OCORA

Open CCS On-board Reference Architecture

Train Display System (TDS)

Discussion Paper

Document ID: OCORA-TWS01-201

Version: 1.0

Date: 23.06.2023

Management Summary

In today's cab architecture, there are at least three main screens in a cab supporting three systems: ETP, TCMS and CVR. Each screen is dedicated to one system. The screen embeds only one business logic to enable data exchange with the appropriate system and elaborates the associated view. This paradigm leads to three main pitfalls:

- Firstly, a screen failure will result in a loss of the system. For instance, if the ETP's DMI fails, the ETP will go into system failure and apply an emergency brake. This will cause a delay to the train and can affect all the trains on a line. The availability of the screen is therefore a key factor in the overall availability of the train and the line.
- Secondly, an update of the ergonomics part or the system itself leads to an update of both parts. This interdependancy increases the cost of maintenance (update). This is more problematic for components with different SIL levels. For example, an ergonomic enhancement to the DMI of the ETP (SIL2 component) leads to an update of the ETP (SIL4 component).
- Thirdly, space in the cab is limited. By introducing new functionalities with the OCORA architecture, new building blocks and services (DAS, MDCM-OB, UID-Reader...) may require space for their dedicated screen... However, the introduction of new display panels in both existing and new trains can be difficult for integrators due to the lack of space.

To solve these problems, OCORA is proposing the introduction of a new building block: the Train Display System (TDS). Other needs are also expressed with the introduction of TDS such as management of extended view, multiple display...

The first version of this document introduces the TDS concept (terminology and main characteristics of the architecture) and high level requirements. All the concepts are still under discussion.

Future versions will include the architecture chosen, after evaluation of the main characteristics, and the design requirements.

Revision History

Version	Change Description	Initials	Date of change
1.0	Official version for OCORA Release R4	GH	23.06.2023
		-	
		-	

Table of Contents

Table of Figures

References

Reader's note: please be aware that the document ids in square brackets, e.g. [OCORA-BWS01-010], as per the list of referenced documents below, are used throughout this document to indicate the references to external documents. Wherever a reference to a TSI-CCS SUBSET is used, the SUBSET is referenced directly (e.g. SUBSET-026). OCORA always reference to the latest available official version of the SUBSET, unless indicated differently.

[OCORA-BWS01-010] – Release Notes
[OCORA-BWS01-020] – Glossary
[OCORA-BWS01-030] – Question and Answers
[OCORA-BWS01-040] – Feedback Form
[OCORA-BWS02-020] - Program Slide Deck
[OCORA-BWS02-030] - Technical Slide Deck
[OCORA-BWS02-040] - Program Posters
[OCORA-BWS02-050] - Technical Posters
[OCORA-BWS02-060] - Confidentiality Clause
[OCORA-BWS03-010] - Introduction to OCORA
[OCORA-BWS03-020] - Guiding Principles
[OCORA-BWS04-010] - Problem Statements
[OCORA-BWS05-010] - Road Map
[OCORA-TWS01-010] – Design Requirements
[OCORA-TWS01-011] – System Requirements
[OCORA-TWS01-020] – System Capabilities
[OCORA-TWS01-030] – System Architecture
[OCORA-TWS01-035] – CCS-On-Board Architecture
[OCORA-TWS05-020] – Stakeholder Requirements
[OCORA-TWS05-021] – Program Requirements
[OCORA-TWS05-022] – Design Requirements
[ERA ERTMS 015560] – ETCS Driver Machine Interface
[NF EN 1686] integration of displays, controls and indicators / design of display
[CLC/TR 50542] - Driver's cab train display controller

1 Introduction

1.1 Purpose of the document

This document is the OCORA Train Display System (TDS) discussion paper.This document introduces the problem statement of the current HMI situation in the cabin. To solve this problem, the TDS concept (terminology and main characteristics of the architecture) and high level requirements are presented. All the concepts are still under discussion.

The requirements listed in this document are developed from a TDS building block perspective. According to the OCORA definition, they are part of the OCORA D-Level requirements (refer to 1.4 - Requirements Engineering Process). The building block requirements (OCORA D-Level requirements) are detailing the OCORA system requirements [OCORA-TWS01-011].

The building block requirements captured in this document are developed to reach a common understanding and communicate a precise OCORA conception of the functional and non-functional requirements towards future TDS.

The building block requirements listed in this document are prepared as an input for:

- EU-Rail and OCORA system architecture and design activities, shaping future TSI specifications, other legal frameworks, and other specifications
- Contracting entities, preparing tenders, and executing testing / certification activities for TDS

This document is addressed to experts in the CCS domain and to any other person, interested in the OCORA requirements for TDS. The reader is invited to provide feedback to the OCORA collaboration and can, therefore, engage in shaping these requirements. Feedback to this document and to any other OCORA documentation can be given by using the feedback form [OCORA-BWS01-040] .

If you are an organisation interested in developing TDS according to the OCORA requirements, information provided in this document can be used as input for your development.

1.2 Applicability of the document

The document is currently considered informative but may become mandatory at a later stage for OCORA compliant on-board CCS solutions. Subsequent releases of this document will be developed based on a modular and iterative approach, evolving within the progress of the OCORA collaboration.

All requirements listed in status "Draft" are still under discussion within OCORA while the requirements in status "Approved" are agreed between the OCORA member organisations.

