INTRODUCTION
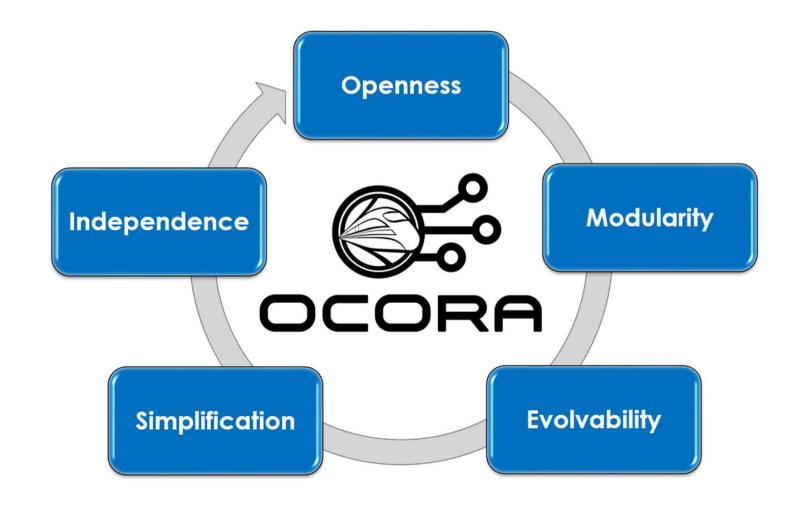

Open CCS On-Board Reference Architecture

European Initiative

Open Standardized Architecture for CCS On-Board

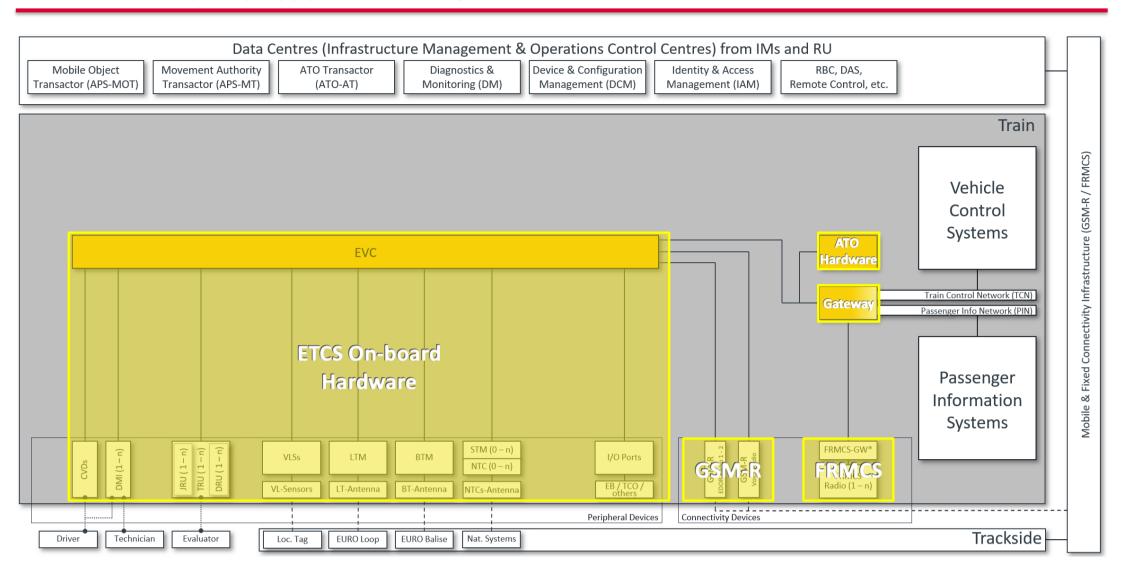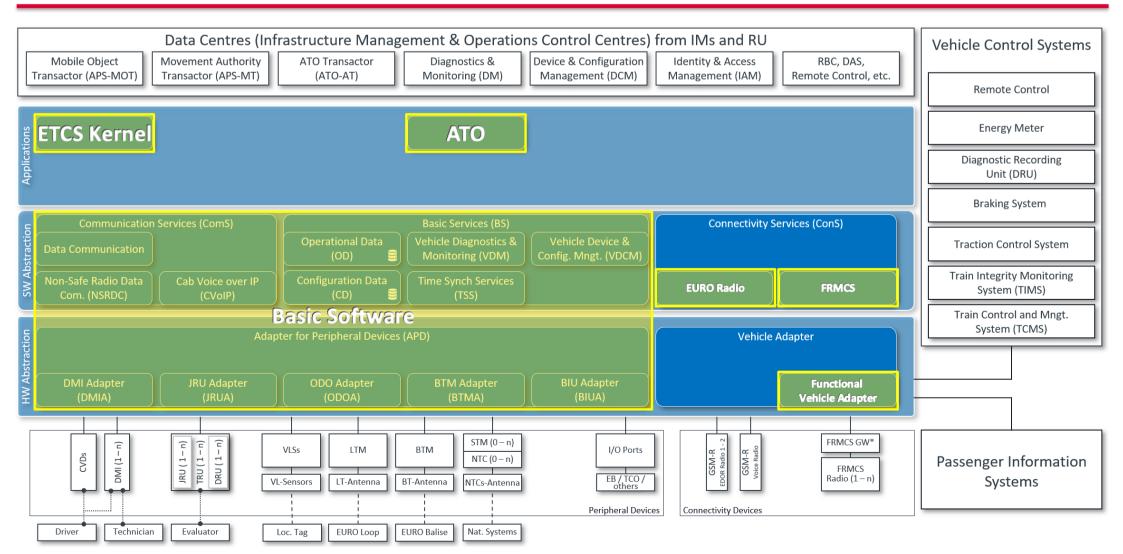## KEY PRINCIPLES

