Draft **ETSI TS 103 765-3** V1.0.0 (2025-07)

TECHNICAL SPECIFICATION

**Rail Telecommunications (RT);
Future Railway Mobile Communication System (FRMCS);
Building Blocks and Functions;
Part 3: Train On-Board functions and interfaces**

Reference

DTS/RT-0085

Keywords

FRMCS, interface, protocol, railways

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00   Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

Important notice

The present document can be downloaded from the
ETSI Search & Browse Standards application.

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format on ETSI deliver repository.

Users should be aware that the present document may be revised or have its status changed,
this information is available in the Milestones listing.

If you find errors in the present document, please send your comments to
the relevant service listed under Committee Support Staff.

If you find a security vulnerability in the present document, please report it through our
Coordinated Vulnerability Disclosure (CVD) program.

Notice of disclaimer & limitation of liability

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.
No recommendation as to products and services or vendors is made or should be implied.
No representation or warranty is made that this deliverable is technically accurate or sufficient or conforms to any law and/or governmental rule and/or regulation and further, no representation or warranty is made of merchantability or fitness for any particular purpose or against infringement of intellectual property rights.
In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

Copyright Notification

ETSI

Contents

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI IPR online database.

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™**, **LTE™** and **5G™** logo are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM**® and the GSM logo are trademarks registered and owned by the GSM Association.

Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Railway Telecommunications (RT) and is now submitted for the combined Public Enquiry and Vote phase of the ETSI Standardisation Request deliverable Approval Procedure (SRdAP).

The present document is part 3 of a multi-part deliverable covering Building Blocks and Functions for the Future Railway Mobile Communication System (FRMCS), as identified below:

    Part 1:   "Transport Stratum";

    Part 2:   "Service Stratum";

    Part 3:   "Train On-Board functions and interfaces";

    Part 4:   "Trackside functions and interfaces";

    Part 5:   "User Equipment (UE) capabilities".

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

1 Scope

The present document specifies the interfaces of the On-Board FRMCS enabling either interaction with On-Board applications or with FRMCS entities outside the train. The present document also specifies the On-Board Multipath Function and a set of procedures the On-Board FRMCS will need to conform to.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found in the ETSI docbox.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long-term validity.

The following referenced documents are necessary for the application of the present document.

[1]   ETSI TS 103 765-1: "Rail Telecommunications (RT); Future Railway Mobile Communication System (FRMCS); Building Blocks and Functions; Part 1: Transport Stratum".

[2]   ETSI TS 103 765-2: "Rail Telecommunications (RT); Future Railway Mobile Communication System (FRMCS); Building Blocks and Functions; Part 2: Service Stratum".

[3]   ETSI TS 103 765-5: "Rail Telecommunications (RT); Future Railway Mobile Communication System (FRMCS); Building Blocks and Functions; Part 5: User Equipment (UE) capabilities".

[4]   ETSI TS 103 793: "Rail Telecommunications (RT); Future Railway Mobile Communication System (FRMCS); Radio Characteristics".

[5]   UIC FFFIS-7950 (V2.1.0): "FRMCS FFFIS Form Fit Functional Interface Specification".

[6]   IETF RFC 6960: "X.509 Internet Public Key Infrastructure, Online Certificate Status Protocol - OCSP".

[7]   IETF RFC 9654: "Online Certificate Status Protocol (OCSP) Nonce Extension".

[8]   IETF RFC 6066: "Transport Layer Security (TLS) Extensions: Extension Definitions".

[9]   IETF RFC 6961: "The Transport Layer Security (TLS) Multiple Certificate Status Request Extension".

[10]   IETF RFC 8555: "Automated Certificate Management Environment (ACME)".

[11]   IETF RFC 7030: "Enrollment over Secure Transport".

[12]   ETSI TS 133 180 (V18.1.0): "LTE; Security of the Mission Critical (MC) service (3GPP TS 33.180 version 18.1.0 Release 18)".

[13]   ETSI TS 124 282 (V18.10.0): "LTE; Mission Critical Data (MCData) signalling control; Protocol specification (3GPP TS 24.282 version 18.10.0 Release 18)".

[14]   ISO 8601 (2019): "Date and time — Representations for information interchange".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long-term validity.

The following referenced documents may be useful in implementing an ETSI deliverable or add to the reader's understanding, but are not required for conformance to the present document.

[i.1]   UIC FRMCS SRS: "FRMCS System Requirements Specification".

[i.2]   ETSI TR 103 791: "Rail Telecommunications (RT); Future Railway Mobile Communication System (FRMCS); Terminology for FRMCS specifications".

[i.3]   GSMA™ SGP.21 V3.1: "RSP Architecture".

[i.4]   GSMA™ SGP.22 V3.1: "RSP Technical Specification".

[i.5]   ETSI TS 124 229 (V18.7.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; 5G; IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3 (3GPP TS 24.229 version 18.7.0 Release 18)".

[i.6]   ETSI TS 103 764: "Rail Telecommunications (RT); Future Railway Mobile Communication System (FRMCS); System Architecture".

3   Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI TR 103 791 [i.2] and the following apply:

OB$_{APP}$ Application Context: context maintained by the On-Board FRMCS for an application instance (identified by the OB$_{APP}$ Application Tuple), in between registration and de-registration

OB$_{APP}$ Application Tuple: tuple of appCategory, staticId, couplingMode

NOTE: As specified in UIC FRMCS FFFIS-7950 [5], clause 9.10.1.

service continuity: capability of the FRMCS system to maintain the communication service for the user in an acceptable level during the Inter-FRMCS-Domain Transition

Serving FRMCS Transport/Service Domain: FRMCS Transport/Service Domain which is currently carrying/serving the communications of applications of Type I (IM interoperable applications)

NOTE: In the Inter-FRMCS-Transport-Domain transition procedure, this is the FRMCS Transport/Service Domain before the transition takes place.

Serving On-Board FRMCS Radio Module: On-Board FRMCS Radio Module carrying in the Serving FRMCS Transport Domain at least the active communication services for applications of Type I (IM interoperable applications) with service continuity requirement

Target FRMCS Transport/Service Domain: FRMCS Transport/Service Domain which is the target of network transition for applications of Type I (IM interoperable applications)

NOTE: At the completion of network transition (from GSM-R or from a previous FRMCS Domain), the Target FRMCS Domain becomes the Serving FRMCS Domain.

Target On-Board FRMCS Radio Module: On-Board FRMCS Radio Module which is intended to be attached to the Target FRMCS Transport Domain following the FRMCS domain transition

NOTE:　　At the completion of network transition (from GSM-R or from a previous FRMCS Domain), the Target On-Board FRMCS Radio Module becomes the Serving On-Board FRMCS Radio Module in the new FRMCS Domain.

3.2　　Symbols

Void.

3.3　　Abbreviations

For the purposes of the present document, the following abbreviations apply:

ACME	Automated Certificate Management Environment
API	Application Programming Interface
CellID	Cell IDentifier
EST	Enrollment over Secure Transport
FA	Functional Alias
FCOP	FRMCS Close of OPeration
FFFIS	Form Fit Functional Interface Specification
FOAP	FRMCS On-Board Application Profile
FRMCS	Future Railway Mobile Communication System
FROP	FRMCS Railway On-Board Profile
FSOP	FRMCS Start of OPeration
GNSS	Global Navigation Satellite System
GSMA	GSM Association
GSM-R	Global System for Mobile Communications - Railway
HSM	Hardware Security Module
HTTP	Hyper Text Transfer Protocol
ID	Identity
IdM	Identity Management
IETF	Internet Engineering Task Force
IFDT	Inter FRMCS Domain Transition
IFSDT	Inter-FRMCS Service Domain Transition
IM	Infrastrcuture Manager
IMS	IP Multimedia Subsystem
IP	Internet Protocol
ISO	International Organisation for Standardisation
JSON	JavaScript Object Notation
MC	Mission Critical
NTT	Network Transition Trigger
OCSP	Online Certificate Status Protocol
PLMN	Public Land Mobile Network
RFC	Request For Comments
RSP	Remote SIM Provisioning
SDS	Short Data Service
SIM	Subscriber Identity Module
SIP	Session Initiation Protocol
SRS	System Requirment Specification
SSE	Server Sent Events
TLS	Transport Layer Security
TPM	Trusted Platform Module
UIC	International Union of Railways
UTC	Coordinated Universal Time