1.3 Context of the document

This document is published as part of an OCORA Release, together with the documents listed in the release notes [OCORA-BWS01-010] . Before reading this document, it is recommended to read the Release Notes [OCORA-BWS01-010]. If you are interested in the context and the motivation that drives OCORA we recommend to read the Introduction to OCORA [OCORA-BWS03-010], and the Problem Statements [OCORA-BWS04-010]. The reader should also be aware of the Glossary [OCORA-BWS01-020] and the Question and Answers [OCORA-BWS01-030].

In addition to the requirements listed in this document, it is referencing the applicable ERA TSI CCS 2023 and TSI LOC & PAS 2023 draft documents. Requirements that are in conflict with the CCS TSI 2023 are highlighted in the remark section of the respective requirement.

1.4 Requirements Engineering Process

This OCORA requirement document is developed, using the Requirements Management Guideline [OCORA-TWS05-010]. The requirements are engineered in a top-down manner:

- As a starting point all **"Stakeholder Requirements"** towards the OCORA initiative **(A-Level requirements)** are captured and formalised.

- In a second step, the **"Program- and Design Requirements" (B-Level requirements)** are developed. These requirements define 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.

- As a next step, the A- and B-Level requirements are further developed in the MBSE analysis to become **"System Requirements" (C-Level requirements).**

- As part of the MBSE architecture work, building blocks are identified taking into account the MBSE analysis (C-Level requirements). All applicable requirements (A-Level, B-Level, and C-Level) are apportioned to the identified building blocks, resulting in **"Building Block Requirements" (D-Level requirements)**, forming the OCORA tender templates, together with the applicable program & design requirements.

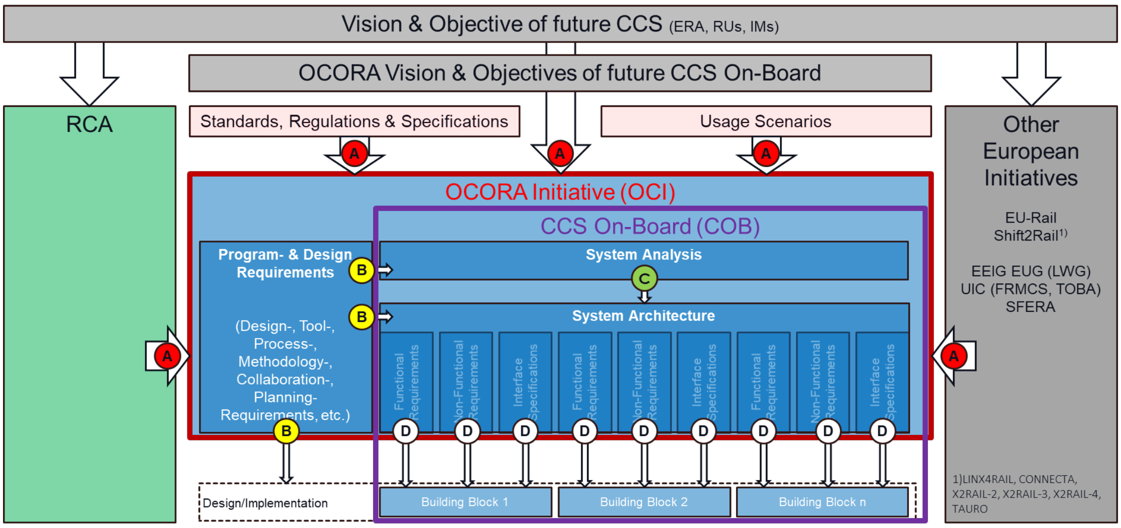

Figure 1 OCORA Requirements Engineering Process

Please note, that the A-Level requirements are applicable to the OCORA Initiative (OCI) while the B- and C-Level requirements are targeted towards the CCS On-Board System (COB) and its architecture. D-Level requirements are applicable to the respective building blocks.

2 TDS concept

2.1 Problem statement

In today's cab architecture, there are at least three main screens in a cab supporting three systems: ETP, TCMS and CVR. Each screen is dedicated to one system. The screen embeds only one business logic to enable data exchange with the appropriate system and elaborates the associated view.

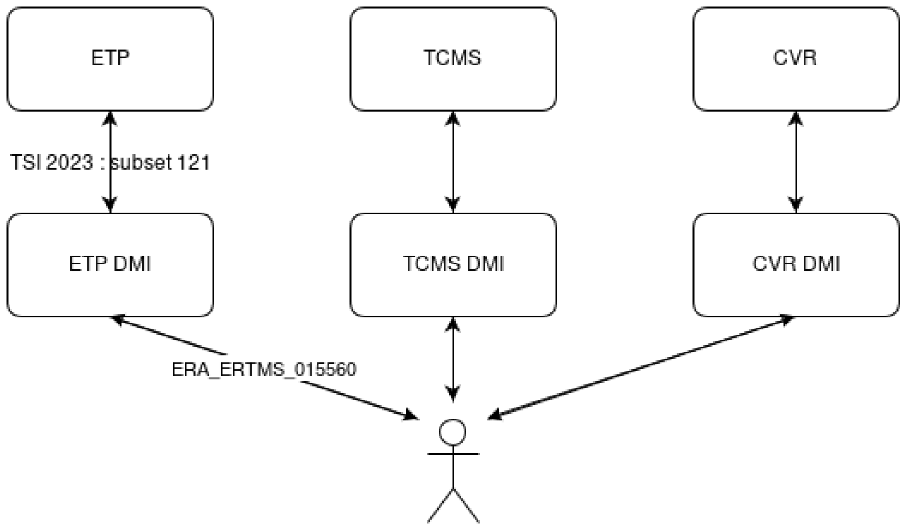

Figure 2 Problem statement

This paradigm leads to some pitfalls:

