INTERNATIONAL UNION
OF RAILWAYS

Welcome to the

DAS - SFERA

Stakeholders workshop
(extended user group)

Online participants:

- *Please rename as [Name Surname (Company)]*
- *Please remain on mute while a speaker is active*

UIC SFERA Working Group

UIC SFERA User Group

08 November 2023, Paris

Welcome
Introduction
Agenda

Philippe Stefanos
Sustainability advisor
Energy and emissions
UIC

Agenda

12:00 Light lunch

12:40 Welcome by UIC Director (Jean-Michel Evanghelou)

12:45 Introduction: status of SFERA (Daniele Arena)

13:00 Planned/Working implementations

- **SFERA Members (Daniele Arena)**
- **Trafikverket (Peter Olsson)**
- **SNCF Réseau (Sébastien Dislaire)**
- **ÖBB (Daniel Friedl)**
- **MTrail (Yves Wyder)**

13:50 Adapting the Common Interface to C-DAS operations (Thomas Pynthe)

14:05 Break

14:25 Looking ahead: Digital instructions and SFERA (Sébastien Dislaire)

14:40 Conclusions of the joint work with X2Rail4 (Benoît Bienfait, Benoît Abisset)

14:55 The beginning of ERJU and its impact on DAS and SFERA (Bart Van der Spiegel)

15:10 Joint SFERA-railML session (Vasco Paul Kolmorgen, Alain Wenmaekers)

15:35 Mini-workshop on SFERA interoperability (in subgroups) (Thomas Sutter, Alain Wenmaekers)

16:15 Fair/Networking

- **Transrail**
- **NS+ProRail**
- **MTrail**
- **SFERA**

17:30 End

Introduction

Daniele Arena
Lead & Project manager
SFERA & Traction energy settlement data
UIC

100 YEARS ANNIVERSARY

INTERNATIONAL UNION OF RAILWAYS

STATUS OF SFERA

Daniele ARENA

UIC, SFERA Working Group

SFERA Workshop, November 8th 2023

It all started in 2016

SFERA project: 2017-2019

SFERA maintenance project: 2021-2023

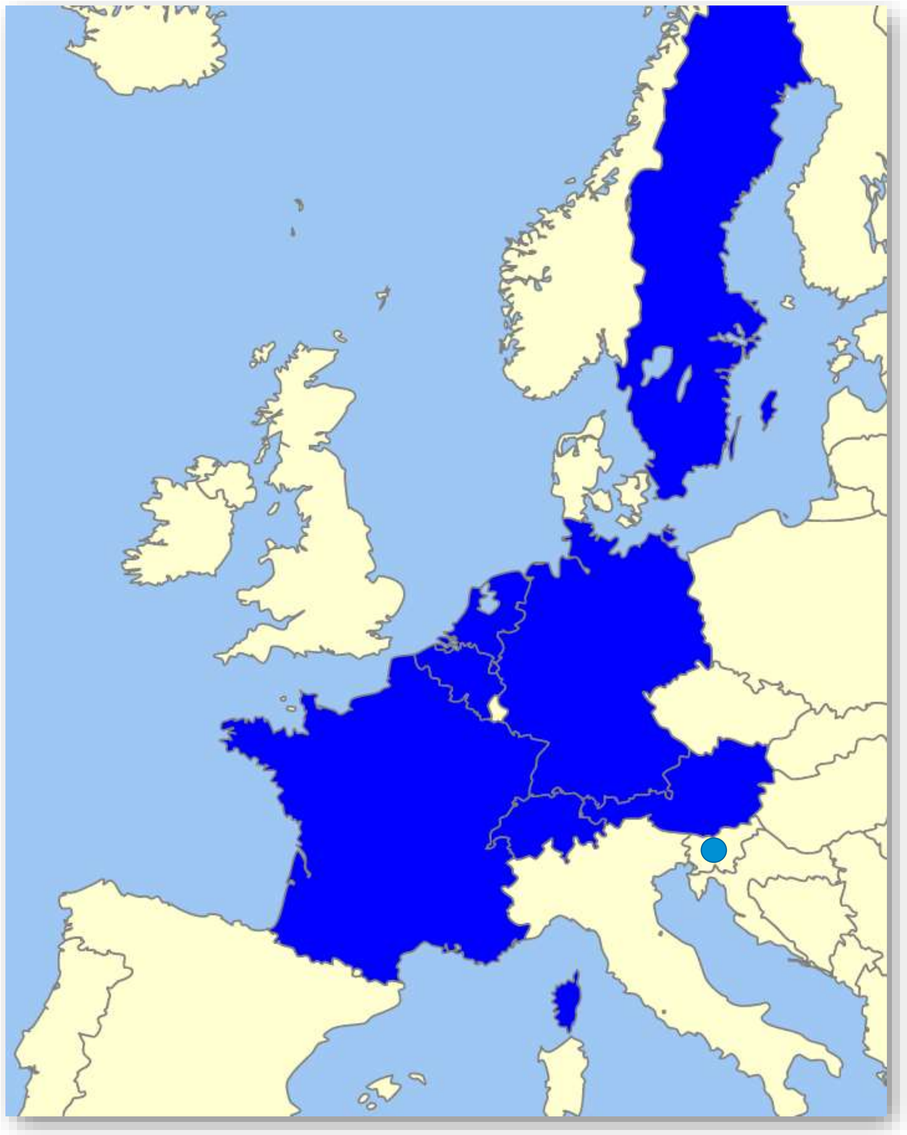
Working Group

End of 2021-2023 SFERA maintenance

Next phase: 2024-2026 SFERA maintenance

- Current members have expressed interest
- 1 potential new member
- There is always time to join! (UIC Members)

DB	Infrabel
NMBS/SNCB	NS
ÖBB	ProRail
SBB	SNCF
Trafikverket	SŽ



User Group

1 webco/meeting every 3 months (more or less)

84 members (subscribed to the mailing list)

Average: less than 3 e-mails per month

Half of you is not registered to the User Group, please sign up!

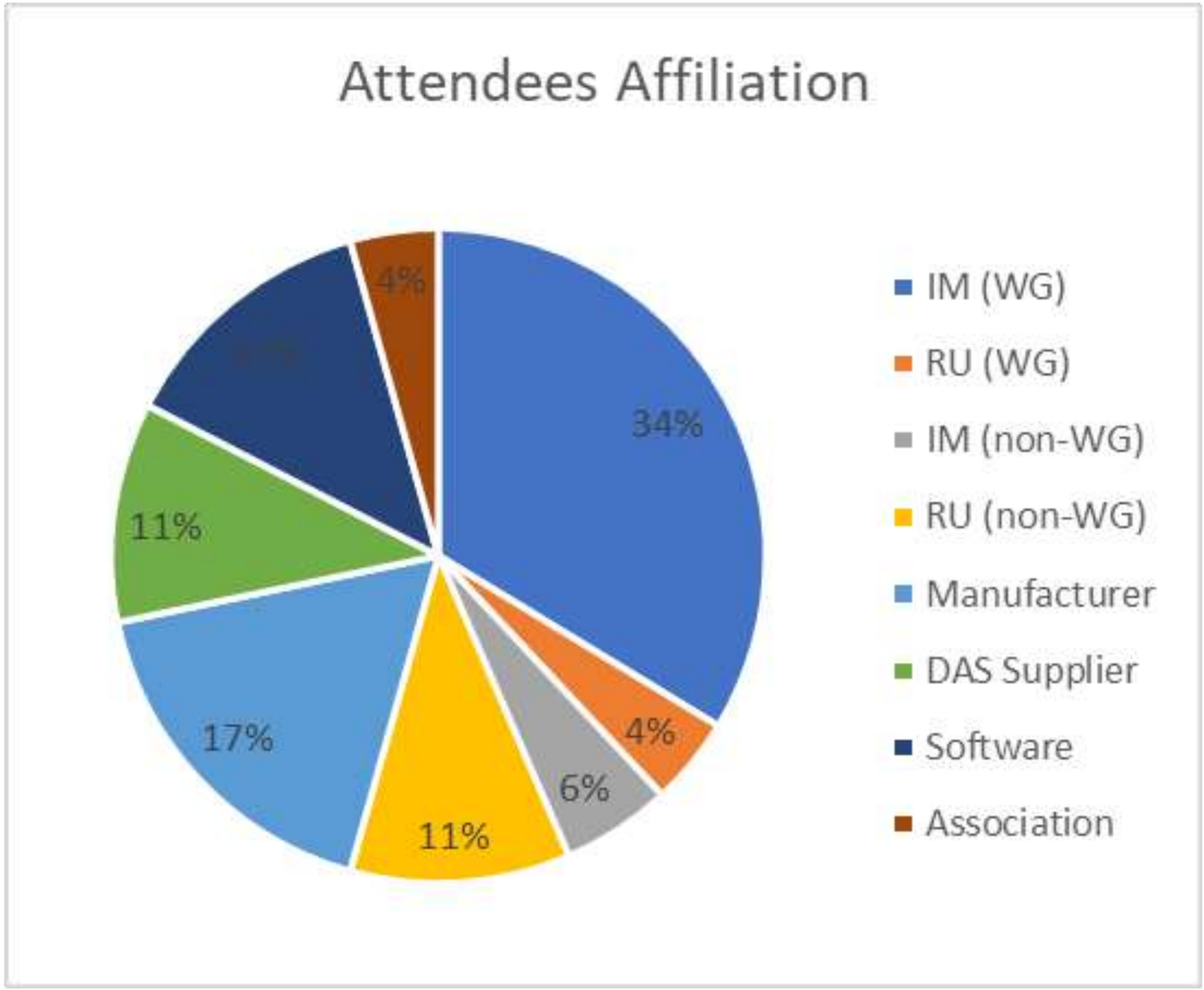
https://uic.org/events/irs-90940-sfera-change-requests-and-sfera-user-group#SFERA-User-Group

Today

This year’s registrations: 94

- 63 in person
- 31 online

48 companies represented



2023-2024 SFERA Timeline

2023-2024 SFERA timeline

2023-2024 SFERA timeline

- Main scope addition for Edition 3
- Digital Instructions project experts

2023-2024 SFERA timeline

Feedback from early adopters of version 2.0
- 6 Change requests on XSD
- Precisions on Appendix B (Communication)

2023-2024 SFERA timeline

- Sharing specification and implementation roadmaps
- Sharing experiences between stakeholders

2023-2024 SFERA timeline

Clarifications on some Appendices
- Appendix B (Communication)

**101 for Edition 1*

2023-2024 SFERA timeline

Currently: 75 change requests since Edition 2 was frozen*

- New Scope: Digital European Instructions
- Improving Interoperability
- Continued effort to enhance the protocol quality
- Additional functionality for DAS

**101 for Edition 1*

Edition 3: enhancement

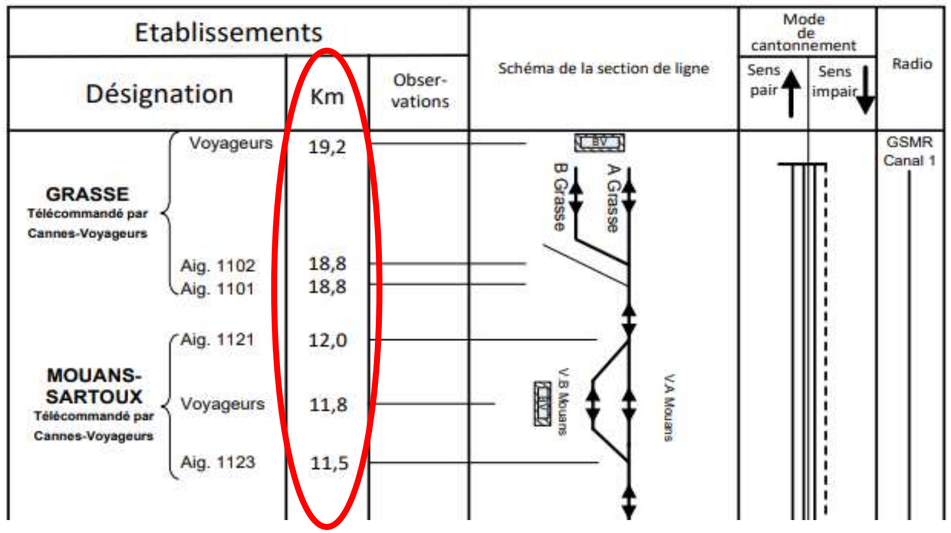
Improve the quality of the protocol

Fixing 30+ “bugs” to clarify details and adjust text in light of real-life tests and in-depth analysis

Addition of details on Platform (e.g. name, side, usage)

Addition of “virtual” KM markers

Addition of visual identifiers of signals

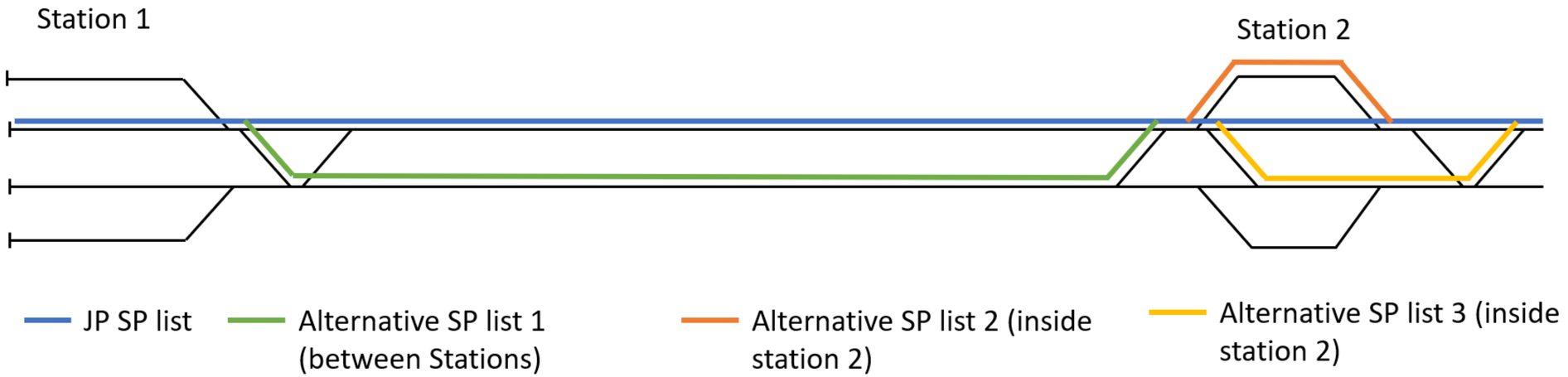


Alternative itineraries

Last moment itinerary change: possible delay in JP update from TMS

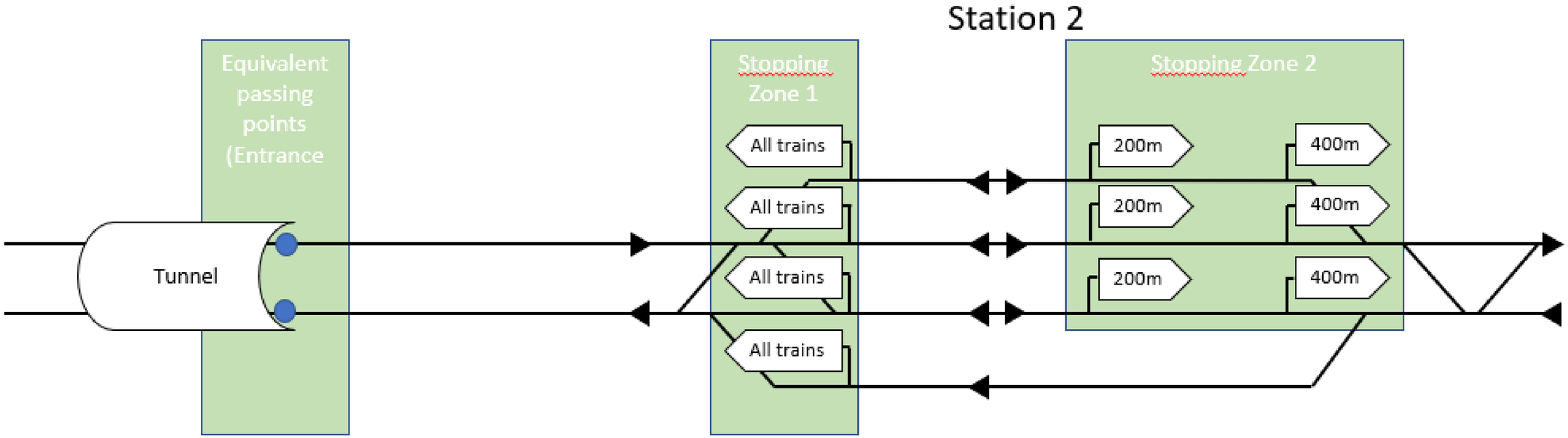
- DAS: Inaccurate Advice
- ATO: risk of stopping point overshoot

Journey profile will include alternative « Segment Profile lists »



Alternative itineraries: Timing Point equivalencies

Timing Point equivalencies will be used for the DAS-OB to determine where to consider the original timing point constraints.



Input requested: Traction Force Curves and different traction modes (poster during “fair”)

SFERA: TRACTION FORCE CURVES

Traction Force Curves are defined in IRS 90940:

As part of Train Characteristics

Sent from Ground to Board

Dependent on:
- Current
- Voltage
- Traction type (Self-propelled, Powerless, Electrical)

How should SFERA improve the handling of Traction Force Curves, specifically for a combination of different traction modes (e.g. battery, hydrogen, diesel, overhead contact line)?

Please provide your input

What parameters can influence Traction Force Curves?

How should degraded situations be handled?

Is it more efficient to calculate TFCs on board? What input is needed?

Edition 3: Improving interoperability

Making the SFERA solution a standard

SFERA: “voluntary adoption” solution

Many projects in Europe show that SFERA covers real business needs

Multiple initiatives towards TSIs:

- CCS: Track-train communication workshops with S2R4 (tbc with ERJU)
- OPE: Proposition to ERA to define the Digital European Instructions protocol
- TAF & TAP:
    - Continued alignment of data objects
    - Presentation to the Telematics Experts Group

TAF/TAP inclusion

Data elements from the TAF/TAP XSD in SFERA

Train Identification: OTN and Train-ID	Company Code	Message Header
Composition sub-elements	DelayCause	Train Ready / Interruption
Network Specific Parameters	GNSS_DynamicPosition	Locations

Currently: “copy/paste”

Objective, following positive feedback from UG: include the TAF/TAP XSD in Edition 3

Next User Group Appointments

Next User Group webcos:

- 15 March 2024 – 10:00-12:00
- 05 June 2024 – 10:00-12:00

Next workshop: probably in spring 2025

Agenda

12:00 Light lunch

12:40 Welcome by UIC Director (Jean-Michel Evanghelou)
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17:30 End

Implementation

SFERA Working Group: Overview

Daniele Arena
UIC

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INTERNATIONAL UNION OF RAILWAYS

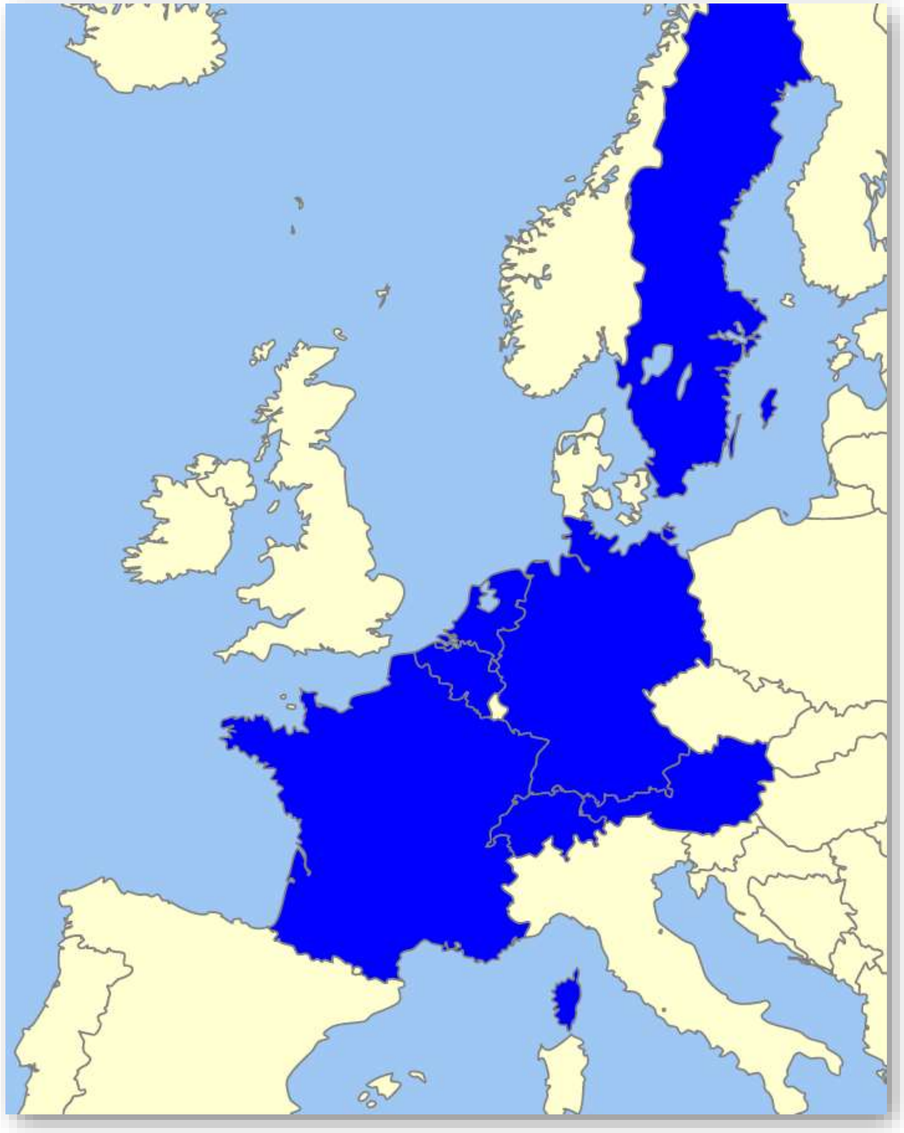
STATUS OF SFERA MEMBERS

DAS and SFERA Implementation - 2023

The SFERA Working Group

UIC Project

DB	Infrabel
NMBS/SNCB	NS
ÖBB	ProRail
SBB	SNCF Réseau
Trafikverket	



DB Netz

DB Netz

DB Netz prepares to send SFERA messages in the next years:

1. C-DAS-C for existing use cases (“Green Functions” of DB Netz) and Related Train Information (Farsight/Rearview) coming in 2024/2025
2. C-DAS-O based on dispatching decisions and location/speed messages coming after 2025
3. continuous C-DAS-O messages and energy messages not yet decided

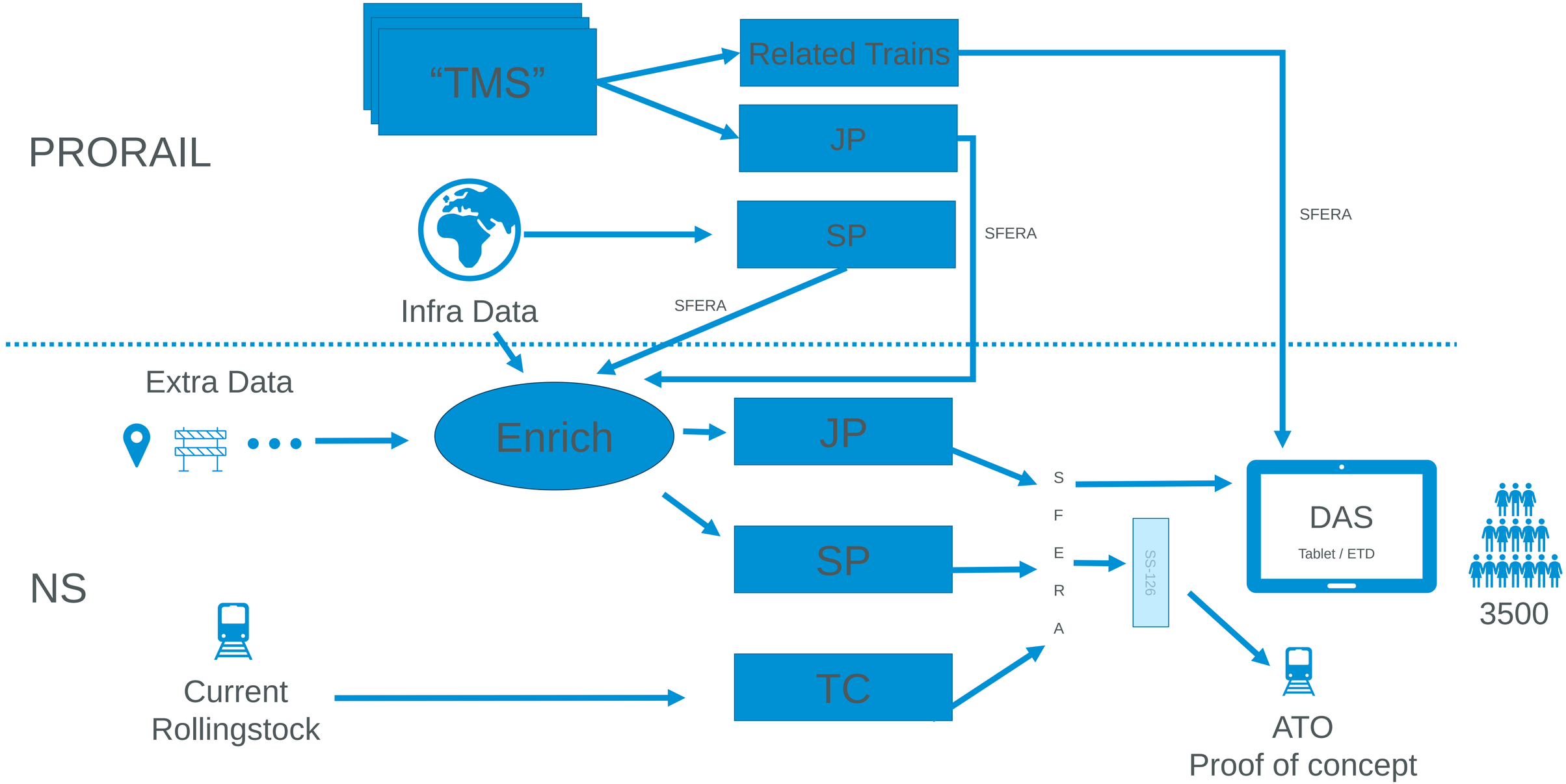
Infrabel

DAS @ Infrabel

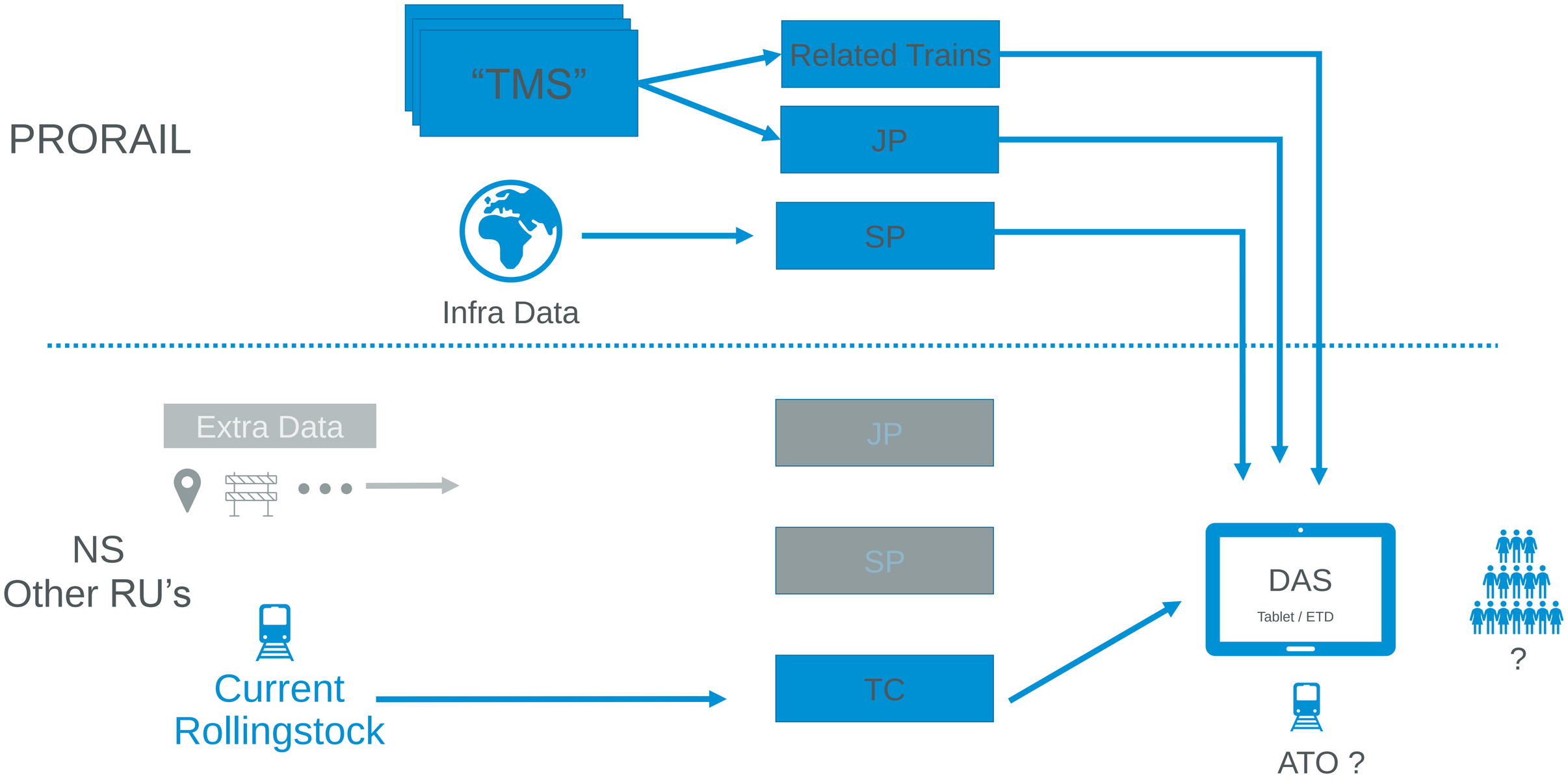
1. We have been further testing the C-DAS-C on lines 50A and 59 (between Gent and Zeebrugge). Recently test also started on a third line.
2. It is possible to extend early 2024 to big parts of freight corridors.
3. We are checking with NMBS how they can add the advice on the driver-app. This app already has a recommended speed when running on time and can then also represent the speed advice coming from Infrabel to avoid a conflict.
4. We were contacted by Thalys (now called Eurostar red). They are now installing EMS on their fleet and are investigating to add a DAS that can work with the data available in France and Belgium and by preference also in Netherlands and Germany.
5. On request we can manually create JPs and SPs for a few train-runs. This is offline data. Such data can be used in a ground server of a DAS-application to start S-DAS function cross-border also for the trajectories in Belgium. If merged with C-DAS-C, this should give already a good result.
6. We need to have requests for implementations needing JPs and SPs to speed up the creation of a DAS-TS able to send this data following SFERA-protocol (C-DAS-O).

NS – ProRail

Current Trackside Implementation NS - Prorail



ROADMAP

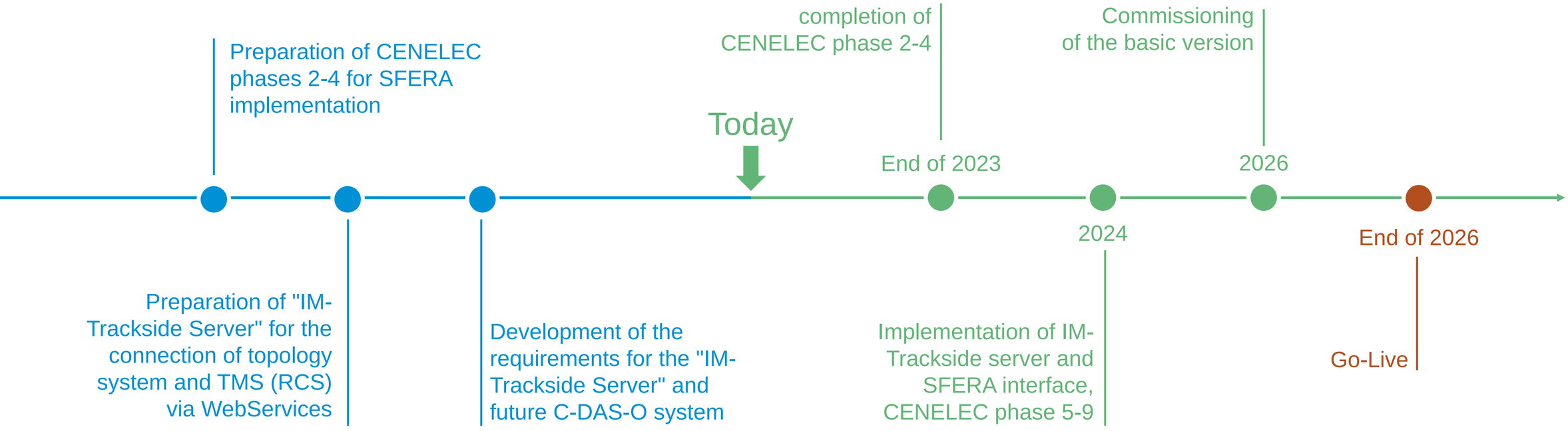

PRORAIL
"TMS"
Related Trains
JP
SP
Infra Data
Extra Data
NS
Other RU's
JP
SP
TC
Current
Rollingstock
DAS
Tablet / ETD
?
ATO ?

SBB

SBB is in the process of implementing SFERA.

The replacement of the existing C-DAS device in Switzerland (LEA / LOPAS) and the migration of the existing communication channel (ADL channel) to the SFERA interface is ongoing. The current system will be fully replaced by the end of 2026.

What we did so far and our plans:

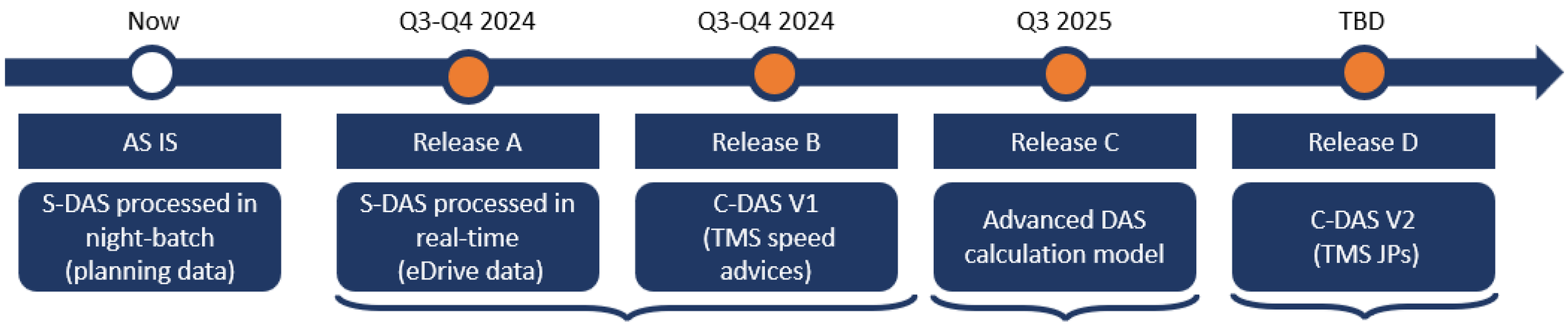


* CENELEC EN50126, Lifecycle Model

SNCB/NMBS

SNCB

eSpeed project



C-DAS-C architecture

- In case of conflict : Speed advices from Infrabel TMS (Release B)
- In case of no-conflict : Speed advices from NMBS backend (Release A)

Interface = eDrive (tablets train drivers), showing:

- Active speed advice to follow
- Active speed mode (e.g. ECO, MAX, CONFICT, …)
- Distance to the next speed advice
- Next speed advices/modes side to timetable (resolution ~ 15 km)

Advanced functionalities of calculation model (flexible granularity, coasting, parameters tuning, performance, …)

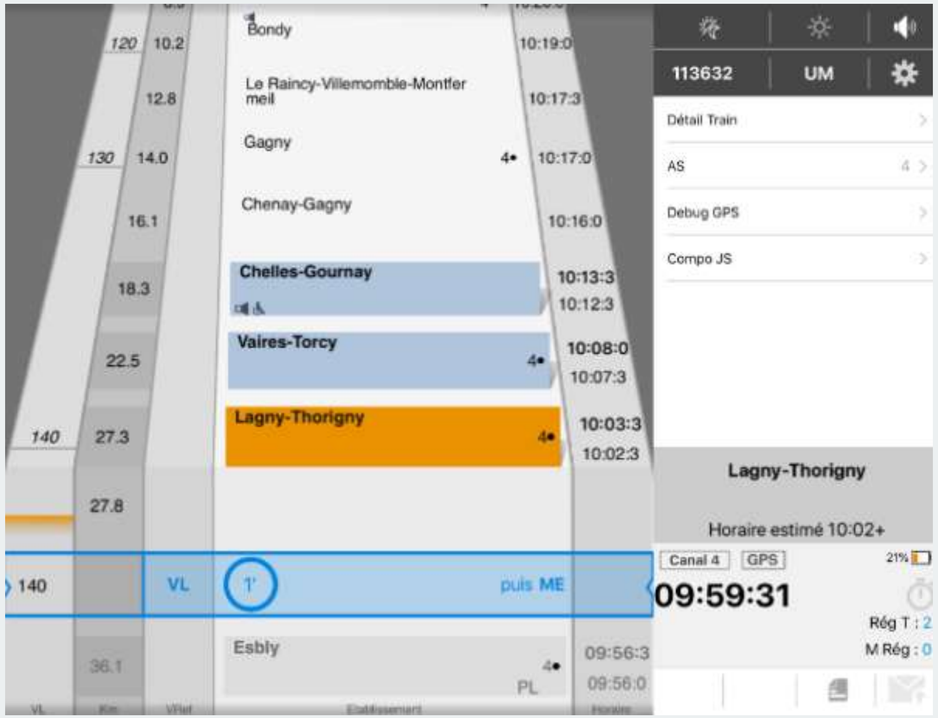
Journey profiles from Infrabel TMS instead of speed advices

SNCF Voyageurs

SNCF Voyageurs

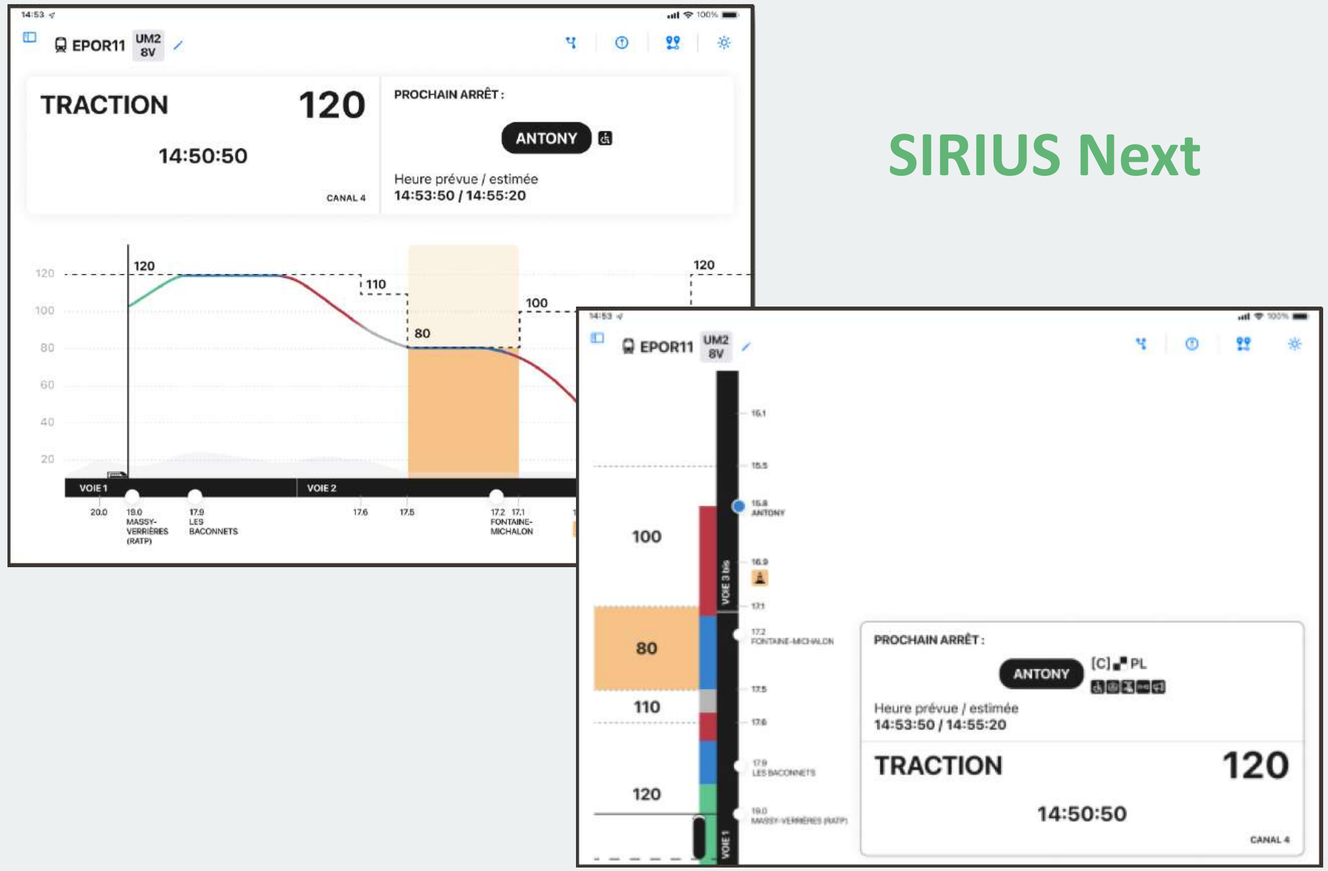
Currently deploying SIRIUS Next for all passenger trains. End of deployment planned mid-2024. This DAS is provided with SFERA data from SNCF Voyageurs allowing short term corrections to fit drivers' requirements and expectations.