4　On-Board FRMCS reference points

4.1　Background

This clause covers the external reference points of the On-Board FRMCS (see Figure 4.1-1) as defined in UIC FRMCS SRS [i.1].
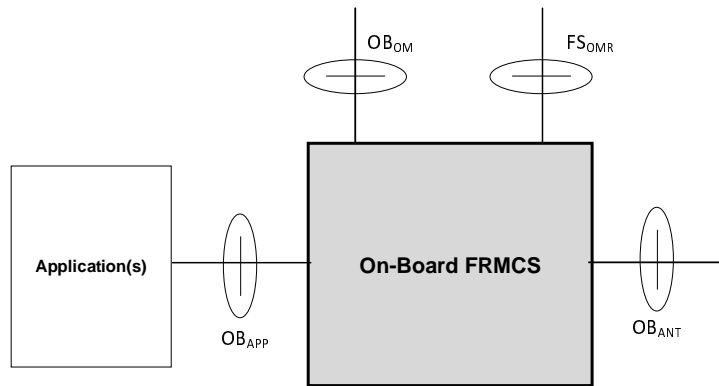
Figure 4.1-1: On-Board FRMCS external reference points

4.2　OB$_{App}$

The on-board communication system will interact with several on-board applications. Due to this, the interface OB$_{APP}$ has to ensure the proper handling and management of the interconnected applications and grant access to the communication services provided taking into account the priority and quality of service profile requested by those applications.

The OB$_{APP}$ reference point is fully specified in UIC FRMCS FFFIS [5]. The behaviour expected from the On-Board FRMCS in relation with the OB$_{APP}$ is specified in clause 7.3.

4.3　FS$_{OMR}$

4.3.1　Introduction

The present document only covers a subset of FS$_{OMR}$ functionality defined in UIC FRMCS SRS [i.1], namely those for the purpose of obtaining FRMCS Railway On-Board Profile (FROP) and FRMCS On-Board Application Profile (FOAP).

4.3.2　Profiles management

The FS$_{OMR}$ enables profiles management in FRMCS for the On-Board FRMCS across three essential functionalities:

- SIM profile management.

- TLS certificates management.

- Management of other profile information.

For SIM profile management, the functionalities are delegated to individual On-Board FRMCS Radio Modules using the GSMA Remote SIM Provisioning architecture (see GSMA SGP.21 [i.3] and GSMA SGP.22 [i.4]), as specified in ETSI TS 103 765-5 [3], clause 4.1.2.

For TLS certificates management, the On-Board FRMCS shall support:

- For certificates revocation checking:

  - The Online Certificate Status Protocol (OCSP) with extensions as specified in IETF RFC 6960 [6] and IETF RFC 9654 [7].

  - OCSP stapling as specified in IETF RFC 6066 [8] and IETF RFC 6961 [9].

- For automated certificate lifecycle management, one of the following protocols:

  - Automated Certificate Management Environment (ACME), as specified in IETF RFC 8555 [10].

  - Enrollment over Secure Transport (EST), as specified in IETF RFC 7030 [11].

NOTE: For automated certificate lifecycle management, the choice of protocols reflects that different railway organizations can have different approaches on this matter.

For management of other profile information, the On-Board FRMCS need to implement a MCData client with support for establishment of MCData IPcon connectivity and MCData Short Data Service.

The MCData client for FS_{OMR} within the On-Board FRMCS shall:

- Support the MCData client general procedures for SDS as specified in ETSI TS 124 282 [13], clauses 9.2.1.2 and 9.2.1.3.

- Support the MCData client terminating procedures for Standalone SDS using signalling control plane as specified in ETSI 124 282 [13], clause 9.2.2.2.2.

4.4   OB$_{ANT}$

The present document does not specify the OB$_{ANT}$ reference point or its use within an On-Board FRMCS.

4.5   OB$_{OM}$

The present document does not specify the OB$_{OM}$ reference point or its use within an On-Board FRMCS.

5   On-Board FRMCS general requirements

5.1   On-Board FRMCS Radio Modules

An On-Board FRMCS Radio Module shall comply with ETSI TS 103 765-5 [3], clause 4.

An On-Board FRMCS Radio Module shall comply with ETSI TS 103 793 [4], clauses 4 and 6.

5.2   Location and positioning

5.2.1   Generalities

The On-Board FRMCS is expected to provide location information based on three possible sources: cellular network, GNSS and external sources. Obtaining information from external sources is out of scope of the present document.

5.2.2   Functional requirements

The On-Board FRMCS shall be equipped with a GNSS receiver.

The GNSS receiver of the On-Board FRMCS shall be able to receive at least two satellite constellations.

The On-Board FRMCS shall be able to obtain CellID information from each of its On-Board FRMCS Radio Modules.

NOTE: The present document does not specify the criteria to select one CellID among several different ones received by the On-Board FRMCS Radio Modules.

5.3   Profile Storage

The support of Loose-Coupled Applications by an On-Board FRMCS and the distribution of functionalities between the MC Clients within the On-Board FRMCS on the one hand and the On-Board FRMCS Radio Module(s) on the other hand imply that the On-Board FRMCS has to store and manage sensitive information (such as credentials) that would traditionally be stored within a SIM card.

The On-Board FRMCS shall be equipped with a secure enclave, i.e. a tamper resistant secure hardware component (e.g. TPM, HSM) or equivalent storage protection mechanisms.

NOTE 1:   The present document does not specify specific requirements on the implementation of the secure enclave.

The On-Board FRMCS shall store at least the following elements in the secure enclave:

- Credentials associated with each MC User ID required by supported On-Board Loose-Coupled Applications.

- IMS/SIP Core credentials associated with each MC User ID required by supported On-Board Loose-Coupled Applications.

NOTE 2:   The Voice Application Service or other Tight-Coupled Applications are expected to be equipped with their own secure profile storage capabilities.

The credentials shall be integrity protected within the On-Board FRMCS secure enclave. The long-term key(s) of the subscription credential(s) shall be confidentiality protected within the On-Board FRMCS secure enclave. The long-term key(s) of the subscription credential(s) shall never be available in the clear outside of the secure enclave. The authentication algorithm(s) that make use of the subscription credentials shall always be executed within the secure enclave.

6   On-Board Multipath Function

An On-Board FRMCS supporting FRMCS Multipath shall:

- Implement a Multipath Client as specified in ETSI TS 103 765-1 [1], clause 5.3.5.

- Comply with the procedures related to the Multipath Client as specified in ETSI TS 103 765-1 [1], clause 5.3.7.

7   On-Board FRMCS procedures

7.1   General procedures

7.1.1   FRMCS Start of Operation

The FRMCS Start of Operation (FSOP) procedure is supporting the transition of On-Board FRMCS operational mode from the train power-up until the moment On-Board FRMCS is in FRMCS Domain availability state. The procedure describes the expected behaviour from On-Board FRMCS and FRMCS Domain upon power-up of the train and the attempt from an On-Board FRMCS to acquire the FRMCS Domain.

Pre-requisite: The On-Board FRMCS knows the FRMCS Transport Domain to connect to.

The following steps are undertaken:

1) The On-Board FRMCS shall select one or more On-Board FRMCS Radio Modules. The mechanism for selection is not specified in the present document.

2) For each On-Board FRMCS Radio Module selected at the previous step, the On-Board FRMCS shall execute the On-Board FRMCS Radio Module registration to the FRMCS Transport Domain procedure as specified in ETSI TS 103 765-1 [1], clause 6.1.

3) The On-Board FRMCS shall select one On-Board FRMCS Radio Module amongst the On-Board FRMCS Radio Modules selected at step 2 to use for FRMCS Multipath discovery.

4) The On-Board FRMCS shall execute the FRMCS Multipath discovery procedure as specified in ETSI TS 103 765-1 [1], clause 5.3.7.1 with the On-Board FRMCS Radio Module selected at the previous step.

5) The On-Board FRMCS shall retrieve from the FRMCS Railway On-Board Profile the list of Startup Applications and their associated parameters. The mechanism for retrieval of the information from the FRMCS Railway On-Board Profile is not specified in the present document.

6) For each Loose-Coupled Application identified at the previous step, the On-Board FRMCS shall execute the MC Client IP assignment procedure as specified in clause 7.2.1 of the present document and assign it to a MC Client. The mechanism for selection of a MC Client to assign is not specified in the present document.

7) For each Loose-Coupled Application identified at the previous step, if the FRMCS Multipath discovery (step 5) was successful and if FRMCS Multipath is enabled according to the FRMCS Railway On-Board Profile (step 6), the On-Board FRMCS shall execute the FRMCS Multipath data path selection procedure as specified in ETSI TS 103 765-1 [1], clause 5.3.7.2 with the FRMCS Multipath parameters obtained at step 6.