- Firstly, a screen failure will result in a loss of the system. For instance, if the ETP's DMI fails, the ETP will go into system failure and apply an emergency brake. This will cause a delay to the train and can affect all the train on a line. The availability of the screen is therefore a key factor in the overall availability of the train and the lines.
- Secondly, an update of the ergonomics systems or the system itself leads to an update of both parts. This interdependency increases the cost of maintenance (update). This is more problematic for components with different SIL levels. For example, an ergonomic enhancement to the DMI of the ETP (SIL2 component) leads to an update of the ETP (SIL4 component).
- Thirdly, space in the cab is limited. By introducing new functionalities with the OCORA architecture, new building blocks and services (DAS, MDCM-OB, UID-Reader...) may require space for their dedicated screen. However, the introduction of new display panels in both existing and new trains can be difficult for integrators due to the lack of space.
- Fourthly, data exchanged between the system and its ergonomics are supplier specifics. As a consequence, screens are not exchangeable and modular. This issue creates a vendor lock-in situation. Despite the introduction of subset 121, which specifies the exchanges between the EVC and the DMI, the links between the other systems (CVR, DAS, MDCM-OB, TCMS, UID-Reader...) and their displays need to be standardised. To date, two options are being considered: extending the use of subset 121 to all systems and their HMIs or dedicated standardisation between each system and its HMI.
- Fifthly, to continue mission with a screen failure, supplier have created proprietary solutions. For instance, TCMS information can be displayed on ETP DMI when TCMS screen fails. This failure management meets an operational needs for Railway Undertaking. However, the lack of standardisation leads to non-portable solutions between trains.

To solve these problems, OCORA is proposing the introduction of a new building block: the Train Display System (TDS). This block provides independancy between systems (ETP, TCMS, CVR...) and DMIs. As the exact boundary of TDS is not yet clearly defined, the rectangle associated with this system is deliberately dotted. However, the main characteristics envisaged for the TDS are presented in 2.3 - TDS architecture and the high levels requirements are given in 3 - Functional requirements.

Other needs are also expressed with the introduction of TDS such as management of extended view, multiple display.

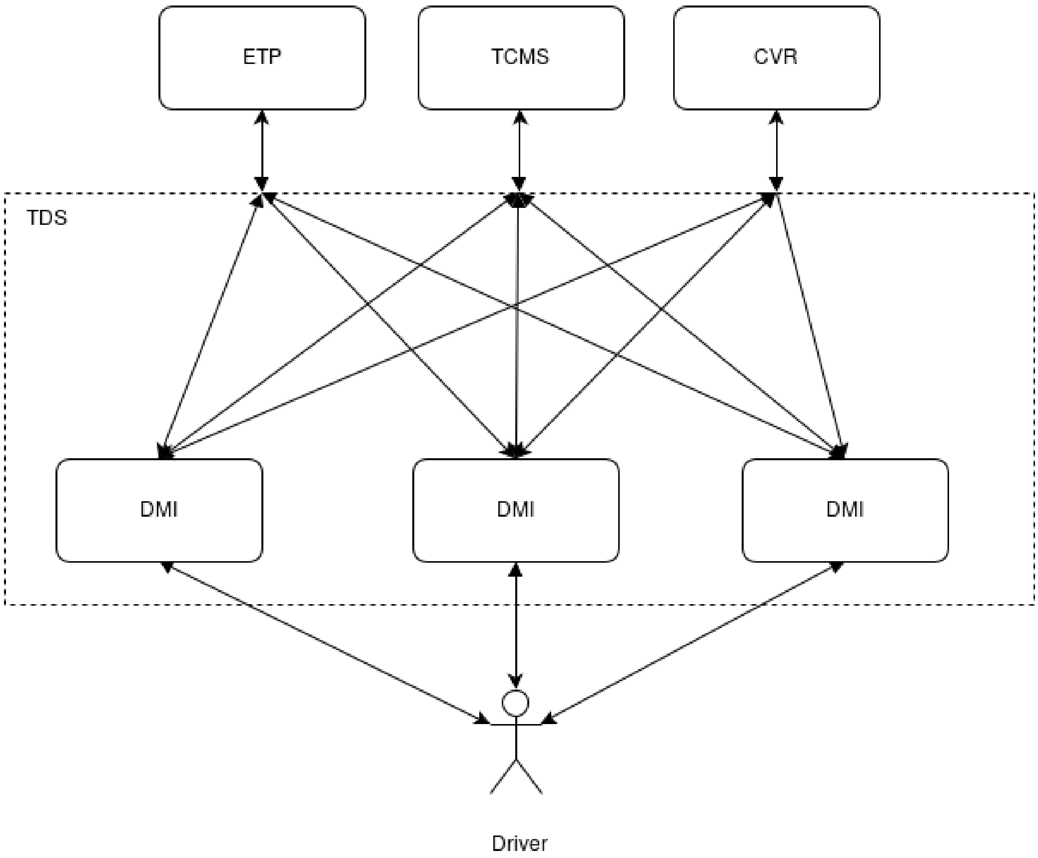

Figure 3 TDS principle

2.2 TDS terminology

In order to better understand the environment associated with managing the driver-machine interface in the driver's cab, the OCORA team needed to represent physical and logical views. Although these views do not offer an exhaustive list of possible integrations, they illustrate the key concepts used in this document.

