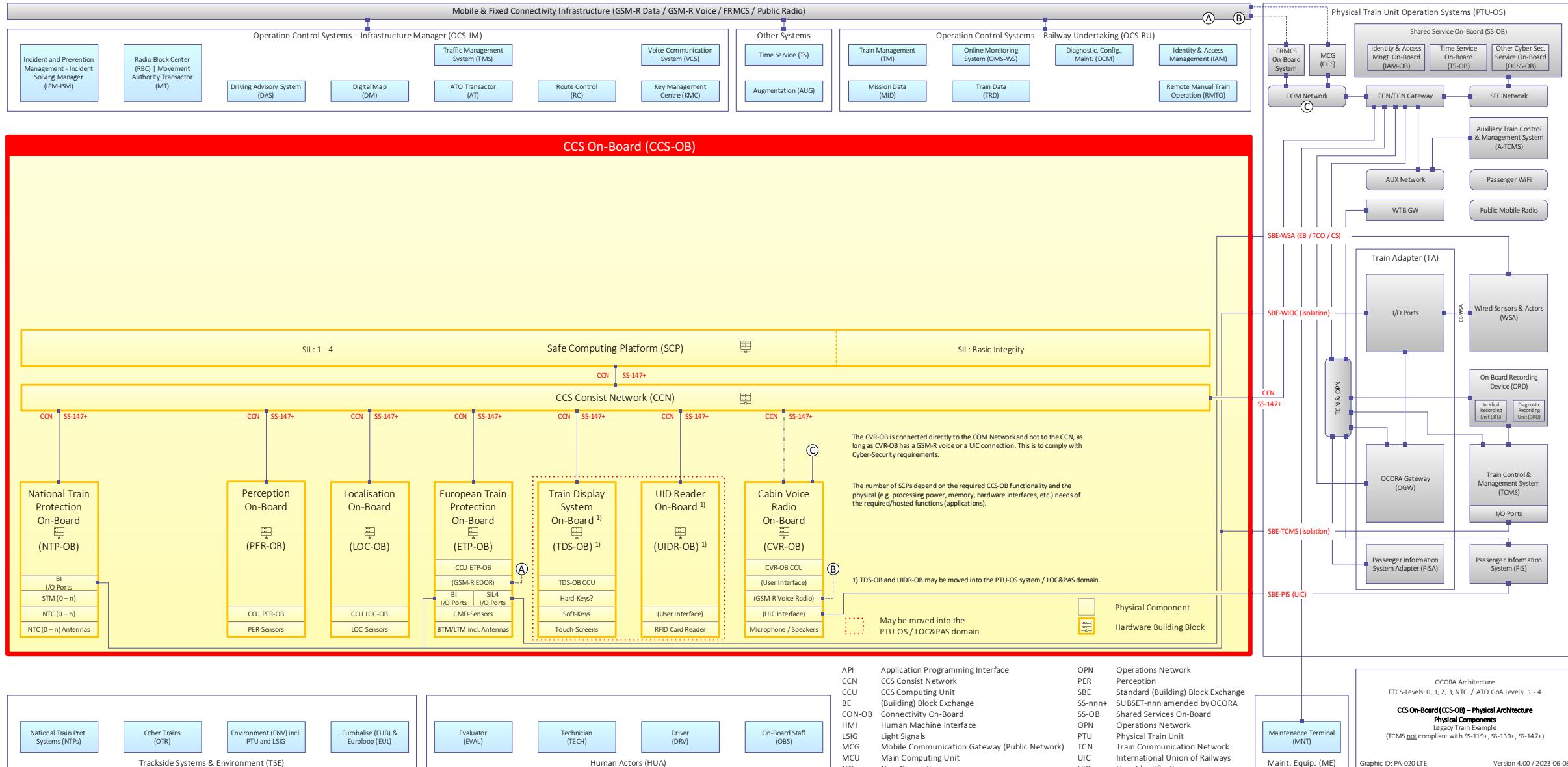
Physical Architecture – Hardware Block Diagram

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CCS-OB Hardware Block Diagram (New Generation Train)



CCS-OB Hardware Block Diagram (Legacy Train Example)





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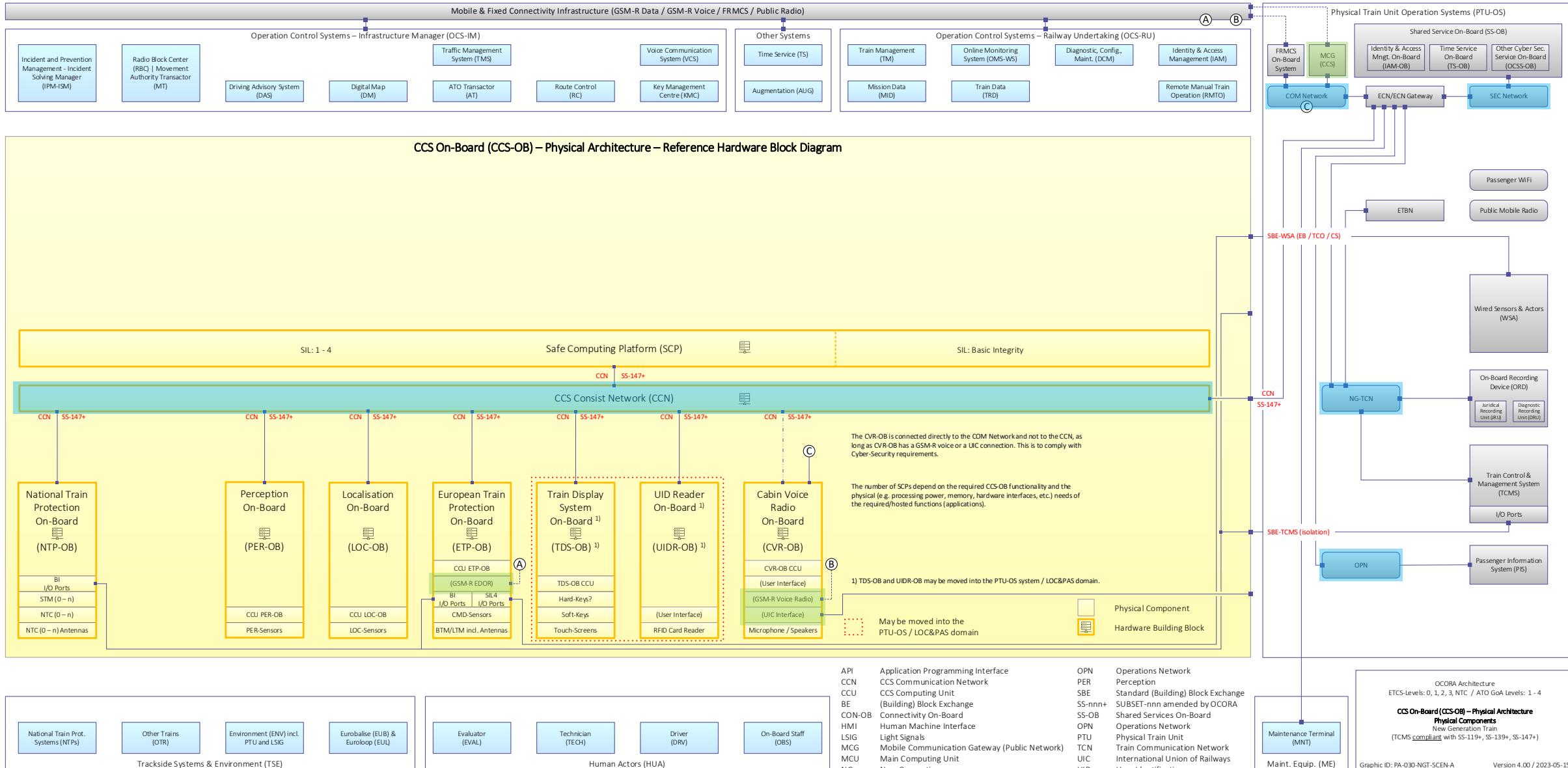
CCS On-Board (CCS-OB)

Physical Architecture – Train Integration Scenarios

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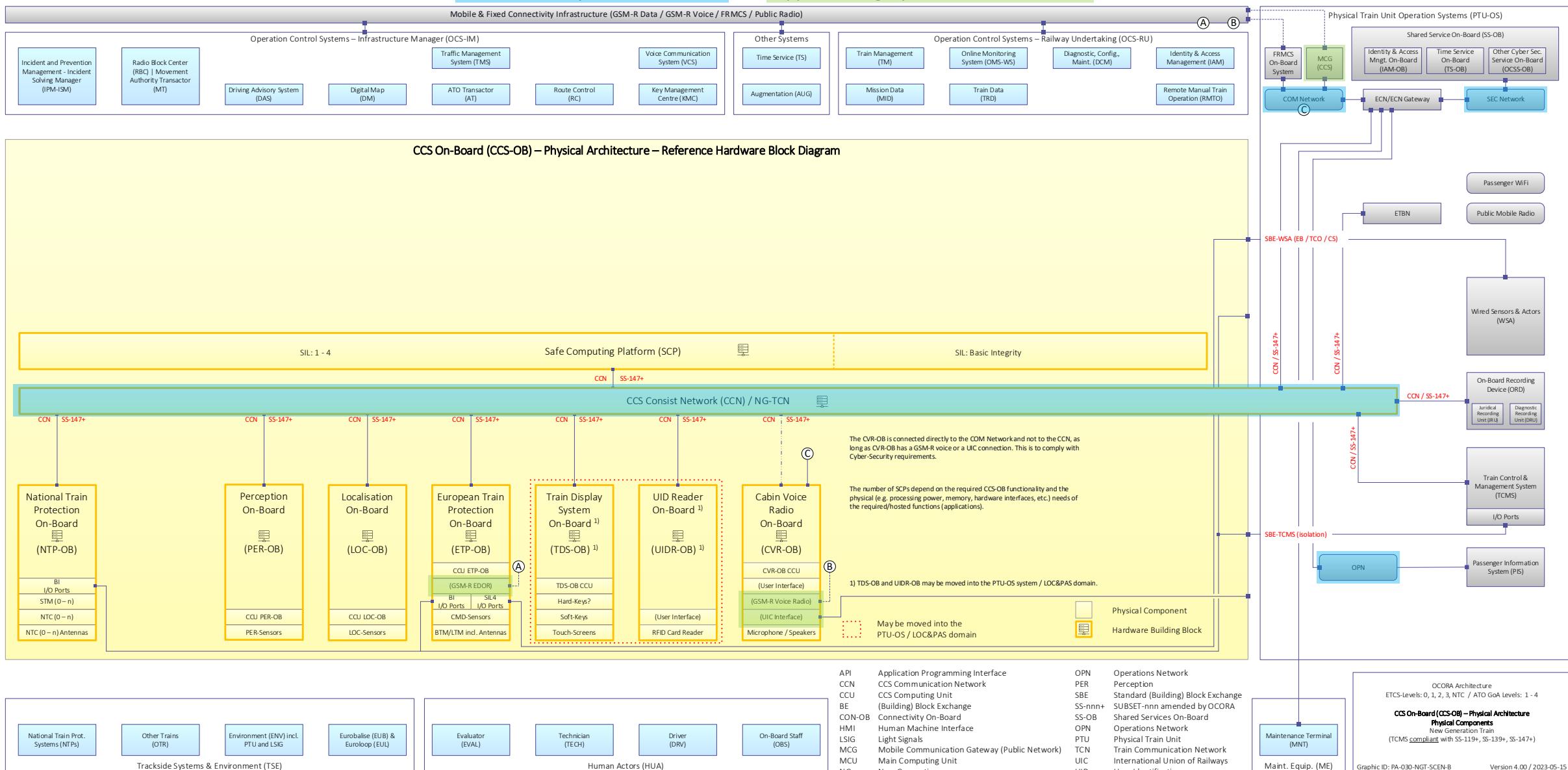
NG-TCN Train – Scenario A

(CCN as physically separated network from Sec Net, Op Net, NG TCN and Com Net with support for legacy trackside infrastructure)



NG-TCN Train – Scenario B

(CCN as logically separated network from NG TCN and physically separated from Sec Net, Op Net and Com Net with support for legacy trackside infrastructure)



NG-TCN Train – Scenario C

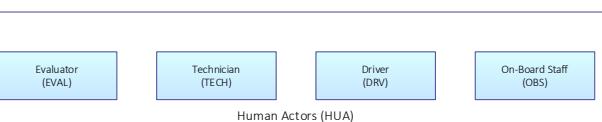
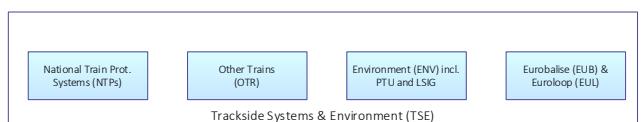
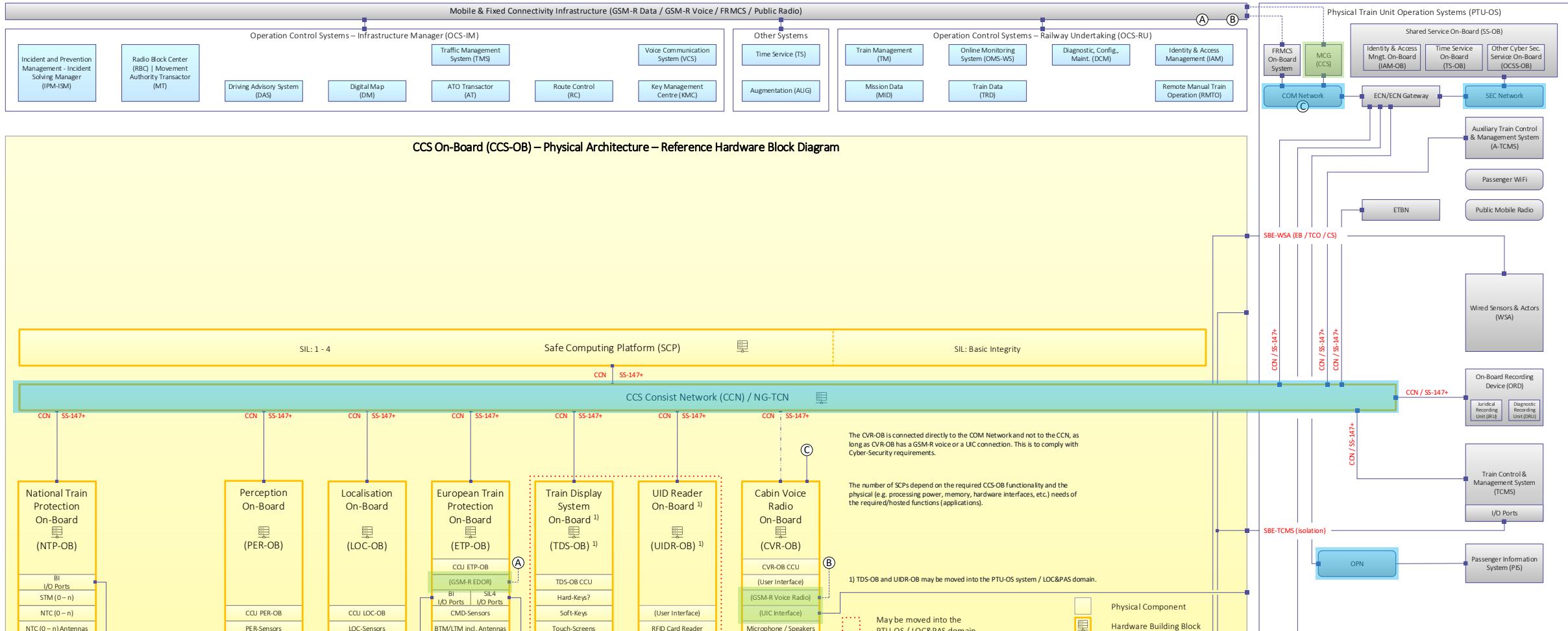
(Common CCN and TCMS network logically separated from A-TCMS and physically separated from Sec Net, Op Net and Com Net with support for legacy trackside infrastructure)



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DB



API	Application Programming Interface
CCN	CCS Communication Network
CCU	CCS Computing Unit
BE	Building Block Exchange
CON-OB	Connectivity On-Board
HMI	Human Machine Interface
LSIG	Light Signals
MCG	Mobile Communication Gateway (Public Network)
MCU	Main Computing Unit
NG	New Generation

OPN	Operations Network
PER	Perception
SBE	Standard (Building) Block Exchange
SS-nnn+	SBUSSET-nnn amended by OCORA
SS-OB	Shared Services On-Board
OPN	Operations Network
PTU	Physical Train Unit
TCN	Train Communication Network
UIC	International Union of Railways
UID	User Identification

OCORA Architecture	ETCS-Levels: 0, 1, 2, 3, NTC / ATO GoA Levels: 1 - 4
CCS On-Board (CCS-OB) – Physical Architecture	
Physical Components	
New Generation Train (TCMS compliant with SS-119+, SS-139+, SS-147+)	