8) The On-Board FRMCS shall execute the Transport path establishment for Mission Critical signalling procedure as specified in ETSI TS 103 765-1 [1], clause 6.2.

9) For each Tight-Coupled Application identified at step 6 and in Locally Bound state, the On-Board FRMCS shall notify the application of the availability of the FRMCS Transport Domain by sending a notification of type ftdAvlNotif on the notification event stream associated with the application as specified in clause 7.3.3.5 of the present document.

10) For each Loose-Coupled Application identified at step 6, the MC Client assigned to the application at step 7 should execute the MC Client readiness procedure as specified in clause 7.2.2.

NOTE: The timely execution of the procedure at step 11 would allow a faster session establishment time. It is left to implementation as to when the On-Board FRMCS executes the procedure.

7.1.2   FRMCS Close of Operation

The FRMCS Close of Operation (FCOP) procedure describes the expected behaviour of On-Board FRMCS and FRMCS Domain upon attempt by an On-Board FRMCS to disconnect from the FRMCS System.

The following steps are undertaken:

1) For each application in Locally Bound state:

   a) the On-Board FRMCS shall notify the application of its upcoming deregistration from the On-Board FRMCS by sending a notification of type upcomingDeregistration on the notification event stream associated with the application as specified in clause 7.3.3.5; and

   b) the On-Board FRMCS shall start a deregistration timer, T_DEREGISTRATION_TIMER, allowing the applications to take actions (e.g. for cleaning up their contexts).

2) At the expiry of the T_DEREGISTRATION_TIMER:

   a) For a Loose-Coupled Application:

      i) The On-Board FRMCS shall perform for each ongoing session the ongoing communication release as specified in clause 7.2.6.

      ii)   The On-Board FRMCS shall execute the MC Client teardown procedure as specified in clause 7.2.4.

      iii)   The On-Board FRMCS shall perform the OB$_{APP}$ Application Context clearance procedure as specified in clause 7.2.5.

  b)   For a Tight-Coupled Application:

      i)   The On-Board FRMCS shall perform the OB$_{APP}$ Application Context clearance procedure as specified in clause 7.2.5.

3)   If a FRMCS Multipath control link is established, the On-Board FRMCS shall execute the Multipath Control Protocol cleanup procedure as specified in ETSI TS 103 765-1 [1], clause 5.3.7.6.

4)   For each On-Board FRMCS Radio Module, the On-Board FRMCS shall execute the On-Board Radio Module deregistration to the FRMCS Transport Domain procedure as specified in ETSI TS 103 765-1 [1], clause 6.3.

7.1.3 Inter-FRMCS Domain Transition using two On-Board FRMCS Radio Modules

7.1.3.1 Inter-FRMCS Domain Transition (IFDT) procedure

Precondition:

- The On-Board FRMCS has received a Network Transition Trigger (NTT) indicating the Target FRMCS Transport Domain (identified by a PLMN ID).

- The On-Board FRMCS has selected a Target On-Board FRMCS Radio Module.

- The Target On-Board FRMCS Radio Module is different from the Serving On-Board FRMCS Radio Module and does not carry any other communication which requires service continuity.

The following steps are undertaken:

1)   For each ongoing communication carried by the Target On-Board FRMCS Radio Module, the On-Board FRMCS shall perform the ongoing communication release as specified in clause 7.2.6.

2)   The On-Board FRMCS shall perform the registration of the Target On-Board FRMCS Radio Module in the Target FRMCS Transport Domain as specified in ETSI TS 103 765-1 [1], clause 6.1.

3)   The On-Board FRMCS shall perform transport path establishment on the Target On-Board FRMCS Radio Module to enable MC signaling towards the Target FRMCS Service Domain as specified in ETSI TS 103 765-1 [1], clause 6.2.

NOTE 1: In the case of IFDT with dual On-Board FRMCS Radio Modules, during the transition, the On-Board FRMCS can still maintain a transport path on the Serving On-Board FRMCS Radio Module towards the Serving FRMCS Domain (e.g. for the purpose MC signalling that allows the proper release of an ongoing communication in Serving FRMCS Service Domain during the transition - see step 4b).

NOTE 2: If the Serving FRMCS Service Domain is not the Home FRMCS Service Domain, the On-Board FRMCS also needs in the following step a transport path towards the Home FRMCS Service Domain (e.g. for the purpose of the HTTP exchanges with primary IdM server).

4)   For each Loose-Coupled Application in Locally Bound state and identified as Type I or III in the FRMCS Railway On-Board Profile:

  a)   If the application has no open session, the On-Board FRMCS shall execute the procedure identified in clause 7.1.3.2.1.

  b)   If the application has an open session, the On-Board FRMCS shall execute the procedure identified in clause 7.1.3.2.2.

5) For each Loose-Coupled Application in Locally Bound state and identified as Type II in the FRMCS Railway On-Board Profile:

    a)   If the On-Board FRMCS is entering a FRMCS Domain within the Domain of applicability of the application, the On-Board FRMCS shall perform the procedure identified in clause 7.1.3.3.1.

    b)   If the On-Board FRMCS is entering a FRMCS Domain which is not in the Domain of applicability of the application, the On-Board FRMCS shall execute the procedure identified in clause 7.1.3.3.2.

6) For each Loose-Coupled Application in Locally Bound state and identified as Type IV in the FRMCS Railway On-Board Profile, the On-Board FRMCS shall execute the procedure identified in clause 7.1.3.4.

7) For each Tight-Coupled Application in Locally Bound state, the On-Board FRMCS shall notify the application of the availability of the Target FRMCS Transport Domain on the notification event stream associated with the application as specified in clause 7.3.3.5. The JSON structure being passed is of type "ftdAvlNotif" (as specified in FRMCS FFFIS-7950 [5], clause 9.11.1.11) filled as follows:

    i)   The ftdAVL field shall be set to TRUE.

    ii)   The nwTransition field shall be set to TRUE.

    iii)   The FrmcsDomain field shall be set to the PLMN ID representing the Target FRMCS Transport Domain.

NOTE 3: The On-Board FRMCS needs to uniquely associate a Target FRMCS Service Domain to a Target FRMCS Transport Domain (PLMN ID) for the network transition points.

NOTE 4: On-Board Tight-Coupled Application will need to uniquely associate a Target FRMCS Service Domain to a Target FRMCS Transport Domain (PLMN ID) for the network transition points. This is however out of scope of the present document and left to the discretion of the implementers of these applications.

7.1.3.2   Inter-FRMCS Domain transition: Type I or Type III applications

7.1.3.2.1   Inter-FRMCS Domain transition: Type I or Type III applications with no open session

For each Loose-Coupled Application in Locally Bound state and identified as interoperable in any FRMCS Domain in the FRMCS Railway On-Board Profile, if the application has no open session, the following steps are undertaken:

1) One of the following cases is performed depending on whether the Target FRMCS service Domain is the Home FRMCS Service Domain or a Foreign FRMCS Service Domain:

    a)   If the Target FRMCS Service Domain is a Foreign FRMCS Service Domain, the On-Board FRMCS shall perform the "MC Service User migration" procedure between Serving FRMCS Service Domain and Target FRMCS Service Domain as specified in ETSI TS 103 765-2 [2], clause 6.4.1, using the MC credentials and IMS credentials retrieved from the FRMCS Railway On-Board Application.

    b)   If the Target FRMCS Service Domain is the Home FRMCS Service Domain, the On-Board FRMCS shall perform "MC User registration" in Home FRMCS Service Domain (see ETSI TS 103 765-2 [2], clause 6.1).

    If the step is unsuccessful, it shall be repeated every T_RETRY_MCUSR_MIG seconds for a maximum of N_RETRY_MCUSR_MIG times before it can be considered as a failure in step 4.

2) If the Serving FRMCS Service Domain is not the Home FRMCS Service Domain, the On-Board FRMCS shall perform "Migrated MC Service User deauthorization" in Serving FRMCS Service Domain (see ETSI TS 103 765-2 [2], clause 6.4.2).

NOTE: This procedure is performed on the same MC User ID which was serving the application in the Serving FRMCS Service Domain before the transition.

3) If step 1 is successful, the On-Board FRMCS shall notify the application of the availability of the FRMCS Service Domain on the notification event stream associated with the application as specified in clause 7.3.3.5. The JSON structure being passed is of type "fsdAvlNotifData" (as specified in FRMCS FFFIS-7950 [5], clause 9.11.1.12) filled as follows:

    i) The fsdAVL field shall be set to TRUE.

    ii) The nwTransition field shall be set to TRUE.

