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Future Railway Mobile Communication System

Functional Requirements Specification

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1 Table of Contents

Document History	3
1 Table of Contents	5
2 List of abbreviations	8
3 List of definitions	9
4 Introduction	17
4.1 Background.....	17
4.2 Purpose of this document.....	18
4.3 Scope.....	18
4.4 Applicability.....	21
4.5 Important readers guide	22
5 Application concept	23
5.1 Goal	23
5.2 Principles	24
5.3 Applications framework and management.....	27
6 FRMCS functional addressing.....	29
6.1 Generic requirements.....	29
6.2 Functional identities	29
7 Introduction to common functions and applications	35
8 Common functions	37
8.1 Introduction	37
8.2 Common functions	37
9 Introduction to applications.....	72
9.1 Introduction	72
9.2 Applications.....	72
9.3 Generic HMI aspects.....	75
10 Voice applications	76
10.1 Basic voice communication functions	76
10.2 Basic voice communication	88
10.3 On-train outgoing voice communication from the train driver towards the controller(s) of a train	92
10.4 On-train incoming voice communication from the controller towards a train driver....	94

10.5	Multi-train voice communication for drivers including ground user(s)	95
10.6	Banking voice communication	99
10.7	Trackside Maintenance voice communication	99
10.8	Shunting voice communication	99
10.9	Public emergency call	99
10.10	Ground to ground voice communication	100
10.11	Railway Emergency Communication	101
10.12	On-train safety device to ground voice communication	108
10.13	Public train emergency voice communication	108
10.14	Working alone	108
10.15	On-train outgoing voice communication from train staff towards a ground user	108
10.16	On-train incoming voice communication from a ground user towards train staff	108
10.17	Railway staff emergency communication	108
11	Data applications	109
11.1	Basic data communication functions	109
11.2	Basic data communication	112
11.3	Role management and presence application	114
11.4	Automatic Train Protection communication	117
11.5	Automatic Train Operation communication	119
11.6	Data communication for Possession Management	121
11.7	Trackside Maintenance Warning System communication	121
11.8	Remote control of engines communication	121
11.9	Monitoring and control of critical infrastructure	121
11.10	Voice Recording and access to the recorded data	121
11.11	Data recording and Access	121
11.12	Shunting data communication	122
11.13	Train integrity monitoring data communication	122
11.14	Public emergency warning	122
11.15	Critical Advisory Messaging services- safety related	122
11.16	Virtual coupling data communication	122
11.17	Train Parking Protection	122
11.18	Safety key management data communication	123
12	Video applications	125
12.1	Basic video communication functions	125

12.2	Critical real time video	125
13	Terminal requirement	126
14	System management and configuration aspects	127
14.1	Introduction	127
14.2	Network management and configuration	127
14.3	FRMCS User equipment management and configuration	128
14.4	Application management	129
15	Digital resilience	131
15.1	Generic requirements	131
15.2	For further study	131
16	FRMCS domain changes	132
16.1	Inter domain changes	132
16.2	Intra domain changes	132
17	References	133
17.1	Normative references	133
17.2	Informative references	133
Appendix A	URS Pr's and GN's covered in FRS	134
Appendix B	Traceability to URS and Use cases	139
Appendix C	Regional requirements	140
1	European Union	140
2	Asia	144
3	US	144
Appendix D	Mapping of functional addressing with GSM-R	145
Appendix E	Examples of "first to accept" call handling	149
Appendix F	Guidance to construct functional identities	153

2 List of abbreviations

ATO	Automatic Train Operation
ATC	Automatic Train Control
ATP	Automatic Train Protection
ADC	Assured Data Communication
AVC	Assured Voice Communication
CCTV	Closed Circuit Television
COTS	Commercial off The Shelf
ERA	European Railway Agency
ETCS	European Train Control System
EVN	European Vehicle Number
FRMCS	Future Railway Mobile Communications System
GNSS	Global Navigation Satellite System
GSM-R	Global System for Mobile Communications – Railway
HMI	Human-Machine Interface (this term encompasses all Human-Machine Interfaces including the Driver-Machine Interface and the Controller-Machine Interface). Human actions can also be voice.
IM	Infrastructure Manager
ISO	International Organisation for Standardisation
MOTS	Modified Off The Shelf
M2M	Machine to Machine
OPE TSI	Operations and Traffic Management Technical Specification for Interoperability
RFID	Radio Frequency Identification
RU	Railway Undertaking
REC	Railway Emergency Communication
TAF TSI	Telematics Applications for Freight Technical Specification for Interoperability
TAP TSI	Telematics Applications for Passenger services Technical Specification for Interoperability
TSI	Technical Specification for Interoperability
UIC	Union Internationale des Chemins de Fer
URS	User Requirements Specification

3 List of definitions

Activation of an application

Activation/deactivation of an application are actions performed by the user in order to start/stop the application. See also Enabling of an application.

Application

Provides functionality to the end user to cover a certain communication need necessary for current and future railway operations.

Application use:

- Critical: applications that are essential for train movements and safety or a legal obligation, such as emergency communications, shunting, presence, trackside maintenance, ATC, etc.
- Performance: applications that help to improve the performance of the railway operation, such as train departure, telemetry, etc.
- Business: applications that support the railway business operation in general, such as wireless internet, etc.

Application management:

Tooling and procedures responsible for management of FRMCS applications, including application repository, version management and configuration management functions.

Attach/attached/attachment

The procedure followed by user's equipment to join the FRMCS system in order to communicate wired or wirelessly.

Bi-directional

Two-way communication.

Common function

A common module of FRMCS application framework providing common functionality for the various communication applications. Common functions are building blocks that each provide a part of the functionality required by the applications such as authorisation, quality of service or multi user talker control functionalities.

Controller

An individual responsible for the conduct of some aspect of train operations. For the purposes of this specification, the following functional identities of controllers are defined:

- Signaller.
- Railway Undertaking (RU) controller.
- Infrastructure Manager (IM) controller.
- Power supply controller.
- Etc.

Depending on local circumstances, a number of functional identities can be assigned to a single controller or a single functional identity can be carried out by a number of controllers.

Cyber security

All solutions and procedures needed to obtain a system that is resilient against malicious acts, theft of data and unintended / unwanted access to systems and data.

Data communication

Exchange of information in the form of transparent data (e.g. voice and video communication).

Depot

The term covers all depots, yards and sidings and other locations where trains operate outside the main line.

Driver

A person capable and authorised to drive trains, including locomotives, shunting locomotives, work trains, maintenance railway vehicles or trains for the carriage of passengers or goods by rail in an autonomous, responsible and safe manner. When ATO is implemented a driver can also be based on the ground.

Driver safety device

An on-train system that monitors the alertness of the driver and provides warnings and alarms to other systems as appropriate.

Equipment identity

An identity which is available after the equipment is logged in to the FRMCS system on application level and registered to a functional identity related to the equipment.

Emergency operation

The operational state of the railway when a current unforeseen or unplanned event has occurred which has life threatening or extreme loss implication and which requires immediate attention. Enabling of an application

The enabling of the application is a prerequisite for the activation of an application by the user. The rationale is e.g. to only allow activation of applications which are authorised for the role of the user and/or authorised in the area where the user is located. Enabling/disabling of an application is performed by the system. See also activation of an application.

Entitled controller

A controller that is responsible for traffic regulation and safe operations of the trains within a defined geographic area.,

Entitled user

A user making use of the FRMCS system for a specific activity for which the user is authorised.

European Union Agency for Railways

The agency for railway safety and interoperability established by Regulation (EC) No 881/2004 of the European Parliament and the Council of 29th April 2004 establishing a European Railway Agency, currently named the European Union Agency for Railways.

External system

A back office type of system connected to the FRMCS system, such as traffic management systems, tracking systems, planning systems, weather report system, etc.

Floor control

A method that determines who has the authority to transmit (talk) at a point in time during a voice communication.

FRMCS application

Provides functionality to the end user to cover a certain communication need necessary for current and future railway operations.

FRMCS user equipment

Combination of hardware and software, both on trackside and on-board side, required to use the FRMCS system.

FRMCS domain

An FRMCS domain is the administrative area for FRMCS communication services.

FRMCS system

The system providing end to end railway specific communications.

Functional identity

A description of the function performed by a user. The functional identity includes alphanumeric characters. This is used within the functional addressing scheme to identify an user/equipment by function or identity rather than by a specific item of radio equipment or user subscription.

Geographic position

A geographic position is an absolute coordinates consisting of latitude, longitude and elevation with a certain accuracy (such as a GNSS coordinate; the accuracy is represented by a circle or polygon).

Ground User

A user that is not on-board a train. The user can be stationary or moving, connected via wire or wireless.

GSM-R user equipment

Combination of hardware and software required to use GSM-R.

Harmonised application

An application specified in this FRS which is agreed among railway stakeholders to be used as the common way to fulfil the need for the functionality.

Harmonised functionality

An agreed functionality among railway stakeholders used as the common way to fulfil the need for the functionality.

Interworking

The ability of two networks to talk to each other, enabling services to be delivered across the two networks. The term interconnection refers to the technical, physical and logical connection between networks.

Lineside Telephony

A communication service installed at a fixed location connected to a fixed or mobile network.

Location information

The information on the location of a user device. This can consist of one or more of the following elements:

- Geographic position;
- Velocity (the combination of speed and direction);
- Infrastructure Location (additional information specifying railway infrastructure elements; for example: signal 123, switch 456, track section 789A, radio access related information (e.g. radio cell identity));
- Quality of Service information (horizontal and vertical accuracy, accuracy of Infrastructure Location, etc)
- Route setting.

Network operator

The entity responsible for operating the FRMCS system.

Machine

An application or a process working autonomously from a human user after being initiated.

Merging

After execution of the merging action on two distinct communications, these are combined into a single communication involving all the participants of both initial ones. Communications can be merged whatever is (are) the type(s) of content (voice, voice+video, voice+data...).

non-FRMCS user

A user with an identity not part of the FRMCS system setting up / receiving communication with/from a FRMCS system (such as a public or a railway private user setting up communication to a driver).

Normal Operation

The state of the railway when it is fully functional and operating as planned. Normal operation also includes any maintenance activities that do not affect the ability to provide a fully functional operational railway.

Public

Persons on trains, on platforms, at stations, at level crossings, etc. not being railway staff.

Off-network

Off-network allows entities to communicate without a telecom infrastructure.

On-network

On-network allows entities to communicate through a telecom infrastructure.

Public emergency call

A user-to-user voice communication, which is used to notify non-railway authorities (such as Police, Ambulance, or fire services) of an emergency situation.

Public emergency operator

The nominated user responsible for answering public emergency calls.

Railway staff

Personal employed by railways.

Route setting

The consecutive route sections reserved for a specific movable user, including the maximum speed of the user by taking into account the restrictive conditions of each route section, in order to run between 2 specific locations.

The characteristics of the route sections differ according to the type of user (e.g.: track sections for train or street sections for a track side worker).

The route setting information is provided to FRMCS by external systems (e.g.: train control systems or streetmaps).

Shunting team

A group of people manoeuvring trains in order to change their location or composition.

Standardised application

An application included in this FRS.

Subscriber identity

An identity which is available to address a communication towards a user's equipment after it is powered on and attached to the FRMCS system.

Trackside staff

Railway staff working as trackside maintenance and/or shunting members.

Train Staff

Railway staff that are on-board a train..

Train

A connected line of car(s)/vehicle(s), with or without a locomotive.

Uni-directional

One-way communication, like a broadcast.

Usability

International standard, ISO 9241-11, defines usability as: the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.

User / FRMCS user

A human user or a machine making use of the FRMCS system (for non FRMCS users the type of user is clearly mentioned e.g. public user, GSM-R user).

User's default device

In the case that the user is using multiple devices, the default device is the device that is actively used for communication, in the case that the communication needs to be automatically connected.

User identity

An identity which is available after the user is logged in to the FRMCS system via the credentials.

Video communication

Exchange of information in the form of streaming video (not a recorded video file), regardless of the transmission method (video is not considered as data in this document).

Voice command

Defines an action that users can initiate by speaking.

Voice communication

Exchange of information in the form of voice (not a recorded voice file), regardless of the transmission method (voice is not considered as data in this document).

4 Introduction

4.1 Background

4.1.1 The predicted obsolescence of GSM-R, combined with the long term life expectancy of ETCS and the Railway business needs, have led to the European Railway community initiating work to identify a successor for GSM-R. This document is one of the first steps in the process where the railways' needs are identified and defined in a consistent and technology independent way, the foundation for next steps on defining the Future Railway Mobile Communications System (FRMCS). (I)

4.1.2 The FRMCS FRS is part of the FRMCS specifications as depicted in [Figure 1](#). (I)

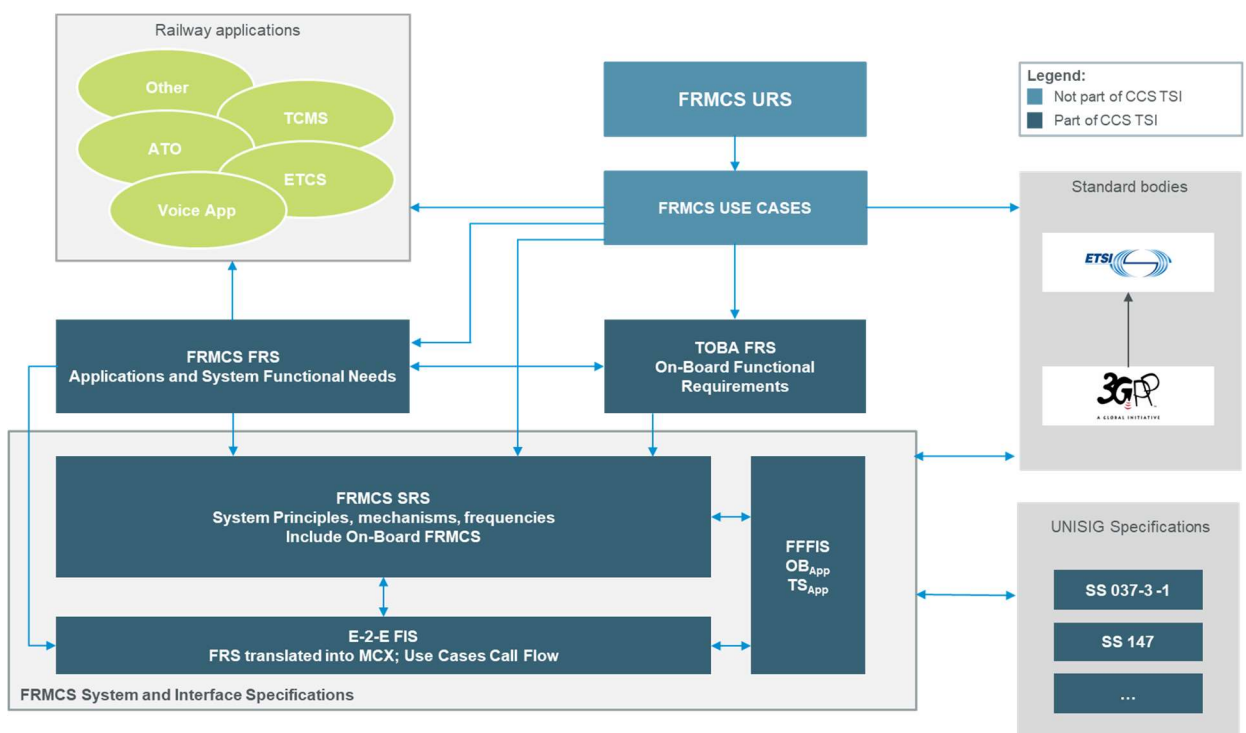


Figure 1: FRMCS specifications

4.2 Purpose of this document

- 4.2.1 The purpose of this document is to specify the functional requirements satisfying the communication needs of the railway sector for the next generation communication system, as a successor of GSM-R. The new communication system is called FRMCS, Future Railway Mobile Communication System. (I)
- 4.2.2 The functional requirements fulfil the needs of the rail sector as described in the URS and Use cases. Implementation of the described applications are based on operational needs and regulation / legislations. (I)
- 4.2.3 The functional requirements aim to provide the railway sector with a system that meets the operational needs of today and tomorrow. This is achieved by not stating the operational rules in the specific requirements but instead allowing the Infrastructure managers (and other stakeholders) to implement the operational needs by configuration. (I)
- 4.2.4 This specification document aims to cover all needs from all members in the railway sector, and is considered a global specification. For usage on regional or specific country level individual requirements can be selected from this specification and classified accordingly. In Appendix C these requirements and classifications are listed. (I)

4.3 Scope

- 4.3.1 The scope of the FRMCS Functional Requirements Specification (FRS) is described in this section. (I)
- 4.3.2 Some of the main users of the FRMCS system are illustrated in [Figure 2](#). These users can be humans or machines. An entity is considered as a user when it interacts with a device included or partly included in the FRMCS system scope. The users are classified into two main categories: (I)
- On-board users: FRMCS users who access the FRMCS system while they are located on a rolling stock;
 - Ground users: FRMCS users who access the FRMCS system while they are not located on a rolling stock.
- 4.3.3 Here are some examples of human users: (I)
- The train driver needs to communicate with controllers. For this purpose, the driver interacts with a HMI which is partly covered by the FRMCS system scope;
 - The railway employees involved in a shunting operation need to communicate to other shunters for the same operation.
- 4.3.4 Here are some examples of non-human users: (I)
- The on-board ATP device, which regularly exchanges data with an ATP application server. The interaction between the driver and the on-board ATP is out of the FRMCS system scope;
 - The trackside warning system needs an interface to the FRMCS system in order to enable exchange of data with railway infrastructure control

systems. The interaction between the trackside workers and the trackside warning system is out of the FRMCS system scope.

- 4.3.5 In order to enable communication between the end users of the public networks and FRMCS users, the required interfaces are included in the FRMCS system scope. In the same way, the interfaces required to enable communication between FRMCS users and the end users of railway legacy telecom systems (GSM-R, TETRA...) are included in the FRMCS system scope. (I)
- 4.3.6 The railway legacy systems are only expected to be adapted thanks to configuration changes. It is not envisaged to introduce modifications in the existing products. (I)
- 4.3.7 The communication media of the FRMCS system are classified into three main categories: (I)
- Voice (e.g. for vocal communication between the train driver and the controller);
 - Data:
 - FRMCS control data (e.g. multi-talker control data);
 - FRMCS user traffic (e.g. FRMCS messaging service, transparent bearer for ATP, transparent bearer for trackside warning system);
 - Video.

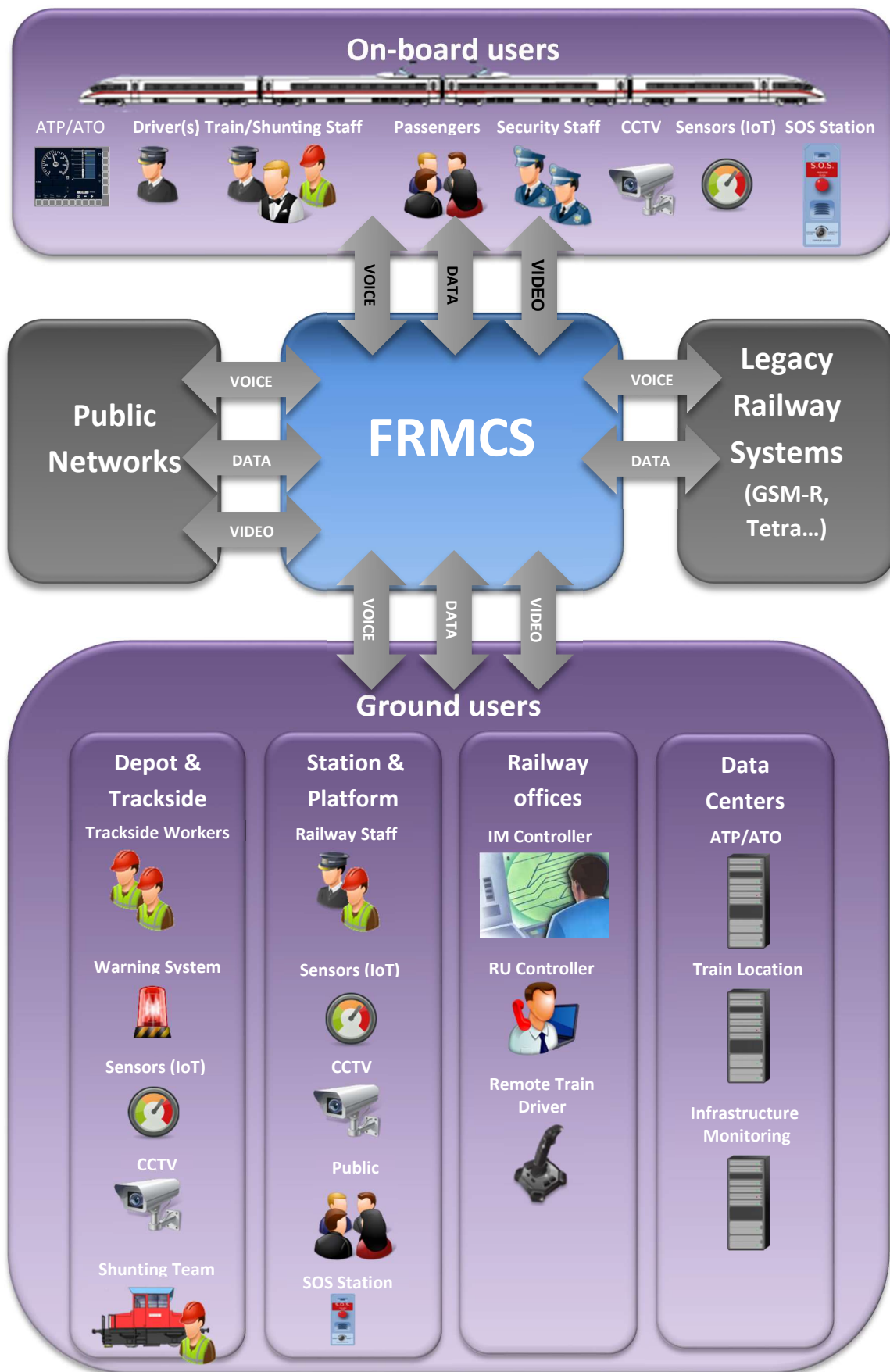


Figure 2: FRMCS system Scope

4.4 Applicability

4.4.1 The statements made in the FRS specification are assigned to the following categories: (I)

- **Mandatory for the System (indicated by ‘(M)’** at the end of the clause). These requirements mean a condition set out in this specification that must be met without exception in order to deliver a system ensuring the fulfilment of essential functional and system needs, compliance to relevant standards and technical integration. The mandatory requirements are identified as sentences using the keyword “shall”.
- **Optional for the system (indicated by ‘(O)’** at the end of the clause). These requirements may be used based on the implementers’ choice. When an option is selected, the related requirement(s) of this specification becomes mandatory for the system. The optional requirements are identified as sentences using the keyword “should”.
- **Information (indicated by ‘(I)’** at the end of the clause). These statements provide additional information to help the reader understanding a requirement.

Please note that NA is used to indicate that a particular item is not applicable and therefore not needed to be provided.

4.4.2 When a requirement clause contains a bulleted list, the categorisation (R/O) precedes the bulleted list indicating that the FRMCS system shall/should support all items in the list. (I)

4.5 Important readers guide

- 4.5.1 For the readers comfort, the authors of this specification advise the readers to consider the following important guidance notes. (I)
- 4.5.2 In this document the reader shall consider the FRMCS system as a black box. The sub components within FRMCS are not specified. (I)
- 4.5.3 The FRS specification defines the *what* and not the *how*. In other words, the FRS specifies the functional requirements to be fulfilled by the FRMCS black box. The technical details to fulfil the functional needs are specified in the further down stream specifications like TOBA FRS, SRS, TOBA SRS, FIS, FFFIS, etc. (I)
- 4.5.4 The [URS] captures the communication needs of the railway sector. In the [URS] the needs are defined as communication applications and support applications. In this FRS some communication applications have an end-to-end character like for railway emergency communication whilst for other communication applications the FRS specifies only the bearer (like for ATP). The support applications are described as common functions (in chapter 8) for the communication applications in the FRS. (I)
- 4.5.5 In chapters 10.1, 11.1 and 12.1 we describe the functionality that is the basis for all applications within these chapters, the functionality is applicable for all applications unless otherwise specified. (I)
- 4.5.6 The FRS specifies the global needs from the railway sector. The requirements that are applicable in a legal framework are described in Appendix C document per regional level. (I)
- 4.5.7 All requirements for off-network functionality in this document are preliminary because a final decision of the needs by the railway sector has not been taken yet. In version 2 of this specification this will be clarified. (I)

5 Application concept

5.1 Goal

- 5.1.1 The main achievements expected from the application concept are: (I)
- The flexibility allowing to fit to the common and specific operational communication needs of each infrastructure manager and railway undertaking, as well as;
 - The cost effectiveness and speed of implementation when the common and specific operational communication needs evolve.
- 5.1.2 Using applications also allows introducing new ones, thereby ensuring correct operation of such applications on devices without affecting existing applications and reducing the need to go through a (new or full) approval process. (I)
- 5.1.3 Other benefits expected from the application concept are reliability and efficiency of the operation and maintenance activities: (I)
- The ability for an easy changing of application´s parameters, according to operational or maintenance needs;
 - Capturing of relevant data related to events and actions performed by an application, for the purpose of keeping historic logs, and elaboration of statistics and calculating performance indicators;
 - Capturing of data related to the running of each application for performance monitoring and fault detection for respectively predictive and corrective maintenance actions.
- 5.1.4 The major factors to achieve the goals are: (I)
- High level of software modularity and reliability allowing:
 - To minimize the impact on the implementation costs and delays, caused by the approval processes. The approval process is applied only if there is an impact on applications which are subject to approval;
 - Application development becoming more independent from equipment;
 - Lean specifications ensuring functionality without impact on flexibility;
 - Ability to run the applications on COTS/MOTS user devices;
 - Ability of a user device to run any of the applications required (e.g. a single cab user device supporting all the required applications);
 - Independence from the radio access technologies allowing the application to be future-proof against the evolution of these technologies.