Graphic ID: PA-030-NGT-SCEN-C Version 4.00 / 2023-05-15

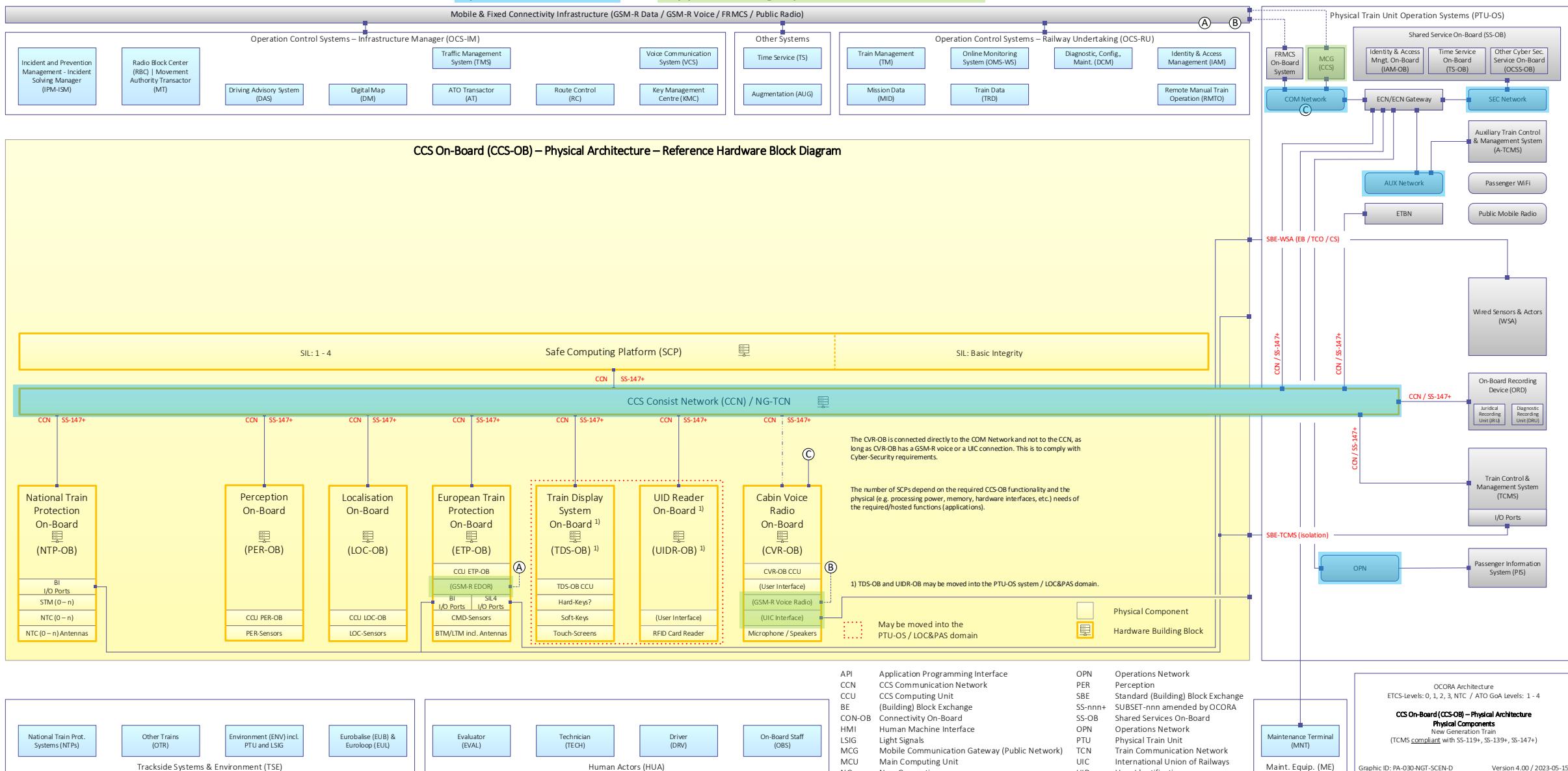


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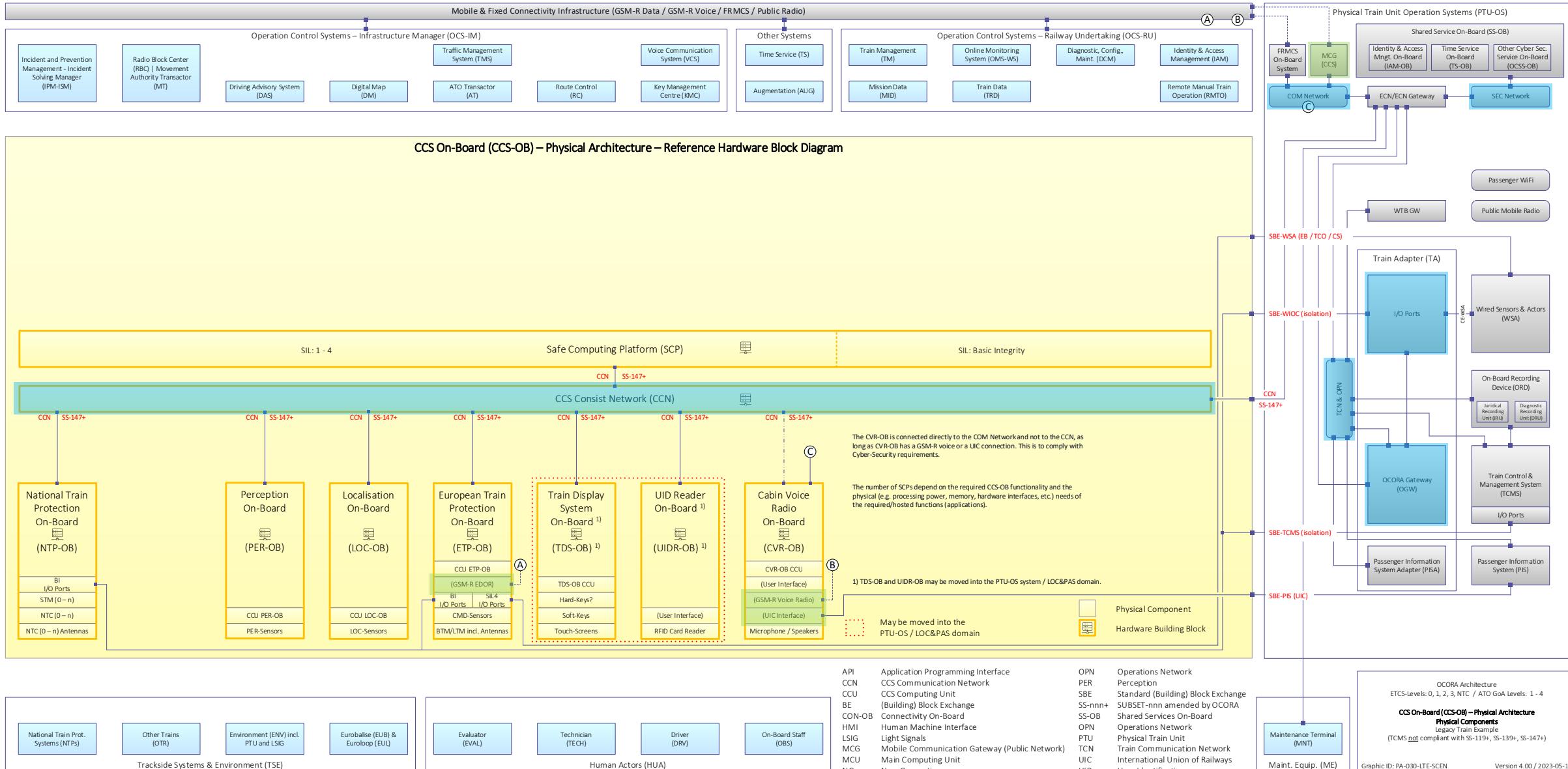
NG-TCN Train – Scenario D

(Common CCN and TCMS network physically separated from A-TCMS, Sec Net, Op Net and Com Net with support for legacy trackside infrastructure)



Legacy Train

(CCN physically separated from Sec Net and Com Net using the OCORA GW connecting to the TCMS / PIS Networks. Support for legacy trackside infrastructure)





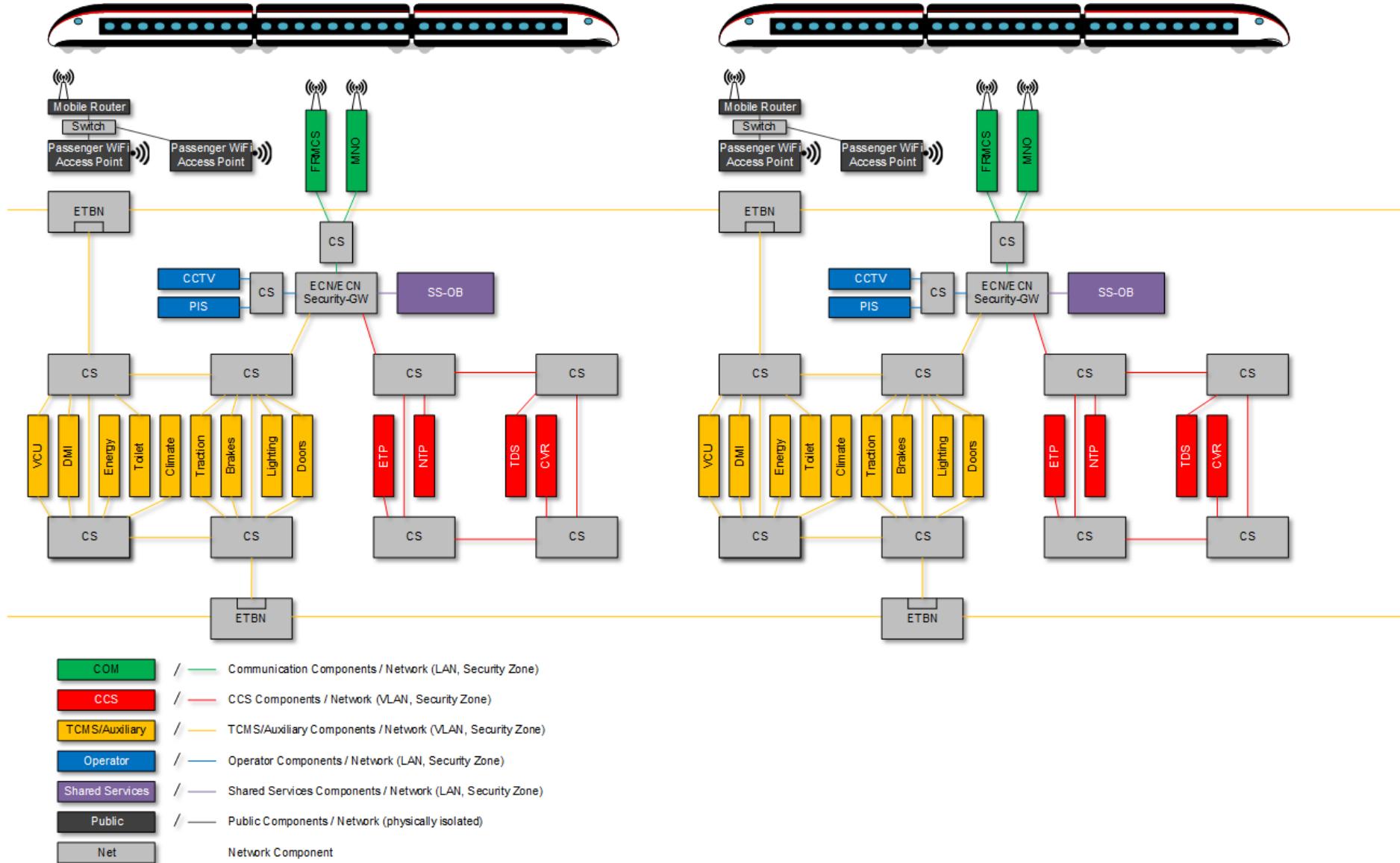
SBB CFF FFS



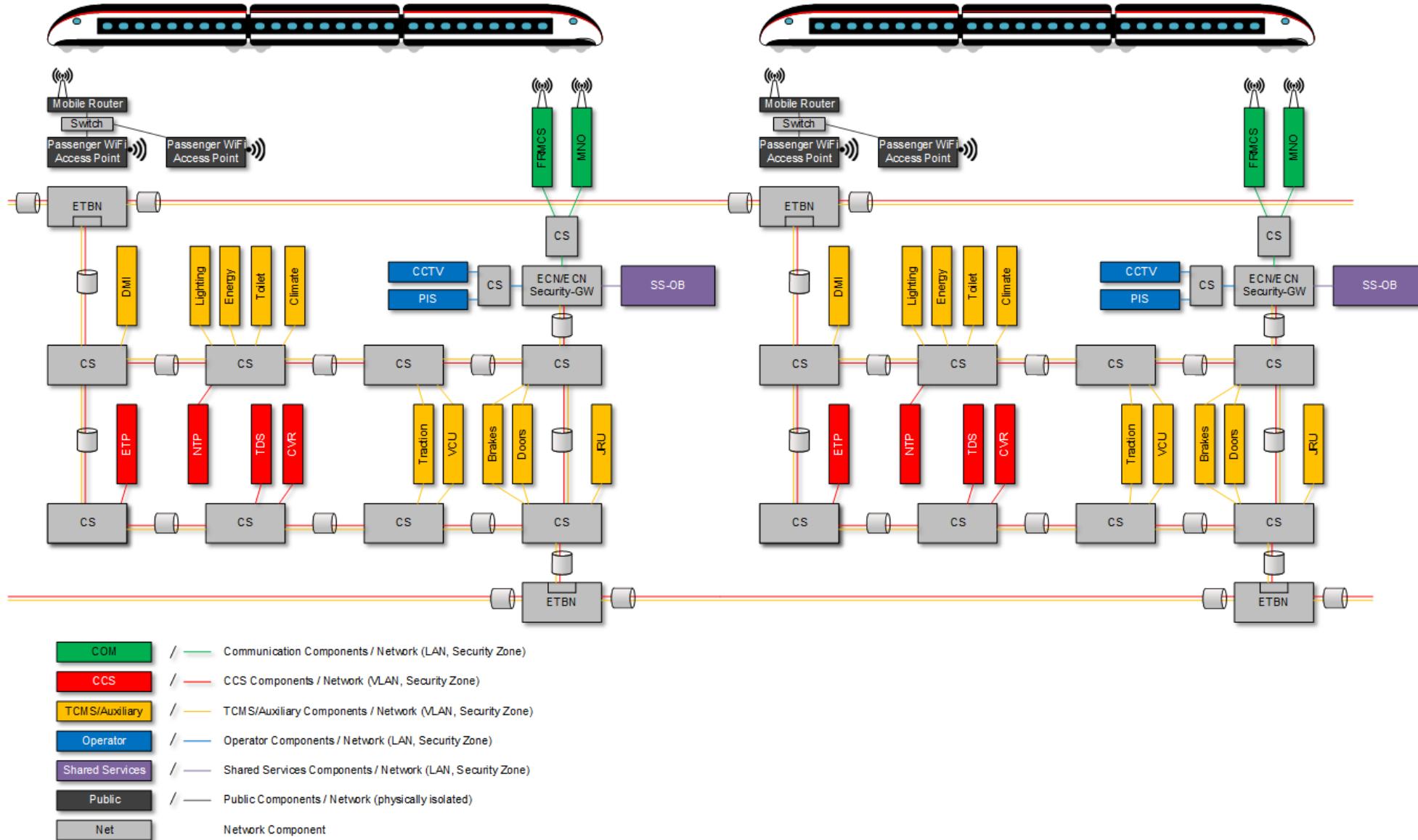
CCS On-Board (CCS-OB)

Physical Architecture – Network Topology Scenarios

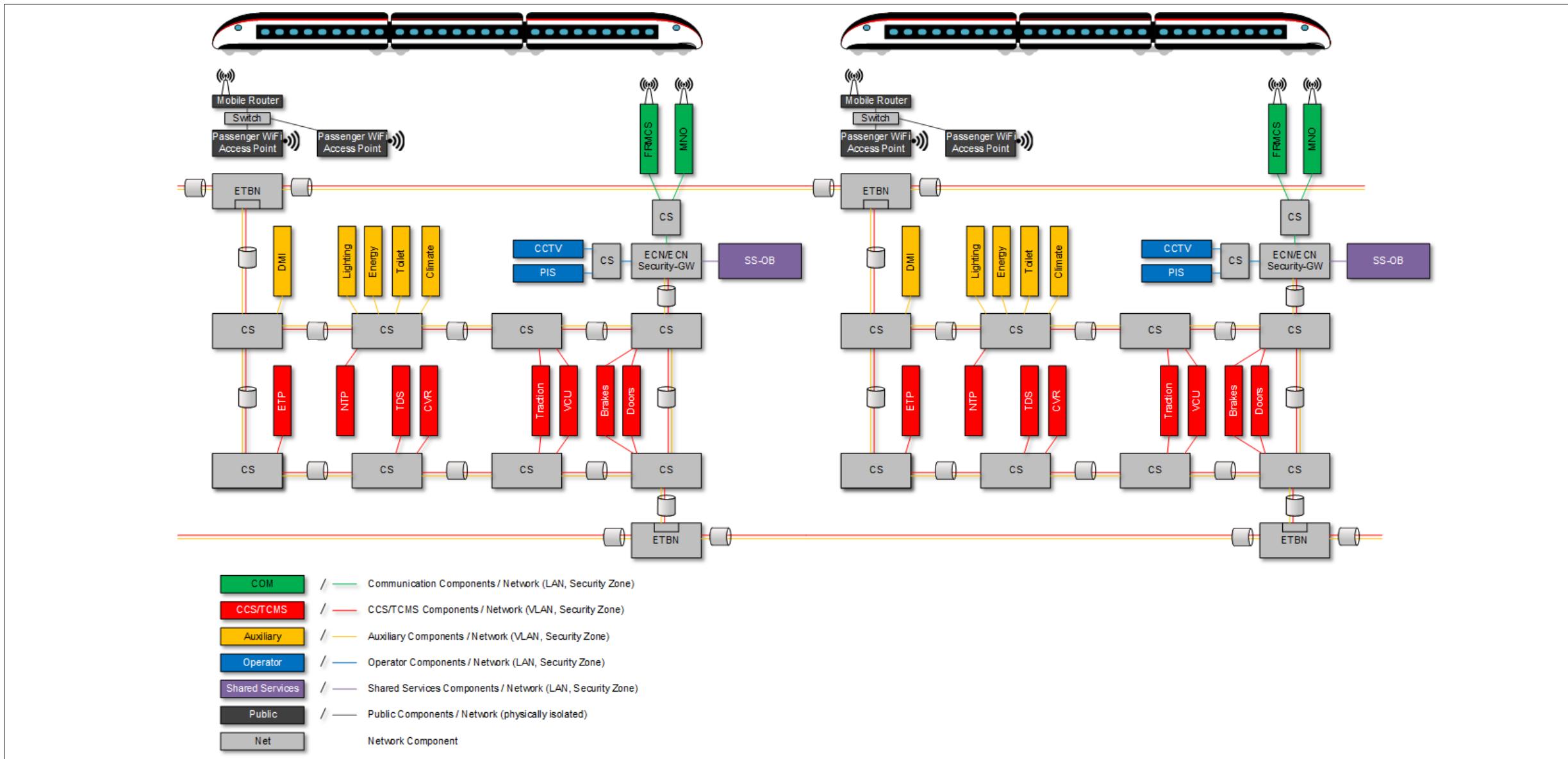
Scenario A: CCN as physically separated network