OCORA System Architecture

HARDWARE VIEW – BUILDING BLOCKS – INITIAL ITERATION

Data Centres (Infrastructure Management & Operations Control Centres) from IMs and RU

Mobile Object Transactor (APS-MOT)	Movement Authority Transactor (APS-MT)	ATO Transactor (ATO-AT)	Diagnostics & Monitoring (DM)	Device & Configuration Management (DCM)	Identity & Access Management (IAM)	RBC, DAS, Remote Control, etc.

Train

Mobile & Fixed Connectivity Infrastructure (GSM-R / FRMCS)

- Vehicle Control Systems
- Passenger Information Systems

EVC

ETCS On-board Hardware

- CVDs
- DMI (1 – n)
- JRU (1 – n)
- TRU (1 – n)
- DRU (1 – n)
- VLSs / VL-Sensors
- LTM / LT-Antenna
- BTM / BT-Antenna
- STM (0 – n) / NTC (0 – n) / NTCs-Antenna
- I/O Ports / EB / TCO / others

ATO Hardware

Gateway — Train Control Network (TCN) / Passenger Info Network (PIN)

GSM-R — EDOR Radio 1 - 2 / GSM-R Voice Radio

FRMCS — FRMCS-GW* / FRMCS Radio (1 – n)

Peripheral Devices · Connectivity Devices

Driver	Technician	Evaluator	Loc. Tag	EURO Loop	EURO Balise	Nat. Systems

Trackside

> In the **Initial Iteration** OCORA plans to introduce a limited number of Building Blocks (yellow blocks).
>
> Each Building Block shall be "Plug & Play"-Like exchangeable.

FUNCTIONAL VIEW – BUILDING BLOCKS – INITIAL ITERATION

Data Centres (Infrastructure Management & Operations Control Centres) from IMs and RU

Mobile Object Transactor (APS-MOT)	Movement Authority Transactor (APS-MT)	ATO Transactor (ATO-AT)	Diagnostics & Monitoring (DM)	Device & Configuration Management (DCM)	Identity & Access Management (IAM)	RBC, DAS, Remote Control, etc.

Vehicle Control Systems
- Remote Control
- Energy Meter
- Diagnostic Recording Unit (DRU)
- Braking System
- Traction Control System
- Train Integrity Monitoring System (TIMS)
- Train Control and Mngt. System (TCMS)

Applications
- ETCS Kernel
- ATO

SW Abstraction

Communication Services (ComS)
- Data Communication
- Non-Safe Radio Data Com. (NSRDC)
- Cab Voice over IP (CVoIP)

Basic Services (BS)
- Operational Data (OD)
- Vehicle Diagnostics & Monitoring (VDM)
- Vehicle Device & Config. Mngt. (VDCM)
- Configuration Data (CD)
- Time Synch Services (TSS)

Connectivity Services (ConS)
- EURO Radio
- FRMCS

HW Abstraction

Basic Software

Adapter for Peripheral Devices (APD)
- DMI Adapter (DMIA)
- JRU Adapter (JRUA)
- ODO Adapter (ODOA)
- BTM Adapter (BTMA)
- BIU Adapter (BIUA)