5.2 Principles

- 5.2.1 Within this FRS, applications describe the functional behaviour expected. This functionality is based on a set of Common functions that act as 'functional building blocks' available to all applications. Each application can use the functionality of the Common functions and adds -where needed- functionality to create the application covering the railway need. In [Figure 3](#) ~~Figure-3~~ the application framework is shown. (I)

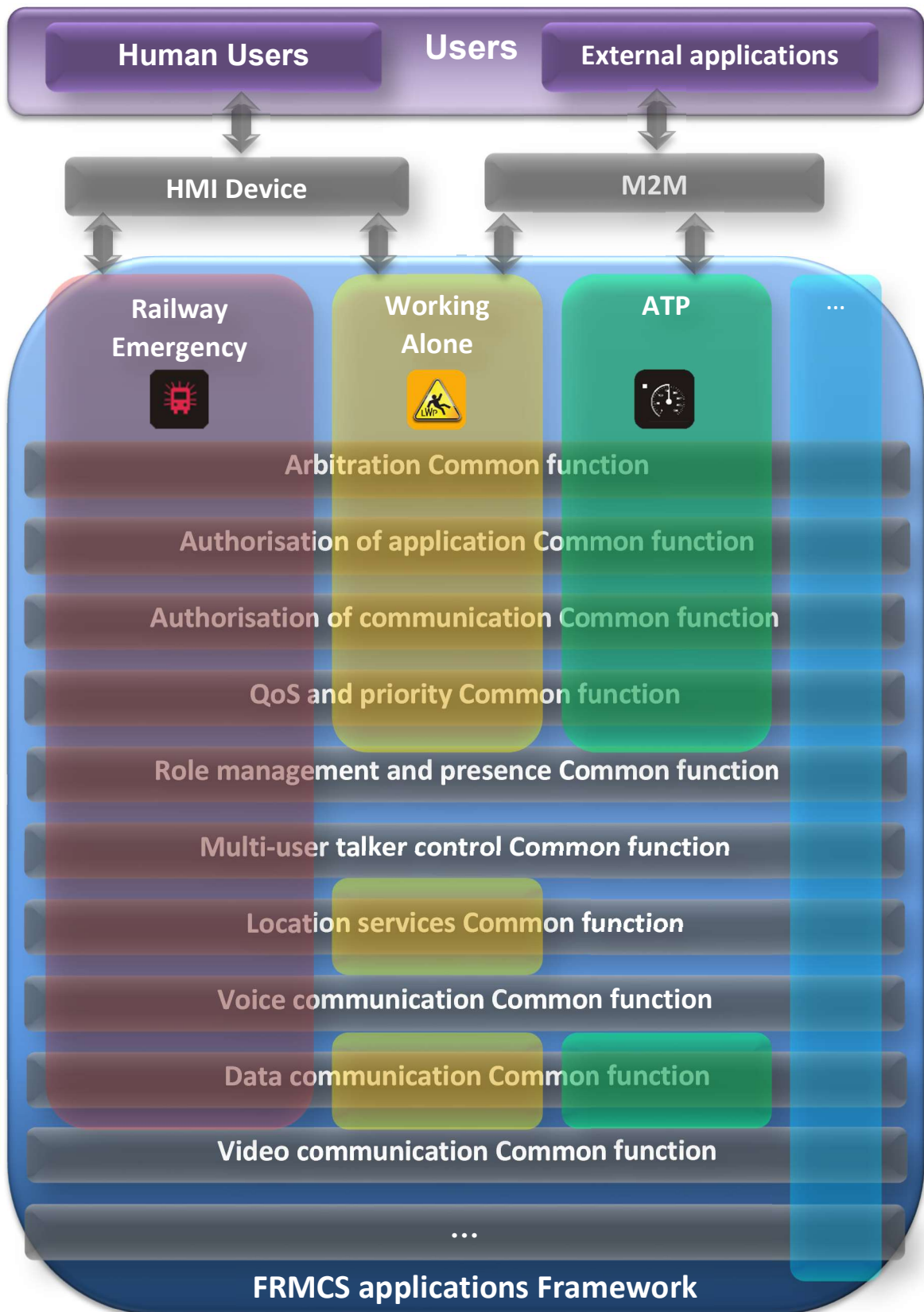


Figure 3: FRMCS application framework

- 5.2.2 To allow a user to use an application on the device, the application is installed and enabled. The installation includes not only the initial installation but also the software updates required during the whole life cycle of the application to cope with the corrective maintenance and the change management. The user does not have the task to make sure applications are up-to-date. This is taken care of by the application management either automatically or based on manual control. (I)
- 5.2.3 Appointed organisations (such as, for the European Union, the European Union Agency for Railways) can determine, in order to make interoperable railway traffic possible, to notify a subset of the standardised communication applications in the FRS to be mandatory. When notified such and described in appropriate regulation, these are referred to as applications performing harmonised functionality, i.e. harmonised applications. (I)
- 5.2.4 Where an application is introduced that does not perform a function as described by the FRS, it is not a standardised FRMCS application. Such an application does not hinder FRMCS applications. (I)

5.3 Applications framework and management

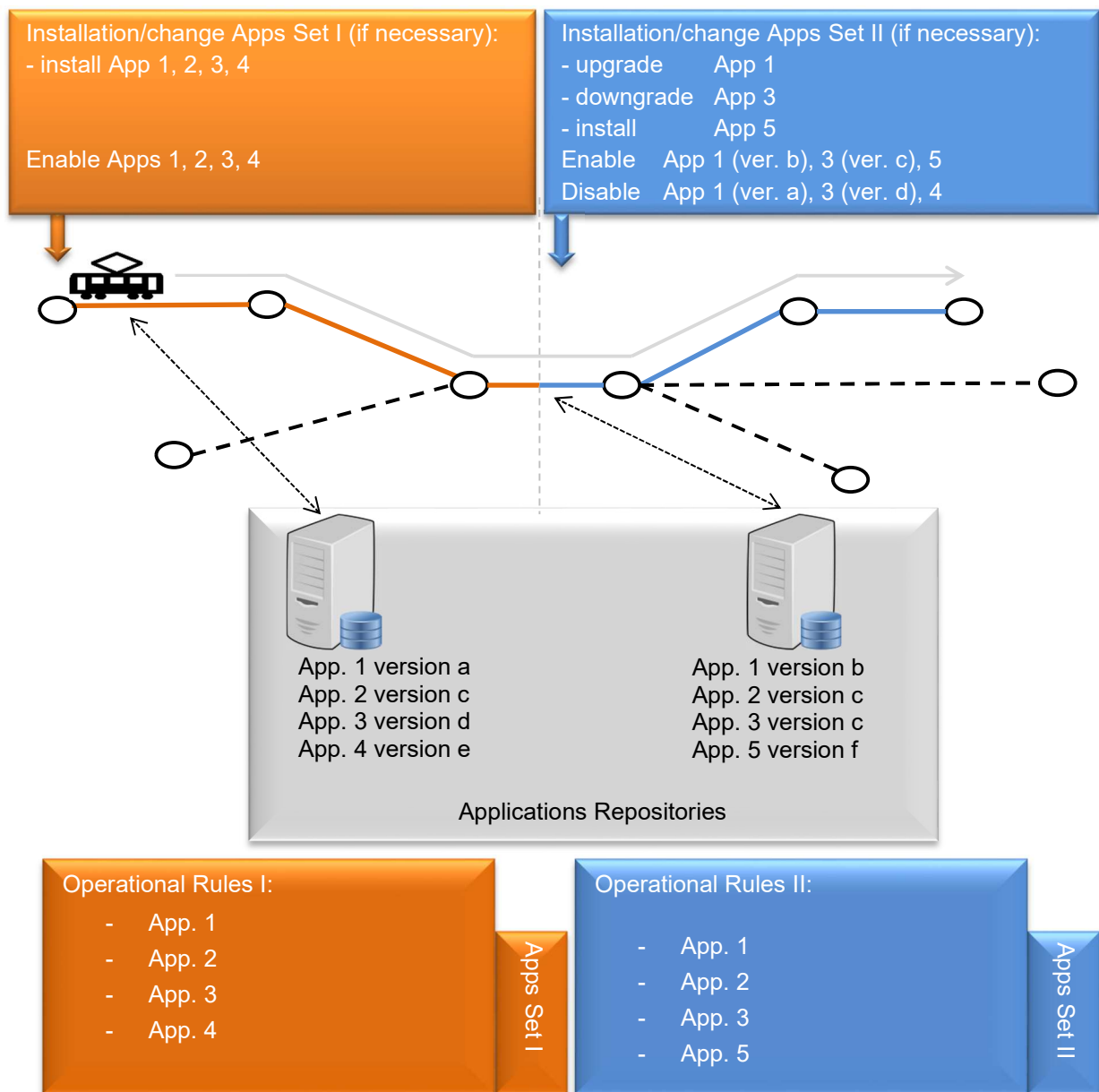


Figure 4: FRMCS application management principles

- 5.3.1 The application management, as shown in ~~Figure 4~~ [Figure-4](#), performs the following tasks: (l)
- a) Provide an application repository, containing applications to provide to the user device in need of a Communication application. This includes the check to verify that the endorsement of the application's functionality was successful;
 - b) Provide version management, determining:
 - a. what valid version(s) of applications are (i.e.: to check that application version in the user device and in the infrastructure are compatible);
 - b. for devices under its responsibility, what application version is to be used and provide the application of the correct version when required;
 - c) Provide configuration version management: determining what configuration parameters are valid for that specific application and area.

- 5.3.2 The application management can be performed by e.g.: (l)
- a) The IM that is responsible for a specific area;
 - b) An RU for railway specific applications;
 - c) An appointed organisation.

- 5.3.3 Version management is performed according to the following functional guidelines. (l)
- a) Version compatibility is determined by the FRS system version (baseline) applicable to the applications;
 - b) When the application management detects that a user device has an incompatible version, it initiates provisioning of the correct version of the application to the user device.
Incompatibility is defined as:
 - a. the application version on the device is a lower version than considered compatible to the infrastructure;
 - b. the application version on the device is a higher version than considered compatible to the infrastructure (note: this can happen during migration phases when a train travels between IM-area's that are and are not equipped with a newer FRS system version).
 - c) Standardised applications in a newer FRS system version can fulfill the requirements of an older FRS system version (i.e. is backwards compatible). In this case, the application management shall consider this 'older' application to be compatible;
 - d) FRMCS user devices can contain different versions of a specific application. It is not needed to delete the application from the user device. Enabling of the correct application version is a task of the application management.

6 FRMCS functional addressing

6.1 Generic requirements

- 6.1.1 The FRMCS system shall be able to support temporary registrations and permanent registrations of functional identities. (M)
- 6.1.2 Temporary registrations are functions, which are registered in the FRMCS system for a limited time (e.g. train number, controller or team member). (I)
- 6.1.3 Permanent registrations are functions, which are registered in the FRMCS system permanently (e.g. vehicle, trackside equipment or specific user profiles). (I)
- 6.1.4 For the FRMCS functional addressing, OC according to [TAF TSI] / [TAP TSI] shall be used in Europe. (M)
- 6.1.5 For the FRMCS functional addressing, Vehicle Identity according to the European Vehicle Number (EVN) specified in [EIN] shall be used in Europe. (M)
- 6.1.6 The “Function Label” defines the operational role of the FRMCS user (human (e.g. driver) or machine (e.g. sensor)). (I)
- 6.1.7 The “Identification Label” defines the identity of a specific object (e.g. vehicle number) or an operational notation (e.g. train number). (I)
- 6.1.8 The “Location Label” indicates a specific location or area (e.g. station ID, trackline ID, track section ID, area ID...). (I)
- 6.1.9 Assignment of the individual parameters to the labels are according to [Table 1](#). (I)

LocationLabel	IdentificationLabel	FunctionLabel	Organisation Code
<ul style="list-style-type: none">• Station ID• Trackline ID• Track section ID• Area ID• ...	<ul style="list-style-type: none">• Train ID• Type/Profile• VehicleIdentity• Equipment• ...	<ul style="list-style-type: none">• Function	<ul style="list-style-type: none">• OC

Table 1: Assignment of the individual attributes to the labels

- 6.1.10 In Appendix D more information is given of the use of labels within a functional identity. (I)

6.2 Functional identities

6.2.1 Temporary Registrations

6.2.1.1 Train function identity

- 6.2.1.1.1 A train function shall be addressed by using the following labels: (M)
- Identification Label;
 - Function Label;
 - Organisation Code.

- 6.2.1.1.2 Identification Label shall contain the following attribute: (M)
- Train ID.
- 6.2.1.1.3 Function Label shall contain one of the following attributes: (M)
- Leading driver;
 - Driver 2;
 - Driver 3;
 - Driver 4;
 - Driver 5 – reserved for Banking;
 - Intercom;
 - Public address;
 - Chief conductor;
 - Second conductor;
 - Third conductor;
 - Fourth conductor;
 - Train crew 5 – 10;
 - Catering staff chief;
 - Catering 2 – 10;
 - Railway security services chief;
 - Railway security 2 – 10.
- 6.2.1.1.4 The system shall allow the adding of additional functions for future use (e.g. international harmonization and/or national use). (M)
- 6.2.1.1.5 Location Label is not used, because a train function identity is not location dependent. (I)
- 6.2.1.1.6 For organisation code, only IM identifiers shall be used. (M)
- 6.2.1.2 **Controller identity**
- 6.2.1.2.1 A controller shall be addressed by using the following labels: (M)
- Location Label;
 - Function Label;
 - Organisation Code.
- 6.2.1.2.2 Location Label shall contain one of the following attributes: (M)
- Station ID;
 - Trackline ID;
 - Track section ID;
 - Area ID.
- 6.2.1.2.3 Function Label shall contain one of the following attributes: (M)
- Primary controller;
 - Secondary controller;
 - Power supply controller;
 - Switchman;
 - Platform inspector;
 - Railway undertaking dispatcher;
 - Technical inspector;
 - Train preparation;

- Emergency manager.
- 6.2.1.2.4 The system shall allow the adding of additional functions for future use (e.g. international harmonization and/or national use). (M)
- 6.2.1.2.5 Identification Label is not used, because a controller identity depends on the location. (I)
- 6.2.1.3 **Team identity**
- 6.2.1.3.1 All team members shall be addressed by using the following labels: (M)
- Location Label;
 - Identification Label;
 - Function Label;
 - Organisation Code.
- 6.2.1.3.2 Location Label shall contain one of the following attributes: (M)
- Station ID;
 - Trackline ID;
 - Track section ID;
 - Area ID.
- 6.2.1.3.3 Identification Label shall contain one of the following attributes for Type: (M)
- Shunting;
 - Maintenance;
 - Railway security.
- 6.2.1.3.4 The system shall allow the adding of additional identification labels for future use (e.g. international harmonization and/or national use). (M)
- 6.2.1.3.5 Function Label shall contain one of the following attributes: (M)
- Driver;
 - Team leader;
 - Team member.
- 6.2.1.3.6 An individual team member shall be addressed by using the following labels: (M)
- Location Label;
 - Identification Label – Type;
 - Function Label.
- 6.2.1.3.7 The system shall allow the adding of additional function labels for future use (e.g. international harmonization and/or national use). (M)

6.2.2 Permanent Registrations

6.2.2.1 Vehicle identity

- 6.2.2.1.1 An individual function of a vehicle-equipment (e.g. diagnoses) shall be addressed by using the following labels: (M)
- Identification Label;
 - Equipment Label;
 - Function Label;
 - Organisation Code.

- 6.2.2.1.2 Identification Label shall use the following attribute: (M)
- Vehicle Identifier.
- 6.2.2.1.3 Equipment Label shall use the following attribute: (M)
- Equipment.
- 6.2.2.1.4 The system shall allow the adding of additional Equipment labels for future use (e.g. international harmonization and/or national use). (M)
- 6.2.2.1.5 Function Label shall contain one of the following attributes: (M)
- To be defined.
- 6.2.2.1.6 The system shall allow the adding of additional functions for future use (e.g. international harmonization and/or national use). (M)
- 6.2.2.1.7 Location Label (LL) is not used, because a vehicle identity is not location dependent. (I)
- 6.2.2.2 [Equipment identity \(trackside or on train\)](#)
- 6.2.2.2.1 An equipment (e.g. device or sensor) shall be addressed by using the following Labels: (M)
- Location Label;
 - Identification Label;
 - Function Label;
 - Organisation Code.
- 6.2.2.2.2 Location Label shall contain one of the following attributes: (M)
- Station ID;
 - Trackline ID;
 - Track section ID;
 - Area ID.
- 6.2.2.2.3 Identification Label shall use the following attribute: (M)
- Equipment.
- 6.2.2.2.4 The system shall allow the adding of additional Equipment labels for future use (e.g. international harmonization and/or national use). (M)
- 6.2.2.2.5 Function Label shall contain one of the following attributes: (M)
- To be defined.
- 6.2.2.2.6 The system shall allow the adding of additional functions for future use (e.g. international harmonization and/or national use). (M)
- 6.2.2.2.7 An individual function of a train-equipment (e.g. power on of air conditioning) shall be addressed by using the following labels: (M)
- Identification Label - Equipment;
 - Function Label.
- 6.2.2.2.8 An individual function of a trackside equipment (e.g. power on of point-heating) shall be addressed by using the following labels: (M)
- Location Label;
 - Identification Label - Equipment;
 - Function Label.

6.2.2.3 Profile Addressing

6.2.2.3.1 Profiles shall be addressed in a defined location using the following labels: (M)

- Location Label;
- Function Label;
- Organisation Code.

6.2.2.3.2 Location Label shall contain one of the following attributes: (M)

- Station ID;
- Trackline ID;
- Track section ID;
- Area ID.

6.2.2.3.3 Function Label shall contain one of the following attributes: (M)

- All;
- Train driver;
- Train staff;
- Catering staff;
- Shunting team members;
- Maintenance team members;
- Railway security team members ;
- Vehicle equipment identity;
- Trackside equipment identity.

6.2.2.3.4 The system shall allow the adding of additional profiles for future use (e.g. international harmonization and/or national use). (M)

6.2.2.3.5 The system shall allow to address a profile without a specific organisation code, (e.g. by using a wild card). (M)

6.2.2.3.6 This profile addressing is used to call e.g. all train drivers in a defined area or station, or transmit messages when entering a particular sector. (I)

6.2.2.3.7 To address a profile from a specific company, the specific organisation code shall be used. (M)

6.2.2.3.8 This profile addressing is used to call e.g. all train drivers of a specific company in a defined area or station, or transmit messages when entering a particular sector. (I)

6.2.2.3.9 Identification Label is not used, because a profile addressing depends on one or several users of the same profile and a location. (I)

6.2.2.4 Relevant Identity of an FRMCS user

6.2.2.4.1 When a user or a group of users has multiple identities, the relevant identity is the one used for addressing and presentation of a certain communication. (I)

6.2.2.4.2 The order for the relevant identity of an FRMCS user shall be based on all of the following rules unless required otherwise by an application: (M)

- a) If available, a functional identity is preferred over user identity;
- b) If available, temporary functional identities are preferred over permanent functional identities;
- c) If no functional identity is available, a user identity is preferred over a subscriber identity.

7 Introduction to common functions and applications

- 7.1.1 The Functional Requirement Specification contains the requirements for common functions and applications. This introduction paragraph gives a reading guide of how this is to be understood by the reader. (I)
- 7.1.2 First the common functions are specified. Examples of common functions are role management and presence, location services or multi-user talker control. After that the applications are specified. The common functions are used by applications to perform a functional task for the user. It is also possible that common functions use other common functions to, in the end, perform the required functionality requested by applications. An application can use one or more common functions. The user in this context can be a human or a machine. (I)
- 7.1.3 In the paragraphs of common functions, the functionality of the common function is specified (*what* shall the common function perform). Also the input and output attributes are specified. These attributes are used by applications to interact with common functions but also common functions can interact with each other. The exact sequence of interactions amongst common functions and between common function and application is not specified. This is considered to be in the area of the *how*, and since the FRS only specifies the *what*, sequences are not specified in this document. Please note that the input and output of a common function is considered to be dynamic. Triggered by the application and/or a common function it can change. (I)
- 7.1.4 Another principle is that only applications can interact with users. Therefore, only in the applications the reader finds HMI requirements but not in the paragraphs of common functions. The level of HMI requirements is concentrated to the functional level and/or to the requirements explicitly required to perform the application. The FRS does not specify the HMI itself in detail (which buttons are needed, what is the colour and size, etc.). HMI aspects are only specified in applications if there are specific requirements applicable. The generic requirements, like a call accept button, are not specific and it is assumed it is commonly understood. (I)
- 7.1.5 Before reading the specification of applications with voice functionality, the reader shall first understand the paragraph with the basic voice function requirements (paragraph 10.1). These requirements are generally applicable to all voice applications. Only the exceptions to this basic voice function are expressed as part of the definition of the voice applications. (I)
- 7.1.6 The common functions and applications are specified for on-network use. Where applicable, off-network use is described specifically per function and application.
- 7.1.7 The common functions are assumed to be constantly active and available for other common functions and applications. (I)

7.1.8

The ordering of paragraphs is as follows: (I)

- Paragraph 8: Common functions:
- Paragraph 9: Introduction to applications
- Paragraph 0: Voice applications
- Paragraph 11: Data applications
- Paragraph 12: Video applications

8 Common functions

8.1 Introduction

8.1.1 This paragraph covers the common functions. Each common function is ordered and specified in the following sections: (I)

- Introduction: brief description of the common function and rationale via information statements;
- Generic requirements: all requirements for the common function (excluding interworking, off-network and network maintenance, configuration and monitoring). If required for readability, subsection marking can be used;
- Requirements for interworking with GSM-R: all requirements relevant for interworking with GSM-R, if any;
- Requirements for off-network, if any;
- Requirements for network maintenance, configuration and monitoring. All requirements relevant for network maintenance, configuration and monitoring, if any;
- Attributes (inputs/outputs): relevant input and output attributes from this common function to other common functions and/or applications are specified in this section.

8.2 Common functions

8.2.1 The following common functions are specified in this paragraph: (I)

URS reference	Name	Paragraph
8.1	Assured voice communication	8.2.2
8.2	Multi user talker control	8.2.3
8.3	Role management and presence	8.2.4
8.4	Location services	8.2.5
8.5	Authorisation of communication	8.2.6
8.7	Authorisation of application	8.2.7
8.8	QoS and priority	8.2.8
8.9	Deleted	n.a.
8.10	Assured data communication	8.2.9
8.11	Inviting-a-user messaging	8.2.10
8.12	Arbitration	8.2.11
8.13	Distribution of synchronised time	8.2.12
10.1	Billing information	14

Table 2: Common function overview

8.2.2 Assured voice communication common function

8.2.2.1 Introduction

8.2.2.1.1 The Assured Voice Communication (AVC) common function provides a clear indication to the users as soon as an end-to-end voice communication link is interrupted or as long as the end-to-end communication link is active. (I)

8.2.2.1.2 The Assured Voice Communication is useful especially in situations, where the users are at risk when the communication is interrupted. Shunting communication during pushing movements is a good use case for the common function. (I)

8.2.2.2 Generic requirements

8.2.2.2.1 The AVC common function shall report to the application as soon as the voice communication is interrupted for at least one of the participating user(s). (M)

8.2.2.2.2 The AVC common function shall report to the application as soon as the voice communication quality is no more fulfilling the minimum quality required to assure an operational communication for at least one of the participating user(s). (M)

8.2.2.3 Requirements for interworking with GSM-R

8.2.2.3.1 No specific requirements. (I)

8.2.2.4 Requirements for off-network

8.2.2.4.1 The AVC common function is required in off-network mode. (M)

8.2.2.5 Requirements for network maintenance, configuration and monitoring

8.2.2.5.1 To be defined in a later version of the specification. (I)

8.2.2.6 Attributes (inputs/outputs)

8.2.2.6.1 The FRMCS system shall support the following input attributes: (M)
a) On which communication AVC is required.

8.2.2.6.2 The FRMCS system shall support the following output attributes: (M)
a) Communication interrupted (yes/no).

8.2.3 Multi user talker control common function

8.2.3.1 Introduction

8.2.3.1.1 The FRMCS system performs mediation between users competing to have the floor (also known as floor control). (I)

8.2.3.1.2 There are different needs for different voice communication to control the talkers. E.g. in case of railway emergency communication the most relevant parties of the communication (e.g. initiator of the communication and responsible controller) are given priority in talking compared to other parties, while in some other type of communication talking permissions are more open. (I)

8.2.3.1.3 Multi user talker control function provide means to configure various talker configurations for different communications. (I)

8.2.3.2 Generic requirements

8.2.3.2.1 The multi user talker common function shall determine at any time of a voice communication which user(s) is(are) allowed to talk . (M)

8.2.3.2.2 The decision of the multi user talker common function shall be based on the following parameters set by the application: (M)

- a) The talker authorisation assigned to each user;
- b) The talker priority assigned to each user;
- c) The maximum number of simultaneous talkers;
- d) Which users are allowed to talk initially;

8.2.3.2.3 The decision of the multi user talker common function should be based on the following parameters set by the application: (O)

- a) The location of the user.

8.2.3.2.4 An entitled user shall be able to overrule the decision of the multi user talker common function regarding the talker priority assignment and the maximum numbers of simultaneous talkers. (M)

8.2.3.2.5 The decision of the multi user talker common function shall be based on the following user triggered events provided by the application: (M)

- a) The request of the permission to talk from a user;
- b) The revoking of the permission to talk of a user;
- c) The information that a user stops talking;
- d) The granting of the permission to talk of a user;
- e) The request to change the maximum number of simultaneous talkers;
- f) The merging of voice communications.

8.2.3.2.6 The decision of the multi user talker common function should be based on the following user triggered events provided by the application: (O)

- a) Change of user's location with respect to the predefined geographical area.

8.2.3.2.7 The multi user talker control common function shall adapt its behaviour according the parameters and events provided by the application which are continuously updated during the whole communication. (M)

8.2.3.2.8 The multi user talker control common function shall be used for both user-to-user as well as for multi user voice communications. (M)

8.2.3.3 General behaviour granting permission to talk

8.2.3.3.1 The multi user talker control common function shall grant the permission to talk by applying the following rules. (M)

8.2.3.3.2 The ~~Figure 5~~Figure-5 and ~~Figure 6~~Figure-6 are visualising the requirements. (I)

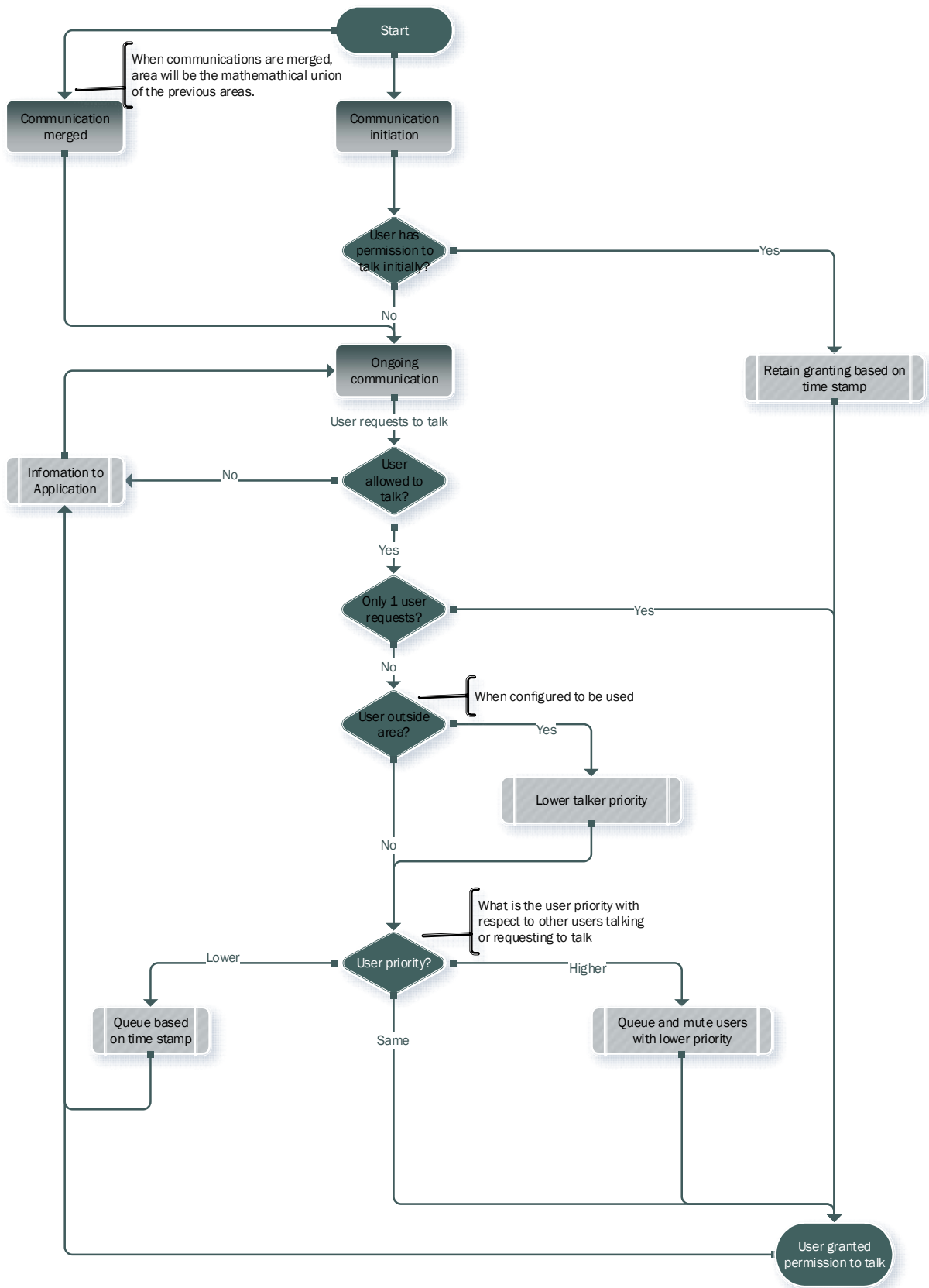


Figure 5: multi user talker control basic stream

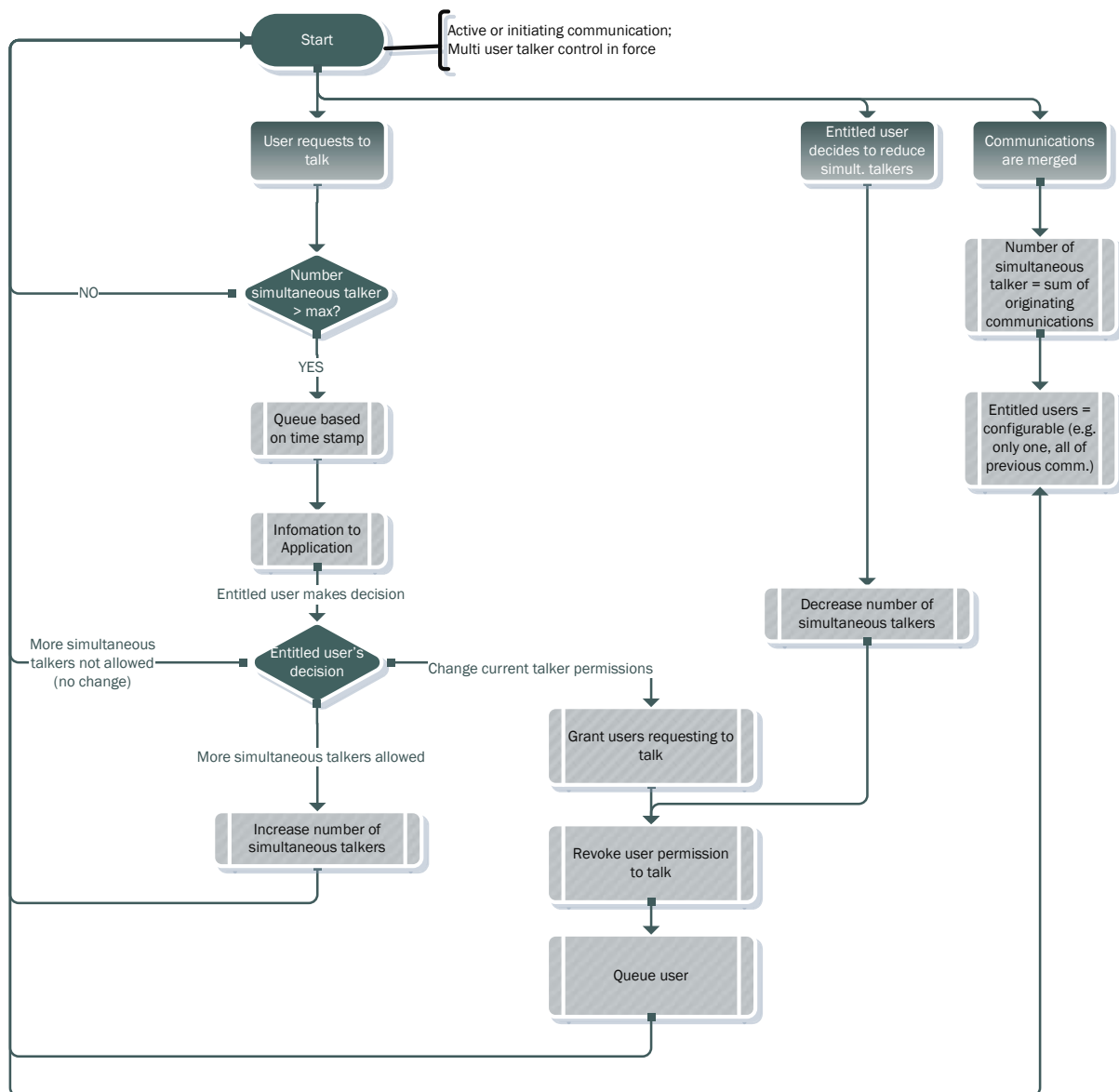


Figure 6: multi user talker managerial stream

- 8.2.3.3.3 Upon request, only a user having talker authorisation shall be granted with the permission to talk. (M)
- 8.2.3.3.4 The permission to talk shall be granted in the case that only one user requests the permission. (M)
- 8.2.3.3.5 The user having a higher priority to talk, shall be granted the permission to talk while users with a lower priority shall be muted and queued. (M)
- 8.2.3.3.6 All users having the same priority shall be granted with the permission to talk, thereby not exceeding the maximum number of user with the permission to talk simultaneously. (M)
- 8.2.3.3.7 All users having a lower priority shall be queued based on time stamp. (M)