Scenario B: CCN as logically separated network



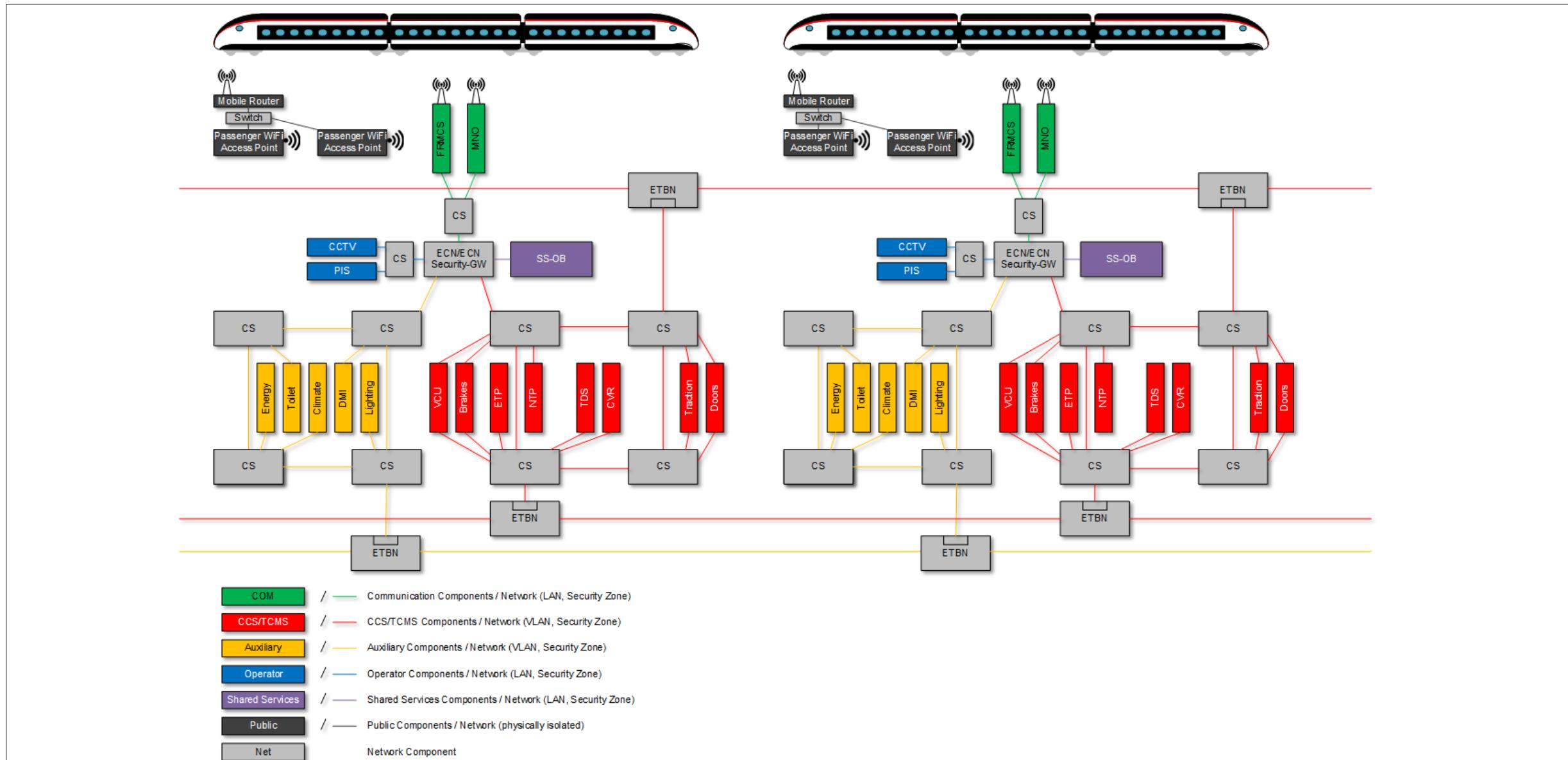
Scenario C: Common critical control network logically separated



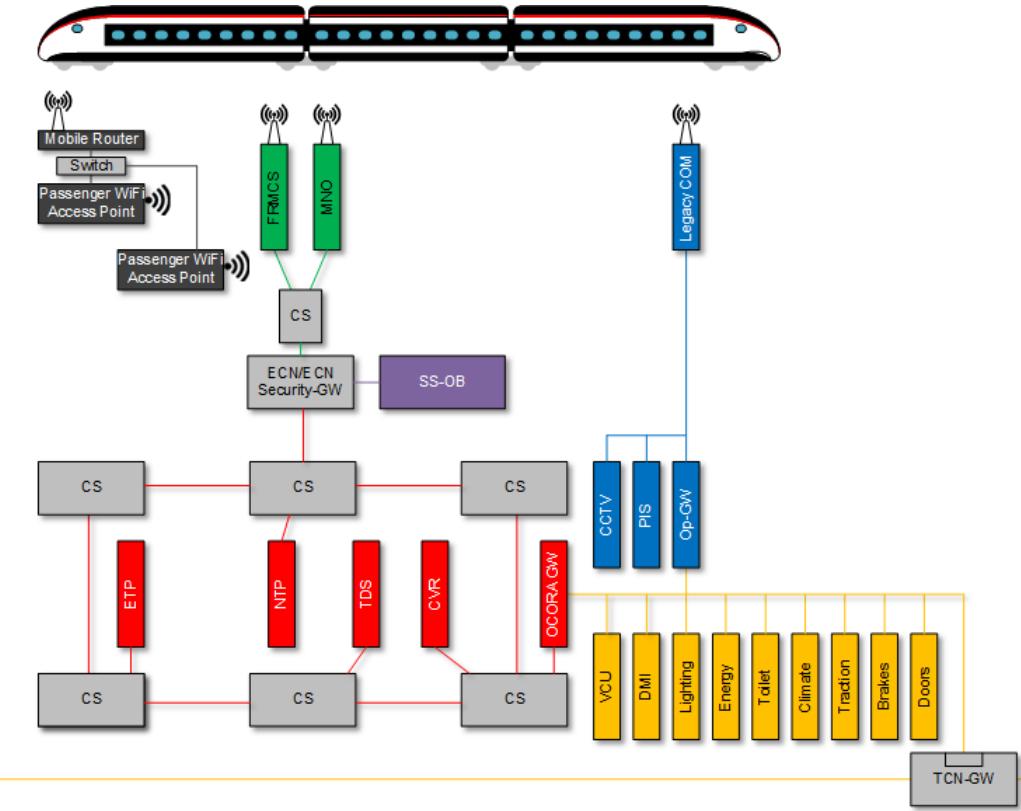
Scenario D: Common critical control network physically separated



SBB CFF FFS

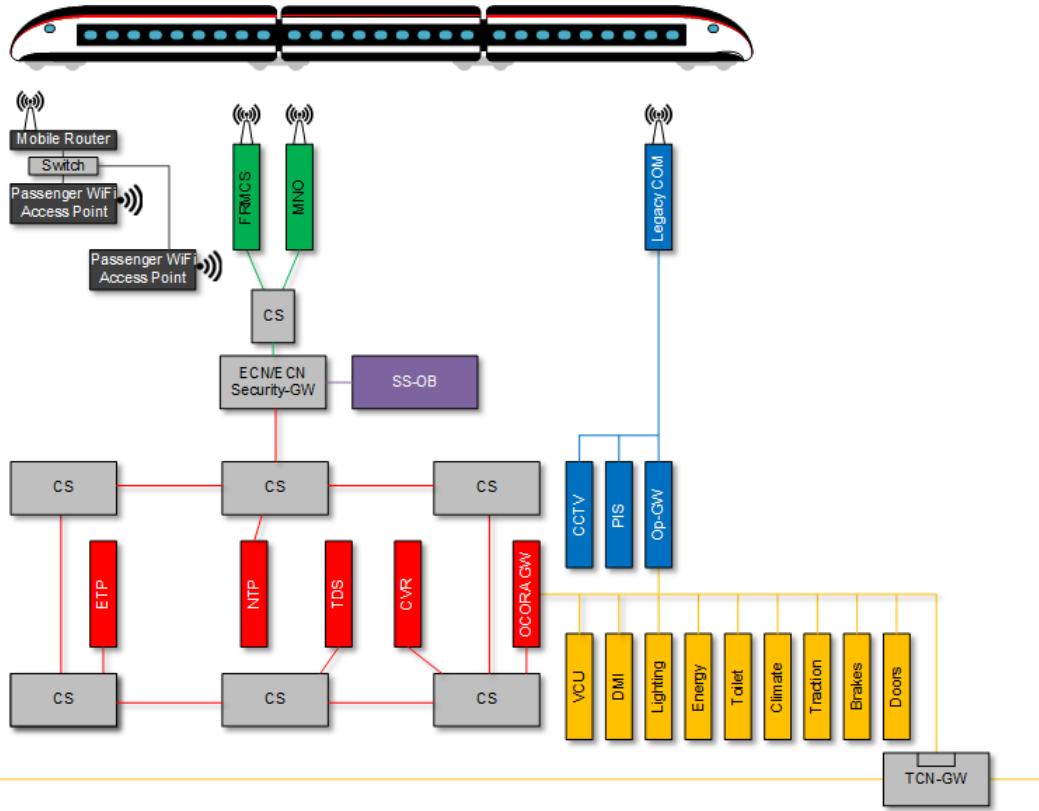


Legacy Train – Integration with OCORA-GW



COM	/	Communication Components / Network (LAN, Security Zone)
CCS	/	CCS Components / Network (VLAN, Security Zone)
TCMS/Auxiliary	/	TCMS/Auxiliary Components / Network (VLAN, Security Zone)
Operator	/	Operator Components / Network (LAN, Security Zone)
Shared Services	/	Shared Services Components / Network (LAN, Security Zone)
Public	/	Public Components / Network (physically isolated)
Net		Network Component

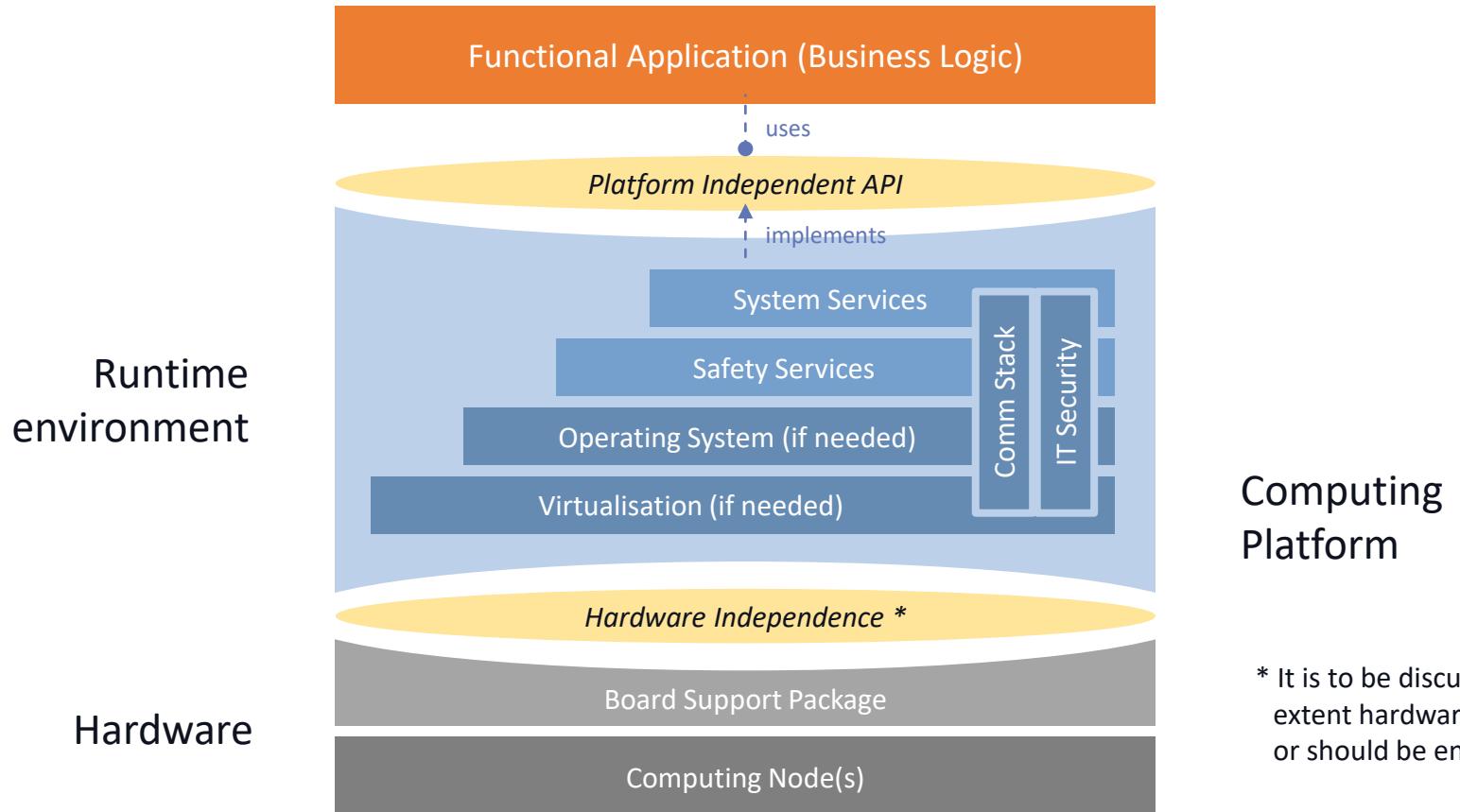
Remark: The network architecture of retrofit vehicles is only an example. Legacy architectures are always vehicle dependent and therefore the CCS integration is project specific.



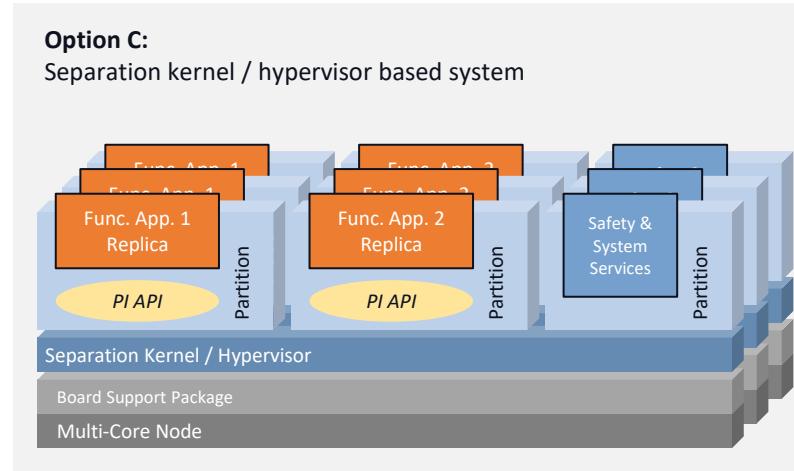
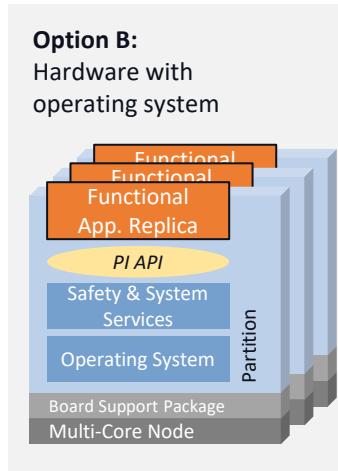
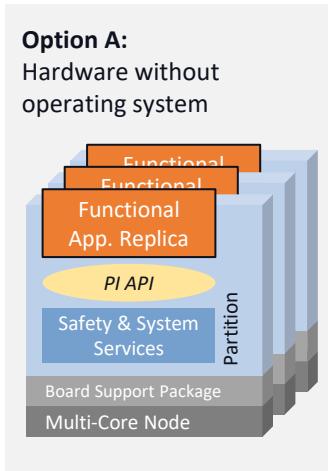


Safe Computing Platform (SCP)

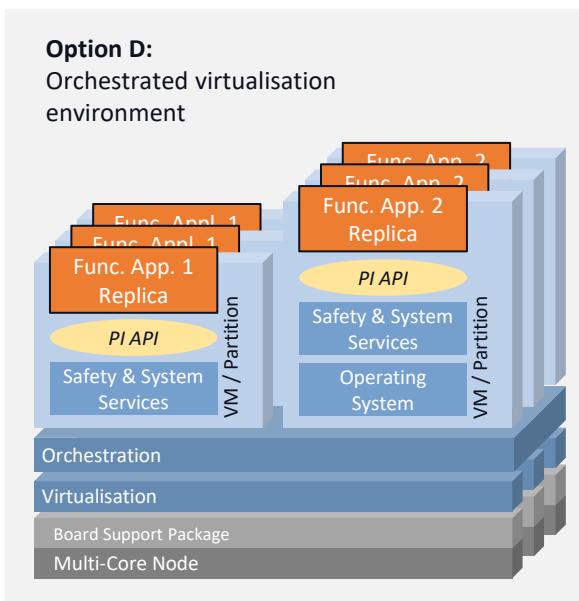
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Computing Platform – Deployment Options



Likely options for **onboard** deployments



Likely option for **trackside** deployments

Platform options where applications are programmed against PI API
Approaches depicted in the diagram are non-exhaustive. The industry may propose different state-of-the-art solutions.



