OCORA

Open CCS On-board Reference Architecture

Synchronisation Concept

Operational Data

Document ID: OCORA-TWS01-250

Version: 1.0

Date: 31.01.2025

Revision History

Version	Change Description	Initials	Date of change
1.0	First official version, published in OCORA R6	CG	31.01.2025

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References

Reader's note: please be aware that the document ids in square brackets, e.g. [OCORA-BWS01-010], as per the list of referenced documents below, are 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.

[OCORA-BWS01-010] – Release Notes

[OCORA-BWS01-020] – Glossary

[OCORA-BWS01-040] – Feedback Form

[OCORA-BWS03-010] - Introduction to OCORA

[OCORA-TWS01-030] – System Architecture

[OCORA-TWS01-035] – CCS-On-Board Architecture

[OCORA-TWS02-030] – OCORA Addendum to SUBSET-147

[OCORA-TWS04-010] - Functional Vehicle Adapter – Introduction

[OCORA-TWS04-015] - Addendum to SUBSET-119

[OCORA-TWS04-016] - Addendum to SUBSET-139

[SUBSET-119] – ERTMS/ETCS – Train Interface FFFIS

[SUBSET-139] - ERTMS/ATO - ATO-OB / ROLLING STOCK FFFIS APPLICATION LAYER

[SUBSET-147] – ERTMS Data Applications – FFFIS part: CCS Consist Network Communication Layers

1 Introduction

1.1 Purpose of the document

The purpose of this document is to provide a proposal how data that is used in different building blocks, but can be provided from different sources, is synchronised. This to ensure that the different building blocks adopt the same values for a specific variable independently from which source the value was provided. Furthermore, the proposal covers a convenience demand from drivers, preventing that they have to enter the very same information in different systems. The latter being also an error prone process.

This OCORA document is intended to be used in tenders for new vehicles, or CCS on-board systems, or one of its building blocks. In the latter case, typically as enhancement or replacement in existing legacy vehicles. This document is based on the architecture described in the CCS On-Board Architecture document [OCORA-TWS01-035] .

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. Feedback to this document and to any other OCORA documentation can be given by using the feedback form [OCORA-BWS01-040].

1.2 Applicability of the document

This document is applicable for integration of CCS on-board into vehicles. It covers the aspect of having the very same data being needed in different building blocks while it can be provided from different channels.

Furthermore, the proposal provides a possible solution to the Swiss NNTR "CH-TSI CCS-032" (single entry for train running number in ETCS on-board and CabRadio).

1.3 Context of the document

This document is published as part of an OCORA Release, together with the documents listed in the Release Notes [OCORA-BWS01-010]. All abbreviations and terms used are defined in the Glossary [OCORA-BWS01-020].