- 8.2.3.3.8 All users having the permission to talk initially, shall be granted the permission to talk for a configurable time. (M)
- 8.2.3.3.9 When during communication the number of users requesting to talk simultaneously exceeds the defined maximum number of simultaneous talkers, the following sequence of behaviours shall be applied: (M)
- a) The requesting user(s) that with their attendance would lead to exceeding the maximum number of simultaneous talkers shall be queued based on time of request;
 - b) The application shall be informed that the number of simultaneous talker requests exceeds the defined maximum number of simultaneous talkers.
- 8.2.3.3.10 When during communication setup or during ongoing communication the number of users requesting to talk simultaneously exceeds the defined maximum number of simultaneous talkers, based on the input from an entitled user having the right to change the setting of the multi user talker control common function, the common function shall support the following behaviours: (M)
- a) Increase the allowed number of simultaneous talkers;
 - b) Set which user keeps / is granted or loses / is not granted (by queuing) the permission to talk.
- 8.2.3.3.11 An entitled user shall be able to revoke the permission to talk of any of the users with permission to talk, thereby lowering the maximum number of simultaneous talkers. (M)
- 8.2.3.3.12 When the permission to talk is revoked by the entitled user, the user(s) losing the permission to talk shall be able to finish talking. (M)
- 8.2.3.3.13 When the permission to talk is revoked by the entitled user, the user(s) losing the permission to talk should be muted after a configurable time. (O)
- 8.2.3.3.14 When, during talking, a user with a higher priority requests to talk, the user having a higher priority to talk shall be granted the permission to talk and all users with a lower priority shall be queued. (M)
- 8.2.3.3.15 When the maximum number of simultaneous talkers is reduced and the reduction results in having more active talkers than permitted, the active talker(s) shall lose(s) their permission to talk as soon as they stop talking until to new maximum number of simultaneous talkers is met. (M)
- 8.2.3.3.16 The multi user talker control common function shall inform the application of user(s) requesting to talk and user(s) actively talking. (M)
- 8.2.3.3.17 The multi user talker control common function shall inform all applications of user(s) in the voice communication, which user(s) is/are talking. The indication shall contain the identity of the user(s). (M)
- 8.2.3.3.18 When a user status is affected (e.g. lost permission to talk, muted, queued), this shall be reported to the user through the application. (M)

- 8.2.3.3.19 If the user is outside the predefined geographical area, as defined per application, it shall be possible to configure a lower talker priority for the user outside of the predefined geographical area. (O)
- 8.2.3.3.20 Upon merging of communications: (M)
- a) The number of simultaneous talkers of the new communication shall be set to the sum of the number of simultaneous talkers in all of the original communications;
 - b) All the entitled users of the original communications shall become entitled for the merged communication.
- 8.2.3.3.21 Upon merging of communications: (O)
- a) The geographical area of the new communication should be set to the union of the geographical areas of all of the original communications.
- 8.2.3.4 [Requirements for interworking with GSM-R](#)
- 8.2.3.4.1 There is no interworking required. The handling of the talker control is expected to be done independently in the GSM-R and FRMCS systems. (I)
- 8.2.3.5 [Requirements for off-network](#)
- 8.2.3.5.1 The multi user talker control common function shall be able to operate in off-network mode. (M)
- 8.2.3.5.2 In off-network mode the multi user talker control common function shall use a predefined default set of multi user talker control attributes, defined per application. (M)
- 8.2.3.5.3 The default set of multi user talker control attributes shall be configurable by the IM/RU. (M)
- 8.2.3.6 [Requirements for network maintenance, configuration and monitoring](#)
- 8.2.3.6.1 No specific requirements. (I)
- 8.2.3.7 [Attributes \(inputs/outputs\)](#)
- 8.2.3.7.1 The FRMCS system shall support the following input attributes for a specific voice communication: (M)
- a) The number of simultaneous talkers (type: number);
Information: this input attribute can be changed at any time during a communication: the entitled user changes the number of simultaneous talkers;
 - b) The application making use of this service (type: application identifier);
 - c) The higher priority talker either queues or mutes user(s) with a lower priority talking at that moment (type: queue/mute);
 - d) The permission (type: yes/no) and priority (type: talker priority level) per group of functional identities (like driver).
- 8.2.3.7.2 The FRMCS system should support the following input attributes for a specific voice communication: (O)

- a) The geographical area relevant per application (type: area identifier).
- 8.2.3.7.3 The FRMCS system shall support the following input attributes for an individual user within a specific voice communication: (M)
- a) The request from a user for the permission to talk (type: trigger);
Information: this input attribute can be changed at any time during a communication: a user raises or lowers the hand, e.g. by pressing or releasing a button or a screen icon.
 - b) Talker authorisation (type: yes/no) and priority (type: priority level);
Information: this input attribute can be changed at any time during a communication: users becoming eligible for the communication or losing that;
 - c) The functional identity of the involved user (type: functional identity information).
- 8.2.3.7.4 The FRMCS system should support the following input attributes for an individual user within a specific voice communication: (O)
- a) The location of the involved user (type: location information).
- 8.2.3.7.5 The FRMCS system shall support the following output attributes for a specific voice communication: (M)
- a) The list of active talker(s), identified by their identity (type: list with user identities);
 - b) The reporting of the function if the number of simultaneous talkers needs to be changed (type: number);
 - c) Indication of request to talk of a user with lower priority (type: event, user identity);
 - d) A list of users with information for each user stating talking, allowed to talk and not allowed to talk.
- 8.2.3.7.6 The FRMCS system shall support the following output attributes for an individual user within a specific voice communication: (M)
- a) The response to a request, which can be either to grant or to deny the permission to talk (type: granted/denied including reason of denial);
 - b) Change of the permission to talk when the allowed maximum number of talker permissions was changed by either the function or the entitled user (type: permission/no permission to talk);
 - c) The request to talk was queued, position in queue (type: number).

8.2.4 Role management and presence common function

8.2.4.1 Introduction

- 8.2.4.1.1 The role management and presence common function is responsible for handling the railway role management of the users and devices and identity registration / deregistration processes. (I)
- 8.2.4.1.2 The Role management and presence common function is responsible for: (I)
- a) Enabling the dynamic allocation of railway operational roles to the users;
 - b) Enabling the addressing of a user based on the functional identity;
 - c) Enabling the addressing of a user based on the user identity;
 - d) Providing the presence status related to the user identity;
 - e) Providing the presence status related to the functional identity.
- 8.2.4.1.3 It is assumed that a subscriber identity is allocated to the FRMCS user's equipment upon attachment to the FRMCS system. At this step, the user of the equipment is not yet logged into the FRMCS system but the user's equipment can already perform communication where only a subscriber identity is required. (I)
- 8.2.4.1.4 Role management makes railway communications more efficient. Some communications even require identification of the users by their identity. This common function also enables the routing based on the initiator functional identity. (I)

8.2.4.2 Initial identities assignment

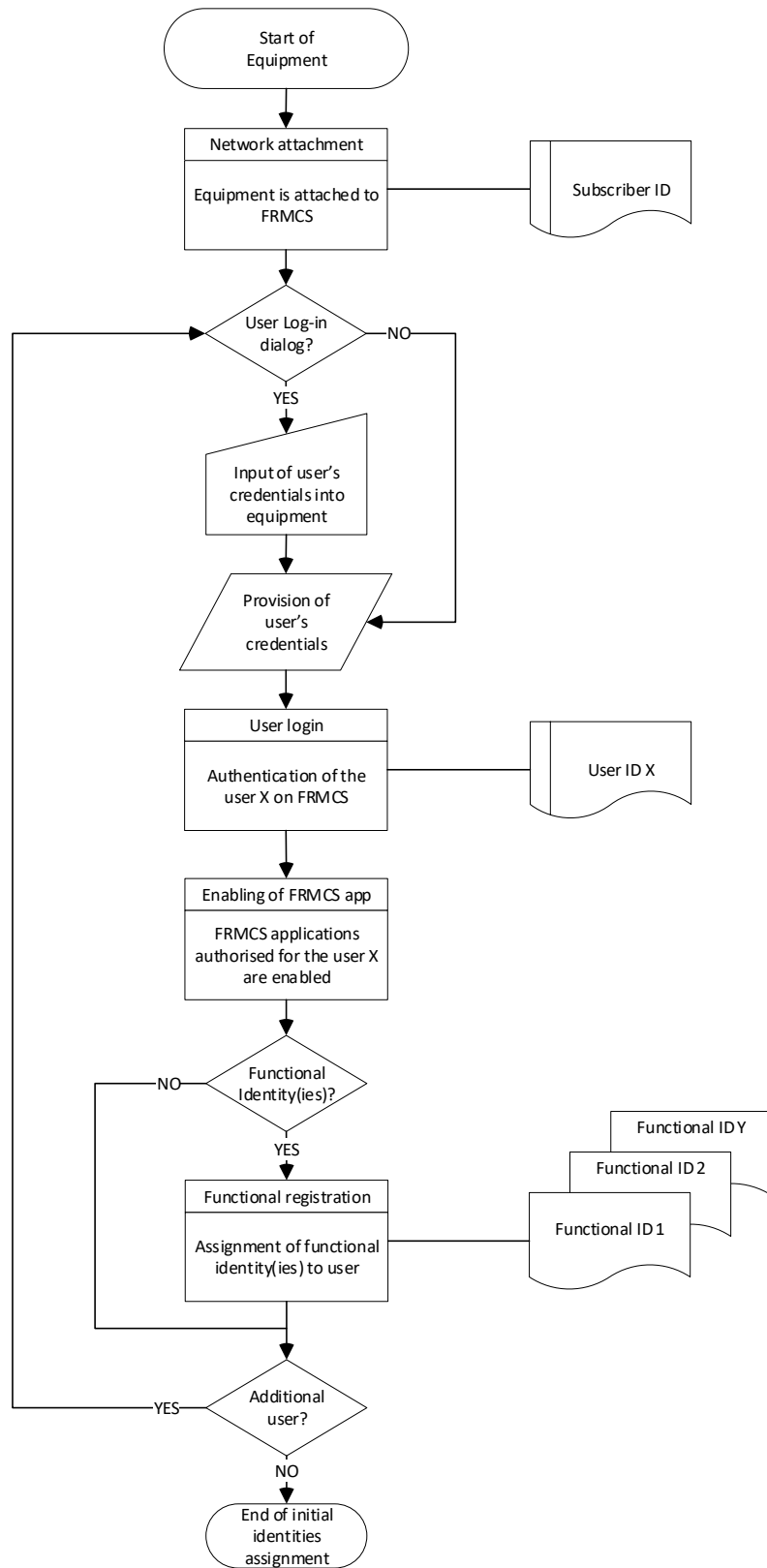


Figure 7: Initial FRMCS identities assignment

- 8.2.4.2.1 Several FRMCS applications can be embedded in the same equipment. For example, the cab radio provides the train driver with the ability to use REC, Shunting and other types of FRMCS applications and the fixed terminals system provides the controller with the ability to use REC, multi-train voice communications and other FRMCS applications. (I)
- 8.2.4.2.2 The equipment is responsible to set up the FRMCS communications related to the needs of the user, e.g. the train driver requests the initiation of a REC. In that case, the train driver is considered as an user for the equipment. (I)
- 8.2.4.2.3 The equipment is also setting up some FRMCS communications for its own needs, e.g. to perform software and configuration management. In that case, the application(s) of the equipment is (are) considered as the user(s). (I)
- 8.2.4.2.4 During the start-up phase, the equipment shall attach to the FRMCS system. (M)
- 8.2.4.2.5 Upon a successful attachment, a subscriber identity is assigned. (M)
- 8.2.4.2.6 The FRMCS system shall support the following user login methods: (M)
- a) By an automatic input of credentials;
 - b) By an explicit input of credentials from a user through a dialog.
- 8.2.4.2.7 Upon a successful login the user shall be assigned a user identity and be able to use authorised applications. (M)
- 8.2.4.2.8 The user shall have the ability to register functional identity(ies) as soon as he is logged in the FRMCS system. (M)
- 8.2.4.2.9 An equipment can have the ability to manage several users simultaneously. (I)
- 8.2.4.2.10 An equipment can be used for voice communication by several users, e.g. a cab radio used by a train driver, through the HMI located in the front cab of the train and used simultaneously by a train conductor through the other HMI located in the rear cab of the train. (I)
- 8.2.4.3 **Generic requirements**
- 8.2.4.3.1 The role management and presence common function shall assign a user identity to a user according to the credentials. (M)
- 8.2.4.3.2 The assignment of a user identity to a user is further called as “user login”. (I)
- 8.2.4.3.3 The role management and presence common function shall allow a system administrator to dynamically define the user’s roles set. (M)
- 8.2.4.3.4 The FRMCS system shall support user role(s) which are considered as a roles set. (M)
- 8.2.4.3.5 A user’s roles set shall define the set of labels’ values which can be assigned to the user for each type of functional identity. (M)

- 8.2.4.3.6 Depending on the operational needs, the roles set can be more or less precise, e.g. for a train function identity the roles set can define a specific train number in addition of the function label (e.g. Leading Driver) and the OC label (e.g. SNCF). See paragraph 0 for label definition. (I)
- 8.2.4.3.7 The role management and presence common function shall support the definition of the role set of the user based on user identity.: (M)
- 8.2.4.3.8 The user authentication (assignment of a user identity) is considered as a prerequisite to get a railway role. The subscriber identity is considered as not sufficient to identify who is using this railway communication function. (I)
- 8.2.4.3.9 The system administrator shall be able to enhance the role management by using one or a combination of the following criteria to determine the user's roles set: (M)
- a) Current user's location information;
 - b) Equipment type;
 - c) Current time.
- 8.2.4.3.10 The role management and presence common function shall provide the user's roles set information to the application upon request. (M)
- 8.2.4.3.11 The role management and presence common function shall assign functional identity/ies to a user upon a request by an application. (M)
- 8.2.4.3.12 The assignment of a functional identity to a user is further called as "functional registration". (I)
- 8.2.4.3.13 The role management and presence common function shall allow several users to share the same functional identity. (M)
- 8.2.4.3.14 A voice communication addressed to a functional identity shared by several users shall be handled in one of the following ways, depending on a predefined configuration set by the system administrator on this functional identity: (M)
- a) A user sharing a functional identity with other users shall no more be addressed by a communication as soon as one of the other users registered to this functional identity has accepted the communication except if the user is also addressed through another identity (see Appendix E);
 - b) A user sharing a functional identity with other users shall be addressed whatever is the actions performed by other users registered in this functional identity.
- 8.2.4.3.15 The role management and presence common function shall provide the application with the information that a user is no more addressed because another user has accepted the communication addressed to their shared functional ID. (M)
- 8.2.4.3.16 The role management and presence common function shall provide an application with the functional identity/ies currently assigned to a user upon request. (M)

- 8.2.4.3.17 The role management and presence common function shall allow an application to provide the user with a predefined list of selectable relevant identities prior to initiate a communication. (M)
- 8.2.4.3.18 The system administrator shall be able to predefine the list of selectable relevant identities for each application. (M)
- 8.2.4.3.19 The aim of this list is to provide guidance and to speed up the initiation of communications but this does not prevent the user to be able to define other identities for initiation. (I)
- 8.2.4.3.20 The relevance of an identity can depend e.g. on the current railway operational role of the initiating user or on the location. (I)
- 8.2.4.3.21 The role management and presence common function shall allow an application to determine all the identities assigned to a participant of a communication. (M)
- 8.2.4.3.22 When configured by a system administrator, the role management and presence common function shall automatically assign functional identity(ies) to a user upon user login. (M)
- 8.2.4.4 [User login](#)
- 8.2.4.4.1 The user identity shall univocally identify the user. (M)
- 8.2.4.4.2 The role management and presence common function shall be able to check the validity of the user's credentials based on information available within FRMCS system. (M)
- 8.2.4.4.3 The role management and presence common function should be able to check the validity of the user's credentials based on information available outside FRMCS system. (O)
- 8.2.4.5 [Functional registration](#)
- 8.2.4.5.1 The role management and presence common function shall verify whether a user is authorised to register a functional identity based on user's current roles set. (M)
- 8.2.4.5.2 The role management and presence common function shall verify what is the number of users allowed to register to a functional identity simultaneously (sharing of functional identities). (M)
- 8.2.4.5.3 The system administrator shall predefine for each functional identity the maximum number of users allowed to share this functional identity by using values between 1 and at least 10. (M)
- 8.2.4.5.4 For the number of shared functional identities the value 1 means that a functional identity is not shared with another user. The value 2 means that a functional identity is shared among two users. (I)
- 8.2.4.5.5 The role management and presence common function shall reject a functional registration request if the maximum allowed number of sharing users is exceeded. (M)

- 8.2.4.5.6 The role management and presence common function shall allow the system administrator to enable and disable a validity time for a functional registration. (M)
- 8.2.4.5.7 Upon validity timer expiration, the assignment of the functional identity to the user identity shall be revoked by the FRMCS system. (M)
- 8.2.4.5.8 The validity timer shall be configurable in steps of one minute with a maximum value of at least one week. (M)
- 8.2.4.5.9 The validity timer shall be independently configurable for each function label. (M)
- 8.2.4.5.10 The system administrator shall be able to assign functional identity(ies) to a user that shall never be deregistered by the user. (M)
- 8.2.4.5.11 The FRMCS system shall be able to register a user into a functional identity automatically upon user login. (M)
- 8.2.4.5.12 The system administrator shall be able to enable and disable the automatic registration of a user. (M)
- 8.2.4.5.13 The system shall support the assignment of minimum 50 functional identities to a user. (M)
- 8.2.4.5.14 Some specific functional identities require to be registered at all times by one or more user(s) (e.g. controller functional identity) when the FRMCS equipment is switched on. (I)
- 8.2.4.5.15 The system administrator shall be able to predefine for each functional identity the minimum registered users that has to be fulfilled at any time by using values between 0 and 10. (M)
- 8.2.4.5.16 For the minimum number of registered users the value 0 means that a functional identity is allowed to be unregistered. The value 1 means that a functional identity is registered at least by one user when the FRMCS equipment is switched on. (I)
- 8.2.4.5.17 The FRMCS system shall reject a deregistration request if the minimum number of registered users is already reached for the concerned functional identity. (M)
- 8.2.4.5.18 The FRMCS system shall handover the functional identity to another predefined user if the minimum number of registered users is no more fulfilled (e.g. due to equipment switch off). (M)
- 8.2.4.5.19 The FRMCS system shall allow a system administrator to set a maximum number of functional identities registration per user. (M)
- 8.2.4.6 **Functional transfer**
- 8.2.4.6.1 The role management and presence common function shall allow a user to perform the following actions: (M)

- a) Re-assign a subset of its functional identities to another user;
 - b) Re-assign all of its functional identities to another user.
- 8.2.4.6.2 The role management and presence common function shall allow an entitled user to perform the following actions: (M)
- a) Re-assign a subset of functional identities registered by one user to another user;
 - b) Re-assign all the functional identities registered by one user to another user.
- 8.2.4.6.3 The system administrator shall be able to configure whether the transfer of a functional identity is conditioned to the acceptance from the target user. (M)
- 8.2.4.7 **Presence**
- 8.2.4.7.1 The role management and presence common function shall enable the provision of the current status of a user to users currently logged in the FRMCS system. (M)
- 8.2.4.7.2 The role management and presence common function shall allocate at any time one of the following status to a user identity not registered in a functional identity: (M)
- a) Offline;
 - b) Available;
 - c) Busy (in communication);
 - d) Do not disturb.
- 8.2.4.7.3 The role management and presence common function shall allocate at any time one of the following status to a user identity registered in (at least) one functional identity: (M)
- a) Offline;
 - b) Ready for operation (registered in a railway function).
- 8.2.4.7.4 The role management and presence common function shall enable the provision of the current status of a functional identity to users currently logged in the FRMCS system. (M)
- 8.2.4.7.5 The role management and presence common function shall allocate at any time one of the following status to a functional identity: (M)
- a) Not registered;
 - b) Ready for operation (at least one user registered in this function);
 - c) Transfer pending.
- 8.2.4.7.6 The status of an identity shall be automatically set by the FRMCS system except for the value “do not disturb” which shall be set by the user itself. (M)
- 8.2.4.8 **Requirements for interworking with GSM-R**
- 8.2.4.8.1 To be defined in a later version of the specification. (I)
- 8.2.4.9 **Requirements for off-network**
- 8.2.4.9.1 No specific requirements. (I)

8.2.4.10 Requirements for network maintenance, configuration and monitoring

8.2.4.10.1 To be defined in a later version of the specification. (I)

8.2.4.11 Attributes (inputs/outputs)

8.2.4.11.1 The FRMCS system shall support the following input attributes: (M)

- a) User's credentials;
- b) Subscriber identity(ies);
- c) User identity(ies);
- d) Functional identity(ies);
- e) Status ("do not disturb" set by user).

8.2.4.11.2 The FRMCS system shall support the following output attributes: (M)

- a) Subscriber identity(ies);
- b) User identity(ies);
- c) Functional identity(ies);
- d) User's own roles set;
- e) Subscriber(s) status;
- f) User(s) status;
- g) Functional identity(ies) status;
- h) Subscriber(s) location information;
- i) User(s) location information.

8.2.5 Location services common function

8.2.5.1 Introduction

8.2.5.1.1 The identification of the location of users require a mechanism to retrieve, store and provide the location information including route settings of each user. (I)

8.2.5.1.2 Location information is an essential data for various applications, both for within the FRMCS system as well as outside the FRMCS system. (I)

8.2.5.1.3 Location service common function allows the correct identification of affected or involved users or devices where the establishment or routing of communication is dependent on location information, for example for Railway Emergency Communications. (I)

8.2.5.2 Generic requirements

8.2.5.2.1 The location service common function shall be able to provide, on request, the location information including route settings of a user device at any time. (M)

8.2.5.2.2 The location information shall be accessible by: (M)

- a) An application;
- b) An external system.

8.2.5.2.3 The location service common function shall support the following elements: (M)

- a) User's geographical horizontal position;
- b) User's geographical horizontal and vertical position;
- c) User's velocity (speed and direction in the horizontal space);
- d) User's acceleration.

8.2.5.2.4 The location service common function should support the following elements: (O)

- a) User's route setting (max. speed of the user, consecutive route sections and their attributes);
- b) Railway infrastructure element(s) linked to the user (e.g. track section ID, station ID, signal box ID, track kilometre marking);
- c) Other infrastructure element(s) linked to the user (e.g. radio cell identity).

8.2.5.2.5 The system is able to support the elements above, but at some time not all the information might be available. (I)

8.2.5.2.6 Each location information element shall be accompanied by both: (M)

- a) The level of accuracy of the location information element;
- b) The time stamp of the location information element.

8.2.5.2.7 The location services common function shall be able to use information provided by external location information source(s) to perform one or a combination of the following actions: (M)

- a) Enhance the accuracy;
 - b) Add other type of location information.
- 8.2.5.2.8 The external source(s) providing location information can be e.g. interlocking system, ATC, sensor, RFID, information from MCx or external GNSS. (I)
- 8.2.5.2.9 The location services common function shall provide, upon request, the identity/ies of the user(s) matching the following criteria: (M)
 - a) User's current geographical position included in a given polygon;
 - b) User's future expected geographical position in a given polygon and given period of time;
 - c) User's velocity included in a given range.
- 8.2.5.2.10 The location services common function should provide, upon request, the identity/ies of the user(s) matching the following criteria: (O)
 - a) User's current geographical position linked to a railway infrastructure element(s) (such as a balise or a level crossing);
 - b) User's future geographical position linked to a railway infrastructure element(s) (such as a balise or a level crossing) in a given period of time;
 - c) User's geographical position linked to other infrastructure element(s) (such as a radio cell identity).
- 8.2.5.3 [Requirements for interworking with GSM-R](#)
- 8.2.5.3.1 No specific requirements. The location services is expected to be used independently in the GSM-R and FRMCS systems. (I)
- 8.2.5.4 [Requirements for off-network](#)
- 8.2.5.4.1 The location services common function shall be able to operate in off-network mode (M)
- 8.2.5.5 [Requirements for network maintenance, configuration and monitoring](#)
- 8.2.5.5.1 To be defined in a later version of the specification. (I)
- 8.2.5.6 [Attributes \(inputs/outputs\)](#)
- 8.2.5.6.1 The FRMCS system shall support the following input attributes: (M)
 - a) The identity of the user;
 - b) The range of positions (polygon including geographical coordinates);
 - c) The velocity in a given range;
- 8.2.5.6.2 The FRMCS system should support the following input attributes: (O)
 - a) The set of railway infrastructure elements;
 - b) The set of other infrastructure elements.
- 8.2.5.6.3 The FRMCS system shall support the following output attributes: (M)

- a) The user's position (geographical position);
- b) The user's velocity;
- c) The user's acceleration;
- d) The level of accuracy;
- e) Time stamp of the location information;
- f) The identities of the users matching the request criteria.

8.2.5.6.4 The FRMCS system should support the following output attributes: (O)

- a) The set of railway infrastructure elements linked to user's position;
- b) The set of other infrastructure elements linked to user's position;

8.2.6 Authorisation of communication common function

8.2.6.1 Introduction

8.2.6.1.1 The FRMCS system is configurable, so that access to voice, data and video communications can be controlled through the use of identities. (I)

8.2.6.1.2 Authorisation of communication common function allows the network operators to control and regulate communications in order to avoid disruption/distraction to the users (for example drivers), preventing unauthorised communication and to minimise network load. (I)

8.2.6.2 Generic requirements

8.2.6.2.1 The authorisation of communication common function shall enable only authorised users to initiate voice, data and video communications. (M)

8.2.6.2.2 The authorisation of communication common function shall enable only authorised users to merge communications. (M)

8.2.6.2.3 The authorisation of communication common function shall enable only authorised users to terminate voice, data and video communications. (M)

8.2.6.2.4 The authorisation of communication common function shall enable only authorised users to leave voice, data and video communications. (M)

8.2.6.2.5 The authorisation of communication common function shall enable only authorised users to reject voice, data and video communications. (M)

8.2.6.2.6 The authorisation of communication common function shall enable only authorised users to invite authorised users to join voice, data and video communications. (M)

8.2.6.2.7 The authorisation of communication common function shall enable only authorised users to kick out users from voice, data and video communications. (M)

8.2.6.2.8 The authorisation of communication common function shall enable only authorised users to put users on hold in voice, block and not buffer data and video communications. (M)

8.2.6.2.9 The FRMCS system shall be able to verify that a FRMCS user is allowed to communicate with other FRMCS user(s). (M)

8.2.6.2.10 The FRMCS system shall be able to verify that a non-FRMCS user is allowed to communicate with FRMCS user(s). (M)

8.2.6.2.11 The FRMCS system shall be able to verify that a FRMCS user is allowed to communicate with non-FRMCS user(s). (M)

8.2.6.2.12 The authorisation of communication common function shall contain a configurable set of rules used to determine which communications functions are authorised based on one or a combination of the following criteria: (M)

- a) Functional identity of the initiator;
 - b) Functional identity of the destination;
 - c) Functional identity related to the equipment;
 - d) User identity of the initiator;
 - e) User identity of the destination.
- 8.2.6.2.13 The authorisation of communication common function should contain a configurable set of rules used to determine which communications functions are authorised based on the identity of a non-FRMCS user and one or a combination of the following criteria: (O)
- a) Functional identity of the initiator;
 - b) Functional identity of the destination;
 - c) Functional identity related to the equipment;
 - d) User identity of the initiator;
 - e) User identity of the destination.
- 8.2.6.2.14 The decision to grant or deny the communication establishment shall be configurable and based on full identities. (M)
- 8.2.6.2.15 The decision to grant or deny the communication establishment shall be configurable and based on subparts of identities. (M)
- 8.2.6.2.16 An example of a full identity is a specific driver on a specific train. An example of a subpart identity is all drivers. (I)
- 8.2.6.2.17 Upon merging of communications, the authorisation of communication common function shall request the application(s) for information on ongoing communications of corresponding communication parties. (M)
- 8.2.6.2.18 The decision to grant or deny merging of communications shall be configurable and based on types of communications. (M)
- 8.2.6.2.19 E.g. merging of Controller to Driver communication with a multi-train communication can be allowed but merging of Controller to Driver communication with Railway Emergency Communication can be denied. (I)
- 8.2.6.2.20 E.g. communication from any driver to public services can be restricted in general (black list), but access to certain specific public services can be allowed separately (white list). (I)
- 8.2.6.2.21 When the verification is positive, the authorisation of communication common function shall grant the requested communication. (M)
- 8.2.6.2.22 When the verification is negative, the authorisation of communication common function shall deny the requested communication and inform the initiator about the reason of denial. (M)
- 8.2.6.3 [Requirements for interworking with GSM-R](#)
- 8.2.6.3.1 No specific requirements. (I)
- 8.2.6.4 [Requirements for off-network](#)
- 8.2.6.4.1 The authorisation of application shall be available in both on-network and off-network conditions for FRMCS users. (M)

8.2.6.4.2 In off-network conditions a default profile defined by the network operator is used. (I)

8.2.6.5 Requirements for network maintenance, configuration and monitoring

8.2.6.5.1 No specific requirements. (I)

8.2.6.6 Attributes (inputs/outputs)

8.2.6.6.1 The FRMCS system shall support the following input attributes: (M)

- a) Initiating identity;
- b) Destination identity;
- c) Type of request (establish or merge);
- d) Status of ongoing communications

8.2.6.6.2 The FRMCS system shall support the following output attributes: (M)

- a) Request granted;
- b) Request denied, with reason of denial;
- c) Request for status of ongoing communications.