SIRIUS NG



Old data flow from SNCF Réseau

SIRIUS Next



SFERA data flow from SNCF Voyageurs

Implementation

Trafikverket (SFERA Working Group)
Peter Olsson

TRAFIKVERKET

C-DAS with SFERA

The progress of Trafikverket’s SFERA implementation

Peter Olsson, Trafikverket
Sweden

TRAFIKVERKET

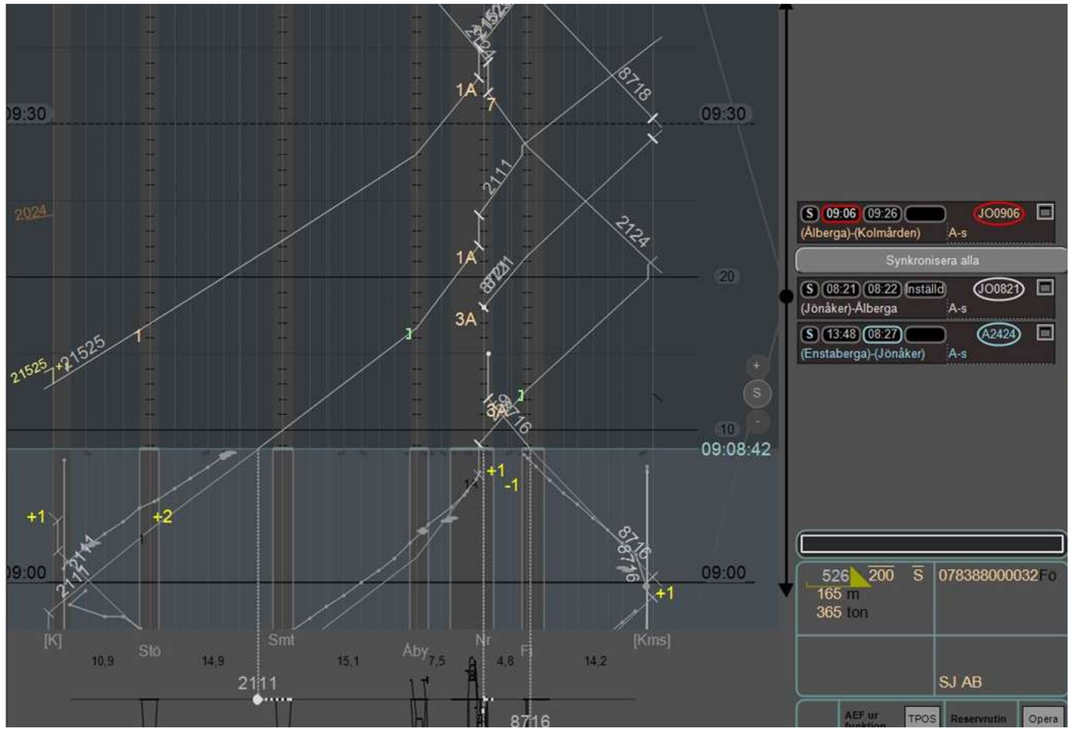
Content

- Background
- Implementation
- Test Possibilities
- The Plan Ahead

TRAFIKVERKET

Traffic Management System

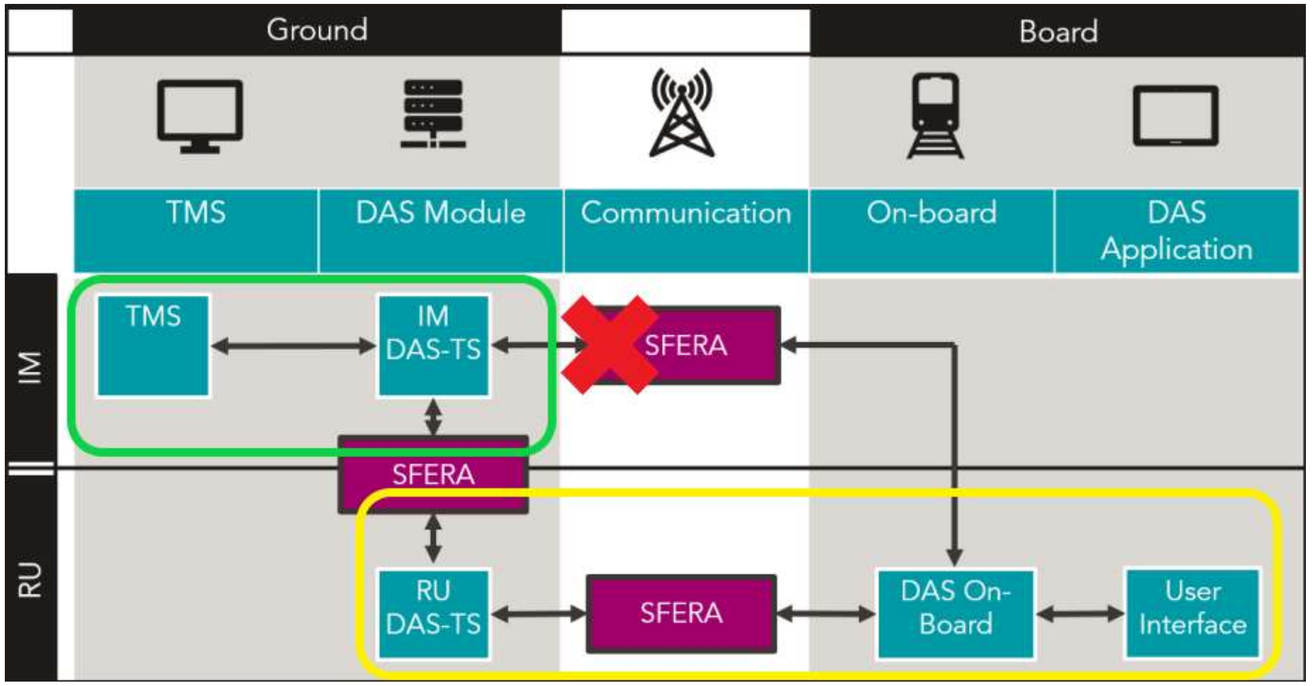
- The in-house developed system Steg
  - The source of the RTTP
  - Planned to cover 60-80% of the remote controlled network in Sweden
- Acts as a platform to test new concepts
  - Part of demonstrations within Europe’s Rail (the new big research and innovation partnership)
- Used to test improvements of the HMI when using C-DAS



TRAFIKVERKET

What We Support

- IM-RU Setup
  - Implementing the IM DAS-TS
- Connection via Common Interface
  - According to SFERA Edition 2
- C-DAS-O Architecture
  - Journey Profile
  - Segment Profile
  - Train Characteristics



Test Possibilities

- A test environment will be established via Common Interface
  - Connected to a test installation of Steg/TMS
  - Runs the IM DAS-TS
  - To be used for tests with the railway undertakings
- A web interface exists for manual tests of the data provided
  - Includes some of the SFERA use cases
  - Will maybe be made available externally
- Test in production with real trains

TRAFIKVERKET

Many Things Left to Do

- More data in the segment profiles
- Build a service that updates the segment profiles
- Improved definition and calculation of the timing points
- Introducing Train Characteristics
- Add more monitoring, testing and simulation capabilities
- Interaction with the TMS
- Tool for visualisation and validation
- ...

TRAFIKVERKET

The Plan Ahead

- Existing C-DAS project ends this year
  - Have been running a non-SFERA implementation as a pilot from 2019
  - Will finish the first implementation with SFERA during 2023
- New project starting in the beginning of next year
  - Continue the work with SFERA and the interaction with the TMS
  - Cooperate with railway undertakings
  - Will last until end of 2026
  - Be part of a Europe’s Rail demonstration (FP1 WP16) in 2026

That was all!

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www.linkedin.com/in/sopolsson

Implementation

SNCF Réseau (SFERA Working Group)

Sébastien Dislaire

Interfaces for Clients and IMs in traffic management (TAF-TAP, ATO, C-DAS)

100 YEARS ANNIVERSARY

INTERNATIONAL UNION OF RAILWAYS

IMPLEMENTATION ROADMAP

SNCF Réseau

Sébastien DISLAIRE

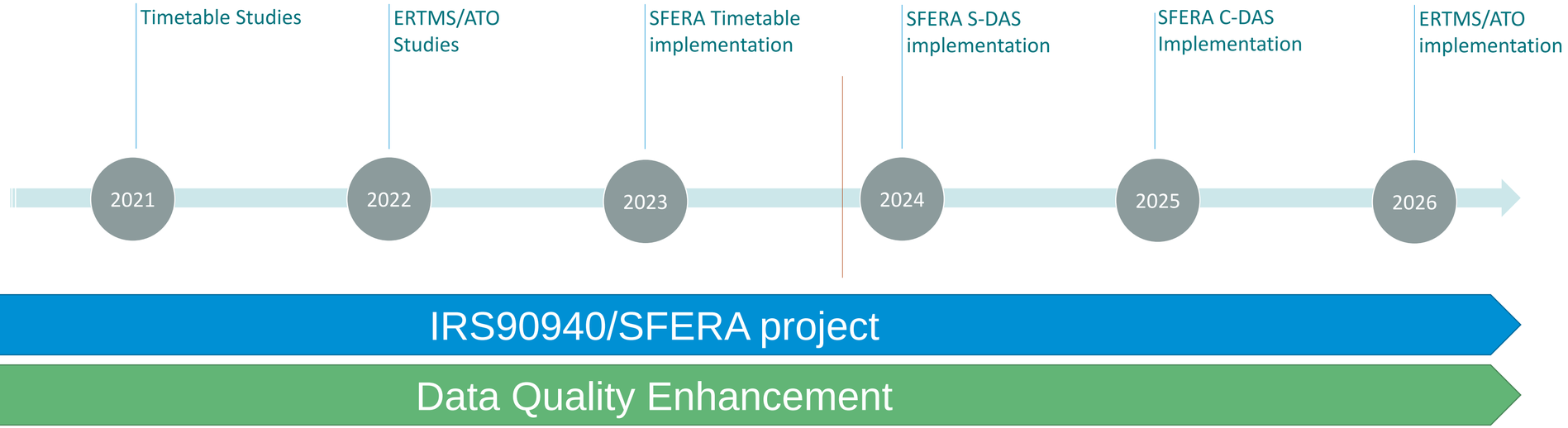
SFERA Edition 2 Workshop / 10/10/2022

Aims of SNCF Réseau implementation roadmap

Capture advantages of DAS : punctuality, capacity, safety, efficiency and quality of service

Establishing the trackside for 100% of trains to operate under DAS or ATO :
- Integrating with RU projects and DAS suppliers

Establishing the stepping stones towards ATO implementation



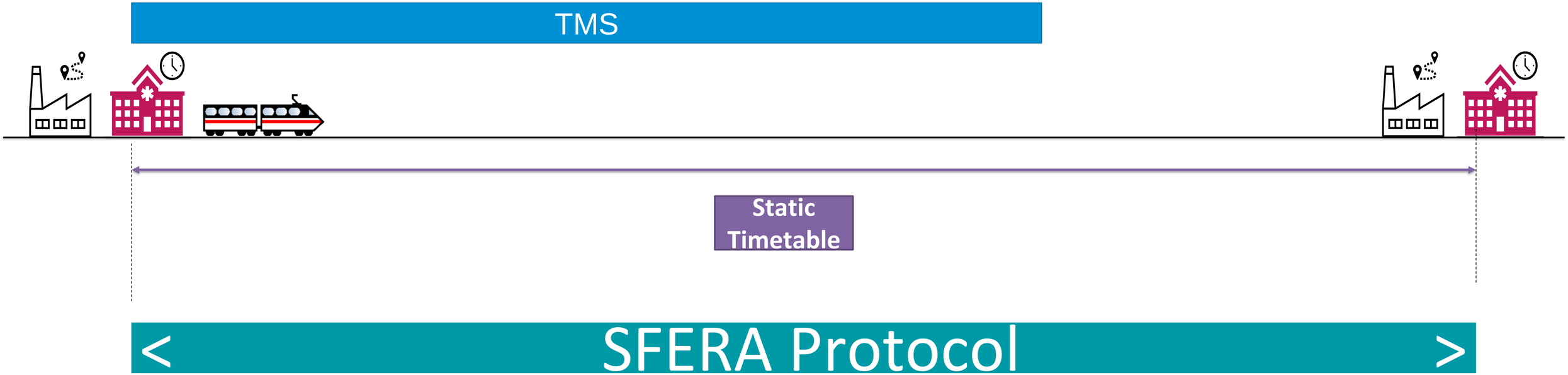
Step 1 : Timetable mode

Objectives :

- End-to-end journey description to drivers
- Core of the segment profile

Journey Profile :
- Applicable OTN
- Theoretical timetable + stop types
- Annotations

Segment Profile :
- Virtual Balises
- Km reference points
- Timing Points at stations
- Max speeds >5km
- Line + track identifier
- Primary Locations (TAF-TAP)
- Traffic management tel contact



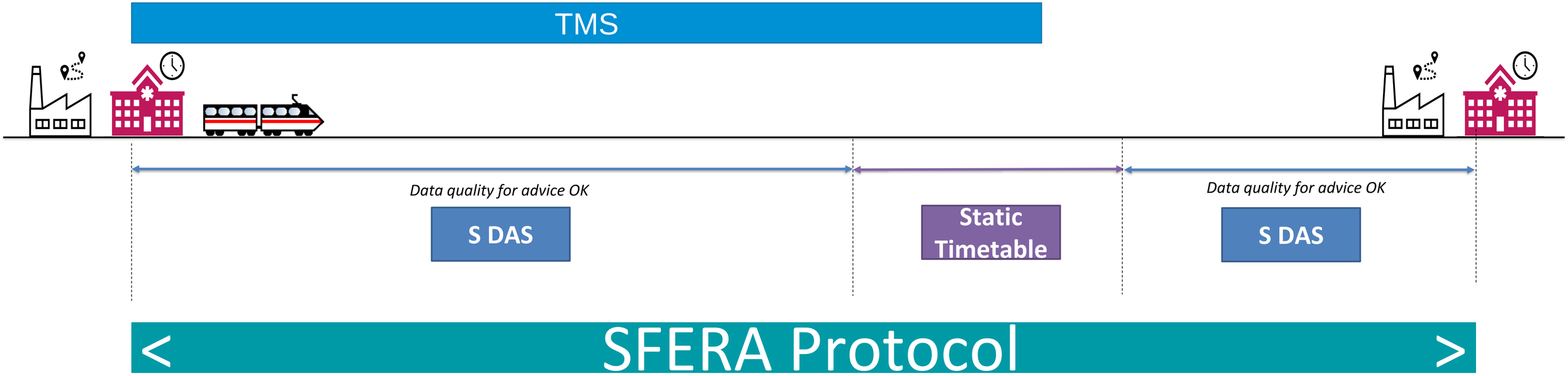
Step 2 : S-DAS

Objectives :

- Add data useful for speed envelope calculation
- Include input from providers and RUs

Journey Profile additions :
- Temporary Speed Restrictions

Segment Profile additions :
- Max speed <5km
- Stopping points of front of train
- Gradients
- Curve radius
- Catenary signals



Step 3 : C-DAS

Objectives :

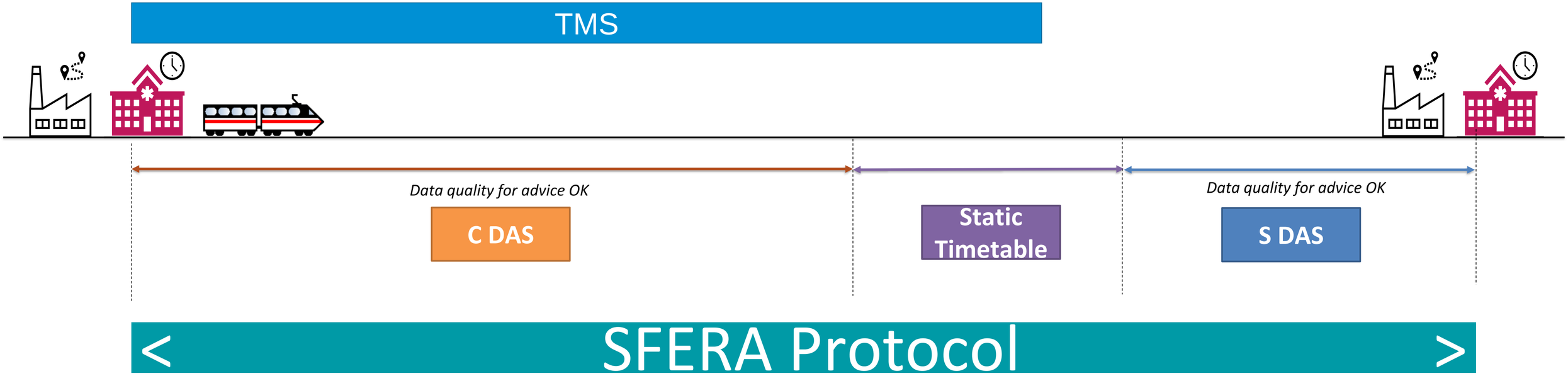
- Data updated throug
- Include input from providers and RUs

Journey Profile additions :

- Timing point and SP list updates based on TMS data
- Train hold/interruption
- ICT optimizations

Segment Profile additions :

- Passing points at signals
- Subsidiary locations (TAF-TAP)



Step 4 : Enhancements

Objectives :

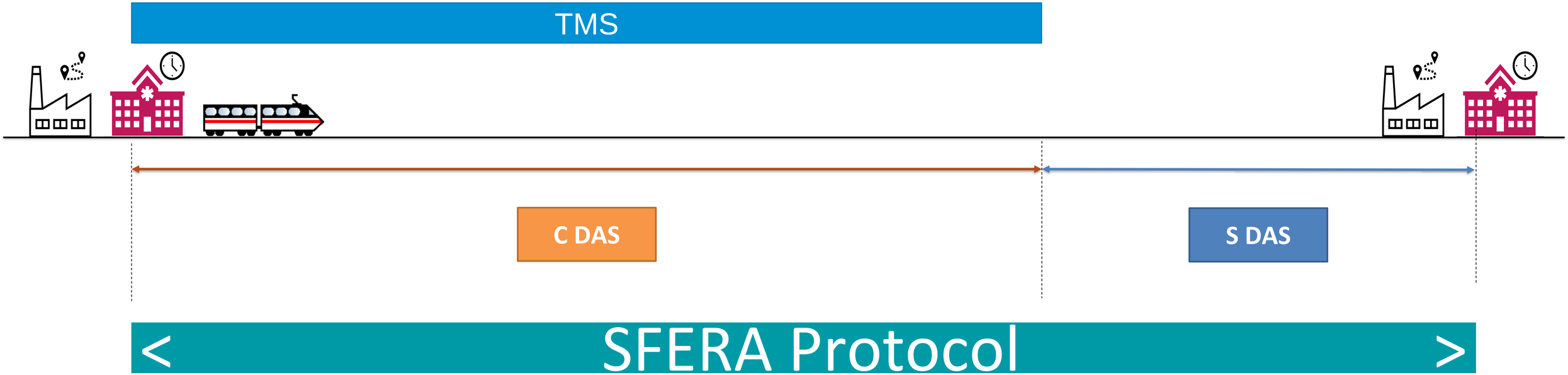
- Enhance data quality on whole network
- Optimize C-DAS functions for more throughput and coordination

Journey Profile additions :

- Traffic manager messages
- Automatic timing point optimization
- …

Segment Profile additions :

- To be defined



Implementation

ÖBB Infrastruktur AG (SFERA Working Group)
Daniel Friedl
Railway system, Train control, ATO

ATO goals & evolutionary development:

Slides explaining the ATO goals and how to achieve them using an evolutionary approach.

Adaptive Zuglenkung and Automatic Train Operation

AZL

Traffic Management System

Semi-automated conflict detection and solution

Dispositive actions and central calculation

Driving recommendation

ATO

Traffic Management System

Semi-automated conflict detection and solution

Dispositive actions and central calculation

Driving instructions

Expected focus of the ATO evaluation project

	 **Mainline**	 **Sideline**	 **Digital train preparation**
Primary goal			
Phase I	**GoA Level 2 over ETCS** for all train journeys of **PT**.	**GoA Level 2 over ETCS** for all train journeys of **PT**.	
Phase II	**GoA Level 2 over ETCS** for all train journeys of **FT**.	**GoA Level 2 over ETCS** for all train journeys of **FT**.	
Secondary goal		**GoA Level 3 Demonstrator**	**GoA Level 4 Demonstrator**

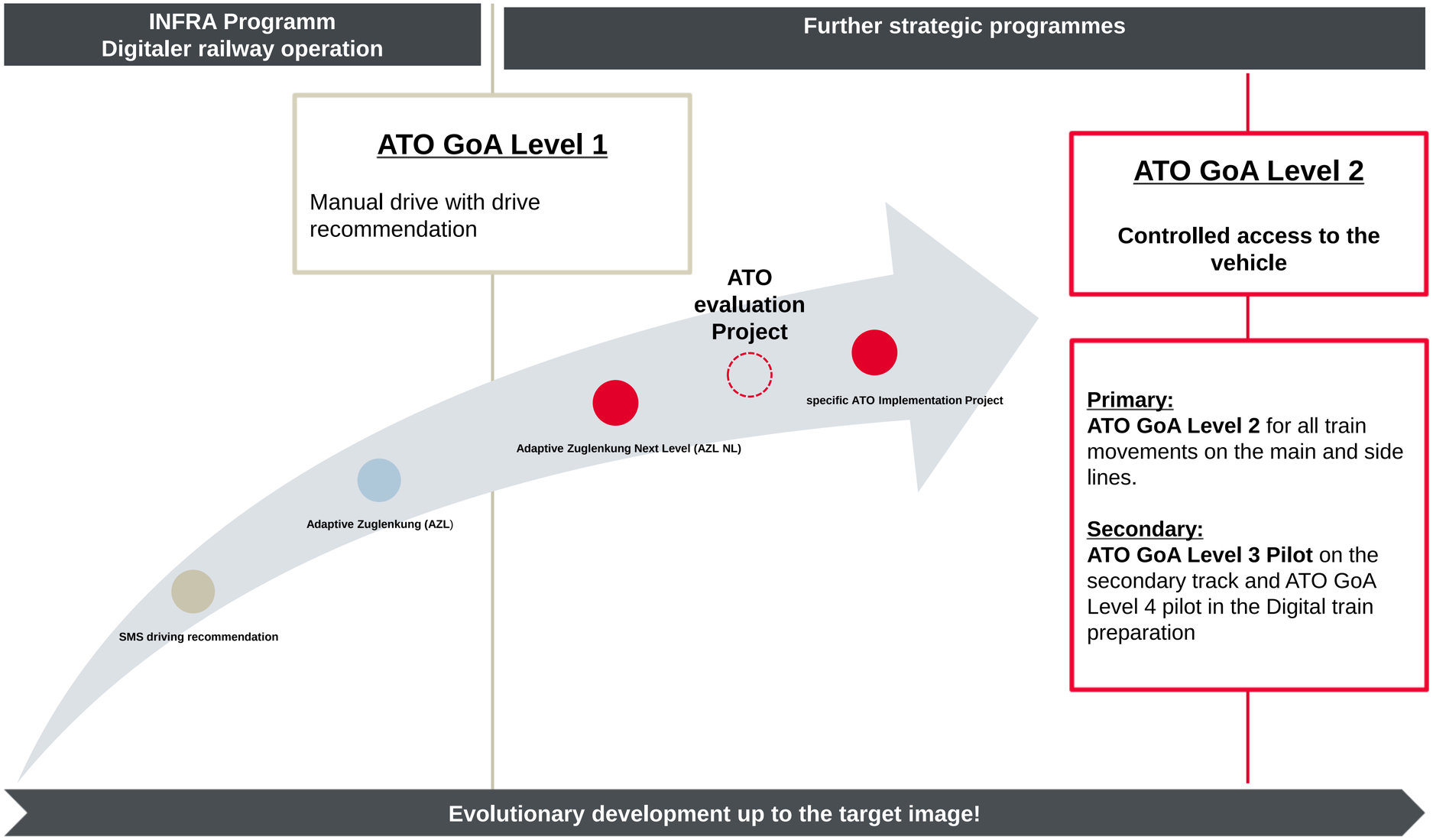
Due to **complex technical, operational** and **legal** challanges (braking behaviour, braking curves, etc.), **GoA Level 2 journeys in freight transport** (FT) can only take place **after the challenges** have been completely **solved**.

An additional essential „Enabler“ technology for the implementation of GoA 2 journeys in freight transport is the Digital Automatic Coupling (DAC)

GoA Level 1 (AZL) is realised as a preliminary stage to **GoA Level 2**.

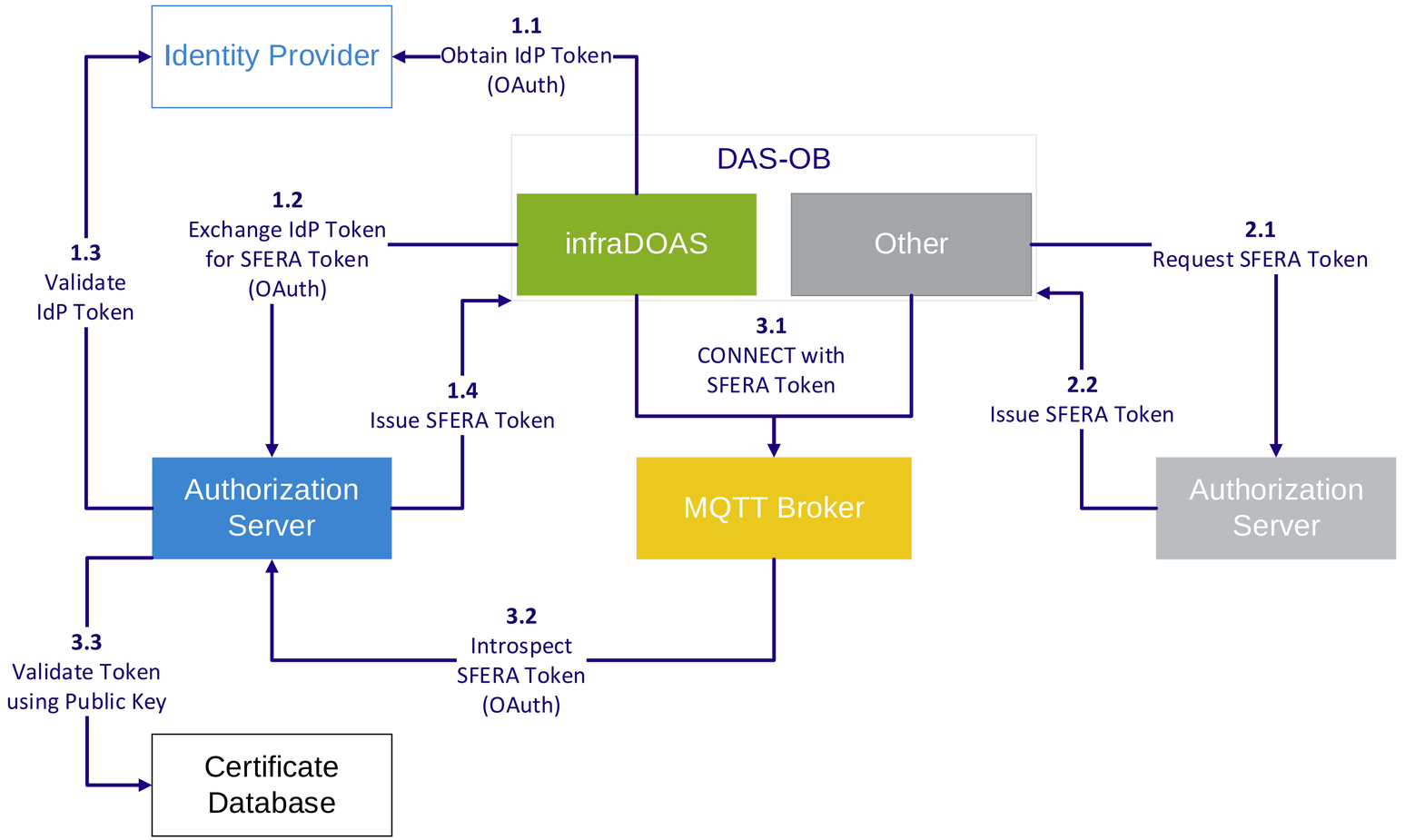
GoA … Grade of Automation
AZL … Adaptive Zuglenkung
ETCS … European Train control System

Projects on the way to GoA Level 2



SFERA Authentication & Authorization Flows - AZL

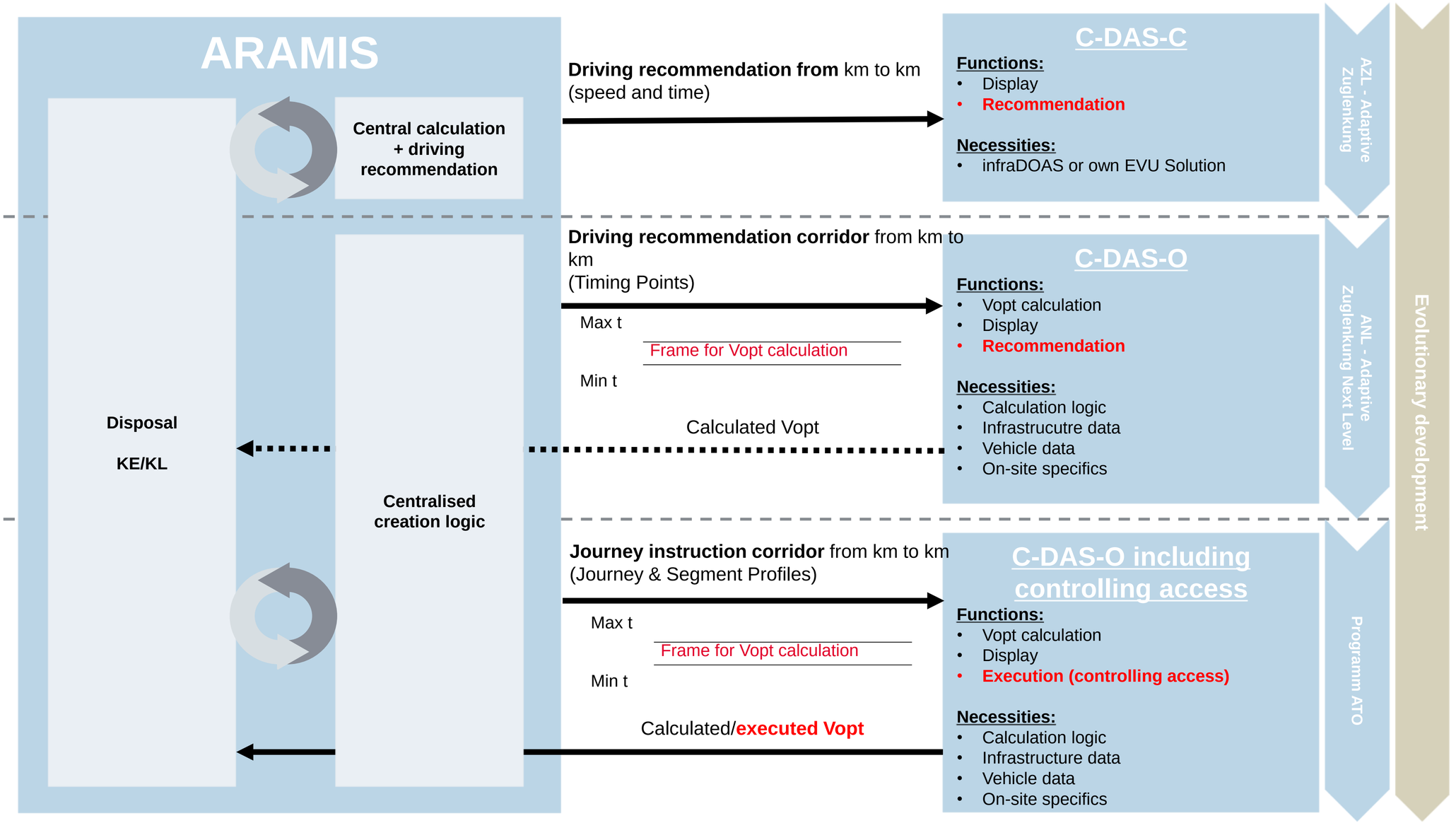
Authentication & Authorization Flows



ATO system technical presentations:

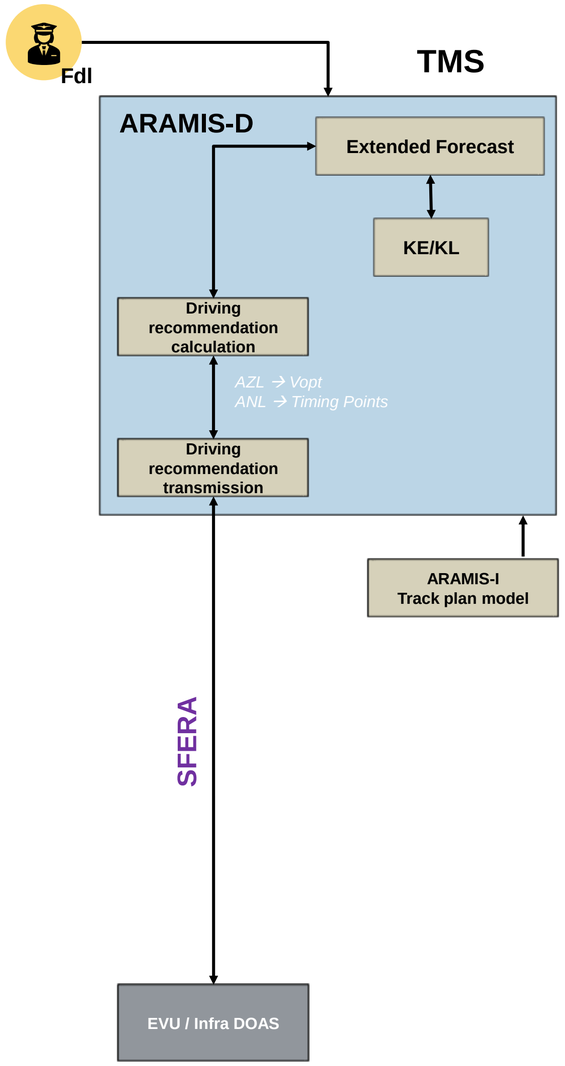
Slides explaining how ATO works from a system engineering perspective

Development C-DAS-C → C-DAS-O → C-DAS-O + controlling feed-through

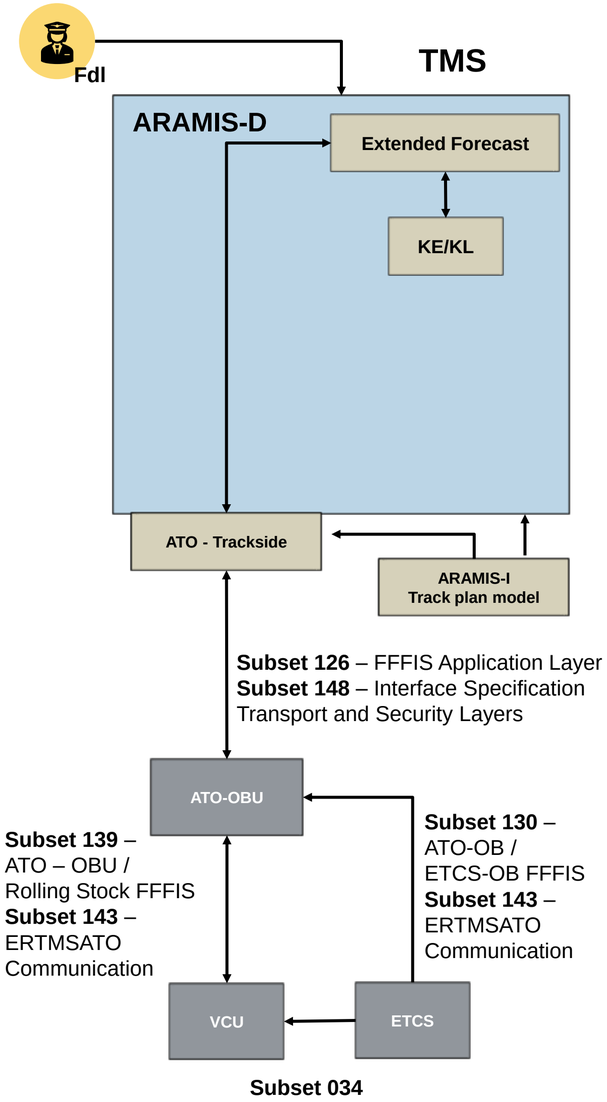


Architecture Comparison SFERA vs ERJU

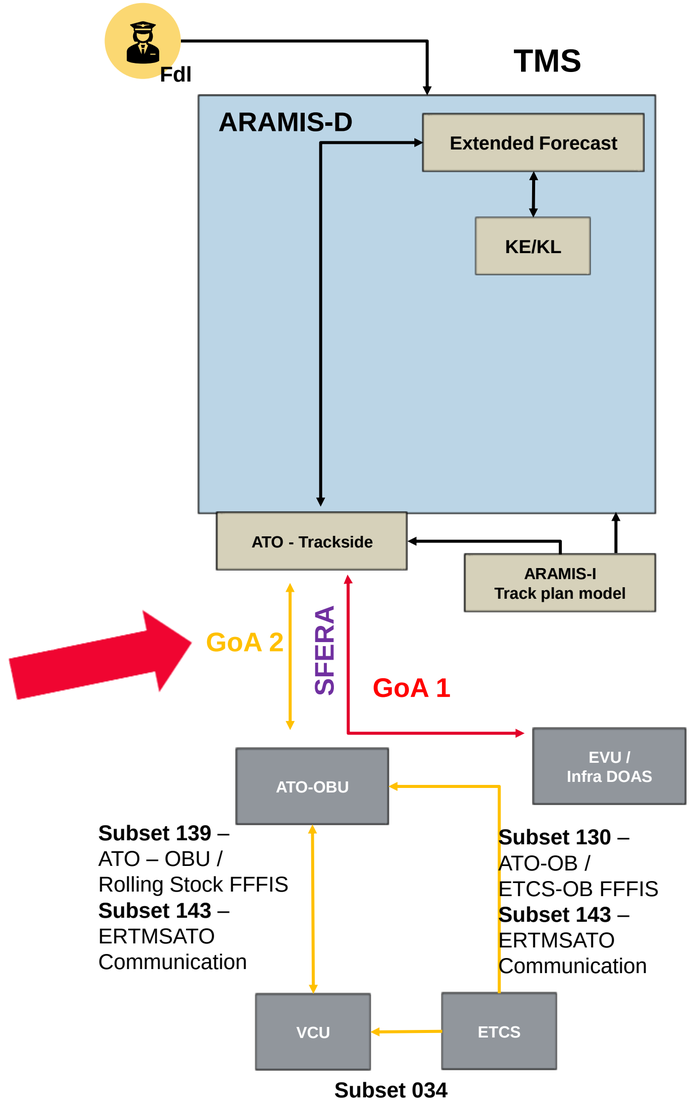
SFERA (GoA 1)



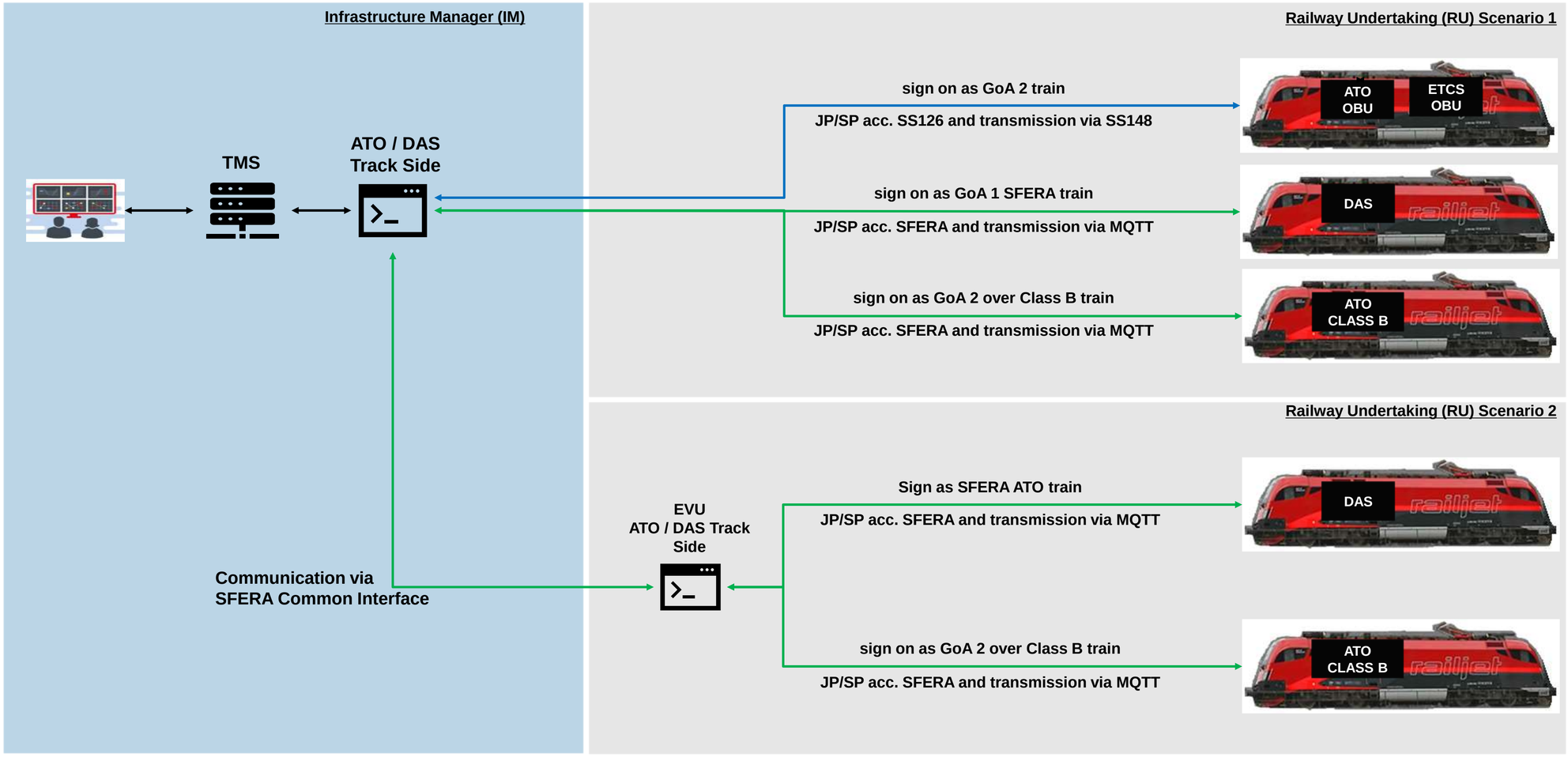
ERJU (GoA 2)