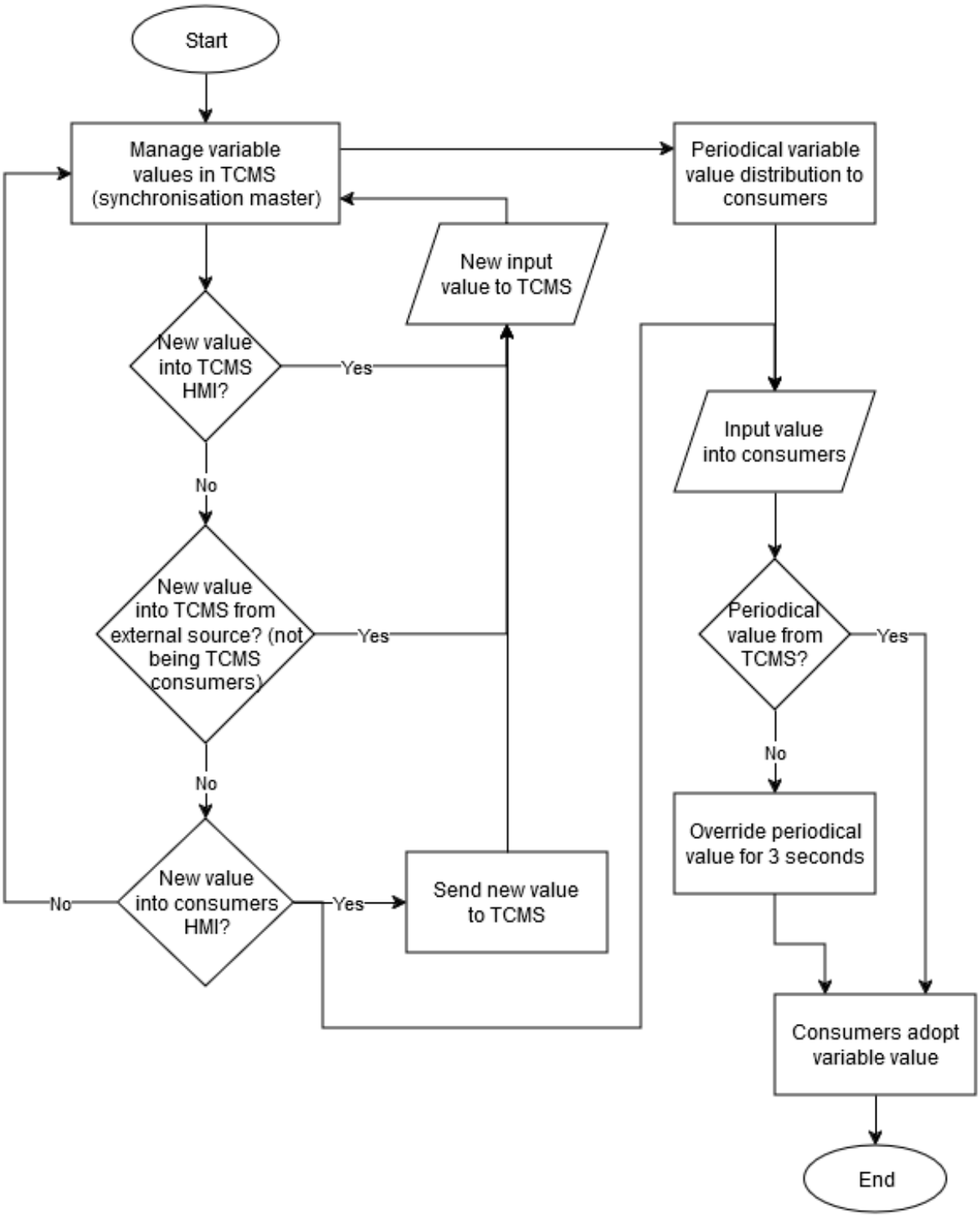
2 Concept

This chapter describes a concept on how operational data (the term "data" will be used in subsequent references) can be synchronised between different building blocks (systems), while the data itself can have different sources (e.g. TCMS, Driver, CVR, RBC, Class B System, etc.). This concept shall ensure a standardised implementation of this synchronisation, consistent data over the different building blocks (systems), and improve driver convenience.

The main principle of the concept is to have a common synchronisation master where the data is centrally collected, and from where it is then distributed to the different consumers. The consumers shall adopt the data distributed by the synchronisation master.
It is proposed to determine the TCMS as being the synchronisation master, this in alignment with [SUBSET-119] where it is defined that the train running number and other operational data shall be provided from TCMS to the ETCS on-board.
The TCMS, acts as the synchronisation master and distributes the data to all different consumers (e.g. ETCS-OB, CVR). This means that the consumers regularly receive (by means of "process data") the needed data from the TCMS.

Conceptually the solution could be implemented as follows:

- When the TCMS receives a new value from an external source (not being one of the consumers to which the TCMS distributes the data) or from the driver through the TCMS human machine interface, then the data is directly adopted by the TCMS (as the synchronisation master) and from there distributed to the different consumers (e.g. the ETCS on-board, CVR, etc.) needing it.
- When a consumer changes a value, the new value is simultaneously sent to the TCMS and adopted by the consumer, temporarily overriding the specific variable received periodically from the TCMS for a duration of 3 seconds (It is assumed that during this time period, the TCMS will adopt the new value and redistribute it to all consumers). When the 3 seconds have elapsed the consumer shall return to use the data distributed from the TCMS.