4) If step 1 failed, the On-Board FRMCS shall notify the application of the unavailability of the Target FRMCS Service Domain on the notification event stream associated with the application as specified in clause 7.3.3.5. The JSON structure being passed is of type "fsdAvlNotifData" (as specified in FRMCS FFFIS-7950 [5], clause 9.11.1.12) filled as follows:

    i) The fsdAVL field shall be set to FALSE.

    ii) The nwTransition field shall be set to TRUE.

7.1.3.2.2 Inter-FRMCS Domain transition: Type I or Type III applications with an open session

For each Loose-Coupled Application in Locally Bound state and identified as interoperable in any FRMCS Domain in the FRMCS Railway On-Board Profile, if the application has at least one open session, the following steps are undertaken:

1) If the FRMCS Railway On-board Profile for the Loose-Coupled Application does not include the "IFSDT_Dual_MCID" parameter:

    a) The On-Board FRMCS shall perform the "MCData IPcon release" procedure as specified in ETSI TS 103 765-2 [2], clause 6.2.2.5 for the open sessions in the Serving FRMCS Service Domain.

NOTE 1: This allows the MC Service Server to clean up the session context but also allows the remote application endpoint to be notified of the intentional closure of this session. This step can include the release of the corresponding transport path on the Serving On-Board FRMCS Radio Module. However, the failure of this step does not prevent proceeding to the next step.

    b) One of the following cases is performed depending on whether the nature of the Target FRMCS service Domain:

        i) If the Target FRMCS Service Domain is a Foreign FRMCS Service Domain, the On-Board FRMCS shall perform the "MC Service User migration" procedure between Serving FRMCS Service Domain and Target FRMCS Service Domain (see ETSI TS 103 765-2 [2], clause 6.4.1), using the IMS credentials retrieved from the FRMCS Railway On-Board Application.

        ii) If the Target FRMCS Service Domain is the Home FRMCS Service Domain, the On-Board FRMCS shall perform "MC User registration" in Home FRMCS Service Domain (see ETSI TS 103 765-2 [2], clause 6.1).

        If the procedure is unsuccessful, it shall be repeated every T_RETRY_MCUSR_MIG seconds for a maximum of N_RETRY_MCUSR_MIG times before it can be considered as a failure in step 1e).

    c) If the Serving FRMCS Service Domain is not the Home FRMCS Service Domain, the On-Board FRMCS shall perform "Migrated MC Service user de-authorization" in Serving FRMCS Service Domain (see ETSI TS 103 765-2 [2], clause 6.4.2).

NOTE 2: Step 1b) is performed on the same MC User ID which was serving the application in the Serving FRMCS Service Domain before the transition.

    d) If step 1b) is successful, the On-Board FRMCS shall notify the application of the availability of the Target FRMCS Service Domain on the notification event stream associated with the application as specified in clause 7.3.3.5. The JSON structure being passed is of type "fsdAvlNotifData" (as specified in FRMCS FFFIS-7950 [5], clause 9.11.1.12) filled as follows:

        1) The fsdAVL field shall be set to TRUE.

     2)   The nwTransition field shall be set to TRUE.

   e)   If step 1b) failed, the On-Board FRMCS shall notify the application of the unavailability of the Target FRMCS Service Domain on the notification event stream associated with the application as specified in clause 7.3.3.5. The JSON structure being passed is of type "fsdAvlNotifData" (as specified in FRMCS FFFIS-7950 [5], clause 9.11.1.12) filled as follows:

     1)   The fsdAVL field shall be set to FALSE.

     2)   The nwTransition field shall be set to TRUE.

2)   If the FRMCS Railway On-board Profile for the Loose-Coupled Application includes the "IFSDT_Dual_MCID" parameter:

   a)   The On-Board FRMCS shall set the flag "IFSDT_DUAL_MCID_IN_PROGRESS" in the application context.

   b)   The On-Board FRMCS shall execute the MC Client readiness procedure as specified in clause 7.2.2.

7.1.3.3   Inter-FRMCS Domain transition: Type II applications

7.1.3.3.1   Inter-FRMCS Domain transition: Type II applications entering the Domain of applicability

For each Loose-Coupled Application in Locally Bound state and for which the On-Board FRMCS is entering a FRMCS Domain within the Domain of applicability of the application as identified from the FRMCS Railway On-Board Profile, the following step is undertaken:

1)   The On-Board FRMCS shall execute the MC Client readiness for network transition procedure as specified in clause 7.2.3.

7.1.3.3.2   Inter-FRMCS Domain transition: Type II applications entering a FRMCS Domain which is not in the Domain of applicability

For each Loose-Coupled Application which are in Locally Bound state and for which the On-Board FRMCS entering a FRMCS Domain which is not in the Domain of applicability of the application as identified from the FRMCS Railway On-Board Profile, the following steps are undertaken:

1)   For open sessions associated to the Loose-Coupled Application:

   a)   The On-Board FRMCS shall perform the "MCData IPcon release" procedure (both SIP and MC layers) in Serving FRMCS Service Domain (see ETSI TS 103 765-2 [2], clause 6.2.2.5).

   b)   The On-Board FRMCS shall notify the application of the termination of the session by sending a notification of type sessionClosure on the notification event stream associated with the application as specified in clause 7.3.3.5.

2)   The On-Board FRMCS shall execute the "MC User deregistration" procedure in Serving FRMCS Service Domain as specified in ETSI TS 103 765-2 [2], clause 6.3.

3)   The On-Board FRMCS shall notify the application of the unavailability of the FRMCS Service Domain on the notification event stream associated with the application as specified in clause 7.3.3.5. The JSON structure being passed is of type "fsdAvlNotifData" (as specified in FRMCS FFFIS-7950 [5], clause 9.11.1.12) filled as follows:

   i)   The fsdAVL field shall be set to FALSE.

   ii)   The nwTransition field shall be set to TRUE.

7.1.3.4 Inter-FRMCS Domain transition: Type IV applications

For each Loose-Coupled Application in Locally Bound state and identified as Type IV in the FRMCS Railway On-Board Profile, if the application has at least one open session:

1) The On-Board FRMCS shall establish home-routed transport path on the On-Board FRMCS Radio Modules as specified in ETSI TS 103 765-1 [1], clause 4.2.3 for relevant reference points.

2) The On-Board FRMCS recovers the ongoing MCData IPcon session towards Home FRMCS Service Domain on the transport path established in step 1.

7.1.4 GSM-R to FRMCS transition

7.1.4.1 GSM-R to FRMCS transition procedure

Precondition:

- The On-Board FRMCS has received a Network Transition Trigger (NTT) indicating the Target FRMCS Transport Domain (identified by a PLMN ID).

- The On-Board FRMCS has selected a Target On-Board FRMCS Radio Module.

- For a given train, all running applications are served either by GSM-R or by FRMCS at a given time during the train journey.

NOTE 1: The present document excludes the implementation scenario where at the given time during the train journey, some applications are running on GSM-R and some others are running on FRMCS.

The following steps are undertaken:

1) The On-Board FRMCS shall perform the registration of the Target On-Board FRMCS Radio Module in the Target FRMCS Transport Domain (see ETSI TS 103 765-1 [1], clause 6.1).

2) The On-Board FRMCS shall perform transport path establishment on the Target On-Board FRMCS Radio Module to enable MC signaling towards the Target FRMCS Service Domain (see ETSI TS 103 765-1 [1], clause 6.2).

NOTE 2: If the Serving FRMCS Service Domain is not the Home FRMCS Service Domain, the On-Board FRMCS needs in the following step a transport path towards the Home FRMCS Service Domain (e.g. for the purpose of the HTTP exchanges with primary IdM server).

3) For each Loose-Coupled Application in Locally Bound state and identified as Type I or III in the FRMCS Railway On-Board Profile, the On-Board FRMCS shall execute the procedure identified in clause 7.1.4.2.

4) For each Loose-Coupled Application in Locally Bound state and identified as Type II in the FRMCS Railway On-Board Profile, if the On-Board FRMCS is entering a FRMCS Domain within the Domain of applicability of the application, the On-Board FRMCS shall perform the procedure identified in clause 7.1.4.3.

5) For each Loose-Coupled Application in Locally Bound state and identified as Type IV in the FRMCS Railway On-Board Profile, the On-Board FRMCS shall execute the procedure identified in clause 7.1.3.4.