Vehicle Adapter
- Functional Vehicle Adapter

Peripheral Devices:
- CVDs
- DMI (1 – n)
- JRU (1 – n)
- TRU (1 – n)
- DRU (1 – n)
- VLSs / VL-Sensors
- LTM / LT-Antenna
- BTM / BT-Antenna
- STM (0 – n) / NTC (0 – n) / NTCs-Antenna
- I/O Ports / EB / TCO / others

Connectivity Devices:
- GSM-R EDOR Radio 1 - 2
- GSM-R Voice Radio
- FRMCS GW*
- FRMCS Radio (1 – n)

Passenger Information Systems

Driver	Technician	Evaluator	Loc. Tag	EURO Loop	EURO Balise	Nat. Systems

OCORA System Architecture

OCORA

NS | SNCF | SBB CFF FFS | ÖBB | DB

HARDWARE VIEW (SCOPE / BUILDING BLOCKS / EXTERNAL INTERFACE IDENTIFCATION) – FINAL ITERATION

Data Centres (Infrastructure Management & Operations Control Centres) from IMs and RU

| Mobile Object Transactor (APS-MOT) | Movement Authority Transactor (APS-MT) | ATO Transactor (ATO-AT) | Diagnostics & Monitoring (DM) | Device & Configuration Management (DCM) | Identity & Access Management (IAM) | RBC, DAS, Remote Control, etc. |

RCA-5 | RCA-6 | RCA-8 | RCA-41 541 | RCA-42 542 | RCA-43 543 | SFERA

Train

Mobile & Fixed Connectivity Infrastructure (GSM-R / FRMCS)

Vehicle Control Systems

CCS On-Board

OCORA Core

CCU n | CCU 2

Universal Vital Control and Command Bus (UVCCB)

OCORA Gateway 390 / 395

190 Train Control Network
195 Passenger Info Network

CCU 1

381 382 383 384

Passenger Information Systems

300 300 300 300 300 | 300 | 300 | 300 | 300 | 300 | 300

| UIDR | CVDs | DMI (1 – n) | MT (1 – n) | JRU (1 – n) | TRU (1 – n) | DRU (1 – n) | VLSs | LTM | BTM | STM (0 – n) / NTC (0 – n) | PS | I/O Ports | GSM-R EDOR Radio 1 - 2 | GSM-R Voice Radio | Public Radio (1 – n) | FRMCS-GW* / FRMCS Radio (1 – n) |

VL-Sensors | LT-Antenna | BT-Antenna | NTCs-Antenna | P-Sensors | EB / TCO / others

101 102 103 104 110 | 120 130 131 132 140 150 | Peripheral Devices | 181 182 183 184 | Connectivity Devices | *may not be a dedicated HW

Driver | Technician | Evaluator | Loc. Tag | EURO Loop | EURO Balise | Nat. Systems

Trackside

In the Final Iteration OCORA plans to introduce considerably more Building Blocks (yellow blocks).