Start
Manage variable values in TCMS (synchronisation master)
Periodical variable value distribution to consumers
New input value to TCMS
New value into TCMS HMI?
Yes
No
Input value into consumers
New value into TCMS from external source? (not being TCMS consumers)
Yes
Periodical value from TCMS?
Yes
No
No
Override periodical value for 3 seconds
New value into consumers HMI?
No
Yes
Send new value to TCMS
Consumers adopt variable value
End

3 Solution

From a data packet perspective the solution shall be implemented as follows:

- The data packets are based on the concept and definitions of [SUBSET-119].
- For data where the TCMS is the synchronisation master, the TCMS implements data distribution packets from the TCMS to the different consumers. Within these data distribution packets the TCMS indicates by means of the validity indications if values of specific variables are active or not (aligned with the concept of [SUBSET-119]).
- The consumers implement the data distribution packets to adopt data being provided by the TCMS. Through these packets the synchronised data is received, consumers shall adopt it by also evaluating the validity indication (aligned with the concept of [SUBSET-119]).
- In addition, the consumers implement synchronisation data packets from the consumers to the TCMS (the synchronisation master). These synchronisation data packets are used in case a consumer receives through a different channel than the TCMS a new value for variables distributed by the TCMS (the synchronisation master). These synchronisation data packets also include validity indications (aligned with the concept of [SUBSET-119]).
- By default the validity indications in the synchronisation data packets are set to "invalid".
- When a consumer receives a new value (new data value) through a different channel than the TCMS, the variable value is inserted in the synchronisation data packet to the TCMS, and the validity indication for the correspondent variable is changed to "valid". The validity indication is changed to "valid" for a period of 1 second, after this time the validity indication is reset to "invalid".
- The TCMS implements the synchronisation data packets. By evaluating the validity indications, the TCMS recognises if new data is provided. If the validity indications declare a specific variable as "valid", the TCMS adopts the respective variable value and provides this information with the data distribution packets to the relevant consumers.

Note: the solution provides to the driver the freedom to enter new data in the system that best suits him operationally, while in the background the data is automatically synchronised between the relevant systems.

4 Requirements specification

This chapter defines requirements related to the data synchronisation mechanism for different building blocks.

4.1 Requirements for CVR

OCORA-10795 - Adopt Train Running Number from TCMS
The CVR shall adopt the Train Running Number obtained from the TCMS, as specified in the variable TR_OBU_NID_OPERATIONAL within “TR Packet 2” of [SUBSET-119].

OCORA-10796 - Provide entered Train Running Number to TCMS
The CVR shall inform the TCMS about a newly Train Running Number entered in CVR, by sending the telegram “OBU Packet Data_Synch” with the variable "TR_OBU_NID_OPERATIONAL" as specified in [Addendum to SUBSET-119].

OCORA-10797 - Adopt Selected Language from TCMS as operating language on CVR human machine interfaces
The CVR shall utilise the Selected Language obtained from the TCMS, as specified in the variable TR_OBU_NID_DRV_LANG within “TR Packet Driver_Information” of [Addendum to SUBSET-119].

OCORA-10798 - Provide Selected Language to TCMS as operating language for all human machine interfaces
The CVR shall inform the TCMS about the Selected Language newly chosen on the CVR human machine interface, by sending the telegram “OBU Packet Data_Synch” with the variable TR_OBU_NID_DRV_LANG as specified in [Addendum to SUBSET-119].

4.2 Requirements for ETCS on-board

OCORA-10799 - Implement interface as defined in [Addendum to SUBSET-119]
The ETCS on-board shall implement the interface to the TCMS as defined in [Addendum to SUBSET-119].

Note: this solution is also applicable in case the ETCS on-board receives a new train running number from the RBC.