6) For each Tight-Coupled Application in Locally Bound state, the On-Board FRMCS shall notify the application of the availability of the Target FRMCS Transport Domain on the notification event stream associated with the application as specified in clause 7.3.3.5. The JSON structure being passed is of type "ftdAvlNotif" (as specified in FRMCS FFFIS-7950 [5], clause 9.11.1.11) filled as follows:

   a) The ftdAVL field shall be set to TRUE.

   b) The nwTransition field shall be set to TRUE.

   c) The FrmcsDomain field shall be set to the PLMN ID representing the Target FRMCS Transport Domain.

NOTE 3: The On-Board FRMCS needs to uniquely associate a Target FRMCS Service Domain to a Target FRMCS Transport Domain (PLMN ID) for the network transition points.

NOTE 4:   On-Board Tight-Coupled Application will need to uniquely associate a Target FRMCS Service Domain to a Target FRMCS Transport Domain (PLMN ID) for the network transition points. This is however out of scope of the present document and left to the discretion of the implementers of these applications.

7.1.4.2   GSM-R to FRMCS transition: Type I or Type III applications

For each Loose-Coupled Application in Locally Bound state and identified as interoperable in any FRMCS Domain in the FRMCS Railway On-Board Profile, the On-Board FRMCS shall execute the MC Client readiness for network transition procedure as specified in clause 7.2.3 of the present document.

7.1.4.3   GSM-R to FRMCS transition: Type II applications entering the Domain of applicability

For each Loose-Coupled Application in Locally Bound state and for which the On-Board FRMCS is entering a FRMCS Domain within the Domain of applicability of the application as identified the On-Board FRMCS shall execute the MC Client readiness for network transition procedure as specified in clause 7.2.3 of the present document.

7.1.4.4   GSM-R to FRMCS transition: Type IV applications

For each Loose-Coupled Application in Locally Bound state and identified as Type IV in the FRMCS Railway On-Board Profile, if the application has at least one open session:

1)   The On-Board FRMCS shall establish home-routed transport path on the On-Board Radio Modules (see ETSI TS 103 765-1 [1], clause 4.2.3 for relevant reference points).

2)   The On-Board FRMCS recovers the ongoing MCData IPcon session towards Home FRMCS Service Domain on the transport path established in step 1.

7.2   Procedures not associated with a reference point

7.2.1   MC Client IP assignment procedure

Each MC Client is reachable via a unique IP address and port from the IP range SD_PUB_IP as described in ETSI TS 103 764 [i.6]. The On-Board FRMCS manages this public IP/port mapping to the private MC Client IP addresses from the IP range OB_PRV_IP as described in ETSI TS 103 764 [i.6].

The IP address assignment procedure shall ensure IP connectivity of the MC Service Client to the FRMCS Service Domain according to local IP network requirements.

7.2.2   MC Client readiness procedure

The following steps are undertaken:

1)   The On-Board FRMCS shall retrieve from FRMCS Railway On-Board Profile the following information:

a)   The mapping rule which allows to derive the MC User ID.

b)   The password credentials for this MC User ID.

c)   The scope associated to this MC User ID (as specified in ETSI TS 133 180 [12], clause B.4.2.2).

d)   The IMS/SIP credentials associated to this MC User ID in Serving and Home FRMCS Domain.

2)   The MC Client shall execute the MC User registration procedure as specified in ETSI TS 103 765-2 [2], clause 6.1 using the retrieved parameters in step 1. Depending on whether this procedure is executed in Home FRMCS Domain or a Foreign FRMCS Domain, different subclauses of ETSI TS 103 765-2 [2], clause 6.1 are applied.

3) If the application is in the Application_Locally_Bound state, the On-Board FRMCS shall notify the application of the availability of the FRMCS Service Domain by sending a notification of type fsdAvlNotif on the notification event stream associated with the application as specified in clause 7.3.3.5. The JSON structure being passed is of type "fsdAvlNotif" (as specified in FRMCS FFFIS-7950 [5], clause 9.11.1.12) filled as follows:

   a) The fsdAVL field shall be set to TRUE.

   b) The nwTransition field shall be set to FALSE.

7.2.3   MC Client readiness for network transition procedure

If the flag "IFSDT_DUAL_MCID_IN_PROGRESS" is not set in the application context within the On-Board FRMCS, the following steps are undertaken:

1) The On-Board FRMCS shall perform the "MC User registration" procedure in Target FRMCS Service Domain using the IMS credentials retrieved from the FRMCS Railway On-Board Application Profile. Depending on whether this procedure is executed in Home FRMCS Domain or a Foreign FRMCS Domain, different clauses of ETSI TS 103 765-2 [2], clause 6.1 are applied.

    If the procedure is unsuccessful, it shall be repeated every T_RETRY_MCUSR_REG seconds for a maximum of N_RETRY_MCUSR_REG times before it can be considered as a failure for the following steps.

2) If step 1 is successful, the On-Board FRMCS shall notify the application of the availability of the FRMCS Service Domain on the notification event stream associated with the application as specified in clause 7.3.3.5. The JSON structure being passed is of type "fsdAvlNotifData" (as specified in FRMCS FFFIS-7950 [5], clause 9.11.1.12) filled as follows:

   i)   The fsdAVL field shall be set to TRUE.

   ii) The nwTransition field shall be set to TRUE.

3) If step 1 failed, the On-Board FRMCS shall notify the application of the unavailability of the Target FRMCS Service Domain on the notification event stream associated with the application as specified in clause 7.3.3.5. The JSON structure being passed is of type "fsdAvlNotifData" (as specified in FRMCS FFFIS-7950 [5], clause 9.11.1.12) filled as follows:

   i)   The fsdAVL field shall be set to FALSE.

   ii) The nwTransition field shall be set to TRUE.

For a Loose-Coupled Application for which the FRMCS Railway On-board Profile includes the "IFSDT_ Dual_MCID" parameter, the FRMCS Railway On-Board Profile contains a second MC User ID (in Home FRMCS Service Domain) and its associated parameters for a given instance of application (single staticId). In the rest of the present clause, this second MC User ID is called the secondary MC User ID.

If the flag "IFSDT_DUAL_MCID_IN_PROGRESS" is set in the application context within the On-Board FRMCS, the following steps are undertaken:

1) The secondary MC User ID (and associated parameters) shall be retrieved from the FRMCS Railway On-Board Profile.

2) If the Target FRMCS Service Domain is a Foreign FRMCS Service Domain, the On-Board FRMCS shall execute the procedure for MC User registration in Foreign FRMCS Service Domain, as specified in ETSI TS 103 765-2 [2], clause 6.1, using the parameters retrieved in step 1.

    Otherwise, if the Target FRMCS Service Domain is the Home FRMCS Service Domain, the On-Board FRMCS shall execute the procedure for MC User registration in Home FRMCS Service Domain, as specified in ETSI TS 103 765-2 [2], clause 6.1, using the parameters retrieved in step 1.

    If the procedure is unsuccessful, it shall be repeated every T_RETRY_MCUSR_REG seconds for a maximum of N_RETRY_MCUSR_REG times before it can be considered as a failure in step 4.

3) If step 2 is successful, the On-Board FRMCS shall notify the application of the availability of the FRMCS Service Domain by sending a notification of type fsdAvlNotif on the notification event stream associated with the application as specified in clause 7.3.3.5. The JSON structure being passed is of type "fsdAvlNotif" (as specified in FRMCS FFFIS-7950 [5], clause 9.11.1.12) filled as follows:

   a) The fsdAVL field shall be set to TRUE.

   b) The nwTransition field shall be set to TRUE.

4) If step 2 failed:

   a) The On-Board FRMCS shall notify the application of the unavailability of the FRMCS Service Domain by sending a notification of type fsdAvlNotif on the notification event stream associated with the application as specified in clause 7.3.3.5. The JSON structure being passed is of type "fsdAvlNotif" (as specified in FRMCS FFFIS-7950 [5], clause 9.11.1.12) filled as follows:

      i) The fsdAVL field shall be set to FALSE.

      ii) The nwTransition field shall be set to TRUE.

   b) The On-Board FRMCS shall unset the "IFSDT_DUAL_MCID_IN_PROGRESS" flag from the OBAPP application context.

7.2.4 MC Client teardown procedure

The following steps are undertaken:

1) For each ongoing session associated with the application, the FRMCS Trackside Gateway shall notify the application of the termination of the session by sending a notification of type sessionClosure on the notification event stream associated with the application as specified in clause 7.3.3.5 of the present document.