2.2.1 Overview

The aim of the representation below is mainly to list all elements in the TDS context and to use it for the definition of the terms used in this document. This overview represents the link between systems such as Cabin Voice Radio, European Train Protection and TCMS to Controller unit dedicated to HMI. These control units use a set of HMI elements (buzzer, display panels, hard keys...) to guarantee the interface with the driver.

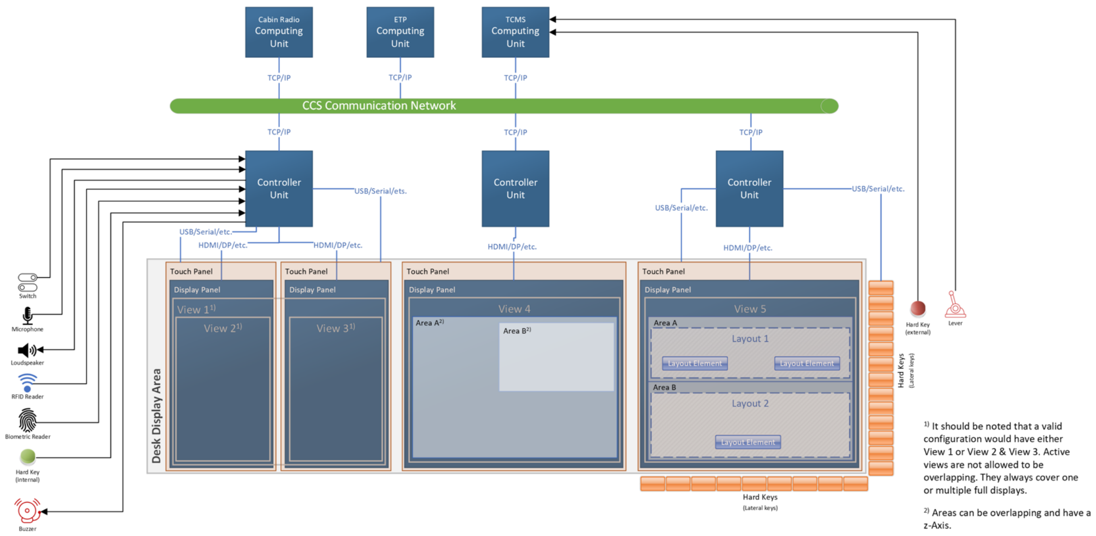

Figure 4 TDS context overview

Here, the communication between the computing units of systems are granted by the CCS Communication Network as OCORA consider mainly the integration of TDS for new train.

Switch, microphone, RFID Reader, Biometric Reader, Hard key and buzzer are connected to a central controller unit. A distributed configuration is also possible.

2.2.2 Physical terminology

This view represents the physical breakdown of the train down to the HMI elements integrated into a desktop.

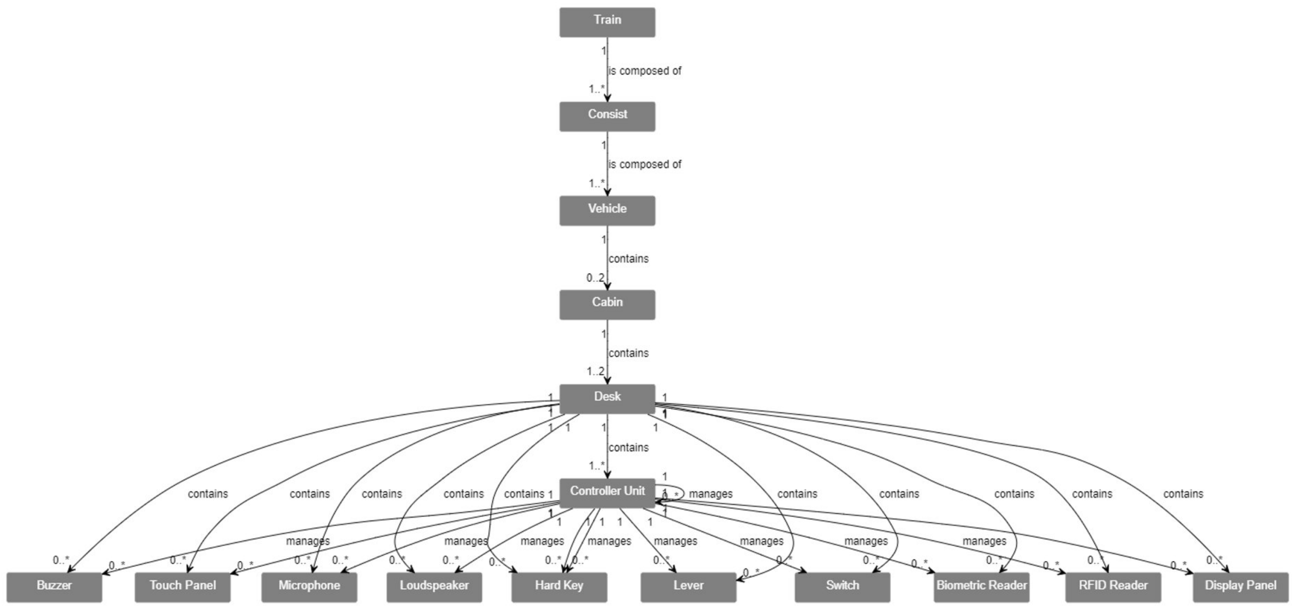

Figure 5 Physical terminology tree

The idea of OCORA is to limit the perimeter of TDS to the management of two desks:

- two desks in the same cabin e.g., in a shunting engine
- one desk per cabin limited to two cabins e.g.,) centralised CCS integration in a consist

2.2.3 Logical terminology

This logical view represents in details the logical and configuration elements involved in the elaboration of the view for a system (ETP, TCMS,...). This view represents all the components involved to provide HMI functionalities to the driver; it doesn't represent only the TDS.

