OCORA

Open CCS On-board Reference Architecture

Questions and Answers

Document ID: OCORA-BWS01-030

Version: 4.11

Date: 22.06.2023

Revision history

Version	Change Description	Initial	Date of change
0.00	Beta release as a starting point	MM	30.06.2020
0.01	▪ Consolidated version with further feedback	NP	19.11.2020
0.02	▪ Additional comments (from SBB)	NP	30.11.2020
1.00	Official version for OCORA Gamma Release	RM	04.12.2020
1.90	▪ Prep version for OCORA Delta Release	RM	17.06.2021
2.00	Official version for OCORA Delta Release	RM	25.06.2021
3.00	Official version for OCORA Release R1	RM	07.12.2021
4.00	Decoupled document from a specific OCORA release	RM	01.07.2022
4.11	Reworking questions and answers to go with the current release state	VI	22.06.2023

Table of contents

Table of tables

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 Note

[2] OCORA-BWS01-020 – Glossary

[3] OCORA-BWS01-040 – Feedback Form

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

[5] OCORA-BWS03-020 – Guiding Principles

[6] OCORA-BWS04-010 – Problem Statements

[7] OCORA-BWS06-020 – Economic Model

1 Introduction

1.1 Purpose of the document

The purpose of this document to provide the reader with the feedback received by different parties on the OCORA architecture, including the respective OCORA answers.

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 [3].

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

If you are an organisation 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 them. If you are interested in the context and the motivation that drives OCORA we recommend reading the Introduction to OCORA [4], the Guiding Principles [5] and the Problem Statements [6]. The reader should also be aware of the Glossary [2].

2 Questions and Answers

ID	Question	Answer
1.	What is the planning of the OCORA collaboration platform; when does it intend to publish its set of specifications for the architecture?	This is a preliminary release of the OCORA Architecture containing the common views and preferences of OCORA members on the preferred development of the train borne CCS function. This publication will be followed by a subsequent release of this document and topic specific documentation in a modular and iterative approach that evolve within the OCORA collaboration.
2.	If OCORA intends to develop a set of informal specifications for e.g. procurement purposes, why make the effort to get these specifications formalised and embedded in the legal and regulatory framework?	The intention is not to formalise these specifications. The aim is to anchor the pre-requisites allowing / enabling an open CCS Onboard Reference Architecture.
3.	When and how does OCORA intend to involve the suppliers, especially since there are multiple projects running in which railways and suppliers are collaborating on similar issues?	OCORA does so by performing continuous exchange with supplier groups (e.g. UNIFE) and other projects involving suppliers (e.g. ERJU).
4.	OCORA has presented its high-level architecture. But what are its priorities? From a business point of view, what are the main drivers for selection? From an architecture development point of view, what are the priorities?	The priorities are to provide the architecture and base technologies first, followed by the functional requirements, non-functional requirements, interface specifications and use cases. From a business point of view, its main drivers are the Problem Statements [6]. From an architecture development point of view, the priorities are based on the Guiding Principles [5].
5.	From the NOBO/ISA perspective to what level of detail does OCORA intend to formulate its specifications (e.g. functional or technical levels)?	OCORA intends to provide the functional requirements.
6.	OCORA now consists of only five railway undertakings. Why not more? Especially: are there plans to involve small operators and rolling stock owners to fortify the representativeness and acceptance of OCORA?	OOCRA is based on five founding members. It is a cooperation open to any railway company such as railway undertakings, fleet keepers and owners.
7.	How does modularity, i.e. a modular architecture, improve performance, reduces costs, etc.?	Modularity will also imply interchangeability, opening up to larger number of standardised products, with wider markets. These standardised products will be put in competition and challenged on their component's prices, therefore reducing their costs.
8.	Has OCORA set up an inventory of relevant documentation it uses for developing its architecture?	Each release contains the whole set of documentation used.
9.	How does OCORA intends to deal with legacy (e.g. class B systems)?	The OCORA architecture allows to integrate legacy class B systems through a Specific Transmission Module (STM) integration while ETCS is the primary ATP.