2) For each ongoing communication associated to the MC Client, the ongoing communication release shall be performed as specified in clause 7.2.6.

3) For each MC User associated with the application, the On-Board FRMCS shall execute the MC Service User deregistration procedure as specified in ETSI TS 103 765-2 [2], clause 6.3.

4) The On-Board FRMCS shall notify the application of the unavailability of the FRMCS Service Domain on the notification event stream associated with the application as specified in clause 7.3.3.5. The JSON structure being passed is of type "fsdAvlNotifData" (as specified in FRMCS FFFIS-7950 [5], clause 9.11.1.12) filled as follows:

   a) The fsdAVL field shall be set to FALSE.

   b) The nwTransition field shall be set to TRUE if the release is due to a network transition. Otherwise, it is set to FALSE.

5) The FRMCS Trackside Gateway shall notify the application of its deregistration from the FRMCS Trackside Gateway by sending a notification of type upcomingDeregistration on the notification event stream associated with the application as specified in clause 7.3.3.5 of the present document.

7.2.5 OB_{APP} Application Context clearance procedure

The following steps are undertaken:

1) If the application is a Loosed Coupled application, for each ongoing MCData IPcon session associated with the application, the On-Board FRMCS shall execute the MCData IPcon session release procedure as identified in ETSI TS 103 765-2 [2], clause 6.2.2.5.

2) The On-Board FRMCS shall clear the OB_{APP} Application Context associated with the OB_{APP} Application Tuple.

7.2.6   Ongoing communication release procedure

The following steps are undertaken for releasing an ongoing communication associated to a Loose-Coupled application:

1) For an ongoing session associated with a Loose-Coupled application, the On-Board FRMCS shall execute the MCData IPcon session release procedure as identified in ETSI TS 103 765-2 [2], clause 6.2.2.5.

2) In parallel to step 1, the On-Board FRMCS shall notify the application of the termination of the session by sending a notification of type sessionClosure on the notification event stream associated with the application as specified in clause 7.3.3.5.

3) The On-Board FRMCS shall release the transport path associated to the released MCData IPcon session as defined in ETSI TS 103 765-1 [1], clause 6.5.

The following steps are undertaken for releasing an ongoing communication associated to a Tight-Coupled application:

1) For a Tight-Coupled Application, the On-Board FRMCS shall release the transport path associated to the ongoing communication as defined in ETSI TS 103 765-1 [1], clause 6.5.

2) The On-Board FRMCS shall notify the application of the unavailability of the FRMCS Transport Domain on the notification event stream associated with the application as specified in clause 7.3.3.5. The JSON structure being passed is of type "ftdAvlNotif" (as specified in FRMCS FFFIS-7950 [5], clause 9.11.1.11) filled as follows:

   i) The ftdAVL field shall be set to FALSE.

   ii) The nwTransition field shall be set to TRUE if the release is due to a network transition. Otherwise, it is set to FALSE.

7.2.7   Logging

For all procedures specified in clause 7.3, the On-Board FRMCS shall log the endpoint invocations which lead to a HTTP status code 400, 401, 403 or 404.

For all procedures specified in clause 7.3.2 (/sessions), the On-Board FRMCS shall log all endpoint invocations.

For each logged event, the On-Board FRMCS shall capture:

- Timestamp (ISO 8601 [14] as UTC).

- Source IP and OBApp Application Tuple (appCategory, staticId).

- HTTP method + endpoint + status code.

- Specific parameters:

  - SessionId for session endpoints.

The On-Board FRMCS shall not include sensitive information such as credentials or passwords in logged events.

7.3   Procedures associated with OB$_{APP}$ endpoints

7.3.0   Introduction

The present clause specifies the behaviour expected from the On-Board FRMCS in relation with the OB$_{APP}$ reference point as specified in FRMCS FFFIS-7950 [5].

For all OB$_{APP}$ endpoint procedures defined below, the On-Board FRMCS shall return HTTP error responses as specified in FRMCS FFFIS-7950 [5] when encountering the following conditions applicable to a given endpoint and HTTP verb:

- **400 Bad Request:** Malformed/invalid request syntax.

- **401 Unauthorized:** Unauthenticated application access attempt.

- **403 Forbidden:** Authorized user but operation not permitted per profile.

- **404 Not Found:** Resource (dynamicId/sessionId/channel) not found.

Additional specific behaviours are noted in individual procedures below.

7.3.1   /registrations endpoint procedures

7.3.1.1   Application registration procedure

Upon invocation of the "/registrations" endpoint with the HTTP POST verb, the On-Board FRMCS is expected to create an OB_{APP} Application Context for the application.

The following steps are undertaken:

1) If an OB_{APP} Application Context associated with OB_{APP} Application Tuple already exists in the On-Board FRMCS, the On-Board FRMCS shall execute the OB_{APP} Application Context clearance procedure as specified in clause 7.2.5.

2) The On-Board FRMCS shall create an OB_{APP} Application Context for the OB_{APP} Application Tuple.

3) The On-Board FRMCS shall set the application state to Application_Registered.

4) The On-Board FRMCS shall respond with a 201 Created response code as specified in FRMCS FFFIS-7950 [5], clause 9.10.1.2. The JSON structure being passed is of type "RegisteredData" with a newly generated DynamicID as specified in FRMCS FFFIS-7950 [5], clause 9.10.1.5.

NOTE: For the Local Binding to be complete, the application is expected to open the notification event stream (clause 7.3.3.1).

7.3.1.2   Application-initiated deregistration procedure

Upon invocation of the "/registrations/{dynamicId}" endpoint with the HTTP DELETE verb, the On-Board FRMCS is expected to clean up any context associated with the application.

The following steps are undertaken:

1) For each ongoing MCData IPcon session associated with the application, the On-Board FRMCS shall execute the MCData IPcon session release procedure as identified in ETSI TS 103 765-2 [2], clause 6.2.2.5.

2) For each MC Service User associated with the application, the On-Board FRMCS shall execute the MC Service User deregistration procedure as specified in ETSI TS 103 765-2 [2], clause 6.3.

3) In parallel to steps 1 and 2, the On-Board FRMCS shall respond with a 204 (No Content) response code as specified in FRMCS FFFIS-7950 [5], clause 9.10.2.

4) The On-Board FRMCS shall clear the OB_{APP} Application Context associated with the OB_{APP} Application Tuple.

7.3.2   /sessions endpoint procedures

7.3.2.1   On-Board-FRMCS-initiated session initiation procedure

Upon invocation of the "/sessions/{dynamicId}" endpoint with the HTTP POST verb, the On-Board FRMCS is expected to open a session towards a remote endpoint.

In the rest of the present clause, the parameters communicationCategory, localAppIPAddress, and recipient (containing remoteId) are those retrieved from the JSON payload of request.

The following steps are undertaken:

1) The On-Board FRMCS shall respond with a 201 (Created) response code and include a payload with the sessionId as specified in FRMCS FFFIS-7950 [5], clause 9.12.1.

2) If the MC Client readiness procedure has not been executed for the application, the On-Board FRMCS shall execute the MC Client readiness procedure as specified in clause 7.2.2.

3) The On-Board FRMCS shall retrieve:

   a) from the FRMCS Railway On-Board Profile:

      i) the destination MC Service User ID/Functional Alias associated to remoteId field of the OB$_{APP}$ request; and

      ii) the Communication Session Category (ETSI TS 103 765-2 [2], clause 6.2.5) associated to communicationCategory field of the OB$_{APP}$ request;

   b) the IP address provided by the application in the localAppIPAddress field of the OB$_{APP}$ request.

4) The On-Board FRMCS shall execute the MCData IPcon session establishment procedure as identified in ETSI TS 103 765-2 [2], clause 6.2.2.3 with the MC Service User ID/Functional Alias for the recipient(s) and the Communication Session Category determined at the previous step. If the FRMCS Railway On-Board Profile indicates that the recipient identifier determined at the previous step is a Functional Alias (FA), the On-Board FRMCS shall set the Functional Alias (FA) parameters for the procedure, as specified in ETSI TS 103 765-2 [2], clause 6.2.2.3.

NOTE 1: If the flag "IFSDT_DUAL_MCID_IN_PROGRESS" is set in the application context within the On-Board FRMCS, the MCData ID which is used as the originator of the session in this step is associated to the secondary MC User ID.