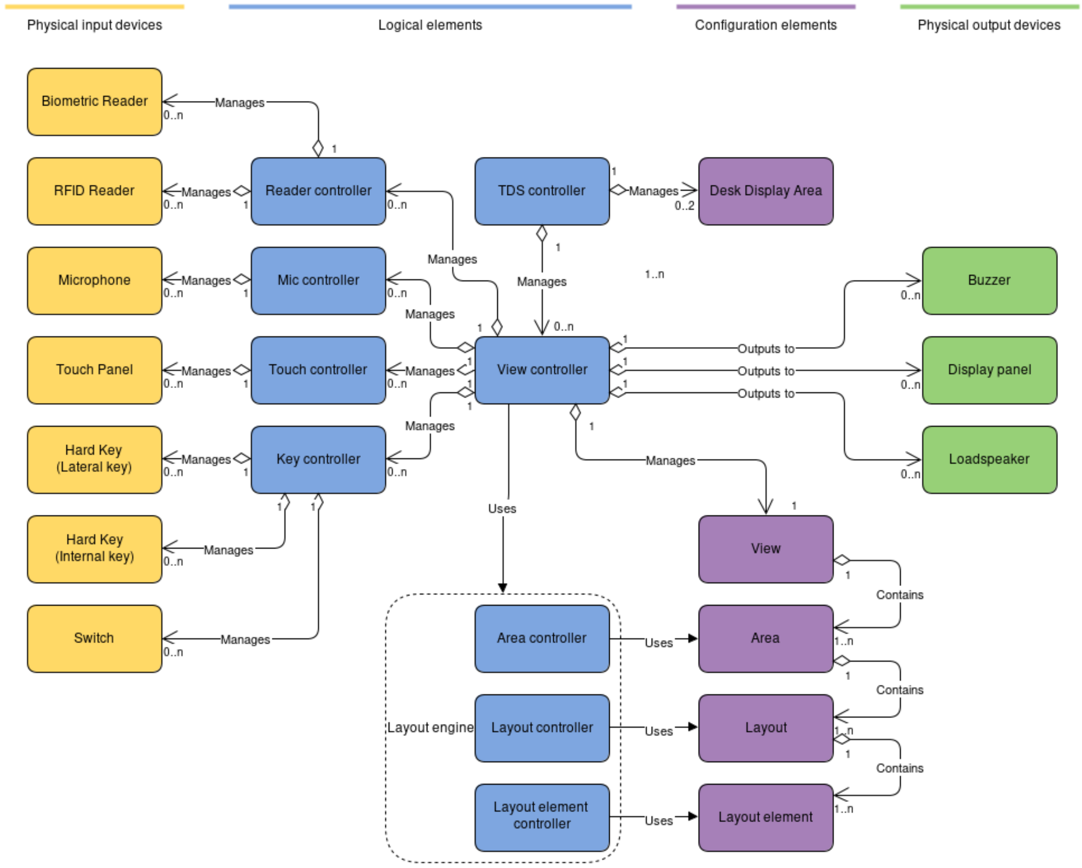

Figure 6 Logical terminology view

2.2.4 Definitions

The following definitions are mainly used in the context of the TDS concept. Other definitions can be found in the Glossary documentation.

Definitions with description highlighted in yellow are subject to discussion.

Title	Abbreviation	Description
Area Controller		The *Area Controller* manages areas for the *View*.
Biometric Reader		Device that reads the identity of a person by comparing some attribute of their physiological being or behavioral traits against a sample database. This reader permits the authentication of the actor.
Button		A *Hard Key* allocated to a dedicated system on a cab. It's designed with a dedicated SIL level. It allows a selection from two states and keeps one state as long as it is pressed.
Buzzer		Electrical device that makes a buzzing noise and is used to provide an audible warning.

Controller Unit	The *Controller Unit* is a hardware component which embeds logical controller(s). There may be only one Hardware or distributed to several HMI elements.
Desk	Inside a cab, the set of operating controls*, which is dedicated to preferred movements in a given direction (i.e. forward movements, in which visibility from the cab is provided to the driver). Exception: some single cab locomotives are fitted with one single desk, allowing normal movements in both directions. *set of operating controls: screens, buttons, traction/brake lever, direction controller, radio control, switches, …Desk
Desk Area	*Desk Area* is a location attribute (left, center...) associated to *HMI Element* for *TDS Controller* to allocate elements to a *View*.
Desk Display Area	The *Desk Display Area* identifies the desk controlled by TDS (in case of multiple cabins controlled only by one TDS such as locomotive or centralised integration).
Display Area - Area	A Zone displaying a piece of visual information of particular system and defined by a size (in cells) and an absolute position (x ,y, z axes). It is more commonly named *Area* in this specification.
Display Panel	Glass (LCD) showing pixels without controller.
Extended View	*View* displayed on more than one *Display Panel*.
External Button	A button which is not directly managed by TDS.
Hard Key	Physical key not part of view. This key can also have a text label or symbol.
HMI Element	An *HMI Element* is a physical component that interacts with the driver: *Buzzer*, *Display Panel*, loudspeaker, *Hard Key*...
Internal Button	The *Internal Button* is a button which is managed directly by TDS.
Key Controller	Controller which manages states and failures of *Hard Keys* (internal and *Lateral Key*) and switches.
Lateral Key	*Hard Key* located close to a *Display Area* allowing soft key technology.
Layout	Layout is a list of layout elements which is displayed in an area.
Layout Controller	The *Layout Controller* manages the *Layout* for an *Area*.
Layout Element	Symbols and text with their characteristics (size, position, type, color, associated icon...).
Layout	The *Layout Element Controller* manages *Layout Elements* of a *Layout*. It knows how to

