European Rail Infrastructure Managers EIM

Position Paper

ERTMS/FRMCS migration strategy

(what to include in the TSI CCS of 2022)

18 July 2019

Introduction

The railway community is since 2015 working on the standardisation of FRMCS. The development of the future radio system is one of the "game changers" identified in the ERTMS Longer Term Perspective document of ERA. The Control Command System Technical Specification for Interoperability (TSI CCS) will incorporate FRMCS as the successor of GSM-R as the radio system to be used for train-to-track voice communications and for ETCS data communication, also supporting new railway functionalities such as ATO.

The work on functional requirements, specifications and standards as well as harmonised spectrum solutions is taking place and is carried out by UIC. The objective is to update the TSI in 2022 with a full description of the standard.

The issue

When assessing the status of the work, EIM thinks that achieving the timeline for updating the TSI in 2022 is ambitious and jeopardised by the complexity of the standardisation work (delivering a complete specification including suitable migration schemes) and the acquisition of harmonised spectrum.

At the same time, we acknowledge that FRMCS can only successfully and timely be introduced if a suitable migration scheme is in place which preserves investments and considers legacy ERTMS (and GSM-R) systems already installed in trains and infrastructure.

Although the standardisation work on migration is in progress, we think that the position of the stakeholders of the railway sector is important:

1. There is a need to express the view of the sector on migration. It is important that the policy/regulatory makers (European Commission, ERA) have a good understanding of ambitions and target timelines of the sector;
2. The sector should provide guidance and governance on what to include in the upcoming CCS TSI in order to meet target timelines;
3. The specification work should be encouraged and supported.

In our view a smooth migration strategy is based on the following principles:

1. Migration of trains first, then infrastructure;
2. Realisation of a dual mode On-board architecture supporting GSM-R and FRMCS;
3. An early standardisation of the architectural framework and interfaces of the On-board considering potential long and diverse timelines of migration and life cycle management;
4. A sufficiently long period (e.g. 5 years) granted by the infrastructure manager regarding the implementation of FRMCS and GSM-R decommissioning.

As an example, some railways envisage that around 2025, an FRMCS service in the form of a public 5G network slice may provide an IP transport service with appropriate Quality of Service as a backup on some ERTMS tracks. Because trains will run on GSM-R and FRMCS infrastructure, a dual mode ETCS On-board is a necessity.

Timelines and plans for migration of ERTMS, EoG and FRMCS

The table below provides an overview of the different plans and provisional timelines of Infrastructure Managers and Railway Undertakings regarding the start of operational use of ERTMS, GSM-R (EoG) and FRMCS [1].

	ERTMS Deployment Start	GSM-R/EoG Deployment Start	FRMCS Deployment Start
Banedanmark	2018	2025	2030
Bane Nor	2022	2022	TBD
Trafik Verket	2020	TBD	2029
Finnish Transport Infrastructure	>2030	n.a.	>2030
ProRail	2022	2022	2029
SNCF	2014 – 2025	2025	2030
Infrabel	2020	2025	2030
Network Rail	2022	2022	2025
HS2	2022	2022	National Plan aligned with Network Rail
Adif	2000	TBD	TBD
PKP PLK S.A.	2021	2024	TBD

Table 1 Deployment planning of ERTMS, EoG and FRMCS

Requirements for migration

Requirements on functionality have been developed by ERTMS User Group and UIC. We support their views and want to highlight **our major requirements related to migration**:

1. The On-board shall support enhancements of the EURORADIO protocol stack as detailed by the ERTMS User Group:
    a. Decoupling of ERTMS application and communication platform, supporting an independent evolution of application and communication in terms of functionality, security and architecture. The communication platform should support upgrades without impact on application level;
    b. Automatic handling of network registration and handover;
    c. Update of ETCS authentication procedures avoiding reauthorisation of the full ETCS application.
2. The On-board shall support GSM-R and FRMCS (dual mode operation);
3. The On-board encompasses a modular and flexible architecture which is future proof and requires minimal certification effort in case of modifications and enhancements;
4. The On-board shall support standardised and off the shelf FRMCS transport services (IP message transfer), Quality of Service support (guaranteed delivery of messages) and bearer flexibility;
5. The On-board shall support adequate measures for protection against cybersecurity threats.

[1] *Note that timelines in the table are indicative and the scope of implementation of ERTMS (geographical footprint) varies from country to country.*

The above requirements are applicable for new On-boards during the migration phase.

For existing ETCS On-boards, changes should be kept to a minimum, hence preserving a minimal impact on train operation. Depending on the remaining lifetime and update cycle of the On-board, it could be beneficial not to change the ERTMS part of the On-board. This means that the EVC functionality and EURORADIO stack remain unchanged. Only the On-board communication platform should be changed.

To preserve Infrastructure Managers' investments, FRMCS migration will also be performed minimising impact on ETCS trackside constituents already in service. To achieve this, a detailed migration and on-trackside integration plan must be provided aligned with the timeline of next CCS TSI update.

On-board architecture solutions

UIC has recognised the importance of migration and of the On-board architecture and established the Telecom On-board Architecture Working Group. The TOBA WG has proposed several solutions/variants for the On-board architecture.

There are three main solutions which are depicted in the chart below. These main "principle" solutions correspond to variants developed by TOBA, but are presented in a more abstract form, showing the essentials with less technical detail.