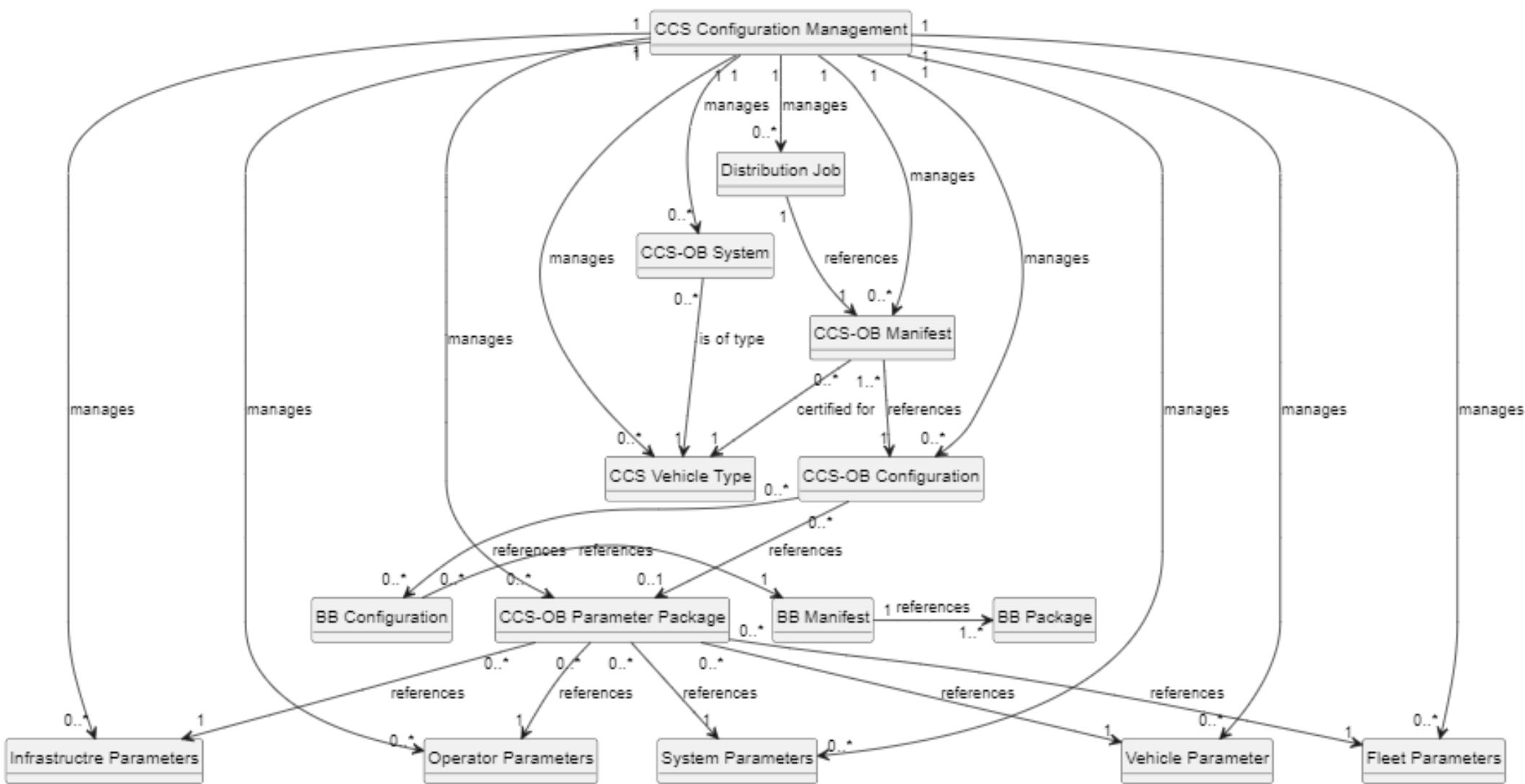
Configuration Management Concept

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Entity Relationship Diagram



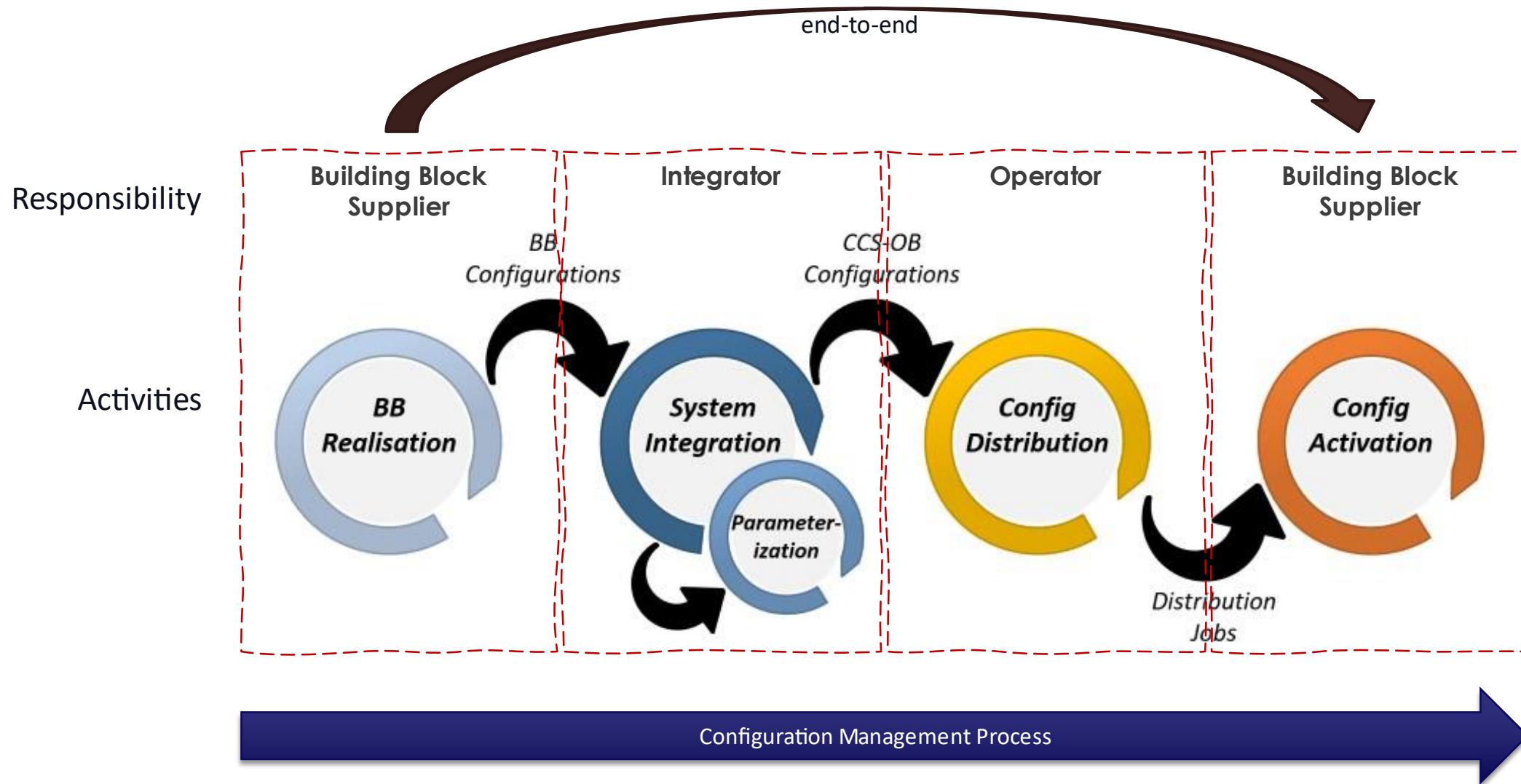
SBB CFF FFS



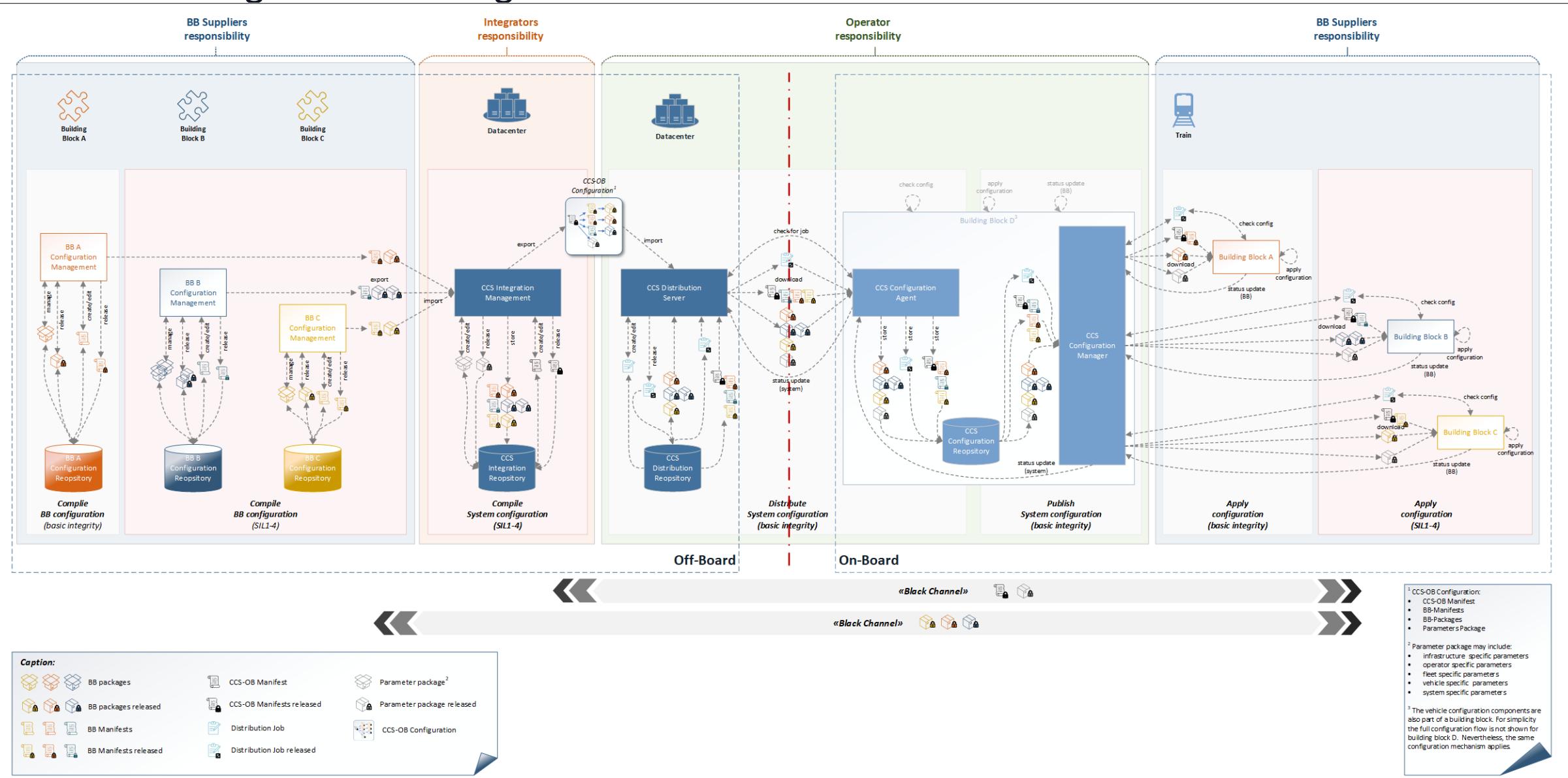
Configuration Management Stakeholders & Activities



SBB CFF FFS



Detailed Configuration Management Process

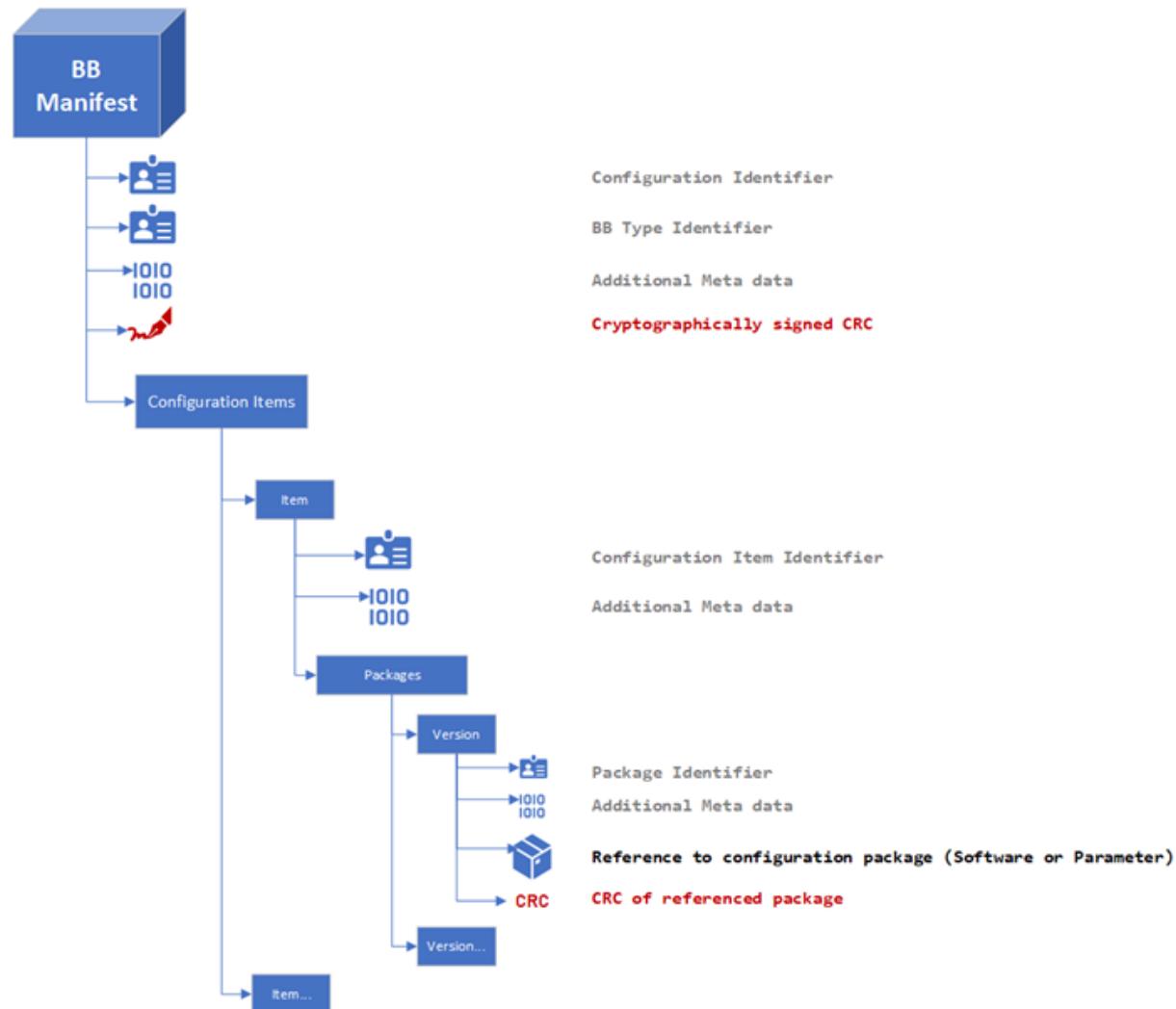


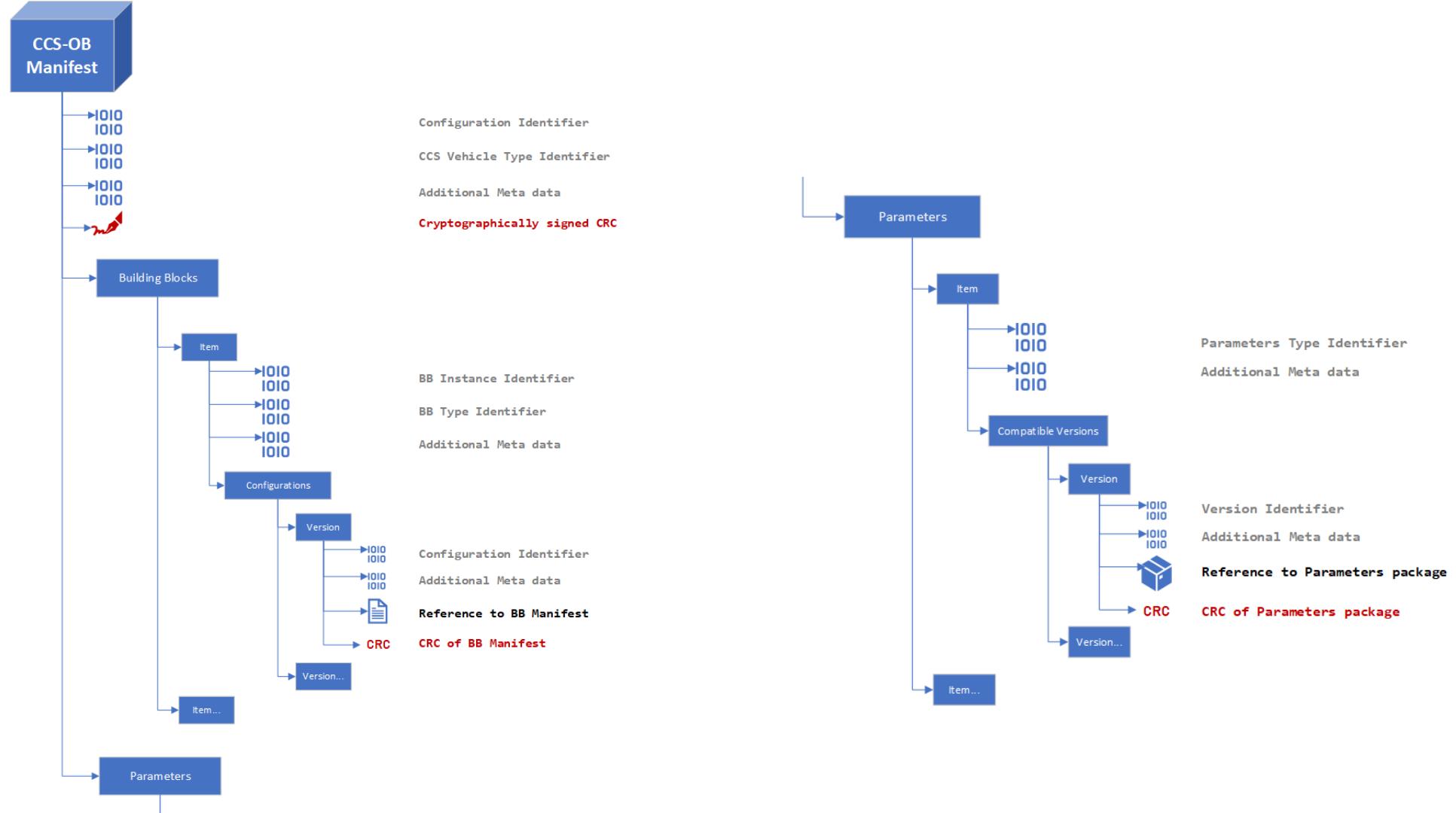
¹ CCS-OB Configuration:
• CCS-OB Manifest
• BB-Manifests
• BB-Packages
• Parameters Package