Element Controller		present itself and how to react on events.
Layout Engine		The *Layout Engine* is a generic piece of software able to generate any *View* based on *Areas*, *Layouts* and *Layout Elements* as defined in a configuration.
Loudspeaker		Device that converts an electrical audio signal into a corresponding sound.
Microphone		Device that translates sound vibrations from the air into electronic signals and scribes them to a recording medium or over a loudspeaker.
Microphone Controller		The *Microphone Controller* manages states and signals of *Microphone*.
Reader Controller		The *Reader Controller* manages states and failures of the *Biometric Reader* and/or the *RFID Reader*.
RFID Reader		Radio Frequency Identification (RFID) refers to a wireless system comprised of two components: tags and readers. The reader is a device that has one or more antennas that emit radio waves and receive signals back from the RFID tag. This reader permits the authentication of the actor.
Soft Key		Context-dependent key which consists of a *Hard Key* with an associated label on the *Display Area*. When using a soft key technology, the driver action is done via the *Hard Key* adjacent to the label.
Switch		Physical component which allows a selection of 2 to N states and keeps the state until its position is changed.
Touch Controller		Controller which manages the states and failures of a *Touch Panel.*
Touch panel		Hardware detecting where the finger touch the panel.
Train Display System	TDS	The Train Display System is the train cab display system that comprises and manages one or more displays on the driver desk and a driver interface. It is composed of at least one display with the associated input devices, at least one loudspeaker and at least one Train Display System Controller. It offers a standardised communication interface to systems that need driver interaction.
Train Display System Controller	TDS Controller	The *TDS Controller* interacts with system (CCS, TCMS,CVR) and manages the *Desk Display Area*.
View		Aggregation of *Areas* required for systems (CCS, TCMS, CVR...). A *View* can represent *Areas* of different systems at the same time.
View Controller		The *View Controller* aggregates the *View*, the output devices and the controller of each input device.

35 items found

2.3 TDS architecture

The consolidation of logical and physical views has led to a review of the architectural definitions and proposals listed in release R3 of the System Architecture document. Rather than updating these multiple views that would be abandoned in favor of a single view after evaluation. It has been decided to evaluate their key characteristics according to OCORA criteria (openness, modularity, evolvability, portability, etc.). In addition, some concepts have been added and will be evaluated as key characteristics, too. In this version, the main characteristics are only presented, no weighted or evaluation results are provided. The results of these unit assessments will be aggregated to produce the architectural views that will be proposed by OCORA.

2.3.1 TDS integration

Regarding the integration of TDS within CCS on board, three options have been identified. Without considering a computing platform as solution, the two first options are only software based. The third option is hardware and software based.

1. The first option is hosting TDS software on a existing HMI Element such as a Display Panel.
2. The second option is hosting TDS software on a existing system (ETP, TCMS...).
3. Third option considered is a standalone building block using dedicated hardware and software.

The first two options are interesting in term of portability but may have huge impacts in term of migrateability, evolvability, RAMS, etc. The last option seems less portable than the previous ones, it could meet more needs defined by OCORA.

Depending on the exact boundary of TDS and the allocation of logic elements to system, the final integration of TDS could be a mix of these three options.

2.3.2 HMI elements management

HMI elements shall be managed by a controller unit and there are two possible implementations. The first option is to connect the HMI elements to a central controller unit. The second option is a distributed management of HMI elements supported by multiple controllers. The second option may provide a better availability for TDS. Nonetheless, it is more complex.

2.3.3 Interface with HMI elements

Another issue is related to the HMI elements that interface with the TDS. Two options are considered. The first option is to use direct proprietary interfaces. Considering that TDS is compatible with many connectors, this option allows the use of HMI elements as they are designed today, thus allowing more suppliers to be involved, and minimises latencies to TDS. However, this may involve a lot of physical connectors. The second option is to use the CCS constist network. This option requires HMI elements to be adapted to fit with subsets 146 and 147, may increase latencies to TDS but will limit the number of connector for TDS.

2.3.4 Interface with external buttons

With regards to external buttons, such as the emergency brake button, two solutions can be considered. As they are considered to be used by the driver, these buttons should be directly in interface with the TDS. This building block would manage this information and transmit it to the train. Otherwise, it is debatable whether such buttons are part of the Physical Train Unit Operation System (PTU-OS), as proposed in the technical slide deck OCORA-BWS02-030_Technical-Slide-Deck.

2.3.5 Number TDS controller

The first logical view presents TDS controller as a unique logical component. However, it is conceivable to design a solution based on multiple TDS controller. A master would be required to control Desk Dispaly area and invoke slaves TDS controller. The communication between all these controllers should lead to a better availibility. However, this would higher complexity, too.