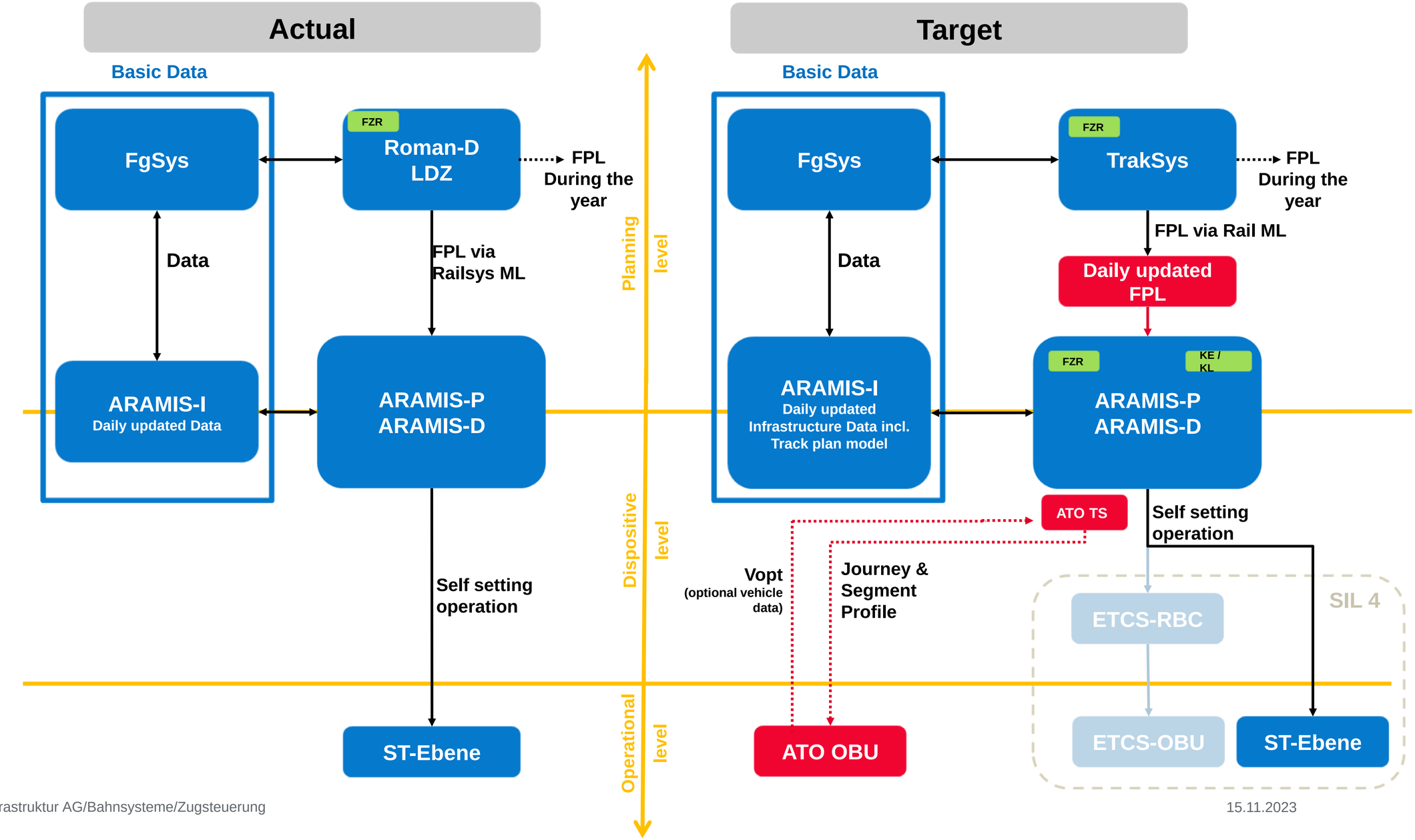
ÖBB target architecture



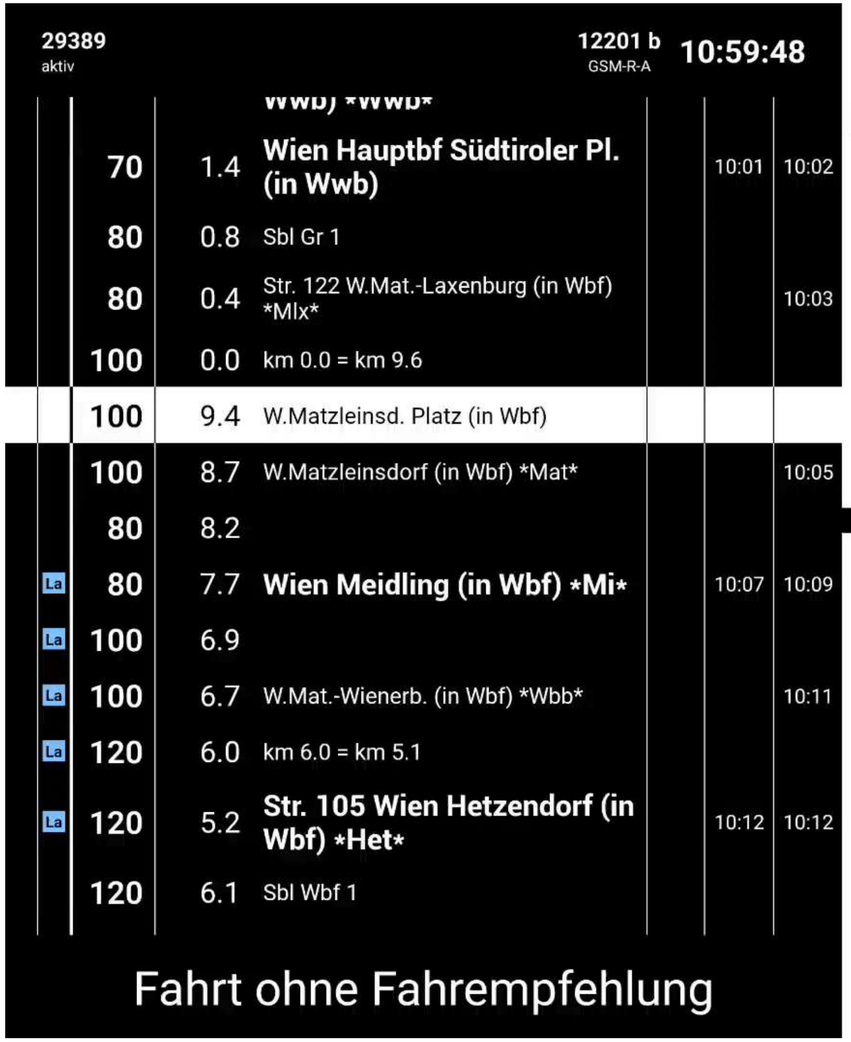
Possible SFERA/ERJU scenarios

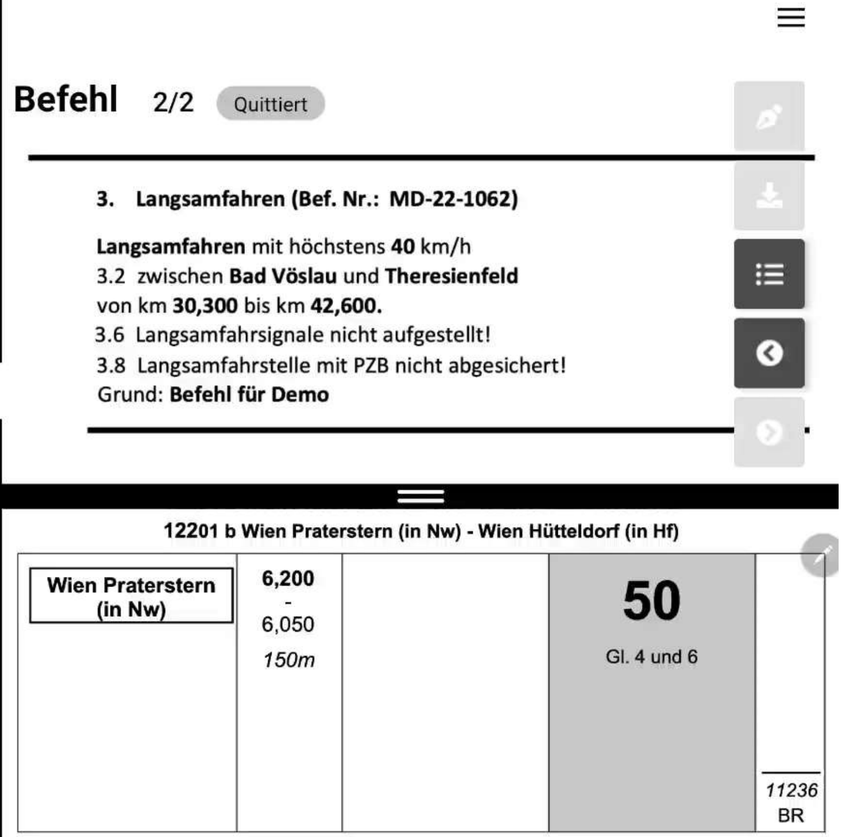


Actual/target process comparison planning/disposition/train journey



Video C-DAS-C Driving Recommendations





Implementation

MTrail
Yves Wyder
Oliver Unger

INTERNATIONAL UNION
OF RAILWAYS

Verifying Interoperability

Presentation and Invitation to Contribute

Oliver Unger, Yves Wyder, Simon Eggler

mtrail

8th November 2023

Who We Are

Oliver Unger
Software Engineer

Yves Wyder
Domain Expert

Simon Eggler
DAS Expert

mtrail

40 more experts

C-DAS-C (RCS ADL and LEA)

SBB CFF FFS

C-DAS-C (RCS ADL and SFERA)

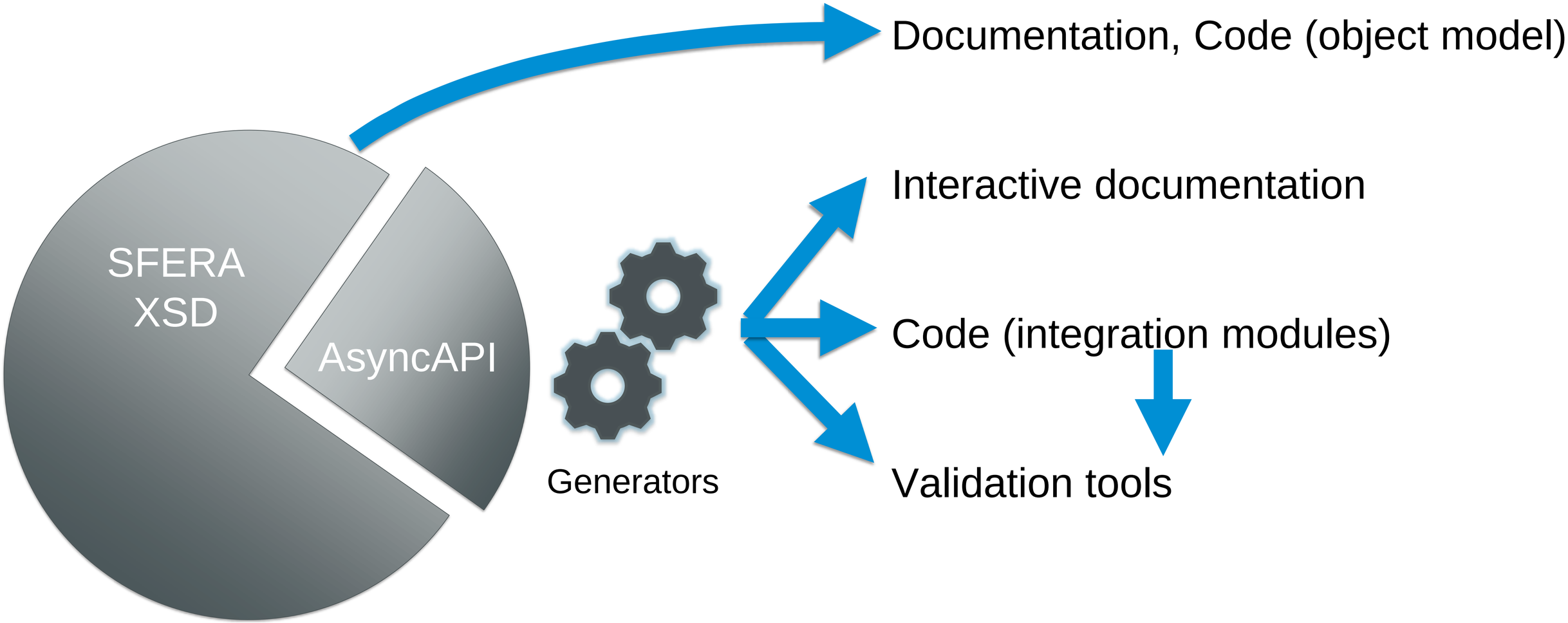
INFRABEL

Our Learnings with SFERA

- ensures **syntactic** correctness
- defines technical requirements
- pushes standardisation
- provides common language

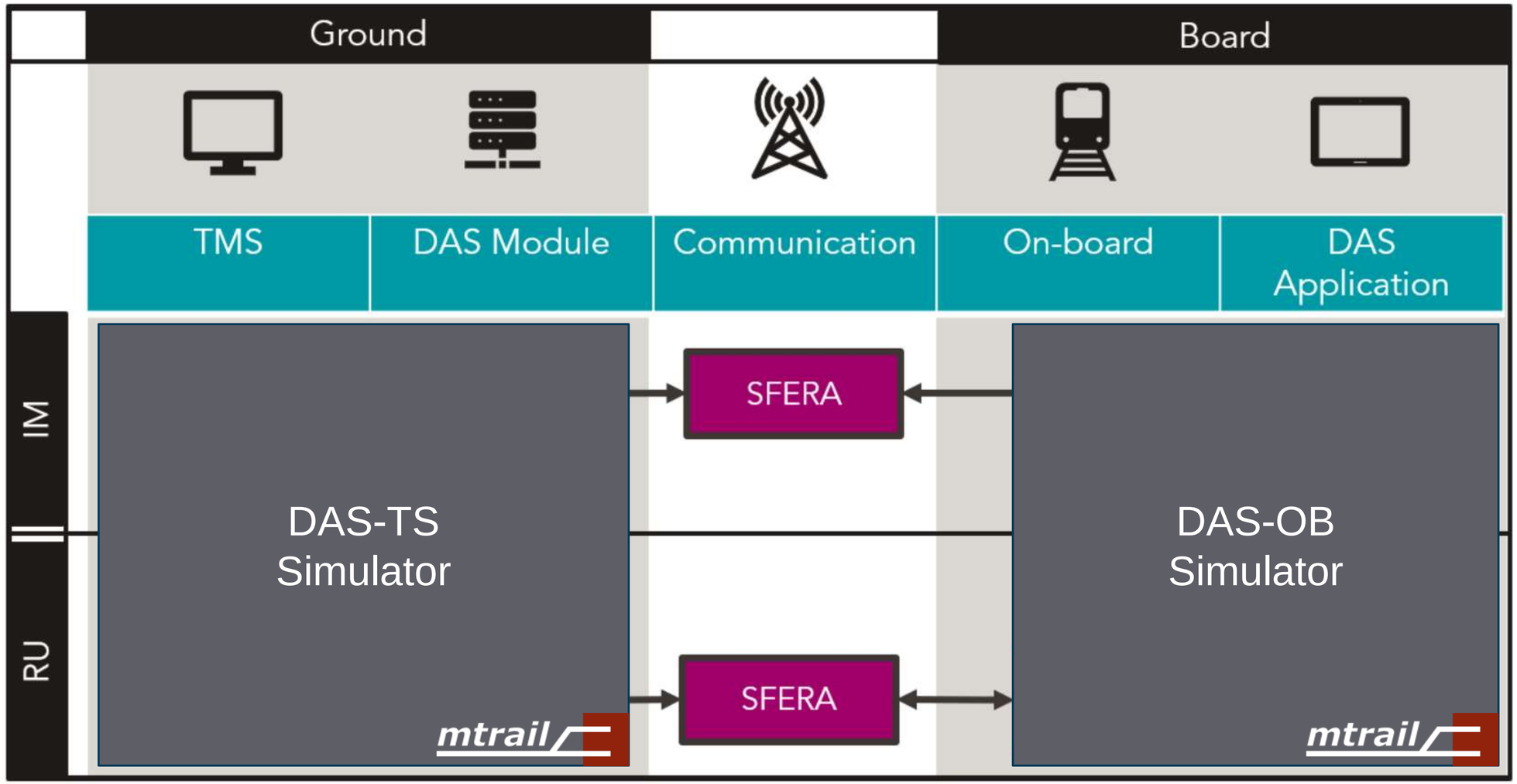
- room for interpretation (interoperability)
- XSD cannot describe dynamic behaviour

Vision of SFERA Specification



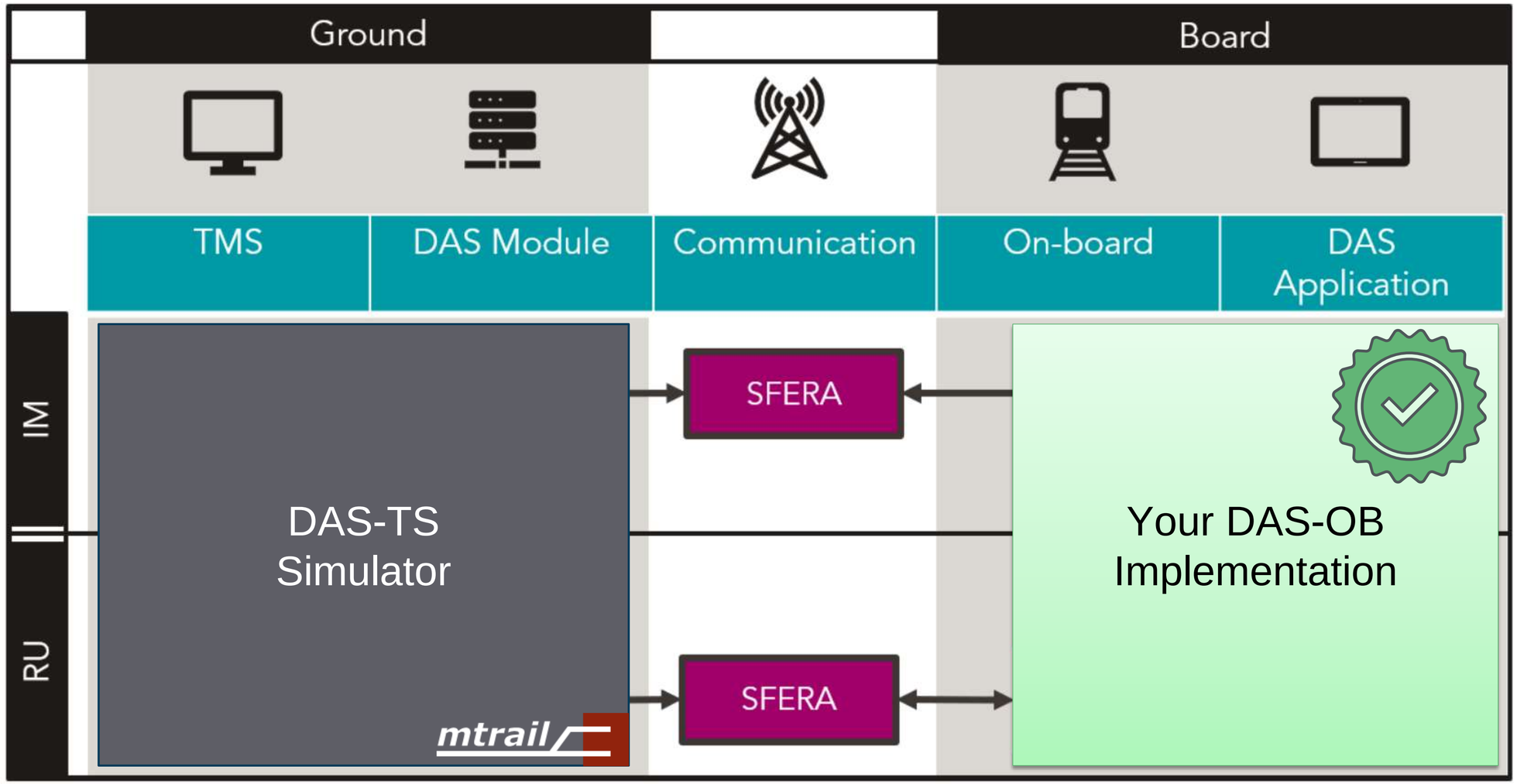
Validation Tools

Reference Implementation



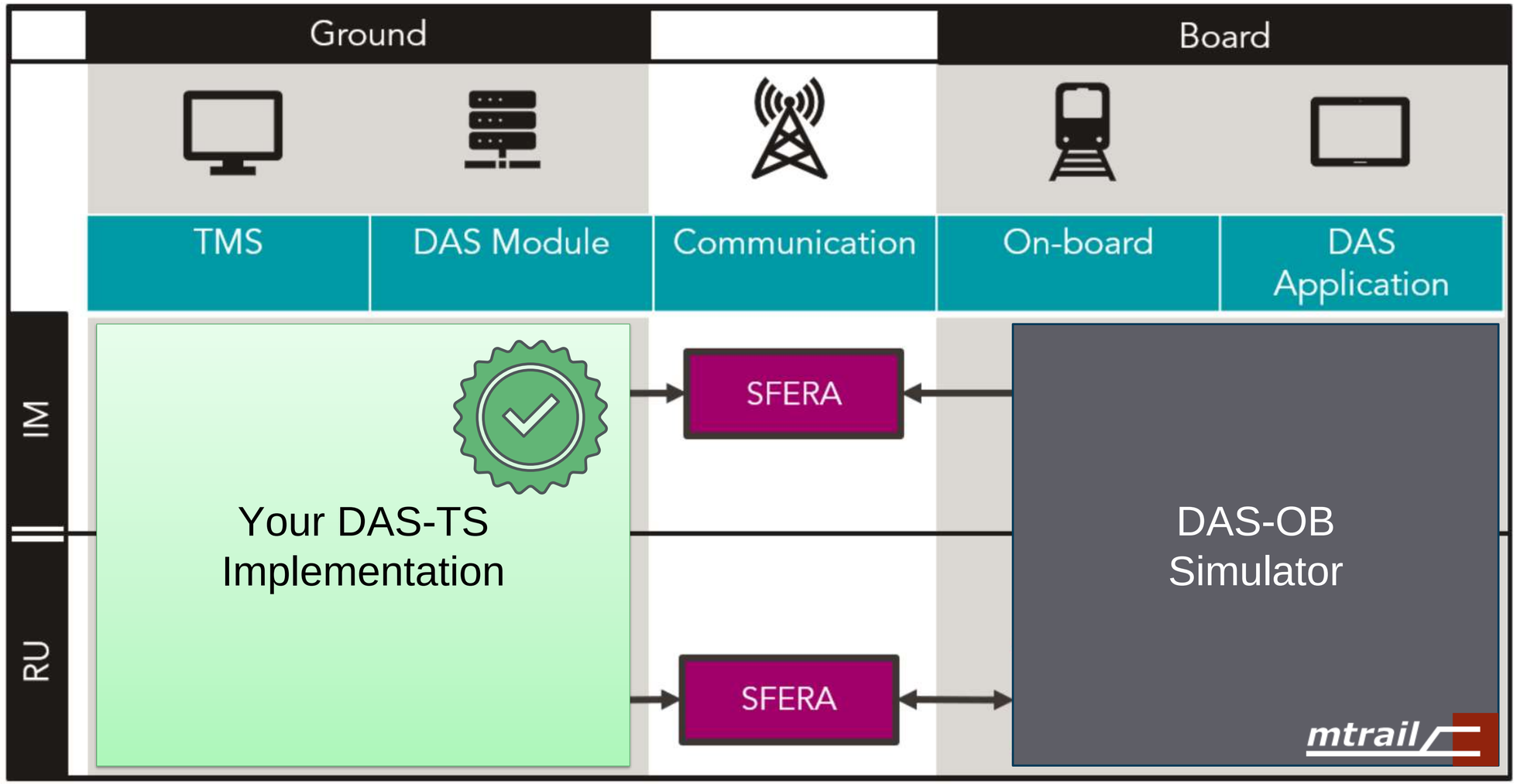
Validation Tools

Verify your DAS-OB implementation



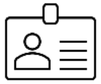
Validation Tools

Verify your DAS-TS implementation



Wish List

- Open access to GitHub
- Reusable friendly licence
- JSON support
- Chat instead of mailing list



Email to: sfera@mtrail.ch

Come to our table

Chat with Simon

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Common interface for C-DAS

Thomas Pynthe
SNCF Réseau

INTERNATIONAL UNION
OF RAILWAYS

COMMON INTERFACE

Serving the needs of C-DAS systems

Thomas PYNTHE – SNCF Réseau

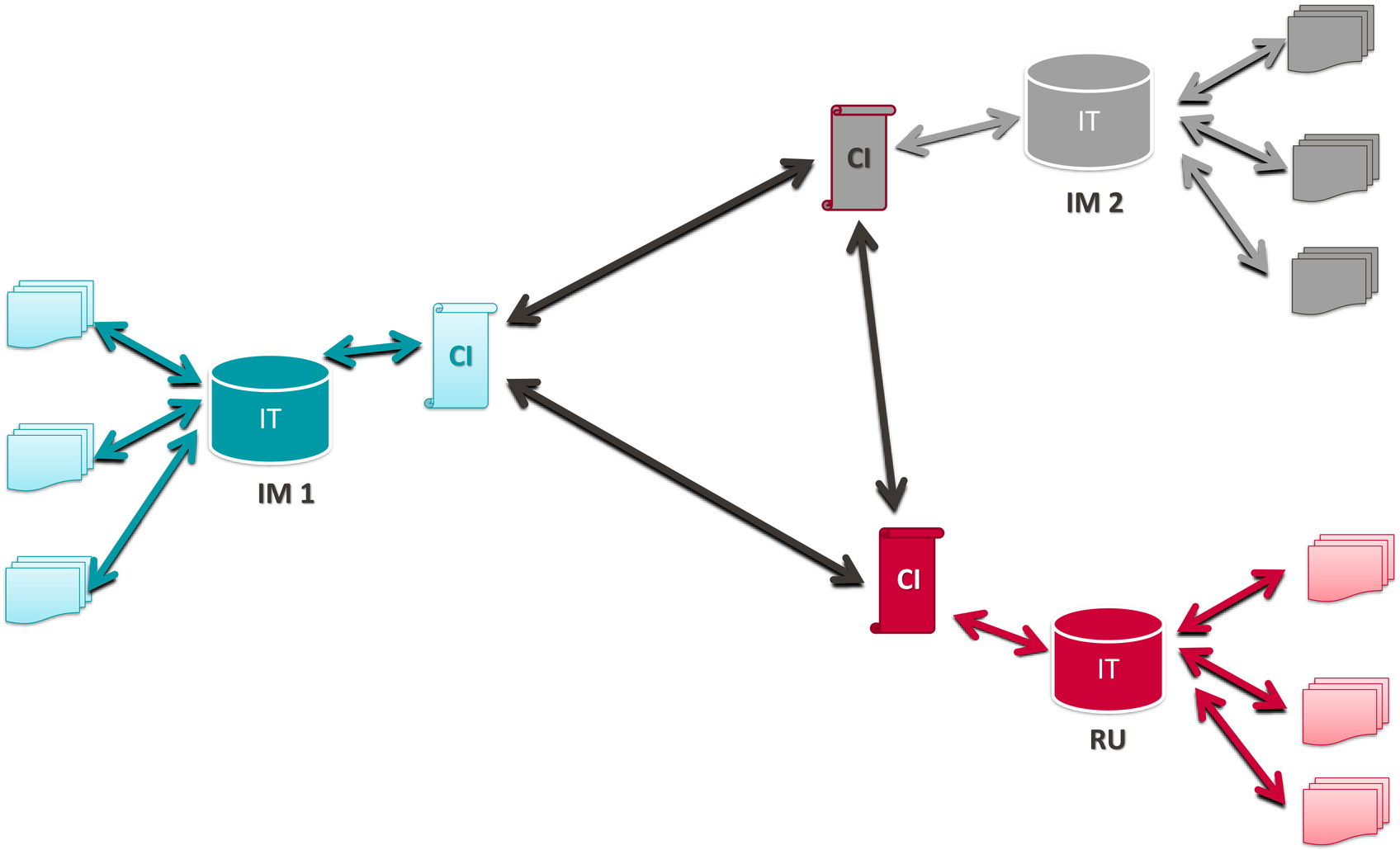
SFERA User Group Plenary meeting

November 8th 2023

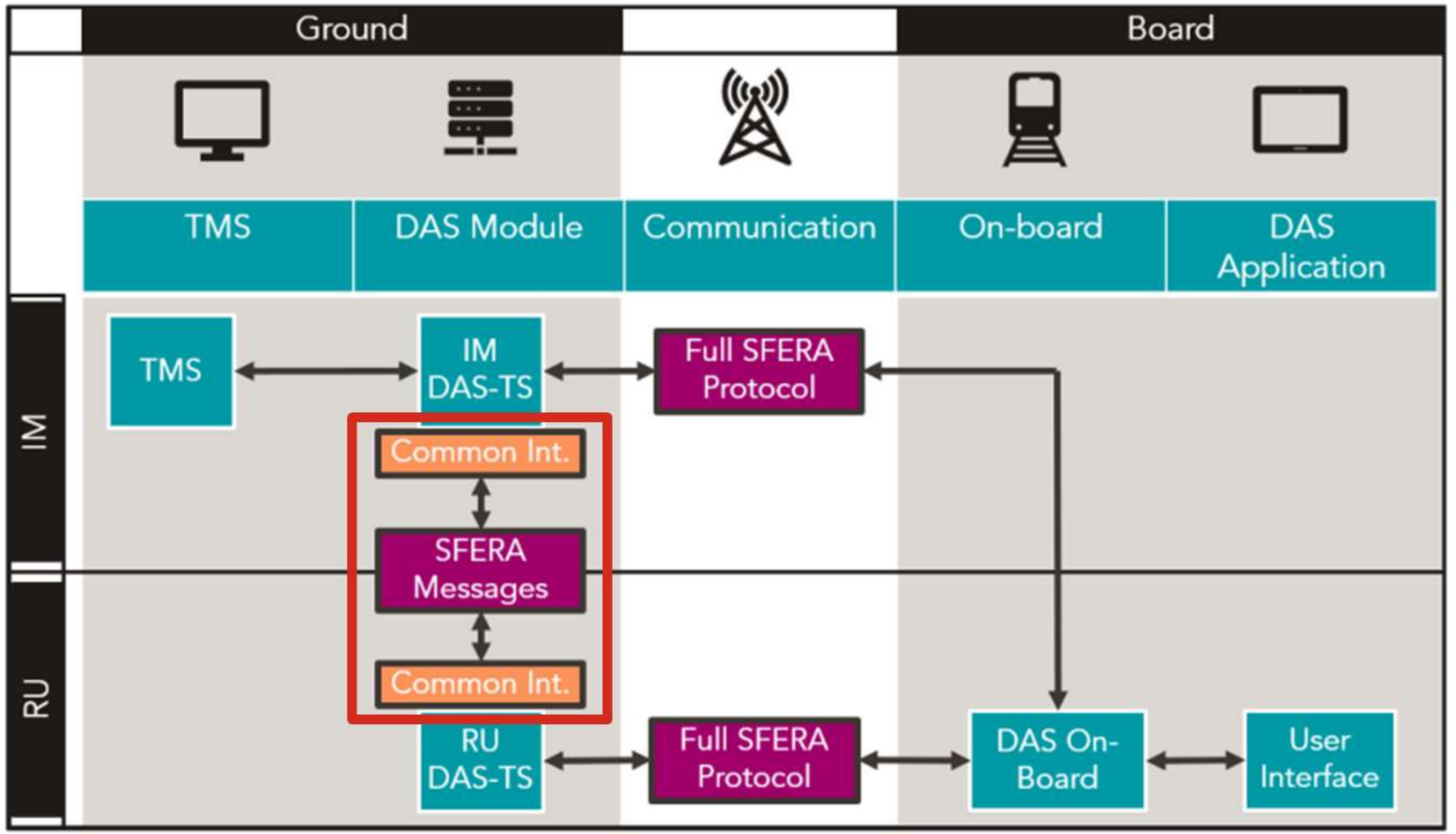
Summary

ARCHITECTURE AND PLACE IN THE IT SYSTEM

CI Architecture

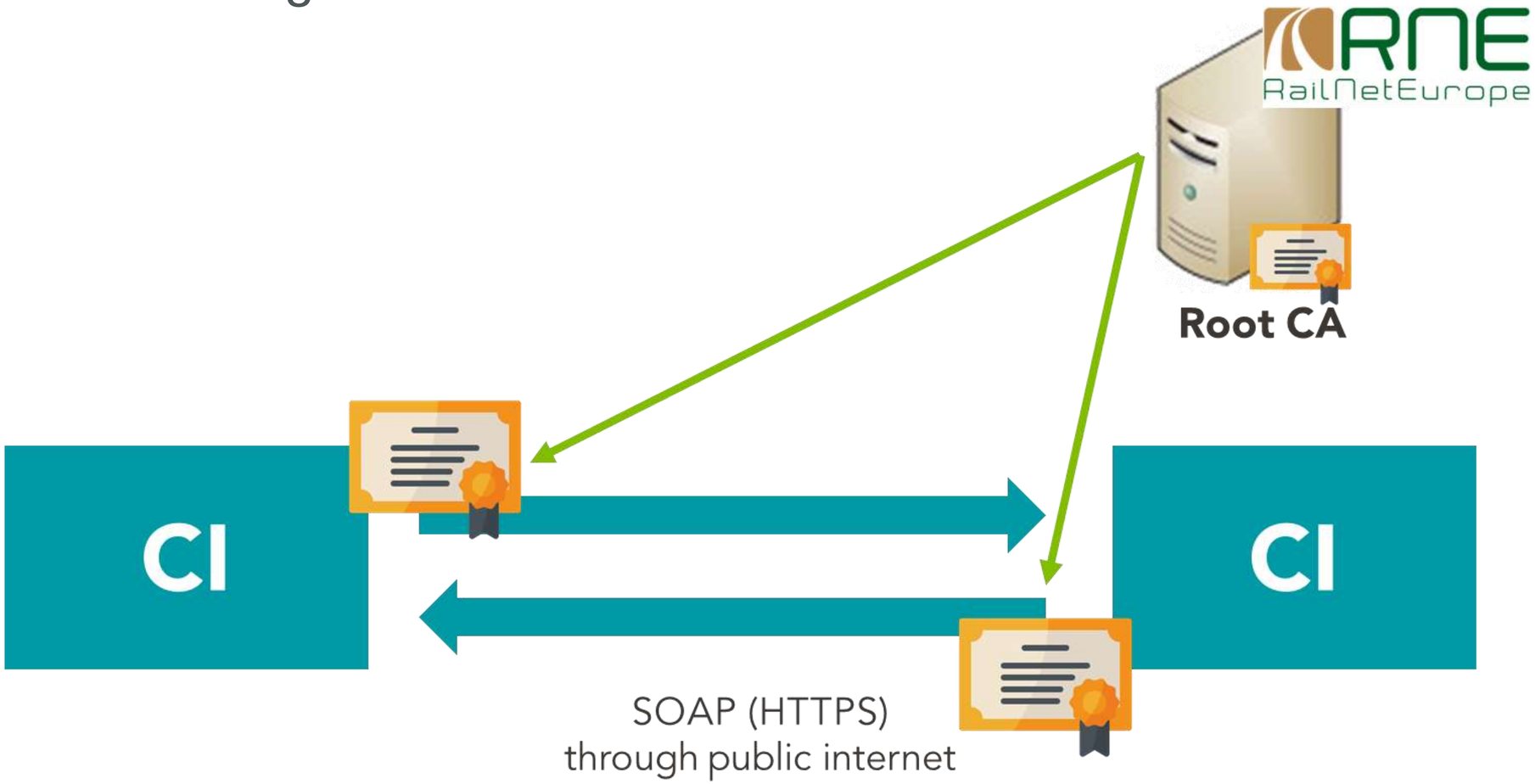


SFERA Architecture including the CI



Inter-CI communication

Standard Technologies



CI can handle many different xsd

… even if not TAF/TAP

```
<MessageHeader>
        <MessageReference>
                <MessageType>SF01</MessageType>
                <MessageTypeVersion>1.0</MessageTypeVersion>
                <MessageIdentifier>randomguid</MessageIdentifier>
                <MessageDateTime>2023-11-
                08T14:00:00</MessageDateTime>
        </MessageReference>
        <Sender>0087</Sender>
        <Recipient>1187</Recipient>
</MessageHeader>
```

XML Message

Header

- CI routing info

Message Payload

- TAF/TAP
- SFERA
- Homemade
- …

Existing use case

NCR SNCF RÉSEAU

Homemade

CI « Off the shelf » ?

Internal Development

CI is a concept, its specifications are described in the TAF/TAP regulations

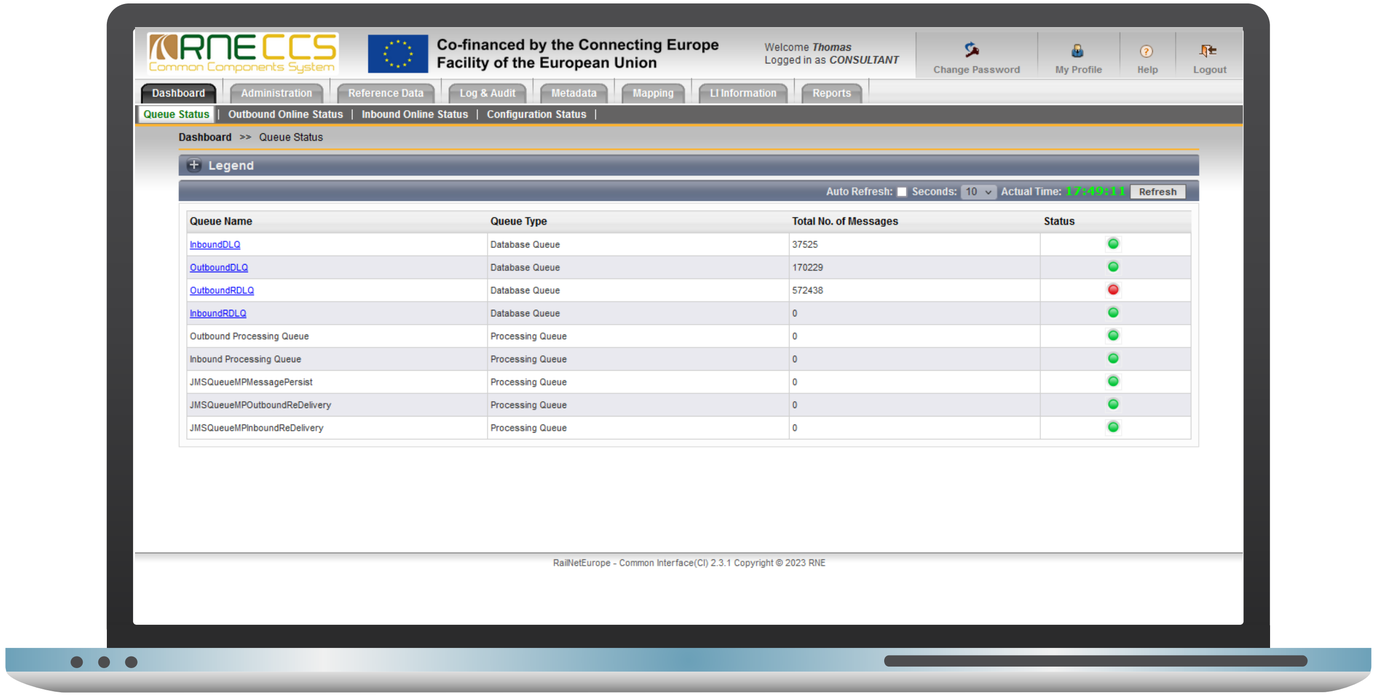
Software Package

CI are also available as « off the shelf » products

RNE CI : UPDATES TO MEET NEW PERFORMANCE NEEDS

Current RNE Common Interface

- Efficient
- Easy to setup
- Widespread use in Europe

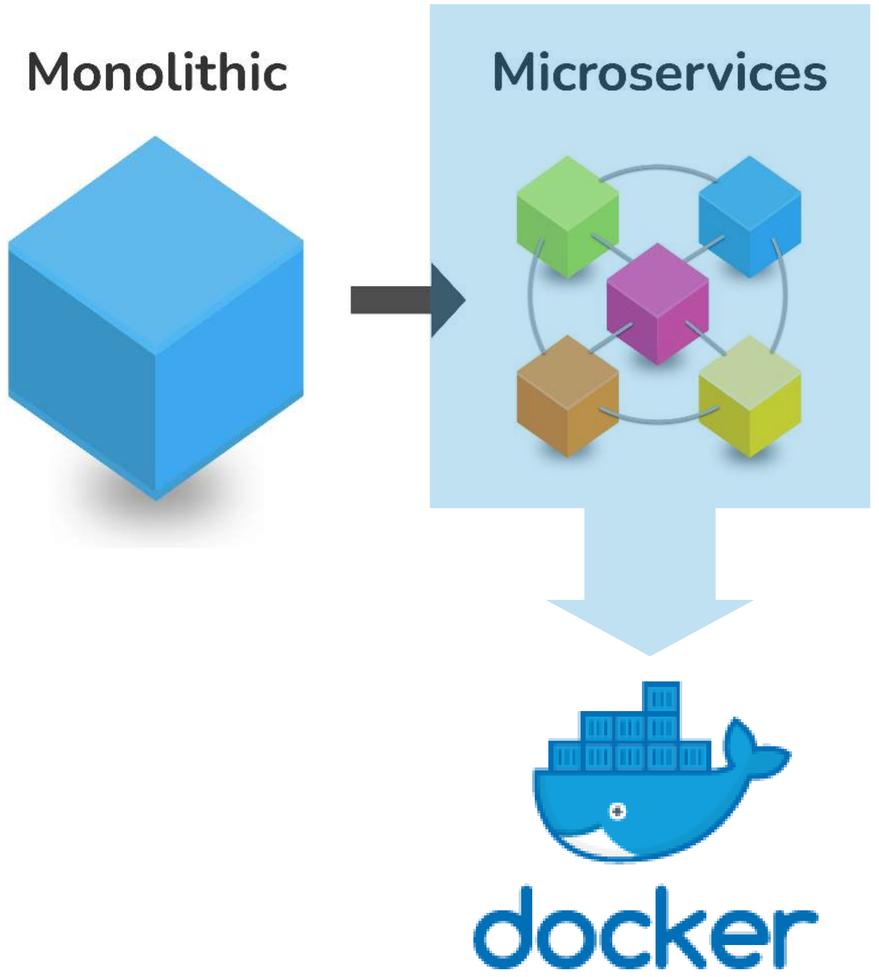


Default Connectors

Connecting to legacy internal applications

RNE New Common Interface

Updating technology stack



- Scalability
- High availability
- Performance

➔ **CI used for critical needs**

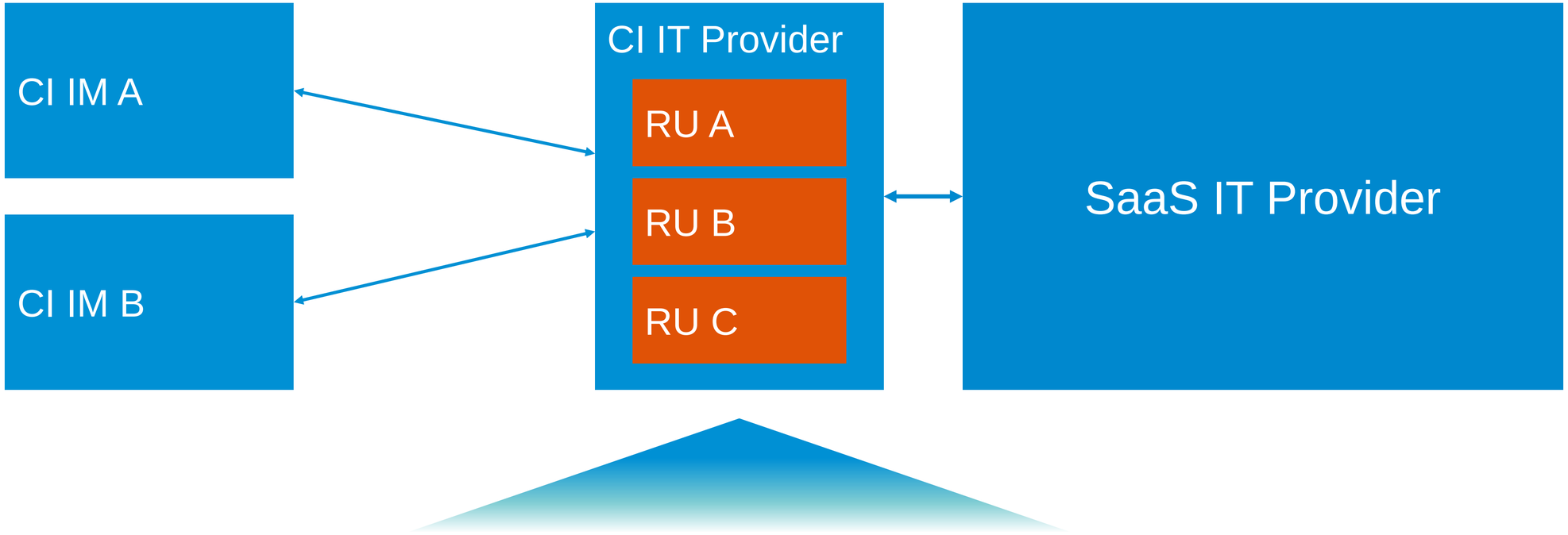
New CI Delivery

RNE Roadmap

2023	2024
S2	04
DEVELOPMENT	RELEASE
0.x previews within RNE	Available to all CCS licensees

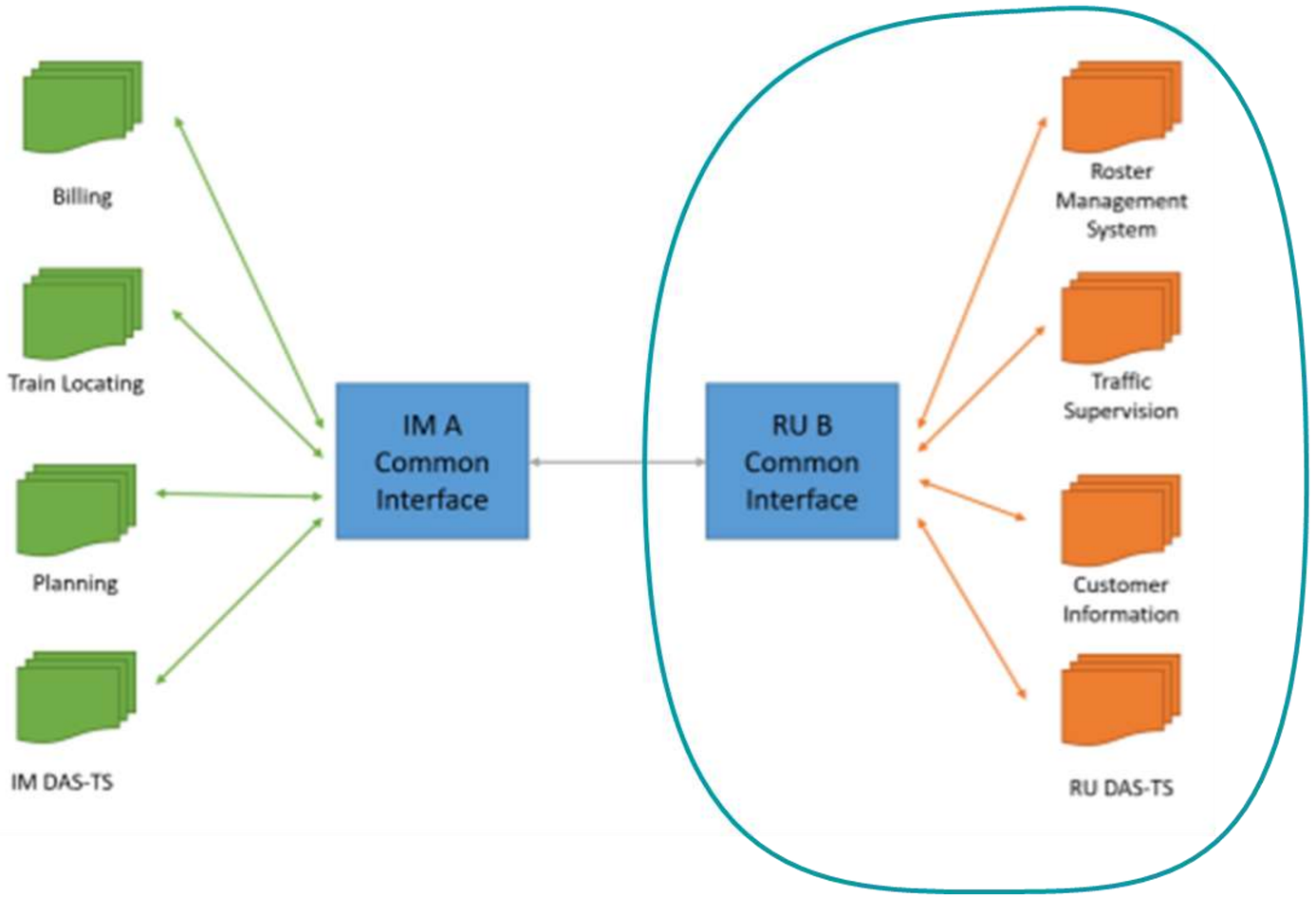
INTEGRATION IN C-DAS PRODUCTS

Opportunity for IT providers



One CI can handle messages for multiple companies

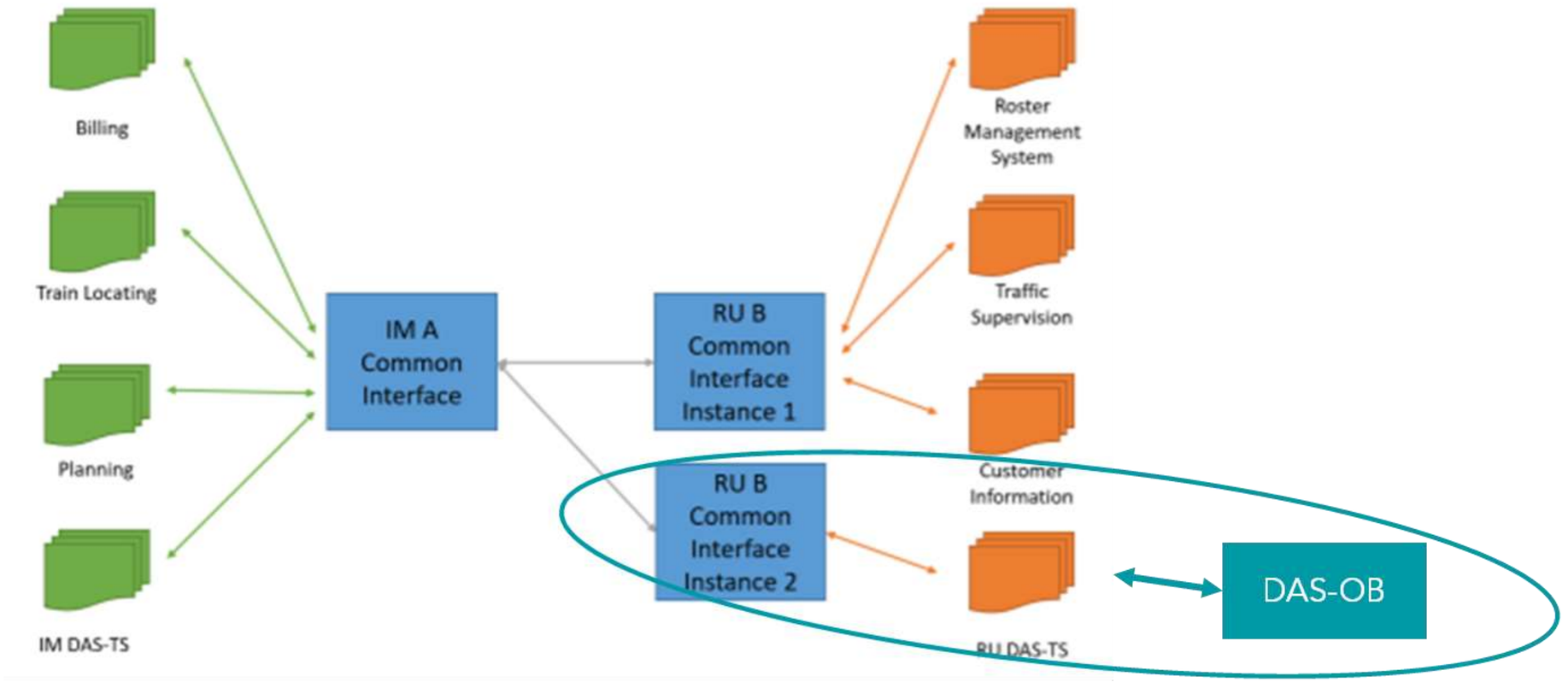
Usual architecture



Example of possibility for an IT provider : global software including C-DAS

Alternative architecture

Possibility to have multiple instances per RU



Example of possibility for an IT provider limited to C-DAS software

Thank You !