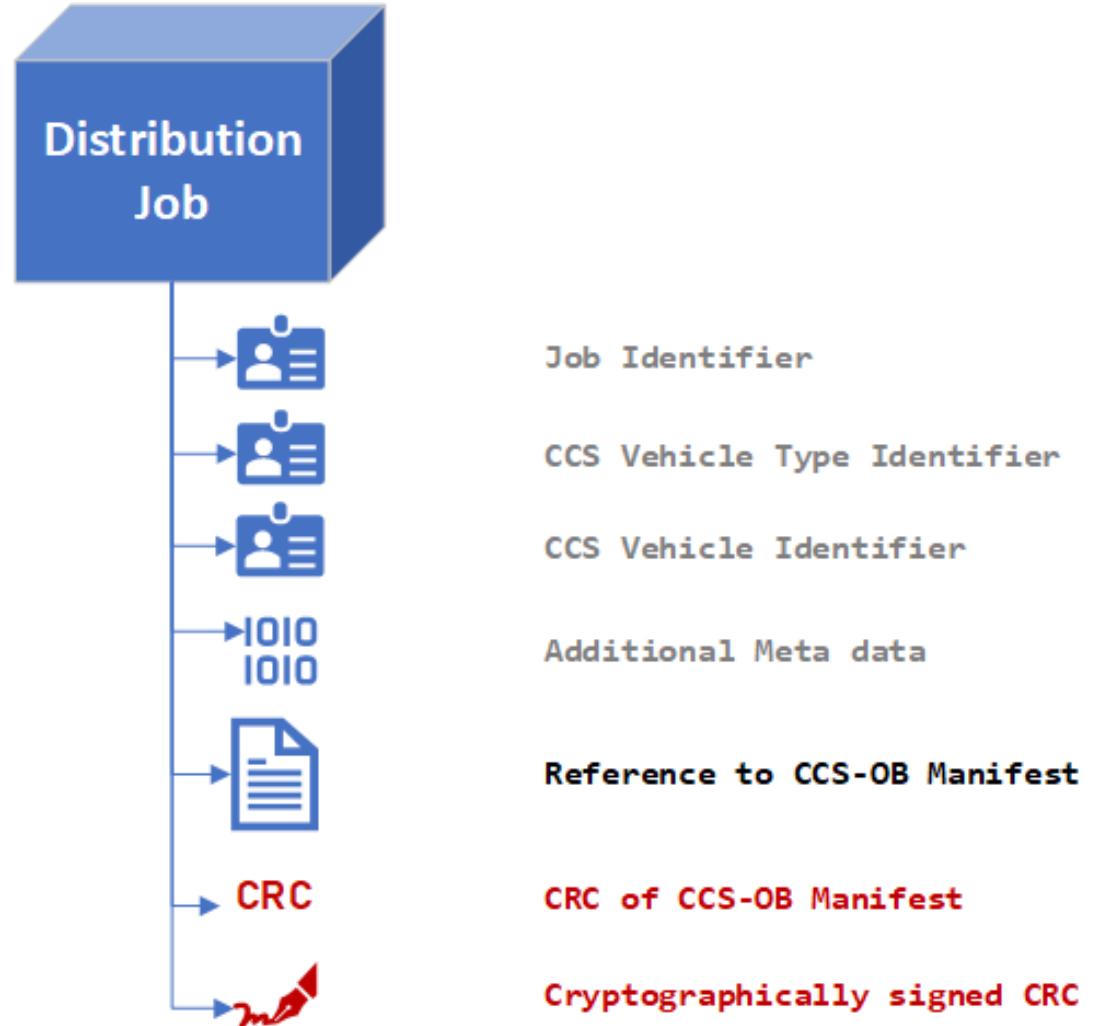
² Parameter package may include:
• infrastructure specific parameters
• operator specific parameters
• fleet specific parameters
• vehicle specific parameters
• system specific parameters

³ The vehicle configuration components are also part of a building block. For simplicity the full configuration flow is not shown for building block D. Nevertheless, the same configuration mechanism applies.

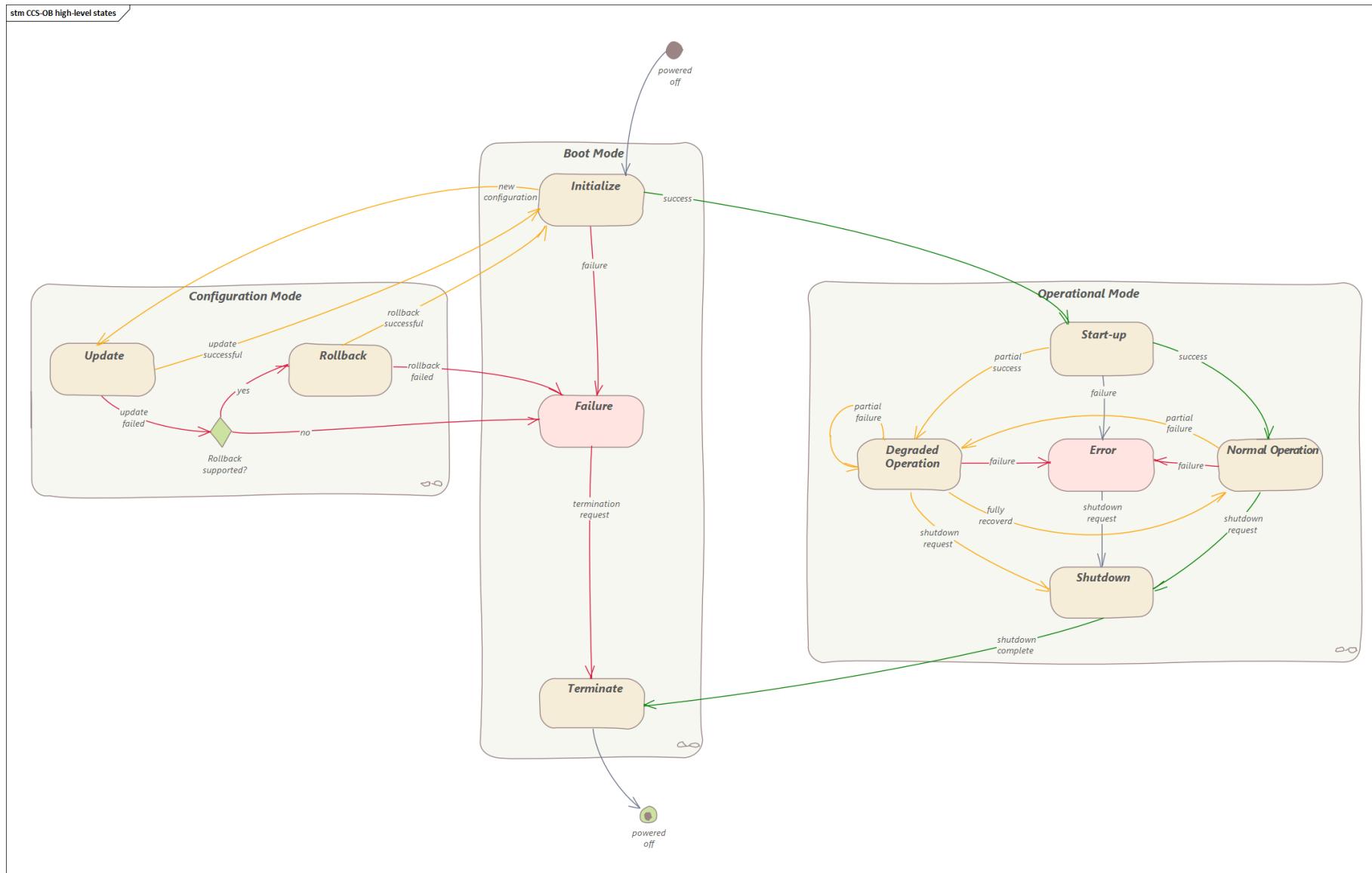








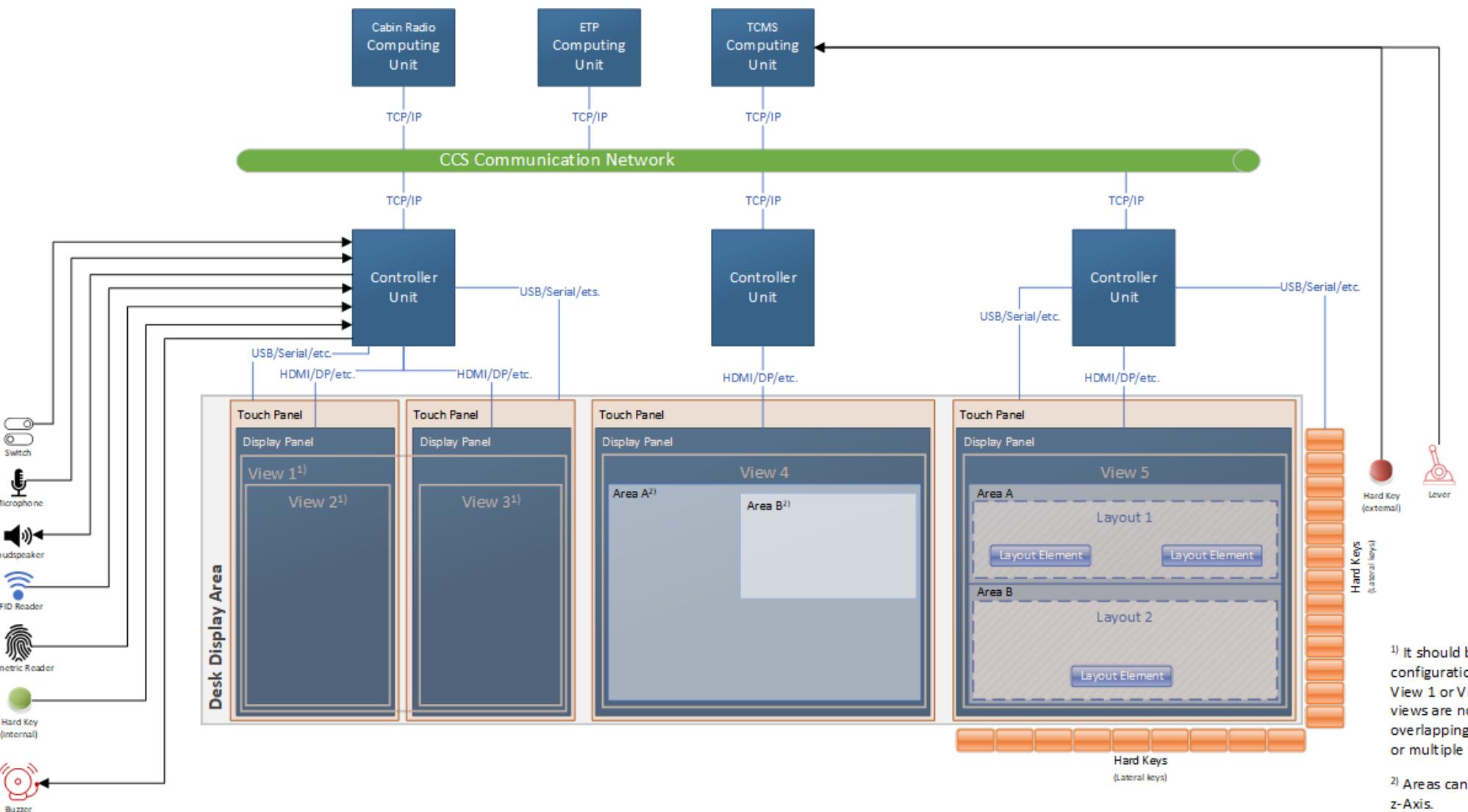
Building Blocks Modes & States

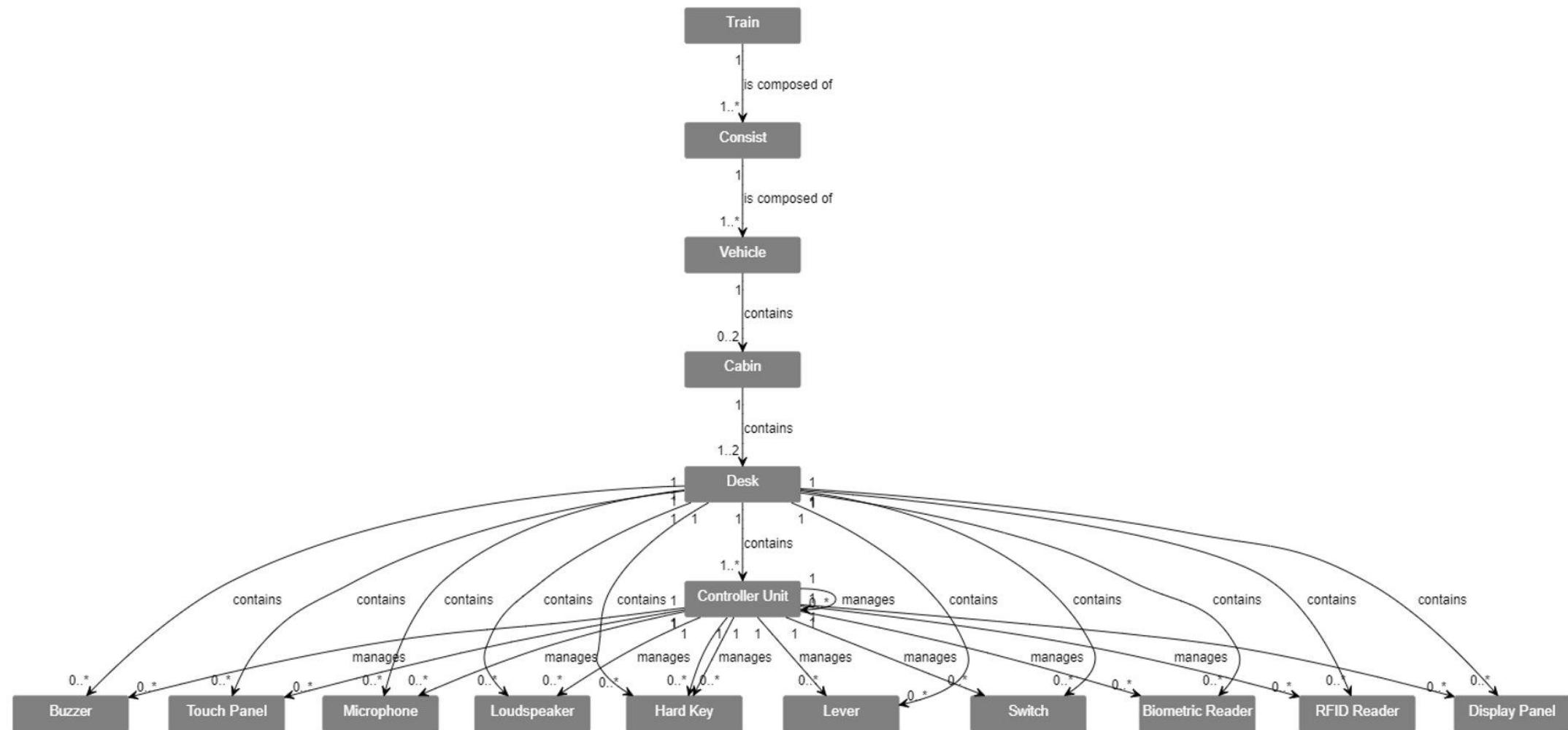


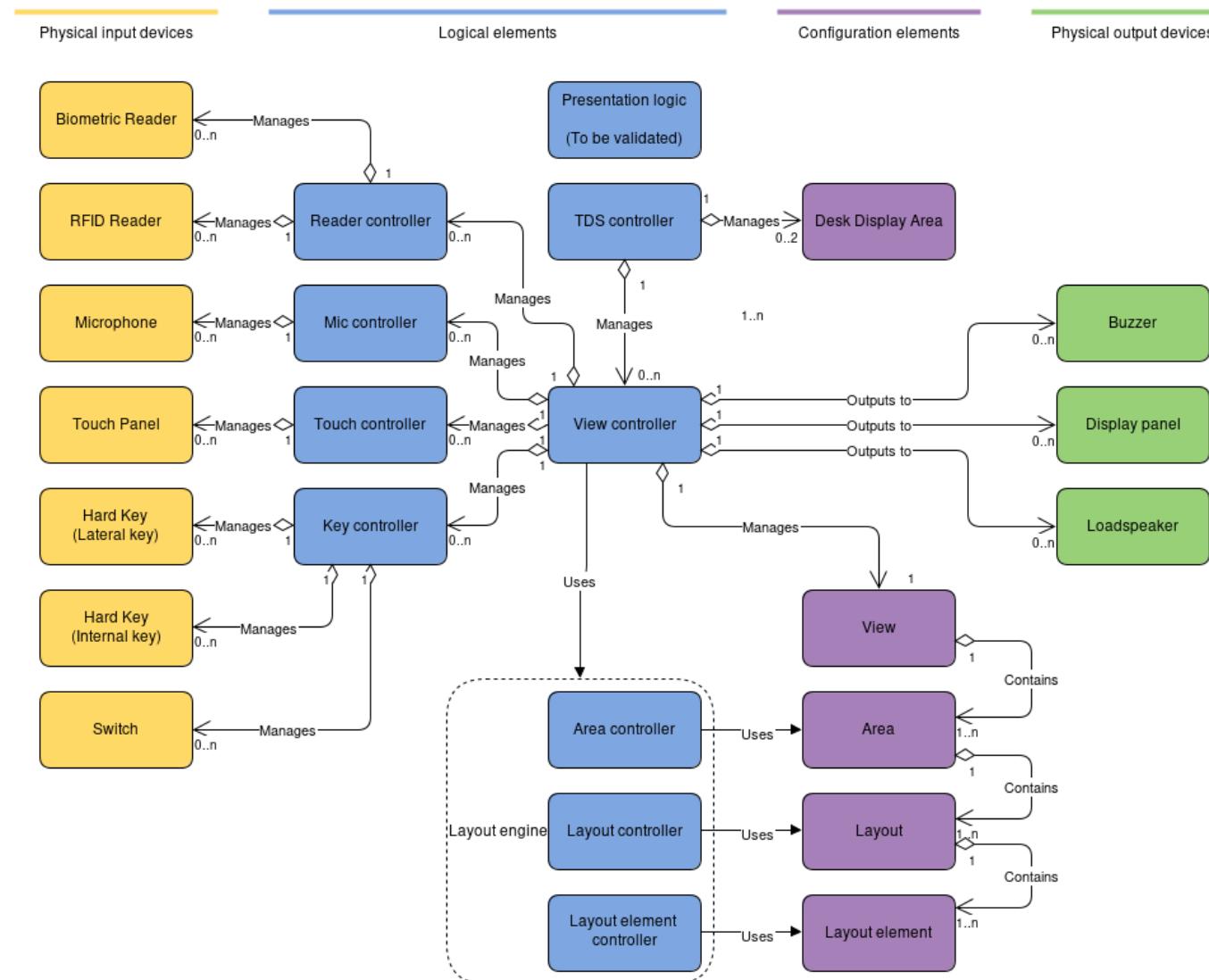


Train Display System (TDS)