8.2.7 Authorisation of application common function

8.2.7.1 Introduction

- 8.2.7.1.1 The FRMCS system is configurable to authorize a user to access application(s) in order to prevent unauthorised usage and minimise network load. The network operator controls the configuration. (I)
- 8.2.7.1.2 In a cross-border situation configurations of the networks are controlled in cooperation by network operators of concerned networks. (I)
- 8.2.7.1.3 When on the FRMCS user device an application is requested to be started, the FRMCS performs a verification against the set of authorised applications. If the verification is positive, the application starts. (I)

8.2.7.2 Generic requirements

- 8.2.7.2.1 Applications that are authorised shall be made available for the user. (M)
 - 8.2.7.2.2 The user shall be informed if an application is no longer authorised. (M)
 - 8.2.7.2.3 If an application is relying on other applications, enabling of all required applications shall be managed by the system. (M)
 - 8.2.7.2.4 The authorisation of application common function shall contain a configurable set of rules used to determine which applications are authorised at a specific moment, based on one or a combination of the following criteria: (M)
 - a) Functional identity related to the user;
 - b) Functional identity related to the equipment;
 - c) User identity;
 - d) Subscriber identity;
 - e) User location;
 - f) Allowances to use the application by the manager of the application (such as IM or RU).
 - 8.2.7.2.5 The authorisation of application common function shall update the set of authorisation applications upon the occurrence of one of the following events: (M)
 - a) The equipment is powered on/off;
 - b) The user logs in/out;
 - c) A functional identity is registered/deregistered;
 - d) The location of the user is moved into or out of a predefined area (where the application is authorised);
 - e) The user attaches to a (new) FRMCS system which can support the application;
 - f) After a defined time frame.
 - 8.2.7.2.6 If an application requires interaction with another application, the network operator configures the set of authorised applications. (I)
- ### 8.2.7.3 Requirements for interworking with GSM-R
- 8.2.7.3.1 No specific requirements. (I)

8.2.7.4 Requirements for off-network

8.2.7.4.1 The authorisation of application common function shall be available in both on-network and off-network conditions for FRMCS users. (M)

8.2.7.4.2 In off-network conditions a default profile defined by the network operator is used. (I)

8.2.7.5 Requirements for network maintenance, configuration and monitoring

8.2.7.5.1 No specific requirements. (I)

8.2.7.6 Attributes (inputs/outputs)

8.2.7.6.1 The FRMCS system shall support the following input attributes: (M)

- a) Equipment powered-on status;
- b) Functional identity related to the user;
- c) Functional identity related to the equipment;
- d) User identity;
- e) Subscriber identity;
- f) User location;
- g) FRMCS system identification;
- h) Allowance of the manager of a specific application;
- i) Defined time frame.

8.2.7.6.2 The FRMCS system shall support the following output attributes: (M)

- a) List of authorised applications;
- b) List of denied applications, with the reason of denial.

8.2.8 QoS and priority common function

8.2.8.1 Introduction

8.2.8.1.1 In order to fulfil the required level of communication quality, the FRMCS system has the ability to manage the Quality of Service (QoS) characteristics of a given application and its corresponding communications. (I)

8.2.8.1.2 The FRMCS system allows that communications of higher priority can get precedence over communications with lower priority and have the ability to pre-empt other communications. (I)

8.2.8.1.3 The QoS and priority common function shall include and support the following parameters and values: (M)

- a) Latency: ULTRA-LOW, LOW, NORMAL or BEST EFFORT;
- b) Reliability: ULTRA-HIGH, HIGH or NORMAL;
- c) Throughput: LOW, MID or HIGH;
- d) Setup time: NORMAL or IMMEDIATE;
- e) Priority level: highest, higher than X, lower than Y or lowest.

8.2.8.2 Generic requirements

8.2.8.2.1 The QoS and priority common function shall be able to identify the required QoS characteristics and priority of the corresponding communication. (M)

8.2.8.2.2 The FRMCS system shall be able to manage the QoS characteristics for each communication. (M)

8.2.8.2.3 The FRMCS system shall enable the use of priorities for each communication. (M)

8.2.8.2.4 The FRMCS system shall constantly monitor the performance of the QoS and priority parameters of the communication. (M)

8.2.8.2.5 The FRMCS system shall indicated QoS degradations to the application. (M)

8.2.8.2.6 When the required QoS is not achieved, the FRMCS system shall support the following behaviours: (M)

- a) Continue the communication;
- b) Release the communication.

8.2.8.3 Requirements for interworking with GSM-R

8.2.8.3.1 For user-to-user/multi-user communication, in the direction from GSM-R to the FRMCS system, the GSM-R priority level is exchanged. Mapping of GSM-R priority level to the FRMCS system priority level shall be performed in the FRMCS system. (M)

8.2.8.3.2 For user-to-user/multi-user communication, in the direction from the FRMCS system to GSM-R, the FRMCS priority level is exchanged. The priority level from the FRMCS system shall be mapped to GSM-R priority level by the FRMCS system. (M)

8.2.8.4 Requirements for off-network

8.2.8.4.1 No specific requirements, only best effort principle. (I)

8.2.8.5 Requirements for network maintenance, configuration and monitoring

8.2.8.5.1 The FRMCS system shall allow the network operator to get statistics about the communication pre-emption, QoS degradation and occurrences of denials. (M)

8.2.8.5.2 A user shall not experience any interruption or divergent behaviour in the usage of an application due to a transition between networks (seamless user experience). (M)

8.2.8.6 Attributes (inputs/outputs)

8.2.8.6.1 The QoS and priority common function shall support the following input attributes: (M)

a) Application identifier.

8.2.8.6.2 The QoS and priority common function shall support the following output attributes: (M)

- a) Assigned QoS and priority parameters;
- b) QoS degradation.

8.2.9 Assured data communication common function

8.2.9.1 Introduction

8.2.9.1.1 The Assured Data Communication (ADC) common function provides a clear indication to the users as soon as an end-to-end data communication link is interrupted or as long as the end-to-end communication link is active (I)

8.2.9.1.2 The Assured Data Communication is useful especially in situations, where the users are at risk when the communication is interrupted. Shunting data communication during pushing movements is a good use case for the common function . (I)

8.2.9.2 Generic requirements

8.2.9.2.1 The ADC common function shall report to the application as soon as data communication is interrupted for at least one of the participating user(s). (M)

8.2.9.2.2 The ADC common function shall report to the application as soon as the data communication quality is no more fulfilling the minimum quality required to assure an operational communication for at least one of the participating user(s). (M)

8.2.9.3 Requirements for interworking with GSM-R

8.2.9.3.1 No specific requirements. (I)

8.2.9.4 Requirements for off-network

8.2.9.4.1 The ADC common function is required in off-network mode. (M)

8.2.9.5 Requirements for network maintenance, configuration and monitoring

8.2.9.5.1 To be defined in a later version of the specification. (I)

8.2.9.6 Attributes (inputs/outputs)

8.2.9.6.1 The FRMCS system shall support the following input attributes: (M)
a) On which communication ADC is required.

8.2.9.6.2 The FRMCS system shall support the following output attributes: (M)
a) Communication interrupted (yes/no).

- 8.2.10 [Inviting-a-user common function](#)
- 8.2.10.1 [Introduction](#)
- 8.2.10.1.1 The users of an ongoing voice communication can have a need for any other user to join the ongoing communication. By Inviting-a-user common function a user can send a message to other user(s) inviting them to join the ongoing voice communication. (I)
- 8.2.10.1.2 The user(s) is/are able to receive, reject, accept or ignore the invite. (I)
- 8.2.10.1.3 An example of using this common function is: during an ongoing multi-user communication, a user has a need to inform a controller that the user is wanted in the communication. The controller receives the invite and takes a decision to join or not to join the communication. (I)
- 8.2.10.1.4 This common function is considered to be native for data and video communication. (I)
- 8.2.10.2 [Generic requirements](#)
- 8.2.10.2.1 The FRMCS system shall support inviting other user(s) to join an ongoing voice communication. (M)
- 8.2.10.2.2 The receiving user shall be able to receive the invite. (M)
- 8.2.10.2.3 The further handling of voice communication is specified in section 10.1 Basic voice communication functions. (I)
- 8.2.10.3 [Requirements for interworking with GSM-R](#)
- 8.2.10.3.1 No specific requirements. The inclusion of additional participants in a voice communication is expected to be done independently in the GSM-R and FRMCS systems. (I)
- 8.2.10.4 [Requirements for off-network](#)
- 8.2.10.4.1 No specific requirements. (I)
- 8.2.10.5 [Requirements for network maintenance, configuration and monitoring](#)
- 8.2.10.5.1 To be defined in a later version of the specification. (I)
- 8.2.10.6 [Attributes \(inputs/outputs\)](#)
- 8.2.10.6.1 The FRMCS system shall support the following input attributes: (M)
 - a) Subscriber identity;
 - b) User identity;
 - c) Functional identity.
- 8.2.10.6.2 The FRMCS system shall support the following output attributes: (M)
 - a) response (accepted/rejected).

8.2.11 Arbitration common function

8.2.11.1 Introduction

- 8.2.11.1.1 The FRMCS system performs arbitration between communications competing for the attention of the user. (I)
- 8.2.11.1.2 The arbitration common function allows to prioritise between competing voice, data and video communications on the end user device in order to ensure that eligible communication is able to be performed when required. (I)
- 8.2.11.1.3 This common function also saves the human user from interacting with the HMI in order to keep the attention on the railway operations when required. (I)
- 8.2.11.1.4 This common function is mainly specified to cover the case where a human user manages the competing communications. However when the user is a system the requirements are also applicable. Some of the requirements below apply to only one of those cases (e.g. requirements related to audible and visible indication). (I)

8.2.11.2 Generic requirements

- 8.2.11.2.1 The arbitration common function shall determine whether the resources of a user device (display, handset, loudspeaker, etc.) are shared or exclusively assigned when more than one communication, related to the same or to different applications, are active. (M)
- 8.2.11.2.2 The arbitration common function shall determine whether an incoming communication is automatically connected to a user while this one is not yet involved in a communication. (M)
- 8.2.11.2.3 The arbitration common function does not cover selection of specific HMI resource for communication when more than one of the same type is available. (I)
- 8.2.11.2.4 The arbitration common function shall determine the expected behaviour of the FRMCS system in case a communication is addressed to a user who is logged-in on more than one user device. (M)
- 8.2.11.2.5 The arbitration within one communication, for example adding video to the voice communication, is handled by the application itself. (I)
- 8.2.11.2.6 The arbitration common function shall apply the predefined rules taking into account all communications, connected or in the queue, of the concerned user. (M)
- 8.2.11.2.7 The network operator shall have the ability to apply arbitration rules which are based on the type of the applications and on the labels of the functional identity(ies) registered. (M)
- 8.2.11.2.8 The definition of the arbitration rules can be part of regulation. (I)

- 8.2.11.2.9 Where the defined arbitration rules do not cover a communication arbitration case (e.g. when a new application requests to communicate), a default arbitration rule defined by the network operator shall be applied (e.g. never presented while user connected to another communication and never automatically connected). (M)
- 8.2.11.2.10 The arbitration common function shall be aware of all communications (involving individual users, equipment and identities) in the FRMCS system. (M)
- 8.2.11.3 **Arbitration for multiple communications, one device**
- 8.2.11.3.1 When a communication is addressed to a user not connected to any communication, the configured arbitration rules shall determine which of the following behaviour applies: (M)
- a) Communication is presented;
 - b) Communication is automatically connected.
- 8.2.11.3.2 When a communication is addressed to a user already connected to a communication, the configured arbitration rules shall determine which of the following behaviour applies: (M)
- a) Incoming communication is automatically connected, previously connected communication is queued;
 - c) Incoming communication is automatically merged with the connected communication;
 - d) Incoming communication is presented with visible and audible indication;
 - e) Incoming communication is presented with visible indication only;
 - f) Incoming communication is not presented.
- 8.2.11.3.3 When a communication is initiated by a user already connected to a communication, the configured arbitration rules shall determine which of the following behaviour applies: (M)
- a) Initiated communication is allowed and previously connected communication is queued;
 - b) Initiated communication is merged with previously connected communication;
 - c) Initiated communication is not allowed.
- 8.2.11.3.4 When the status of a connected communication changes (terminated, left or put on hold), the configured arbitration rules shall determine for each queued communication which of the following behaviour applies: (M)

- a) The queued communication is not (or no more) be presented;
- b) The queued communication is presented with visible and audible indication;
- c) The queued communication is presented with visible indication only;
- d) The queued communication is presented to the user and automatically connected;
- e) The queued communication is presented to the user, automatically connected then merged with another queued communication.

8.2.11.3.5 In case of a non-voice communication, “merging” is to be interpreted as “it is allowed for human to interact with both communication in parallel”. (I)

8.2.11.3.6 Arbitration rules shall also apply when the device is equipped with multiple sets of HMI component(s) like displays, handsets, microphones and loudspeakers. (M)

8.2.11.3.7 In the case an incoming communication has not been presented to the user due to an arbitration rule, this communication (if still active) shall be presented as soon as no arbitration rule is preventing it. Otherwise, the user shall be informed about having missed a communication because of arbitration process. (M)

8.2.11.4 Arbitration for one user, multiple devices

8.2.11.4.1 The expected behaviour of a communication being performed on more than one user device, leads to the user having the same understanding irrespective of the device used. (I)

8.2.11.4.2 Arbitration for multiple communications shall also apply for each of the multiple devices in which a user is logged in. (M)

8.2.11.4.3 A communication addressed to a user logged in on several devices having the corresponding application active, the configured arbitration rules shall determine which of the following behaviour applies: (M)

- a) Presentation on all the user’s devices;
- b) Presentation on all the user’s devices and automatic connection to the current user’s default device.

8.2.11.4.4 If automatic connection to the user’s default device is not successful, the communication shall be automatically connected to another device of the user. (M)

8.2.11.5 Delayed presentation of a communication

8.2.11.5.1 A visual notification shall be kept active during the whole communication on user’s devices which are not connected to the communication in order to allow the user to participate the ongoing communication(s) from one of these devices. (M)

- 8.2.11.5.2 In the case an incoming communication has not been presented to the user due to an arbitration rule, this communication (if still active) shall be presented as soon as no arbitration rule is preventing it. Otherwise, the user shall be informed about having missed a communication because of arbitration process. (M)
- 8.2.11.6 [Requirements for interworking with GSM-R](#)
- 8.2.11.6.1 For a communication outgoing from GSM-R system towards the FRMCS system, the network operator shall be able to define arbitration rules based on the priority level provided by GSM-R system. (M)
- 8.2.11.6.2 For a communication outgoing from FRMCS system towards GSM-R system, the arbitration common function shall assign a priority level to the communication in order to enable arbitration for GSM-R users. (M)
- 8.2.11.7 [Requirements for off-network](#)
- 8.2.11.7.1 The arbitration common function shall operate in both on-network and off-network conditions. (M)
- 8.2.11.7.2 When arbitration common function is operated in off-network, the functionality is limited in arbitration performed by FRMCS user equipment only. (M)
- 8.2.11.8 [Requirements for network maintenance, configuration and monitoring](#)
- 8.2.11.8.1 To be defined in a later version of the specification. (I)
- 8.2.11.9 [Attributes \(inputs/outputs\)](#)
- 8.2.11.9.1 The arbitration common function shall support the following input attributes: (M)
- a) The relevant functional identity(ies) registered;
 - b) The identities of the applications involved by the competing communications;
 - c) The user's default device in the case the user is logged-in on more than one user device;
 - d) The references of the communications involving the user's device (connected and in the queue) at any time.
- 8.2.11.9.2 The FRMCS system shall support the following output attributes: (M)
- a) The status to be applied for each communication involving the user's device: not presented, visible presentation, visible and audible presentation, connected, connected and merged.

8.2.12 Distribution of synchronised time common function

8.2.12.1 Introduction

8.2.12.1.1 Centralised and synchronised time service is required to provide other common functions, applications or O&M functions/tools with a reliable time reference. (I)

8.2.12.1.2 The FRMCS system distributes the synchronised time information to equipment and applications. (I)

8.2.12.1.3 For example, European Train Control System (ETCS) implementations over the FRMCS system require system wide and centralised synchronised time service in order to provide required security levels. Synchronised time is needed for analysing various audit logs, backup and restore functions and evaluating the validity of various certificates such as ETCS public key certificates. (I)

8.2.12.1.4 Location services provided by the FRMCS system require synchronised time service. When the positioning is provided by an on-board equipment (e.g. odometry) which is not intrinsically time- synchronised, centralised time service is required. (I)

8.2.12.2 Generic requirements

8.2.12.2.1 Distribution of synchronised time common function shall provide synchronised and accurate reference time supporting operational needs. (M)

8.2.12.2.2 Distribution of synchronised time common function shall provide reference time to authorised common functions, applications and O&M functions/tools if needed. (M)

8.2.12.2.3 Distribution of synchronised time common function shall provide reference time. (M)

8.2.12.2.4 Distribution of synchronised time common function shall provide accuracy information of the reference time. (M)

8.2.12.2.5 Distribution of synchronised time common function shall provide the reference time and the accuracy information upon a request from an application. (M)

8.2.12.2.6 The following methods shall be supported to provide the reference time and the accuracy information: (M)

- a) Single provision;
- b) Periodical provision.

8.2.12.2.7 Distribution of synchronised time common function shall retrieve its reference time with a secure and recognised upstream time source. (M)

8.2.12.2.8 A secure and recognised upstream time source can be a global navigation satellite system or an atomic clock. (I)

8.2.12.2.9 The reference time provided by the distribution of synchronised time common function shall be interoperable with standardised time protocols. (M)

- 8.2.12.2.10 Network Time Protocol (NTP) is an example of such a standardised time protocol. (I)
- 8.2.12.2.11 The reference time provided by the distribution of synchronised time common function shall be authentic and protected against possible frauds. (M)
- 8.2.12.3 [Requirements for interworking with GSM-R](#)
- 8.2.12.3.1 No specific requirements. The distribution of synchronised time is expected to be done independently in the GSM-R and FRMCS systems, but the use of the same time source is advisable. (I)
- 8.2.12.4 [Requirements for off-network](#)
- 8.2.12.4.1 Equipment and applications used off-network shall synchronise their internal time information regularly (when used on-network) with the reference time distributed by the FRMCS system to achieve best possible time accuracy for later off-network use. (M)
- 8.2.12.5 [Requirements for network maintenance, configuration and monitoring](#)
- 8.2.12.5.1 The system operator shall be able to monitor the accuracy of the centralised and synchronised time received from upstream time source. (M)
- 8.2.12.6 [Attributes \(inputs/outputs\)](#)
- 8.2.12.6.1 The FRMCS system shall support the following input attributes: (M)
- a) Time request;
 - b) Type of request (single request for reference time, continuous request for reference time or cancellation of continuous request).
- 8.2.12.6.2 The FRMCS system shall support the following output attributes: (M)
- a) Reference time;
 - b) Accuracy of the reference time;
 - c) Request granted;
 - d) Request denied, with reason of denial.

9 Introduction to applications

9.1 Introduction

9.1.1 In the following paragraph the various voice, data and video applications are specified. The ordering is: (I)

- paragraph 10: voice applications
- paragraph 11: data applications
- paragraph 12: video applications

9.1.2 Each application is ordered and specified in the following sections: (I)

- Introduction: brief description of the application via information statements;
- Generic requirements: all requirements for the application (excluding interworking, off-network and network maintenance, configuration and monitoring). If required for readability subsection marking can be used;
- HMI requirements: all requirements relevant for HMI characteristics. The HMI itself is not specified here;
- Requirements for interworking with GSM-R: all requirements relevant for interworking with GSM-R, if any;
- Requirements for off-network;
- Requirements for network maintenance, configuration and monitoring, all requirements relevant for network maintenance, configuration and monitoring;
- Involved common functions: all common functions that are required for this application.

9.2 Applications

9.2.1 The following applications are specified in this document: (I)

URS Ref.	Application	Paragraph	Type	Category
-	Basic voice communication	10.2	Voice	Critical
-	Basic data communication	11.2	Data	Critical
-	Basic video communication	12.2	Video	Critical
-	Role management and presence	11.3	Data	Critical
5.1	On-train outgoing voice communication from the train driver towards the controller(s) of the train	10.3	Voice	Critical
5.2	On-train incoming voice communication from the controller towards a train driver	10.4	Voice	Critical
5.3	Multi-Train voice communication for drivers including ground user(s)	10.5	Voice	Critical
5.4	Banking voice communication	10.6	Voice	Critical
5.5	Trackside Maintenance Voice communication	10.7	Voice	Critical
5.6	Shunting Voice Communication	10.8	Voice	Critical
5.7	Public emergency call	10.9	Voice	Critical
5.8	Ground to ground voice communication	10.10	Voice	Critical

URS Ref.	Application	Paragraph	Type	Category
5.9	Automatic Train Protection communication	11.4	Data	Critical
5.10	Automatic Train Operation communication	11.5	Data	Critical
5.11	Data communication for Possession Management	11.6	Data	Critical
5.12	Trackside Maintenance Warning System communication	11.7	Data	Critical
5.13	Remote control of engines communication	11.8	Data	Critical
5.14	Monitoring and control of critical infrastructure	11.9	Data	Critical
5.15	Railway Emergency Communication	10.11	Voice&Data	Critical
5.16	On-train safety device to ground communication	10.12	Voice&Data	Critical
5.17	Public train emergency communication	10.13	Voice&Data	Critical
5.18	Working alone	10.14	Voice&Data	Critical
5.19	Voice Recording and access to the recorded data	11.10	Data	Critical
5.20	Data recording and Access	11.11	Data	Critical
5.21	Shunting data communication	11.12	Data	Critical
5.22	Train integrity monitoring data communication	11.13	Data	Critical
5.23	Public emergency warning	11.14	Data	Critical
5.24	On-train outgoing voice communication from train staff towards a ground user	10.15	Voice	Critical
5.25	On-train incoming voice communication from a ground user towards train staff	10.16	Voice	Critical
5.26	Railway staff emergency communication	10.17	Voice&Data	Critical
5.27	Critical real time video	12.2	Video	Critical
5.28	Critical Advisory Messaging services- safety related	11.15	Data	Critical
5.29	Virtual coupling data communication	11.16	Data	Critical
5.30	Train Parking Protection	11.17	Data	Critical
5.31	Safety application key management data communication	11.18	Data	Critical
6.1	Deleted	n.a.	n.a.	n.a.
6.2	Deleted	n.a.	n.a.	n.a.
6.3	Multi-Train voice communication for drivers excluding ground user(s)	tbd	Voice	Performance
6.4	On-train voice communication	tbd	Voice	Performance
6.5	Lineside telephony	tbd	Voice	Performance
6.6	On-train voice communication towards passengers (Public Address)	tbd	Voice	Performance
6.7	Station Public Address	tbd	Voice	Performance
6.8	Communication at stations and depots	tbd	Voice	Performance
6.9	On-Train Telemetry communications	tbd	Data	Performance
6.10	Infrastructure Telemetry communications	tbd	Data	Performance
6.11	On-train remote equipment control	tbd	Data	Performance
6.12	Monitoring and Control of Non-Critical Infrastructure	tbd	Data	Performance
6.13	Non-critical real time video	tbd	Video	Performance
6.14	Wireless on-train data communication for train staff	tbd	Data	Performance
6.15	Wireless data communication for railway staff on platforms	tbd	Data	Performance
6.16	Deleted	n.a.	n.a.	n.a.

URS Ref.	Application	Paragraph	Type	Category
6.17	Train driver advisory -train performance	tbd	Data	Performance
6.18	Train Departure data communications	tbd	Data	Performance
6.19	Messaging Services	tbd	Data	Performance
6.20	Transfer of data	tbd	Data	Performance
6.21	Record and broadcast of information	tbd	Data	Performance
6.22	Transfer of CCTV archives	tbd	Data	Performance
6.23	Real time video call	tbd	Video	Performance
6.24	Augmented reality data communication	tbd	Data	Performance
6.25	Real time translation of speech data communication	tbd	Data	Performance
7.1	Information Help Point for public	tbd	Voice	Business
7.2	Emergency Help Point for public	tbd	Voice	Business
7.3	Wireless internet on-train for passengers	tbd	Data	Business
7.4	Wireless internet for passengers on platforms	tbd	Data	Business

Table 3: Applications overview

9.3 Generic HMI aspects

- 9.3.1 In this chapter fundamental HMI requirements are specified to help fulfil the operational needs for the FRMCS user. (I)
- 9.3.2 Application specific HMI requirements are described in the relevant application section. (I)
- 9.3.3 In addition, HMI aspects are also partly covered in the basic voice and data function sections. (I)
- 9.3.4 The HMI shall offer the possibility to present communication related audible and/or visual information to the user initiating, receiving or participating in a communication. (M)
- 9.3.5 Examples of communication related information to be presented on the HMI are: (I)
- Status of the intended recipient;
 - Functional identity of the currently connected user/s, meaningfully grouped (e.g. local user, controller(s), other drivers, other staff);
 - Information relating to the location of the currently connected user/s;
 - Status of the request to talk (granted, rejected or revoked);
 - List of active talker(s);
 - Current number of simultaneous talkers;
 - Change between on-network and off-network mode;
 - Status of communication, such as on-hold, call waiting, call terminated, call rejected, microphone muted/unmuted, etc.
 - List of intended recipients of communication, based on information available in the FRMCS system.

10 Voice applications

10.1 Basic voice communication functions

- 10.1.1.1 The aim of this section is to define the requirements related to the common functions which are implemented to support the FRMCS applications requiring a voice communication. The voice applications which are specified in the chapter allow all or some of the functions specified in this section. Therefore, in order to avoid the duplication of equivalent requirements all along this paragraph, the functional specification of each voice application refers to the common functions defined hereafter. Moreover, some of the common functions described in this section are referring to common functions already described in paragraph 8. The requirements related to the common voice functions are structured in three different phases/contexts of a voice communication. The diagrams aim to help the reader to understand the different functional steps required but certainly not to define the technical implementation of the system. For each context, the diagram describes the possible use cases and outcomes from one specific involved user point of view. (I)
- 10.1.1.2 The FRMCS system shall provide a means to establish Voice communications between 2 or more users. (M)
- 10.1.1.3 All basic voice communication functions are applicable for all voice applications, unless otherwise specified per application. (I)
- 10.1.1.4 All basic voice communication functions shall work by default in on-network mode. (M)
- 10.1.1.5 Specific off-network mode requirements of basic voice communication functions are specified in the corresponding application. (I)

10.1.2

User initiating a voice communication

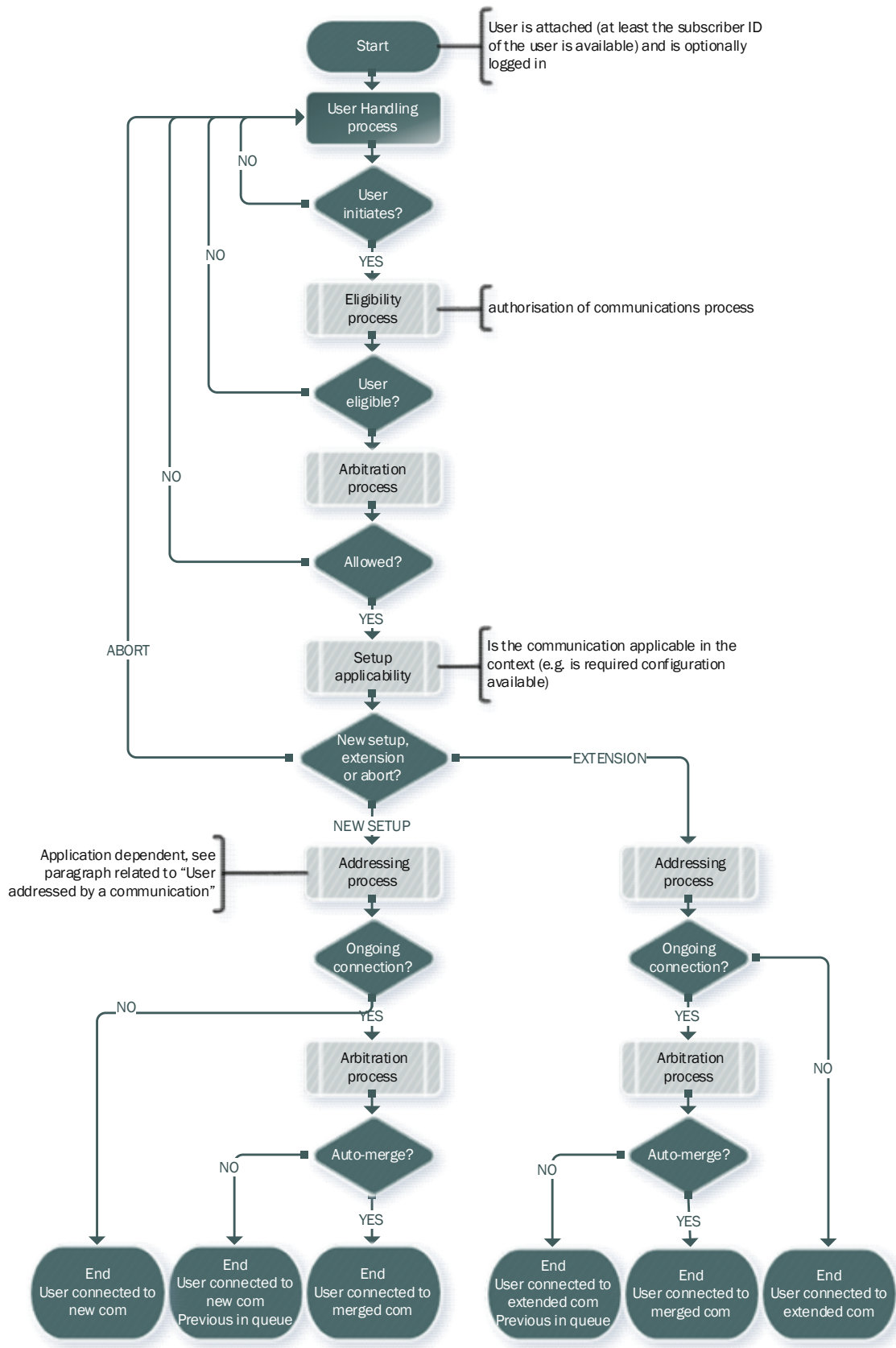


Figure 8: User initiating a communication

- 10.1.2.1 As a start of ~~Figure 8~~Figure-8, it is assumed that the user is attached to the FRMCS system, has a valid subscriber identity and is optionally logged in. (I)
- 10.1.2.2 Prior to the initiation of the communication by the user, the system should allow the user to be aware of the status of other users classified on the basis of the following: (O)
- a) functional identities elements (e.g. role, area) of the users;
 - b) location information of other users.
- 10.1.2.3 A user shall be able to address a user in a voice communication by providing the identity of the addressed user through the HMI. (M)
- 10.1.2.4 Upon a communication initiation by the user, the system shall determine whether the user is eligible to be the initiator of this communication. (M)
- 10.1.2.5 The user eligibility depends on the result of the authorisation of communication common function process. (I)
- 10.1.2.6 The arbitration common function checks whether the initiation of the communication is allowed based on other ongoing communications for this user. (I)
- 10.1.2.7 Upon a communication initiation by the user, the system shall check the setup applicability with one of the following outcomes: (M)
- a) The communication initiation is aborted;
 - b) A new communication is set up;
 - c) An existing communication is extended to cover the communication characteristics related to the user's initiation request.
- 10.1.2.8 For extensions of the communication the further outcome shall be one of the following: (M)
- a) The user is connected to the extended communication and the previously connected communication is put in the user's queue;
 - b) The user is connected to the communication merging the extended one and the previously connected one;
 - c) The user is connected to the extended communication (auto-merge process not applicable).
- 10.1.2.9 For new setup, depending on the connection status of the user and – if applicable – on the result of the arbitration common function related to auto-merge decision process, the outcome shall be one of the following: (M)
- a) The user is connected to the new communication (auto-merge process not applicable);
 - b) The user is connected to the new communication and the previously connected communication is put in the user's queue;
 - c) The user is connected to the communication merging the new one and the previously connected one.