5) Upon the success of the procedure at step 4, the On-Board FRMCS shall set up a route for IP packets coming from the tunnel established at step 4 to the Local Application IP address provided in the JSON payload of the POST request. In addition, the On-Board FRMCS shall add the sessionId to the OB$_{APP}$ Application Context.

6) The On-Board FRMCS shall notify the application with a final answer on the notification event stream associated with the application as specified in clause 7.3.3.5. The JSON structure being passed is of type "openSessionFinalAnswerNotif" (as specified in FRMCS FFFIS-7950 [5], clause 9.11.1) filled as follows:

   i) Upon the success of the procedure at step 4, the openSessionFinalAnswerNotif is of type "success" with the following structure:

      1) The sessionId field shall be set to the sessionId sent at step 1.

      2) The nextHopIPAddress field shall be set to the local On-Board FRMCS IP address to be used by the application for the session.

      3) The destApplicationIPAddress field shall be set to the virtual IP address representing the Trackside Application within the On-Board FRMCS for this OB$_{APP}$ session.

   ii) Upon the failure of the procedure at step 5, the openSessionFinalAnswerNotif is of type "failed" with the following structure:

      1) The sessionId field shall be set to the sessionId sent at step 1.

      2) The ErrorCause field shall be set as in Table 7.3.2.1-1, depending on the error code and warning text within MCData IPcon response.

      3) The ErrorDetail field can provide more details.

NOTE 2: In case 3 from Table 7.3.2.1-1, the On-Board FRMCS can perform a number of retrials of MCData IPcon establishment before sending openSessionFinalAnswerNotif to the application.

iii) If the procedure at step 4 indicates that the terminating application endpoint has declined the incoming session, the openSessionFinalAnswerNotif is of type "declined" with the following structure:

1) The sessionId field shall be set to the sessionId sent at step 1.

2) The ErrorCause field shall be set to REMOTE_ENDPOINT_DECLINED.

3) The ErrorDetail field can provide more details.

Table 7.3.2.1-1: ErrorCause in openSessionFinalAnswerNotif

Case	Error code (and warning text) in MCData IPcon response	ErrorCause in openSessionFinalAnswerNotif
1	480 ("FRMCS - terminating application is not locally bound")	TERMINATING_APPLICATION_ENDPOINT_NOT_REACHABLE
2	408 ("FRMCS-Terminating application did not respond in time to session invitation")	TERMINATING_APPLICATION_ENDPOINT_NOT_REACHABLE
3	408 (without the warning text in case 2)	MCX_ENDPOINT_NOT_REACHABLE
4	403 ("FRMCS - terminating application is not allowed by profile to receive incoming session")	TERMINATING_APPLICATION_ENDPOINT_NOT_ALLOWED

7.3.2.2   On-Board-FRMCS-initiated session termination procedure

Upon invocation of the "/sessions/{dynamicId}/{sessionId}" endpoint with the HTTP DELETE verb, the On-Board FRMCS is expected to terminate the referred session.

The following steps are undertaken:

1) The On-Board FRMCS shall execute the MCData IPcon session release procedure as identified in ETSI TS 103 765-2 [2], clause 6.2.2.5.

2) The On-Board FRMCS shall unset the route for IP packets coming from the tunnel established for the station towards the Local Application IP address associated with the session.

3) If all the previous steps are successful, the On-Board FRMCS shall respond with a 204 (No Content) response code as specified in FRMCS FFFIS-7950 [5], clause 9.12.4. If an error occurs at the previous steps for which an error response has not been specified above, the On-Board FRMCS shall respond as indicated below.

4) If the flag "IFSDT_DUAL_MCID_IN_PROGRESS" is set in the application context within On-Board FRMCS, upon a successful execution of step 1:

a) the On-Board FRMCS shall execute the MC Service User deregistration procedure as specified in ETSI TS 103 765-2 [2], clause 6.3; and

b) the On-Board FRMCS shall unset the "IFSDT_DUAL_MCID_IN_PROGRESS" flag from the application context.

7.3.2.3   On-Board-FRMCS-terminated incoming session invite procedure

NOTE 1: The present document only specifies the handling of incoming MCData IPcon session invites.

Upon receipt of a "SIP INVITE request for IP Connectivity session for terminating MCData client" by the MC Client associated with a Loose-Coupled Application, the On-Board FRMCS is expected to notify the application.

The following steps shall be undertaken:

1) If the application is not in the Application_Locally_Bound state, the On-Board FRMCS shall send a 480 (Temporarily Unavailable) response with the warning text equal to "FRMCS - terminating application is not locally bound" as specified in ETSI TS 103 765-2 [2], clause 6.2.2.3 to reject the request.

2) If the parameters fetched from the FRMCS On-Board Application Profile indicate that the application is not allowed to receive incoming sessions, the On-Board FRMCS shall send a 403 (Forbidden) response with the warning text equal to "FRMCS - terminating application is not allowed by profile to receive incoming session" as specified in ETSI TS 103 765-2 [2], clause 6.2.2.3 with warning text "FRMCS-Terminating application is not allowed to receive an incoming session" to reject the request.

3) The On-Board FRMCS shall notify the application of the incoming session request on the notification event stream associated with the application as specified in clause 7.3.3.5. The JSON structure being passed is of type "incomingSessionNotif" (as specified in FRMCS FFFIS-7950 [5], clause 9.11.1) filled as follows:

    i) The sessionId field shall be set to a new sessionId.

    ii) The remoteId field shall be set to the originating application identity value within the <application-data> attribute of the SIP INVITE received by the terminating MCData client.

    iii) The communicationCategory field shall be set to the value mapped to the <user-requested-priority> retrieved from the SIP INVITE.

4) The On-Board FRMCS shall start a timer T_INCOMING_SESSION associated with the application and the session.

5) If the timer T_INCOMING_SESSION set at step 4 expires before being cleared, the On-Board FRMCS shall send a 408 (Request Timeout) response with the warning text equal to "FRMCS-Terminating application did not respond in time to session invitation" as specified in ETSI TS 103 765-2 [2], clause 6.2.2.3 to reject the request.

NOTE 2: If T_INCOMING_SESSION is longer than SIP Timer B (64* timer T1 or about 32 seconds), the standard behaviour ETSI TS 124 229 [i.5] is presumed. If T_INCOMING_SESSION is shorter than SIP Timer B, the normative statement of step 5 applies.

NOTE 3: The actual positive response to the SIP INVITE needs to be sent as part of the handling of the HTTP PUT verb on /sessions/{dynamicId}/{sessionId}in clause 7.3.2.4.

7.3.2.4 On-Board-FRMCS-terminated incoming session response procedure

Upon invocation of the "/sessions/{dynamicId}/{sessionId}" endpoint with the HTTP PUT verb, the On-Board FRMCS is expected to provide a response to the "SIP INVITE request for IP Connectivity session for terminating MCData client" received prior.

The following steps are undertaken:

1) The On-Board FRMCS shall clear the timer T_INCOMING_SESSION associated with the application and the session.

2) If the field incomingSessionAppResponse in the IncomingSessionNotificationResponseData JSON payload is set to "accepted":

    a) The On-Board FRMCS shall provide the MC Client associated with the application with the IP address provided by the application in the field localAppIPAddress.

    b) The MC Client associated with the application shall accept the SIP INVITE request as specified in ETSI TS 103 765-2 [2], clause 6.2.2.3 and shall include the IP address provided at step 2.a as part of the <application-data> element within the AnyExt extension field.

    c) The On-Board FRMCS shall respond with a 201 (Created) response code as specified in FRMCS FFFIS-7950 [5], clause 9.12.5.

3) If the field incomingSessionAppResponse in the IncomingSessionNotificationResponseData JSON payload is set to "rejected":

    a) The MC Client associated with the application shall send a 603 (Decline) response as specified in ETSI TS 103 765-2 [2], clause 6.2.2.3 to reject the SIP INVITE request.

    b) The On-Board FRMCS shall respond with a 204 (No Content) response code as specified in FRMCS FFFIS-7950 [5], clause 9.12.5.

7.3.2.5   On-Board-FRMCS-terminated session termination procedure

Upon receipt of a "SIP BYE" request for releasing an MCData IPcon session by the terminating MC Client associated with a Loose-Coupled Application, if there is a sessionId in OB$_{APP}$ Application context associated to the MCData IPCon session and if the RELEASE_CAUSE in the SIP Reason header field of SIP BYE is set to 1 ("user ends call"):

1)   The On-Board FRMCS shall notify the application of the termination of the session by sending a notification of type sessionClosure on the notification event stream associated with the application as specified in clause 7.3.3.5.