10.	High investments have already been done in current products. Is OCORA going to change the specification, thus questioning these investments?	The specification will stay the same. In fact: • OCORA members have also done high investments; only 10% of the members' fleet is on a LOOSE-LOOSE situation on CAPEX; • technological obsolescence is going to change the specification. OCORA aims at proposing future-proof proven architectural solutions. OCORA does not affect existing investment from end customer. Investments done by suppliers should be reusable if they already provide independence, modularity and evolvability.
11.	Why should current products be changed since they are good enough and ready for game changers?	With the readiness of products for games changers comes the questions of where to find the specification to purchase such products under competition. Radio evolution was first to reveal that one change was changing it all. Method and discipline are needed to decouple game changers and ETCS Today ETCS products are often exporting constraints to the vehicle or the track. The quality/reliability is not good enough and no contract allows predictable and affordable price that covers all identified game changers.
12.	Is there a business case for the industry within OCORA?	There is no existing business case if the OBU migration takes an additional 30 years because: • for major suppliers, the business case should be seen at the scale of a line corridor to equip with ETCS and game changers, not only on fleet equipment; • for outsiders, it is an occasion to enter the railway sector as there can be multiple suppliers for subsystems; • long term business case is in the supply chain and services. In fact, the business case is that supplier will share their valuable resources on the "non-product differential part" of the product to consolidate their resources to the "product differential part of the product" e.g. sensoric, project implementation, new innovation, technology, … If low prices allow for quicker fleet equipment and innovation creates a business case for quicker evolution, there can be a win-win situation. OCORA is ready and willing to engage discussion with the industry and public authorities to investigate a new business model for CCS onboard equipment compliant with OCORA principles. There must be a common trajectory to ensure consistency and guarantee that investments will be preserved.

		The modularity inherent to OCORA will also imply interchangeability, opening up to larger sales volumes, with wider markets. Even if margins will be reduced for each of these modules, there will be more trains to equip.
13.	Can you guaranty that RUs will order OCORA within their tender and procurement?	OCORA members guarantee that this is the intention as OCORA is aiming to deliver sufficient and harmonised specifications allowing for predictable quality and performance. This will allow for the formation of an industrial standard which allows for scale economies, both for suppliers and customers.
14.	Is delivering an integrated solution of ATO with ETCS much easier, quicker and already giving the necessary cost reduction?	The problem with this solution lies in the performance management (and value for operation) of two integrated subsystems that do not have the same level of maturity. It also raises questions such as: What about the lifecycle cost? and if there is an update? What about being flexible? What about shorter time to market? What about standardization on the long term? In practice, integrated solutions are very demanding maintainability wise and might probably not allow to go for GoA4.
15.	OCORA will not allow for mature products before a decade, can ERTMS deployment wait for OCORA?	It does not appear to be existing business cases for RUs in order to deploy ERTMS. OCORA's intent is to have mature products within five years. OCORA is expected to boost product development as it is delivering a reference set of specification and the necessary open platform to integrate future products. The same reasoning applies to any ERTMS game changers. OCORA will not delay other projects as the current deployment work must be continued. As a matter of fact, the initiative allows parallel work to be carried out to modernize the system.
16.	OCORA and modularity will harm European signalling industry, is this acceptable from a European industry competitiveness perspective?	As stated in answer 12, OCORA and modularity can be profitable for the European signalling industry as low prices allow for quicker fleet equipment, and innovation creates a business case for quicker evolution. OCORA is about promoting the signalling industry and allowing manufacturers to concentrate on their core competencies. It should create new business case with less risk.
17.	OCORA is questioning investment already done in ERTMS and rolling stock, how can this be acceptable for ERTMS early birds?	OCORA is not affecting investment done but offers alternative migration path to a digital railway with future standardized technology.