INTERNATIONAL UNION
OF RAILWAYS

Stay in touch with UIC:

www.uic.org

#UICrail

Thank you for your attention.

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15 minutes

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Digital European Instructions

Sébastien Dislaire

100 YEARS ANNIVERSARY

INTERNATIONAL UNION OF RAILWAYS

DIGITAL EUROPEAN INSTRUCTIONS

SFERA members' vision for interoperable digital instructions

SFERA WG

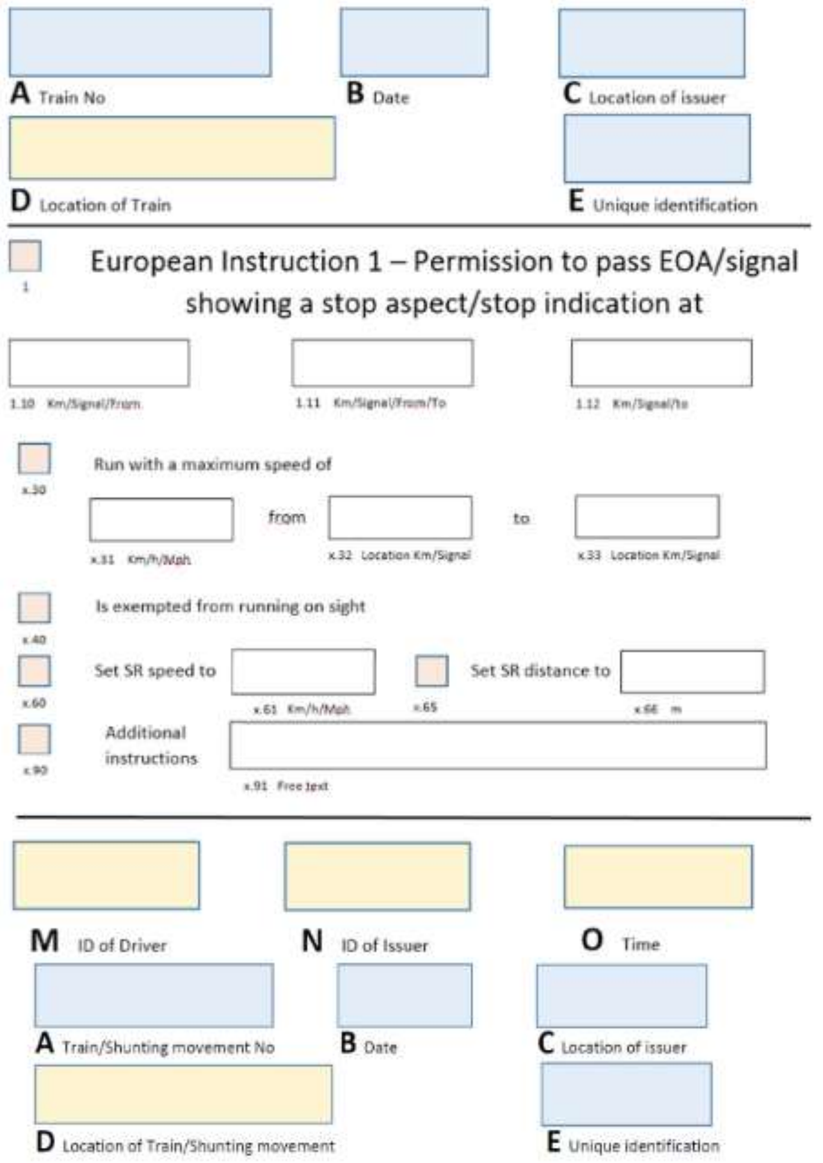
What are European Instructions?

Safety of train operation is primarily ensured by technical systems (signalling…).

Instructions are used to give drivers:

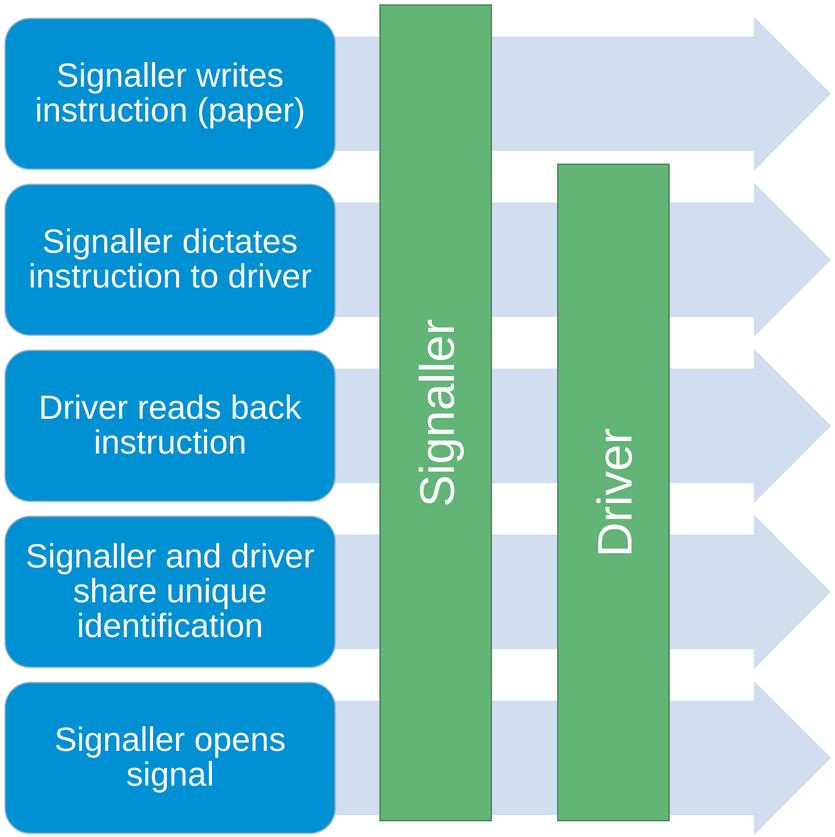
- Authorisation to bypass those technical systems
- An order to adopt a more restrictive behaviour

OPE TSI defines standard instructions that are set to replace national instructions.

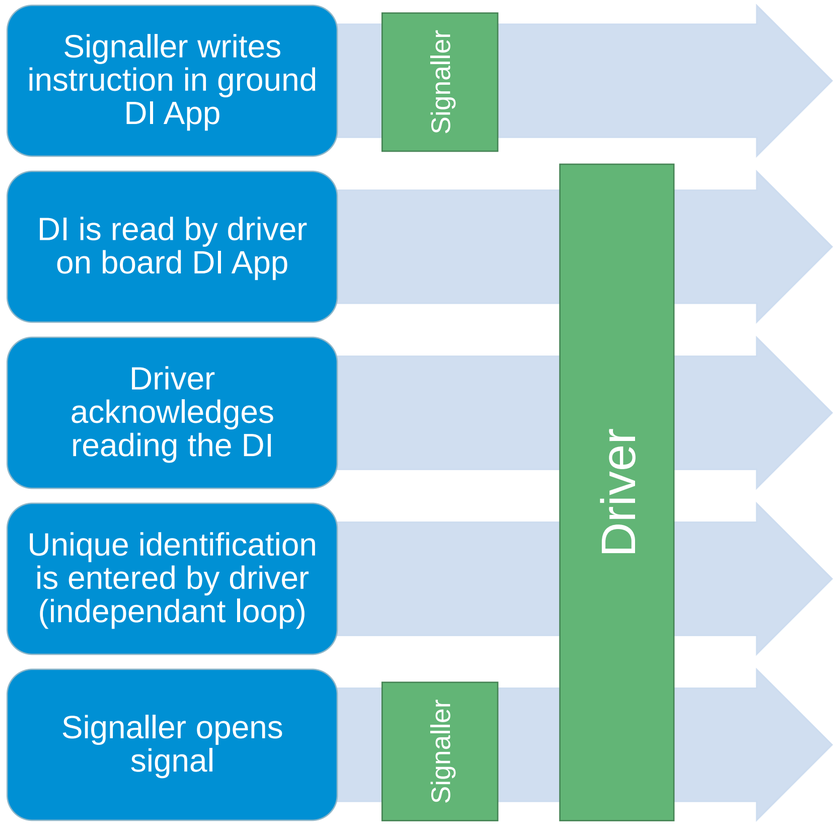


What are Digital Instructions?

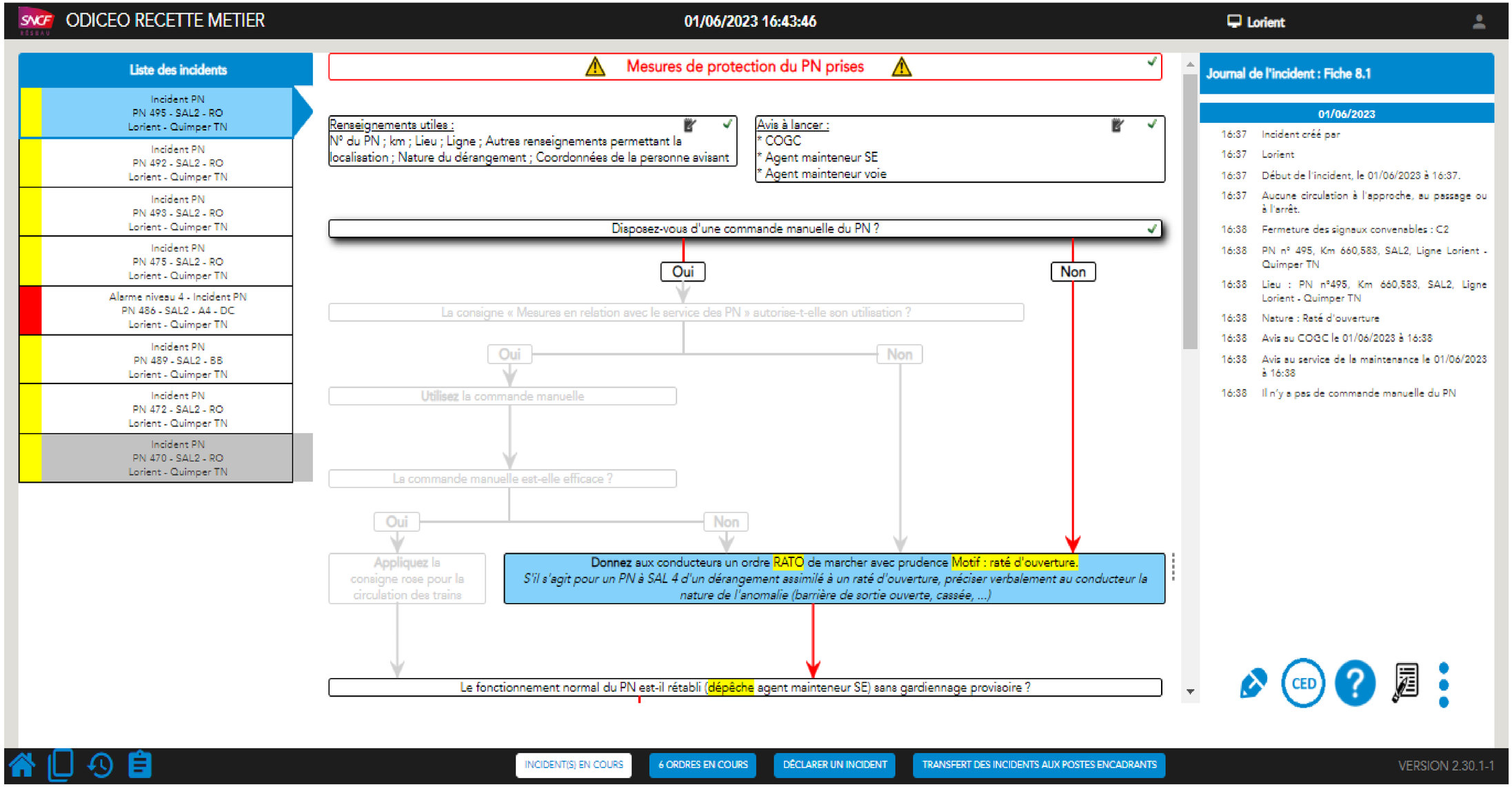
Today:



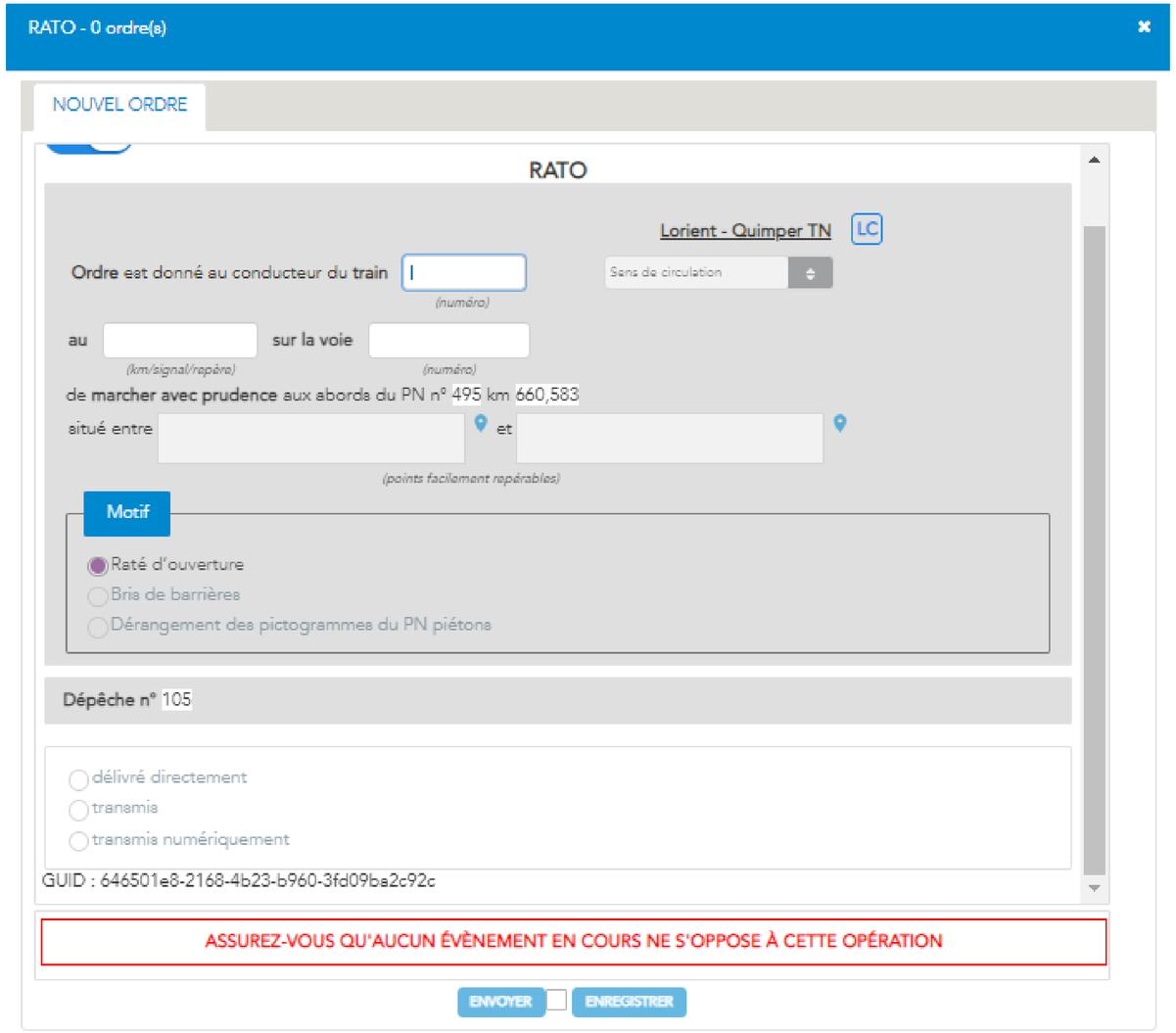
Tomorrow: digital instructions (DI)

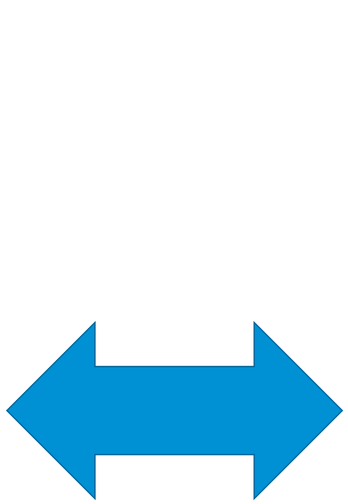


What are Digital Instructions ?

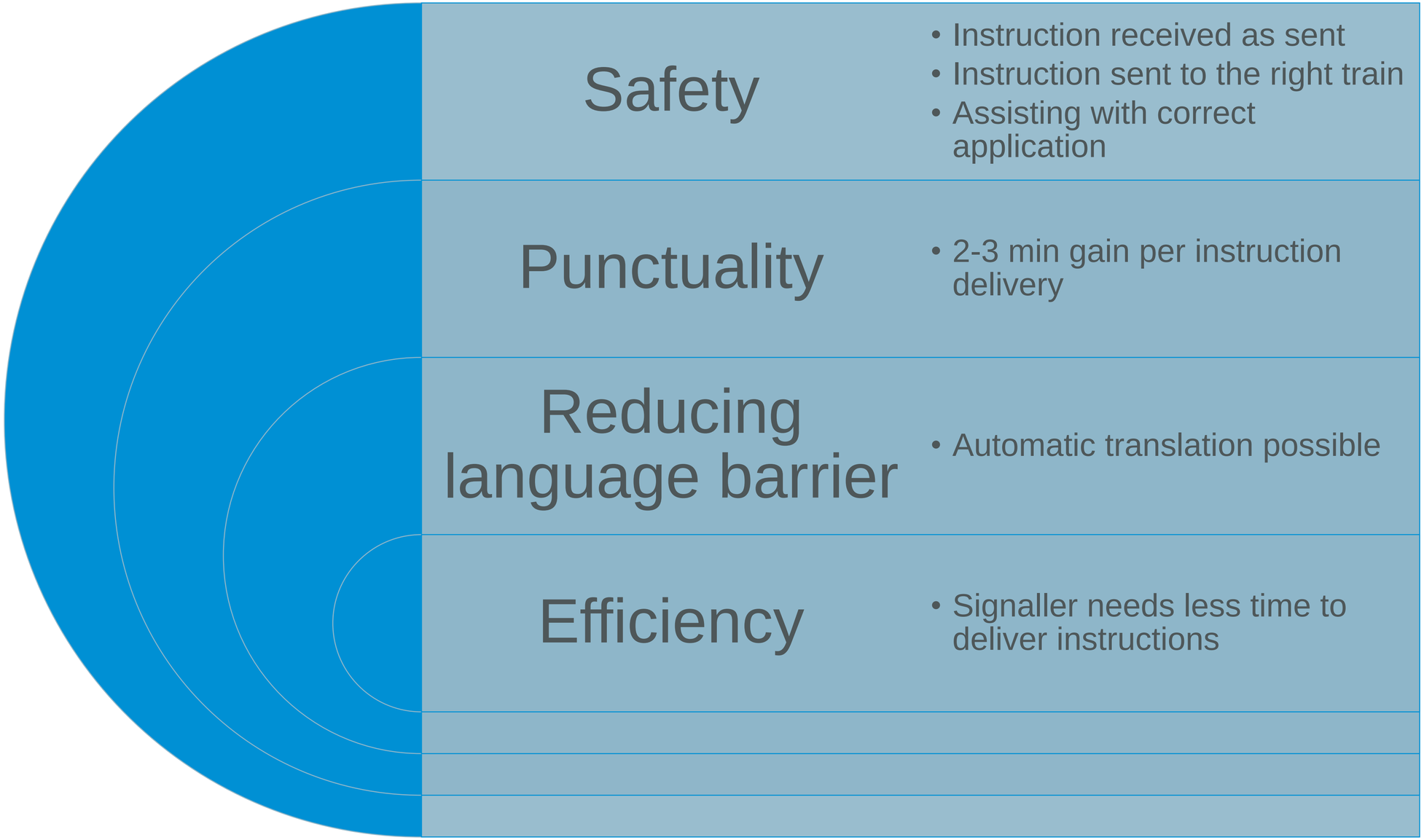


What are Digital Instructions?





Why Digital instructions?

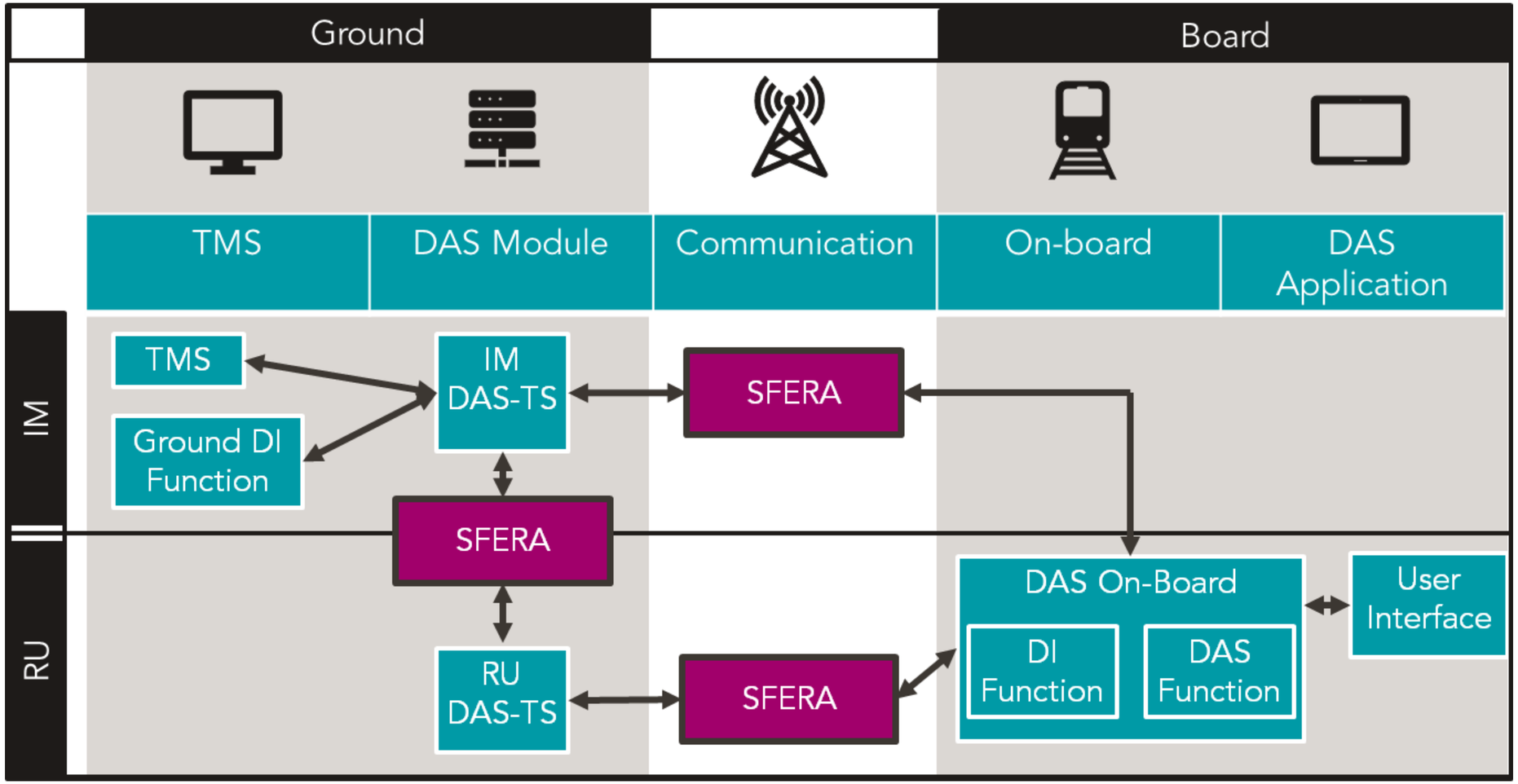


Long Term Vision

Like for C-DAS, Digital Instructions via SFERA would aim to become a *de facto* standard through adoption of the respective members (there are at least 8 different projects in Europe).

ERA wishes to define an interoperable digital protocol for European Instructions. The SFERA protocol has been proposed as the harmonised solution.

Architecture



Main Principles

Even though the protocol is unique, DAS and DI data flows can be separated

Board and ground DI functions can be independent from TMS and DAS-OB functions

DI data flow concentrates on the delivery of the instruction in structure and content

Additional functions could be included in the DAS data flow. Examples:

- Notification to open DI function
- Application Reminder
- Ensuring DAS advice does not contradict instruction

Where are we?

Organisation
- Task Force established in February 2023
- Experts from DI projects of SFERA members
- Scope defined

Requirements
- List of Additional requirements to SFERA established
- 1st level of prioritisation

DI Core Data Model
- November 9th: Data models of DI projects to be shared/compared
- Next step: defining the core data model for the instruction
- Aim: first level of harmonisation

Processes and use cases
- Define new processes and use cases
- Adapt existing use cases (e.g. handshake)
- Focus on priority requirements

Messages
- Define message payloads (DI and DAS dataflows)

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X2Rail4
Conclusions

Benoît Bienfait
Benoît Abisset
X2Rail4 - Alstom

INTERNATIONAL UNION
OF RAILWAYS

SFERA and X2Rail4

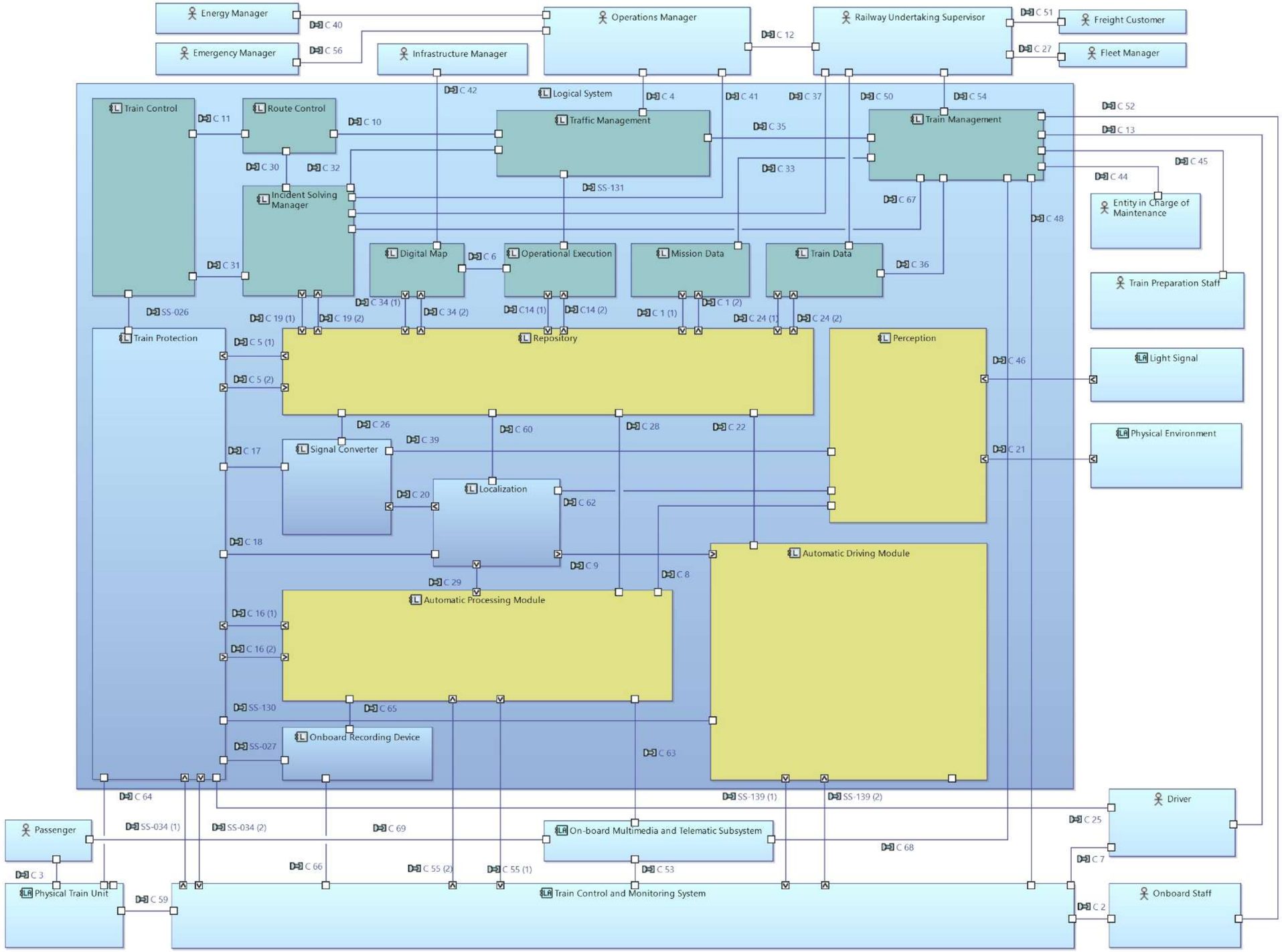
Joint work towards the next TSI

DAS SFERA Workshop
8/11/2023

Agenda

1. Logical Architecture (basic design criteria)
2. Focus on the track/train communication interoperability principles
3. Exchanged data
4. Joined group achievement and next steps

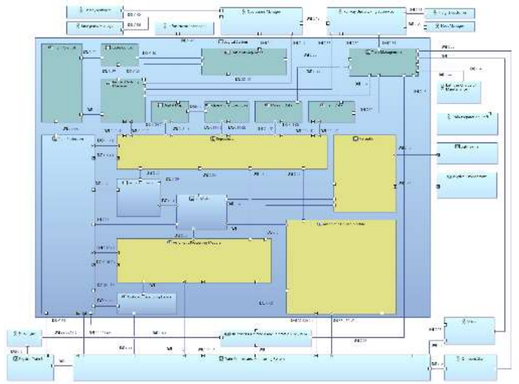
Logical Architecture



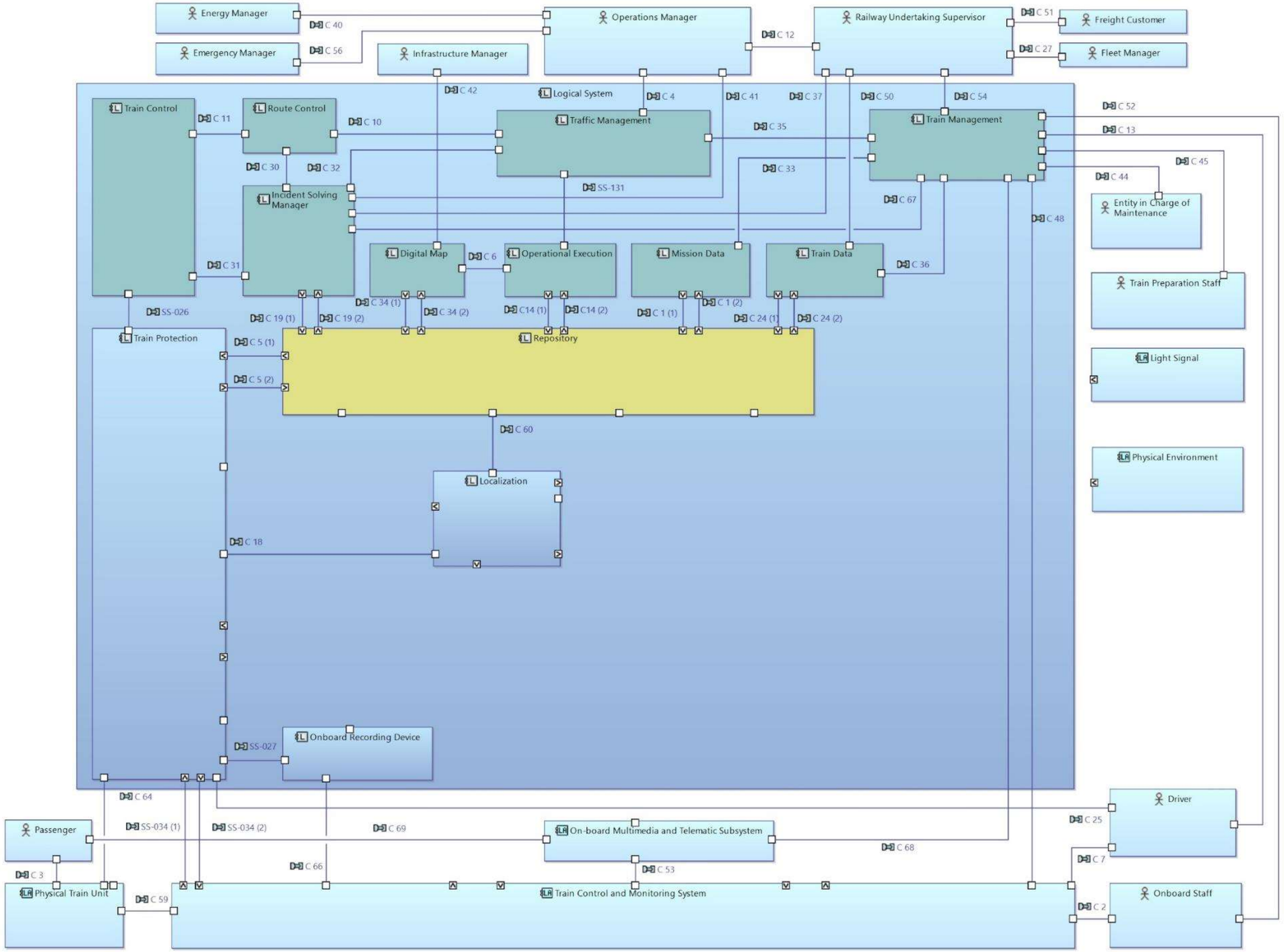
System architecture

Design criteria

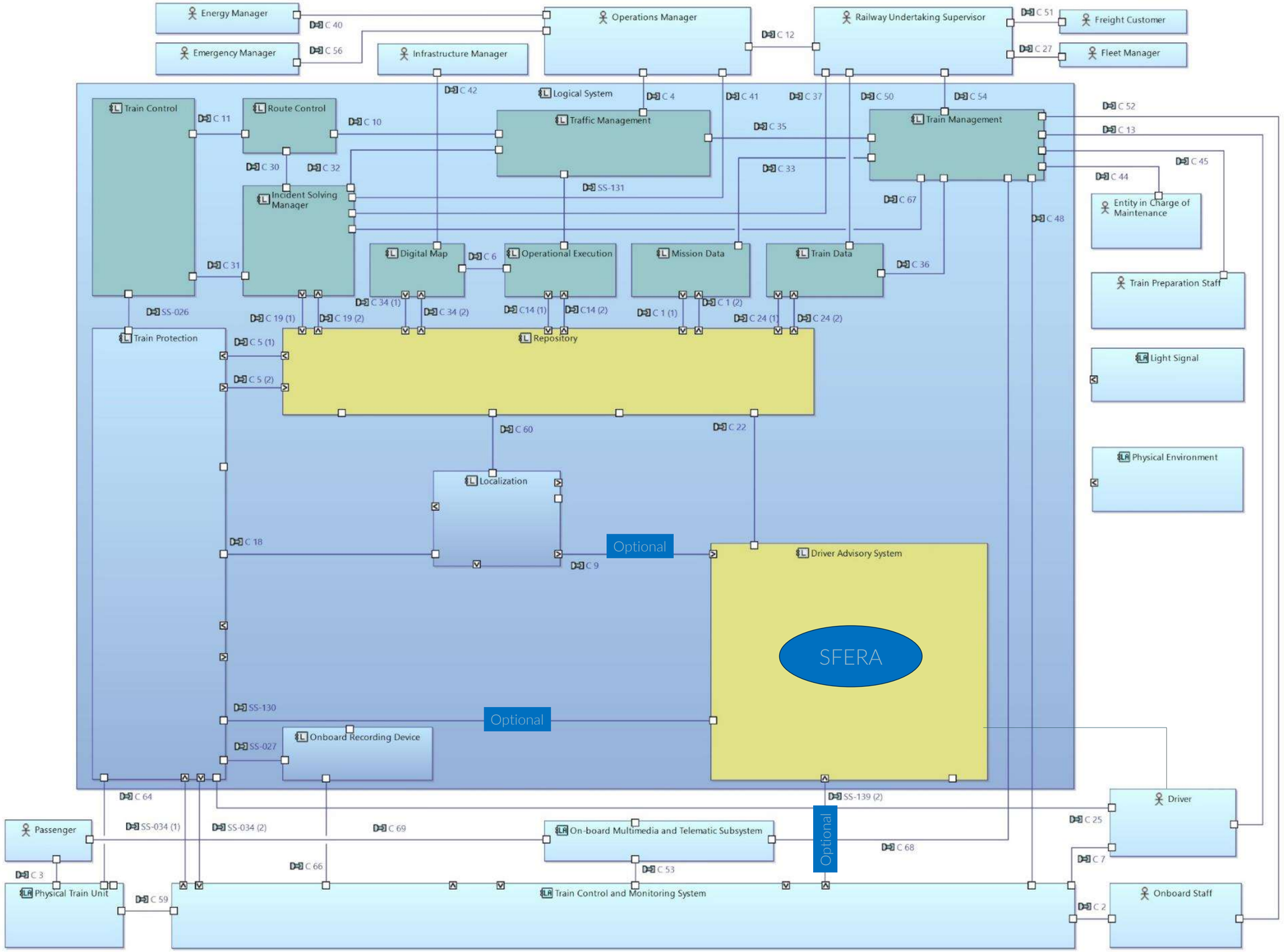
- Interchangeability
  - The Logical Blocks shall be interchangeable
  - Only the interfaces between the Logical Blocks will be standardised
- Flexibility
  - The Logical Blocks may not be split.
  - There are several Physical Architecture Candidates
  - The Logical Blocks may be implemented on separate cubicles (FFFIS interfaces).
  - Several Logical Blocks may be implemented on the same cubicle (FIS interfaces)
- Incrementability
  - The Logical Blocks are defined to permit a smooth migration across the different GoAs (from GoA1 to GoA4)
- Extensibility
  - New Logical Blocks supporting other functions than ATO may be added without jeopardising the architecture nor the track/train communication interoperability principles
  - Common Logical Blocks will remain (LOC, REP, PER)
  - New layers may be added if additional Digital Map data are needed