3 Functional requirements

Despite the absence of a final architecture selection, OCORA has expressed high-level requirements for the Train Display System. These requirements will continue to be relevant regardless of the solution adopted.

OCORA-10011, D-Level - Managing input and output devices

The TDS shall manage a defined set of input and output devices that are used for user interaction on a desk

Status	Draft
Classification	Requirement
Rationale	Reduce the number of HMI elements on the desk.
Category	Functional
Acceptance Method	Certification
Acceptance Criteria	
Remark	

OCORA-10012, D-Level - Managing desks

The TDS shall manage at most two desks.

Status	Draft
Classification	Requirement
Rationale	Limit the scope of TDS.
Category	Functional
Acceptance Method	Certification
Acceptance Criteria	
Remark	Allowing to manage shunting engine and centralised integration in a consist.

OCORA-10013, D-Level - Allocating input/output devices to dedicated system

The TDS shall allocate input and output devices to a dedicated system.

Status	Draft
Classification	Requirement
Rationale	Provide necessary devices to a system.
Category	Functional
Acceptance Method	Certification
Acceptance Criteria	
Remark	Devices allocated to a system shall not be use by another system.

OCORA-10014, D-Level - Allocations registered as configuration

The TDS shall manage all device allocations as configuration.

Status	Draft
Classification	Requirement
Rationale	One configuration gives all input/output devices allocations for the systems.
Category	Functional
Acceptance Method	Certification
Acceptance Criteria	
Remark	

OCORA-10015, D-Level - Active configuration

The TDS shall allow to set the active configuration.

Status	Draft
Classification	Requirement
Rationale	Only one configuration is active at a time.
Category	Functional
Acceptance Method	Certification
Acceptance Criteria	
Remark	Events may be driver selection (with swicth), failure detection of a system (e.g. ETCS system failure or isolation mode), input/output device failure (Failure of a screen) or events (train in motion...).

OCORA-10016, D-Level - Extended view concept

The TDS shall allow by configuration a view that extent on multiple display panel.

Status	Draft
Classification	Operator Choice
Rationale	- Save space in comparison to two full grid screens i.e., two half grid screens are smaller (1.5 vs. 2) - Keep the screen in a central area for drivers - Being resilient to a failure in order to continue a mission (by displaying only "speed" half-grid part in case of screen failure)
Category	Functional
Acceptance Method	Test
Acceptance Criteria	
Remark	example : ETCS information is extended on 2 half-grid screens (one screen display the “speed” half-grid part and a second screen display the “planning area” half-grid part).

OCORA-10017, D-Level - Modularity

The TDS shall be able to display any system output on any display panel.

Status	Draft
Classification	Requirement
Rationale	• Enhance flexibility for configuration • Rationalise the number of display panels in the cab for space and costs saving
Category	Functional
Acceptance Method	Design Review
Acceptance Criteria	
Remark	Limitation to physical characteristics

OCORA-10018, D-Level - Systems management

The TDS shall manage input/ouput of multiple systems e.g., ETP, TCMS, CVR, etc.

Status	Draft
Classification	Requirement
Rationale	Enhance availibility, concurrency management, prioritisation
Category	Functional
Acceptance Method	Design Review
Acceptance Criteria	
Remark	Legacy train: multiple means limited to specific systems supporting TDS. New train: multiple means all systems

OCORA-10019, D-Level - Multiple systems on one display

The Train Display System may display areas from different systems on the same display panel.

Status	Draft
Classification	Optional Requirement
Rationale	Depending the size of the display panel, several areas might be displayed on the same panel. It may decrease the number of panel embedded in cab.
Category	Functional
Acceptance Method	Test
Acceptance Criteria	
Remark	

OCORA-10114, D-Level - Testing scripts

The TDS shall be able to embed scripts that emulate driver interactions with systems e.g., ETP, TCMS, etc.

Status	Draft
Classification	Operator Choice
Rationale	For testing purposes, it is interesting to automatically interact with systems e.g., ETP, TCMS, etc. For instance, start of mission of the ETP can be performed automatically before a test run.
Category	Functional
Acceptance Method	Test
Acceptance Criteria	
Remark	Scripts may be time or event based e.g., one shot timer. Such scripts shall not be used on operation.

4 External interfaces

4.1 Data exchange interfaces

OCORA-7675, D-Level - Compliance with a single data exchange standard (OSI layer 7)

The TDS shall exchange data on application level (OSI layer 7) with any other CCS-OB building block, and any CCS-OB external system, compliant with a single standard (to be defined).

Status	Draft
Classification	Requirement
Rationale	Rational for the interfaces: • To allow exchange of information between the TDS and any CCS-OB building block, and any CCS-OB external system. Rational for standardisation of the interfaces: • To support the possibility to manage the life-cycles and the sourcing of the TDS independently of the original supplier(s) of the TDS, of any other interfacing CCS-OB building block, and of any interfacing CCS-OB external system. • To allow the manufacturers of the TDS, of any other interfacing CCS-OB building block, and of any interfacing CCS-OB external system, developing their products according to a standard and therefore to reduce product variety and costs. • To facilitate the integration, installation, testing, and maintenance of a TDS. • To support the compatibility between different implementations of the TDS, of any other interfacing CCS-OB building block, and of any interfacing CCS-OB external system.
Category	Maintainability
Acceptance Method	Certification
Acceptance Criteria	
Remark	• Subset 121 introduced by TSI-CCS 2023 for the interface between ETP and DMI could be a promising solution. However, this subset should be consolidated for TDS needs. • Legacy application such as TCMS and CVR can continue using their proprietary solution. However, design products with direct compliance to this single standard or use an adaptor supporting it would ease the integration of TDS. • New applications such as DAS, MDCM shall integrate this protocol.