2)   The On-Board FRMCS shall unset the route for IP packets coming from the tunnel established for the session towards the Local Application IP address associated with the session.

7.3.2.6   Information query on ongoing sessions for an application

Upon invocation of the "/sessions/{dynamicId}" endpoint with the HTTP GET verb, the On-Board FRMCS is expected to provide information on the ongoing sessions associated to the application.

If the query is authorized, the On-Board FRMCS shall respond with a 200 (OK) response code as specified in FRMCS FFFIS-7950 [5], clause 9.12.3. The JSON structure being passed is of type "SessionsListData" (as specified in FRMCS FFFIS-7950 [5], clause 9.12.3.2).

7.3.2.7   Information query on a specific ongoing session for an application

Upon invocation of the "/sessions/{dynamicId}/{sessionId}" endpoint with the HTTP GET verb, the On-Board FRMCS is expected to provide information on the designated session.

If the query is authorized, the On-Board FRMCS shall respond with a 200 (OK) response code as specified in FRMCS FFFIS-7950 [5], clause 9.12.2. The JSON structure being passed is of type "SessionStatusData" (as specified in FRMCS FFFIS-7950 [5], clause 9.12.2.2).

7.3.3   /notifications endpoint procedures

7.3.3.1   Procedure for opening the notification event stream

Upon invocation of the "/notifications/{dynamicId}/events" endpoint with the HTTP GET verb, the On-Board FRMCS is expected to open an SSE notification stream towards the application.

The following steps are undertaken:

1)   The On-Board FRMCS shall register the notification types identified in FRMCS FFFIS-7950 [5], clause 9.11.1.2 in the OB$_{APP}$ Application Context.

NOTE: The notifications associated to an OB$_{APP}$ session (i.e. OpenSessionFinalAnswerNotif, IncomingSessionNotif, and SessionClosureNotif) are only relevant to Loose-Coupled applications.

2)   The On-Board FRMCS shall open a SSE event stream and respond with a 200 (OK) response code.

3)   The On-Board FRMCS shall set the application state to Application_Locally_Bound.

4)   If the application is a Loose-Coupled Application for which "On-Board-application-terminated sessions" are allowed in FRMCS Railway On-Board Profile and if the MC Client readiness procedure has not yet been executed for the application, the On-Board FRMCS shall execute the MC Client readiness procedure as specified in clause 7.2.2 of the present document.

5)   If the application is a Loose-Coupled Application and the MC Client readiness procedure has been successfully executed for the application, the On-Board FRMCS shall notify the application of the availability of the FRMCS Service Domain on the notification event stream associated with the application as specified in clause 7.3.3.5. The JSON structure being passed is of type "fsdAvlNotifData" (as specified in FRMCS FFFIS-7950 [5], clause 9.11.1.12) filled as follows:

i)   The fsdAVL field shall be set to TRUE.

    ii)   The nwTransition field shall be set to FALSE.

6)   If the application is a Tight-Coupled Application, the On-Board FRMCS shall notify the application of the availability of the FRMCS Transport Domain on the notification event stream associated with the application as specified in clause 7.3.3.5. The JSON structure being passed is of type "ftdAvlNotif" (as specified in FRMCS FFFIS-7950 [5], clause 9.11.1.11) filled as follows:

    i)   The ftdAVL field shall be set to TRUE.

    ii)   The nwTransition field shall be set to FALSE.

7.3.3.2   Procedure upon subscription to a channel

Upon invocation of the "/notifications/{dynamicId}/channels/{channel}" endpoint with the HTTP POST verb, the On-Board FRMCS is expected to add the notification types associated with the requested channel to the list of notification types in the OB_{APP} Application Context.

The following steps are undertaken:

1)   The On-Board FRMCS shall register the notification types associated with the channel in the OB_{APP} Application Context.

2)   The On-Board FRMCS shall respond with a 200 (OK) response code and include a payload with the subscriptionId as specified in FRMCS FFFIS-7950 [5], clause 9.11.3.

NOTE: A specific procedure for the location channel is specified in clause 7.3.3.6.

7.3.3.3   Procedure upon unsubscription from all channels

Upon invocation of the "/notifications/{dynamicId}/channels" endpoint with the HTTP DELETE verb, the On-Board FRMCS is expected to clear all subscription to notification types in the OB_{APP} Application Context, except for those identified in clause 7.3.3.1.

The following steps are undertaken:

1)   The On-Board FRMCS shall deregister all notification types in the OB_{APP} Application Context except for those identified in clause 7.3.3.1.

2)   The On-Board FRMCS shall respond with a 204 (No Content) response code as specified in FRMCS FFFIS-7950 [5], clause 9.11.4.

7.3.3.4   Procedure upon unsubscription from a channel

Upon invocation of the "/notifications/{dynamicId}/channels/{channel}" endpoint with the HTTP DELETE verb, the On-Board FRMCS is expected to clear the subscription to notification types associated with the requested channel from the list of notification types in the OB_{APP} Application Context.

The following steps are undertaken:

1)   The On-Board FRMCS shall deregister the notification types associated with the channel in the OB_{APP} Application Context.

2)   The On-Board FRMCS shall respond with a 204 (No Content) response code as specified in FRMCS FFFIS-7950 [5], clause 9.11.5.

7.3.3.5   Procedure of notification to an application over a channel

The SSE *data* field shall be filled with the JSON data structure as passed to the procedure.

EXAMPLE: For a successful final answer notification, the JSON data structure would be:

```
{ "openSessionFinalAnswerNotif":
  "success": {
    "sessionId": <data>,
    "nextHopIpAddress": <data>,
```

```
                    "destApplicationIPAddress": <data>
                }
```

The SSE *event* and the SSE *id* fields shall not be used.

7.3.3.6 Procedure upon subscription to location reporting channel

Upon invocation of the "/notifications/{dynamicId}/channels/location" endpoint with the HTTP POST verb, the On-Board FRMCS is expected to add the notification types associated to the requested channel to the list of notification types in the OB$_{APP}$ Application Context.

The following steps are undertaken:

1) If the locReportType in the JSON payload of HTTP POST is set to travelledDistanceLocRep and the On-Board FRMCS does not support distance-based location report, the On-Board FRMCS shall respond with a 501 (Not Implemented) response code and skip the below steps.

2) The On-Board FRMCS shall register the notification types associated to the location reporting in the OB$_{APP}$ Application Context.

3) The On-Board FRMCS shall respond with a 200 (OK) response code and include a payload with the locReportId as specified in FRMCS FFFIS-7950 [5], clause 9.11.3.

7.3.3.7 Procedure to list subscriptions of an application

Upon invocation of the "/notifications/{dynamicId}/channels" endpoint with the HTTP GET verb, the On-Board FRMCS is expected to provide a list of notifications to which application has subscriptions.

If the query is authorized, the On-Board FRMCS shall respond with a 200 (OK) response code as specified in FRMCS FFFIS-7950 [5], clause 9.11.2.2. The JSON structure being passed is of type "SubscriptionsListData" (as specified in FRMCS FFFIS-7950 [5], clause 9.11.2.2).

7.3.3.8 Procedure to unsubscribe an application from a specific subscription

Upon invocation of the "/notifications/{dynamicId}/channels/{subscriptionId}" endpoint with the HTTP DELETE verb, the On-Board FRMCS is expected to unsubscribe an application from a specific notification subscription.

If the query is authorized, the On-Board FRMCS shall respond with a 204 (No Content) response code as specified in FRMCS FFFIS-7950 [5], clause 9.11.6.2.

7.3.4 /versions endpoint procedure

Upon invocation of the "/versions" endpoint with the HTTP GET verb, the On-Board FRMCS is expected to provide the list of versions it supports.

The following steps are undertaken:

1) The On-Board FRMCS shall prepare an API VersionsData data structure with the list of versions supported as specified in FRMCS FFFIS-7950 [5], clause 9.6.

2) The On-Board FRMCS shall respond with a 200 (OK) response code as specified in FRMCS FFFIS-7950 [5], clause 9.6.

7.3.5 /keepalive endpoint procedure

Upon invocation of the "/keepalive" endpoint with the HTTP GET verb, the On-Board FRMCS is expected to provide a HTTP-level response to indicate the OB$_{APP}$ reference point is responsive.

The On-Board FRMCS shall respond with a 204 (No Content) response code as specified in FRMCS FFFIS-7950 [5], clause 9.13.

History

Version	Date	Status
V1.0.0	July 2025	SRdAP process EV 20251008: 2025-07-10 to 2025-10-08