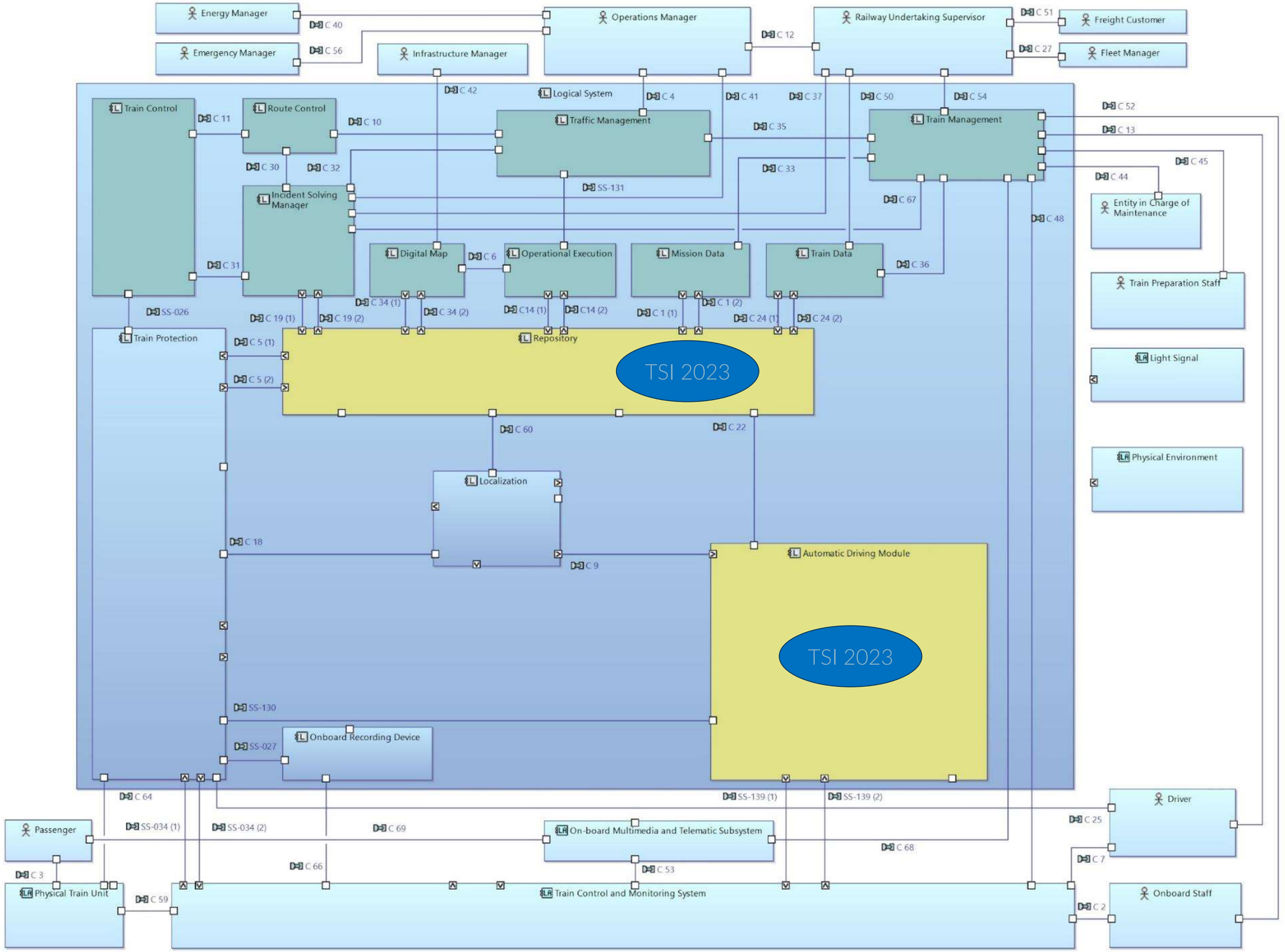
GoA1 Logical Architecture



GoA1 (with DAS) Logical Architecture



GoA2 Logical Architecture

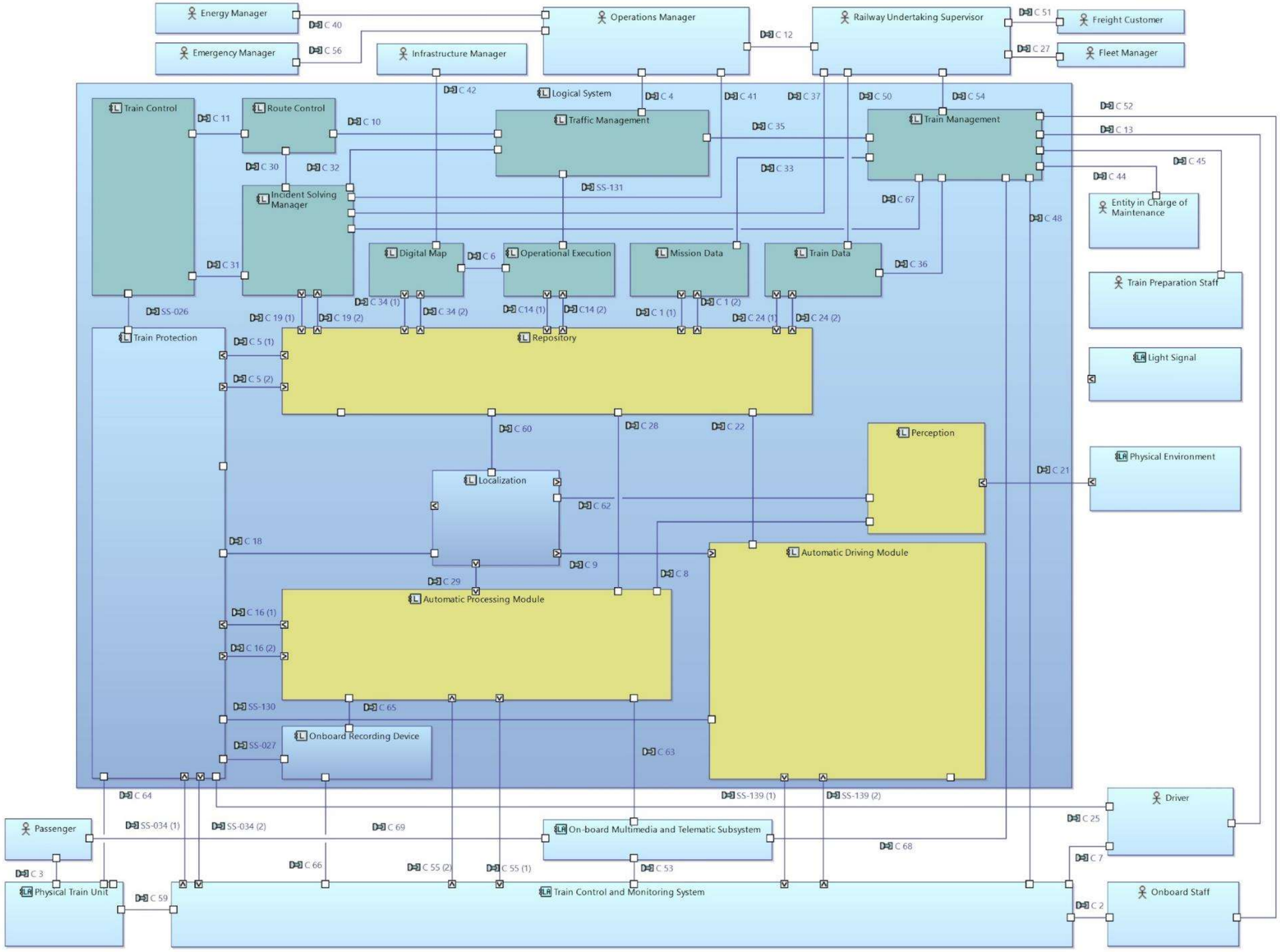


REPOSITORY
&
Automatic Driving Module

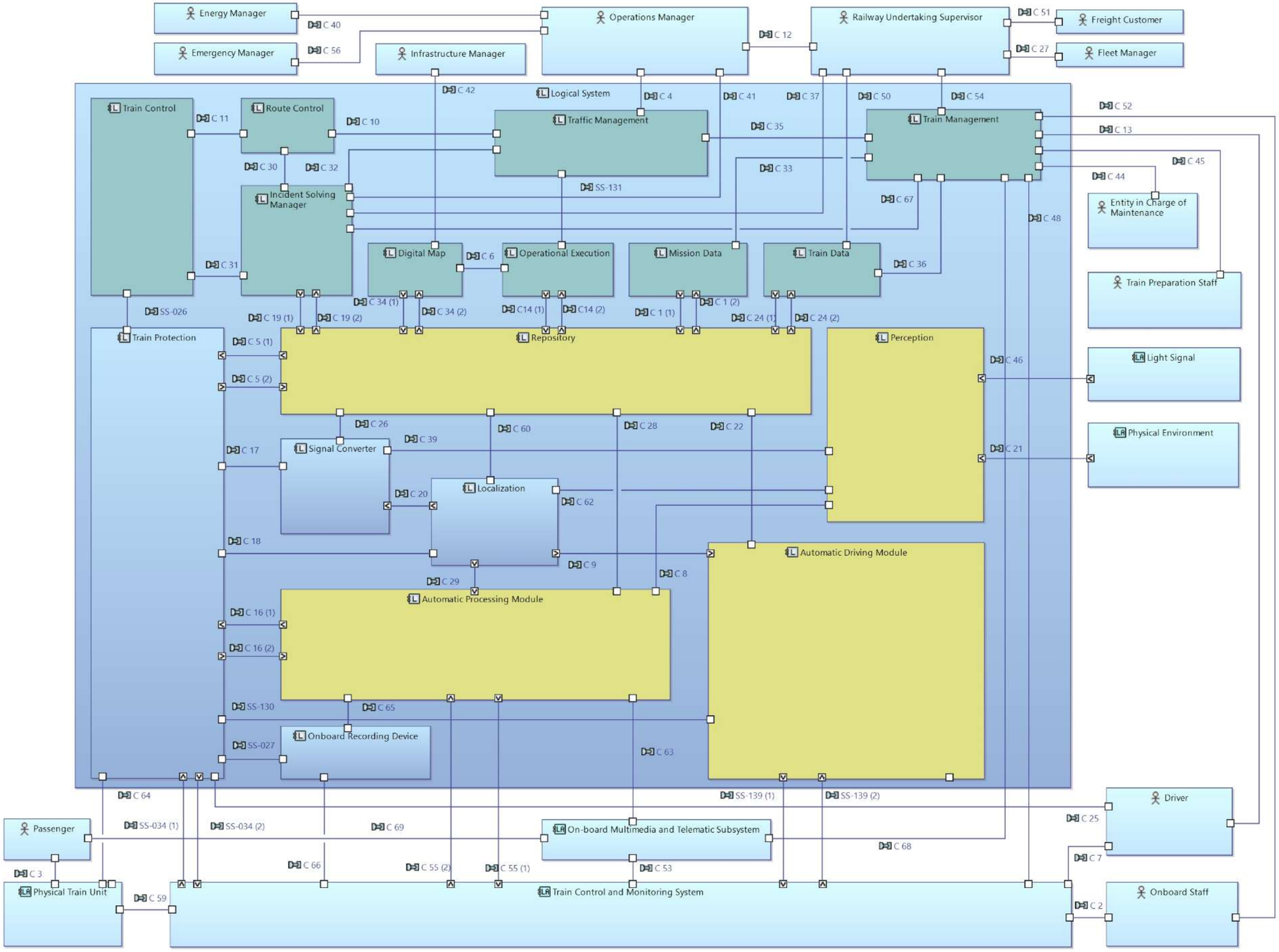
Cover

ATO-OB
from the TSI 2023

ATO (up to GoA4) Logical Architecture



ATO (up to GoA4 with Signal Converter) Logical Architecture



Main assumptions on system architecture

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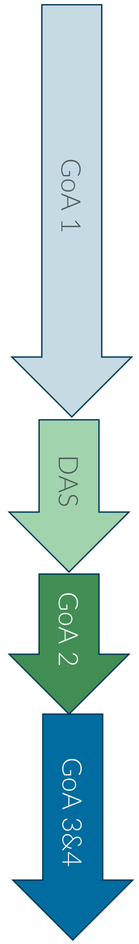
  - New layers may be added if additional Digital Map data are needed

Logical Blocks

- Repository
  - Manages the interoperable track/train communication
  - Determine the appropriate track side server (transactors) in all situations (wake-up, border crossing, RU change, …)
  - Acquire all the data required for the train operation (Mission, Train composition data, Time table information, foreseen routes, track plan data, etc…)
  - Check the operation data consistency
  - Disclose the relevant data to the other on-board Logical Blocks according to their subscription
- Localisation
  - Determine the train location based on GPS coordinates and base on the distance from the beginning of the occupied Segment Profile
- Train Protection
  - ETCS-OB mandatory Logical Block
- Driver Advisory System (SFERA)
  - Gives advisory speed profile to the driver
- Automatic Driving Module
  - Driving according an optimum speed profile
  - Supporting traction/brake based on the SS-139 interface
  - Recovered from GoA2 (TSI 2023)
- Perception for obstacles and environment detection
  - Replace the eyes and other sensors of the driver
- Automatic Processing Module
  - Replace the brain of the driver
  - Inform the ETCS-OB about obstacles not detected by the track circuit s or axle counter.
- Signal Aspect Perception and Signal Converter (optional)
  - To be used when the ETCS is not yet installed trackside



Agenda

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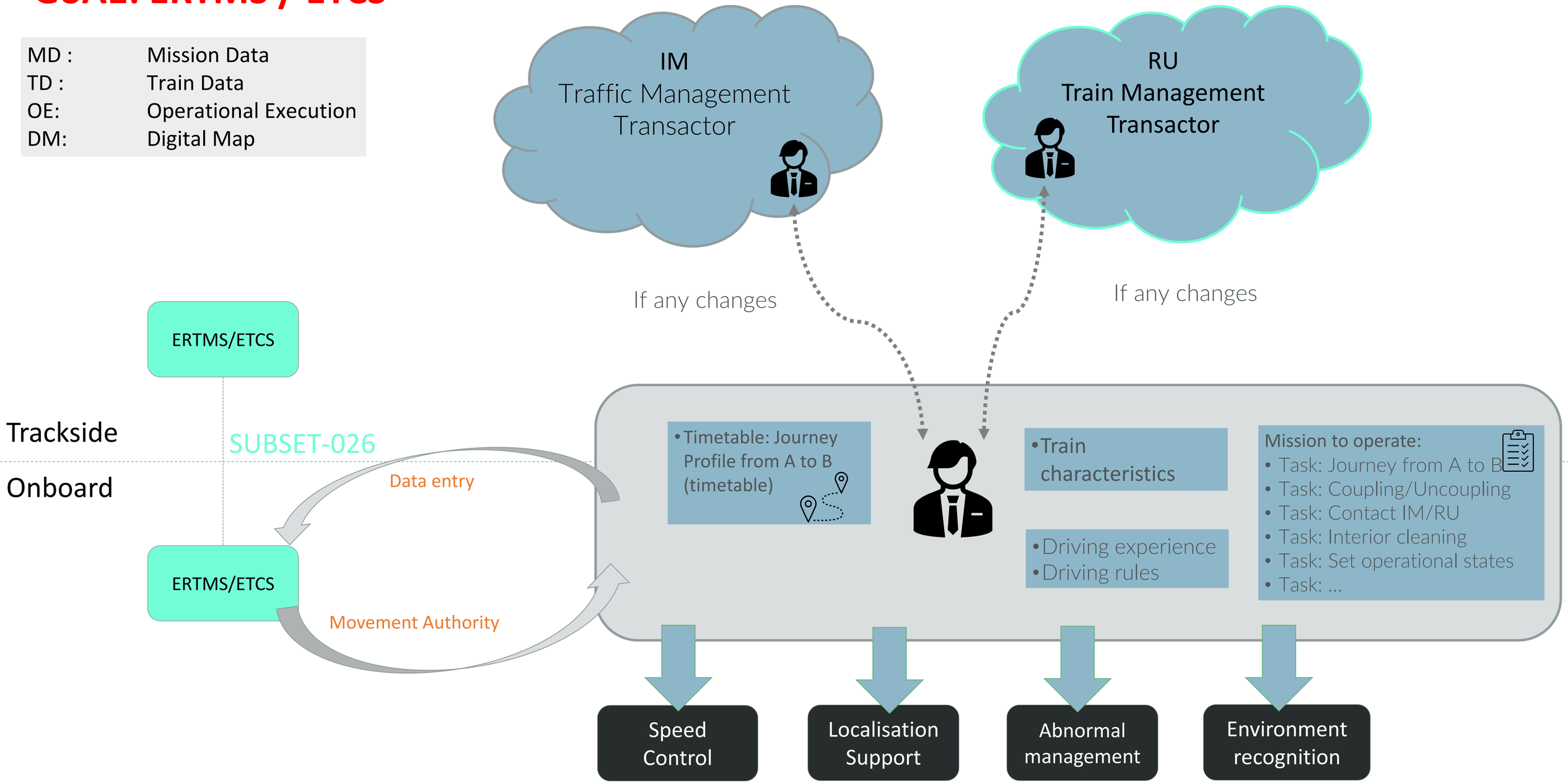
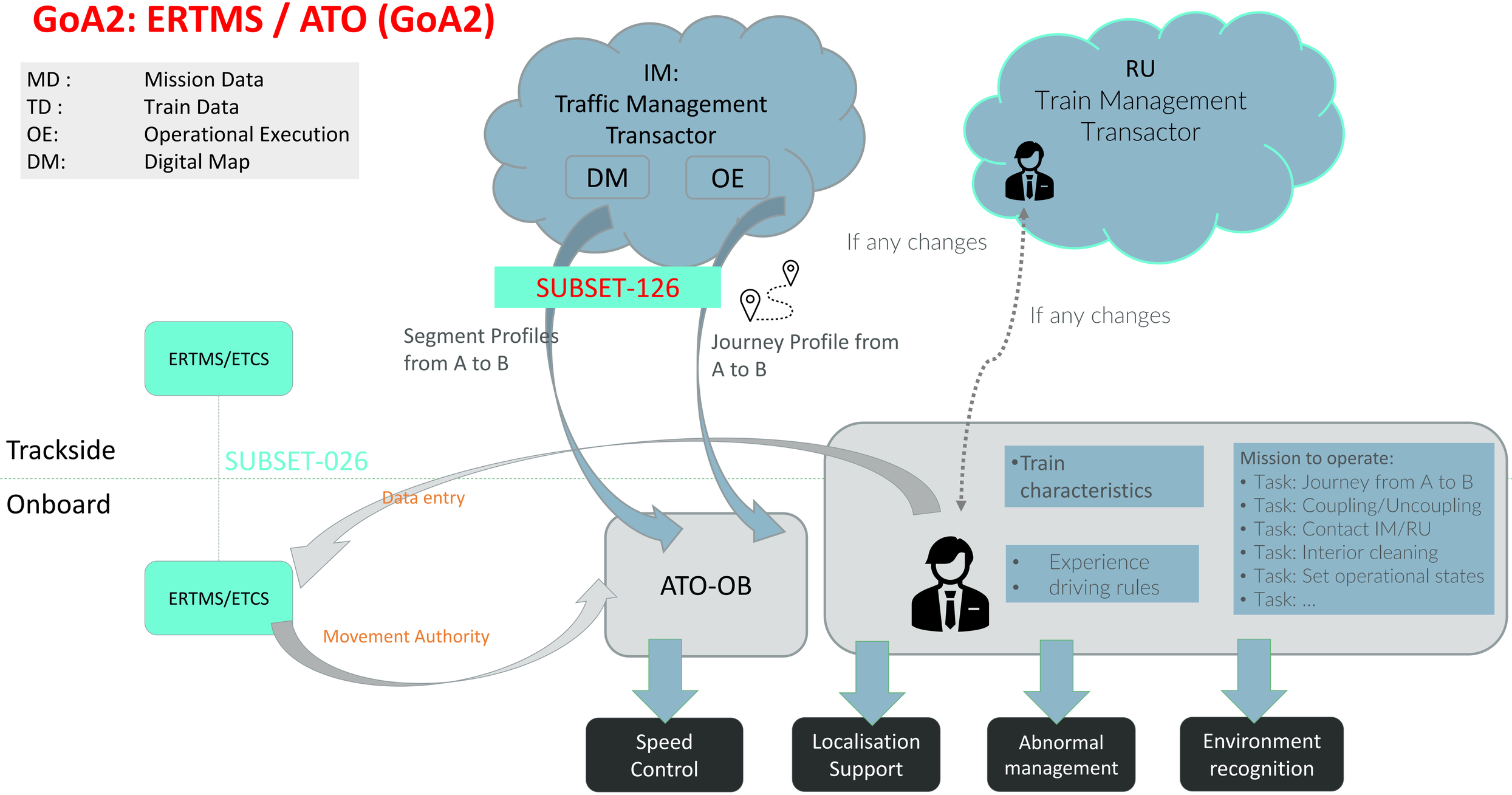
GoA1: ERTMS / ETCS

MD :	Mission Data
TD :	Train Data
OE:	Operational Execution
DM:	Digital Map



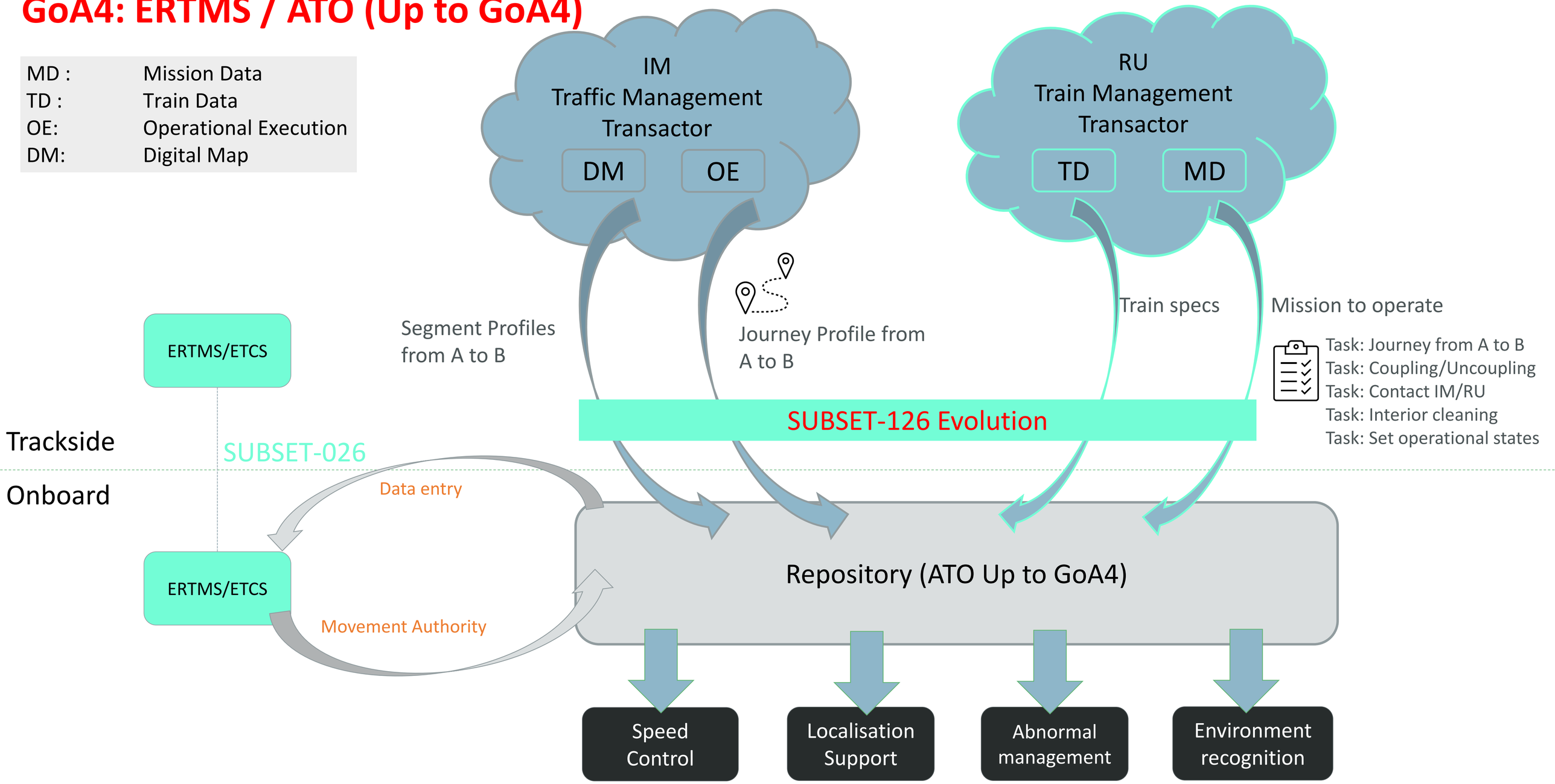
GoA2: ERTMS / ATO (GoA2)

MD :	Mission Data
TD :	Train Data
OE:	Operational Execution
DM:	Digital Map



GoA4: ERTMS / ATO (Up to GoA4)

MD :	Mission Data
TD :	Train Data
OE:	Operational Execution
DM:	Digital Map



Scope of REPOSITORY

1. Request MP/JP,
2. Request SP if not already stored or obselete,
3. Check version and consistency of MP/JP/SP,
4. Check consistency between JP path and ETCS linking information,
1. Safe path from the current train position to the current EoA
5. Store passed segments for future use.
6. Define the reference location for 1D Localization (not ETCS),
7. Place the data of each segment in this unique reference location.

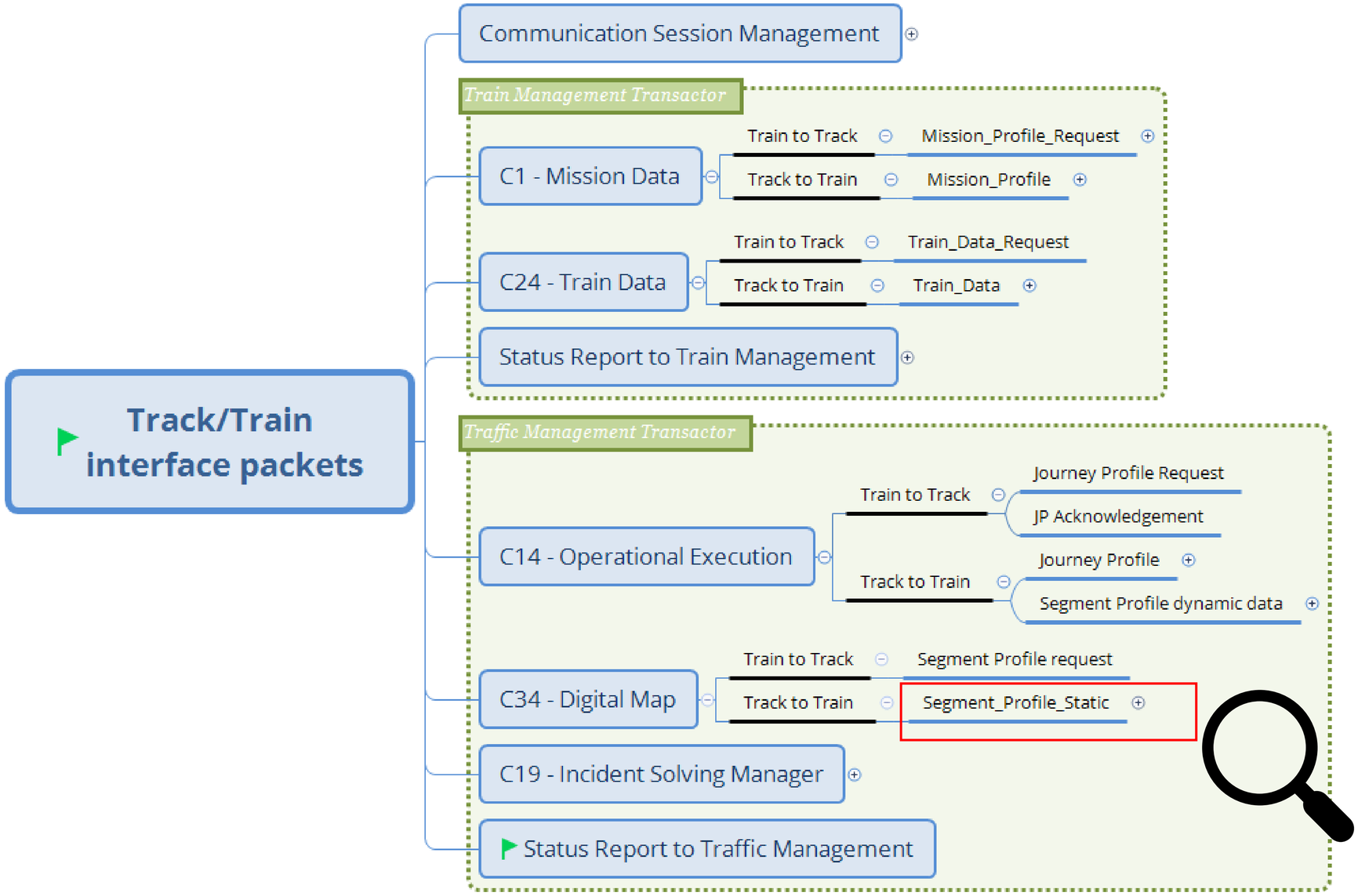
JP	: Journey Profile
MP	: Mission Profile
SP	: Segment Profile

Agenda

1. Logical Architecture (basic design criteria)
2. Focus on the track/train communication interoperability principles
3. Exchanged data
4. Joined group achievement and next steps

Segment Profile Static

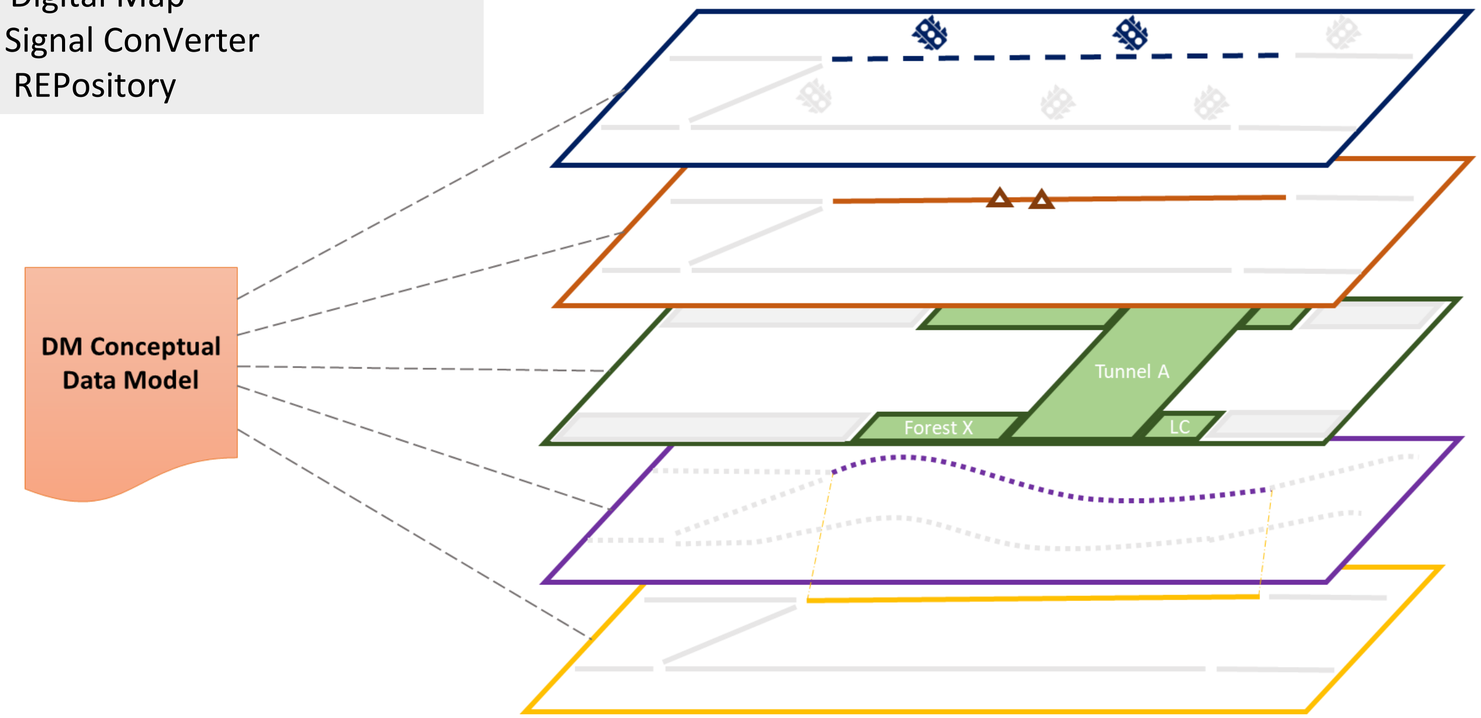
JP : Journey Profile



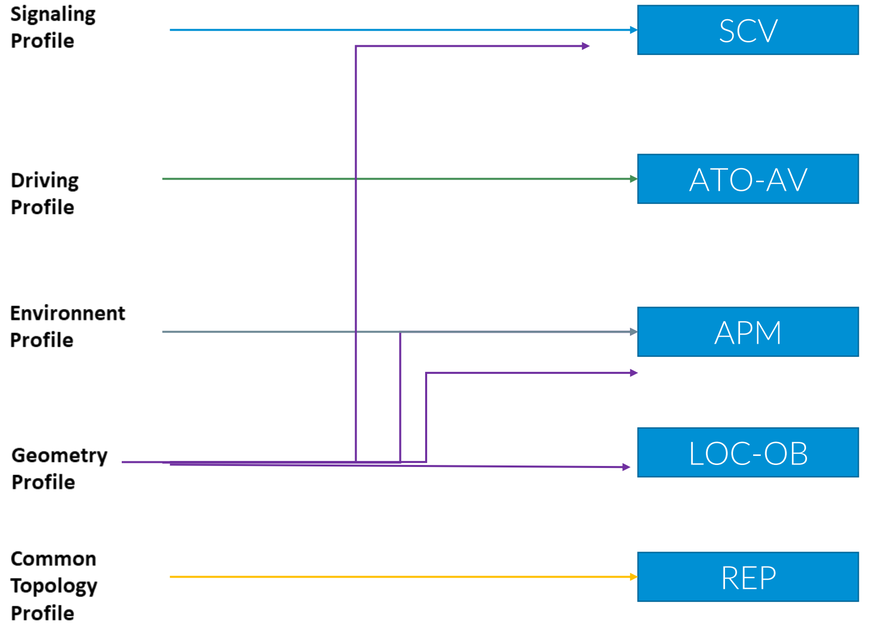
Segment Profile Static overview

Segregate data of each segment into a layered architecture

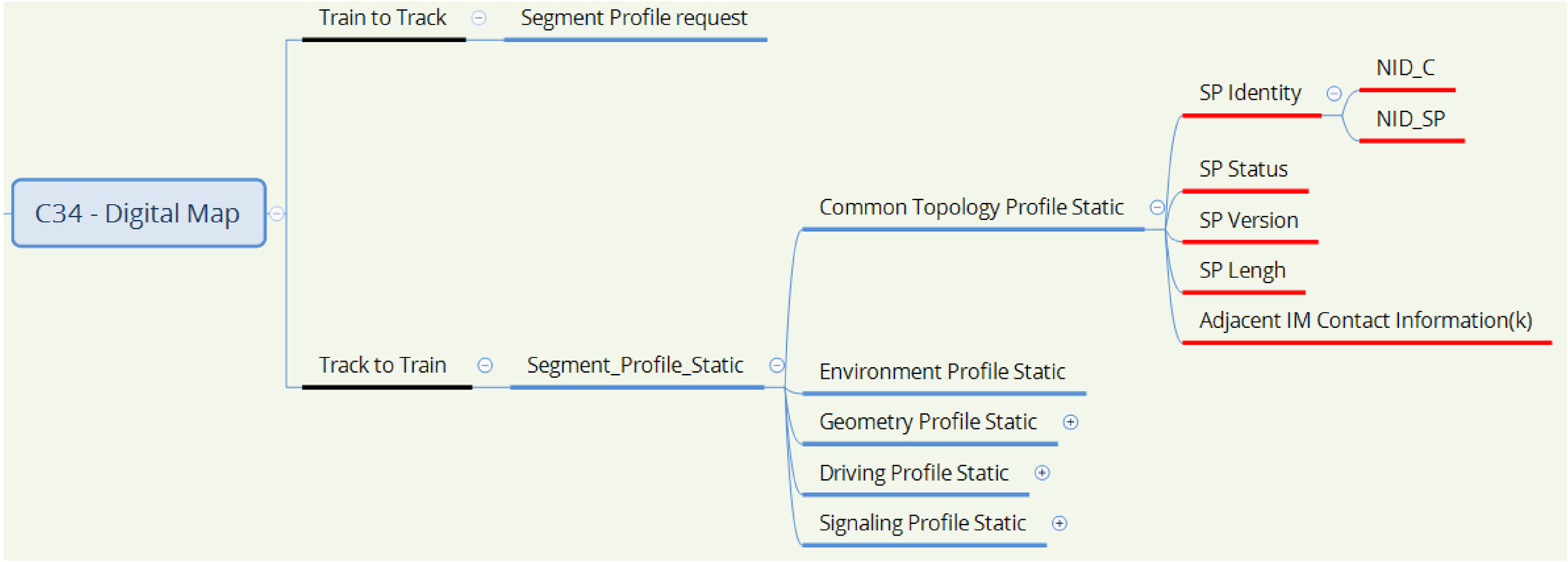
APM: Automatic Processing Module
ATO: Automatic Train Operation
ADM: Automatic Driving Module
DM: Digital Map
SCV: Signal ConVerter
REP: REPository

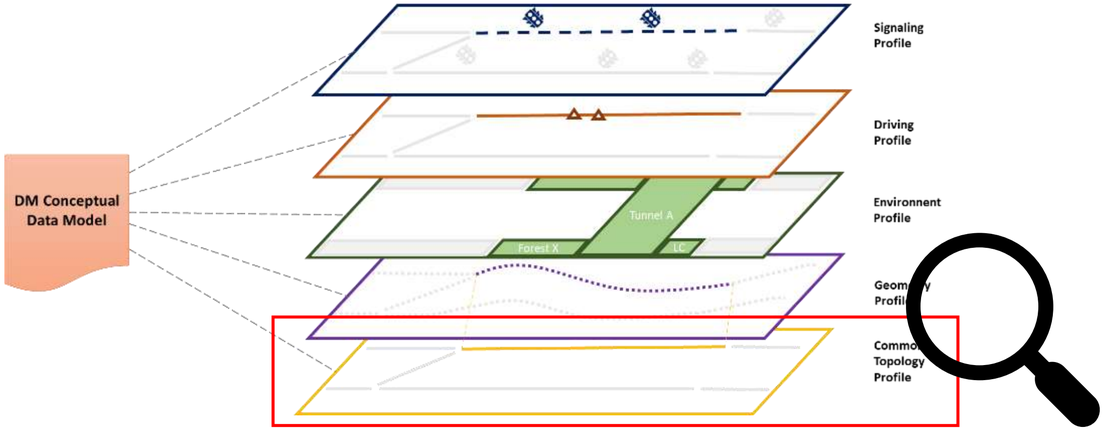


Onboard customers:



Common Topology Profile overview





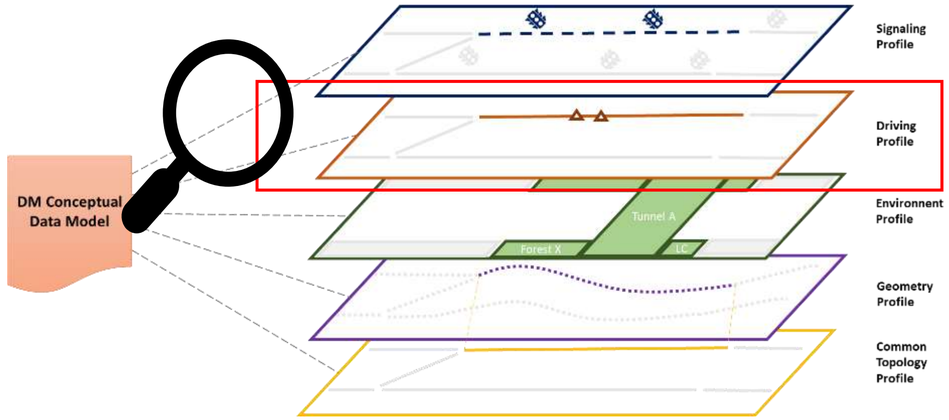
IM: Infrastructure Manager
SP: Segment Profile

: **Data from S2R**

: **Data from SS126**

Opportunity: Reuse SS126 to create the driving profile

- Segment_Profile_Static
  - Driving Profile Static
    - Local UTC Time of the SP
    - Altitude at the beginning of the SP
    - Distance to stop the train in rear of an EoA
    - Static Speed Profiles
    - Gradient Profile
    - Curve Profile
    - Power Voltage Profile
    - Current limitation area information
    - Balise Groups information
    - Balises Information
    - Timing Points Information
    - Platform area information
    - Tunnel Information
    - Axle Load Speed Profiles
    - Unprotected LX
    - Permitted Braking Distance Information
    - Swich Off Regenerative Brake area information
    - Swich Off Eddy Current Brake area information
      - For EB
      - For SB
    - Switch Off Magnetic Shoe brake area information
    - Inhibition of the Dynamic Brake area information
    - Dynamic brake force limit area

