OCORA

Open CCS On-board Reference Architecture

Questions and Answers

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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	30.06.2021
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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 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

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 [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 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], and the Problem Statements [6]. The reader should also be aware of the Glossary [2] and the Question and Answers [3].

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 performs continuous exchange with the sector.
4.	OCORA has presented is high level architecture. What are its priorities and what are the main drivers for selection?	The priorities are to provide the architecture and base technologies first, followed by the functional requirements, nonfunctional requirements, interface specifications and use cases.
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.	Why is there an RCA and an OCORA architecture? Why not just one?	RCA is driven by Infrastructure Managers, while OCORA is driven by Railway Undertakings. Important is, that OCORA and RCA secure compatibility, hence to the outside word the liaison of OCORA and RCA provide a single architecture.
7.	OCORA now consists of only 5 railways. 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. OCORA is an open cooperation for any railway company, for instance railway undertakings, fleet keepers or owners.
8.	What is the relation between RCA and OCORA, and how are responsibilities between RCA and OCORA divided?	OCORA is liaising with EUG-EULYNX collaboration for RCA in order to achieve convergent and synergetic approaches to system architecture, functional modelling and technologies for CCS.

9.	How does modularity resp. a modular architecture improve performance, reduces costs, etc.?	Modularity will also imply interchangeability, opening up to larger volumes, with wider markets, even if margins will be reduced for each of these modules. There will be more trains to equip.
10.	The problem with the gateway is how to deal with the vehicle side. How does OCORA intends to deal with this issue?	The “OCORA gateway” is the “bridge” between a OCORA standardized on-board CCS and the vehicle. Since legacy vehicles vary in their architecture, the “OCORA gateway”, including the functional vehicle adapter, needs to be adapted on the vehicle side for each CCS retrofit project.
11.	How does OCORA intends to deal with legacy (e.g. class B systems)?	The OCORA architecture allows to integrate legacy class B systems through an STM integration while ETCS is the primary ATP.
12.	We just need the gateway to the train. For the rest we will deliver a life cycle service. No need for the bus and the modularization of the CCS.	Is there a business model supporting this statement? • Suppliers may bankrupt, and know-how may fade away • With OCORA, our intent is that EU railway operation and EU technology shall prevail • European operation shall continue to be the worldwide railway shopping window. • Life cycle service doesn’t solve evolutive maintenance nor regulatory changes. • Supplier will not be able to take over the risk for e.g. 4 countries service model and deliver a reasonable price.
13.	We have already done high investments in current products and OCORA is going to change the specification.	Why do you assume specification will be changed due to OCORA? ➡Members of OCORA have also done high investment. ➡We are currently in a LOOSE-LOOSE situation on CAPEX, but for only 10% of the fleet. ➡ Technological obsolescence is going to change the specification anyway. 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
14.	No change of the current products, since they are good enough and ready for the game changers.	If products are ready for game changers, where to find specification to purchase those products under competition? ➡ Radio evolution was first to reveal that one change was changing it all. ➡We now need method and discipline to decouple game changers and ETCS Today ETCS products are often exporting constraints to the vehicle or to the track. The quality/reliability is not good enough and no

		contract allow predictable and affordable price covering all identified game changers.
15.	Interoperability, Interchangeability and modularity will be developed within S2R.	Which are the TDs delivering this? Are suppliers ready to adapt all their products in line with S2R results? by when? ➡If so it is a good news. ➡As per today, S2R did not yet address system architecture. The reference architecture is a key concept of modularity. E.g. ERTMS will not be a topic within S2R. And we also need to enhance ETCS. S2R regulation does not allow for industrialization of serial product. It addresses mainly demonstrators and pre-industrialisation. There is today no TD focusing as interchangeability or modularity. Full interoperability would require a formal approach to ERTMS specification which is not today in the S2R workshop. Need for alignment on product development and acceptance/homologation, which can only be done by the 5 partner operators in OCORA. The work will have to be taken up and challenged about architecture. In S2R there is the LinX4Rail approach, which educates the subject of the architecture of the whole system. The OCORA work is intended to feed into the work of L4R and then S2R2 (July 2021). The ambition is to initiate the work and to set up relevant architectures for operators and suppliers, so that it can be taken up by the "official" European authorities
16.	Harmonisation of the operation rules is the key – not again a new spec since 20 years.	What are potentially painfull operational rules? What is the cost impact for product development? ➡We agree that harmonizing the operational rules of game changers should be the priority. Harmonization of operation rules is not a CCS or vehicle topic. It is an operation topic. There was never an assessment provided by suppliers of potentially painfull operational rules. It is anyhow unrealistic to wait for full harmonization of operational rules as those rules are often linked to all legacy assets and the ERTMS deployment should start now and not in 50 years…
17.	We should start to deploy and not changing the spec – Baseline 3.6 is good enough and has been proven.	Why do you see a risk that OCORA will disrupt current TSI if it is good enough and fully proven? How to understand remaining errors to be corrected, difficulties in testing and recent incident with ERTMS? ÆMaintaining compatibility with the specification of B3.6 should be our common goal then.

