OCORA

Open CCS On-board Reference Architecture

Capella Modelling

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Revision history

Version	Change Description	Initial	Date of change
1.05	Official version for OCORA Delta Release	ML	30.06.2021
2.00	Official version for OCORA Release R1	ML	03.12.2021
3.00	Official version for OCORA Release R2	ML	22.06.2022

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References

Reader's note: please be aware that the numbers in square brackets, e.g. [1], as per the list of referenced documents below, is 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.

[1]   OCORA-BWS01-010 – Release Notes

[2]   OCORA-BWS01-020 – Glossary

[3]   OCORA-BWS01-030 – Question and Answers

[4]   OCORA-BWS01-040 – Feedback Form

[5]   OCORA-BWS03-010 – Introduction to OCORA

[6]   OCORA-BWS04-010 – Problem Statements

[7]   OCORA-BWS08-010 – Methodology

[8]   OCORA-BWS08-020 – Tooling

[9]   OCORA-TWS01-030 – System Architecture

[10]   OCORA-TWS01-050 – Capella Model Export

[11]   OCORA-TWS01-041 – MBSE Modelling Guidelines

1 Introduction

1.1 Purpose of the document

The purpose of this document is to provide the reader:

- the reasoning why OCORA is using Model Based System Engineering (MBSE),
- the tools proposed for MBSE,
- the status of MBSE modelling activities for CCS on-board and
- information about the next steps for MBSE

This document is addressed to experts in the CCS domain and to any other person, interested in the OCORA concepts for on-board CCS. The reader is invited to provide feedback to the OCORA collaboration and can, therefore, engage in shaping OCORA. Feedback to this document and to any other OCORA documentation can be given by using the feedback form [4].

If you are a railway undertaking, you may find useful information to compile tenders for OCORA compliant CCS building blocks, for tendering complete on-board CCS system, or also for on-board CCS replacements for functional upgrades or for life-cycle reasons.

If you are an organization interested in developing on-board CCS building blocks according to the OCORA standard, 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 a standard 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.

1.3 Context of the document

This document is published as part of the OCORA Release together with the documents listed in the release notes [1]. Before reading this document, it is recommended to read the Release Notes [1]. If you are interested in the context and the motivation that drives OCORA we recommend to read the Introduction to OCORA [5], and the Problem Statements [6]. The reader should also be aware of the Glossary [2] and the Question and Answers [3].

2 Why is OCORA using MBSE?

Current ETCS documentation (Subset 026, 034, 119, etc.) is expressing the system requirements in textual form. Although these specifications are quite comprehensive, they still leave room for interpretation (**problem #1**) and are lacking details in some cases (**problem #2**). In addition, the sheer number of specifications naturally causes inconsistencies (**problem #3**) and creates risks for errors during implementation (**problem #4**). As a result, testing and certification efforts increase accordingly (**problem #5**). All this may lead to quality and performance issues and generates very high total costs of ownership for ETCS on-board solutions.

To overcome the issues mentioned, it is important to decompose the CCS on-board system in well specified components / building blocks (refer to System Architecture documentation [9] for details) and to use MBSE to develop the needed specifications for all building blocks. The resulting model is intended to amend the current TSI specifications with the necessary details allowing CCS system or component providers to implement high quality ETCS on-board systems at a competitive price. Furthermore, MBSE based simulations will help reducing the test and certification effort.

3 Why is OCORA using Arcadia / Capella?

OCORA members have decided to use MBSE for developing the detailed system level specifications. There are certainly many different tools and methodologies available to support the MBSE process. For the following reasons, the Arcadia method has been chosen:

- Arcadia is a system engineering method developed for safety critical systems and therefore relevant in the context of OCORA.

- The method is supported by a dedicated, powerful tool (Capella).

- Most founding members of OCORA are using the Arcadia method and the Capella tool in their CCS projects already.

- Capella is available with free licenses, hence allowing all interested parties to use it at no cost.

It is yet to be decided to what extent and in what phases of the product definition/development cycle the Arcadia method will be used. Refer also to document [7] and [8] for further details.

4   Status on MBSE modelling

Specialists from different OCORA founding members (DB, SNCF, NS, SBB) are currently conducting MBSE activities, using Capella. For the CCS on-board scope, these activities are mainly around the ATO Vehicle (AV) and the Vehicle Locator (VL).

These activities are, to some extent, already synchronized with each other and with other activities in the same field (e.g., S2R, X2RAIL, SFERA, RCA, etc.). However, there is currently no focus for a common, open, standardized on-board model that is compatible with the intended OCORA architecture / platform.

OCORA provides with its R1 release a starting point for discussions regarding the modelling work of the OCORA CCS on-board system. Refer to the System Architecture documentation [9] for details.

For this release (Release R2), the logical architecture perspective in Capella was updated further to reflect the architectural changes developed for Release R2. The taken approach on the logical perspective is still the same as it was in the R1 Release. However, for this release OCORA started developing the MBSE Modelling Guidelines [11] to standardise the modelling process and to define the modelling rules to be used within OCORA. The MBSE Modelling Guidelines published with this release covers at the current stage the system perspective only and will be extended in upcoming releases to also cover the other perspectives of the Arcadia methodology. The model [10] published as part of this release was updated with an initial set of system capabilities to apply and verify the MBSE Modelling Guidelines.

5   Next steps for MBSE modelling

The MBSE Modelling Guidelines will be evolved further to cover the additional perspectives of the Arcadia method.

Modelling activities on the system perspective will be continued by adding system capabilities as content becomes available.

Important note: *in addition to the official OCORA releases, frequent publications of the Capella Model shall facilitate discussions with other initiatives (e.g., RCA, X2Rail4, LinX4Rail) and/or potential suppliers without overreaching someone. Model updates will be available for download on the OCORA public GitHub.*