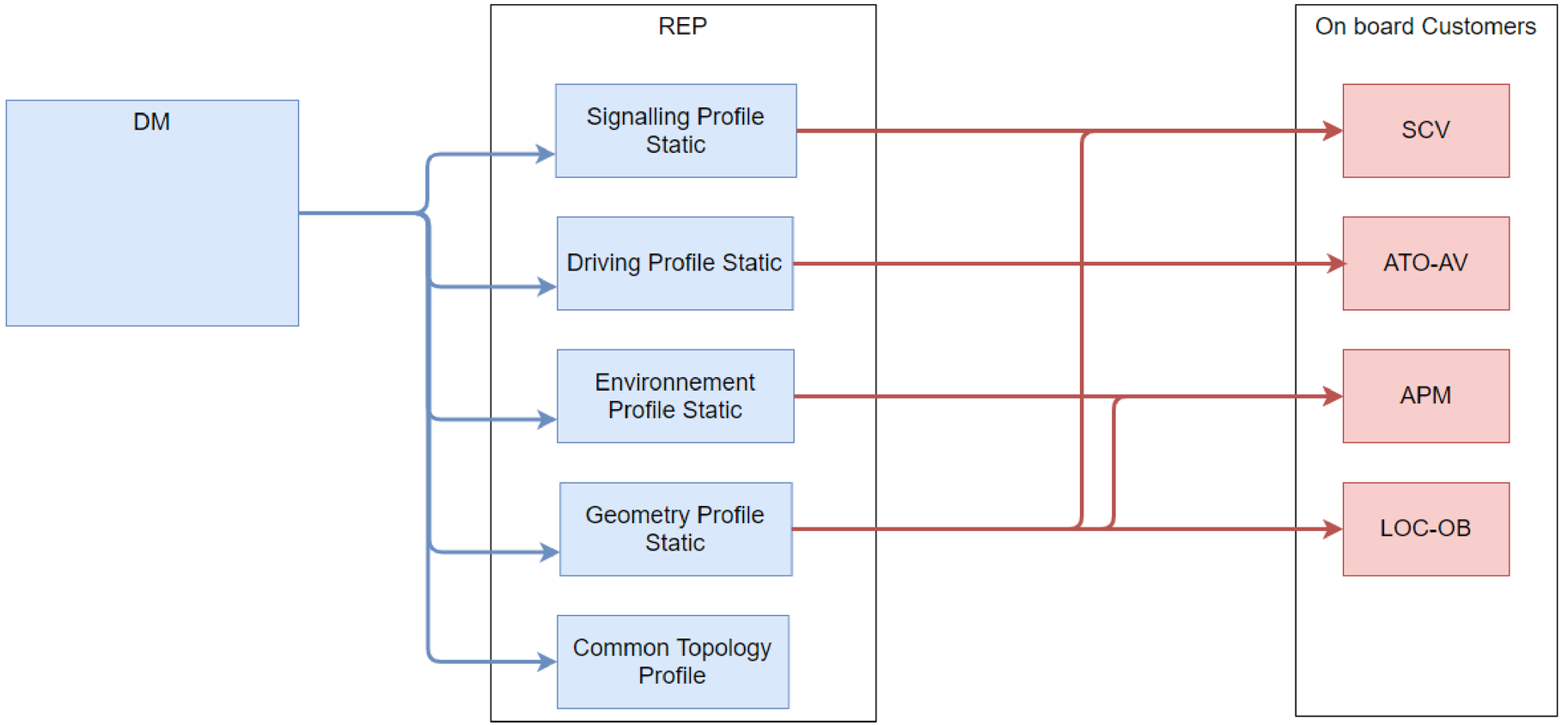


: **from S2R**

: **from SS126**

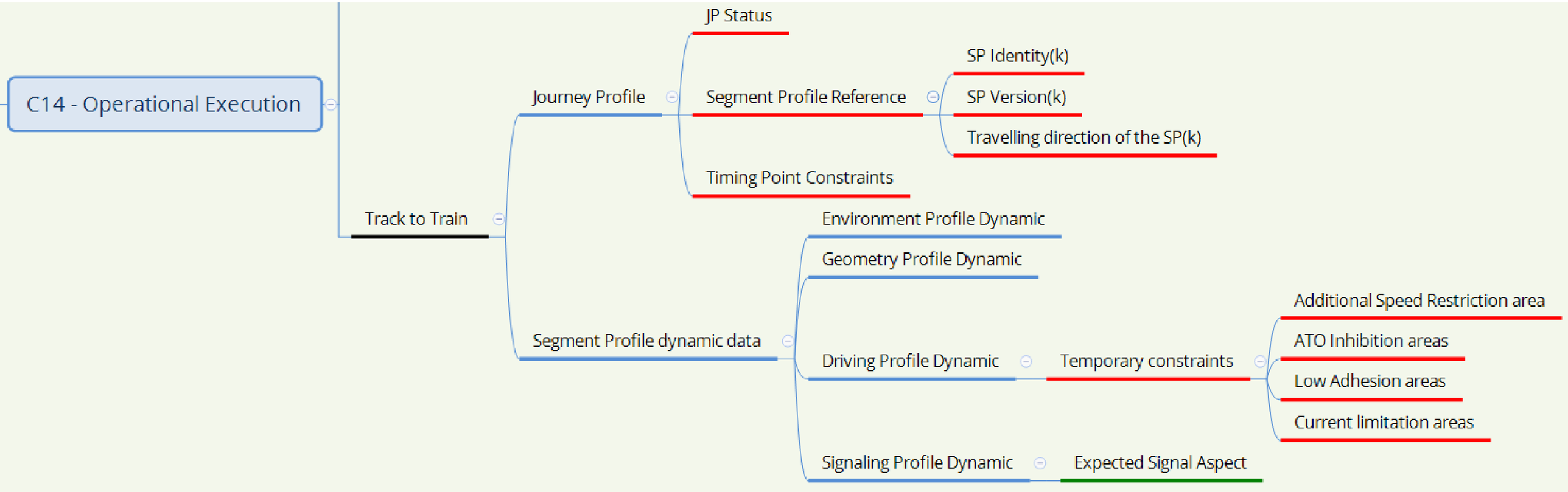
ATO : Automatic Train Operation
EB : Emergency Brake
EoA : End of Authority
LX : Level Crossing
SB : Service Brake
SP : Segment Profile

Opportunity: REP to merge static and dynamic data



APM: Automatic Processing Module
ATO: Automatic Train Operation
ATO-AV: ATO - Vehicle
DM: Digital Map
LOC-OB: Localization On-Board
SCV: Signal ConVerter
REP: REPository

Opportunity: Reuse the common topology profile and SS126 to place dynamic data in the Segment Profile dynamic OE

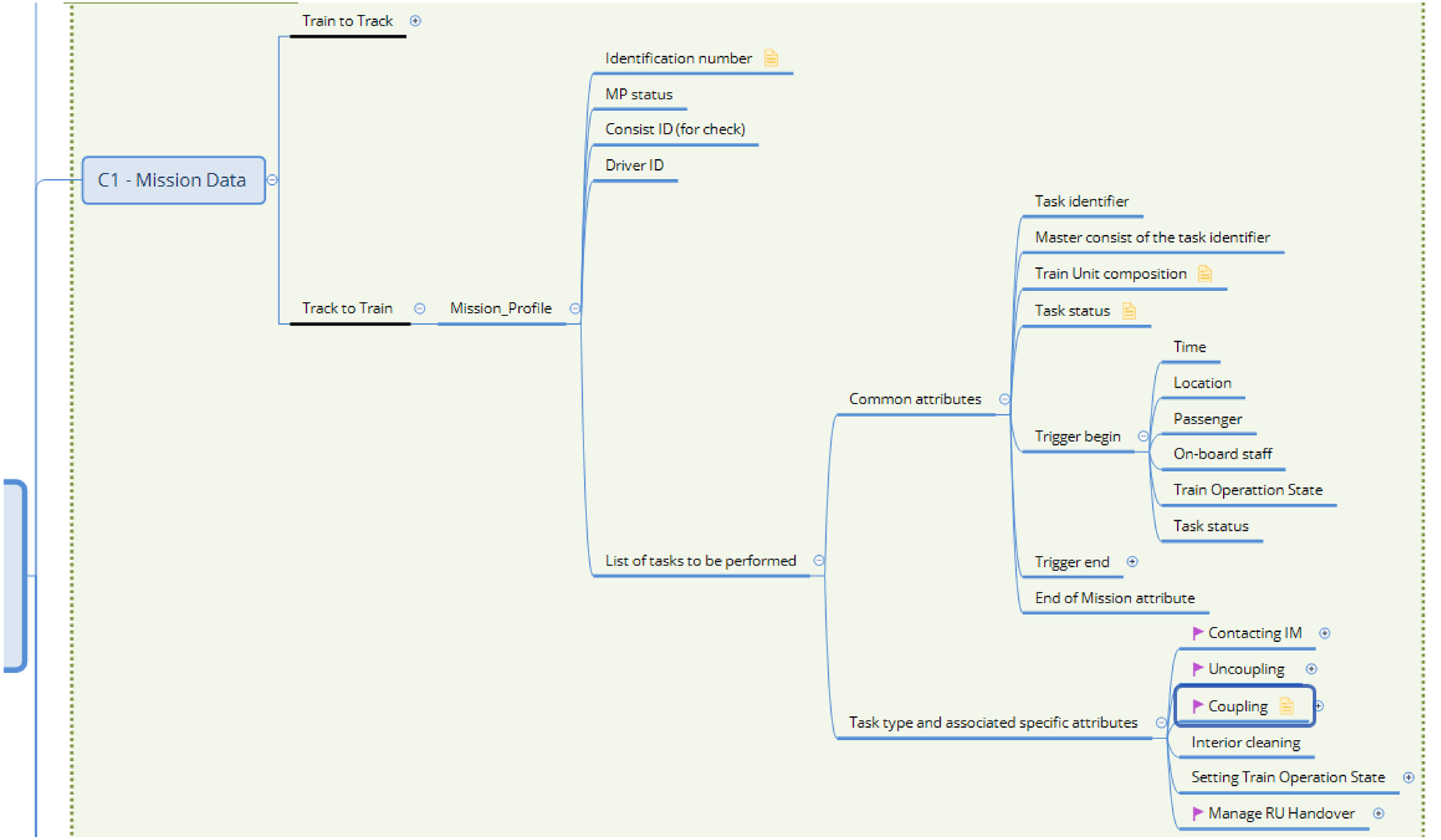


ATO : Automatic Train Operation
JP : Journey Profile
OE : Operational Execution
SP : Segment Profile

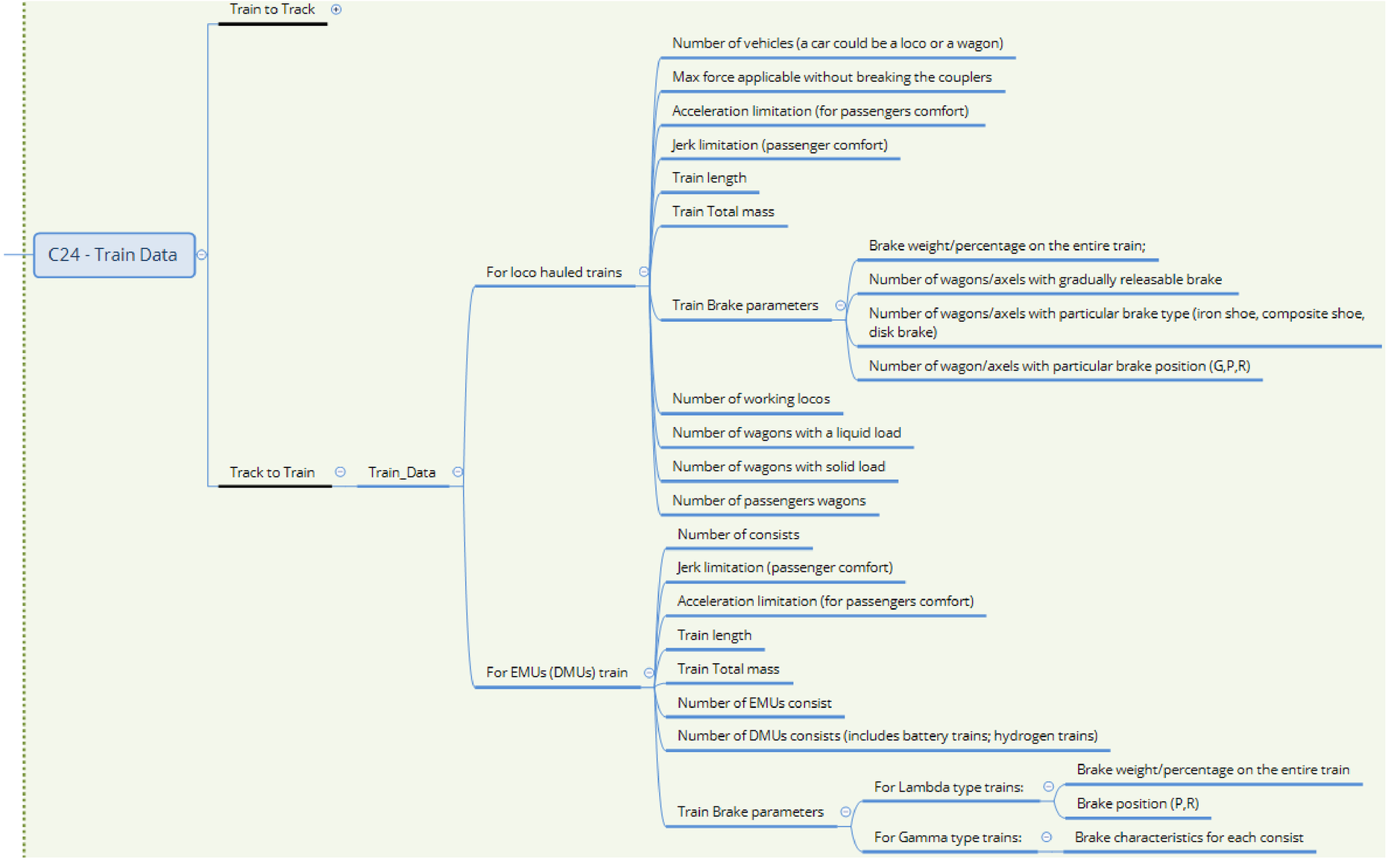
: **from S2R**

: **from SS126**

Mission Profile



Train Data Set



Agenda

1. Logical Architecture (basic design criteria)
2. Focus on the track/train communication interoperability principles
3. Exchanged data
4. Joined group achievement and next steps

Joined group achievements and next steps

- Achievements
  - A common vision on the architecture and interoperability principles
  - A proposal for new data format
  - Communication Session Management Concepts
  - Mission Profile concept
- On-going (to be continued in EURail)
  - Data content definition for Mission Profile, Train Data Set, Journey Profile, Segment Profiles (Static & Dynamic)

Agenda

12:00 Light lunch

12:40 Welcome by UIC Director (Jean-Michel Evanghelou)
12:45 Introduction: status of SFERA (Daniele Arena)
13:00 Planned/Working implementations
13:50 Adapting the Common Interface to C-DAS operations (Thomas Pynthe)

14:05 Break

14:25 Looking ahead: Digital instructions and SFERA (Sébastien Dislaire)
14:40 Conclusions of the joint work with X2Rail4 (Benoît Bienfait, Benoît Abisset)
→ 14:55 The beginning of ERJU and its impact on DAS and SFERA (Bart Van der Spiegel)
15:10 Joint SFERA-railML session (Vasco Paul Kolmorgen, Alain Wenmaekers)
15:35 Mini-workshops on SFERA interoperability, subgroups (Thomas Sutter, Alain Wenmaekers)
16:15 Fair/Networking

17:30 End

ERJU and DAS/SFERA

Bart Van der Spiegel

Energy manager

SFERA WG

Infrabel

INTERNATIONAL UNION
OF RAILWAYS

The start of EU-Rail

SFERA User Group

UIC HQ, Paris
8/11/2023

The ambition: a modern harmonised interoperable European railway system

In line with the Sustainable and Smart Mobility Strategy, the ambition of the Union and Member States, with the support of ERA and Shift2Rail JU, is to create a modern harmonised robust and reliable interoperable European railway system. Such a system is necessary for the rail sector to better address customer needs, maintain safety and digital security, improve operational efficiency and performance, reduce costs, support European rail supply industry competitiveness and increase the speed of adoption of performance-enhancing improvements.

Therefore, in the process of designing the new Europe's Rail Joint Undertaking (EU-Rail), the EC and Member States have agreed that there should be within EU-Rail a dedicated structure - process, governance and resources - to provide a unique opportunity to allow the Rail sector to converge on a strategic vision for the evolution of the Single European Rail Area (SERA).

The System Pillar is the instrument to achieve the ambition

The System Pillar within EU-Rail is the chosen approach to support the rail sector in the development of the strategic vision of the SERA. This vision will be underpinned by a performance-based concept of operation(s), and supported by the necessary functional system architecture. This will build on the lessons learned from the current Shift2Rail JU, but also from other partnerships and programmes.

It is a fact that railways across Europe do not operate in the same manner and utilise many different components and technologies. This includes many different operational rules, assets, components, databases, interfaces and know how. Thus, in addition to the strategic vision, it is essential the System Pillar recognises and proposes relevant migration strategies from those historic systems to a new system i.e. simpler for its customer and operator, integrated, interoperable, modular interchangeable, borderless, technological agnostic operations. Therefore, the strategic vision of the future railway concept of operations and system architecture must recognise historical limitations while maintaining and achieving the ambitious objectives.

Europe's Rail

DELIVER AN **INTEGRATED EUROPEAN RAILWAY NETWORK** BY DESIGN

DEVELOP A **UNIFIED OPERATIONAL CONCEPT AND A FUNCTIONAL SYSTEM ARCHITECTURE** FOR INTEGRATED EUROPEAN RAIL TRAFFIC AND CCS/AUTOMATION

DELIVER A **SUSTAINABLE AND RESILIENT RAIL SYSTEM**

DELIVER A **COMPETITIVE, GREEN RAIL FREIGHT** FULLY INTEGRATED INTO THE LOGISTICS VALUE CHAIN

DEVELOP A **STRONG AND GLOBALLY COMPETITIVE EUROPEAN RAIL INDUSTRY**

EUROPE'S RAIL:

ONE INTEGRATED R&I PROGRAMME

SYSTEM PILLAR

OPERATIONAL CONCEPTS

FUNCTIONAL SYSTEM ARCHITECTURE

A SINGLE COORDINATING BODY FOR THE WHOLE SECTOR EVOLUTION

OPEN INTERFACES TO OTHER TRANSPORT MODES AND BUSINESSES

SYSTEM REQUIREMENT SPECIFICATIONS

INNOVATION PILLAR

TECHNOLOGICAL AND OPERATIONAL SOLUTIONS FOR SERVICES OF FUTURE

FLAGSHIP PROJECTS

LARGE-SCALE DEMONSTRATIONS

EXPLORATORY AND FUNDAMENTAL R&I

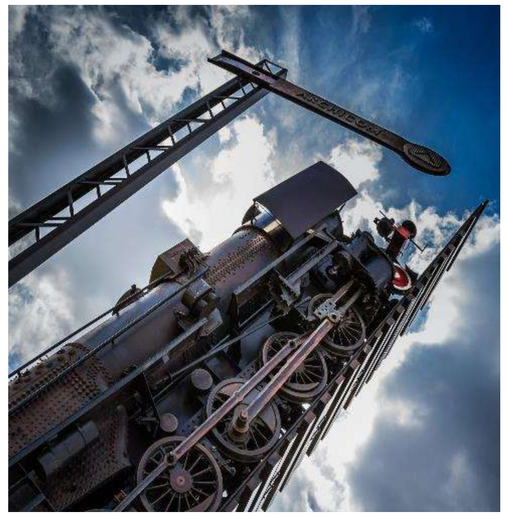
1	EUROPEAN RAIL TRAFFIC AND MOBILITY MANAGEMENT	Manage and improve rail traffic at EU level Adjust rail traffic management in function of the mobility demand
2	DIGITALISATION & AUTOMATION IN TRAIN OPERATIONS	ATO implementation Digital train operations
3	SUSTAINABLE AND DIGITAL ASSETS	Integrated assets testing & life-cycle framework Zero-emmission, silent rail system
4	COMPETITIVE, DIGITAL, GREEN RAIL FREIGHT	New digital customer interaction & innovative rail freight services Multimodal and rail freight innovation integration
5	REGIONAL RAIL SERVICES IN LOW DENSITY AREAS	New system approach to regional rail services in low density areas

DEPLOYMENT GROUP

FUTURE SOLUTIONS DEPLOYED IN A COORDINATED AND CONSISTENT WAY AT EUROPEAN LEVEL, TAKING INTO ACCOUNT ALTERNATIVE ROLLOUT SCENARIOS, BEHAVIOURAL AND ORGANISATIONAL CHANGES, SYNERGIES WITH OTHER MODES OF TRANSPORT

An Innovation Pillar: and a System Pillar

- The **System Pillar** builds its specifications on solid foundations of known/proven technology
    - Project timing under control, no technical “surprises”
- The **Innovation Pillar** searches in parallel but independently for interesting technological innovations
    - 6 “Flagship projects”
    - Proofs of concept, pilot projects
    - New initiatives will be added
- When an innovation is ready for general use, the results are “transferred” from the innovation pillar to the system pillar



Europe's Rail Flagship Projects - Phase 1

Rail Research and Innovation to make Rail the Everyday Mobility

New multimodal TMS system

Lower Cost Regional Rail

FP6: FUTURE
Innovative rail services to revitalise capillary lines and regional rail services

Value: EUR 32.9 million
Partners involved: 50
Duration: 48 months

FP1: MOTIONAL
Mobility management in multimodal environment and digital enablers

Value: EUR 92.6 million
Partners involved: 88
Duration: 46 months

Digital automated up to autonomous train operation

FP2: R2DATO
Rail to digital automated up to autonomous train operation

Value: EUR 160.8 million
Partners involved: 76
Duration: 42 months

Transforming Europe's Rail Freight

FP5: TRANS4M-R
Transforming Europe's rail freight

Value: EUR 95.1 million
Partners involved: 71
Duration: 45 months

FP3: IAM4RAIL
Holistic and integrated asset management for Europe's rail system

Value: EUR 106.9 million
Partners involved: 94
Duration: 48 months

Holistic and integrated asset management

FP4: RAIL4EARTH
Sustainable and green rail system

Value: EUR 95.1 million
Partners involved: 71
Duration: 48 months

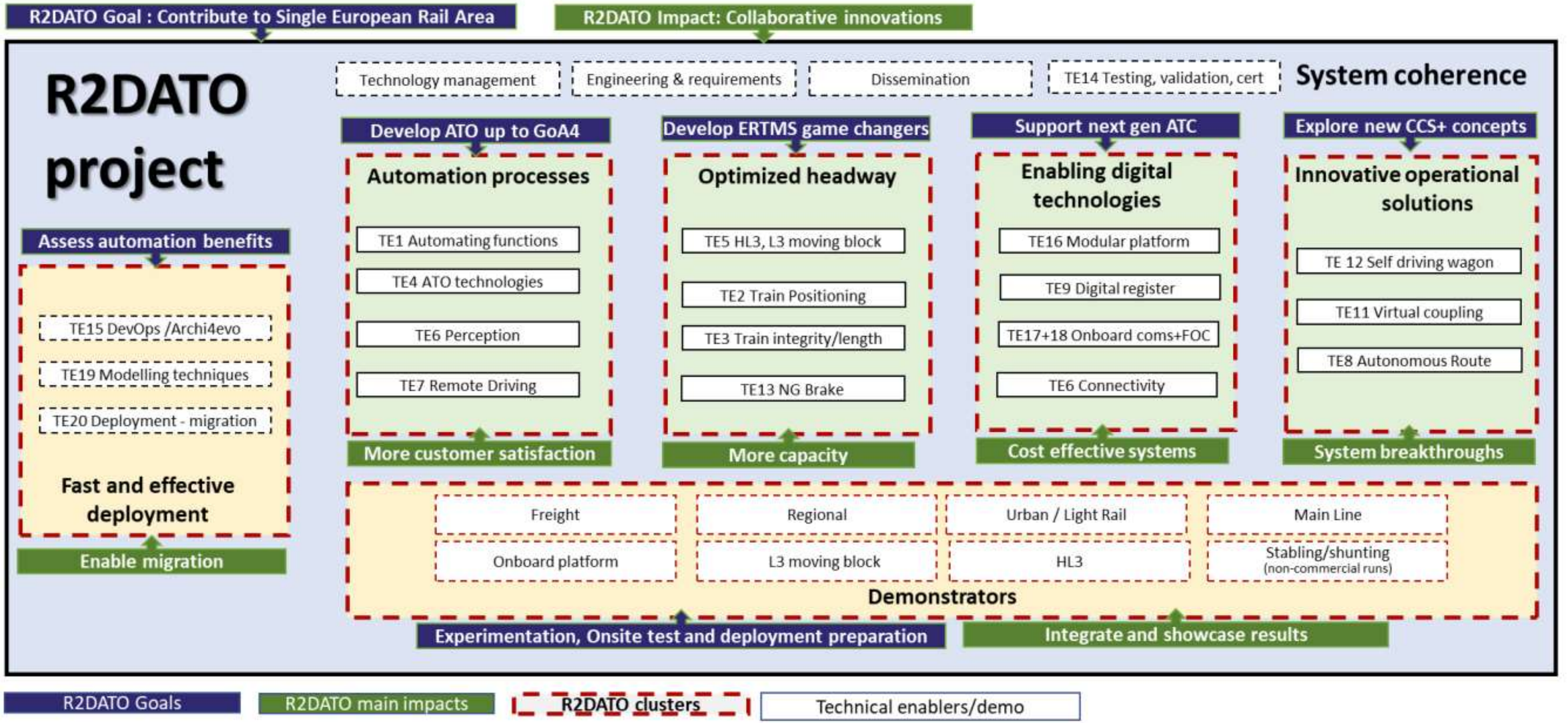
Sustainable and Green rail system

R2DATO

Flagship Project 2: R2DATO - Rail to Digital automated up to autonomous train operation

To meet the increasing demand for transportation of both passengers and freight, FP2-R2DATO will take the advantages of digitalisation and automation to develop the next generation ATC and deliver scalable digital and automatic (up to autonomous) train operation (DATO) capabilities in order to enhance the capacity of the existing rail networks. Tangible results of FP2-R2DATO are expected to be delivered by 2025 on key topics: ATO, ETCS hybrid level 3 and level 3 moving block, digital technologies (5G-connectivity and a standardised onboard ICT-platform), and guidelines and methods for fast and cost-effective deployment and migration of DATO throughout Europe. Through these technical improvements FP2-R2DATO will meet the objectives and impacts defined in the Europe's Rail Master Plan and Annual Work Programme, such as contribute to increased punctuality, reliability and productivity of staff, rolling stock and infrastructure. FP2-R2DATO will pay attention to potential risks, such as acceptance by the public, synchronising with ETCS-deployment and potential legal issues.

R2DATO


R2DATO Goal : Contribute to Single European Rail Area
R2DATO Impact: Collaborative innovations
R2DATO project
Technology management
Engineering & requirements
Dissemination
TE14 Testing, validation, cert
System coherence
Develop ATO up to GoA4
Develop ERTMS game changers
Support next gen ATC
Explore new CCS+ concepts
Automation processes
TE1 Automating functions
TE4 ATO technologies
TE6 Perception
TE7 Remote Driving
Optimized headway
TE5 HL3, L3 moving block
TE2 Train Positioning
TE3 Train integrity/length
TE13 NG Brake
Enabling digital technologies
TE16 Modular platform
TE9 Digital register
TE17+18 Onboard coms+FOC
TE6 Connectivity
Innovative operational solutions
TE 12 Self driving wagon
TE11 Virtual coupling
TE8 Autonomous Route
Assess automation benefits
TE15 DevOps /Archi4evo
TE19 Modelling techniques
TE20 Deployment - migration
Fast and effective deployment
Enable migration
More customer satisfaction
More capacity
Cost effective systems
System breakthroughs
Freight
Regional
Urban / Light Rail
Main Line
Onboard platform
L3 moving block
HL3
Stabling/shunting (non-commercial runs)
Demonstrators
Experimentation, Onsite test and deployment preparation
Integrate and showcase results
R2DATO Goals
R2DATO main impacts
R2DATO clusters
Technical enablers/demo

Standardisation and TSI input plan

Outputs of the System Pillar = inputs for other processes

SP/IP Documents approved by SP Steering

Standardisation and TSI Input plan

List of potential CR's by 11/2023

ERA is member of Core Group and Steering Group

TSI Change Request (@ERA)

EC Standardisation Request (@CEN, CENELEC, RASCOP)

Iterative process

TSI

EN Standard

SP Document

Standardisation and TSI input plan

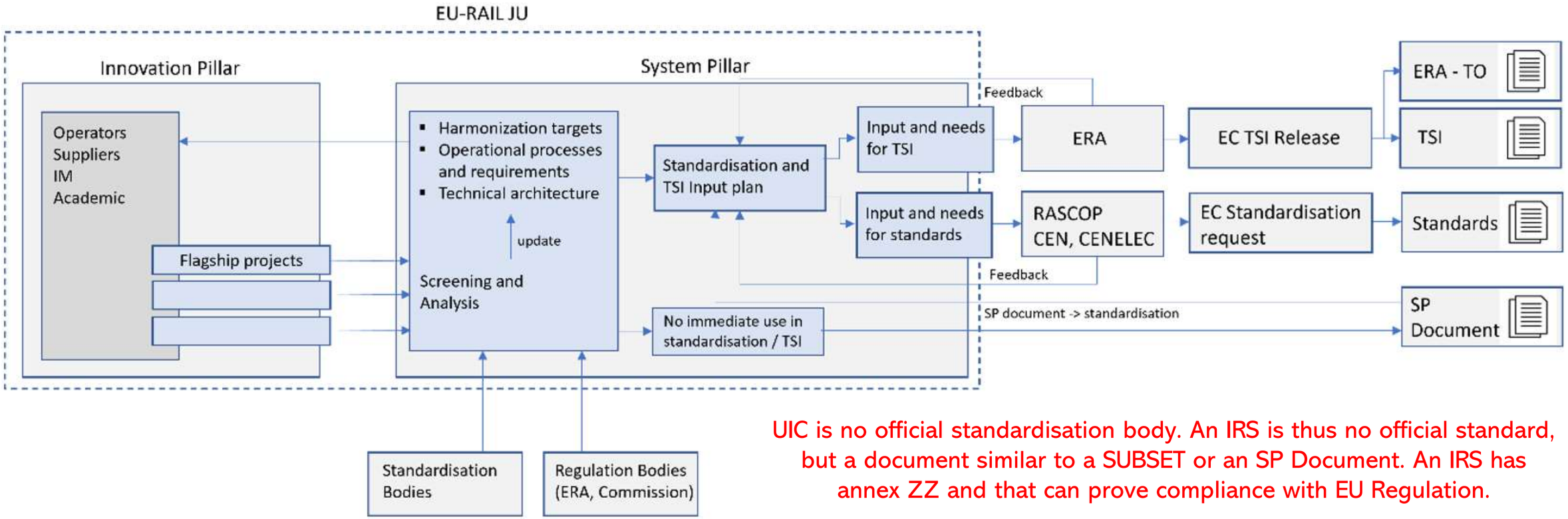
The role of the “Standardisation/TSI Input Plan” (STIP)

- The STIP will identify a list of proposals for TSI Change Requests (CR) emerging from the EU-RAIL activities (SP and IP)
- The STIP can potentially apply to any TSI
- ERA participates in the strategic definition and validation of the STIP in the SP Core Group and SP Steering Committee meetings,
- The SP Core Group will finalise the list of SP and IP’s CRs (or for ENs) by November 2023

Harmonisation process

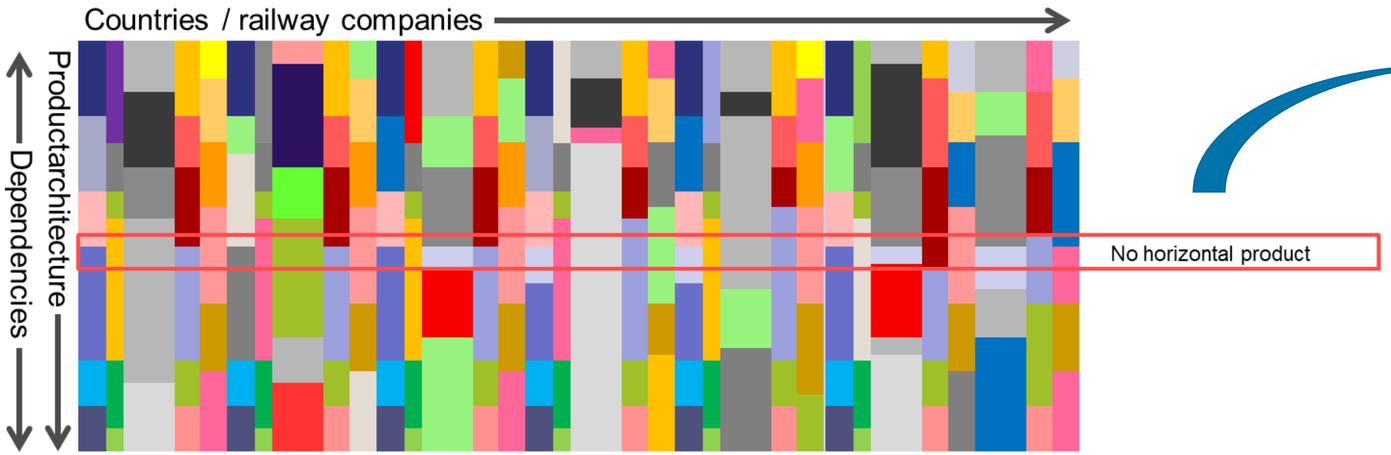
Integrated, system-based approach:

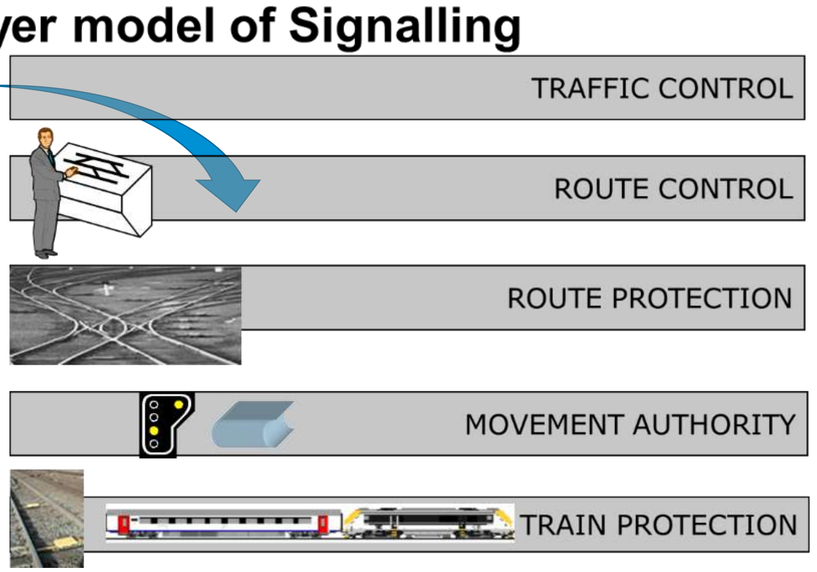
- Interface between the research activities (IP, SP, external) and the standardisation and regulation bodies
- Identification of inputs and requirements for harmonization
- Assessment (alignment with customer requirements and operational needs)
- Integration in harmonisation process (TSI, Standards, SP documents)



UIC is no official standardisation body. An IRS is thus no official standard, but a document similar to a SUBSET or an SP Document. An IRS has annex ZZ and that can prove compliance with EU Regulation.

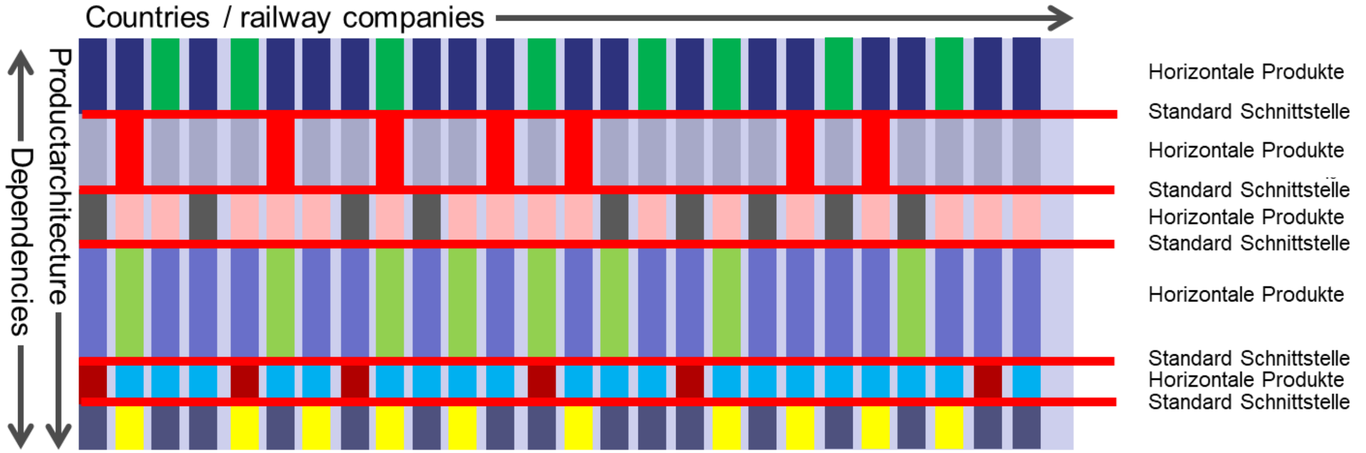
From national systems towards a European System Pillar





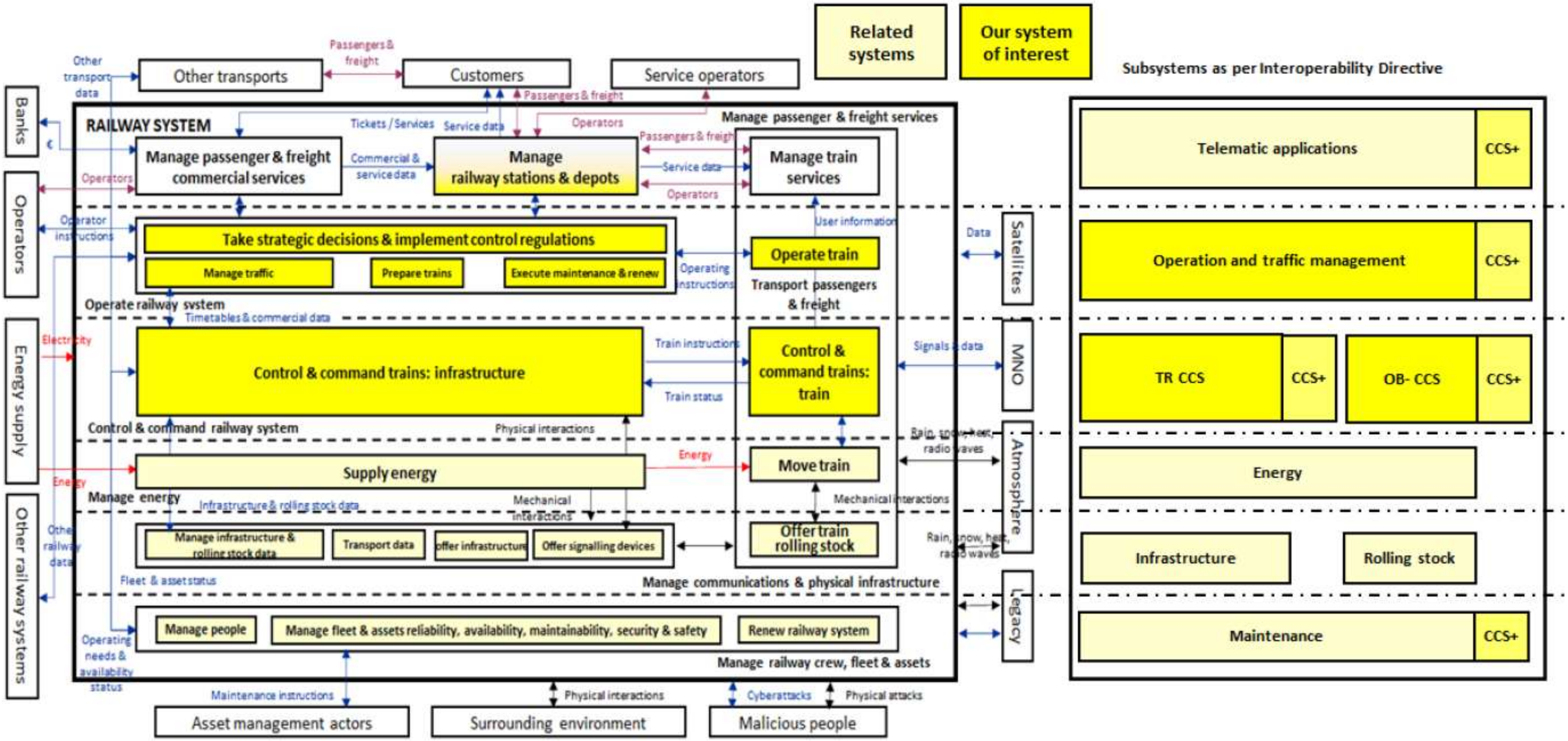
Aims

- Interoperability
- Harmonised operations
- Low Life Cycle Costs
- Single modular framework
- Adaptability
- Migratability
- Safe investment

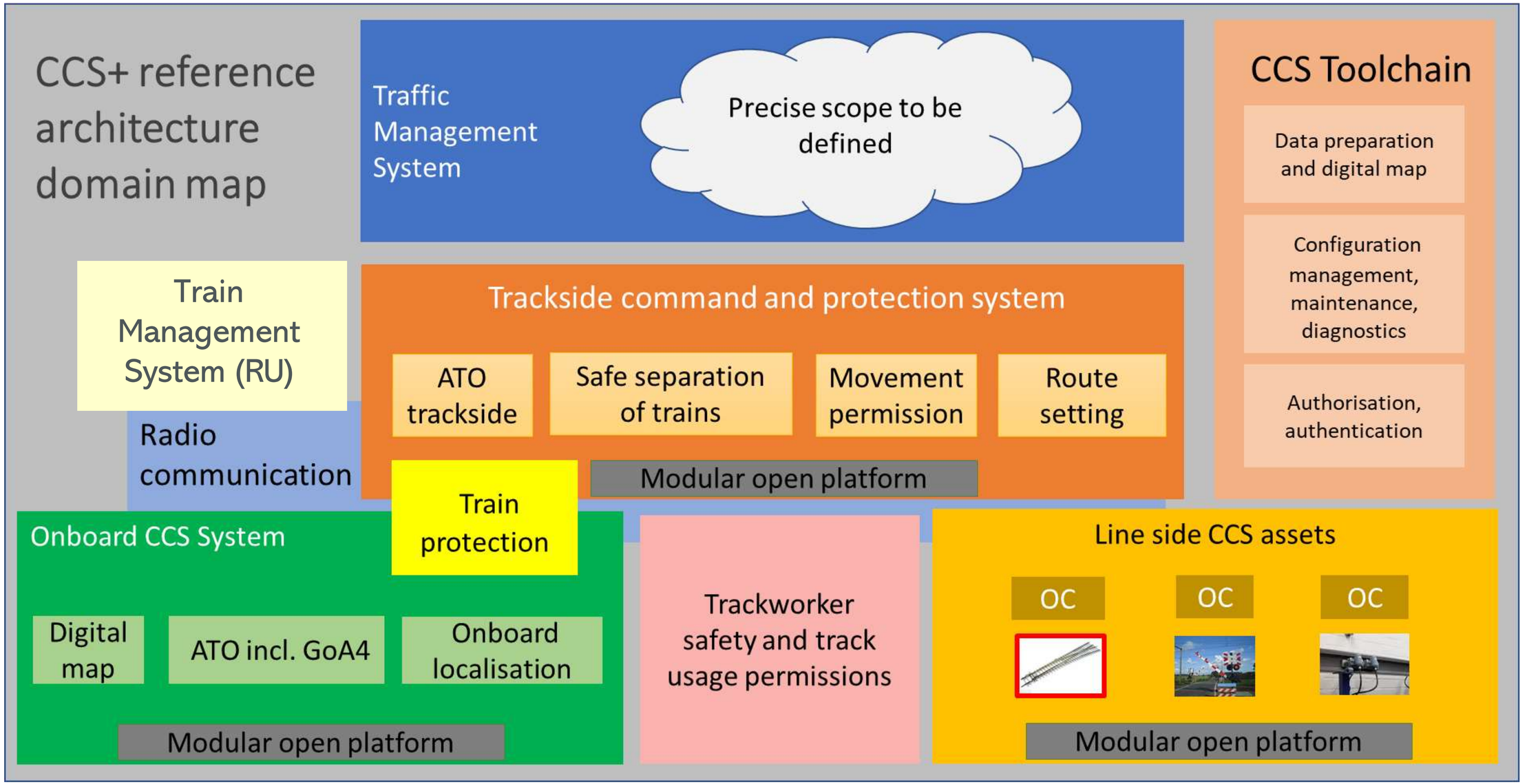


Functional scope of the System Pillar

SFERA-focus is on interface to train on operate train in order to reduce energy consumptions. Other interfaces are partially included.