		No proof for the stability of the 3.6 until today. Time to market to long and investment risk still to high – see experience of ERTMS implementation from the last 20 years. With current level of prices, rail freight will be bankrupted before all fleets are equipped.
18.	There is no business case for the Industry within OCORA	Is there a real business case if OBU migration take an additional 30 years? ➡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. ➡Long term business case is in the supply chain and services. 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 price allows for quicker fleet equipment and innovation create a business case for quicker evolution, there can be a win-win situation. In general, 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. Modularity will also imply interchangeability, opening up to larger volumes, with wider markets, even if margins will be reduced for each of these modules. There will be more trains to equip.
19.	Can you guaranty that RU´s will order OCORA within their tender and procurement?	Who can guarantee the decision on a private investment? ➡We can guarantee that it is the intention. OCORA is aiming to deliver sufficient specifications allowing for predictable quality and performance. With this we will form an industrial standard which allows for scale economies, both, for suppliers and customers
20.	Delivering an integrated solution of ATO with ETCS is much easier, quicker and already give the necessary cost reduction.	How would you propose to manage the performance (and value for operation) of 2 integrated subsystems when they don’t have the same level of maturity? Cost reduction for RUs and increase in capacity for railway What about the lifecycle cost, if there is a update? What about being flexible? What about shorter time to market?

		What about standardization on the long term? Integrated solutions are hardly maintainable and might probably not allow to go for GoA4.
21.	OCORA will not allow for mature products before a decade, can ERTMS deployment wait for OCORA?	Is there today a business case for RUs to deploy ERTMS? ➡The slow take-off of ERTMS deployment ERTMS is not due to OCORA. ➡Our intent is to have mature OCORA products within 5 years. We expect that OCORA will boost the development, since it is delivering a reference set of specification and the necessary open platform to integrate future products. Same reasoning applies to any ERTMS game changers. OCORA won't stop everything, the current deployment work must be continued. OCORA allows parallel work to be carried out to modernize the system
22.	OCORA and modularity will harm European signaling industry, is this acceptable from a European industry competitiveness perspective?	Why couldn't we find a win-win business model with OCORA? See Answer to Question 7. OCORA is about promoting the industry and allowing manufacturers to concentrate on their core competencies. It should create new business case with less risk.
23.	OCORA is questioning investment already done in ERTMS and rolling stock, how can this be acceptable for ERTMS early birds?	Why would there be a risk for early birds? ➡Early birds in ERTMS on-board are facing two challenges: upgrade from B2 to B3 and the arrival of FRMCS. ➡The question of evolutivity of those early bird product 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 OCORA is not touching any investment. OCORA is not a risk. OCORA is just a chance for future standardized technology. OCORA is not affecting investment done but offers alternative migration path to a digital railway
24.	By defining detailed specification OCORA will kill any possibility to innovate and optimize industrialization.	What innovation would be jeopardized by an OCORA based approach? ➡OCORA is aiming at the opposite: open area of innovations in building blocks while managing interfaces and the on-board architecture. OCORA modularity, allows many innovations to emerge (autonomous localization module, new technology for environment perception…). Moreover, modularity allow different maturity

		paths for product, therefore helps industrialization and migration
25.	What are your use cases for RUs with OCORA?	➡ATO and Localisation for Train holders? Use the benefits of Automation to increase productivity, capacity and quality. Stabilize ETCS Baseline 3.
Infrastructure Managers:		
26.	We rollout the infrastructure with ETCS/ATO and ETCS/ATO Onboard will be anyway part of the rollout and paid by the ministry.	Have you certainty about 100% funding for RUs? ➡The Ministry cannot pay for all private RUs ➡RUs/vehicle holders are in direct competition ➡Engineering cooperations like OCORA What about lifecycle cost and updates? What about the investment risk? It is not the case in every country and not for all kind of RUs in particular international operators.
27.	If Germany will rollout ETCS/ATO incl. the Onboard there will “de facto standard” by rollout and paid by the ministry – no technical specification of OCORA is necessary.	How could this allow a modal shift in EU and better railway economic performance? ➡This is not a technical solution and will be forced by one European player. We need both – a technical strategy and strong rollout. What about the updates after the rollout with new technologies e.g. ATO GoA 4? Localization? ➡It is FRMCS If a German standard emerge, it will be put at risk by other national roll out, therefore over next year will need evolution. OCORA is about risk mitigation for all national roll out.
28.	The version 3.6.0 is now stable and functionally complete. We don’t want to touch it again.	How do you plan to manage GSM-R? ATO? Do you plan to implement L3? ➡FRMCS starts in 2030 for roll-out. You need to consider it even. See SBB moratorium – no further investment in Baseline 3 for B2 upgrades, if there is no solution for modularity, upgradeability, etc. 3.6.0 needs to be changed for GSM-R obsolescence. OCORA will anyhow be compatible with 3.6.0
29.	Who will take the responsibility of the OCORA spec and software?	What is the role you would expect from RUs, IMs, suppliers, authorities and standardization bodies. ➡The railway sector if OCORA is globally adopted Same as today. OCORA is just a set of specification. Nothing will change? This is about vehicle life cycle responsibilities and about sector organization. Fleet owners should lead and own specifications over time. Software maintenance could be managed by an open source community or specific suppliers.