		Indeed, early birds in ERTMS on-board are facing two challenges: upgrade from BL2 to BL3 and the arrival of FRMCS. The question of evolution of those early bird products is either to continue on the same line with a proprietary solutions and supplier dependencies or change of strategy with OCORA. The great opportunity lays in the fact that only 10% of the overall European fleet is equipped today.
18.	By defining detailed specification, would not OCORA will kill any possibility to innovate and optimize industrialisation?	On the contrary, OCORA is aiming at an open area of innovations in building blocks while managing interfaces and the on-board architecture. OCORA's modularity allows many innovations to emerge (autonomous localization module, new technology for environment perception…). Moreover, modularity allow different maturity paths for product, therefore helps industrialisation and migration.
Infrastructure Managers:		
19.	Why worrying about the funding as the infrastructure is being rolled out with ETCS/ATO, and ETCS/ATO Onboard will be anyway part of the rollout and paid by the ministry?	All RUs funding sources must be clearly identified. The Ministry cannot pay for all the private RUs, thus RUs/vehicle holders are in direct competition. Lifecycle costs, updates and investment risk must also be taken into account. Not every government is covering them and not for all kind of RUs, in particular international operators.
20.	Who will take the responsibility of the OCORA specifications and software?	This responsibility lies within the RUs, IMs, suppliers, authorities and standardisation bodies; and more generally the railway sector if OCORA is globally adopted.
21.	Can OCORA help equipping yellow fleets?	Yes, with a major concern on CAPEX for the yellow fleet. Indeed, current solutions are not adapted for yellow fleet but OCORA is an opportunity for simpler fitment of yellow fleet.
Railway Undertakings:		
22.	I equipped my fleet with ETCS and no modification was necessary until today. Why do I need OCORA?	FRMCS and ATO technologies allowing for an increased capacity by improving the braking curves, ATO GoA4 and more are coming. Thus, further digital innovation can be expected. These technologies are not needed now but further evolution of ERTMS will probably be a case for using OCORA specifications.
23.	OCORA will increase the procurement cost and complicate quick integration. Why do I need OCORA?	OCORA will decrease costs thanks to a common architecture for all components. OCORA will be helpful to manage the evolution of CCS-OB to implement future needs.
24.	Is there a business case of OCORA investment for regional, high speed and cargo?	Yes, since it is about reduction of total cost of ownership and reduction of investment risk. Be referred to the OCORA documentation about the business model [7].

25.	Who takes the responsibility of system integration, life cycle management, obsolescence management, … if I order OCORA?	The Integration, Verification and Validation process is central for OCORA. OCORA being a set of specification there is no modification of the process. As providers of a gateway to standardised OCORA bus, Vehicle Supplier would be responsible of it. Same applies to CCS supplier providing CCS equipment. As some modules could be purchased to specific manufacturers, responsibilities and maintenance is a question of the specific contracting and internal RU/ECM organisation.
26.	Who will ensure that OCORA will be available and maintained during the vehicle lifecycle?	OCORA is not a product but a set of specifications supporting a reference architecture. Therefore, there question of having OCORA available and maintained during the vehicle lifecycle is obsolete. The question should instead be about the availability and maintenance of products created following OCORA architecture.
27.	If open source is used, will the RU be responsible for the safety and performance of the purchased train?	No, the RU will not be responsible for the safety and performance of the purchased train. As with closed source, there should be the respect of responsibility, process, certification… All engineering rules remains for closed and open source. The advantage of being open source is that the development is under more control by being open to the public in order to produce a better software quality. Suppliers can be made responsible of the use of open source.
28.	When a service contract for the rolling stock maintenance is in place, how OCORA could be implemented?	If a service contract is in place, an evolution to get the gateway installed can be asked in OCORA-compliant equipment.
29.	If CCS and LOC&PAS domains are split, who will be responsible in case of accident due to a malfunctioning of CCS component?	CCS and LOC&PAS are split in integration (IVV activity). So, the responsibility is defined in the contract. The architecture should help to know the root cause of failures and therefore facilitate responsibility management. But this point needs to be further discussed with Authorities.
30.	Is there an opportunity with OCORA to add new functionality in the train (e.g. energy management, cyber security…)?	Yes, there is such an opportunity. Indeed, OCORA as an open platform envisages to allow innovative software application and new safety related device to be installed on trains.
31.	Life cycle costs seem to be a main concern for OCORA. But how can OCORA guaranty the reduction of CAPEX?	The standardisation and openness related to OCORA will result in a simplified and common architecture for all suppliers. Thus, their products will be put in competition and challenged on their component's prices. As a consequence, CAPEX will be reduced.

32.	How can OCORA guarantee robust operations with ERTMS and ATO?	Such guarantee comes from the system stabilisation given by OCORA. The initiative will also: • help join railway forces through resource sharing; • improve systems through openness.

Table 1 OCORA Questions and Answers