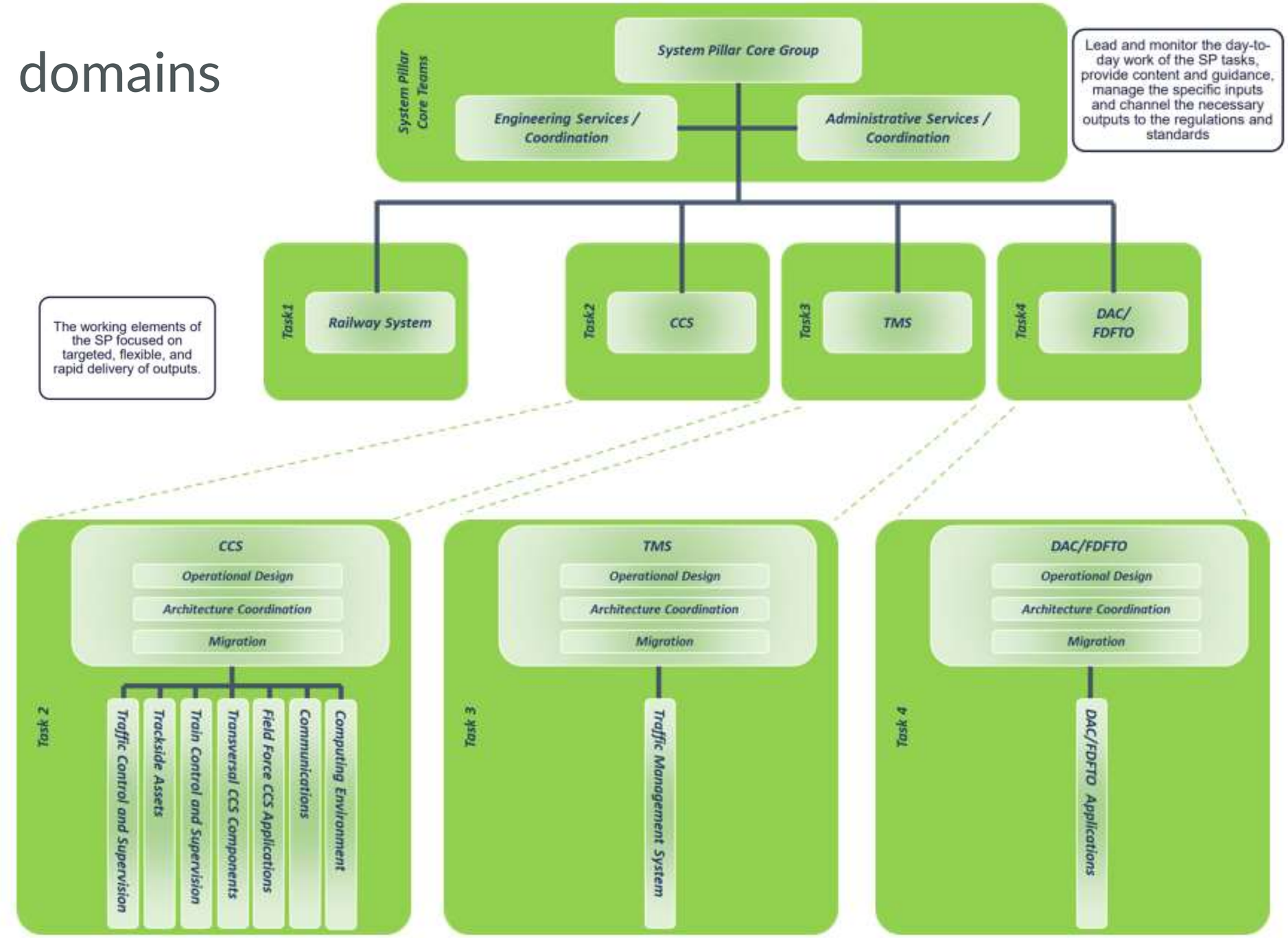


CCS Functional scope

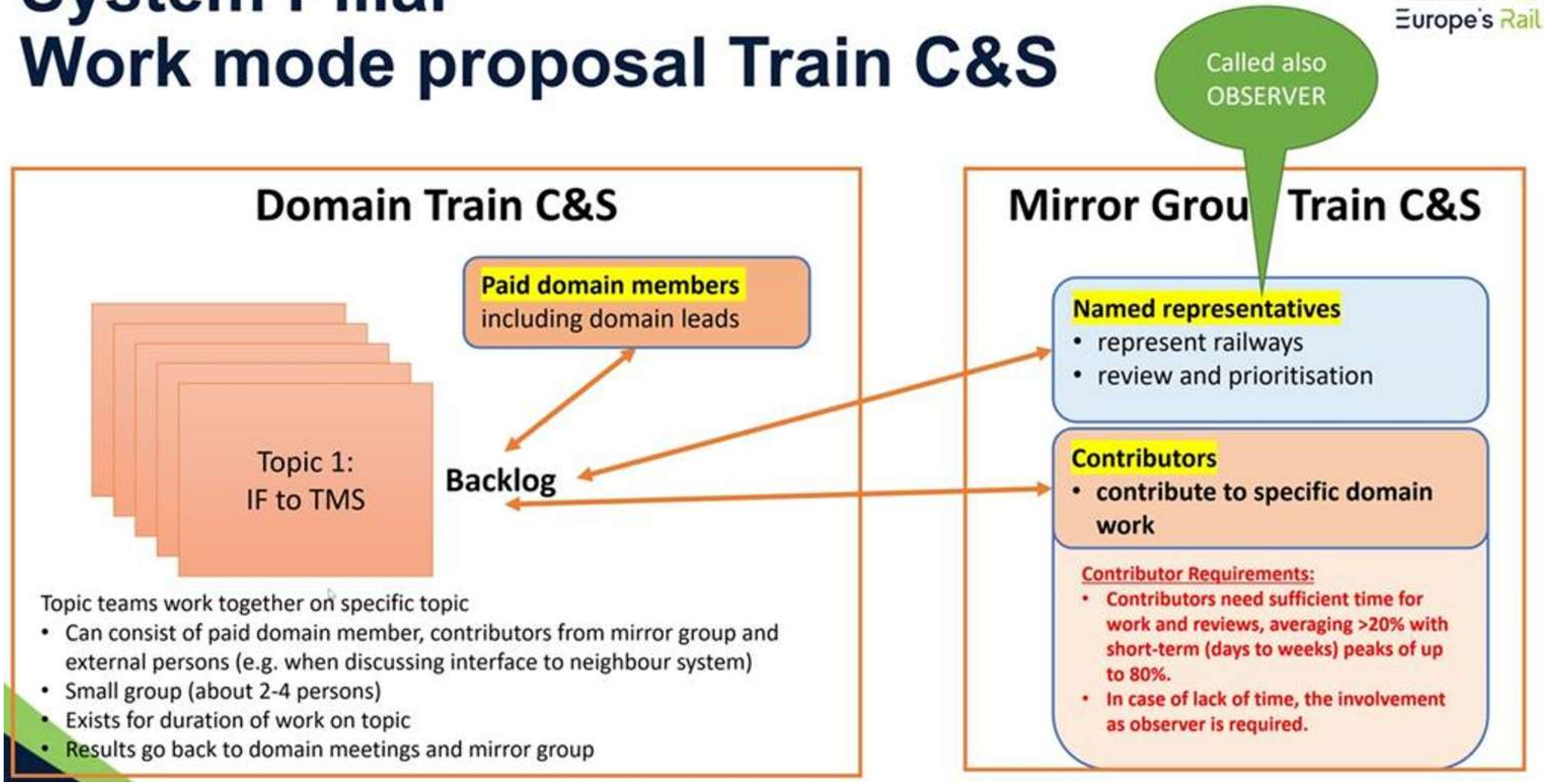


In R2DATO located on track side.

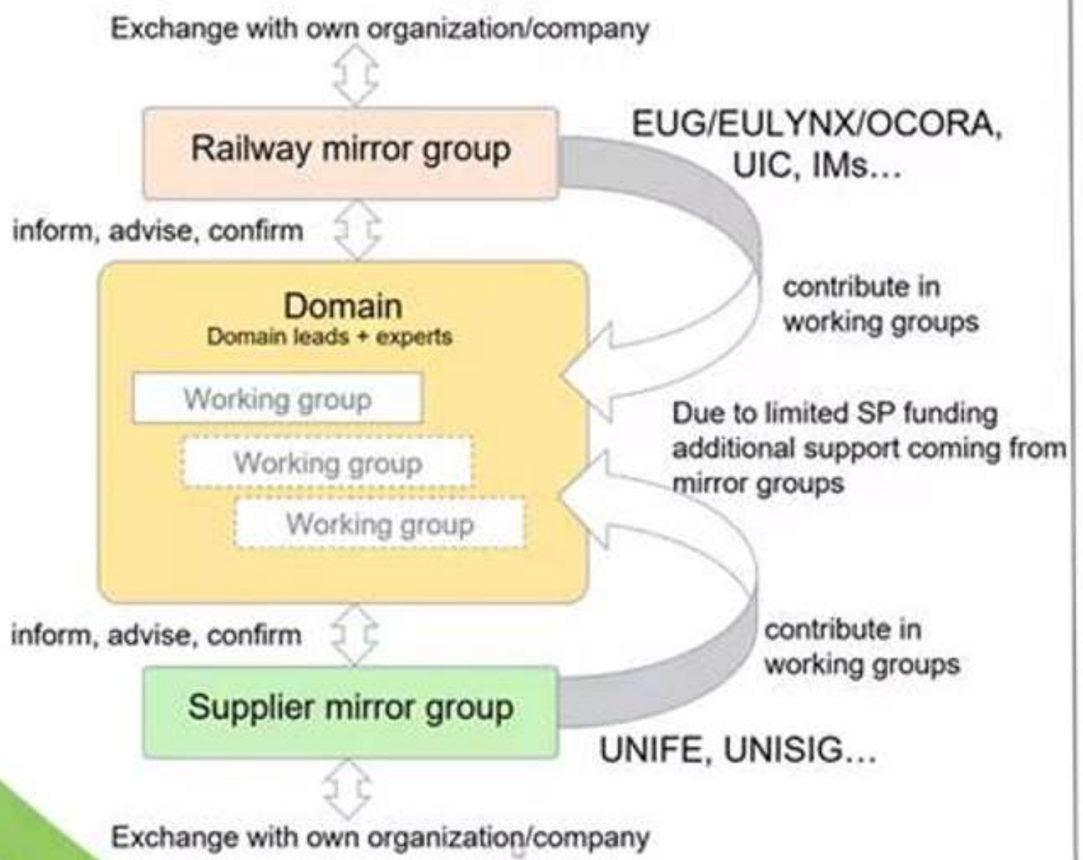
Tasks and domains



System Pillar
Work mode proposal Train C&S



Domain mirror group organisation



Mirror Group members

- provide the voluntary contribution of the individual sector companies
- represent their company (or representative bodies)
- are involved to review/correct/confirm domain work
- can support the work of the domain experts as (unpaid) contributors, provided that they work in the interest of the System Pillar (similar as the domain experts)
- are organized as a mirror group and/or participate in the domain working groups as contributor
- role is to align the sector and the domain work, ensuring the sector buy-in and input, supporting the planning and reviewing process for the domain. The role is advisory, consensus is not mandatory, potential disagreement will be visible and recorded.

Mirror groups are normally based on/or supported by working groups/clusters of one of the technical bodies UIC, EUG, EULYNX, OCORA, UNISIG, etc. Participation in a mirror group is not limited to the members of a any body, but open for all sector companies.

Domain Team persons

- work on behalf of the SP, representing the SP as neutral experts
- report to the SP Coregroup
- follow and implement the SP processes and workflows
- responsible to achieve the fulfilment of the special contracts and project/domain targets
- are lead authors and/or give direction to the mirror group or domain working groups
- organise the work, meetings, review processes of the mirror group and the domain
- are the contact persons for all sector experts concerning the domain issues

Domain mirror group organisation

Domain-Group Meetings:

- Weekly Working Meeting (Domain members)
- Bi-Weekly “Status Overview” during working Meeting (Domain members)
- Working Topics leaded by defined responsible domain member

Mirror-Groups **Contributors** (Railway representatives and optionally Suppliers):

- Initialized by the working topics and convened by domain topic responsible and/or domain lead with **nominated railway mirror group topic lead**
- Coordination Meetings within the mirror group members (registered to the corresponding topic)
- Work for special topics (architecture, ATO, localization,…)
- Work plan / work rhythm according to the task defined by the mirror group leader
- Output for Domain Working Topic Groups
- Special Meeting within mirror group tbd

Mirror-Groups **Observer** (Railway representatives and optionally Suppliers):

- Will be regularly informed about status and topics (bi-)monthly base

Domain mirror group organisation

Task/domain	lead railways		lead suppliers	
Central Modelling	Marc Sango	marc.sango@sncf.fr	Ignacio Gonzalez	igtorque@cafsignalling.com
PRAMSS	Frédéric Henon	HENON@uic.org	Markus Hirt	markus.hirt@urbanandmainlines.com
PRAMMS	Matthias Moritz	matthias.moritz@deutschebahn.com	Markus Wischy	markus.wischy@siemens.com
External Architecture Support	Loïc Lesauce	loic.lesauce@cesames.net	Loïc Lesauce	loic.lesauce@cesames.net
Task 1 Railway System	Christian Chavanel	CHAVANEL@uic.org	Antonella Trombetta	antonella.trombetta@hitachirail.com
Task 2 Operational Design	Renato Rodrigues	renato.a.rodrigues@capgemini.com	Danilo Iovino	salvatore.iovino@hitachirail.com
Task 2 Architecture and Release Coordination	Davinder Bhatia	Davinder.Bhatia@networkrail.co.uk	Bjorn Litzén	bjorn.litzen@alstomgroup.com
Task 2 Migration and Roadmap	Ernst Kleine	ekleine@ertms.be	Bjorn Litzén	bjorn.litzen@alstomgroup.com
Task 2 Traffic Control and Supervision	Roman Treydel	Roman.R.Treydel@deutschebahn.com	Udo Golebniak	udo.golebniak@siemens.com
Task 2 Trackside Assets Control and Supervision	Mirko Blazic	mirko.blazic@bce.si	Malik Benameur	malik.benameur@siemens.com
Task 2 Train Control and Supervision	Jack Schneider	hansjakob.schneider@sbb.ch	Hartwig Schuster	hartwig.schuster@siemens.com
Task 2 Transversal CCS Components	Ralph Müller	ralph.r.mueller@deutschebahn.com	Vladimir Kampik	Kampik.Vladimir@azd.cz
Task 2 Communications	Dan Mandoc	mandoc@uic.org	Olivier Eudes	olivier.eudes@kontron.com
Task 2 Computing Environment	Patrick Marsch	Patrick.Marsch@deutschebahn.com	Markus Spindler	markus.spindler@urbanandmainlines.com
Task 3 TMS/CM Design	Marcus Voelcker	marcus.voelcker@sbb.ch	Marco Nanni	marco.nanni@alstomgroup.com
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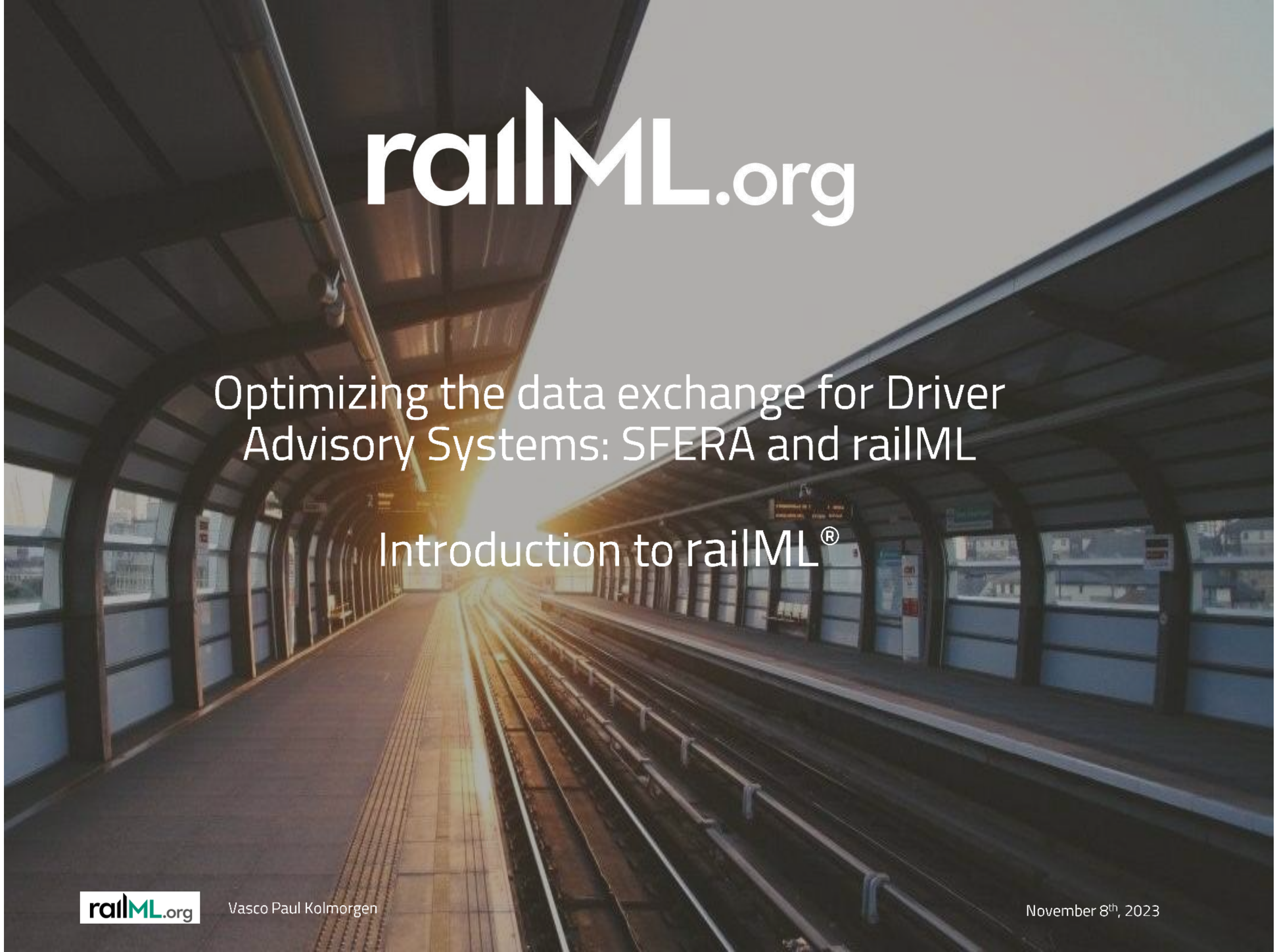
Joint RailML - SFERA session

Vasco Paul Kolmorgen
Coordinator, Organisation
railML

railML.org

Optimizing the data exchange for Driver Advisory Systems: SFERA and railML

Introduction to railML®



railML.org

Vasco Paul Kolmorgen

November 8th, 2023

Summary
railML in a nutshell

- railML® is an open standard for the exchange of railway data
- Three railML® Schemas for *infrastructure*, *rolling stock* and timetable have already been published; *interlocking* schema in preparation
- The railML-consortium is a union of partners from industry, railway and research, who are working together on the development of the railML-schemas
- 15 programmes are listed on the railML-website which use railML® data for exchange
- Development of further subschemas always under consideration
- Participation of new partners and users is always welcomed

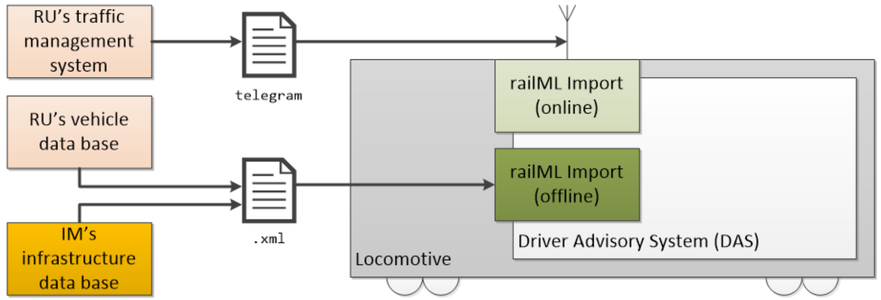
Introduction to railML.org e.V.

The organisation

- The railML.org e.V. association is the **backbone** of the railML initiative
- Registered in the German register of associations in Dresden.
- The association is **open to everybody**
- Decisions are made by the **stakeholders** (governance issues) and the **coordinators** (technical issues)
- Input from the **community and the users**

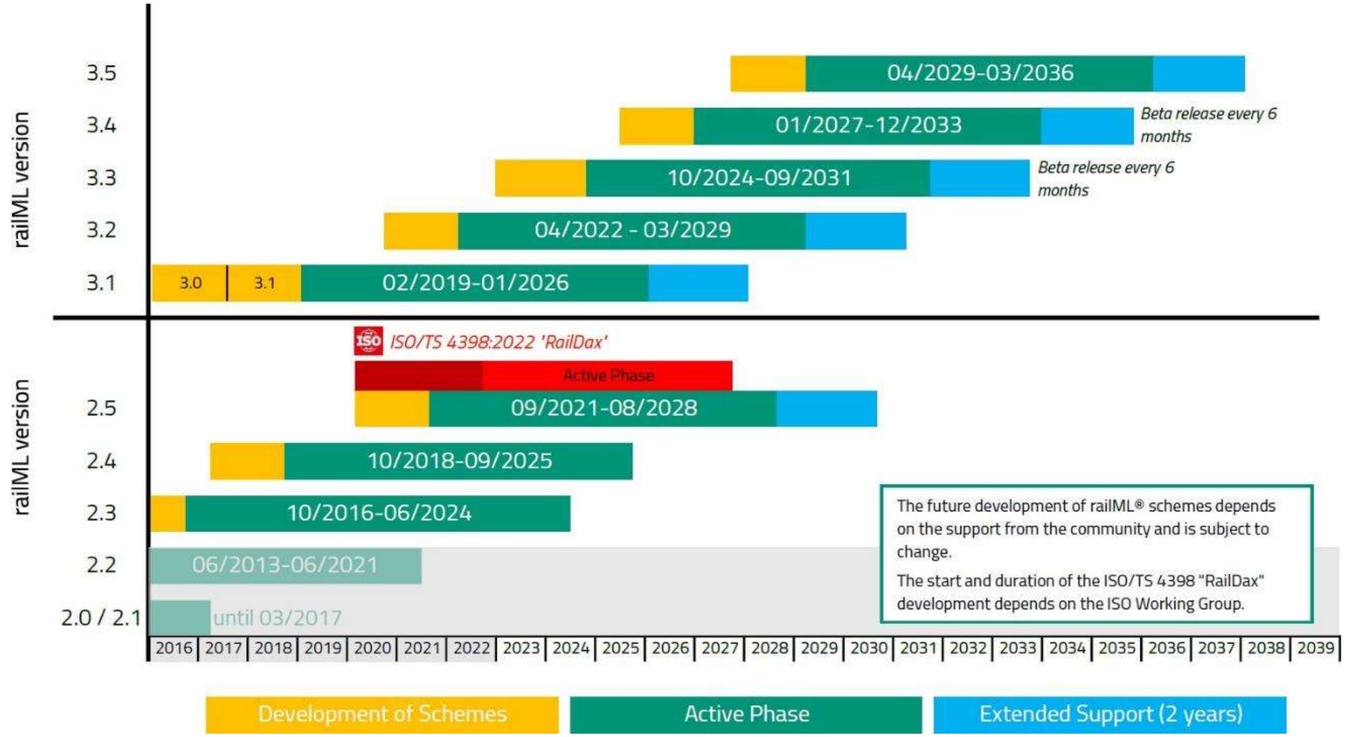
railML and the Driver Advisory System use case

- Currently fulfilled by railML® schemes
  - Track attributes → IS
  - Scheduling attributes → TT
  - Vehicle attributes → RS
- Big networks and timetables as well as single operations up to highly complex data fragments
- Constantly changing information (event-based, daily or weekly)



railML releases
Schema planning and lifecycle policy

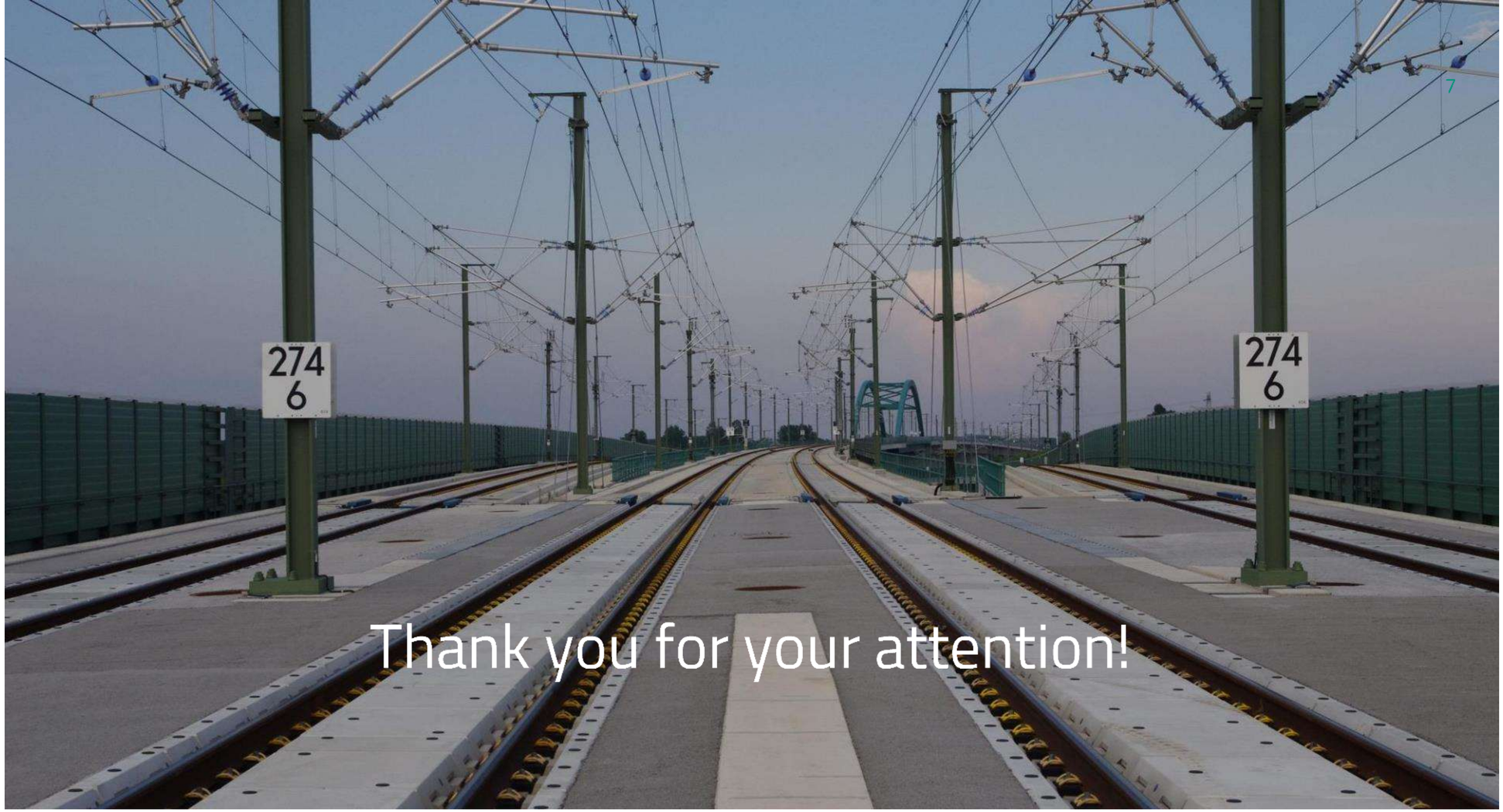
- Clear lifecycle policy for railML schemes like in OS
- Guaranteed: railML 2.3-2.5 and 3.x supported for min. 6-8 years after release
- Extended support for developers with paid partnership
- Support end of each version will be announced at least 2 years in advance



Contribute to the development!

Current working groups

Working Group	Schema Coordinator
Infrastructure Currently encompasses three sub working groups: • Integrated Traffic Management System (ITMS) • Schematic Track Planning (SCTP) • ETCS Track Net (ETCS), joint work with Interlocking Wiki: https://wiki.railml.org/wiki/Infrastructure Forum: https://www.railml.org/forum/index.php?t=thread&frm_id=4&	Christian Rahmig (DLR, Braunschweig)
Timetable Wiki: https://wiki.railml.org/wiki/Timetable Forum: https://www.railml.org/forum/index.php?t=thread&frm_id=5&	Milan Wölke (Bahnkonzept, Dresden)
Rolling Stock Wiki: https://wiki.railml.org/wiki/Rollingstock Forum: https://www.railml.org/forum/index.php?t=thread&frm_id=7&	Jörg von Lingen (IfB, Dresden)
Interlocking Wiki: https://wiki.railml.org/wiki/Interlocking Forum: https://www.railml.org/forum/index.php?t=thread&frm_id=8&	Jörg von Lingen (IfB, Dresden)
Common Wiki: https://wiki.railml.org/wiki/Common Forum: https://www.railml.org/forum/index.php?t=thread&frm_id=6&	Thomas Nygreen (Jernbanedirektoratet)



Thank you for your attention!

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Joint
RailML - SFERA
session

Alain Wenmaekers
Business analyst
SFERA WG
Infrabel

INTERNATIONAL UNION
OF RAILWAYS

SFERA & RAILML

Alain Wenmaekers
Consultant / Business Analyst at Infrabel

8th November 2023

DAS systems

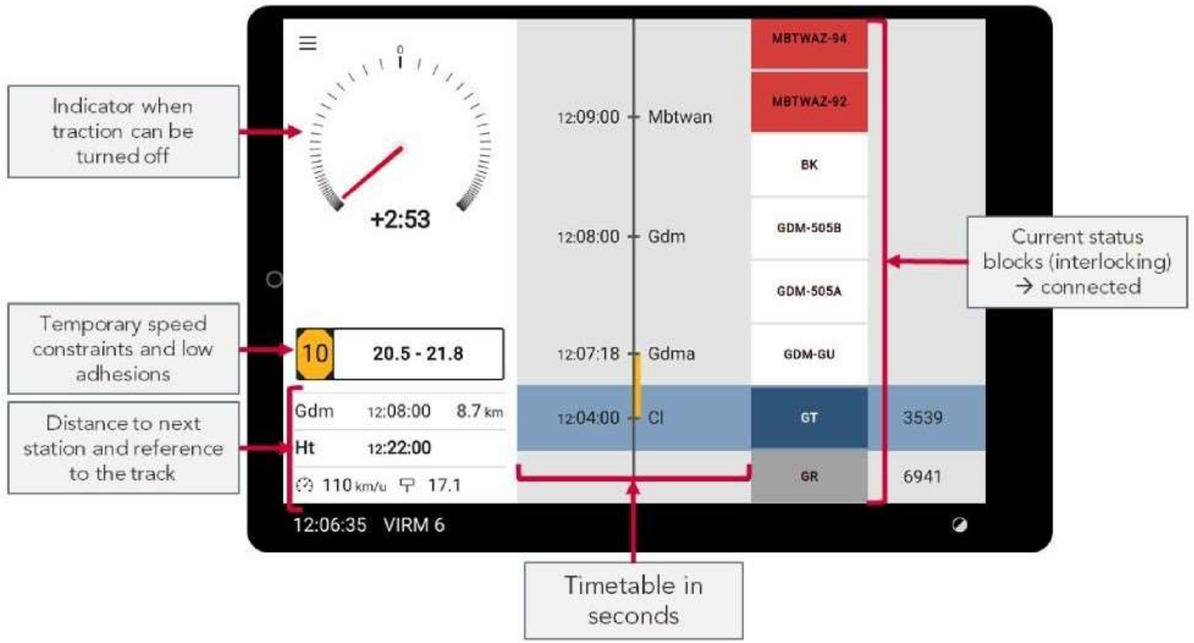
DAS: Driver Advisory System

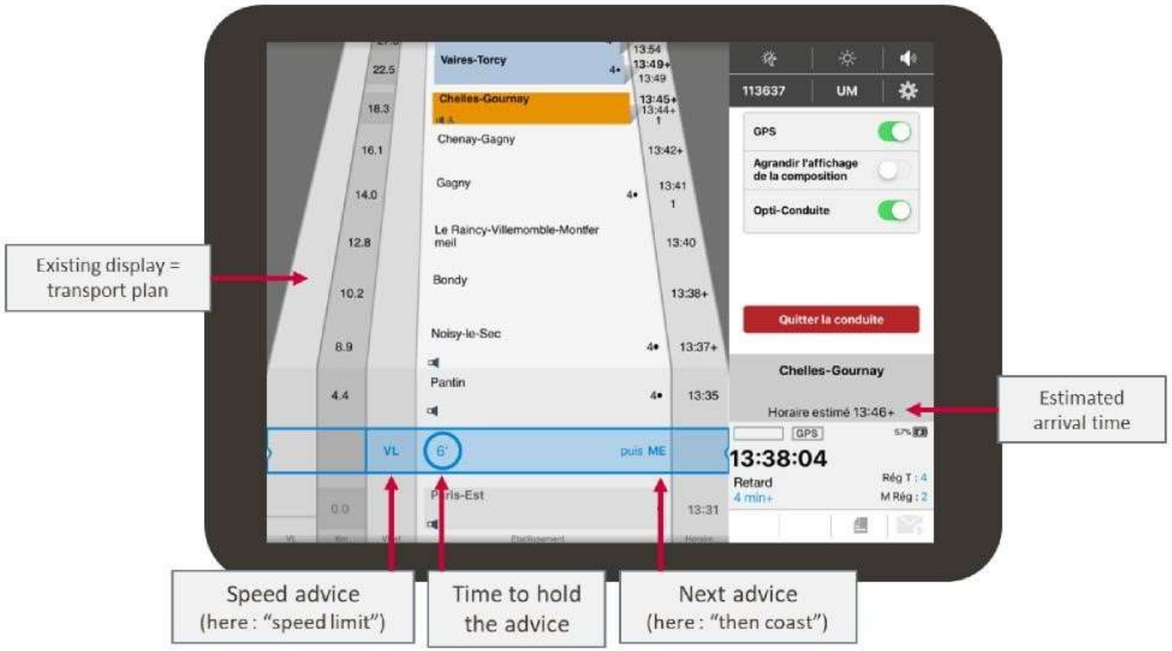
Tool providing advice to the driver in order to: **be on time** & **save energy**

It can be stand-alone or connected to the Traffic Management System (TMS)

Can save up to 10-15% of energy consumption

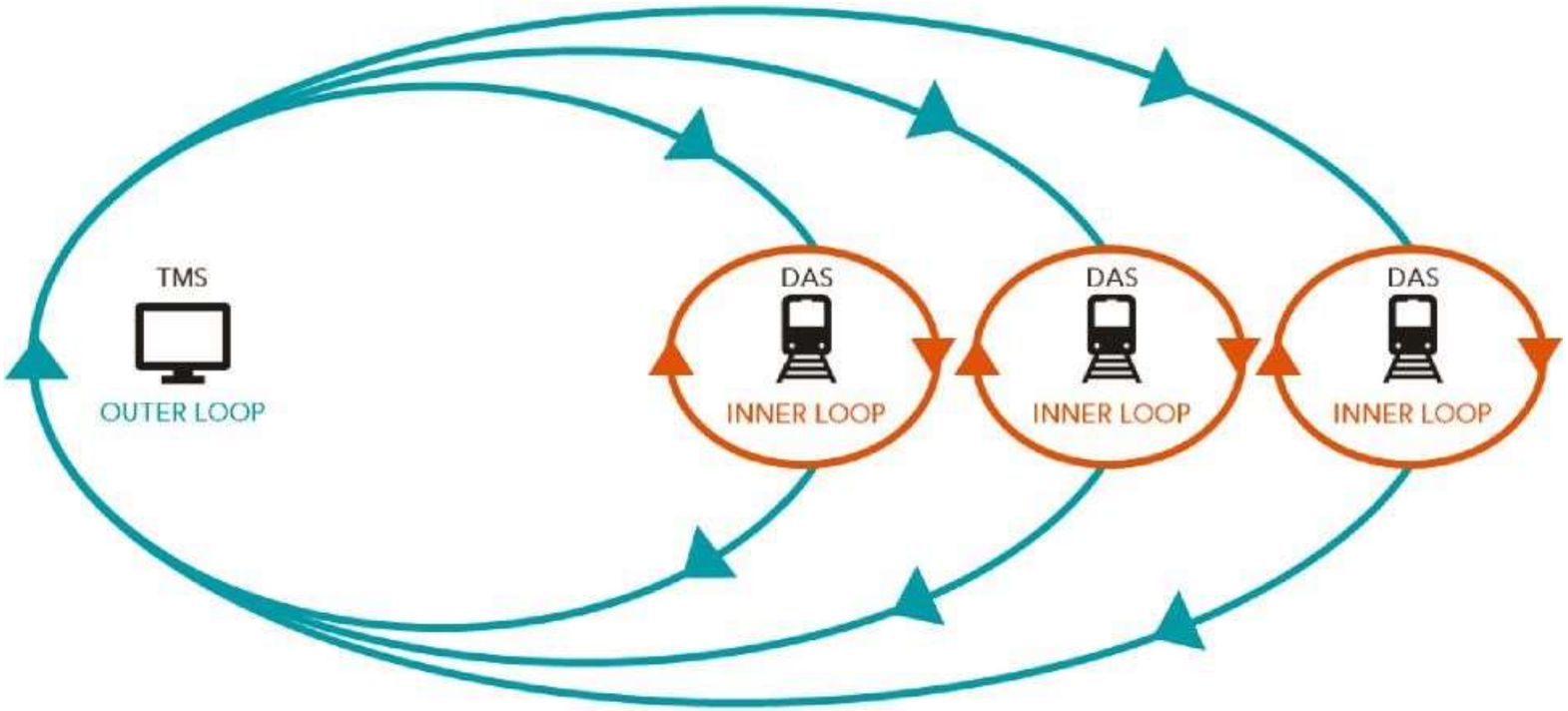
Helps in fluidifying traffic, by actively avoiding conflicts





Fluidifying traffic through real-time coordination

Infrastructure (nominal and dynamic)
Timetable constraints
Rolling Stock Characteristics



FEEDBACKS

- Updated train characteristics
- Train position
- Status reports

The SFERA protocol

What is SFERA

UIC IRS 90940: Single messaging standard for DAS data exchange between IMs, RUs and on-board devices

In a multi-RU environment

Across IM borders

Goals:

Harmonise DAS board-ground communications

Avoid vendor lock-in

Allow IMs to offer the same interface to all RUs

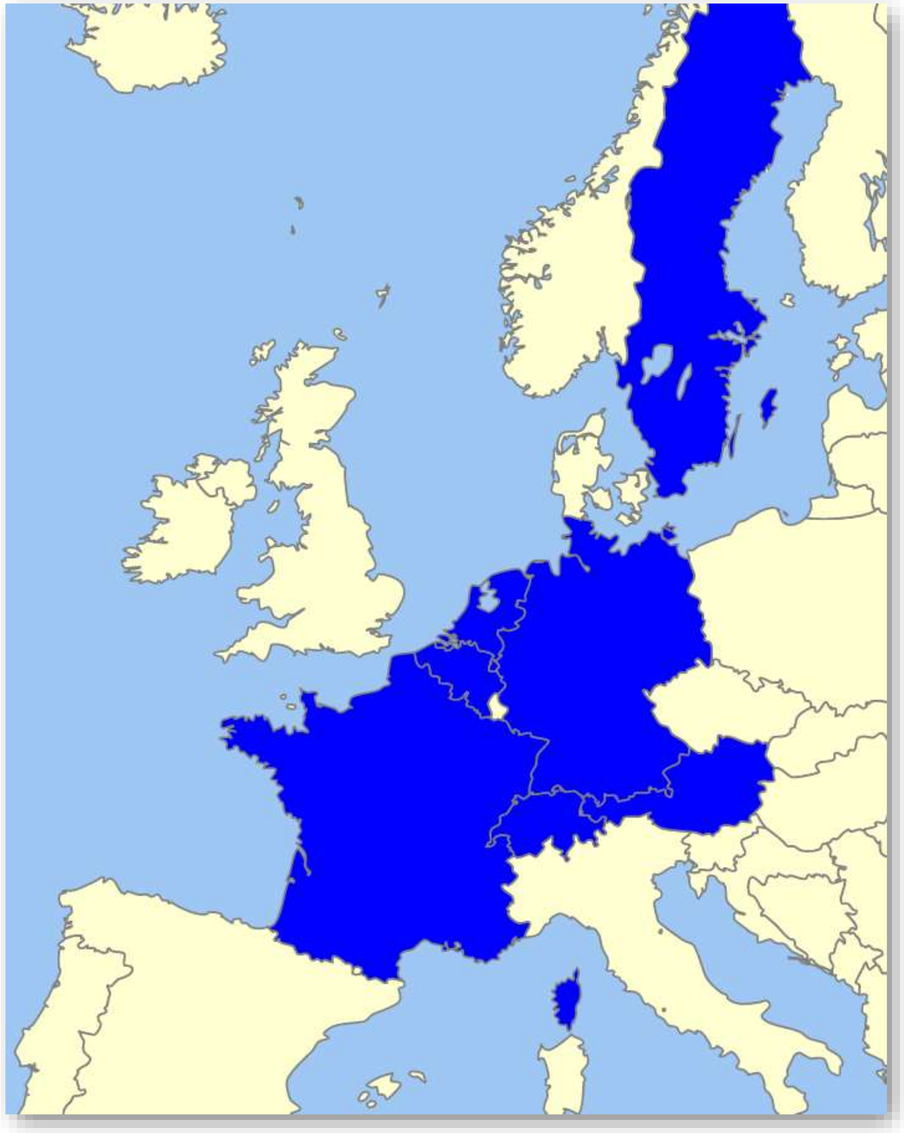
On ERTMS lines

On Legacy Class B ATP Lines

The SFERA Working Group

UIC Opt-In Project (since 2017)