30.	We will a quick 3.6. rollout. If you come now with OCORA the rollout will be again delayed.	Why would you see a risk that OCORA will impact the rollout if there is a local business case to implement already developed 3.6 products? ➡same Answer as 30 OCORA is an opportunity for a cheaper on board roll out and shall not affect IMs deployment
31.	Can OCORA help equipping yellow fleets?	Yes with a major concern on CAPEX for the yellow fleet. Current solutions are not adapted for yellow fleet. OCORA is an opportunity for simpler fitment of yellow fleet.
Railway Undertakings:		
32.	I equipped my S-Bahn fleet (Closed System) with ETCS and no modification was necessary until today. Why do I need OCORA?	FRMCS, ATO are coming. Further digital innovation can be expected. Increasing capacity by improving of braking curves, ATO GoA 4, … You don't need it now but further evolution of ERTMS will probably be a case for using OCORA specifications
33.	OCORA will increase the procurement cost and will make a quick integration complication. Why do I need OCORA?	Why do you consider that OCORA will increase cost? ➡You need OCORA to manage the evolution that endanger your business Scale effect can only decrease cost. Architecture can further decrease cost.
34.	What do i have after 2 years in my hand, if I join OCORA?	What will you have if you are not collaborating? ➡In 2022, you may have a new way of tendering CCS on-board product in an open competition You will have after 2 years a set of advanced specification which you can use for your tendering for free from RU engineering experts. A partial set of proven specification, and access to expertise.
35.	Is there a business case of OCORA investment for regional, high speed and cargo?	Yes, cases are to be collectively modeled. Yes, since it is about reduction of total cost of ownership and reduction of investment risk. Business model shall be worked out until the first release. For any vehicle there can be a specific business case, especially depending on performance / functional needs.
36.	Who takes the responsibility of system integration, life cycle management, obsolescence management, … if I order OCORA?	How would you like to manage the related responsibilities? ➡IVV is central for OCORA. No spec without its IVV means. Same as today. OCORA is just a set of specification. No changing of the process. Vehicle Supplier would provide a gateway to standardized OCORA bus. CCS supplier would provide CCS equipment. Some modules could be purchased to specific manufacturers. Responsibilities and maintenance is a question of

		the specific contracting and internal RU/ECM organization.
37.	Who will ensure, that OCORA will available and maintained during the vehicle lifecycle?	Do you have already such a guarantee for a decent price? ➡The sector (UIC, EUG) or OCORA Members themselves Same as today. OCORA is just a set of specification. No changing of the process. OCORA is a set of specification supporting a reference architecture not the product.
38.	If open source is used, will the RU be responsible for the safety and performance of the purchased train?	No ➡Same as for closed source. There is no difference between closed and open source with respect of responsibility, process, certification, … its always the same. All engineering rules remains for closed and open source. Open source will be just under more control und public eyes. Suppliers can be made responsible of the use of open source. Open source before all give guarantee on software quality.
39.	When a service contract for the rolling stock maintenance is in place, how OCORA could be implemented?	What are the difficulties you foresee? If a service contract is in place, it should be easy to ask for an evolution to get a gateway installed. Installation of OCORA compliant equipment.
40.	I need to equip my train in 5 years' time with ERTMS due to deployment constraints (class B decommissioning), will OCORA be ready and mature?	What would be your baseline scenario? How would you qualify maturity? ➡Yes (We need an OCORA generic planning) That's the goal of OCORA. To shorten time to market. In 5 years, current ERTMS hardly deliver. With OCORA, we can expect a platform to be ready but might not encompass all function (e.g. ATO or FRMCS)
41.	If CCS and LOC&PAS domains are split, who will be responsible in case of accident due to a malfunctioning of CCS component?	How do you manage IC today? ➡They are split in integration (IVV activity) This a about contracting. In general architecture should help to know the root cause of failures and therefore facilitate responsibility management. This point needs to be further discussed with Authorities.
42.	Is there an opportunity with OCORA to add new functionality in the train (e.g. energy management, cyber security…)?	Yes OCORA as an open platform allow to envisage innovative software application and new safety related device to be installed on the trains.
43.	You only talk about LCC. How can OCORA guaranty reduction of CAPEX?	➡Simplification of the architecture CAPEX will be reduced by competition through standardization and openness.

44.	How can OCORA guarantee that we get robust operations with ERTMS and ATO?	By using standards, it will help to stabilize systems. By sharing resources, it will help to join forces to improve systems and stabilize them. By being open it helps to join all interested forces to improve and stabilize a system.

Table 1 OCORA Questions and Answers