Each Building Block shall be "Plug & Play"-Like exchangeable.
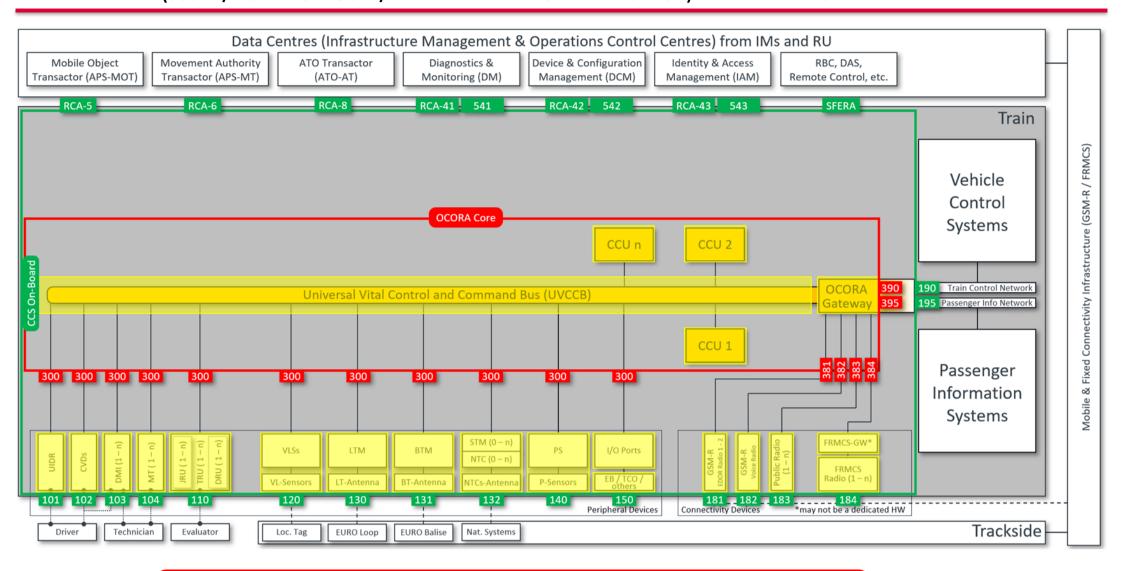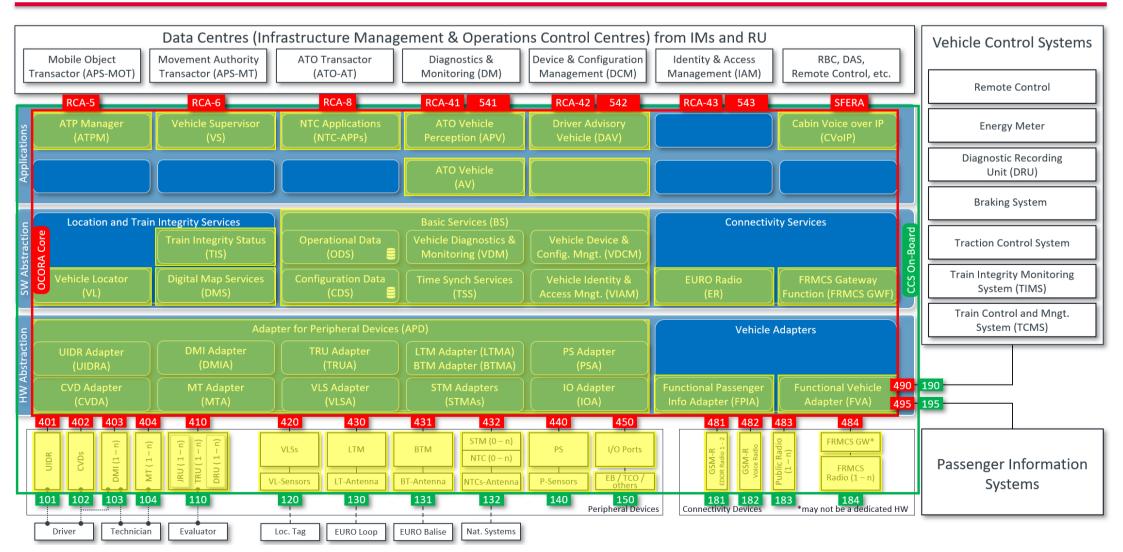
FUNCTIONAL VIEW (SCOPE / BUILDING BLOCKS / EXTERNAL INTERFACE IDENTIFCATION) – FINAL ITERATION

Data Centres (Infrastructure Management & Operations Control Centres) from IMs and RU

| Mobile Object Transactor (APS-MOT) | Movement Authority Transactor (APS-MT) | ATO Transactor (ATO-AT) | Diagnostics & Monitoring (DM) | Device & Configuration Management (DCM) | Identity & Access Management (IAM) | RBC, DAS, Remote Control, etc. |

Vehicle Control Systems

RCA-5 | RCA-6 | RCA-8 | RCA-41 541 | RCA-42 542 | RCA-43 543 | SFERA

Applications

| ATP Manager (ATPM) | Vehicle Supervisor (VS) | NTC Applications (NTC-APPs) | ATO Vehicle Perception (APV) | Driver Advisory Vehicle (DAV) | | Cabin Voice over IP (CVoIP) |

ATO Vehicle (AV)

OCORA Core | CCS On-Board

SW Abstraction

Location and Train Integrity Services | Basic Services (BS) | Connectivity Services

| | Train Integrity Status (TIS) | Operational Data (ODS) | Vehicle Diagnostics & Monitoring (VDM) | Vehicle Device & Config. Mngt. (VDCM) | |

| Vehicle Locator (VL) | Digital Map Services (DMS) | Configuration Data (CDS) | Time Synch Services (TSS) | Vehicle Identity & Access Mngt. (VIAM) | EURO Radio (ER) | FRMCS Gateway Function (FRMCS GWF) |

HW Abstraction

Adapter for Peripheral Devices (APD) | Vehicle Adapters

| UIDR Adapter (UIDRA) | DMI Adapter (DMIA) | TRU Adapter (TRUA) | LTM Adapter (LTMA) BTM Adapter (BTMA) | PS Adapter (PSA) | |

| CVD Adapter (CVDA) | MT Adapter (MTA) | VLS Adapter (VLSA) | STM Adapters (STMAs) | IO Adapter (IOA) | Functional Passenger Info Adapter (FPIA) | Functional Vehicle Adapter (FVA) 490 / 495 |

