OCORA

Open CCS On-board Reference Architecture

System Architecture – Capella Model

Beta Release

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Revision history

Version	Change Description	Initials	Date of change
0.01	Release for review	AL	2020-06-02
0.02	Review comments incorporated	AL	2020-06-18
1.00	Release for OCORA Core Team review	AL	2020-06-23
1.01	Release for OCORA Steering Committee endorsement	AL	2020-06-30

Table of contents

References

The following references are used in this document:

[1] OCORA-10-001-Beta – Release Notes

[2] OCORA-10-003-Beta – Feedback Form

[3] OCORA-30-001-Beta – Introduction to OCORA

[4] OCORA-30-002-Beta – Problem Statements

[5] OCORA-30-006-Beta – High Level Methodology

[6] OCORA-30-007-Beta – High Level Tooling

[7] OCORA-30-010-Beta – Set of Requirements

[8] OCORA-40-001-Beta – System Architecture

[9] OCORA-90-001-Beta – Question and Answers

[10] OCORA-90-002-Beta – Glossary

1 Introduction

1.1 Document context and purpose

This document is published as part of the OCORA Beta release, together with the documents listed in the release notes [1]. The current version provides the reader:

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

1.2 Why should I read this document and how to provide feedback?

This document is addressed to technical experts in the CCS domain and to any other person, interested in the OCORA technical concepts for on-board CCS. The reader will gain insights regarding the topics listed in chapter 1.1, will be able (and indeed 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 beta release documentation can be given by using the feedback form [2].

Before reading this document, it is recommended to read the Release Notes [1], the Introduction to OCORA [3], the Problem Statements [4], the Set of Requirements [7], and the System Architecture [8]. The reader should also be aware of the Question and Answers [9] and the Glossary [10].

2 Why is OCORA using MBSE?

Current ETCS documentation (Subset 026, 034, 119, etc.) are expressing the system requirements in textual form. Although these specifications are quite comprehensive, they still leave room for interpretations (**problem #1**) and are lacking details in some cases (**problem #2**). In addition, the magnitude of the specification naturally causes inconsistencies (**problem #3**) and provide many error opportunities during implementation (**problem #4**). As a result, testing and certification efforts increase accordingly (**problem #5**). All this leads to quality / performance issues and to 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 subsystems (refer to System Architecture documentation [8] for details) and to develop for all subsystems the needed specifications, using MBSE methodology. The resulting models of the different components are extending the current TSI specifications to the necessary detail and can be used by all CCS system or component providers to implement high quality ETCS on-board systems at reasonable costs. Furthermore, testing and certification efforts can be reduced through the use of MBSE based simulations.

3 Why is OCORA using Arcadia / Capella?

For the development of the detailed system level specification, MBSE is used. For the following reasons, OCORA has decided to use the Arcadia method for MBSE:

- Arcadia is a system engineering method developed for safety critical subjects 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 [5] and [6] for further details.

4 Current 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, SFERA, RCA, etc.). However, there is currently no focus for a common, open, standardized AV, VS, VL on-board model that is compatible with the intended OCORA architecture / platform.

OCORA provides with its Beta release a starting point for discussions and modelling the Automated Train Protection Manager (ATPM), the Vehicle Supervisor (VS), the Vehicle Locator (VL), the ATO Vehicle (AV), etc. Refer to the System Architecture documentation [8] for details.

5 Next steps for MBSE modelling

OCORA aims to provide some first tentative high-level models for VS, VL, AV, and ATPM in its Gamma release, if possible. However, detailed modelling activities will start in the year 2021 only.