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CCS onboard application
platform for trackside related
functions - COAT

WORKING HYPOTHESIS

1 Disclaimer

This document is a DRAFT version which is still under construction. Its content may change in the ongoing concept phase of smartrail 4.0. The document is not completely verified and is not finalized by now. The document is published to enable an open discussion of the ongoing work of the smartrail 4.0 program.

Links and references inside of this document may refer to other documents inside of the program smartrail 4.0, that may not be published at this stage.



2 Content

1	Disclaimer.....	1
2	Content.....	1
3	Introduction.....	2
3.1	As-is situation	2
3.2	Increasing demand onboard functionality.....	2
3.3	Initial assessment	3
4	Possible Solution.....	4
4.1	Vision	4
4.2	Initial architecture proposal.....	4
4.3	Initial homologation proposal	5
4.4	Subjects with a need for deeper analysis	5
4.5	Subjects where close cooperation applies	5
5	References	6
5.1	List of figures	6
5.2	List of tables.....	6
5.3	Appendices.....	6

3 Introduction

This document is about all trackside related command and control functions onboard rolling stock vehicles within the program smartrail 4.0. Hereunder we focus on the synergy potential, hence on the common needs of these functions. The functions itself are subject to other investigations within the program smartrail 4.0.

3.1 As-is situation

Digital vehicle equipment onboard rolling stock is increasing, same applies to the number of upgrades required and dependencies between functions. This is a general tendency, even without the program smartrail 4.0.

Today's investment, as well as operational costs for command and control systems vehicle equipment are several times higher than appropriate from a technical point of view. The main causes are: complex non-standardized vehicle architecture, special hardware for each function with very small product series, high integration risks and high approval efforts.

Currently railway undertakings are mainly requesting command and control system equipment (e.g. ETCS Level 2) by using functional requirements. This applies to both, new build and refitting projects. Equipment (hardware and software) is sourced including engineering, installation, commissioning and approval, while maintenance contracts usually cover the operational phase.

The prognosis and analysis of the increasing number and cost of upgrades, homologations and integration processes leads to a high risk, that the digitization and automation of the CCS onboard functionality will stagnate. Larger optimization potentials cannot be gained. Obsolete technologies cannot be exchanged. The today's lifecycle cost of these components reached a level that forces rolling stock undertakings to stop the functional optimization process. An advanced "upgradeability" is the only chance for a real digitization and automation. It is the only assurance for investors that their investments in CCS onboard functionality is safe.

3.2 Increasing demand onboard functionality

The program smartrail 4.0 requests functionality which needs to be made available onboard vehicles:

- ETCS Level 3 / Full moving block– automatic train protection based on moving block
- FRMCS – data- & voice radio (GSM-R successor)
- ATO – Automatic Train Operation on GoA2, later GoA3 and 4
- Virtual Balise / safe, precise und continuous mobile localization (GLAT project)
- Safe train length measurement including TIMS (full track occupation and train integrity)
- Cab signaling / full supervision / full moving block for shunting and fallback systems for ETCS L3 (MTC project)

Some of these functionalities are completely new, some are subsequent developments from nowadays existing systems. In addition, the program smartrail 4.0 requests fast migration concepts and a lean rollout process.

3.3 Initial assessment

There is no doubt that the increasing demand for onboard functionality from the program smartrail 4.0 cannot be served by using the same, known approach. Only a change and standardization in the vehicle architecture, including a modular approval strategy, will provide a solid basis. In the next chapter these aspects are drafted and subjects requiring deeper analysis are identified.

4 Possible Solution

4.1 Vision

The basic strategy is "software instead of special hardware". This vision is visualized as follows:



FIGURE 1 – VISION “SOFTWARE INSTEAD OF SPECIAL HARDWARE”

If a supplier today wants to develop or change a function for a mobile phone, the effort, the barriers to entry and the investment risk are many times lower, while the market, the amortization potential and competition has increased many times per product type.