10.1.3 User addressed by a voice communication

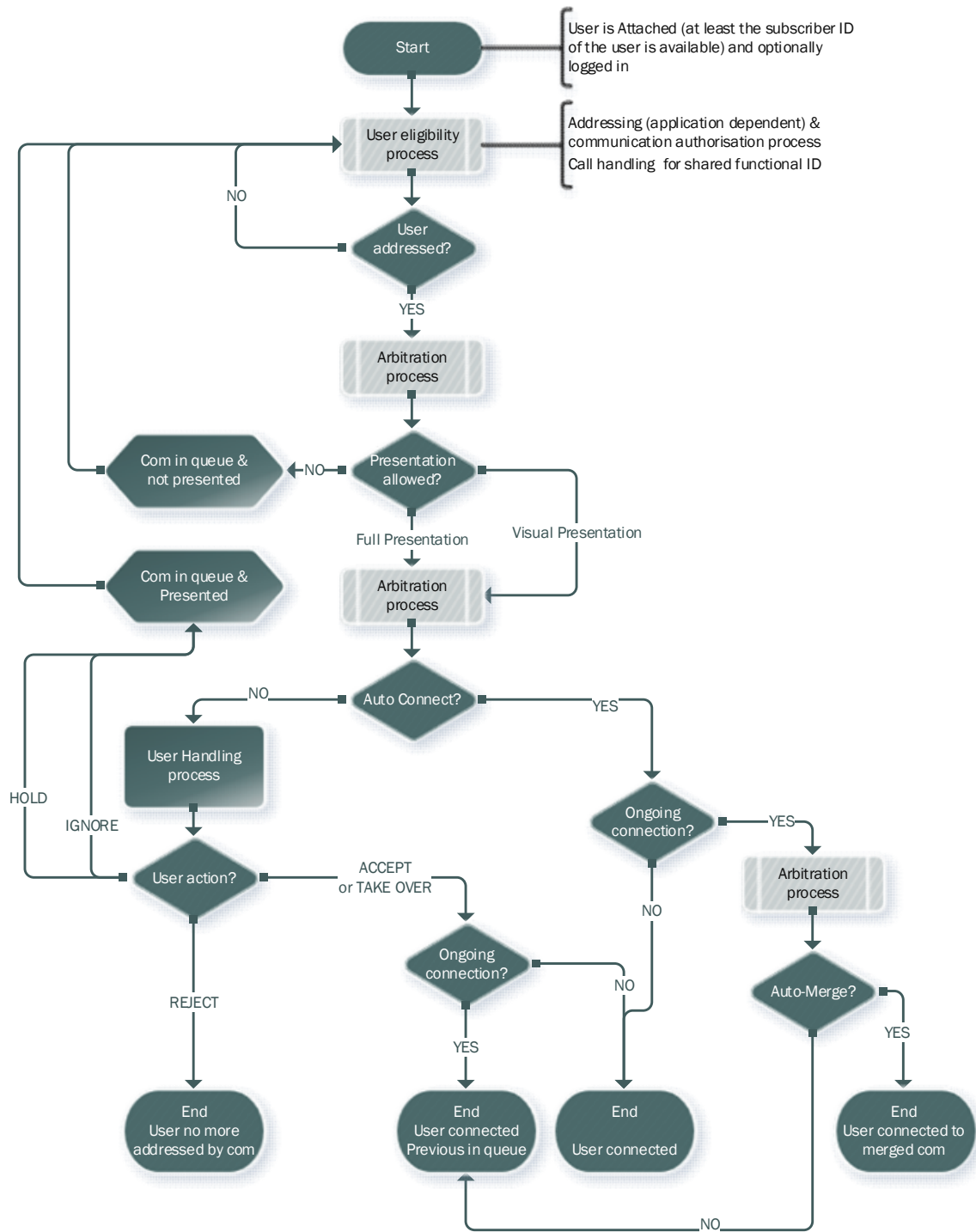


Figure 9: User addressed by a communication

- 10.1.3.1 As a start of ~~Figure 9~~Figure 9, it is assumed that the user is attached to the FRMCS system, has a valid subscriber identity and is optionally logged in. (I)
- 10.1.3.2 Reception of invitation to a communication is considered as addressing a user to the corresponding communication. (I)
- 10.1.3.3 Upon the setup and until the termination of a voice communication, the system shall continuously check whether each user is eligible to be a participant of the communication. (M)
- 10.1.3.4 The user eligibility shall be determined, based on the following: (M)
- a) The addressing mechanism of the related voice application;
 - b) The result of the authorisation of communication common function process;
 - c) The predefined behaviour for the addressed shared functional identity.
- 10.1.3.5 When the user is eligible to be a participant, the user is addressed by the communication. (I)
- 10.1.3.6 When the user is already involved in a communication(s) the new communication is queued for the user. (I)
- 10.1.3.7 The arbitration common function continuously checks whether a communication in the user's queue is to be presented to the user. (I)
- 10.1.3.8 Depending on the result of the arbitration common function related to presentation process, the outcome shall be one of the following: (M)
- a) The communication is only visually presented;
 - b) The communication is fully presented;
 - c) The communication is not presented but kept in the user's queue.
- 10.1.3.9 The aim of the visual only presentation is to avoid excessive disturbance for the user. Full presentation can also imply audible indications and vibrations depending on the user settings. (I)
- 10.1.3.10 The visual presentation of a voice communication shall include the following: (M)
- a) The relevant identity of the initiator or inviting user;
 - b) A visual information allowing the user to determine the concerned application.
- 10.1.3.11 A user shall be able to determine through which functional identity(ies) it is currently addressed by a communication. (M)
- 10.1.3.12 The applicability of a registered functional identity is determined by the application. (I)
- 10.1.3.13 The arbitration common function continuously checks whether a communication in the queue is to be connected without user's confirmation. (I)
- 10.1.3.14 When a communication is subject to presentation on several devices of the user, a visual indication shall be kept during the whole communication on the user's devices which are not connected in order to allow at any time the user to take over the connected communication from one of these devices. (M)

- 10.1.3.15 Connecting a communication without user's confirmation is defined as an Auto Connect. (I)
- 10.1.3.16 Depending on the result of the arbitration common function related to Auto Connect decision process, the outcome shall be one of the following: (M)
- a) The connection results from the User Handling process;
 - b) The connection is performed automatically.
- 10.1.3.17 Depending on the connection status of the user (ongoing connection or not), the outcome shall be one of the following: (M)
- a) In case of no ongoing connection, the user is automatically connected to the communication (auto-merge process not applicable);
 - b) In case of an ongoing connection, a decision is taken by the arbitration common function.
- 10.1.3.18 The arbitration common function continuously checks whether a communication in the queue shall be merged with an already connected communication without user's confirmation. (I)
- 10.1.3.19 To merge two ongoing communications without user's confirmation is defined as an Auto-Merge. (I)
- 10.1.3.20 Depending on the result of the arbitration common function related to auto-merge decision process, the outcome shall be one of the following: (M)
- a) The user is automatically connected to the communication and the previously connected communication is put in the user's queue;
 - b) The user is connected to the communication merging the new joined one and the previously connected one.
- 10.1.3.21 Upon presentation of a communication, the user shall be able to select one of the following actions: (M)
- a) To accept the communication;
 - b) To reject the communication;
 - c) To put on hold the communication;
 - d) To ignore the communication (do nothing).
- 10.1.3.22 According to the user selection, the outcome shall be respectively one of the following: (M)
- a) The user is connected to the communication, previously connected communication (if applicable) is put in the user's queue;
 - b) The user is no longer addressed by the communication;
 - c) The user is not connected but the communication is kept in the user's queue and is still visually presented;
 - d) The communication is kept in the user's queue but automatically rejected after a predefined delay or the communication initiator stopped the attempt.
- 10.1.3.23 In the case that the user ignores a communication, the delay for automatic rejection shall be configurable. (M)

- 10.1.3.24 In the case that a user is addressed several times for the same communication due to the fact that this communication is addressed to several identities assigned to this user, the communication shall only be presented once. (M)
- 10.1.3.25 In the case that a user is addressed several times for the same communication due to the fact that this communication is addressed to several identities assigned to this user, the user's authorisation for this communication shall be the union of all authorisation defined for these identities. (M)
- 10.1.3.26 Before accepting a voice communication, the user should have the ability to divert this communication to an alternative HMI component of the same device (e.g. loudspeaker). (O)

10.1.4

User handling of an ongoing voice communication

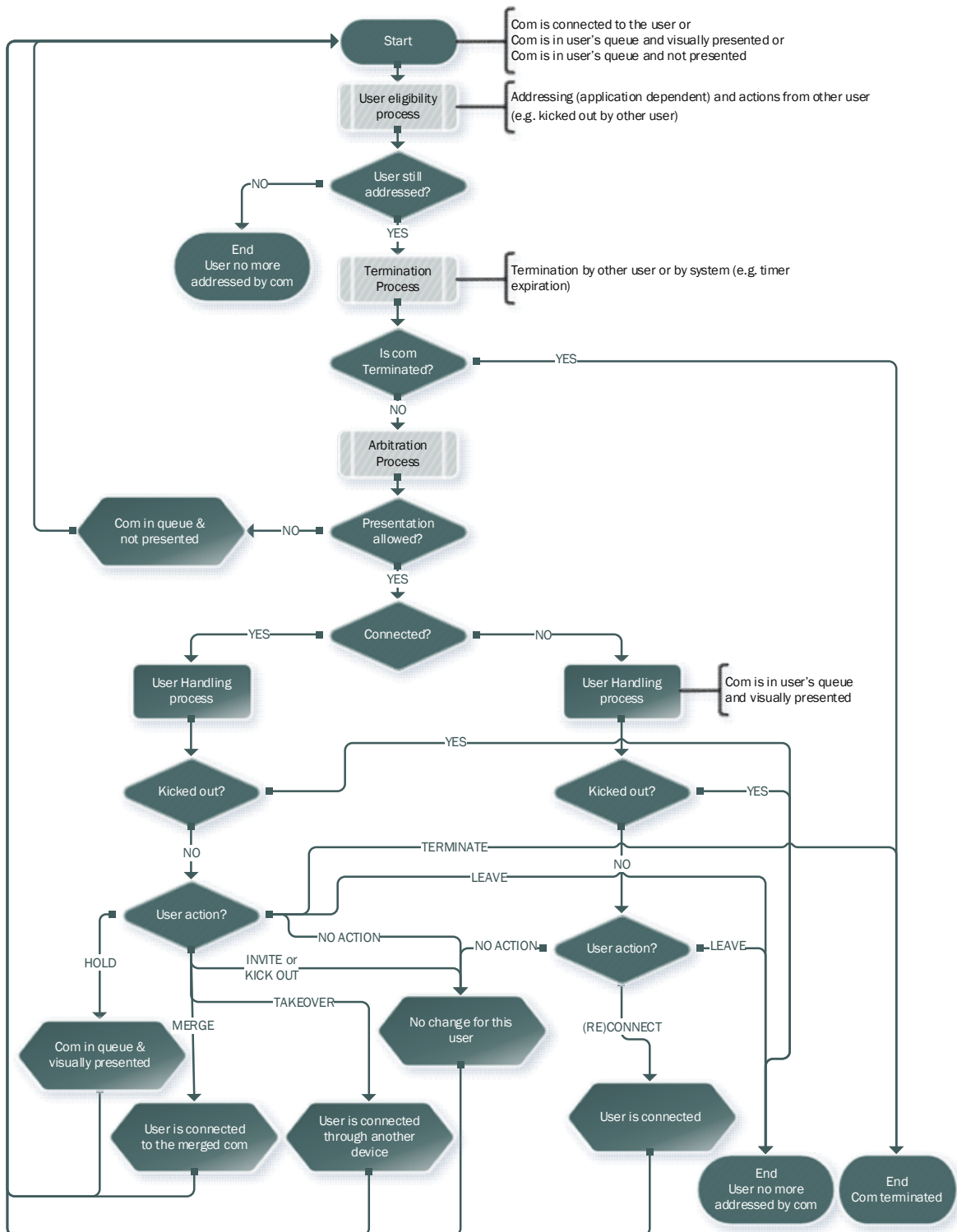


Figure 10: User handling of an ongoing communication

- 10.1.4.1 As a start of Figure 10, it is assumed that the user is connected to a communication, or there is a communication in the queue (either visually presented or not). (I)
- 10.1.4.2 For a user addressed by a communication, the system shall continuously check whether this user is eligible to be a participant of the communication. (M)
- 10.1.4.3 The user eligibility shall be determined, based on the following: (M)
- a) The addressing mechanism of the related voice communication application;
 - b) The actions performed by other users.
- 10.1.4.4 If the user is no more eligible, the user shall no longer be addressed. (M)
- 10.1.4.5 The granted authorisation can be withdrawn at any time e.g. due to the fact the registered function has changed. (I)
- 10.1.4.6 The system continuously checks whether the communication has to be terminated due to system rules (timer expired, etc.), system operator action or user action. (I)
- 10.1.4.7 Upon termination, the communication shall be stopped. (M)
- 10.1.4.8 If the communication is not terminated, the arbitration common function continuously checks whether the communications which are in the user's queue are to be presented, and if the user is already connected or not to a communication. (I)
- 10.1.4.9 If presentation is not allowed, the communication shall be queued and not presented. (M)
- 10.1.4.10 If presentation is allowed, the outcome shall be one of the following: (M)
- a) The communication is not connected;
 - b) The communication is connected.
- 10.1.4.11 When a voice communication has been put on hold, the user shall be able to reconnect later. (M)
- 10.1.4.12 Any user connected to a voice communication shall be presented with the relevant identity of the currently talking user(s). (M)
- 10.1.4.13 If not connected, based on user handling, an authorised user shall be able to kick out the user from a communication. In this case the kicked out user is no longer addressed by the communication. (M)
- 10.1.4.14 If not connected, based on user handling, when the user is not kicked out, the user shall be able to select one of the following actions: (M)
- a) Connect: the user (re-)connects a communication from user's queue;
 - b) Leave: the user is no longer addressed by the communication;
 - c) No action: The communication remains in the user's queue.

- 10.1.4.15 If connected, based on user handling, an authorised user shall be able to kick out another user from a communication. In this case the kicked out user is no longer addressed by the communication either. (M)
- 10.1.4.16 If connected, based on user handling, the user shall be able to select one of the following actions: (M)
- d) Hold: the user disconnects the communication but keep it in user's queue;
 - e) Merge: the user merges the connected communication with one of the communications from the user's queue;
 - f) Invite: the user invites another user to join the communication;
 - g) Kick out: the user kicks out another user from the communication;
 - h) Leave: the user is no longer addressed by the communication;
 - i) Terminate: the communication is stopped;
 - j) No action: the user performs no action
- 10.1.4.17 The user who has initiated the merging of two ongoing communications shall be considered as the initiator of the resulting communication. (M)
- 10.1.4.18 In communications handling where the initiator identity has to be taken into account (such as display of initiator identity to other participants, check of authorisation related to the initiator of the communication), the identity of the user who has performed the merging is to be considered as the initiator. (I)
- 10.1.4.19 A user involved in an ongoing voice communication shall be able to request to display the relevant identities of the other participants of the communication. (M)
- 10.1.4.20 A voice communication application shall be able to request the relevant identities of the other participants of the communication. (M)
- 10.1.4.21 A user involved in an ongoing voice communication shall be able to request to display all the identities related to one of the other participants of the communication. (M)
- 10.1.4.22 A voice communication application shall be able to request all the identities related to one of the other participants of the communication. (M)
- 10.1.4.23 A user involved in an ongoing voice communication shall be able to request to display the available location information related to one of the other participant of the communication. (M)
- 10.1.4.24 A voice communication application shall be able to request the available location information related to one of the other participant of the communication. (M)
- 10.1.4.25 A user shall be able to invite a user in a voice communication by providing the identity of the invited user through the HMI. (M)
- 10.1.4.26 A user shall be able to invite users to join a voice communication by selection of the identity from a list presented by the HMI. (M)

- 10.1.4.27 Prior to inviting a user to join a voice communication, the system shall allow the inviting user to be aware of the status of other users classified on the basis of the following: (M)
- a) Functional identities elements (role, area,..) of the users;
 - b) Location information of others users.
- 10.1.4.28 For inviting a user, the system shall allow the application to filter the list of other users displayed based on the following: (M)
- a) Ongoing communication(s);
 - b) Functional identities registered by the user.
- 10.1.4.29 A user connected to a voice communication shall be able to mute or unmute the microphone. (M)
- 10.1.4.30 The FRMCS system shall allow the selection of the active HMI component(s) in a voice communication by the following methods: (M)
- a) Without any user's intervention based on the configuration of the device and on the type of communication E.g. an incoming railway emergency call can be configured to be connected automatically to the external loudspeaker of the driver's cabin though handset is currently used by the user for an ongoing communication;
 - b) By the user. E.g the user can choose to accept an incoming communication to the handset by picking it up, though already ongoing communicating was connected to the external loudspeaker and microphone.
- 10.1.4.31 A voice communication shall allow the simultaneous connection of at least 100 participants. (M)
- 10.1.4.32 A voice communication shall allow at least 10 participants to talk at the same time. (M)
- 10.1.4.33 When more than one simultaneous talker is allowed, operational rules including talker discipline ensure proper communication. (I)
- 10.1.4.34 When a user is connected to the audio stream, the user ability to speak to the voice communication depends on the authorisation granted by the multi user talker common function. (I)
- 10.1.4.35 The user shall have the ability to divert the ongoing communication to an alternative HMI component of the same device (e.g. loudspeaker). (M)
- 10.1.4.36 The user shall be able to take over a connected voice communication from another device having the corresponding application active. (M)

10.1.5 User handling of talker control during an ongoing voice communication

10.1.5.1 The FRMCS system shall support the following means to manage the talker control: (M)

- a) Push-To-Talk functionality;
- b) Voice command mechanism.

10.1.5.2 The FRMCS user equipment shall support at least one the following means to manage the talker control: (M)

- a) Push-To-Talk functionality;
- b) Voice command mechanism.

10.2 Basic voice communication

10.2.1 Introduction

10.2.1.1 This application is for users to perform voice communications between two users or between multiple users based on recipient identity. (I)

10.2.2 Generic requirements

10.2.2.1 A user shall be able to initiate a basic voice communication to one user. (M)

10.2.2.2 A user shall be able to initiate a basic voice communication to multiple users. (M)

10.2.2.3 A user shall be able to initiate a basic voice communication to a user outside of the FRMCS system. (M)

10.2.2.4 A user shall be able to receive a basic voice communication. (M)

10.2.2.5 A user shall be able to receive a basic voice communication from a user outside the FRMCS system. (M)

10.2.2.6 A user shall be able to perform the initiation of a basic voice communication by defining each recipient by the subscriber identity. (M)

10.2.2.7 A user shall be able to perform the initiation of a basic voice communication by defining each recipient by the user identity. (M)

10.2.2.8 A user shall be able to perform the initiation of a basic voice communication by defining the full functional identity. (M)

10.2.2.9 A user shall be able to perform the initiation of a basic voice communication by defining a part of the functional identity. (M)

10.2.2.10 When part of the functional identity is used to address a basic voice communication, all the matching functional identities shall be addressed with the voice communication. (M)

10.2.2.11 Part of a functional identity can represent a group of users e.g. all the train drivers of certain train operator. (I)

10.2.2.12 The system administrator shall be able to be univocally map a subscriber identity to a short code. (M)

10.2.2.13 The system administrator shall be able to be univocally map a user identity to a short code. (M)

10.2.2.14 The system administrator shall be able to be univocally map a functional identity to a short code. (M)

10.2.2.15 The system administrator shall be able to be univocally map a part of functional identity to a short code. (M)

10.2.2.16 It could happen that a terminal has no screen but only a dialpad e.g. trackside phones. (I)

10.2.2.17 A user shall be able to perform the initiation of a basic voice communication dialling a short code. (M)

- 10.2.2.18 A user involved in an ongoing basic voice communication shall be able to invite user(s) to join the communication. (M)
- 10.2.2.19 A user shall be able to invite a user(s) to an ongoing basic voice communication by defining each recipient by the subscriber identity. (M)
- 10.2.2.20 A user shall be able to invite a user(s) to an ongoing basic voice communication by defining each recipient by the user identity. (M)
- 10.2.2.21 A user shall be able to invite a user(s) to an ongoing basic voice communication by defining the recipient(s) by the full functional identity. (M)
- 10.2.2.22 A user shall be able to invite a user(s) to an ongoing basic voice communication by defining the recipient(s) by a part of the functional identity. (M)
- 10.2.2.23 When not defined differently by the used basic voice communication application or by the user, the latest functional identity registered shall be used by default as the functional identity to be presented for basic voice communication. (M)
- 10.2.2.24 The user shall be able to choose functional identity to be presented for basic voice communication. (M)
- 10.2.2.25 The following QoS and priority parameters shall be used: (M)
- a) Latency: LOW;
 - b) Reliability: NORMAL;
 - c) Throughput: LOW;
 - d) Setup Time: NORMAL;
 - e) Priority Level: lower than REC-voice.
- 10.2.2.26 The system administrator shall be able to define addressing rules taking into account the functional identity of the initiator of the basic voice communication. The addressing rule shall be based on label(s) included in the initiator's functional identity. (M)
- 10.2.3 **HMI requirements**
- 10.2.3.1 No specific requirements. (I)
- 10.2.4 **Requirements for interworking with GSM-R**
- 10.2.4.1 It is assumed that the inviting user (FRMCS or GSM-R user) may not be aware to which system the invited user is logged in (FRMCS or GSM-R system). (I)
- 10.2.4.2 The inviting FRMCS user needs only to provide (e.g. select or dial) FRMCS formatted identities. When the invited user is a GSM-R user, the FRMCS system shall perform the translation and the mapping between the corresponding functional identities. (M)
- 10.2.4.3 The inviting GSM-R user needs only to provide (e.g. select or dial) GSM-R formatted identities. When the invited user is an FRMCS user, the FRMCS system shall perform the translation and the mapping between the corresponding functional identities. (M)

Inviting a GSM-R user to a basic voice communication

- 10.2.4.4 An FRMCS user shall be able to invite a GSM-R user to join a voice communication by using one of the following: (M)
- a) The (MS)ISDN number of the invited GSM-R user;
 - b) One of the functional identities of the invited GSM-R user.
- 10.2.4.5 The FRMCS system shall present the functional identity of the inviting FRMCS user to the invited GSM-R user in a format compliant to GSM-R numbering plan. (M)
- 10.2.4.6 When no relevant functional identity is available for the initiator/inviting user, the user identity or subscriber identity in a GSM-R compatible format shall be presented to the GSM-R user. (M)

Call a FRMCS user from a GSM-R network

- 10.2.4.7 An FRMCS user shall be able to receive a communication from a GSM-R user using one of the following addressing methods: (M)
- a) The user identity or subscriber identity of the FRMCS user in a GSM-R compatible format;
 - b) A GSM-R functional identity corresponding to the functional identity of the FRMCS user. Example: 90004120123401 translates to [1234.Leading_driver@2185](#).
- 10.2.4.8 The functional identity corresponding to the functional number provided by GSM-R network shall be presented to the FRMCS user. (M)
- 10.2.4.9 If no functional number is provided by GSM-R network, the (MS)ISDN number shall be presented to the FRMCS user. (M)

User moving between a GSM-R and an FRMCS network

- 10.2.4.10 When a user is moving from/to the GSM-R system to/from the FRMCS system, the reregistration of the functional identity in the new system and reconnection of ongoing communication(s) shall be done automatically. (M)
- 10.2.4.11 An interruption of voice communication during the move from/to GSM-R to/from FRMCS is acceptable. (I)
- 10.2.4.12 It is up to the end user device implementation how this service interruption is as short as possible for the user. (I)
- 10.2.5 [Requirements for off-network](#)
- 10.2.5.1 To be defined in a later version of the specification. (I)
- 10.2.6 [Requirements for network maintenance, configuration and monitoring](#)
- 10.2.6.1 To be defined in a later version of the specification. (I)
- 10.2.7 [Involved common functions](#)
- 10.2.7.1 To be defined in a later version of the specification. (I)

- 10.3 On-train outgoing voice communication from the train driver towards the controller(s) of a train
- 10.3.1 Introduction
- 10.3.1.1 A driver is able to initiate a voice communication to the controller(s) responsible for the movement of the train. (I)
- 10.3.1.2 There are in some countries also a need to call other types of controllers not directly responsible for the movement of the train, like power controller or secondary controller. (I)
- 10.3.2 Generic Requirements
- 10.3.2.1 A driver shall be able to initiate a voice communication to the controller(s) responsible for the movement of the train. (M)
- 10.3.2.2 The controller(s) receiving the call shall be presented the incoming communication by the following: (M)
- a) Functional identity of the driver,
 - b) Type of incoming communication.
- 10.3.2.3 The controller(s) receiving the call should be presented the incoming communication by: (O)
- a) The location of the driver.
- 10.3.2.4 If the functional identity of the driver is not available, the functional identity of the vehicle shall be presented. (M)
- 10.3.2.5 During the call, the location information of the initiator presented to the controller(s) should be updated continuously. (O)
- 10.3.2.6 The initiating driver shall not be presented with status information of the intended recipient(s) prior to initiating the driver to controller(s) voice communication. (M)
- 10.3.2.7 The driver can be presented with the location information of the connected controller(s) during a driver to controller(s) voice communication. (I)
- 10.3.2.8 The responsible controller(s) shall be addressed based on one or a combination of the following: (M)
- a) Location information of the initiator;
 - b) Functional identity of the initiator.
- 10.3.2.9 The responsible controller(s) should be addressed based on: (O)
- a) System configuration on which controller(function) is responsible for which part of the track/station/etc.
- 10.3.2.10 The following QoS and priority parameters shall be used: (M)
- a) Latency: LOW;
 - b) Reliability: HIGH;
 - c) Throughput: LOW;
 - d) Setup Time: NORMAL;
 - e) Priority Level: lower than REC-voice.