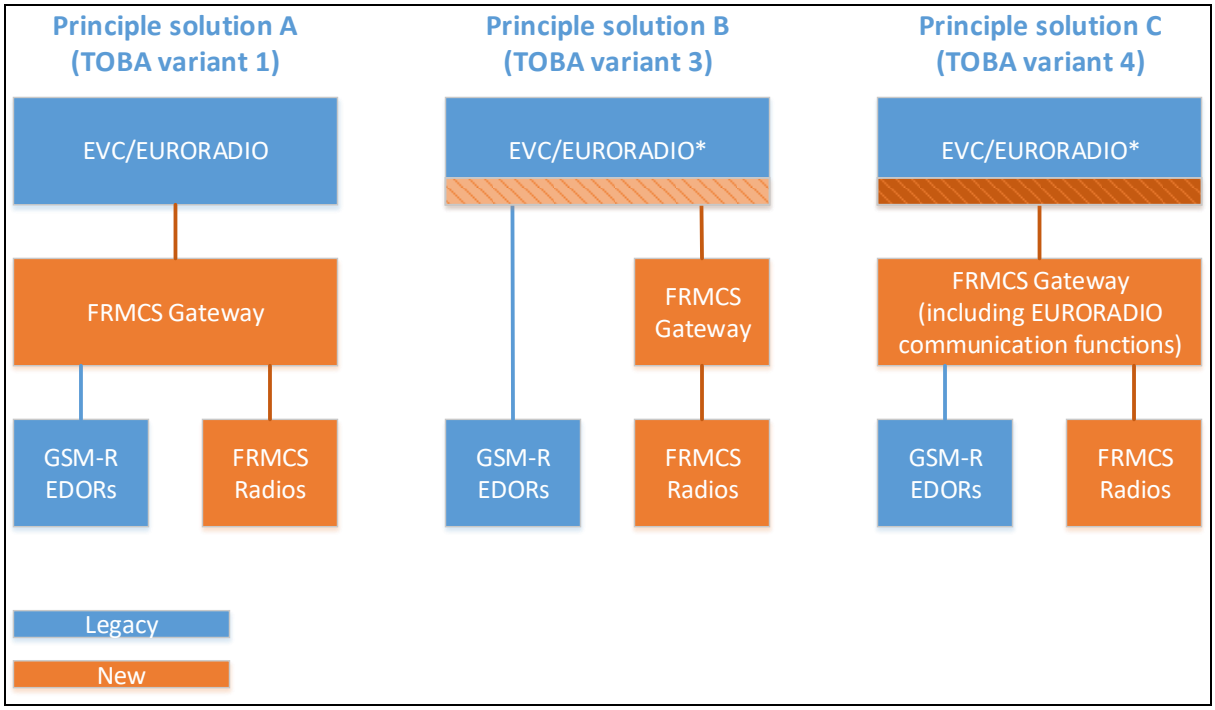

Chart 1 ERTMS/FRMCS On-board architecture "principle" solutions (abstract presentation of TOBA variants)

Principle solution A: in this solution the FRMCS Gateway takes control over GSM-R and FRMCS. The most distinctive factor here is that the EVC/EURORADIO functionality is not touched, which makes this solution *a priori* suitable for existing ETCS On-boards. Another advantage is that cybersecurity functions could be performed by the Gateway, enhancing current (inadequate) GSM-R security functions.

Principle solutions B and C are suitable for new ETCS On-boards. EURORADIO functionality is changed in both solutions.

Principle Solution B: keeps EURORADIO in the ETCS domain but simplifies interworking with GSM-R EDORs compared to Solution A.

Principle solution C: full bearer management of GSM-R and FRMCS is performed by the FRMCS Gateway and EURORADIO communication functions are shifted towards it.

A detailed technical and economic survey of the solutions (including voice and ATO) is required to evaluate which one is most appropriate considering certain migration scenarios.

EIM Proposal

1. The CCS TSI should support a migration strategy based on the principle of migrating the On-board first and then the infrastructure, i.e.: dual mode operation.
2. In order to facilitate migration towards FRMCS the CCS TSI should be updated with a specification of the ERTMS/FRMCS On-board (reference architecture including interfaces) and network transport services required for ETCS.
3. To facilitate and complete the migration towards FRMCS before GSM-R becomes obsolete, the upgrade of the CSS TSI should take place in 2022 and not be further delayed beyond that date. From that date onwards, vehicle owners could prepare for implementation of ERTMS/FRMCS On-boards without investment loss while facilitating and encouraging migration towards FRMCS.
4. A single reference architecture for the On-board (including standardised interfaces) is required. However, flexibility should be provided to facilitate migration of existing ETCS On-boards in legacy trains.
5. FRMCS migration should be performed taking into account preservation of investment for both On-board and for ETCS trackside constituents already in service.
6. A detailed technical and economic survey of potential On-board solutions is required. The evaluation should be carried out in short term in order to meet the 2022 milestone.

EIM invites ERA to adopt these recommendations and we will continue supporting the Agency in the identification and inclusion of the necessary changes in the 2022 CCS TSI update.

****

For information please contact:

Bardo Schettini Gherardini
Manager Policy & Technical Operations
bardo.schettini@eimrail.org

EIM, the association of European Rail Infrastructure Managers, was established in 2002 to promote the interests and views of the rail independent infrastructure managers in Europe, following the liberalisation of the EU railway market. It also provides technical expertise to the appropriate European bodies such as the European Union Agency for Railways. EIM's primary goal is promoting growth of rail traffic and the development of an open sustainable, efficient, customer orientated rail network in Europe. For more information, visit www.eimrail.org or follow us on Twitter: @EIMrail