4.2 Initial architecture proposal

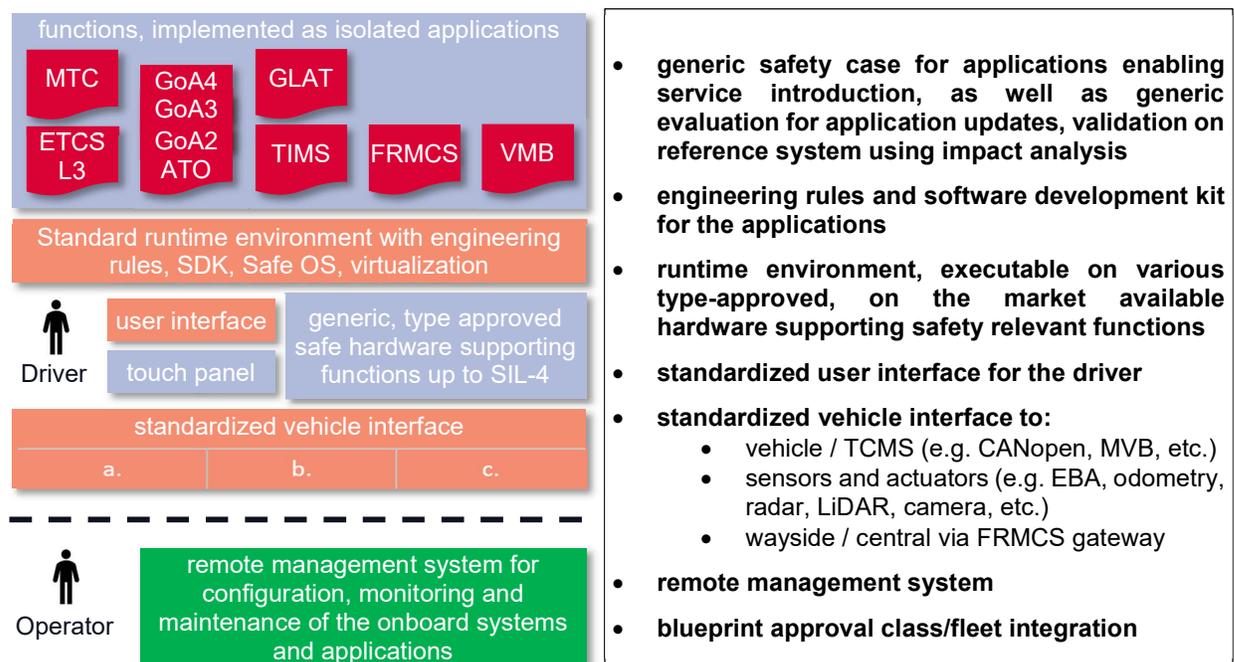


FIGURE 2 – CCS ARCHITECTURE FOR TRACKSIDE RELATED FUNCTIONS

4.3 Initial homologation proposal

The initial homologation proposal contains the following setup:

- Type approval for:
 - generic hardware
 - runtime environment
 - interfaces
 - remote maintenance
- Approval for class/fleet integration
- Generic safety case for applications enabling service introduction
- Generic evaluation for application updates - validation on reference system using impact analysis

4.4 Subjects with a need for deeper analysis

The following subjects have been identified to require deeper analysis and initial set of questions:

homologation concept	<ul style="list-style-type: none"> • identification of conflicts between a modular, capsuled homologation concept and the existing common safety methods • definition of homologation concept • proof of concept • safety concept in line with the program smartrail 4.0
runtime environment	<ul style="list-style-type: none"> • availability of suitable solutions • security concept in line with the program smartrail 4.0
Hardware supporting functions up to SIL-4	<ul style="list-style-type: none"> • availability of suitable products
vehicle interfaces	<ul style="list-style-type: none"> • inventory of currently used interfaces between CCS and vehicle • roadmap of in the future required interfaces • specification and European standardization of interfaces between CCS and vehicle
upgradeability and maintenance	<ul style="list-style-type: none"> • identification of requirements to ensure upgradeability • definition of maintenance concept • proof of concept • availability of suitable remote maintenance solutions
user interface	<ul style="list-style-type: none"> • inventory of already existing standards for applications like ETCS and ATO • definition of user interface guideline
business case	<ul style="list-style-type: none"> • comparison of investment cost and operational costs between a platform-based approach versus a non-platform-based approach.

TABLE 1 – SUBJECTS WITH A NEED FOR DEEPER ANALYSIS

4.5 Subjects where close cooperation applies

The following subjects have been identified to require close cooperation due to ongoing standardization activities or developments, both inside and outside the program smartrail 4.0: ETCS Level 3, openETCS initiative, FRMCS, TSI-CCS and ATO.

5 References

5.1 List of figures

Figure 1 – vision “software instead of special hardware”	4
Figure 2 – CCS architecture for trackside related functions.....	4

5.2 List of tables

Table 1 – subjects with a need for deeper analysis	5
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5.3 Appendices

Glossar smartrail 4.0