190
195

Vehicle Control Systems

- Remote Control
- Energy Meter
- Diagnostic Recording Unit (DRU)
- Braking System
- Traction Control System
- Train Integrity Monitoring System (TIMS)
- Train Control and Mngt. System (TCMS)

401 402 403 404 410 | 420 430 431 432 440 450 | 481 482 483 484

| UIDR | CVDs | DMI (1 – n) | MT (1 – n) | JRU (1 – n) | TRU (1 – n) | DRU (1 – n) | VLSs | LTM | BTM | STM (0 – n) / NTC (0 – n) | PS | I/O Ports | GSM-R EDOR Radio 1 - 2 | GSM-R Voice Radio | Public Radio (1 – n) | FRMCS GW* / FRMCS Radio (1 – n) |

VL-Sensors | LT-Antenna | BT-Antenna | NTCs-Antenna | P-Sensors | EB / TCO / others

101 102 103 104 110 | 120 130 131 132 140 150 | Peripheral Devices | 181 182 183 184 | Connectivity Devices | *may not be a dedicated HW

Driver | Technician | Evaluator | Loc. Tag | EURO Loop | EURO Balise | Nat. Systems

Passenger Information Systems

EUPL | CC BY SA

OCORA System Architecture

FUNCTIONAL BUILDING BLOCKS WITH INTERFACES

Data Centers (Infrastructure Management & Operation Control Centers)
- Mobile Object Transactor (APS-MOT) — RCA-5, RCA-5
- Movement Authority Transactor (APS-MT) — RCA-6, SS-026
- ATO-Transactor (ATO-AT) — RCA-8, [IRS 90940] [SS 126]
- Diagnostics & Monitoring (DM)
- Device & Configuration Management (DCM)
- Identity & Access Management (IAM)
- RBC, DAS, Remote Control, etc.

Vehicle Control Systems
- Remote Control
- Energy Meter
- Energy Meter
- Diagnostic Recording Unit (DRU)
- Braking System
- Traction Control System
- Train Integrity Monitoring System (TIMS)
- Train Control and Mngt. Systems (TCMS)

- Automated Train Protection Manager (ATPM)
- Vehicle Supervisor (VS) — Subset-026
- NTC Applications (NTC-APPs)
- ATO Preception Vehicle (APV) — GoA 3 - 4
- Driver Advisory Vehicle (DAV)
- Cabin Voice over IP (CVoIP)
- ATO Vehicle (AV) — Subset-125
- SS-130

Location and Train Integrity Services
- Train Integrity Status (TIS)
- Vehicle Locator (VL) — Subset-026
- Digital Map Services (DMS)
- SS-130

Basic Services (BS)
- Operational Data (ODS)
- Vehicle Diagnostics & Monitoring (VDM)
- Vehicle Device & Config. Mngt. (VDCM)
- Configuration Data (CDS)
- Time Sync Services (TSS)
- Vehicle Identity & Access Mngt. (VIAM)

Connectivity Services (CS)
- EURO Radio (ER)
- FRMCS Gateway Function (FRMCS GWF)
- SS-034 [SS 129] [SS 139] [SS 143]

Adapter for Peripheral Devices (APD)
- UIDR Adapter (UIDRA)
- CVD Adapter (CVDA)
- DMI Adapter (DMIA) — [SS 121]
- MT Adapter (MTA)
- TRU Adapter (TRUA) — [SS 027] [SS 140]
- VLS Adapter (VLSA) — 97X2675B
- LTM Adapter (LTMA) BTM Adapter (BTMA) — SS-026 SS-101
- STM Adapters (STMAs) — SS-085 SS-058 SS-101
- PS Adapter (PSA)
- IO Adapter (IOA) — SS-034 SS 119

- Functional Vehicle Adapter (FVA)
- Functional Passenger Info Adapter (FPIA)
- Passenger Information Systems

Peripheral Devices
- UIDR
- CVDs
- DMI (1-n) — ERA_ERTMS_015560
- MT (1-n)
- JRU (1-n)
- TRU (1-n) — SS 027
- DRU (1-n)
- VLSs
- LTM — SS-044
- BTM — SS-036
- STM (0-n) / NTC (0-n)
- PS
- I/O Ports
- GSM-R EDOR Radio — SS-037
- Public Radio
- GSM-R Voice Radio
- FRMCS-GW / FRMCS Radio