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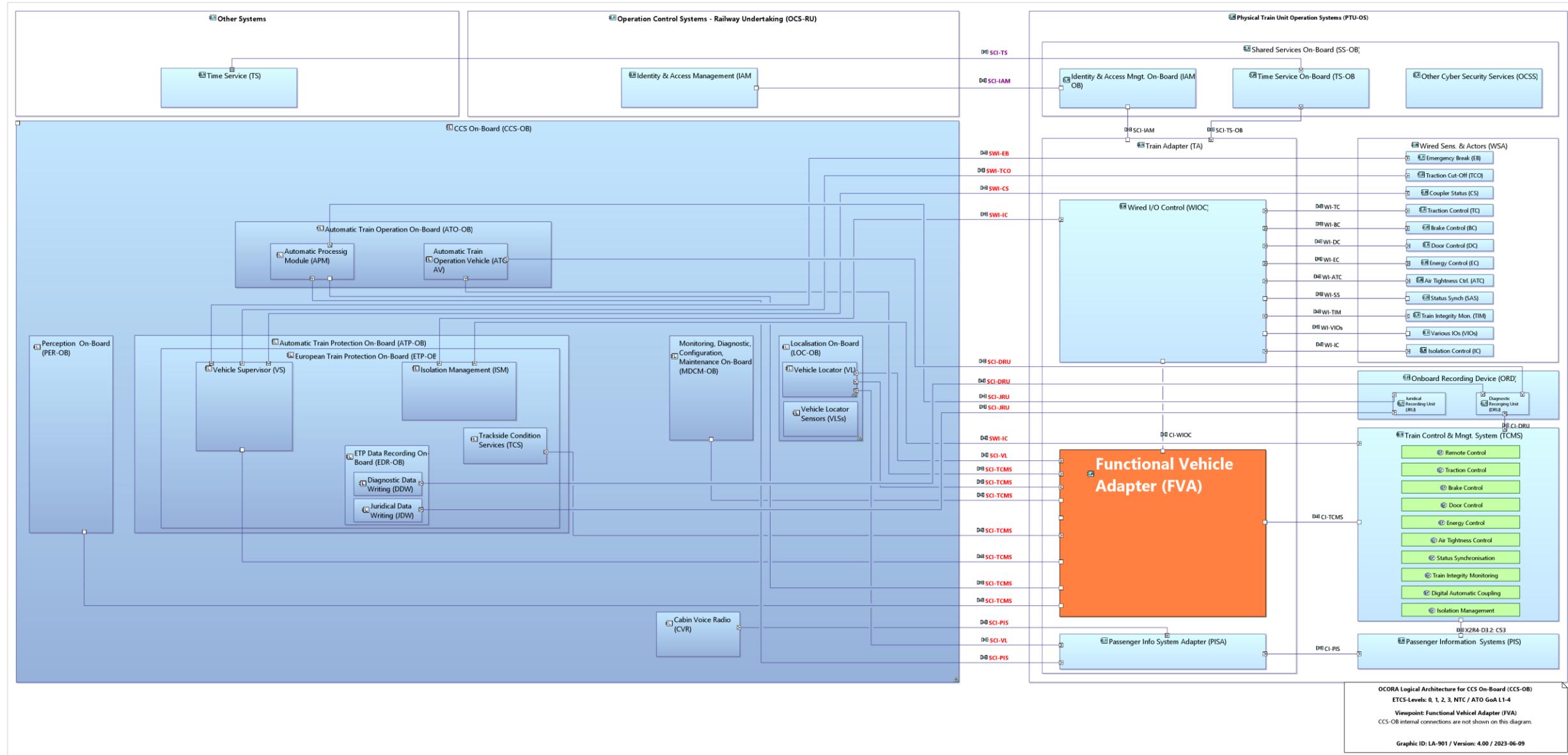


Functional Vehicle Adapter (FVA)

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Legacy Train Example – Focus FVA