10.3.3 HMI requirements

- 10.3.3.1 A single HMI action shall be used to initiate a voice communication to a current responsible controller(s). (M)
- 10.3.3.2 A single HMI action shall be available to initiate a voice communication to other types of controller(s) such as secondary controller or power controller. (M)
- 10.3.3.3 The driver shall be able to select from a list the next controller(s) based on the route setting of the train. (M)
- 10.3.3.4 The driver shall be able to select from a list the previous controller(s) based on the route setting of the train. (M)

10.3.4 Requirements for interworking with GSM-R

Driver attached to GSM-R

- 10.3.4.1 A driver attached to GSM-R shall be able to call a controller registered into the FRMCS system. (M)

Driver in FRMCS and controller in GSM-R

- 10.3.4.2 A driver registered to FRMCS shall be able to call a controller registered into the GSM-R system. (M)

10.3.5 Requirements for off-network

- 10.3.5.1 No specific requirements. (I)

10.3.6 Requirements for network maintenance, configuration and monitoring

- 10.3.6.1 To be defined in a later version of the specification. (I)

10.3.7 Involved common functions

- 10.3.7.1 To be defined in a later version of the specification. (I)

- 10.4 On-train incoming voice communication from the controller towards a train driver
 - 10.4.1 Introduction
 - 10.4.1.1 A controller is able to initiate a voice communication to the driver of a train. (I)
 - 10.4.2 Generic Requirements
 - 10.4.2.1 A controller shall be able to initiate a voice communication to a driver by the driver's functional identity. (M)
 - 10.4.2.2 The driver shall be able to receive the incoming call from the controller. (M)
 - 10.4.2.3 The driver receiving the incoming communication shall be presented with the following: (M)
 - a) Functional identity of the controller;
 - b) Type of incoming communication.
 - 10.4.2.4 The following QoS and priority parameters shall be used: (M)
 - a) Latency: LOW;
 - b) Reliability: HIGH;
 - c) Throughput: LOW;
 - d) Setup Time: NORMAL;
 - e) Priority Level: lower than REC-voice.
 - 10.4.3 HMI requirements
 - 10.4.3.1 No specific requirements. (I)
 - 10.4.4 Requirements for interworking with GSM-R
 - Controller*
 - 10.4.4.1 A controller shall, regardless if the driver is active in the FRMCS system or in the GSM-R system, be able to initiate a voice communication to a driver by the driver's functional identity. (M)
 - 10.4.5 Requirements for off-network
 - 10.4.5.1 No specific requirements. (I)
 - 10.4.6 Requirements for network maintenance, configuration and monitoring
 - 10.4.6.1 To be defined in a later version of the specification. (I)
 - 10.4.7 Involved common functions
 - 10.4.7.1 To be defined in a later version of the specification. (I)

10.5 Multi-train voice communication for drivers including ground user(s)

10.5.1 Introduction

10.5.1.1 The driver is able to initiate a multi-train voice communication for drivers including ground user(s) and/or other drivers (in this section called multi-train voice communication). (I)

10.5.1.2 A ground user is able to initiate a multi-train voice communication with drivers and other ground user(s). (I)

10.5.1.3 The multi-train voice communication is used for operational communication between drivers and ground users(s). (I)

10.5.1.4 The implementation of multi-train voice communication is based on operational rules in the specific railway environment, for example complexity of route and maximum permissible line speed. (I)

10.5.1.5 The multi-train voice communication is based on the concept of an targeted area (the area where users are likely to receive the multi-train voice communication) and addressed users (users addressed or to be addressed by the multi-train voice communication). (I)

10.5.1.6 The targeted area can be a geographical area around the location of the initiator, predefined by configuration in the system or automatically defined at setup time according to specific operational rules. (I)

10.5.1.7 When the targeted area has been determined, the system identifies the addressed users eligible to receive the multi-train voice communication. (I)

10.5.2 Requirements for off-network

10.5.2.1 No specific requirements. (I)

10.5.3 Specific pre-conditions

10.5.3.1 In a multi-train voice communication, at least one user shall have the right to change the settings of the multi user talker control common function. (M)

10.5.3.2 The user having these rights can, for example, be the initiating user (the driver) or the first ground user to be included. (I)

10.5.4 Requirements

10.5.4.1 A driver shall be able to initiate a multi-train voice communication with ground user(s) and other drivers with the minimum of interaction (for example a single button press or selection from list). (M)

10.5.4.2 A ground user shall be able to initiate a multi-train voice communication with ground user(s) and other drivers. (M)

10.5.4.3 The targeted area of a driver initiated multi-train voice communication, predefined by configuration in the system or automatically defined during setup phase, shall be based on the following: (M)

- a) The location information of the initiator;

- b) The functional identity of the initiator. (M)
- 10.5.4.4 Addressed driver(s) shall be driver(s) inside the targeted area. (M)
- 10.5.4.5 Addressed driver(s) shall be drivers outside the targeted area moving towards the targeted area and for which the location information matches certain criteria set by infrastructure. (M)
- 10.5.4.6 The addressed ground user(s) of the driver initiated multi-train voice communication shall be included in the multi-train voice communication based on one or a combination of the following: (M)
 - a) The targeted area;
 - b) The location information of the ground user(s).
- 10.5.4.7 The addressed ground user(s) of the driver initiated multi-train voice communication shall be included in the multi-train voice communication based on the functional identity of the ground user(s). (M)
- 10.5.4.8 The initiating driver shall have the option to address other driver(s) and ground user(s) based on a list of users eligible for a multi-train voice communications for drivers including ground user(s), presented to the driver by the HMI. The list shall dynamically be generated based on one or a combination of the following criteria: (M)
 - a) The functional identity of the initiator (driver's functional identity preferred in case of multiple simultaneous registrations for same user);
 - b) The currently registered functional identities of the intended recipients (driver's functional identity preferred in case of multiple simultaneous registrations for same user);
 - c) The location information.
- 10.5.4.9 Additionally, the dynamically generated list of multi-train voice communications for drivers including ground user(s) all shall be able to be enhanced by any functional identity entered manually by the initiating driver. (M)
- 10.5.4.10 The ground user shall be able to initiate a multi-train voice communication with drivers and other ground user(s) by selecting the targeted area. (M)
- 10.5.4.11 The ground user shall be able to initiate a multi-train voice communication with drivers and other ground user(s) by selecting a specific driver which location's defines the targeted area. (M)
- 10.5.4.12 The initiating ground user shall have the option to address other driver(s) and ground user(s) outside the targeted area based on a list of users eligible for a multi-train voice communications for drivers including ground user(s), presented to the ground user by the HMI. The list shall dynamically be generated based on the currently registered functional identities of the intended recipients. (M)
- 10.5.4.13 Additionally, the dynamically generated list shall be able to be enhanced by any drivers or ground user's functional identity entered manually by the ground user. (M)

- 10.5.4.14 An example of entries of a list of multi-train voice communications for drivers including ground user(s) is: (I)
- a) Depot x (all the drivers on depot area or approaching it including the relevant ground users at depot);
 - b) Station x traffic control (all the drivers on station or approaching it including all the relevant controllers related to the station environment);
 - c) Station x brake inspection (all the drivers of the initiators train including brake inspectors of the corresponding station);
 - d) All drivers of RU x in station y;
 - e) All drivers on track x.
- 10.5.4.15 The system shall continuously check the eligibility of users (ground users and drivers) to participate in the ongoing multi-train voice communication and adapt the recipients accordingly. (M)
- 10.5.4.16 A user shall be able to leave the multi-train voice communication. (M)
- 10.5.4.17 A user shall be able to put the multi-train voice communication on hold. (M)
- 10.5.4.18 When the last driver leaves multi-train voice communication for drivers including ground user(s), the FRMCS system shall allow to define one of the following: (M)
- a) Multi-train voice communication is terminated;
 - b) Multi-train voice communication remains active.
- 10.5.4.19 An entitled ground user shall be able to terminate the multi-train voice communications. (M)
- 10.5.4.20 An entitled driver shall be able to terminate the multi-train voice communications. (M)
- 10.5.4.21 An example of a driver allowed to terminate a multi-train voice communication is the initiating driver or any other driver based on functional identity. (I)
- 10.5.4.22 On termination of the multi-train voice communication, all involved users shall be informed. (M)
- 10.5.4.23 The following QoS and priority parameters shall be used for multi-train voice communication: (M)
- a) Latency: LOW;
 - b) Reliability: HIGH;
 - c) Throughput: LOW;
 - d) Setup Time: NORMAL;
 - e) Priority Level: lower than REC-voice.

10.5.5 HMI requirements

- 10.5.5.1 The initiation of a mutli-train voice communication, the action of putting it on hold or to connect to it is achieved with the minimum of interaction (for example, a single button press or selection from a list). Where selection from a list is determined to be the preferred option, then the list is accessed with the minimum of interaction and be intuitive. (I)

10.5.6 Requirements for interworking with GSM-R

- 10.5.6.1 A multi-train communication initiated within the FRMCS system shall be routed to the appropriate GSM-R drivers and GSM-R ground user(s). (M)
- 10.5.6.2 The FRMCS systems shall route a group call initiated within the GSM-R system to the appropriate FRMCS drivers and FRMCS ground user(s). (M)
- 10.5.6.3 The Multi-train voice communication for drivers including ground user(s) communication shall be linked together and controlled by the FRMCS. (M)
- 10.5.6.4 Service interworking between the talker control in the GSM-R system and the FRMCS is not required. The handling of the talker control is expected to be done independently in the GSM-R and FRMCS systems. (I)

10.5.7 Requirements for network maintenance, configuration and monitoring

- 10.5.7.1 To be defined in a later version of the specification. (I)

10.5.8 Involved common functions

- 10.5.8.1 To be defined in a later version of the specification. (I)

- 10.6 Banking voice communication
 - 10.6.1 Introduction
 - 10.6.1.1 To be defined in a later version of the specification. (I)
- 10.7 Trackside Maintenance voice communication
 - 10.7.1 Introduction
 - 10.7.1.1 To be defined in a later version of the specification. (I)
- 10.8 Shunting voice communication
 - 10.8.1 Introduction
 - 10.8.1.1 To be defined in a later version of the specification. (I)
- 10.9 Public emergency call
 - 10.9.1 Introduction
 - 10.9.1.1 To be defined in a later version of the specification. (I)

10.10 Ground to ground voice communication

10.10.1 Introduction

10.10.1.1 This section describes the requirements for the ground to ground voice communication application. Ground to ground voice communication is used for i.e. controller to controller communication or any other point to point or multiuser ground user voice communication. (I)

10.10.1.2 The requirements for this application are covered by section 10.2. (I)

10.11 Railway Emergency Communication

10.11.1 Introduction

- 10.11.1.1 Railway emergency communication (REC) is used for communication during an emergency situation, it is considered as a high priority communication and has distinct means for set-up and presentation. (I)
- 10.11.1.2 The implementation of REC is based on operational rules in the specific railway environment. (I)
- 10.11.1.3 The behaviour for call handling is defined by operational rules and the operational rules are reflected in parameters and values in the common functions. (I)
- 10.11.1.4 The REC application and the common functions are configurable in order to fulfil local operational rules. (I)
- 10.11.1.5 A REC consists of a REC-alert (which is always set up) including an optional notification. After the REC-alert has been set up, an optional REC-voice and/or REC-data communication can be added. (I)
- 10.11.1.6 The REC is based on the concept of an targeted area (the area where users are likely to be affected by the emergency situation) and addressed users (users affected or to be affected by the emergency). (I)

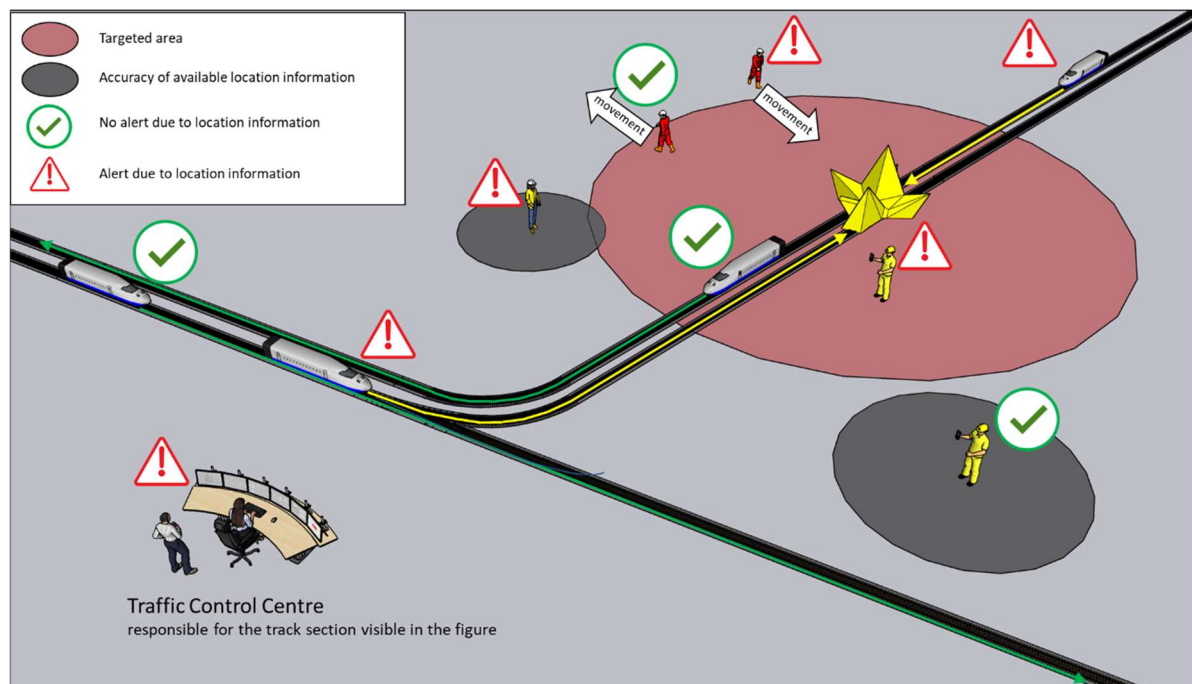


Figure 11: REC targeted area

- 10.11.1.7 The REC is initially set up in an area around the actual emergency location. This area, which is called the targeted area, is calculated differently for different initiators. The targeted area is initially calculated with some safety margin and can be adjusted (fine-tuned) further on when knowledge of the actual emergency situation evolves. (I)
- 10.11.1.8 The size of the targeted area is defined by the infrastructure manager, based on various criteria like line speed, track characteristics, reaction time of the user as well as location information of the user, including route setting and accuracy of the location information. (I)
- 10.11.1.9 The targeted area and users can be shared by two FRMCS domains in case of border crossing. (I)
- 10.11.1.10 The location information available is used to determine the initiator's location and furthermore the targeted area. It is up to the implementation to define which location elements and in which order the elements are used to determine the location information. (I)
- 10.11.1.11 When the targeted area has been determined, the system identifies users eligible to receive the REC-alert. (I)
- 10.11.1.12 REC-alert is considered to be a data communication utilising the data communication function. (I)
- 10.11.1.13 Being involved in a REC-alert does not prevent a user from initiating a new REC-alert as long as allowed by the arbitration common function (I)
- 10.11.1.14 Being involved in a REC-alert does not prevent a user from initiating another communication, as long as allowed by the arbitration common function (I)
- 10.11.1.15 In the context of REC, the term "driver" is used for a group of users who are railway employees working in or around the track (like train driver, track side worker, shunter) as defined by the infrastructure manager. (I)
- 10.11.1.16 In the context of REC the term "controller" is used for a group of users who are managing the work on or around the tracks (like train traffic controller, track side work controller, shunting controller) as defined by the infrastructure manager. (I)
- 10.11.1.17 With REC-data is meant a pre-recorded message, pictures, etc. (I)

10.11.2 [Generic requirements](#)

- 10.11.2.1 A controller shall be able to initiate a REC-alert. (M)
- 10.11.2.2 A driver shall be able to initiate a REC-alert. (M)
- 10.11.2.3 It shall be possible to authorise other users to initiate REC-alert. (M)
- 10.11.2.4 A controller shall be able to initiate a REC-alert by selecting the targeted area. (M)

- 10.11.2.5 A controller shall be able to initiate a REC-alert by selecting a specific train. (M)
- 10.11.2.6 When a controller initiates a REC-alert by selecting a specific train, the targeted area shall be based on the location of the specific train. (M)
- 10.11.2.7 For a driver-initiated REC-alert, the targeted area shall be based on the location information of the initiator. (M)
- 10.11.2.8 Recipients (addressed users) of the REC-alert at initiation shall be one or a combination of the following: (M)
- a) Users inside the targeted area for which the label of the functional identity matches criteria set by the infrastructure manager;
 - b) Users outside the targeted area moving towards the targeted area and for which the location information matches certain criteria set by infrastructure manager (not all trains moving towards the targeted area -for example slow driving trains- are immediately affected);
 - c) Predefined user(s) for the targeted area, such as controller(s).
- 10.11.2.9 It shall be possible to include in the REC-alert message additional information (e.g. text, voice prompts) that are forwarded to and presented continuously to the recipients. (M)
- 10.11.2.10 It shall be possible for an authorised user to change the size of the targeted area during an ongoing REC-alert. (M)
- 10.11.2.11 The system shall continuously check the eligibility of users to participate in the REC-alert and adapt the recipients accordingly. (M)
- 10.11.2.12 Users no longer eligible for being addressed by the ongoing REC-alert shall be informed and disconnected from the REC-alert. (M)
- 10.11.2.13 The authorised user(s) shall be able to be continuously informed on the relevant identity of the recipients currently alerted. (M)
- 10.11.2.14 The ongoing REC-alert shall be continuously indicated to the recipients. (M)
- 10.11.2.15 The authorised user(s) shall be informed on which users have left the REC-alert. (M)
- 10.11.2.16 An authorised user shall be able to initiate a REC-alert, when this user is already in another REC-alert. (M)
- 10.11.2.17 It shall be possible for an authorised user to merge two ongoing REC-alert. (M)
- 10.11.2.18 When merging two REC-alerts, the resulting targeted area shall be calculated as the union of the merged areas. (M)
- 10.11.2.19 The FRMCS system shall allow, on the termination of the REC-alert, to include additional information (e.g. text, voice prompts) which is presented to the recipients. (M)
- 10.11.2.20 An entitled user shall be able to initiate a REC voice communication (REC-Voice) associated to the REC-alert. (M)

- 10.11.2.21 The recipients of a REC-voice upon its initiation shall be the same as the ones of the associated REC-alert. (M)
- 10.11.2.22 An entitled user shall be able to initiate a REC-data communication (REC-data) associated to the REC-alert. (M)
- 10.11.2.23 The recipients of a REC-data upon its initiation shall be the same as the ones of the associated REC-alert.(M)
- 10.11.2.24 The FRMCS system shall allow to predefine whether a REC-voice shall be initiated for a given initiating function label, the outcome being the following: (M)
- a) REC-voice is set up automatically upon initiation of the REC-alert;
 - b) No REC-voice upon initiation of the REC-alert.
- 10.11.2.25 The FRMCS system shall allow to predefine whether a REC-voice shall be initiated for a given targeted area, the outcome being the following: (M)
- a) REC-voice is set up automatically upon initiation of the REC-alert;
 - b) No REC-voice upon initiation of the REC-alert.
- 10.11.2.26 In the case of using function label and targeted area for setting up a REC-voice communication, the FRMCS system shall ensure that the configuration leads to a predictable outcome. (M)
- 10.11.2.27 The FRMCS system shall allow a system administrator to predefine for each function label and per targeted area, whether a REC-data is set up automatically upon initiation of the REC-alert. (M)
- 10.11.2.28 An authorised user shall be able to merge an ongoing REC-voice with any other type of ongoing voice communication. (M)
- 10.11.2.29 When the user is no longer eligible for receiving the REC-alert, and there is an active associated REC-voice communication, the user shall remain addressed by the REC-voice communication. (M)
- 10.11.2.30 When the user is no longer eligible for receiving the REC-alert, and there is an active associated REC-data communication, the user shall remain addressed by the REC-data communication. (M)
- 10.11.2.31 When a REC-voice is active and upon termination of the associated REC-alert, the FRMCS system shall predefine the outcome being one of the following: (M)
- a) REC-voice communication remains active;
 - b) REC-voice communication is terminated.
- 10.11.2.32 When a REC-data is active and upon termination of the associated REC-alert, the FRMCS system shall predefine the outcome being one of the following: (M)
- a) REC-data communication remains active;
 - b) REC-data communication is terminated.
- 10.11.2.33 A REC-alert shall be recorded. (M)

10.11.2.34 When a REC-voice is active, the REC-voice communication shall be recorded. (M)

10.11.2.35 When a REC-data is active, the REC-data communication shall be recorded. (M)

10.11.3 HMI requirements

10.11.3.1 The initiation of the REC-alert by a driver shall be performed with a single HMI-action. (M)

10.11.3.2 The initiation of the REC-alert by a single HMI-action shall be made by using a dedicated activator. (M)

10.11.3.3 Details on the activator (e.g. colour, placement, size) is out of scope of this document. (I)

10.11.3.4 Additional means of initiating the REC-alert, such as voice activation, are subject to standardization. (I)

10.11.3.5 The risk of accidental initiation of the REC-alert shall be mitigated. (M)

10.11.3.6 The mitigation shall not introduce a significant delay on the initiation of the REC-alert. (M)

10.11.3.7 The user shall be able to unambiguously identify a REC-alert and distinguish between multiple REC-alerts. (M)

10.11.3.8 On every REC-alert the following information shall be indicated (M):

- a) An ongoing REC-voice communication that is connected to the speaker of the end user device;
- b) An ongoing REC-voice communication that is not connected to the speaker of the end user device;
- c) The existence of unread REC-data messages;
- d) The existence of read REC-data messages.

10.11.3.9 The HMI shall allow the user to select another, or switch between, different REC-voice communications. (M)

10.11.4 Requirements for interworking with GSM-R

Driver attached to GSM-R

10.11.4.1 The FRMCS system shall route a Railway Emergency Call initiated within the GSM-R system to the appropriate FRMCS user(s) by establishing a REC-alert and initiating automatically a REC-voice. (M)

10.11.4.2 The Railway Emergency Call in the GSM-R system and the REC-voice in the FRMCS system shall be linked together and controlled by the FRMCS system. (M)

10.11.4.3 Service interworking between the talker control in the GSM-R system and the FRMCS system is not required. The handling of the talker control is expected to be done independently in the GSM-R and FRMCS systems. (I)

10.11.4.4 When the Railway Emergency Call in the GSM-R system is terminated, the REC-alert and the REC-voice in the FRMCS system shall be terminated. (M)

- 10.11.4.5 When the REC-voice in the FRMCS system is terminated and there is a Railway Emergency Call in the GSM-R system connected, both the Railway Emergency Call in the GSM-R system and REC-alert in the FRMCS system shall also be terminated. (M)
- 10.11.4.6 When the REC-alert in the FRMCS system is terminated and there is a Railway Emergency Call in the GSM-R system connected, both the Railway Emergency Call in the GSM-R system and REC-voice in the FRMCS system shall not be terminated. (M)
- Mobile user attached to FRMCS*
- 10.11.4.7 A REC-alert initiated within the FRMCS system shall be routed to the appropriate GSM-R drivers and GSM-R ground user(s) by establishing a Railway emergency call. (M)
- 10.11.4.8 In this case, the FRMCS system shall initiate the REC-voice automatically. (M)
- 10.11.4.9 The REC-voice in the FRMCS system and Railway Emergency Call in the GSM-R system shall be linked together and controlled by the FRMCS system. (M)
- 10.11.4.10 Service interworking between the talker control in the FRMCS system and the GSM-R system is not required. The handling of the talker control is expected to be done independently in the GSM-R and FRMCS systems. (I)
- 10.11.4.11 When the REC-voice in the FRMCS system is terminated, both the Railway Emergency Call in the GSM-R system and the REC-alert in the FRMCS system shall also be terminated. (M)
- 10.11.4.12 When the REC-alert in the FRMCS system is terminated, both the Railway Emergency Call in the GSM-R system and REC-voice in the FRMCS system shall not be terminated. (M)
- 10.11.4.13 When the Railway Emergency Call in the GSM-R system is terminated, the REC-alert and the REC-voice in the FRMCS system shall be terminated. (M)
- 10.11.5 [Requirements for off-network](#)
- 10.11.5.1 No specific requirements. (I)
- 10.11.6 [Requirements for network maintenance, configuration and monitoring](#)
- 10.11.6.1 To be defined in a later version of the specification. (I)
- 10.11.7 [Involved common functions](#)
- 10.11.7.1 [Authorisation of communication for REC](#)
- 10.11.7.1.1 The rules defined in the authorisation of communication common function allow the Infrastructure Manager to implement the operational needs by configuration. (I)
- 10.11.7.1.2 The actions authorised for a user involved in a REC-alert are configurable. (I)
- 10.11.7.1.3 The actions authorised for a user involved in a REC-voice are configurable. (I)

10.11.7.1.4 The actions authorised for a user involved in a REC-data are configurable.(I)

10.11.7.2 QoS and priority for REC

10.11.7.2.1 The REC-alert shall use the following QoS and priority parameters: (M)

- a) Latency: LOW;
- b) Reliability: HIGH;
- c) Throughput: LOW;
- d) Setup Time: IMMEDIATE;
- e) Priority Level: the highest available for data communication.

10.11.7.2.2 The REC-data communication shall use the following QoS and priority parameters: (M)

- a) Latency: LOW;
- b) Reliability: HIGH;
- c) Throughput: LOW;
- d) Setup Time: NORMAL;
- e) Priority Level: lower than REC-alert.

10.11.7.2.3 The REC-voice communication shall use the following QoS and priority parameters: (M)

- a) Latency: LOW;
- b) Reliability: HIGH;
- c) Throughput: LOW;
- d) Setup Time: NORMAL;
- e) Priority Level: the highest available for voice.

10.11.7.3 Arbitration for REC

10.11.7.3.1 The rules defined in the arbitration common function shall define the handling of the presentation and connection to a REC-alert appropriate to the priority of the REC within the operational rules. (M)

10.11.7.3.2 The rules defined in the arbitration common function shall define the handling of the presentation and connection to a REC-voice for each addressed user. (M)

10.11.7.3.3 The rules defined in the arbitration common function shall define the handling of the presentation and connection to a REC-data for each addressed user. (M)

10.11.7.3.4 The rules defined in arbitration common function shall define the allowance of the initiation a REC-alert for each authorised user. (M)

10.11.7.4 Multi user talker control for REC

10.11.7.4.1 During a limited time after the initiation of a REC-voice communication, the initiator and some other predefined users shall receive the exclusive permission to talk based on the multi user talker function configuration. (M)

10.11.7.4.2 The Multi user talker control function shall define for a REC-voice, which connected users, are allowed to talk at any time of the communication (M).

- 10.12 On-train safety device to ground voice communication
 - 10.12.1 Introduction
 - 10.12.1.1 To be defined in a later version of the specification. (I)
- 10.13 Public train emergency voice communication
 - 10.13.1 Introduction
 - 10.13.1.1 To be defined in a later version of the specification. (I)
- 10.14 Working alone
 - 10.14.1 Introduction
 - 10.14.1.1 To be defined in a later version of the specification. (I)
- 10.15 On-train outgoing voice communication from train staff towards a ground user
 - 10.15.1 Introduction
 - 10.15.1.1 To be defined in a later version of the specification. (I)
- 10.16 On-train incoming voice communication from a ground user towards train staff
 - 10.16.1 Introduction
 - 10.16.1.1 To be defined in a later version of the specification. (I)
- 10.17 Railway staff emergency communication
 - 10.17.1 Introduction
 - 10.17.1.1 To be defined in a later version of the specification. (I)

11 Data applications

11.1 Basic data communication functions

- 11.1.1.1 Among the applications that use data communication, some are fully specified within the scope of the FRMCS system (such as REC alert or train parking detection) and some applications just use the FRMCS system as a data bearer (such as ATP). (I)
- 11.1.1.2 The aim of this section is to define the requirements related to the common functions used by both types of data applications which are implemented. The data applications which are specified in this chapter allow all or some of the functions specified in this section. Therefore, in order to avoid the duplication of equivalent requirements all along this paragraph, the functional specification of each data application refers to the common functions defined hereafter. Moreover, some of the common functions described in this section are referring to common functions already described in paragraph 8. The requirements related to the common data functions are structured in three different phases/contexts of a data communication. The diagrams in this section aim to help the reader to understand the different functional steps required but certainly not to define the technical implementation of the system. For each context, the diagram describes the possible use cases and outcomes from one specific involved user point of view. (I)
- 11.1.1.3 The FRMCS system shall provide a means to establish data communications between 2 or more users. (M)
- 11.1.1.4 All data communication functions shall be applicable for all data application, unless otherwise specified per application. (M)
- 11.1.1.5 All data communication functions shall work by default in on-network mode. (M)
- 11.1.1.6 Specific off-network mode requirements of data communication functions are specified in the corresponding application. (I)

11.1.2 User initiating a data communication

- 11.1.2.1 It is assumed that the user is attached to the FRMCS system, has a valid subscriber identity and is optionally logged in. (I)
- 11.1.2.2 A data application shall be able to address a user in a data communication by sending its identity to the FRMCS system. (M)
- 11.1.2.3 Upon a data communication initiation by the user, the system shall determine whether the user is eligible to be the initiator of this data communication. The user eligibility shall depend on all of the following: (M)
- a) The result of the arbitration common function process;
 - b) The result of the authorisation of communication common function process.
- 11.1.2.4 Upon a data communication initiation by the user, the system shall check the setup applicability for the concerned application and determines one of the following outcomes: (M)
- a) The data communication initiation is aborted (e.g. target user unavailable or initiation rejected);
 - b) A new data communication is set up.
- 11.1.2.5 If a new data communication is setup, the further outcome is depending on the connection status of the addressed user. (I)

11.1.3 User addressed by a data communication

- 11.1.3.1 It is assumed that the user is attached to the FRMCS system, has a valid subscriber identity and is optionally logged in. (I)
- 11.1.3.2 Reception of invitation to a communication is considered as addressing a user to the corresponding data communication. (I)
- 11.1.3.3 Upon the communication setup and until the termination of the data communication, the system shall continuously check whether each of the users is eligible to be a participant of the communication. (M)
- 11.1.3.4 The user eligibility depends on the result of the authorisation of communication common function process. (I)
- 11.1.3.5 When the user is eligible to be a participant, the user is addressed by the communication. (I)
- 11.1.3.6 Depending on the type of user (human or machine) and on each application needs, the arbitration common function manages the handling of the data communication (e.g. rejecting or accepting) on the addressed user. (I)
- 11.1.3.7 During the data communication the relevant identity of the initiator shall be provided to the addressed user(s). (M)
- 11.1.3.8 Upon reception of a data communication, the user handling process shall allow the user to select one of the following actions: (M)
- a) To accept the data communication;
 - b) To reject the data communication;
 - c) To ignore the data communication (do nothing).

