OCORA

Open CCS On-board Reference Architecture

Problem Statements

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Revision history

Version	Change Description	Initial	Date of change
0.01	▪ First Proposal for Gamma Release	RM	29-10-2020
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1.11	▪ Draft for Delta Release	RM	17-06-2021
2.00	Official version for OCORA Delta Release	RM	30-06-2021
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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

1 Introduction

1.1 Purpose of the document

The purpose of this document is to describe the existing problems to overcome with the OCORA collaboration.

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. Its focus is on CCS On-board.

1.3 Context of the document

This document is published as part of the OCORA Delta 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]. The reader should also be aware of the Glossary [2] and the Question and Answers [3].

2 Problem Statements

The scope of the following problem statements is focusing on CCS On-board in general. In order to develop/compile the problem statements RUs have collected issues on current ETCS On-board solutions. In addition, foreseeable challenges such as the game changer developments have been considered in order to determine the gap between the existing and the future solutions.

Current ETCS On-board solutions:

1. are based on the TSI specifications ensuring interoperability, but the **subset specifications are incomplete and ambiguous**. Therefore, interoperability[1] is not a given.
2. are **more expensive[2] than technologically justifiable**. This seems to be a result of high integration engineering and certification efforts, as well as small batch sizes and high project risks.
3. are **difficult to be integrated into existing vehicles**.
4. are **difficult and time consuming to adapt/change/update/upgrade**:
    - In the case of patching in non SIL area (e.g. cyber- security patching)
    - In the case of error correction in SIL area
    - In the case of baseline upgrade (e.g. ETCS baseline 2 to 3)
    - In the case of functional enrichment (ex. base for game changer introduction is not a given)
5. do **not respect different, non-overlapping life cycles** (e.g. vehicle vs. CCS vs. connectivity)
6. are **difficult to maintain** (e.g. maintenance, monitoring, diagnose possibilities very limited)
7. are **lacking built-in cyber security**, since this is a newer topic, especially in combination with 4 + 6.
8. are **performing below expected availability and reliability** (from overall ETCS system perspective).

In addition:

- The benefit of ETCS On-board only pays off, if the ERTMS rollout progresses in Europe on large scale.
- The ETCS On-board functions as such also need some improvements (e.g. braking curve, odometry accuracy, etc.) to serve current operational needs.
- Difficult, expensive and time consuming ETCS On-board fitments in general, are delaying national deployment plans, impacting trackside investments, and postponing ERTMS rollouts.

[1] Here “interoperability” addresses not only the interaction between vehicle and trackside CCS equipment. But also, same behavior / interchangeability of on-board equipment from different suppliers on one trackside installation and same behavior of one on-board installation on trackside installations from different suppliers.
[2] More expensive in invest/CAPEX and operation/OPEX. OCORA always focus total cost of ownership, hence the full life cycle.

3 OCORA Actions

The following list aligns high level Business Objectives to identified action fields. It is expected that the list will grow in future mainly in the dimension of identified action fields. Nevertheless, over time, additional Business Objectives could emerge as well.

Business Objectives:	OCORA Actions:
Ensure easier Access to Interoperability	• Perform formal functional modelling on selected subsets together with the industry to improve and complete TSI subset specifications • Establish common test center / reference system facilities including trackside and on-board end to end testing, off production.
Reduction of one-off efforts increase standardization	• Establish modular safety by design in line with current standards • Automate generic and specific safety case documentation and process • Address existing fleet while introducing a standardized gateway • Perform investigation in Acceptance of global standards • Separate SIL from NonSIL functionality
From **Project to Product**, increase batch size	• Define, and promote OCORA as common tendering base • Encapsulate all vehicle specific configuration and adaptation in the functional vehicle adapter, FVA • Introduce an ethernet based network technology to standardize peripheral device interfaces
Introduce Modularity and precisely **defined Interfaces** to **ensure Upgradeability**	• Introduce a common, open architecture and identify a balanced amount of building blocks • Structure EVC monolith into functional blocks, separate ETCS core from other functions • Allow both, designs with a deployment on multiple hardware, as well as multiple functionalities on the same hardware platform • Promote standardized interfaces between building blocks on all OSI layers to allow for plug-and-play like replaceability/upgradeability • Elaborate test methods and set requirements to ensure exchangeability
Improve Product Maturity (maintenance, monitoring, diagnose, performance)	• Introduce remote maintenance, monitoring and diagnostics to reduce operational cost and improve reaction / correction time • Follow a stepwise approach, use gained upgradeability to serve individual migration strategies and set the basis for a faster ERTMS rollout in Europe • Collect and analyse performance issues of whole ETCS system, define steps to improve these • Introduce state-of-the-art (cyber-) security by design

Figure 1 OCORA Actions