4.2 Communication interfaces

OCORA-7981, D-Level - Compliance with SUBSET-147

The TDS shall communicate (OSI layer 1 - 6) with any other CCS-OB building block and with any CCS-OB external system, compliant with SUBSET-147.

Status	Draft
Classification	Requirement
Rationale	• To be compliant with the TSI-CCS Rational for the interfaces: • To allow exchange of information between the TDS and any CCS-OB building block, and any CCS-OB external system. Rational for standardisation of the interfaces: • To support the possibility to manage the life-cycles and the sourcing of the TDS independently of the original supplier(s) of the TDS, of any other interfacing CCS-OB building block, and of any interfacing CCS-OB external system. • To support the compatibility between different implementations of the TDS, of any other interfacing CCS-OB building block, and of any interfacing CCS-OB external system. • To allow the manufacturers of the TDS, of any other interfacing CCS-OB building block, and of any interfacing CCS-OB external system, developing their products according to a standard and therefore to reduce product variety and costs. • To facilitate the integration, installation, testing, and maintenance of a TDS.
Category	
Acceptance Method	Certification
Acceptance Criteria	
Remark	

OCORA-7982, D-Level - Compliance with the OCORA addendum to SUBSET-147

The TDS shall communicate (OSI layer 1 - 6) with any other CCS-OB building block, and with any CCS-OB external systems, compliant with SUBSET-147.GitHub Issue #457 GitHub Task #457

<table>
<tr><td>Status</td><td>Draft</td></tr>
<tr><td>Classification</td><td>Requirement</td></tr>
<tr><td>Rationale</td><td>

To ensure unambiguous implementation of the communication.
To consider currently not specified functionalities.

Rational for the interfaces:

To allow exchange of information between the TDS and any CCS-OB building block and any CCS-OB external system.

Rational for standardisation of the interfaces:

To support the possibility to manage the life-cycles and the sourcing of the TDS independently of the original supplier(s) of the TDS, of any other interfacing CCS-OB building block, and of any interfacing CCS-OB external system.
To support the compatibility between different implementations of the TDS, of any other interfacing CCS-OB building block, and of any interfacing CCS-OB external system.
To allow the manufacturers of the TDS, of any other interfacing CCS-OB building block, and of any interfacing CCS-OB external system, developing their products according to a standard and therefore to reduce product variety and costs.
To facilitate the integration, installation, testing, and maintenance of a TDS.

</td></tr>
<tr><td>Category</td><td></td></tr>
<tr><td>Acceptance Method</td><td>Test</td></tr>
<tr><td>Acceptance Criteria</td><td></td></tr>
<tr><td>Remark</td><td>

The Contracting Entity must decide what requirements of the OCORA addendum (refer to GitHub Task #457) shall be applicable to a specific tender. Current topics are: selection of the protocols, etc.
EU-Rail and OCORA system architecture and design activities shall ensure that the points addressed in this requirement are considered for standardisation. Eventually, this requirement can disappear.

</td></tr>
</table>

5 Non-functional requirements (PRAMSS)

5.1 Performance requirements

OCORA-10020, D-Level - Compatible performance according existing systems

The TDS shall be compatible with the performance requirements of each systems in interface with e.g., ETP, TCMS, CVR, etc.

Status	Draft
Classification	Requirement
Rationale	keep compliance with subset 41 (chapters 5.2.1.X), TSI LOC & PASS (noise emission...).
Category	
Acceptance Method	Certification
Acceptance Criteria	
Remark	

5.2 Reliability requirements

To be added in a future release.

5.3 Availability requirements

OCORA-10022, D-Level - Dynamic configuration management

The TDS shall manage dynamic reconfiguration.

Status	Draft
Classification	Requirement
Rationale	The TDS shall manage redundant input/output devices in a fully transparent way for systems.
Category	Availability
Acceptance Method	Test
Acceptance Criteria	
Remark	As example, a redundant Display Panel may be available, the master and redundant Display panel shall be managed with independent connections. In case of master Display panel failure, the redundant Display Panel shall take over automatically the display within the time validity of the data transmission.'- A redundant Display Panel is necessary to mitigate random hardware failure

5.4 Maintainability requirements

OCORA-10113, D-Level - Reconfiguration data

The TDS shall inform systems (ETP, TCMS, etc.) and record maintenance data (root cause of reconfiguration, new configuration) in case of reconfiguration.

Status	Draft
Classification	Requirement
Rationale	Provide configuration informations to systems and maintainer.
Category	Maintainability
Acceptance Method	Test
Acceptance Criteria	
Remark	

5.5 Safety requirements

OCORA-10021, D-Level - Compatible safety requirements according to existing systems

The TDS shall be compatible with the safety requirements of each system it interfaces with (ETP, TCMS, CVR, etc.).

Status	Draft
Classification	Requirement
Rationale	Keep compliance with subset 91 (DMI-XXx reported on ETCS_OB10).
Category	Safety
Acceptance Method	Certification
Acceptance Criteria	
Remark	The maximum current SIL level for train display is SIL2 (ETP DMI). Nowadays, no system requires higher SIL Level.

5.6 Security requirements

To be added in a future release.