- 11.1.3.9 Respectively to the user handling actions order, the outcome of the user handling shall be one of the following: (M)
- a) The user is connected to the data communication;
 - b) The user is no longer addressed by the data communication;
 - c) The data communication is automatically rejected after a predefined delay or the data communication initiator stopped the attempt.
- 11.1.3.10 The delay for automatic rejection when the user ignores a data communication shall be configurable. (M)
- 11.1.4 **User handling of an ongoing data communication**
- 11.1.4.1 It is assumed that the user is connected to a data communication. (I)
- 11.1.4.2 The user eligibility depends on the result of the authorisation of communication common function process. (I)
- 11.1.4.3 If the user is no more eligible, the user shall no longer be addressed. (M)
- 11.1.4.4 The system shall continuously check whether the data communication shall be terminated due to system rules (timer expired, etc.), system operator action or user action. Upon termination, the data communication is stopped. (M)

11.2 Basic data communication

11.2.1 Introduction

11.2.1.1 The basic data communication is to provide for a FRMCS user connectivity. This application is for users to perform data communications between two users or between multiple users. (I)

11.2.2 Generic requirements

11.2.2.1 A user shall be able to initiate a basic data communication to one user. (M)

11.2.2.2 A user shall be able to initiate a basic data communication to multiple users. (M)

11.2.2.3 A user shall be able to initiate a basic data communication to a user outside of the FRMCS system. (M)

11.2.2.4 A user shall be able to receive a basic data communication. (M)

11.2.2.5 A user shall be able to receive a basic data communication from a user outside the FRMCS system. (M)

11.2.2.6 A user shall be able to perform the initiation of a basic data communication by defining each recipient by the subscriber identity. (M)

11.2.2.7 A user shall be able to perform the initiation of a basic data communication by defining each recipient by the user identity. (M)

11.2.2.8 A user shall be able to perform the initiation of a basic data communication by defining the full functional identity. (M)

11.2.2.9 A user shall be able to perform the initiation of a basic data communication by defining by a part of the functional identity. (M)

11.2.2.10 A human user involved in an ongoing basic data communication shall be able to invite user(s) to join the communication. (M)

11.2.2.11 A human user shall be able to invite a user(s) to an ongoing basic data communication by defining each recipient by the subscriber identity. (M)

11.2.2.12 A human user shall be able to invite a user(s) to an ongoing basic data communication by defining each recipient by the user identity. (M)

11.2.2.13 A human user shall be able to invite a user(s) to an ongoing basic data communication by defining the recipient(s) by the full functional identity. (M)

11.2.2.14 A human user shall be able to invite a user(s) to an ongoing basic data communication by defining the recipient(s) by a part of the functional identity (profile addressing). (M)

11.2.2.15 The maximum number of simultaneous participants in a basic data communication shall be configurable. (M)

11.2.2.16 The number of simultaneous participants in a basic data communication is sufficient to fulfil the railway's operational needs. (I)

- 11.2.2.17 The latest functional identity registered shall be used by default as the functional identity to be presented by for basic data communications. (M)
- 11.2.2.18 The user shall be able to choose which functional identity to be presented by for basic data communications. (M)
- 11.2.2.19 The following QoS and priority parameters shall be used: (M)
- a) Latency: NORMAL;
 - b) Reliability: NORMAL;
 - c) Throughput: LOW;
 - d) Setup Time: NORMAL;
 - e) Priority Level: lower than REC-alert and ATP/ATO.
- 11.2.3 [HMI requirements](#)
- 11.2.3.1 No requirements. (I)
- 11.2.4 [Requirements for interworking with GSM-R](#)
- 11.2.4.1 No requirements applicable. (I)
- 11.2.5 [Requirements for off-network](#)
- 11.2.5.1 Data communication can be needed off-network. In those cases, the behaviour shall be the same one as when using the function on-network. (I)
- 11.2.6 [Requirements for network maintenance, configuration and monitoring](#)
- 11.2.6.1 To be defined in a later version of the specification. (I)
- 11.2.7 [Involved common functions](#)
- 11.2.7.1 To be defined in a later version of the specification. (I)

11.3 Role management and presence application

11.3.1 Introduction

11.3.1.1 This application specifies the interface aspects of the Role management and presence common function to the user. (I)

11.3.2 Generic requirements

11.3.2.1 A user shall be able to invoke the role management and presence dialogue to perform actions related to user login and functional identities management. (M)

11.3.2.2 The application shall allow the user to provide the credentials that are required for a login to the FRMCS system. (M)

11.3.2.3 The login of a human user can support methods available to the equipment used (e.g. keycode, username / password, smart card, finger print, retina scan). (I)

11.3.2.3.1 The user shall be informed about the outcome of its login procedure. (M)

11.3.2.3.2 After a successful login, the application shall only list the type of functional identities and the corresponding label values allowed by the user's current roles set. (M)

11.3.2.3.3 Upon invoke of the role management application dialogue, the application shall only list the type of functional identities and the corresponding label values allowed by the user's current roles set. (M)

11.3.2.3.4 The user shall be able to compose one or several functional identity(ies). (M)

11.3.2.3.5 For a label which is not specified in the roles set (e.g. running number of a train function identity), the user shall have the ability to provide a specific label value. (M)

11.3.2.3.6 The user shall be able to enter one or several functional identity(ies) without using the selection menu. (M)

11.3.2.3.7 The user shall be able to initiate its registration into the enter/composed functional identities. (M)

11.3.2.3.8 The registration into a functional identity shall be available for all the applications authorised for this user. (M)

11.3.2.3.9 The user shall be informed about the outcome of a functional registration attempt. (M)

11.3.2.3.10 The user shall be able to request the change of (a) label(s) from a registered functional identity. (M)

11.3.2.3.11 The user shall be informed about the outcome of a registration change attempt. (M)

11.3.2.3.12 The user shall be able to request the deregistration from (a) registered functional identity(ies). (M)

- 11.3.2.3.13 The user shall be informed about the outcome of the deregistration attempt. (M)
- 11.3.2.3.14 The user shall be able to request its log out from the FRMCS system. (M)
- 11.3.2.3.15 The user shall be able to request a list of users identities and functional identities based on one or a combination of the following: (M)
- a) The user's current role(s);
 - b) The user's location information.
- 11.3.2.3.16 The resulting list of users identities and functional identities shall contain all the following informations: (M)
- a) Presence status of the user;
 - b) Location information.
- 11.3.2.3.17 A user shall be able to request information about a specific user / role. (M)
- 11.3.2.3.18 Upon request, an entitled user shall be able to get one or a combination of the following additional information: (M)
- a) List of functional identities assigned to a user;
 - b) List of users corresponding to a functional identity;
 - c) Timestamp of registration related to a functional identity.
- 11.3.2.3.19 A user shall be able to invoke a search to request the list of users and roles based on a certain context (such as a specific label or a location information). (MR)
- 11.3.2.3.20 A user shall be able to retrieve its own current functional identities. (M)
- 11.3.2.3.21 An entitled user shall be able to deregister another user. (MR)
- 11.3.3 Functional identity transfer**
- 11.3.3.1.1 An entitled user shall be able to transfer functional identity(ies) from one user to another user. (M)
- 11.3.3.1.2 A user shall be able to offer its current functional identity(ies) to another user. (M)
- 11.3.3.1.3 A user being the target of a functional identity(ies) transfer shall be able to accept or decline. (M)
- 11.3.3.1.4 A user offering a functional identity shall be informed about the outcome of this attempt. (M)

- 11.3.4 HMI requirements
- 11.3.4.1 No specific requirement. (I)
- 11.3.5 Requirements for interworking with GSM-R
- 11.3.5.1 To be defined in a later version of the specification. (I)
- 11.3.6 Requirements for off-network
- 11.3.6.1 No specific requirement. (I)
- 11.3.7 Requirements for network maintenance, configuration and monitoring
- 11.3.7.1 To be defined in a later version of the specification. (I)
- 11.3.8 Involved common functions
- 11.3.8.1 To be defined in a later version of the specification. (I)

11.4 Automatic Train Protection communication

11.4.1 Introduction

- 11.4.1.1 An ATP application on-board is able to initiate a data communication to the ATP application trackside responsible for the movement of the train. (I)
- 11.4.1.2 Trackside to on-board and trackside to trackside data communications are out of scope for this section of the specification. (I)

11.4.2 Generic Requirements

- 11.4.2.1 An ATP application on-board shall be able to initiate a data communication to the ATP application trackside responsible for the movement of the train. (M)
- 11.4.2.2 The ATP application trackside shall be able to receive the incoming communication. (M)
- 11.4.2.3 The FRMCS system should allow the ATP application on-board to register to a functional identity. (O)
- 11.4.2.4 The functional identity of the ATP application on-board and type of incoming communication should be made available to the ATP application trackside receiver of the data communication. (O)
- 11.4.2.5 If the functional identity of the ATP application is not available, the functional identity of the vehicle should be presented to the ATP application trackside receiver of the data communication. (O)
- 11.4.2.6 The location information of the ATP application on-board should be made available to the ATP application trackside receiver of the data communication. (O)
- 11.4.2.7 During the data communication, the information of the location of the initiator presented to the ATP application trackside receiver should be updated continuously. (O)
- 11.4.2.8 The ATP application can have its own location system, which is used at application level, but the FRMCS location can be used in the future. (I)
- 11.4.2.9 The ATP application can have its own IDs and addressing scheme, which is used at application level. (I)
- 11.4.2.10 The ATP data communications are strictly point-to-point. (I)
- 11.4.2.11 It shall be possible to address the responsible ATP trackside application based on one or a combination of the following: (M)
 - a) Location information of the initiator;
 - b) Functional identity of the initiator;
 - c) System configuration on which ATP (function) is responsible for which part of the track/station/etc;
 - d) Own ATP application addressing.
- 11.4.2.12 The following QoS and priority parameters shall be used: (M)
 - a) Latency: ULTRA-LOW or LOW;
 - b) Reliability: ULTRA-HIGH or HIGH;

- c) Throughput: LOW;
- d) Setup Time: IMMEDIATE;
- e) Priority Level: highest available below REC-alert.

- 11.4.2.13 For ATP the arbitration common function is not used. (I)
- 11.4.3 [HMI requirements](#)
- 11.4.3.1 No requirements applicable. (I)
- 11.4.4 [Requirements for interworking with GSM-R](#)
- 11.4.4.1 No requirements applicable. (I)
- 11.4.5 [Requirements for off-network](#)
- 11.4.5.1 No requirements applicable. (I)
- 11.4.5.2 Some modes of ATP operation can require off-network communications. This requirement does not correspond to the mode of operation where communication is established between the application on-board of the train and the one in the control center at the trackside (ground system). It can correspond to other modes of operation where communication is established between the application on-board of the trains and/or trackside elements. (I)
- 11.4.6 [Requirements for network maintenance, configuration and monitoring](#)
- 11.4.6.1 To be defined in a later version of the specification. (I)
- 11.4.7 [Involved common functions](#)
- 11.4.7.1 To be defined in a later version of the specification. (I)

11.5 Automatic Train Operation communication

11.5.1 Introduction

- 11.5.1.1 An ATO application on-board is able to initiate a data communication to the ATO application trackside responsible for the movement of the train. (I)
- 11.5.1.2 Trackside to on-board and trackside to trackside data communications are out of scope for this section of the specification (I).

11.5.2 Generic Requirements

- 11.5.2.1 An ATO application on-board shall be able to initiate a data communication to the ATO application trackside responsible for the movement of the train. (M)
- 11.5.2.2 The ATO application trackside shall be able to receive the incoming communication. (M)
- 11.5.2.3 If required by the ATO implementation, the functional identity of the ATO application on-board and when available the location information and type of incoming communication shall be made available to the ATO application trackside receiver of the data communication. (M)
- 11.5.2.4 When required by the ATO implementation, during the data communication, the information of the location of the initiator presented to the ATO application trackside receiver shall be updated continuously. (M)
- 11.5.2.5 The ATO application has its own location system, which is used at application level, but the FRMCS location can be used in the future (I).
- 11.5.2.6 When required by the ATO implementation, in the case the functional identity of the ATO application is not available, the functional identity of the vehicle shall be presented to the ATO application trackside receiver of the data communication. (M)
- 11.5.2.7 The ATO application has its own IDs and addressing scheme, which is used at application level (I).
- 11.5.2.8 The ATO data communications are strictly point-to-point. (I)
- 11.5.2.9 It shall be possible to address the responsible ATO trackside application based on one or a combination of the following: (M)
 - a) Location information of the initiator;
 - b) Functional identity of the initiator;
 - c) System configuration on which ATO (function) is responsible for which part of the track/station/etc;
 - d) Own ATO application addressing.
- 11.5.2.10 The following QoS and priority parameters shall be used: (M)
 - a) Latency: LOW;
 - b) Reliability: HIGH;
 - c) Throughput: LOW;
 - d) Setup Time: NORMAL;
 - e) Priority Level: level lower than ATP.

- 11.5.2.11 For ATO the arbitration common function is not used. (I)
- 11.5.3 [HMI requirements](#)
- 11.5.3.1 No requirements applicable. (I)
- 11.5.4 [Requirements for interworking with GSM-R](#)
- 11.5.4.1 No requirements applicable. (I)
- 11.5.5 [Requirements for off-network](#)
- 11.5.5.1 No requirements applicable. (I)
- 11.5.5.2 Some modes of ATO operation can require off-network communications. This requirement does not correspond to the mode of operation where communication is established between the application on-board of the train and the one in the control center at the trackside (ground system). It can correspond to other modes of operation where communication is established between the application on-board of the trains and/or trackside elements. (I)
- 11.5.6 [Requirements for network maintenance, configuration and monitoring](#)
- 11.5.6.1 To be defined in a later version of the specification. (I)
- 11.5.7 [Involved common functions](#)
- 11.5.7.1 To be defined in a later version of the specification. (I)

11.6	Data communication for Possession Management
11.6.1	Introduction
11.6.1.1	To be defined in a later version of the specification. (I)
11.7	Trackside Maintenance Warning System communication
11.7.1	Introduction
11.7.1.1	To be defined in a later version of the specification. (I)
11.8	Remote control of engines communication
11.8.1	Introduction
11.8.1.1	To be defined in a later version of the specification. (I)
11.9	Monitoring and control of critical infrastructure
11.9.1	Introduction
11.9.1.1	To be defined in a later version of the specification. (I)
11.10	Voice Recording and access to the recorded data
11.10.1	Introduction
11.10.1.1	To be defined in a later version of the specification. (I)
11.11	Data recording and Access
11.11.1	Introduction
11.11.1.1	To be defined in a later version of the specification. (I)

- 11.12 **Shunting data communication**
- 11.12.1 Introduction
- 11.12.1.1 To be defined in a later version of the specification. (I)
- 11.13 **Train integrity monitoring data communication**
- 11.13.1 Introduction
- 11.13.1.1 To be defined in a later version of the specification. (I)
- 11.14 **Public emergency warning**
- 11.14.1 Introduction
- 11.14.1.1 To be defined in a later version of the specification. (I)
- 11.15 **Critical Advisory Messaging services- safety related**
- 11.15.1 Introduction
- 11.15.1.1 To be defined in a later version of the specification. (I)
- 11.16 **Virtual coupling data communication**
- 11.16.1 Introduction
- 11.16.1.1 To be defined in a later version of the specification. (I)
- 11.17 **Train Parking Protection**
- 11.17.1 Introduction
- 11.17.1.1 To be defined in a later version of the specification. (I)

11.18 Safety key management data communication

11.18.1 Introduction

- 11.18.1.1 A KMS application on-board is able to initiate a data communication to the KMS application trackside responsible for the information related to the train. (I)
- 11.18.1.2 KMS to on-board and KMS to trackside data communications are out of scope for this section of the specification (I).

11.18.2 Generic Requirements

- 11.18.2.1 A KMS application on-board shall be able to initiate a data communication to the KMS application trackside responsible for the information of the train. (M)
- 11.18.2.2 The KMS application trackside shall be able to receive the incoming communication. (M)
- 11.18.2.3 When required by the KMS implementation, the functional identity of the KMS application on-board and when available the location information and type of incoming communication shall be made available to the KMS application trackside receiver of the data communication. (M)
- 11.18.2.4 When required by the KMS implementation, during the data communication, the information of the location of the initiator presented to the KMS application trackside receiver shall be updated continuously. (M)
- 11.18.2.5 When required by the KMS implementation, in the case the functional identity of the KMS application is not available, the functional identity of the vehicle shall be presented to the KMS application trackside receiver of the data communication. (M)
- 11.18.2.6 The KMS application has its own IDs and addressing scheme, which is used at application level (I).
- 11.18.2.7 The KMS data communications are strictly point-to-point. (I)
- 11.18.2.8 It shall be possible to address the responsible KMS trackside application based on one or a combination of the following: (M)
 - a) Location information of the initiator;
 - b) Functional identity of the initiator;
 - c) System configuration on which KMS (function) is responsible for which part of the track/station/etc;
 - d) Own KMS application addressing.
- 11.18.2.9 The following QoS and priority parameters shall be used: (M)
 - a) Latency: NORMAL;
 - b) Reliability: NORMAL;
 - c) Throughput: LOW;
 - d) Setup Time: NORMAL;
 - e) Priority Level: lower than ATP.
- 11.18.2.10 For KMS the arbitration common function is not used. (I)

- 11.18.3 HMI requirements
- 11.18.3.1 No requirements applicable. (I)
- 11.18.4 Requirements for interworking with GSM-R
- 11.18.4.1 No requirements applicable. (I)
- 11.18.5 Requirements for off-network
- 11.18.5.1 No requirements applicable. (I)
- 11.18.5.2 Some modes of KMS operation can require off-network communications. This requirement does not correspond to the mode of operation where communication is established between the application on-board of the train and the one in the key management center at the trackside (ground system). It can correspond to other modes of operation where communication is established between the application on-board of the trains and/or trackside elements. (I)
- 11.18.6 Requirements for network maintenance, configuration and monitoring
- 11.18.6.1 To be defined in a later version of the specification. (I)
- 11.18.7 Involved common functions
- 11.18.7.1 To be defined in a later version of the specification. (I)

12 Video applications

12.1 Basic video communication functions

12.1.1.1 The aim of this section is to define the requirements related to the common functions which are implemented to support the FRMCS applications requiring a video communication. The video applications which are specified in the paragraph 12 shall allow all or some of the functions specified in this section. Therefore, in order to avoid the duplication of equivalent requirements all along this paragraph, the functional specification of each video application refers to the common functions defined hereafter. Moreover, some of the common functions described in this section are referring to common functions already described in paragraph 8. The requirements related to the common video functions are structured in three different phases/contexts of a video communication. The diagrams aim to help the reader to understand the different functional steps required but certainly not to define the technical implementation of the system. For each context, the diagram describes the possible use cases and outcomes from one specific involved user point of view. (I)

12.1.1.2 All basic video communication functions are applicable for all video application, unless otherwise specified per application. (M)

12.1.1.3 All basic video communication functions shall work by default in on-network mode. (M)

12.1.1.4 Specific off-network mode requirements of basic video communication functions are specified in the corresponding application. (I)

12.1.1.5 This section is for further study. (I)

12.2 Critical real time video

12.2.1 Introduction

12.2.1.1 To be defined in a later version of the specification. (I)

13 Terminal requirement

13.1.1.1 This chapter is for further study. (I)

14 System management and configuration aspects

14.1 Introduction

14.1.1 The FRMCS system needs to integrate a comprehensive set of tools dedicated to the operation and maintenance (O&M) of the entire system, namely the core network, the radio network and the FRMCS user equipment. (I)

14.1.2 The system needs to provide an unified solution to provide administration, monitoring, fault analysis and handling, performance data analysis, accounting, and security, with a high level of automated functions contributing for efficient operation with reduced OPEX costs. Besides, this system shall have the capability to combine and correlate the network and FRMCS user equipment data to achieve an integrated operation and maintenance of the FRMCS system, namely the fault and performance management functions. (I)

14.2 Network management and configuration

14.2.1 The FRMCS system shall offer network and configuration management tools to the entitled user. (M)

14.2.2 The configuration and management tools can be COTS or MOTs. (I)

14.2.3 Network management shall be based on the principles of the ISO Network Management Model FCAPS (Fault, Configuration, Accounting, Performance and Security). (M)

14.2.4 The FRMCS system shall support standardized alarm interfaces. (M)

14.2.5 The FCAPS model covers the following aspects: (I)

- a) Corrective maintenance, (fault diagnosis and recovery);
- b) Preventive and Predictive maintenance, (risk prediction and prevention capabilities);
- c) Change and configuration management, including network and service configuration, subscriber management, software life cycle management, application authorisation, rollout management and configuration tools;
- d) "Testing functions for fault diagnosis and fault recovery";
- e) Accounting management and service utilization;
- f) Performance Management, including measurement of network and service performance (KPI and SLA compliance), of end to end service quality (KQI - Key Quality Indicators), prediction and analysing of network and service performance degradations;
- g) Post-incident/accident analysis, tools and information sharing;
- h) Interconnection and roaming with other FRMCS- and public networks, including service continuity, network access and routing, breakout control and traffic steering;
- i) Service Management, including end-to-end service monitoring, real time prediction and analyzing of service performance degradations and generation of service reports;

- j) Security management;
- k) Identity and access management;
- l) Required operational roles and processes, monitoring tools and information sharing between railways IM and/or RU's.

14.2.6 Accounting management and service utilization shall be possible on the level of individual users and individual communications, departments and RU's, so that users can be appropriately billed or charged for accounting purposes. (M)

14.2.7 An entitled user shall be able to obtain information for any type of on-network communication from the FRMCS system in order to be able to generate bills and statistics. (M)

14.2.8 As the FRMCS system is supposed to consist of multiple bearers (public and non-public), billing aspects will be important. (I)

14.3 FRMCS User equipment management and configuration

14.3.1 The FRMCS system shall provide tools for the logging of the FRMCS user equipment with the purpose of track error reporting and related data, in a centralized way. (M)

14.3.2 The FRMCS user equipment shall generate and record O&M log data. (M)

14.3.3 This information shall be accessible by a ground based system and/or a local system. (M)

14.3.4 The log data generated by the FRMCS user equipment shall include at least the following type of information: (M)

- a) Functional identity (e.g number of the engine);
- b) Location data;
- c) Time stamp;
- d) Type of bearer and conditions (e.g. RF parameters) available at a given time;
- e) Applications registered to the FRMCS system at a given time;
- f) Type of bearer used by each app, at a given time;
- g) Amount of data uploaded and downloaded by each app over each period of time;
- h) Faults detected on the radio interface;
- i) Faults detected internally in the FRMCS user equipment;
- j) Authentication mechanism used by the apps.

14.3.5 The log files received from the FRMCS user equipment, typically contain timestamps, time reference, equipment identification, interface identification, events, history, geographically information, protocol versions, results, fault information, performance information, change in configuration data, etc. (I)

14.3.6 The FRMCS system shall provide tools for the configuration management of the FRMCS equipment with the purpose of service configuration, software lifecycle management, etc. The system shall allow the update of configuration parameters, software and firmware releases. (M)

14.3.7 The change and configuration tasks, shall be possible to perform remotely. (M)

14.3.8 The gathered information from the FRMCS user equipment can be combined and correlated with network data for fault diagnosis as well as end-to-end performance analysis. (I)

14.4 Application management

14.4.1 The FRMCS application management shall guarantee that the FRMCS user equipment uses the valid application for the specific IM area. (M)

14.4.2 The FRMCS system guarantees that obtaining applications shall not have any impact on the railway operation of the FRMCS system. (M)

14.4.3 If an impact is foreseen, like a restart of the user equipment or interruption of ongoing communications, this is done when the user equipment is not operationally in use. (I)

14.4.4 Applications realising harmonised functionality are to be installed, enabled and retained on the relevant FRMCS user equipment. (I)

14.4.5 Obtaining applications in the context of application management means having the appropriate version of the application (which can mean upgrading, downgrading, installing or removing). (I)

14.4.6 Application management functionality shall be active permanently on each FRMCS user equipment to be able to check the validity of applications, when triggered. (M)

14.4.7 The trigger(s) for the check of the validity of applications shall be configurable. (M)

14.4.8 A trigger for checking the validity of an application can be one of the following: (I)

- a) Upon request from the on-board or trackside application management, e.g. on departure;
- b) Upon change of the IM area;
- c) Upon request from the repository on trackside, e.g. when a new application is available on the repository;
- d) Upon starting a maintenance function of the user equipment.

14.4.9 Application management functionality can at least allow software checking/update and enable/disable specific non-harmonised applications when changing the IM area. (I)

14.4.10 Application management functionality shall be able to only access authorised application repositories. (M)

14.4.11 Application management functionality shall be able to access at least the application repositories responsible for the IM areas where FRMCS user equipment is expected to operate. (M)

14.4.12 If enabled by configuration, application management functionality can access application repositories outside the IM areas where FRMCS user equipment is expected to operate, in order to obtain additional applications. (I)

- 14.4.13 A Railway Undertaking and/or an Infrastructure Manager and/or any other authorised entity can provide application repositories. (I)
- 14.4.14 The application repository shall contain the applications that are verified. (M)
- 14.4.15 Verified applications shall be: (M)
- a) Applications that perform the intended function with the required level of security;
 - b) Applications that do not perform malicious functions, hamper functionality or imply other functions to perform sub-optimally regarding the application management itself, other applications or devices/equipment;
 - c) Applications for which the version management is set (including to which FRS version they are designed, when applicable).
- 14.4.16 All the requirements applicable for application management shall also be applicable to the application manager (performing the application management task on the FRMCS user equipment) itself. (M)
- 14.4.17 The technical and legal means to verify the applications are outside the scope of the FRS. (I)
- 14.4.18 The procedural aspects of application management are for further study. (I)

15 Digital resilience

15.1 Generic requirements

- 15.1.1 The FRMCS system shall allow an implementer to achieve its cyber security objectives through the use of resilient means against cyber security threats. (M)
- 15.1.2 Cyber security covers the end to end usage of the FRMCS system, it consists of both technical means and procedures. (I)
- 15.1.3 The FRMCS system shall provide the means to authenticate a user, a user equipment or an application. (M)
- 15.1.4 The FRMCS system shall provide encryption and key management methods for those applications that require it. (M)
- 15.1.5 The FRMCS system shall implement the principles defined in cyber security standards applicable to railways. (M)

15.2 For further study

- 15.2.1 The FRMCS System shall be designed with adequate levels and degrees of: (I)
- a) Resilience, Reliability and Availability;
 - b) Disaster Tolerance;
 - c) Sustainability;
 - d) Adaptability.

16 FRMCS domain changes

16.1 Inter domain changes

- 16.1.1 This section specifies requirements during inter domain change, when changing from one FRMCS domain to another. (I)
- 16.1.2 FRMCS shall support changing of FRMCS domains, e.g. when a user crosses a country border or changes FRMCS domain within a country. (M)
- 16.1.3 FRMCS shall support changing of FRMCS domain both user initiated and by another trigger (e.g. by a balise, location information). (M)
- 16.1.4 FRMCS should support the automatic change of FRMCS domains. (O)
- 16.1.5 Upon changing FRMCS domains, the necessary service (re)configuration actions (e.g. (de)registering of identities, (re)setting authorisation of communication and application) shall be transparent (no interaction required with the user) for the user. (M)
- 16.1.6 It shall be possible to inform the user when a change of FRMCS domain has occurred. (M)
- 16.1.7 The change between FRMCS domains shall not lead to a drop of the ongoing communication. (M)
- 16.1.8 A short interruption within the ongoing communication during the change of FRMCS domain is acceptable (e.g. short interruption of speech or data transfer without a drop of communication). (I)

16.2 Intra domain changes

- 16.2.1 This section specifies requirements during intra domain change, when changing within one FRMCS domain. A change in this context is considered as a change of the set of access functions and corresponding core functions applicable for the FRMCS system (e.g. changing of radio access). (I)
- 16.2.2 Changes within the FRMCS domain shall be transparent (no interaction required with the user) for the user. (M)

17 References

17.1 Normative references

[TAP TSI] Commission regulation (EU) No 454/2011 (5 May 2011) and its amendments Section 4.2.14: “Train preparation” and section 4.2.15 « train running information and forecast » Technical document B.30 annex III (see ERA-TD-105: TAF TSI - Annex D.2: Appendix F -TAF TSI Data and Message Model, Version 2.0.)

[TAF TSI] Commission regulation (EU) No 1305/2014 (11 December 2014) Section 4.2.3 “Train preparation” and section 4.2.4 “Train running forecast” Technical document TAF/TSI: ‘Annex D.2: Appendix F — TAF TSI Data and Message Model’ listed in Appendix I

[OPE TSI] Commission Regulation 2015/995/EU (8 June 2015), amending Decision 2012/757/EU (14 November 2012) and repealing Decision 2013/710/EU (2 December 2013) Technical Document « Appendix A to Technical Specifications Operation and Traffic Management » version 4.

[EIN] Structure and content of the European identification number (COMMISSION IMPLEMENTING DECISION (EU) 2018/1614 of 25 October 2018 laying down specifications for the vehicle registers referred to in Article 47 of Directive (EU) 2016/797 of the European Parliament and of the Council and amending and repealing Commission Decision 2007/756/EC).

17.2 Informative references

[URS] FRMCS User Requirements Specification FU-7100 (latest version applies)

[UC] FRMCS Use cases MG-7900 (latest version applies)

Appendix A URS Pr's and GN's covered in FRS

In this appendix an overview is given which Pr's (Principles) and GNs (Guidance) from the URS are covered where in the FRS, or elsewhere.