DB	Infrabel
NMBS/SNCB	NS
ÖBB	ProRail
SBB	SNCF
Trafikverket	



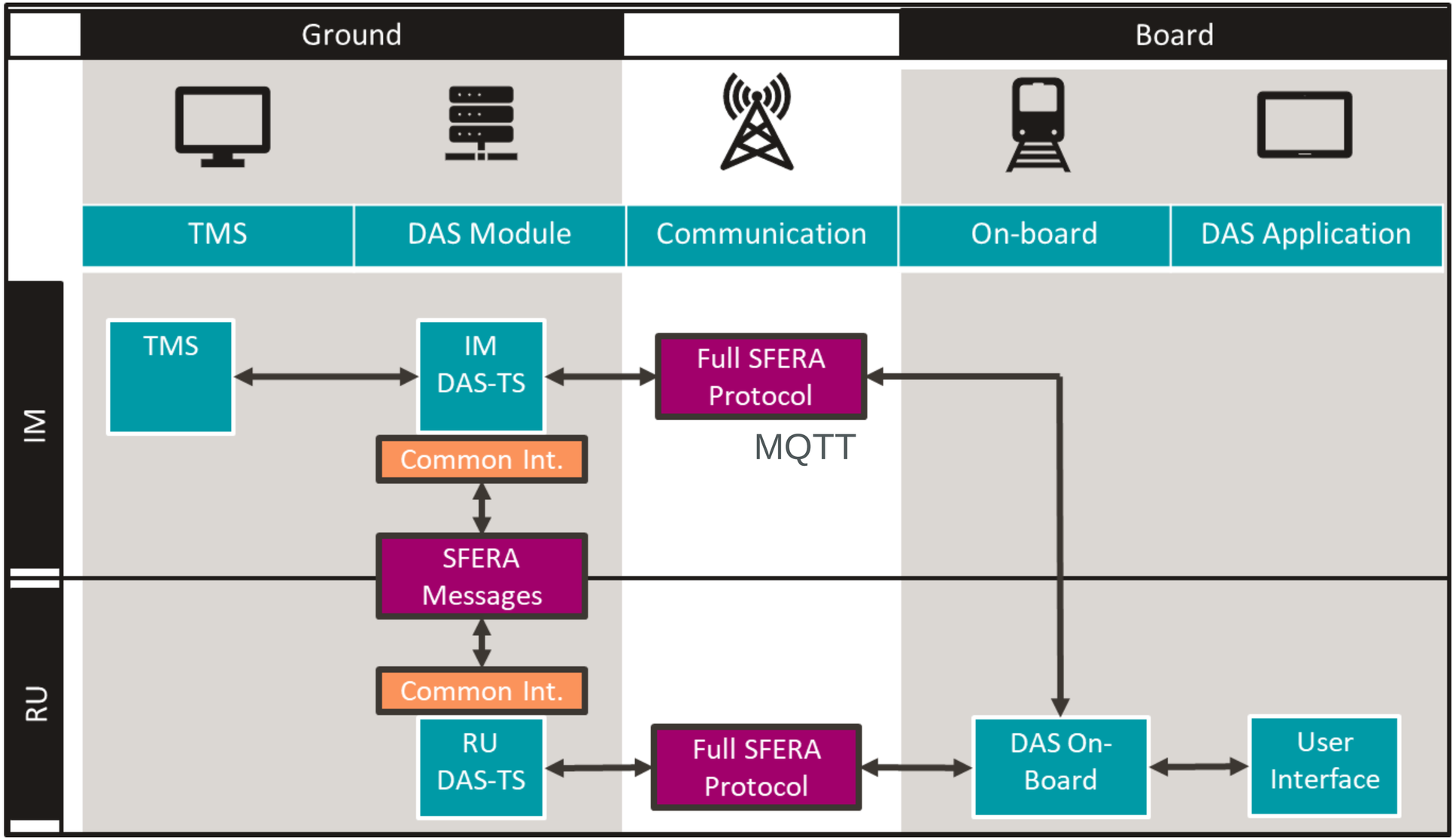
An effort started in 2016

SFERA project: 2017-2019

- SFERA maintenance project: 2021-2023

- New SFERA maintenance project: 2024-2026
  - Major Topic for Ed 3: Digital European Instructions

SFERA Interoperability

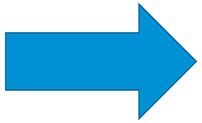


SFERA & RailML

Difference in target

RailML

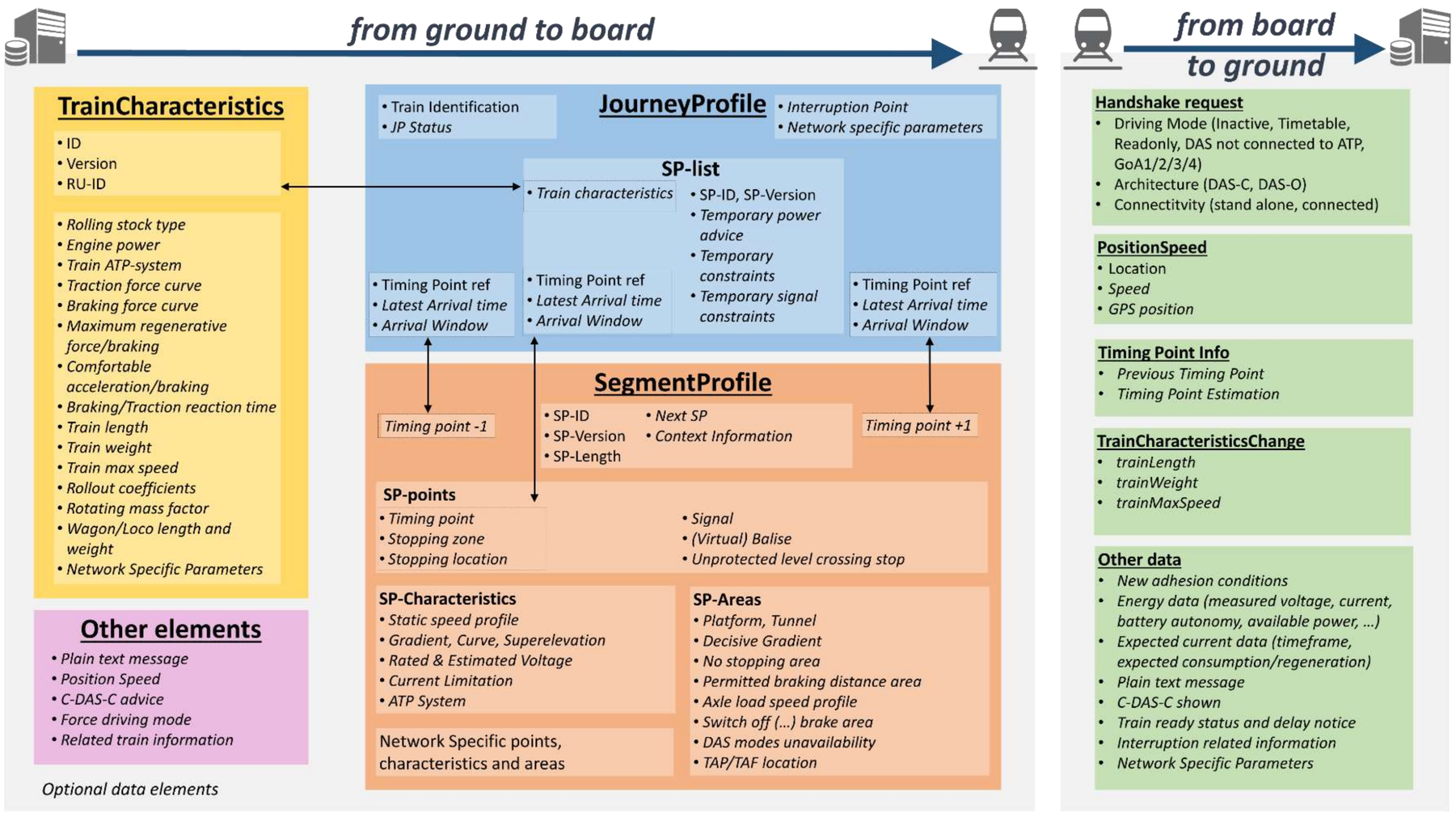
- RailML is a **data format**
- RailML is popular for exchanging complete train schedules and full infrastructure sets
- RailML can be used as a source format to feed a planning system or TMS



SFERA

- SFERA is a **messaging protocol**
- SFERA concentrates on a single train and a linear infrastructure
- Compatibility with SUBSET-126 for ATO
- Control trains with a trackside (e.g. TMS) by sending constraints
- Focus on elements a train will encounter which have impact on runtime calculation

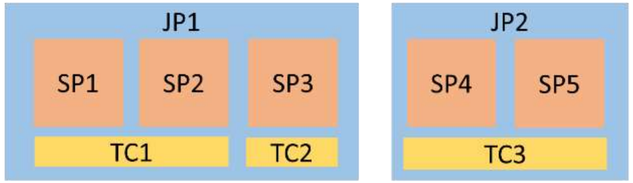
SFERA Message structure



Common Header

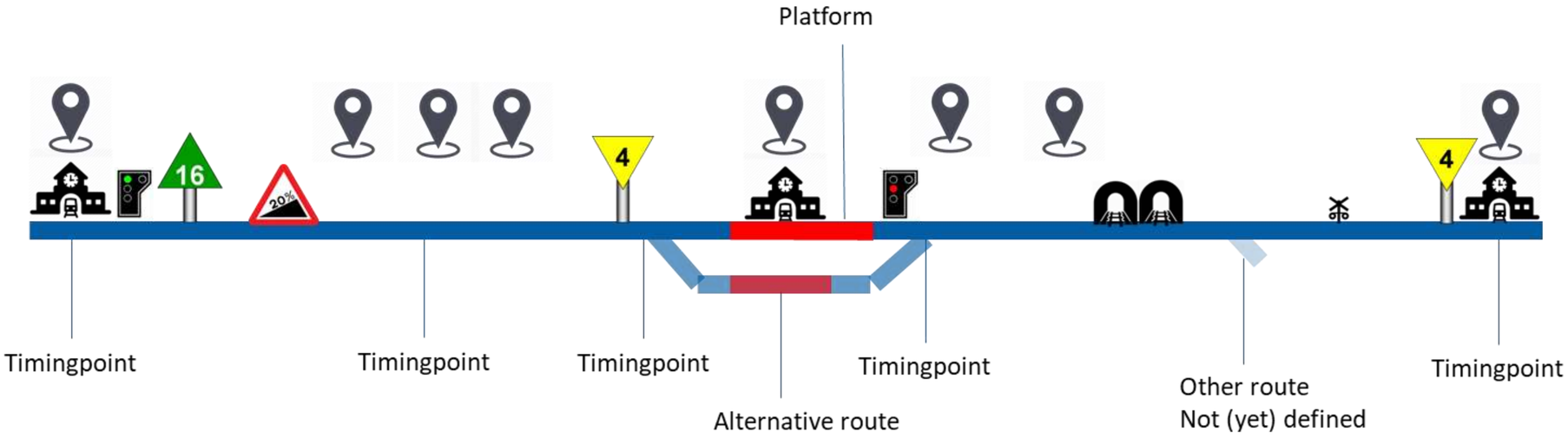
SFERA Message Header
- Message-ID
- Timestamp
- Sender
- Recipient
- *Correlation-ID*

Composition



Linear view

Train optimizes within timingpoint constraints



RailML conversion table

- RailML and SFERA both describe the timetable and infrastructure seperately
  - Timetable <-> Journeyprofiles
  - Infrastructure <-> Segment Profiles
- SFERA uses a different way of linking the data elements
- Data elements in SFERA correlate with RailML
- UIC made a conversion table at the release of SFERA Ed1

RailML conversion table Proposal

- Update conversion table
  - RailML 3 Timetable
  - SFERA Edition 2 update
- Review
  - Current conversion table needs to be reviewed by RailML experts
- Who?
  - Joint effort

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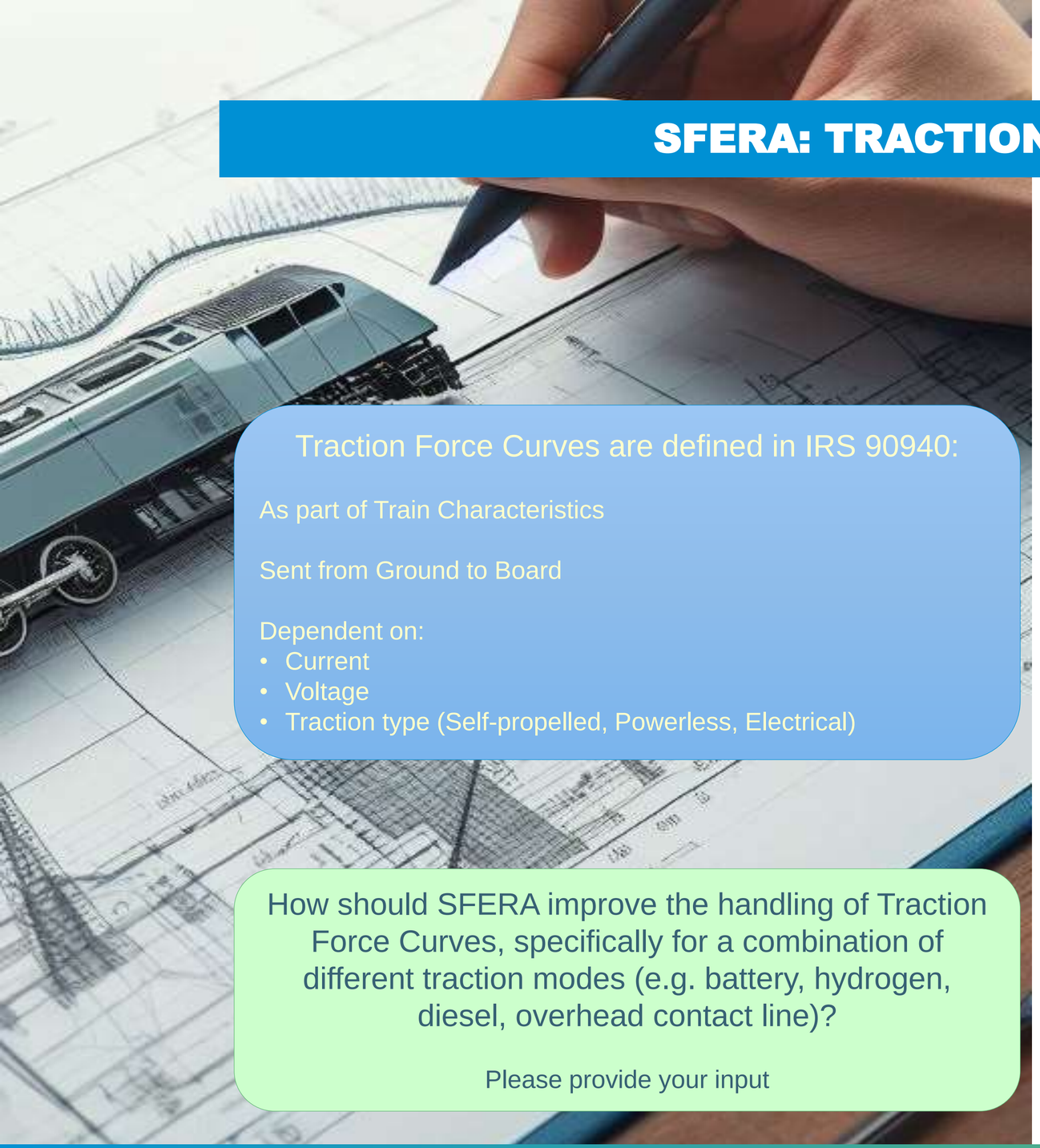
Thank you for your attention.

SFERA
Traction force curves

Mini workshop



SFERA: TRACTION FORCE CURVES

Traction Force Curves are defined in IRS 90940:

As part of Train Characteristics

Sent from Ground to Board

Dependent on:
- Current
- Voltage
- Traction type (Self-propelled, Powerless, Electrical)

How should SFERA improve the handling of Traction Force Curves, specifically for a combination of different traction modes (e.g. battery, hydrogen, diesel, overhead contact line)?

Please provide your input

What parameters can influence Traction Force Curves?

How should degraded situations be handled?

Is it more efficient to calculate TFCs on board? What input is needed?

SFERA Interoperability

Thomas Sutter (SBB) & Alain Wenmaekers (Infrabel)

Subgroups

INTERNATIONAL UNION
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SFERA

Mini Workshop “Interoperability”

SFERA
08/11/2023

Starting Position: Neighbouring Countries may Use Different Setup and Modes of SFERA Implementations.

Country 1

Setup: IM-RU
Mode: DAS-O

Country 2

Setup: IM-Train
Mode: DAS-C

Country 4

Setup: IM-Train
Mode: DAS-O

Country 3

Setup: IM-RU
Mode: DAS-C

Interoperability workshop
Online session

Question 1 – DAS-O and DAS-C:

IRS90940 aims for interoperable DAS-O systems in accordance with ERTMS/ATO.

Which mode does your company aim for and why?

Explanations:

DAS-C: Central calculation of driving advice.

DAS-O: On-board calculation of driving advice.

Answers from web participants:

Infrabel: (shortterm) DAS-C, (longterm) DAS-O

ERA: In DAS-C how does the centralised system take train-related data into account?

SiemensMobility: C-DAS-O calculate the rec. Speed profile on board on base of timingpoint

TTG: DAS-O - DAS-O - Its superior in providing dynamic advice that can adjust based on driver behaviour regardless of network coverage.

SBB: DAS-O – provides speed profiles and calculates on board

Mtrail: My opinion, a mixture of both. You should keep the timetable/speedprofile as up to date as possible, with the possibility to dynamically add speed advice

Question 2 – IM-RU and IM-Train:

Do you see IM-RU or IM-Train as your primary setup, or both?

What are your pros and cons?

Explanations:

IM-RU: Communication from IM via Server at RU (or vendor) to the train.

IM-Train: Direct communication from IM to train.

Answers from web participants:

IM-RU 

SBB

Infrabell

TTG

IM-RU -: very complicated, many involved systems, a lot of sources for errors

IM-RU +: IM can enrich

IM-Train 

SBB

ÖBB INFRA

Infrabell

TTG

IM-Train +: low latency, RU doesn't need infrastrucutre

IM-Train -: implementing generell agreed auth rules

Question 3 – What to do:

How should the crossing from one IM to another be handled concerning interoperability?

Explanations:

IRS 90940 promotes DAS-O but leaves the setup (IM-RU, IM-Train) open.

How can interoperability with other modes (DAS-C) and different setups be achieved?

Answers from web participants:

SFERA compliance certificate

SFERA central registry for all SFERA suppliers → standardized acceptance phase

Specify MVP SFERA package for each implemented setup

ETCS KEY management compareable auth solution

Interoperability map of SFERA implementations

Define the minimum set of data

Definition of usecases how to deal with implemented setups

Interoperability workshop
RU & IM group

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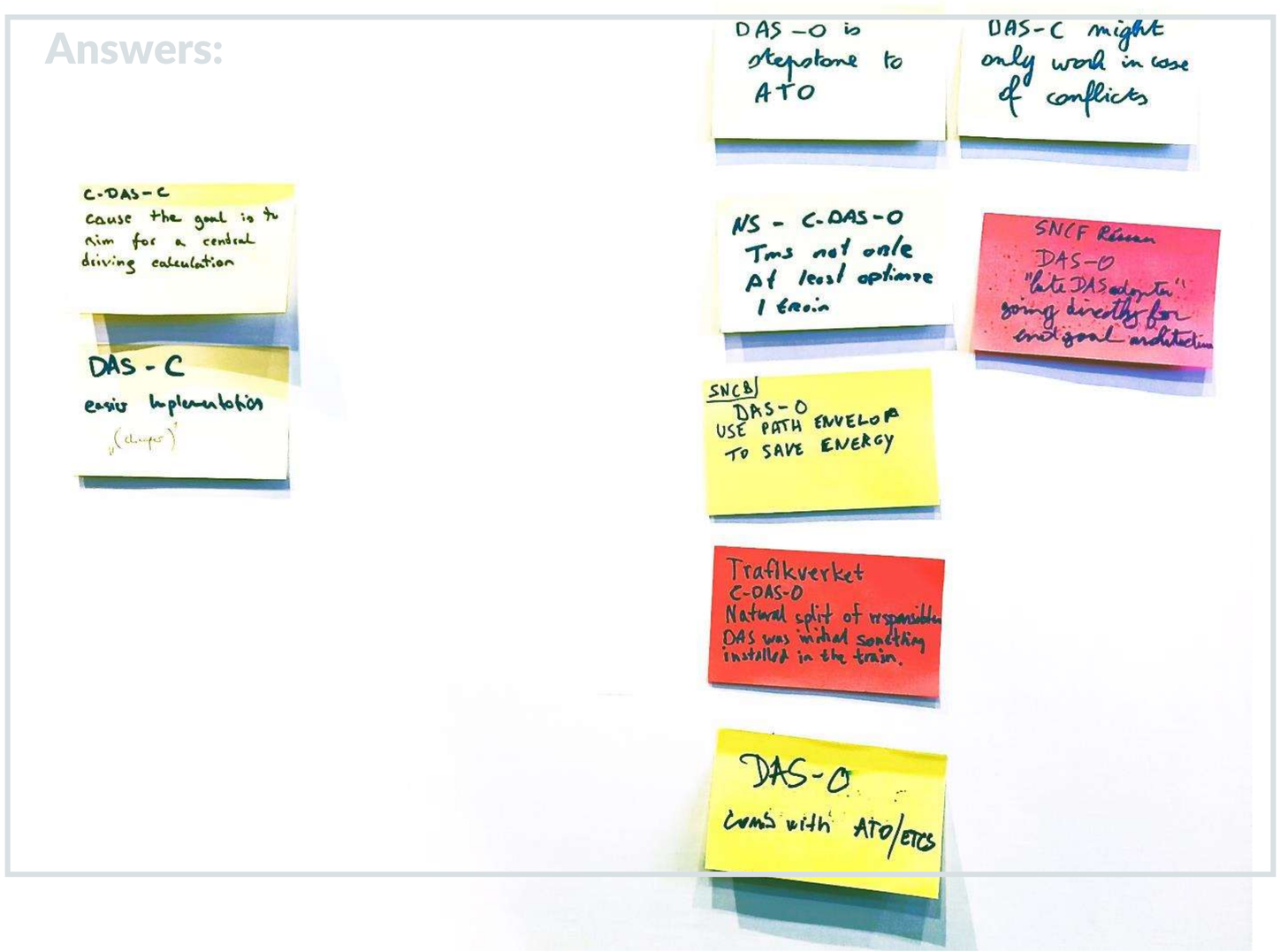

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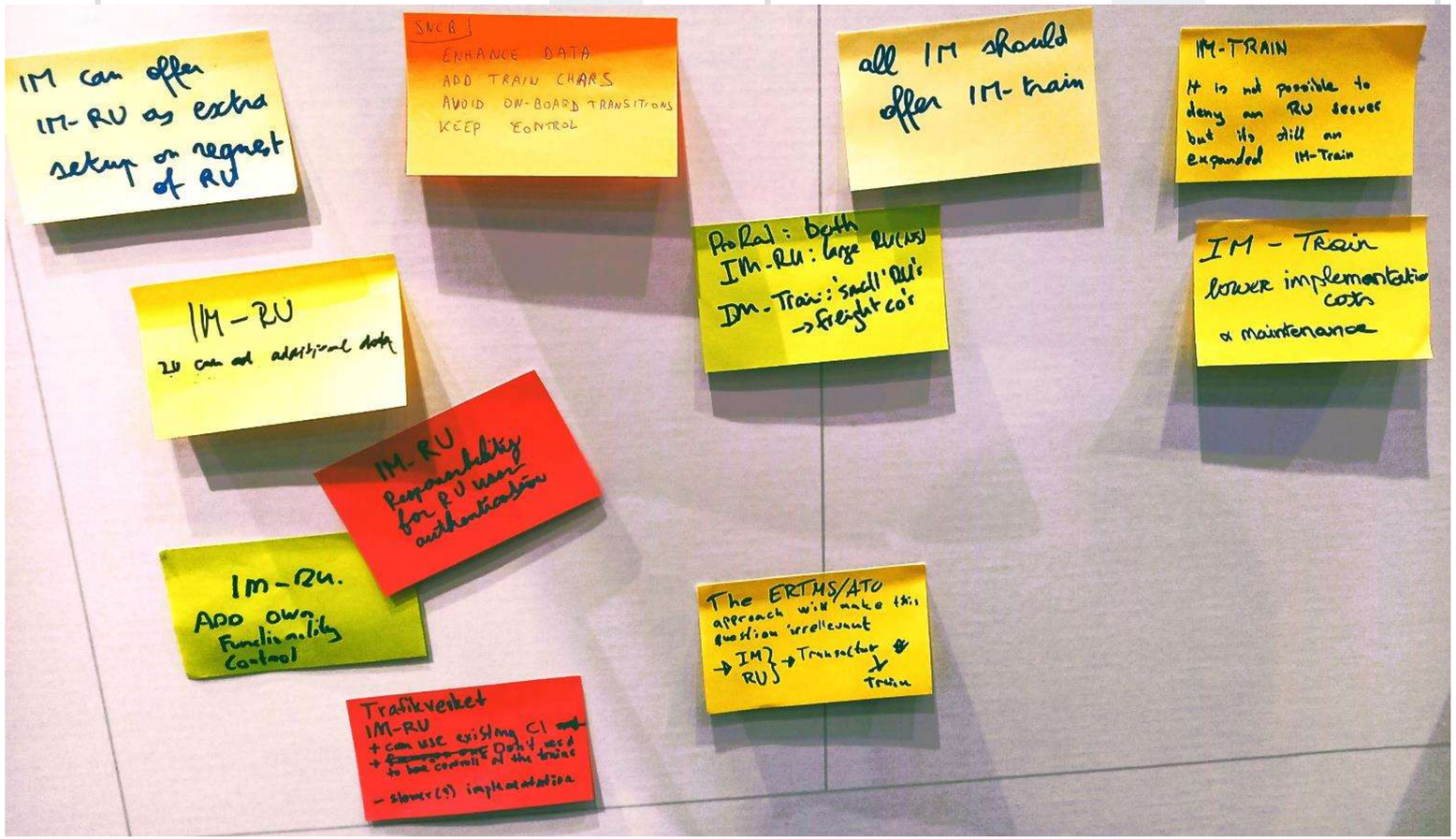
Answers:

IM-RU 

IM-Train 



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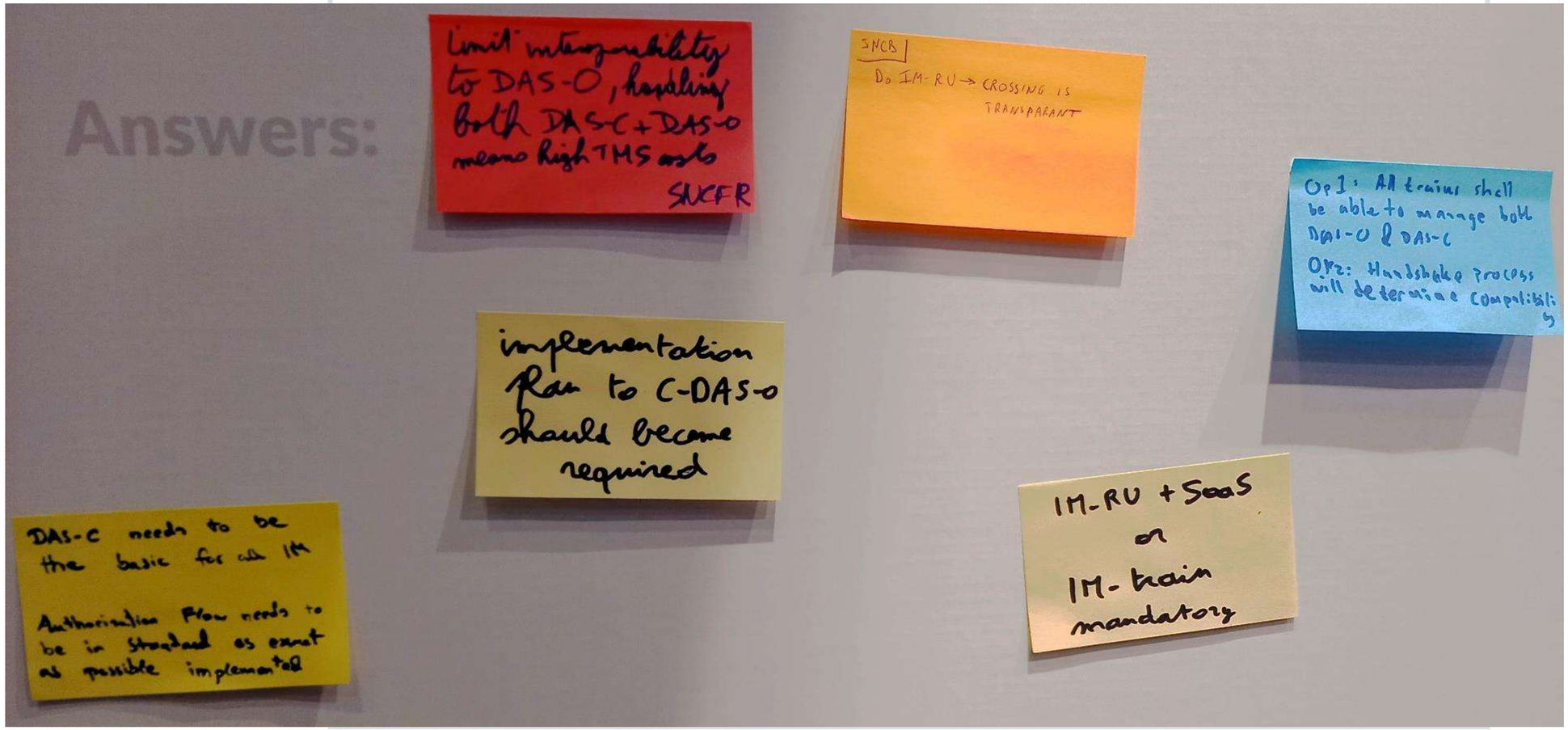

Interoperability workshop Stakeholder group

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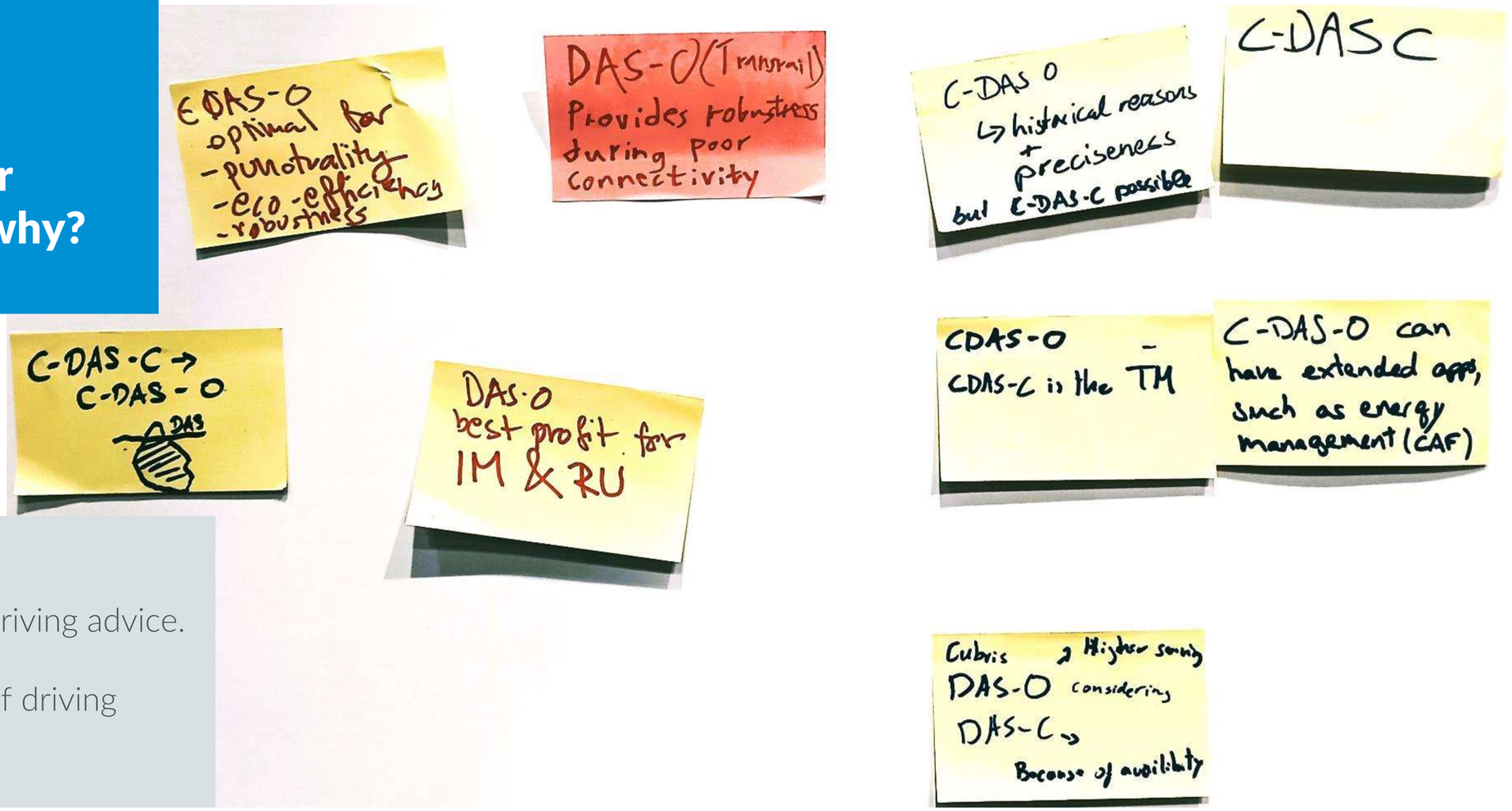
Answers:



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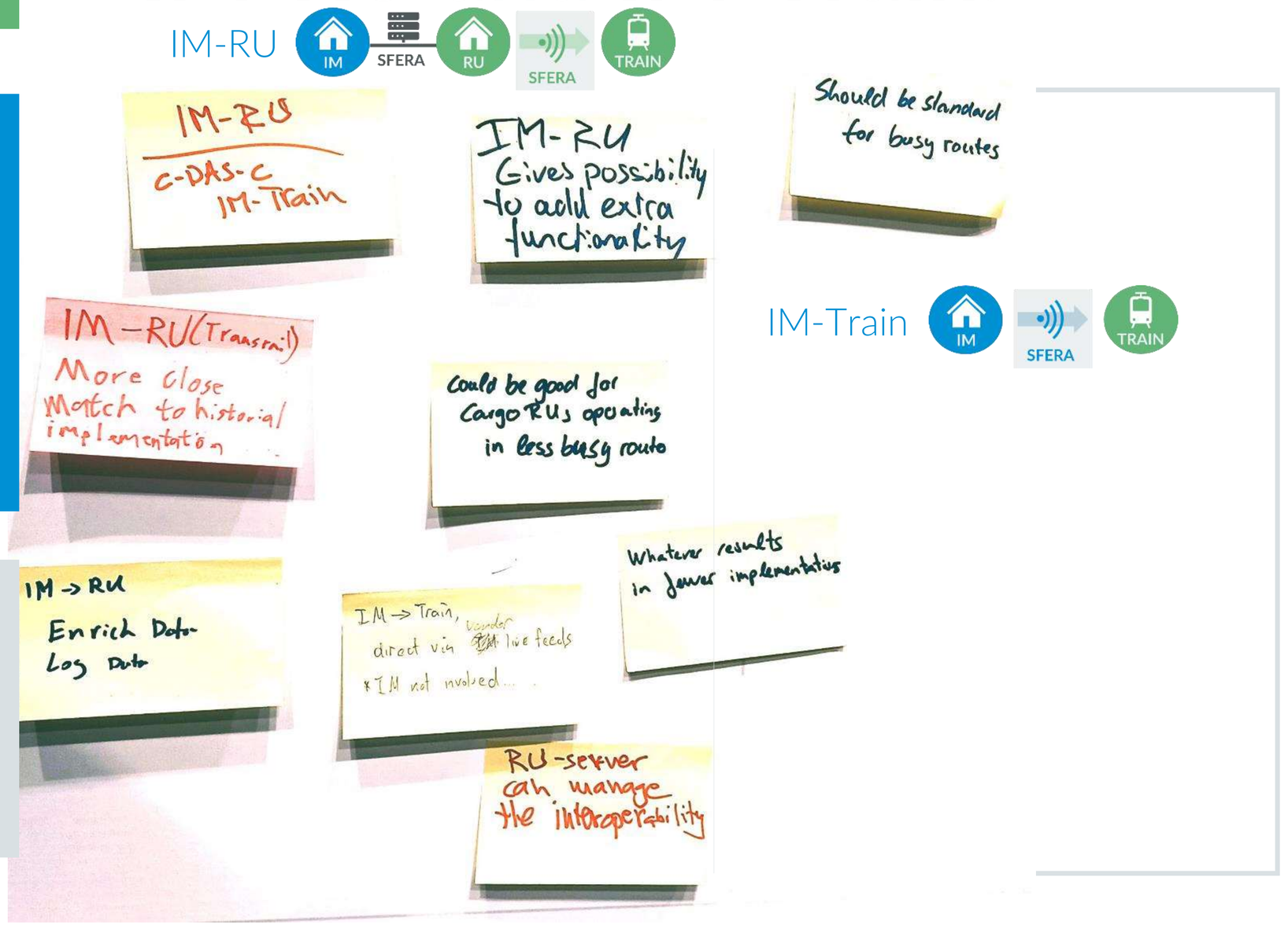

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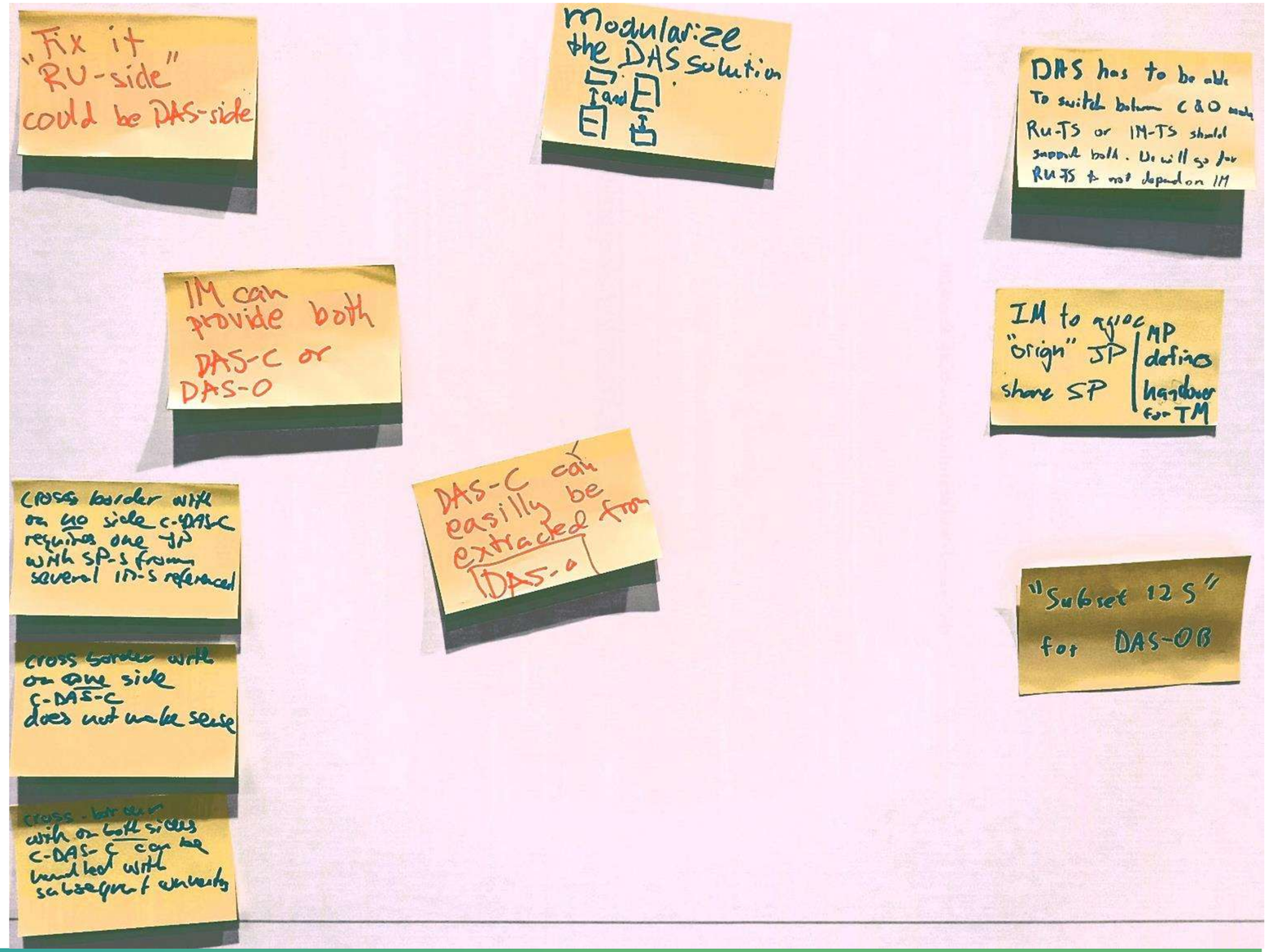

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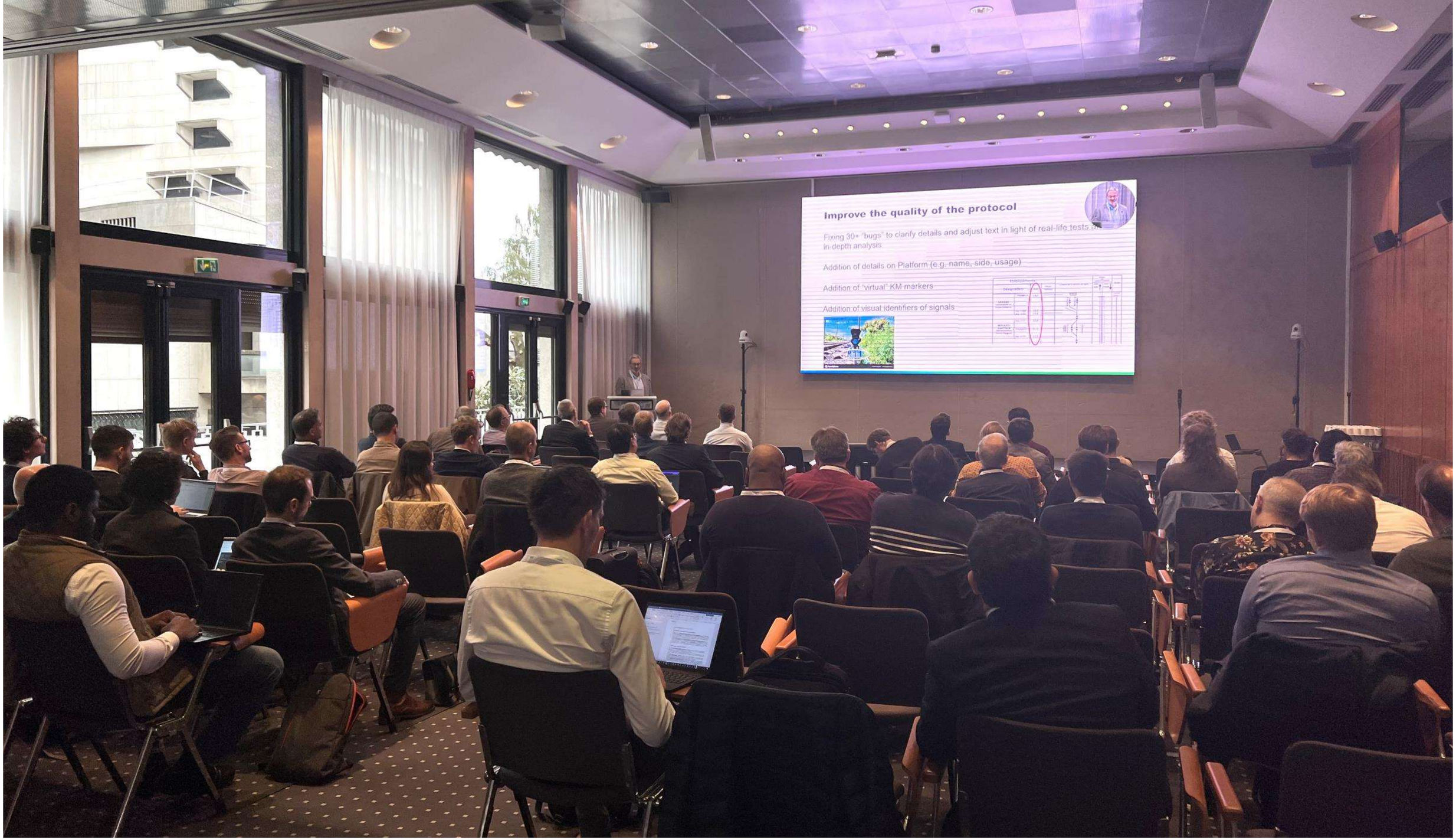
UIC SFERA project

Thank you for your attention.


Alternative itineraries
Last moment itinerary change: possible delay in JP update from TMS
- DAS: Inaccurate Advice
- ATO: risk of stopping point overshoot
Journey profile will include alternative « Segment Profile lists »


Improve the quality of the protocol
Fixing 30+ "bugs" to clarify details and adjust text in light of real-life tests & in-depth analysis
Addition of details on Platform (e.g. name, side, usage)
Addition of "virtual" KM markers
Addition of visual identifiers of signals