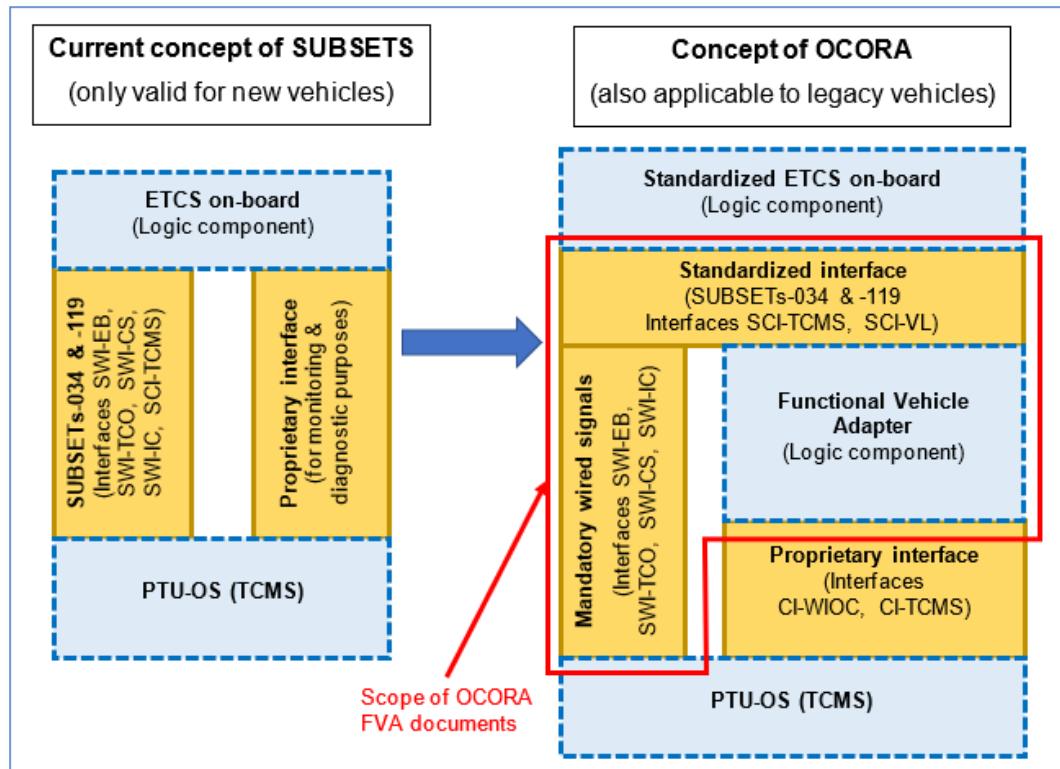
Actors and External Interfaces



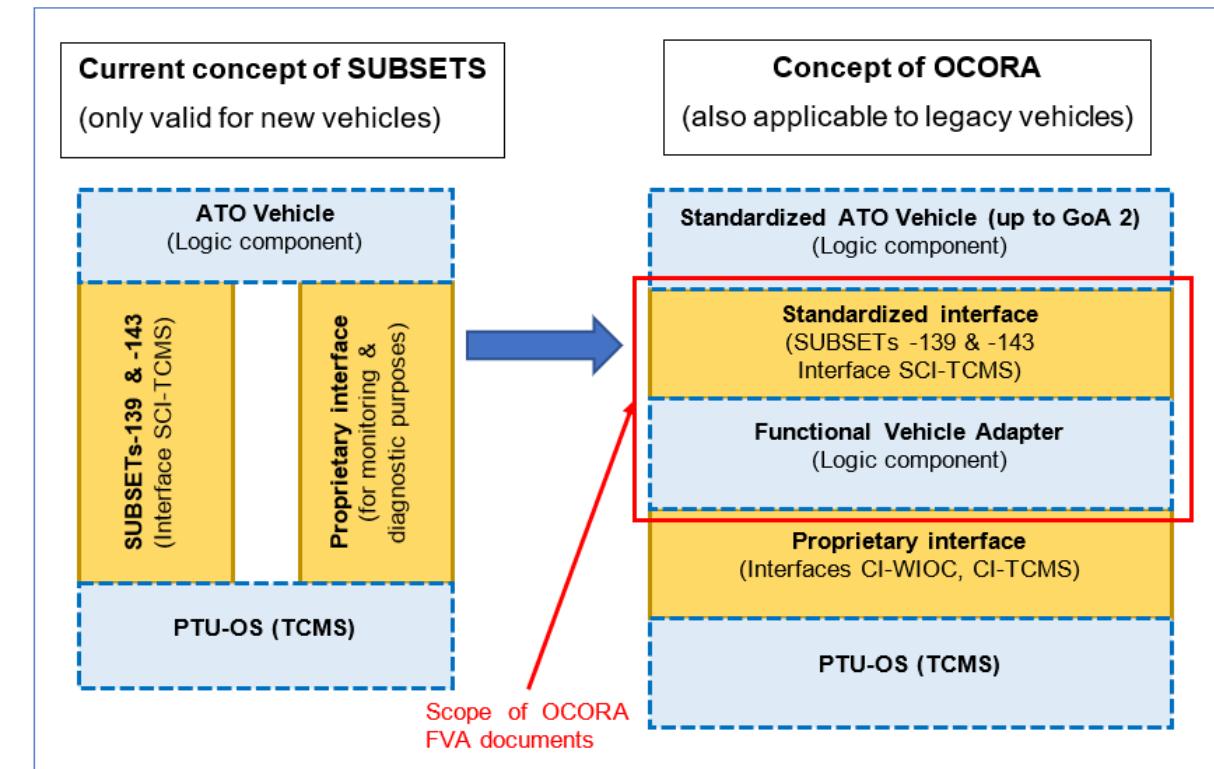
OCORA

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ETCS

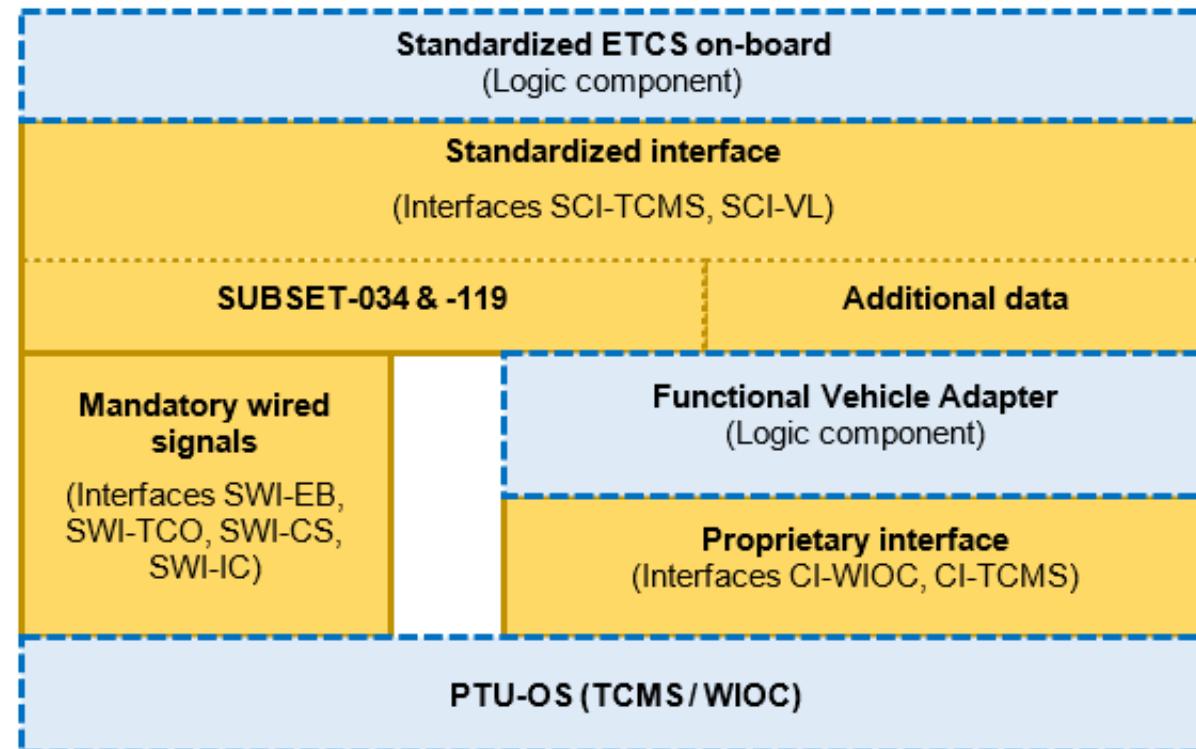


ATO

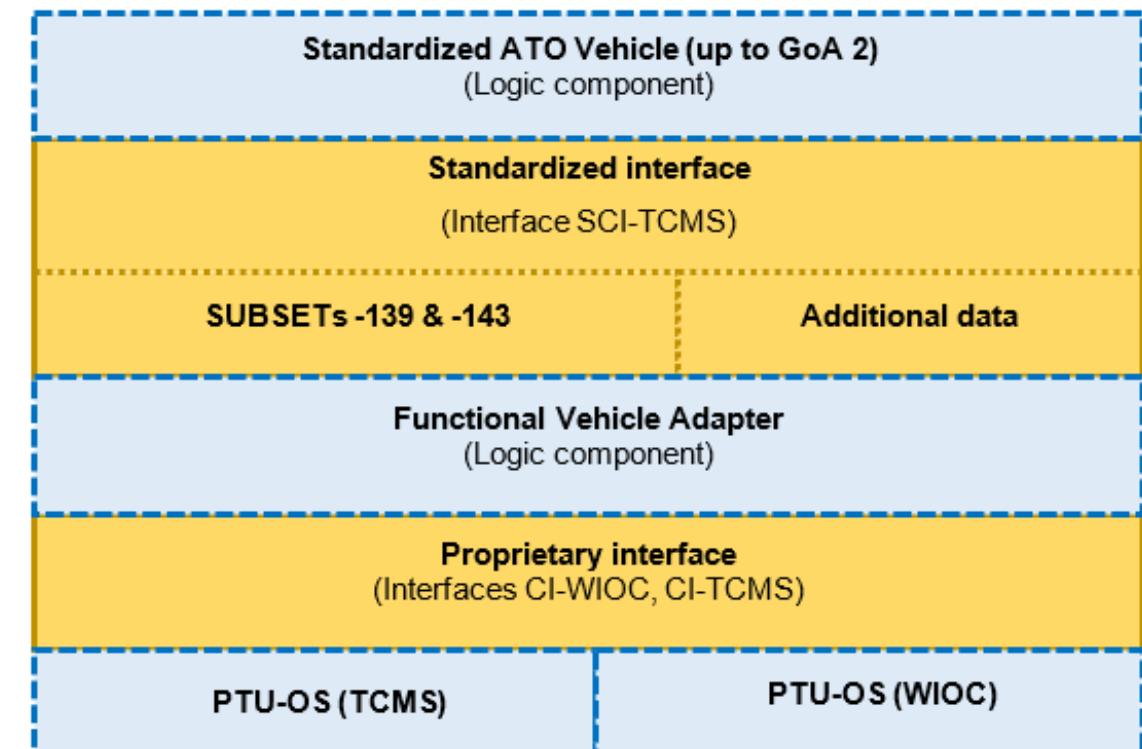


Details in Document: OCORA-TWS04-010 – Functional Vehicle Adapter - Introduction

ETCS



ATO



Details in Documents: OCORA-TWS04-013 – Design Guideline



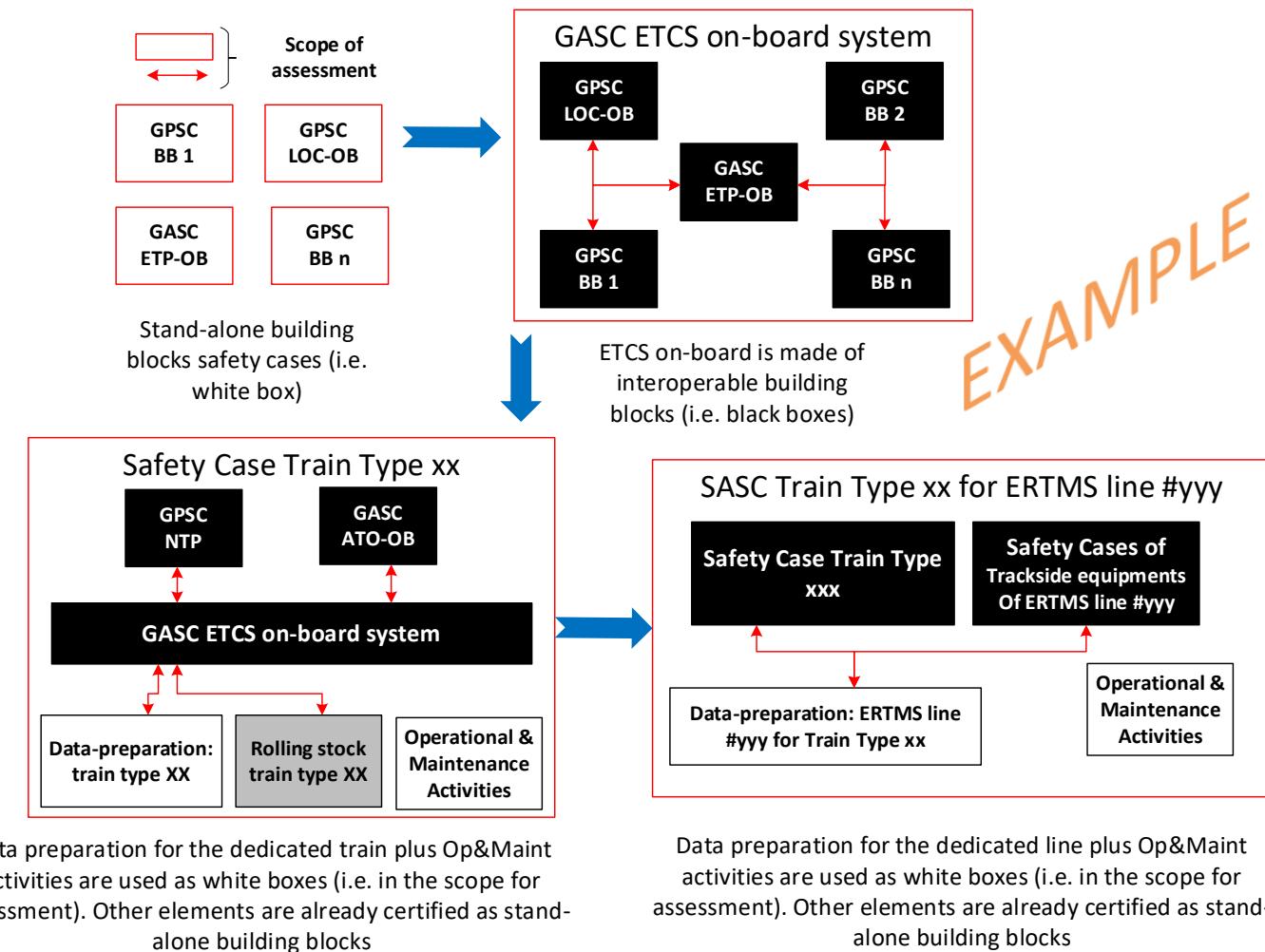
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Modular Safety

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- Modular Safety defines the hierarchy between safety cases from building blocks to specific application(s).
- One of the main goal is to **reduce the certification efforts from BB to specific application(s)**; initial and re-certification by limiting the “Domino’s effect (propagation of modifications at all upper levels) without degrading the safety level of the analyses.
- Modular Safety shall also defines the safety elements to allow the homologation of stand-alone building blocks:
 - Hazardous events based on TSI CCS SUBSET-088
 - TFFR (Tolerable Functional Failure Rate) based on TSI CCS SUBSET-088
 - Safety requirements based on OCORA R3
 - Harmonised and generic set of SRAC/AC



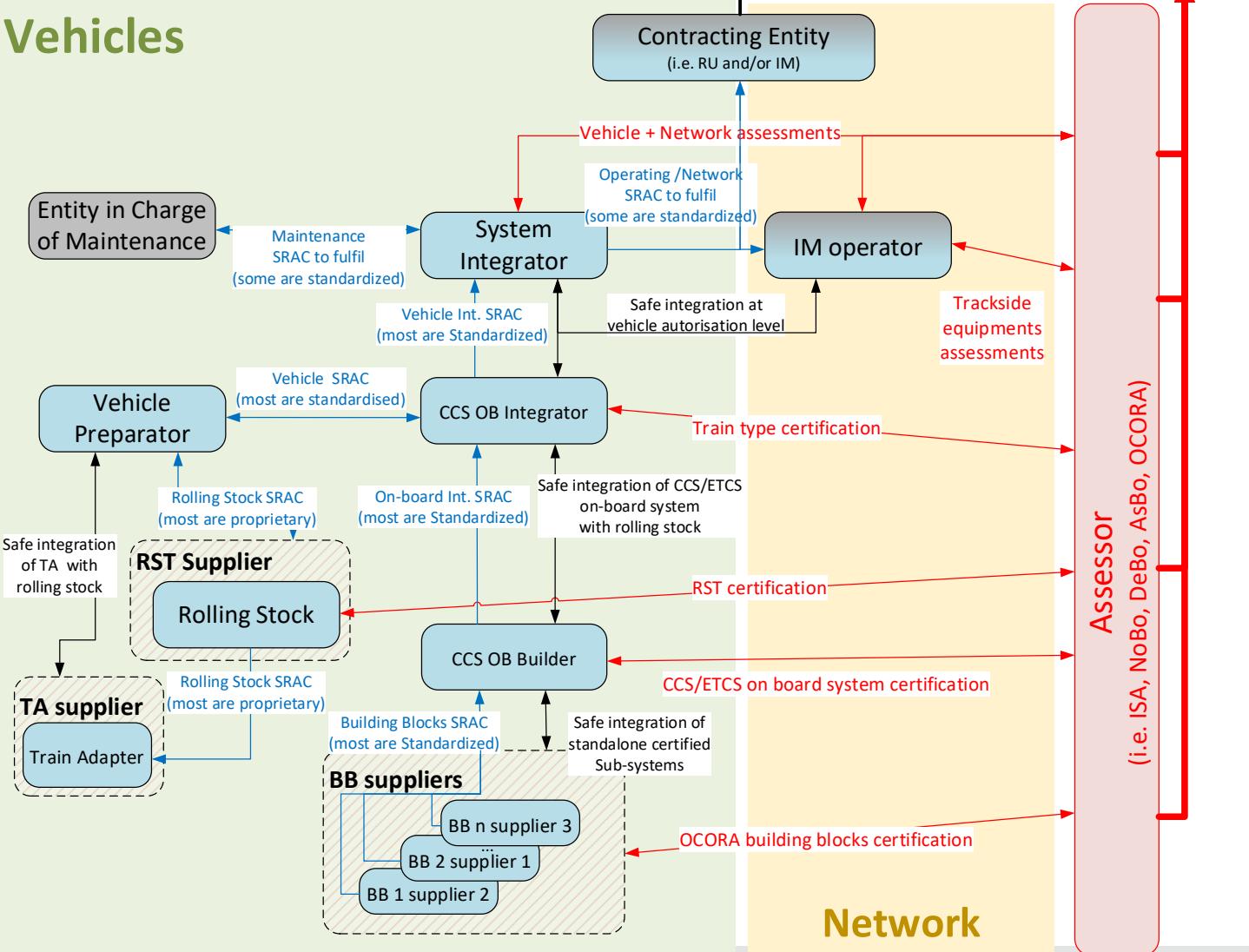
OCORA – Modular Safety - Stakeholders



*Who can apply for a vehicle authorisation?

The applicant for vehicle authorisation is the natural or legal person requesting an authorisation. The law does not impose a restriction on who can play the role of applicant: it can be a railway undertaking, an infrastructure manager, a manufacturer, an owner or a keeper.

Vehicles



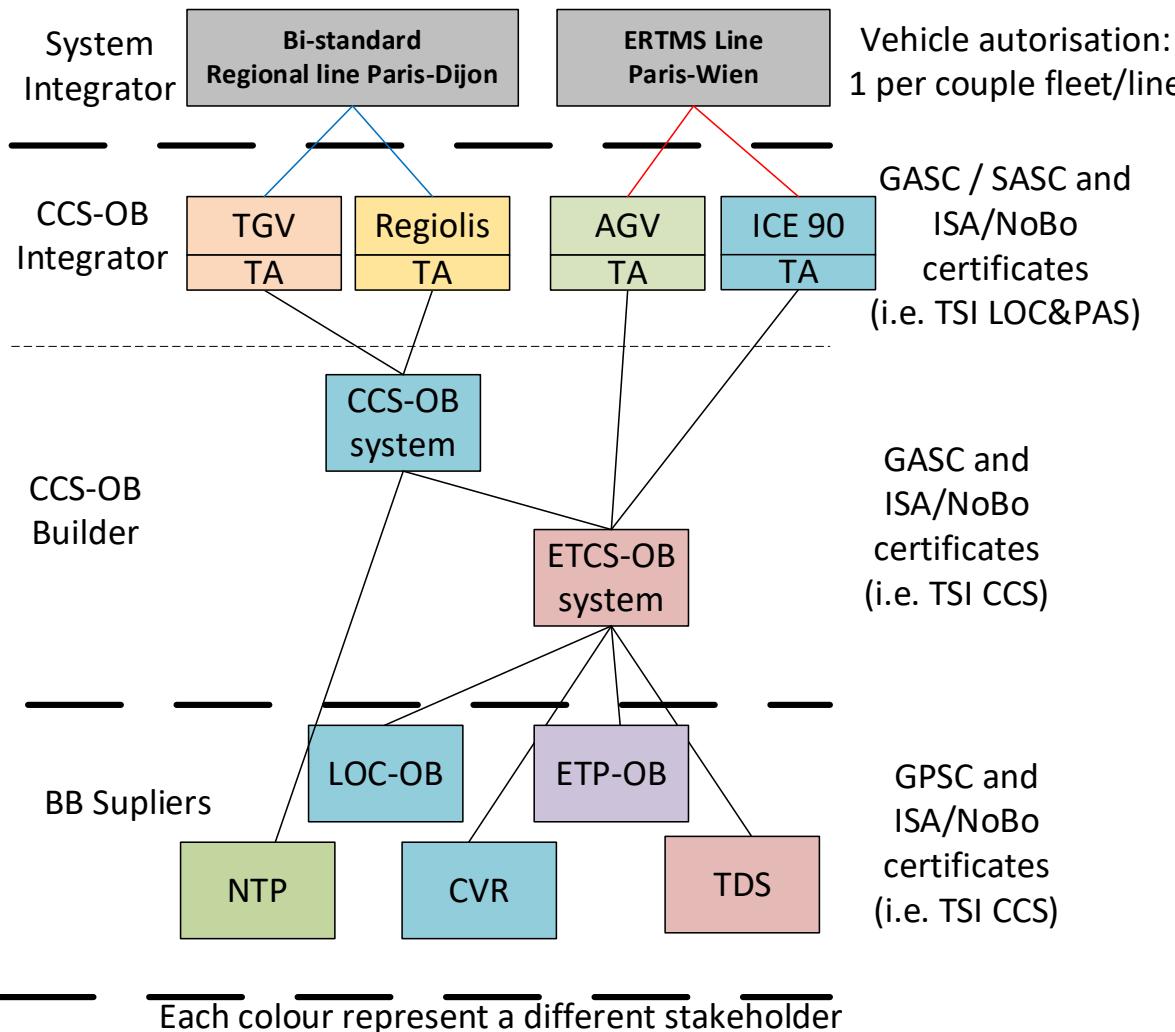
- **BB suppliers** shall create the building blocks and ensuring their certification (NoBo, OCORA, ISA...)
- **CCS-OB Builder** shall ensure the *safe integration* of the different BB and ensure its certification (NoBo, OCORA, ISA...)
- **TA Supplier** shall provide the train adapter according to the Vehicle Environment and ensure its certification (NoBo, OCORA, ISA...)
- **Vehicle Preparator** shall perform the *safe integration* of the TA in the Vehicle Environment
- **CCS-OB Integrator** shall perform the *safe integration* of the CCS-OB system in the prepared vehicle and ensure its certification (NoBo, OCORA, ISA/AsBo...)
- **System Integrator** in collaboration with the IM shall perform the *safe integration* of the full Vehicle in the selected network and ensure its certification (NoBo, DeBo, AsBo...)
- **Contracting Entity** shall realise the call for tenders for all stakeholders and handle the final Authorisation for Placing on the Market with the NSA/ERA

safe integration scope of activities is defined into:
era_1209-063_clarification_note_on_safe_integration_en



OCORA – Modularity & Safety Approval

Key roles



Case of two independent systems made of building blocks from different suppliers

- Different *reference systems* can be created:
 - ETCS-OB
 - CCS-OB
- The *reference systems* can be reused in any type of train thanks to the Train Adapters
- No re-certification is required for them => cross acceptance rules defined by OCORA are respected
- A reference system at train and then at system levels can be created and reuse as basis for all other vehicles equipped with the CCS/ETCS-OB system. Certifications focuses on the different conditions of use (to be defined post OCORA R3)
- That mutualises projects resources at RU's level on similar fleets and ease the process to get the Authorisation for Placing on the Market
- For the next certifications steps (during the lifetime), a generic and systematic approach defined by OCORA, based on CSM-RA will then help any stakeholder to handle easier (I.e. less delay and costs than today) the evolutions at any level

OCORA – Modularity & Integration Tasks



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→ System Integrator

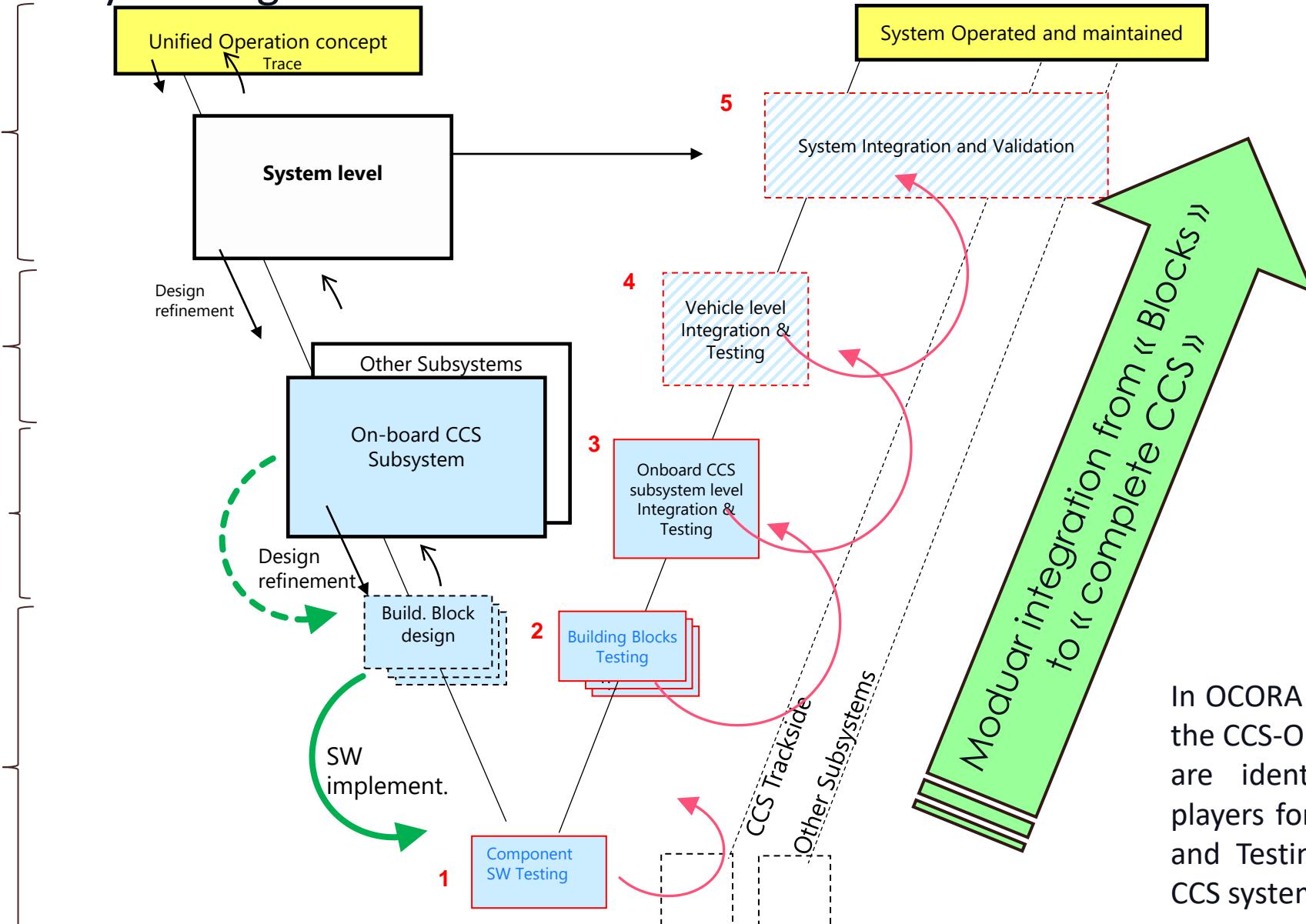
→ CCS-OB Integrator

→ CCS-OB Builder

→ Building Blocks Suppliers

Scope of OCORA

1, 2...: integration steps



In OCORA compliant projects, the CCS-OB builder/integrator are identified as the key players for Safety, Integration and Testing of the on-board CCS system.