Pr/GN	FU-7100 (URS)	FU-7120 (FRS)	Target (proposal)	Destination in FRS
Pr1.	The FRMCS is able to satisfy the communication needs of the railway operation.	Not included	-	-
GN1.	Railway operation includes normal, degraded and emergency operating conditions. Some characteristics can be affected by the operational conditions, such as capacity, availability, quality of communication, etc.	To be determined	FRS	-
GN2.	Evolution of the characteristics of the route or introduction of new routes can affect the operational needs. The system is scalable to cope with these changes.	Included	FRS ch 5	ch 5 - Application concept
GN3.	Operational conditions can vary depending on the characteristics of the route, for example maximum permissible line speed, headway between trains, complexity of route (single, double, multiple track layout), low/medium/high density routes, climatic environment, volume of train journey commencing, frequency and likelihood of accidents and/or operational incidents (conflict points, level crossings etc.). These can require different classes of service.	Included	FRS ch QoS and priority	§8.2.7 - QoS and priority
GN4.	Capacity, reliability, availability, maintainability, quality of service are characteristics to be used to meet the operational needs of the railways. The "End to End" performance and functionalities can be relaxed or strengthened compared to the legacy radio system (for example GSM-R), depending on specific operational needs.	Included	FRS ch8-12 SRS	§8.2.7 - QoS and priority
GN5.	Other characteristics such as integrity, clarity, accuracy etc. have to be taken into account and can also vary depending on the operational conditions.	?	?	-
GN6.	Deleted.	Not included	-	-
GN7.	It's possible to maintain system functionalities in the environment or climatic conditions required for the operation.	To be included	FU-7100 ch13 and/or FU-7100 ch14.	§14.1 - Terminal equipment
GN8.	The system is able to co-exist (spectrum wise) and operate in parallel with other mobile communication systems keeping the required functionality and performance.	Not included	SRS	-
GN9.	Information inside the FRMCS system can be made available to other external systems, such as traffic management systems, tracking systems, planning	To be included	FU-7100 ch13 or ch16	§8.2.4 - Location services (as current example)

Pr/GN	FU-7100 (URS)	FU-7120 (FRS)	Target (proposal)	Destination in FRS
	systems, etc. The relevant interfaces have to be defined.			
GN10.	It's possible to Harmonisation different types of data for FRMCS internal and external railway use (like location data, caller identity, etc.).	Not included	SRS	-
GN11.	Deleted.	Not included	-	-
GN12.	The FRMCS is able to facilitate connectivity to and from public operators, both mobile and fixed networks.	To be included	FRS ch8-13 and ch16 §10.3?	§10.3 - Basic voice communication
GN12i.	Additionally the FRMCS users are able to use resources and services provided by other mobile networks according to corresponding agreements.	Not included	SRS?	-
GN13.	It's possible to communicate in the event of loss/lack of infrastructure. In this case it is acceptable for a limited number of applications only to be made available. Reduction of the performance is also acceptable.	Included	FRS ch8-13	§8.2 - Common functions §10.3 - Basic voice function §10.4 - Train driver to controller voice comm. §10.5 - Controller to train driver voice comm. §10.6 - Multi-train voice comm. for drivers §10.8 - REC §11.2 - ATP §11.3 - ATO §11.4 - Safety key management §13.1 - Role management and presence application
GN13i.	The FRMCS is able to avoid/limit the interdependency between different interconnected FRMCS (such as cross border situations).	Not included	SRS?	-
GN14.	The system is flexible and supports new created apps or new functionality in the future.	Included	FRS ch 5	§5.1 - Goal
Pr2.	FRMCS supports the applications independently of the used FRMCS networks and radio access technologies by any of the users. Transition of a user to or from other FRMCS networks or radio access technologies does not lead to interruption of the usage of the applications.	Not included	-	-
GN14i.	The system is able to provide voice and data communication. It's possible to utilise multiple communication bearers to achieve this.	Included Not included	FRS ch8-13 -	ch 10 - Voice applications ch 11 - Data applications
GN14ii.	The system is able to provide all basic telephony features and supplementary services as commonly used (for example Call forwarding, call transfer, etc.).	Included	FRS §8.2, §8.3, §10.3	§10.1 - Basic voice communication functions §10.3 - Basic voice communication
GN15.	FRMCS networks are able to interconnect/interwork with GSM-R or and/other networks (mobile or fixed).	Included	FRS ch8-13 and ch16	§10.3 - Basic voice communication (as example)
GN16.	The transition between networks is automatic, without any interaction required from the user unless otherwise required.	To be included	FRS ch8-13	§9.4.3

Pr/GN	FU-7100 (URS)	FU-7120 (FRS)	Target (proposal)	Destination in FRS
GN17.	The user doesn't experience any interruption in the usage of the application due to a transition between networks (seamless user experience). In the case of transition to/from GSM-R, a degradation of the user experience including interruption is acceptable. The application and/or the end user device are able to automatically re-establish the communication session of the application (like a voice call).	Included To be included	FRS ch8-13	§9.4.3, §9.4.4 and §9.4.8. §10.3 - Basic voice communication (as example) §8.2.7 - QoS and priority (is this the right location to put this?)
GN17i.	A seamless user experience in the case of transition means that the ongoing communication session is not terminated. A short interruption, not impacting the application session or the user communication, is acceptable.	see GN17	-	§9.4.5 and §9.4.7
GN18.	The user does not experience any difference in the behaviour of the application regardless of which network the user is active or other users are active on.	Included To be included	FRS ch8-13	§9.4.3, §9.4.8, §9.4.9. §10.3 - Basic voice communication (as example) §8.2.7 - QoS and priority (is this the right location to put this?)
GN18i.	When one of the users is active in a GSM-R network, a degradation of the user experience is acceptable.	See GN18	-	-
Pr3.	The FRMCS is able to place the human being at the centre of the design.	Not included	-	-
GN19.	Human-Machine Interfaces are intuitive.	Not included	-	-
GN20.	Human-Machine Interfaces are standardised where possible.	Included	FRS ch8-13	ch 15 - HMI aspects
GN21.	Functionality/application remain consistent across all devices used.	Included	FRS	ch 15 - HMI aspects
GN22.	Messaging is operationally meaningful.	Included	FRS ch8-13	§10.8 - REC (as example)
GN23.	Data input is mostly automated to facilitate the operation of voice and data applications.	Included	FRS ch8-13	ch 11 - Data applications
GN24.	initiation or accepting voice communication is possible by minimal interactions.	Included	FRS ch8-13	ch 15 - HMI aspects
GN25.	Tones and alerts do not conflict with others within the operating environment.	To be included	FRS ch15	ch 15 - HMI aspects
GN26.	For voice communication, the system allows the user to switch between different modes of using the microphone and loudspeaker (e.g. handset, headset, hands-free, etc.) based on the operational needs.	To be included	FRS ch15	ch 15 - HMI aspects
Pr4.	The FRMCS is able to support the application of the harmonised operational rules and principles where available. For EU countries, these are defined in [OPE TSI].	Included	FRS	ch 7 - Introduction to common functions and applications
GN27.	It's possible to issue and revoke movement authorities according to the harmonised operational rules and principles where available.	Not included	-	-
GN28.	Voice communication during operation respects the harmonised operational rules and principles where available.	Not included	-	-
GN29.	The structure of operational messages or information follows the harmonised operational rules and principles where available.	Not included	-	-

Pr/GN	FU-7100 (URS)	FU-7120 (FRS)	Target (proposal)	Destination in FRS
Pr5.	The FRMCS is able to support the exchange of information and performance of actions without the manual assistance of humans (machine to machine communication) both for operational and maintenance purposes.	Not included	-	-
GN30.	Activities relating to the maintenance of on-board and infrastructure assets is automated. Over-the-air software updates, configuration changes, fault diagnosis and rectification shall be allowed by the system architecture and applications.	To be included	FRS ch 16	§16.3 – FRMCS user equipment management and configuration
GN31.	Automatic and remote monitoring of the characteristics of the railway assets is supported.	To be included	FRS ch 11	ch 11 - Data applications
GN32.	Direct exchange of information between devices, for example, between infrastructure elements (such as a point and a barrier for a level crossing) or between trackside elements and other elements (such as a sensor and a device on board of a train or between different trains), is supported.	Included	FRS several paragraphs	§8.2 - Common functions §10.3 - Basic voice function §10.4 - Train driver to controller voice comm. §10.5 - Controller to train driver voice comm. §10.6 - Multi-train voice comm. for drivers §10.8 - REC §11.2 - ATP §11.3 - ATO §11.4 - Safety key management §13.1 - Role management and presence application
Pr6.	The FRMCS is able to mitigate the risk of miscommunication.	Not included	-	Pr6
GN33.	Caller identification is available.	Included	FRS ch8-13	§10.1 Basic voice communication functions
GN34.	Train location information is available.	Included	FRS ch8-13	§10.1 Basic voice communication functions
GN35.	There shall be a mechanism that prevents background noise being overheard by participants.	Included	FRS or SRS	ch 15 - HMI aspects
GN36.	It's possible to pass confirmation data messages that can be used as a reference point by the user during a related activity.	To be included	FRS	tbd
GN37.	The system is able to provide technical solutions to mitigate the risk of miscommunication in multi-user voice communication, like Push-to-Talk, voice detection, etc. Optionally it's possible to use this solution in a user-to-user communication, based on operational rules.	Included	FRS ch8-13	§8.2.2 Multi user talker control common function
Pr7.	The FRMCS is cost effective.	Not included	-	-
GN38.	The re-use of installed base, for example GSM-R, is considered by enabling the re-use of existing equipment that has not reached the end of its lifecycle such as the base station installations, on-board installations, track side installations, controller installations, etc.	Included	FRS SRS	-
GN39.	Reduction in capital expenditure, whilst providing access to the benefits associated with the future radio mobile communication system during the migration phase.	Not included	-	-

Pr/GN	FU-7100 (URS)	FU-7120 (FRS)	Target (proposal)	Destination in FRS
GN39i.	Ability to capitalise on true COTS (for both hardware and software) products, and make use of open and standardised interfaces (non-propriety).	Not included	-	-
Pr8.	The FRMCS is able to provide precautionary measures to prevent unauthorised access.	Included	FRS ch 16 or §8.2.7? SRS?	§14.4 - Digital resilience
GN40.	To prevent unauthorised and potential malicious acts affecting the use of the communication system and any associated data.	Included	FRS ch 16 SRS	§14.4 - Digital resilience
GN41.	Certain applications require strong authentication, encryption and key management methods and the communication system is able to support these when required.	Included	FRS ch 16 or §8.2.7? SRS?	§14.4 - Digital resilience
GN42.	Access to applications is configured within the system and based upon the permissions associated with each entitled user.	Included	FRS §8.2.6	§8.2.6 - Authorisation of application
GN43.	The system is able to mitigate (cyber) security threats.	Included	SRS	§14.4 - Digital resilience

Table 4: URS Pr's and GN's covered in FRS

Appendix B Traceability to URS and Use cases

To be added in a later version of this specification.

Appendix C Regional requirements

In this appendix the classification of the FRS requirements applicable for a specific region of individual country are specified.

The section 1 of this annex is the placeholder for identifying the requirements relevant for interoperability in the European Union, i.e. the requirements, with respect to the authorisation in the EU according to the TSI, that are considered in the European Directives to be relevant for interoperability as fulfilling the essential requirements for the Control-Command and Signalling (CCS) subsystem related to safety and technical compatibility which must be met by the rail system, the subsystems, and the interoperability constituents, including interfaces according to the corresponding conditions set out in Directive (EU) 2016/797. It is mandatory that each railway subsystem in the EU meets these requirements on lines under the scope of the Directive and the CCS TSI to ensure technical compatibility between Member States and safe integration between train and track.

At this stage, the version of this specification is not considered complete for the purpose of tendering On-Board FRMCS equipment, and the identification of all requirements relevant for interoperability is for further study.

This annex part is therefore only informative.

1 European Union

1.1 Scope and Purpose

- 1.1.1 This document lists a classification into categories of all the clauses in the FRMCS Functional Requirements Specifications (FRMCS FRS).
- 1.1.2 The purpose of this document is to ease the assessment of the compliance of an FRMCS on-board and trackside equipment with the FRS.
- 1.1.3 To that effect, this document comprehensively identifies which clauses contain requirements allocated to the FRMCS on-board and/or trackside equipment and conversely which ones do not.

1.2 Definitions

- 1.2.1. The following categories are used to classify each FRS clause:
 - 1.2.1.1. FRMCS on-board requirement: a clause containing requirement(s) that must be fulfilled by an FRS compliant FRMCS on-board
 - 1.2.1.2. FRMCS trackside requirement: a clause containing requirement(s) that must be fulfilled by an FRS compliant FRMCS trackside, in case the corresponding function is implemented
 - 1.2.1.3. Informative: a clause that helps the reader to better understand the context or the justification of requirement(s)
 - 1.2.1.4. Others: a clause that does not belong to any of the above categories

- 1.2.2. In case a requirement equally applies to both FRMCS on-board equipment and FRMCS trackside or in case it is not possible to distinguish between on-board and trackside, requirements are kept together in the concerned clause.

1.3 List of clauses

The below table covers sections of the FRS. The categorisation of individual clauses is for a next version of the FRS.

Legenda:

Y = Yes

N = No

tbd = to be defined

Section / clause number	Clause classification				Justification remark (to be deleted in final version)
	FRMCS on-board requirement	FRMCS trackside requirement	Informative	Others	
1			x		
2			x		
3			x		
4			x		
5			x		
6	Y	Y			
7			x		
8.1			x		
8.2.1			x		
8.2.2	tbd	tbd			
8.2.3	Y	Y			
8.2.4	Y	Y			
8.2.5	Y	Y			
8.2.6	Y	Y			
8.2.7	Y	Y			
8.2.8	Y	Y			
8.2.9	tbd	tbd			
8.2.10	Y	Y			
8.2.11	Y	Y			
8.2.12	Y	Y			
9.1			x		
9.2			x		
9.3	Y	Y			
10.1	Y	Y			
10.2	Y	Y			
10.3	Y	Y			
10.4	Y	Y			
10.5	Y	Y			
10.6	tbd	tbd			
10.7	tbd	tbd			
10.8	tbd	tbd			
10.9	tbd	tbd			

Section / clause number	Clause classification				Justification remark (to be deleted in final version)
	FRMCS on-board requirement	FRMCS trackside requirement	Informative	Others	
10.10			x		
10.11	Y	Y			
10.12	tbd	tbd			
10.13	tbd	tbd			
10.14	tbd	tbd			
10.15	tbd	tbd			
10.16	tbd	tbd			
10.17	tbd	tbd			
11.1	Y	Y			
11.2	Y	Y			
11.3	Y	Y			
11.4	Y	Y			
11.5	Y	Y			
11.6	tbd	tbd			
11.7	tbd	tbd			
11.8	tbd	tbd			
11.9	tbd	tbd			
11.10	tbd	tbd			
11.11	tbd	tbd			
11.12	tbd	tbd			
11.13	tbd	tbd			
11.14	tbd	tbd			
11.15	tbd	tbd			
11.16	tbd	tbd			
11.17	tbd	tbd			
11.18	Y	Y			
12	tbd	tbd			
13	tbd	tbd			
14.1			x		
14.2	N	N			
14.3	Y	Y			
14.4	Y	Y			
15	Y	Y			
16	Y	Y			

2 Asia

To be added in a later version of this specification.

3 US

To be added in a later version of this specification.

Appendix D Mapping of functional addressing with GSM-R

This appendix specifies the mapping between the numbering plan of GSM-R and the addressing schema of FRMCS.

Legend:

→ = required

→ = required, but action to be taken by implementers due to conceptual differences

→ = not required (e.g. considering not changing GSM-R)

FRMCS		GSM-R	
Organisation Code (OC)			RAC
AAAA	→	←	NNN
+++++			
On-train outgoing voice communication from the train driver towards the controller(s) of a train (URS 5.1)			Call Type 1
driver to primary controller	→	←	SDC 1200
driver to secondary controller	→	←	SDC 1300
driver to power supply controller	→	←	SDC 1400
+++++			
Train function identity			Call Type 2
<u>TrainID (IL)</u>			<u>Train Function Number</u>
A..(41)..A	→	←	NNNNNNNN
<u>Function (FL)</u>			<u>Function Code</u>
Leading driver	→	←	01 - Leading driver
Driver 2	→	←	02 - Driver 2
Driver 3	→	←	03 - Driver 3
Driver 4	→	←	04 - Driver 4
Driver 5 – reserved for Banking	→	←	05 - Driver 5 – reserved for Banking
Intercom	→	←	07 - Intercom
Public address	→	←	08 - Public address
Chief conductor	→	←	10 - Chief conductor
Second conductor	→	←	11 - Second conductor

FRMCS		GSM-R	
Third conductor	→	←	12 - Third conductor
Fourth conductor	→	←	13 - Fourth conductor
Train crew 5-10	→	←	14-19 - Train crew 5-10
Catering staff chief	→	←	20 - Catering staff chief
Catering 2-10	→	←	21-29 - Catering 2-10
Railway security services chief	→	←	30 - Railway security services chief
Railway security 2-10	→	←	31-39 - Railway security 2-10
		←	40-49 - ERTMS/ETCS
		←	50 - Train-borne recorder
		←	51 - Diagnostics
		←	52 - Train data bus
		←	53 - Train location system
		←	60 - Pre-recorded passenger info
		←	61 - Displayed passenger information unit
+++++			
Vehicle identity			Call Type 3/4
<u>VI (IL)</u>			<u>CT3 - Engine Function Number</u> <u>CT4 - Coach Function Number</u>
A..(41)..A	→	←	CT3 - NNNNNNNN CT4 - NNNNNNNN
<u>Function (FL)</u>			<u>Function Code</u>
Function*	→	←	NN
+++++			
Profile Addressing			Call Type 5(0)
<u>Location (LL)</u>			<u>Group Call Area</u>
A..(41)..A	→	←	NNNNN
<u>Profile (FL)</u>			<u>Group ID</u>
Everybody			---
Train driver	→	←	200, 555
Train staff			---

FRMCS		GSM-R	
Catering staff			---
Shunting team members	→	←	500-529
Maintenance team members	→	←	560-569
Railway security team members	→	←	530-539
Vehicle Equipment identity	→	←	(VBS) 203, 221-229, 540-550
Trackside Equipment identity			---
+++++			
Team identity			Call Type 6
<u>Location (LL)</u>			<u>Location Number</u>
A..(41)..A	→	←	NNNNN
<u>Type (IL)</u>			<u>Function Code</u>
Shunting 1	→	←	6LLLLLYYXX
Shunting 2	→	←	6LLLLLYYXX
Shunting 3	→	←	6LLLLLYYXX
Maintenance 1			---
Maintenance 2			---
Maintenance 3			---
Railway security 1			---
Railway security 2			---
Railway security 3			---
<u>Function (FL)</u>			<u>Function Code – only for shunting</u>
Driver	→	←	6LLLLL54XX
Team leader	→	←	6LLLLL50XX
Team member 1	→	←	6LLLLL51XX
Team member 2	→	←	6LLLLL52XX
Team member 3	→	←	6LLLLL53XX
Team member 4			---

FRMCS		GSM-R	
Team member 5			---
+++++			
Controller identity			Call Type 7
<u>Location (LL)</u>			<u>Location Number</u>
A..(41)..A	→	←	NNNNN
<u>Function (FL)</u>			<u>Function Code</u>
Primary controller	→	←	01 - Primary controller
Secondary controller	→	←	02 - Secondary controller
Power supply controller	→	←	03 - Power supply controller
Switchman	→	←	04 - Switchman
Platform inspector	→	←	05 - Platform inspector
Railway undertaking dispatcher	→	←	06 - Railway undertaking dispatcher
Technical inspector	→	←	07 - Technical inspector
Train preparation	→	←	08 - Train preparation
Emergency manager	→	←	09 - Emergency manager

Table 5: Mapping of functional addressing with GSM-R

Appendix E Examples of “first to accept” call handling

In this appendix some examples of scenario related to the requirement specified in § 8.2.4.3.14 a) are given .

I. Example 1

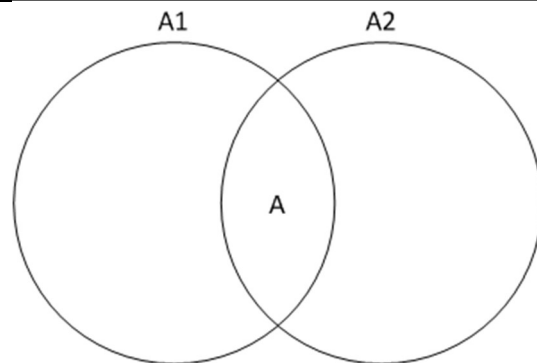
- User A1 is registered to functional identity A
- User A2 is registered to functional identity A

An incoming communication addressed to functional identity A is presented to user A1 and A2.

If the incoming communication is accepted by user A1, the user A2 sharing the same functional identity is released from the incoming communication.

The user A2 shall be informed, that the incoming communication was alternatively accepted.

The context of identity A is fulfilled.



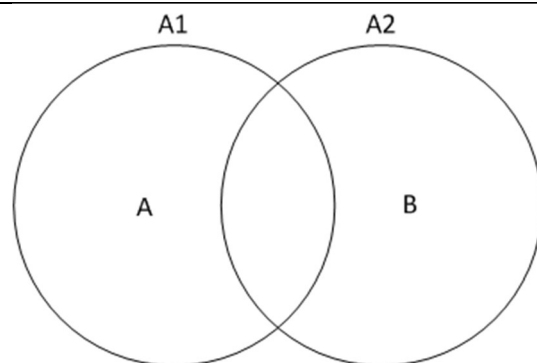
II. Example 2

- User A1 is registered to functional identity A
- User A2 is registered to functional identity B

An incoming communication addressed to functional identities A and B is presented to user A1 and A2.

If the incoming communication is accepted by user A1, the incoming communication is still presented to user A2.

Only the context of identity A is currently fulfilled.



III. Example 3.1

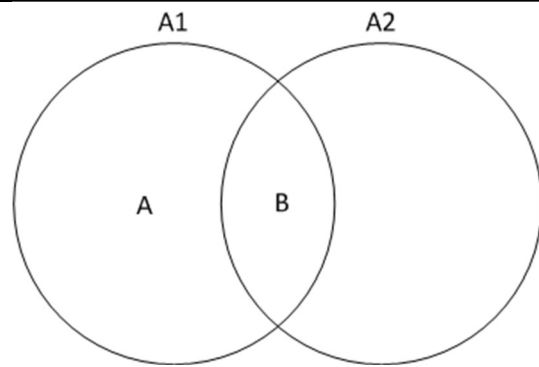
- User A1 is registered to functional identities A+B
- User A2 is registered to functional identity B

An incoming communication addressed to functional identities A and B shall be presented to user A1 and A2.

If the incoming communication is accepted by user A1, user A2 shall be released from the incoming communication.

The context of identity A+B is fulfilled.

User A2 shall be informed, that the incoming communication was alternatively accepted.



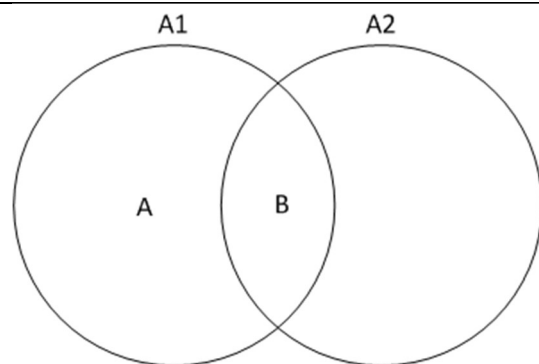
IV. Example 3.2.

- User A1 is registered to functional identities A+B
- User A2 is registered to functional identity B

An incoming communication addressed to functional identities A and B shall be presented to user A1 and A2.

If the incoming communication is accepted by user A2, the incoming communication is still be presented to user A1.

Only the context of identity B is currently fulfilled.



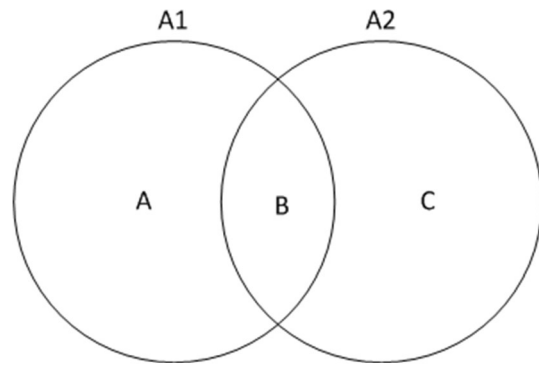
V. Example 4

- User A1 is registered to functional identities A+B
- User A2 is registered to functional identities B+C

An incoming communication addressed to functional identities A, B and C is presented to user A1 and A2.

If the incoming communication is accepted by user A1, the incoming communication is still presented to user A2.

Only the context of identity A+B is currently fulfilled.



VI. Example 5.1

- User A1 is registered to functional identities A+B
- User A2 is registered to functional identities B+C
- User A3 is registered to functional identities A+B+C

An incoming communication addressed to functional identities A, B and C is presented to user A1, A2 and A3.

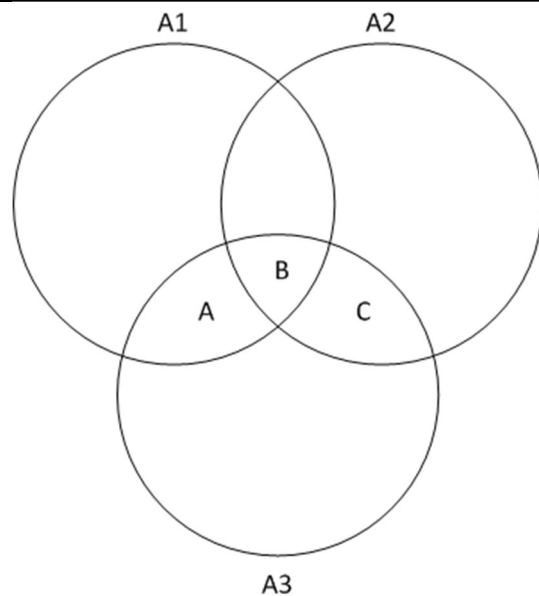
Step 1: The incoming communication is accepted by user A1, the incoming communication is still presented to user A2 and A3.

Only the context of identity A+B is currently fulfilled.

Step 2: The incoming communication is accepted by user A2, user A3 is released from the incoming communication.

The context of identity A+B+C is now fulfilled.

User A3 shall be informed, that the incoming communication was alternatively accepted.



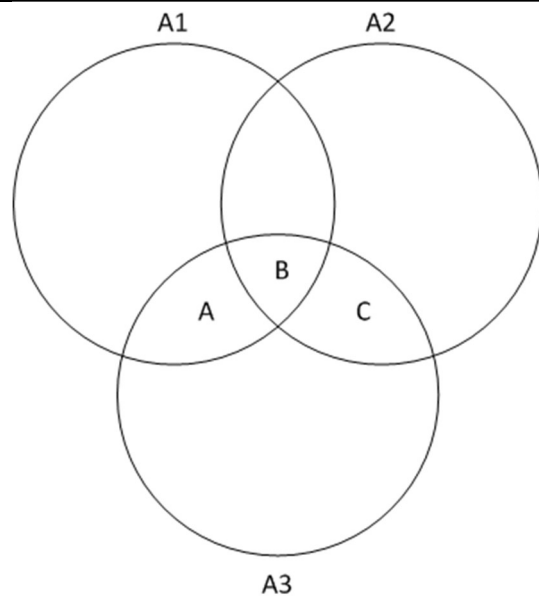
VII. Example 5.2

- User A1 is registered to functional identities A+B
- User A2 is registered to functional identities B+C
- User A3 is registered to functional identities A+B+C

An incoming communication addressed to functional identities A, B and C is presented to user A1, A2 and A3.

The incoming communication is accepted by user A3, user A1 and A2 are released from the incoming communication.

The context of identity A+B+C is fulfilled.



Appendix F Guidance to construct functional identities

In this appendix an overview is given how to construct functional identities and the different labels within that.

<i>Identity</i>	<i>LocationLabel</i>	<i>IdentificationLabel</i>	<i>FunctionLabel</i>	<i>OrganisationCode</i>
Train function identity	Train ID		<ul style="list-style-type: none"> • Leading driver • Driver 2 • Driver 3 • Driver 4 • Driver 5 – reserved for Banking • Intercom • Public address • Chief conductor • Second conductor • Third conductor • Fourth conductor • Train crew 5 – 10 • Catering staff chief • Catering 2 – 10 • Railway security services chief • Railway security 2 – 10 	OC
Controller identity	Station ID		<ul style="list-style-type: none"> • Primary controller • Secondary controller • Power supply controller • Switchman • Platform inspector • Railway undertaking dispatcher • Technical inspector • Train preparation • Emergency manager 	OC
	Trackline ID		<ul style="list-style-type: none"> • Primary controller • Secondary controller • Power supply controller • Switchman • Platform inspector • Railway undertaking dispatcher • Technical inspector • Train preparation • Emergency manager 	OC
	Track section ID		<ul style="list-style-type: none"> • Primary controller • Secondary controller • Power supply controller • Switchman • Platform inspector • Railway undertaking dispatcher • Technical inspector • Train preparation • Emergency manager 	OC
	Area ID		<ul style="list-style-type: none"> • Primary controller • Secondary controller • Power supply controller • Switchman • Platform inspector • Railway undertaking dispatcher • Technical inspector • Train preparation • Emergency manager 	OC
Team identity	Station ID	Type: <ul style="list-style-type: none"> ○ Shunting ○ Maintenance ○ Railway security 	<ul style="list-style-type: none"> • Driver • Team leader • Team member 	OC
	Trackline ID	Type: <ul style="list-style-type: none"> ○ Shunting ○ Maintenance ○ Railway security 	<ul style="list-style-type: none"> • Driver • Team leader • Team member 	OC
	Track section ID	Type: <ul style="list-style-type: none"> ○ Shunting ○ Maintenance ○ Railway security 	<ul style="list-style-type: none"> • Driver • Team leader • Team member 	OC
	Area ID	Type: <ul style="list-style-type: none"> ○ Shunting ○ Maintenance ○ Railway security 	<ul style="list-style-type: none"> • Driver • Team leader • Team member 	OC
<i>Identity</i>	<i>IdentificationLabel</i>	<i>IdentificationLabel</i>	<i>FunctionLabel</i>	<i>OrganisationCode</i>

<i>Identity</i>	<i>LocationLabel</i>	<i>IdentificationLabel</i>	<i>FunctionLabel</i>	<i>OrganisationCode</i>
Vehicle identity	Vehicle Identifier	Equipment	tbd	OC
<i>Identity</i>	<i>LocationLabel</i>	<i>IdentificationLabel</i>	<i>FunctionLabel</i>	<i>OrganisationCode</i>
Equipment identity (trackside or train)	Station ID	Equipment	tbd	OC
	Trackline ID	Equipment	tbd	OC
	Track section ID	Equipment	tbd	OC
	Area ID	Equipment	tbd	OC
<i>Identity</i>	<i>LocationLabel</i>	<i>IdentificationLabel</i>	<i>FunctionLabel</i>	<i>OrganisationCode</i>
Profile Addressing	Station ID		<ul style="list-style-type: none"> • All • Train driver • Train staff • Catering staff • Shunting team members • Maintenance team members • Railway security team members • Vehicle equipment identity • Trackside equipment identity 	OC
	Trackline ID		<ul style="list-style-type: none"> • All • Train driver • Train staff • Catering staff • Shunting team members • Maintenance team members • Railway security team members • Vehicle equipment identity • Trackside equipment identity 	OC
	Track section ID		<ul style="list-style-type: none"> • All • Train driver • Train staff • Catering staff • Shunting team members • Maintenance team members • Railway security team members • Vehicle equipment identity • Trackside equipment identity 	OC
	Area ID		<ul style="list-style-type: none"> • All • Train driver • Train staff • Catering staff • Shunting team members • Maintenance team members • Railway security team members • Vehicle equipment identity • Trackside equipment identity 	OC

Table 6: Guidance to construct functional identities