OCORA

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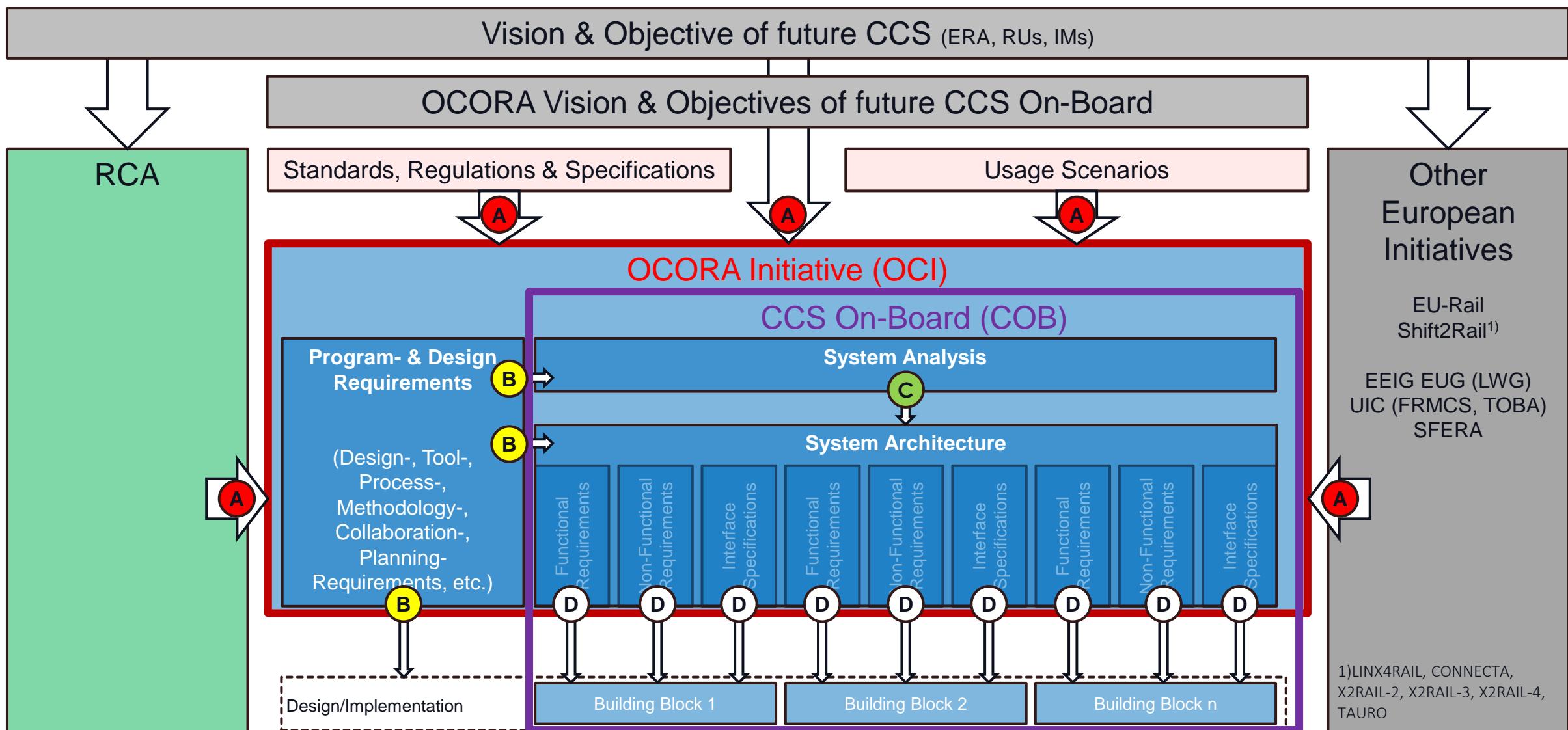
SBB CFF FFS



Methodology & Tooling

OCORA-BWS02-030 / v4.00 / 04.07.2023

Structuring the Requirements



1)LINX4RAIL, CONNECTA,
X2RAIL-2, X2RAIL-3, X2RAIL-4,
TAURO

OCORA Requirements Engineering

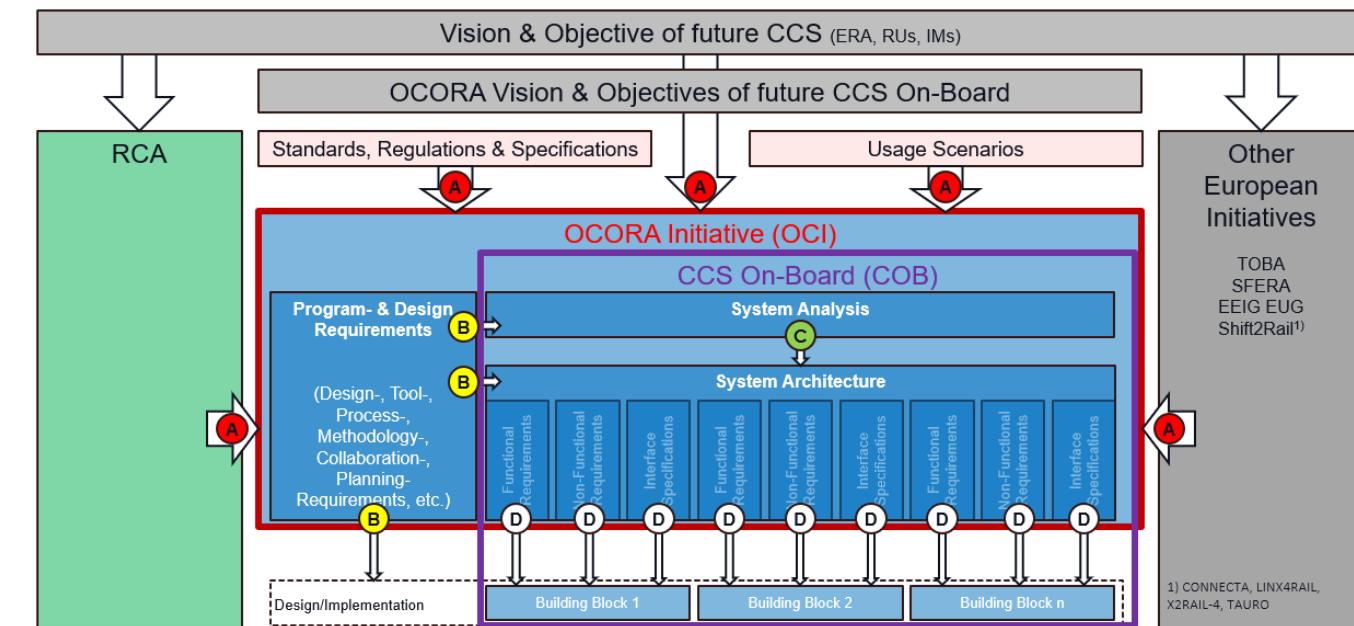
Requirement Definitions

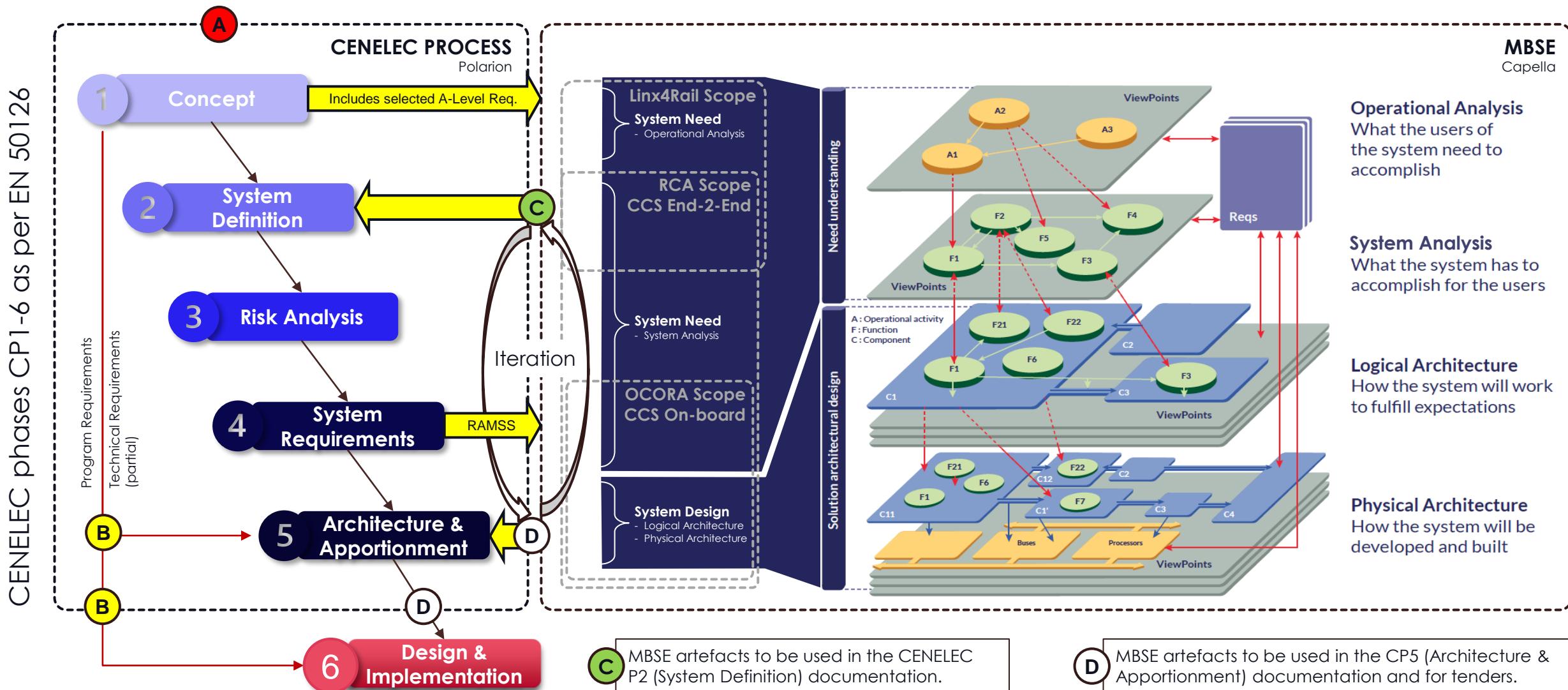
A Stakeholder Requirements: OCORA has to manage many different requirements, coming from many different stakeholders.

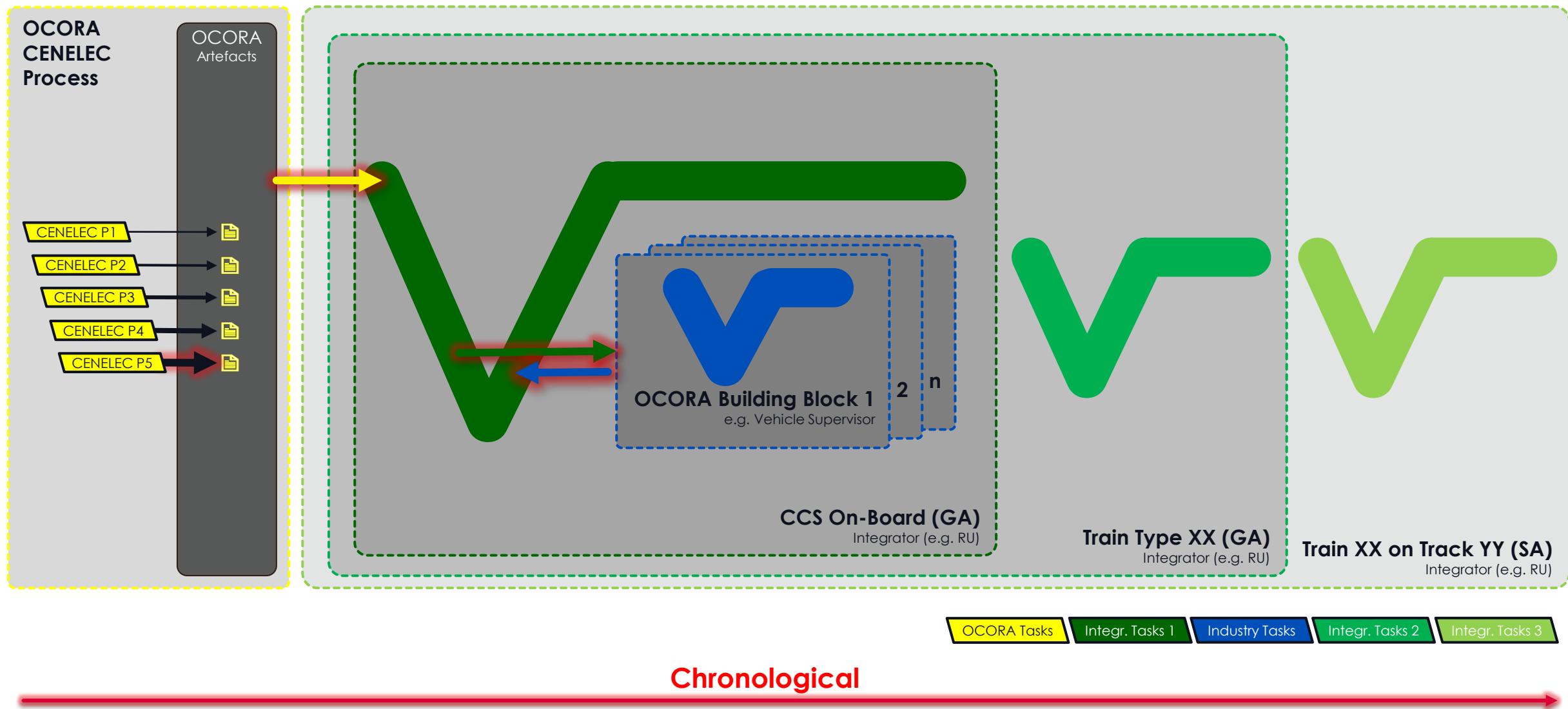
B Program- & Design Requirements: The OCORA program defines tools, processes, methodologies and design rules to be used within the program and to be considered during the system analysis and the system design/architecture work.

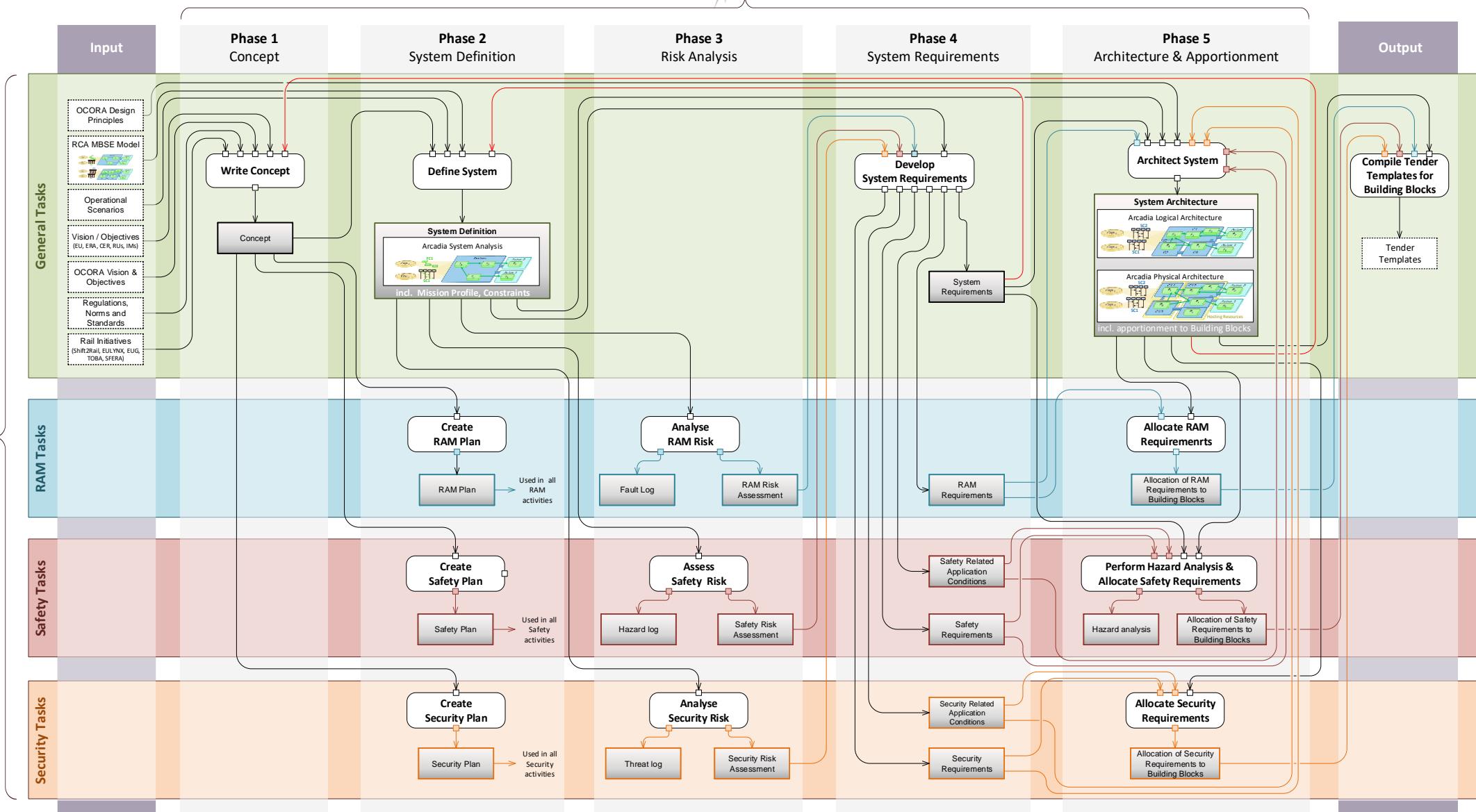
C System Requirements: Requirements in regards to the OCORA system are developed in the MBSE System Analysis (RCA & OCORA), taking into account the A- and B-Level Requirements.

D Building Block Requirements: Requirements in regards to the OCORA building blocks are developed in the MBSE System Architecture (logical / physical), taking into account the MBSE System Analysis. The resulting documentation form the OCORA tender templates, together with the applicable program requirements.











Operational Concept

OCORA-BWS02-030 / v4.00 / 04.07.2023

Operational Concept Overview



Live Cycle of Passenger, Freight, and Construction Trains

+/- 40 years overall life-time

