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Document history

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Key to contributors:

Name	Company	
Gary Portsmouth	RSSB	
Stuart McFarland	RSSB	
Richard Carr	RSSB	
Dan Mandoc	Network Rail	
Begoña Domingo	ERA	
Chiel Spaans	ERA	
Markus Gross	OEBB	
Jani Lehtinen	CINIA	
Christian Naenni	SBB	
Erik van Bommel	PRORAIL	
Vincent Caudron	INFRABEL	
Peter Kuehn	Deutsche Bahn	
Peter Kotti	TRAFIKVERKET	
Herman Tijsma	EIM	

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1 List of abbreviations

ATC	Automatic Train Control
ATO	Automatic Train Operation
CCTV	Closed Circuit Television
COTS	Commercial off The Shelf
DSD	Driver Safety Device
ENE TSI	Energy subsystem of the rail Technical Specification for Interoperability
ERA	European Railway Agency
ERIG	European Radio Implementation Group (part of UIC)
ETCS	European Train Control System
FRMCS	Future Railway Mobile Communications 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)
IM	Infrastructure Manager
ISO	International Organisation for Standardisation
JRU	Juridical Recorder Unit
MOTS	Modified Off The Shelf
OPE TSI	Operations and Traffic Management Technical Specification for Interoperability
PSR	Permanent Speed Restriction
RU	Railway Undertaking
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

2 List of definitions

Application

Provides a solution for a communication need that is considered necessary for current and future railway operations.

Controller

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

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

Dependent upon local circumstances, a number of functional roles can be carried out by a single controller or a single functional role can be carried out by a number of controllers.

Data communication

Exchange of information in the form of data, including video (excluding voice 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

Driver safety device

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

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

Entitled Controller

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

European Railway Agency

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.

Functional identity

A description of the function performed by a called or calling party. The functional identity can include characters and numbers. This is used within the functional addressing scheme to identify an end user/system by function or role rather than by a specific item of radio equipment or user subscription.

Ground User

A user that is not on-board a train.

Initiator context dependent addressing

Previously known in the GSM-R system as location dependent addressing which describes the process of addressing a particular function (typically a controller). However for future requirements the term has been changed to incorporate a broader scope such as:

- initiator location
- initiator travel direction
- initiator functional identity
- initiator status (e.g. involved in a shunting communication)

Lineside Telephony

Equipment that provides a communication service installed at a fixed location that can be connected to a fixed or mobile network.

Network operator

The entity responsible for operating the FRMCS network.

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

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 who is responsible for answering public emergency calls.

Railway staff

Personal employed by the railways other than driver, controllers, trackside staff or train staff.

Shunting team

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

Trackside staff

Staff working as trackside maintenance and/or shunting members.

Train Staff

Railway staff that are on-board a train but are not drivers, for example conductors, catering staff, security staff etc.

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.

Voice communication

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

Please note definitions specifically linked to applications are contained in chapter 4.

3 Introduction

3.1 Background

- 3.1.1 Globally, many railway infrastructure managers and railway undertakings currently use an interoperable radio communications network, GSM-R (Global System for Mobile Communications – Rail), for operational voice communications and to provide the data bearer for ETCS (European Train Control System). In the European Union this is legally mandated in the Technical Specifications for Interoperability that are applicable in the European Member States. Voice and data communications are also used for various other applications.
- 3.1.2 GSM-R is a MOTS (modified off the shelf technology) system based around manufacturers' commercial GSM (Global System for Mobile Communications) offerings, enhanced to deliver specific "R" (railway) functionality. Due to the product modifications required to provide "R" functionality, and the need to utilise non-commercial radio spectrum, much of the equipment utilised for GSM-R comprises manufacturers' special-build equipment and/or software variants. The use of MOTS technology for GSM-R has proven expensive for the railways, both in-terms of capital and operational expenditure.
- 3.1.3 The predicted obsolescence of GSM-R by 2030, combined with the long term life expectancy of ETCS (2050) and the Railway business needs, have led to the European Railway community initiating work to identify a successor for GSM-R. The successor has to be future proof, learn from past mistakes and comply with Railway requirements. This document is one of the first steps in this process, where the user's needs are identified and defined in a consistent and technology agnostic way, the foundation for next steps on defining the Future Railway Mobile Communications System (FRMCS).

3.2 Purpose of this document

- 3.2.1 The purpose of this document is to define a set of technology independent user requirements for the FRMCS.
- 3.2.2 The technology independent user requirements for the future radio mobile communications are defined in the form of individual applications. Each application has been defined to provide or support an identified communications need that is considered necessary for current and future railway operations. The inclusion of an application is justified by an identified use case (rationale).
- 3.2.3 The document's role is to consult/inform standardisation bodies and the supply industry, identifying the railway-specific needs to be considered when solutions are proposed. This document is also used in other FRMCS development groups (for example, Spectrum working group and Architecture working group).

3.3 Scope

- 3.3.1 The scope of the FRMCS is depicted in Figure 1 from the perspective of the user. Figure 1 shows the complexity of the communication needs in the railway environment, and illustrates only a certain number of relationships between the actors (users) and equipment (trackside and on-board).
- 3.3.2 In the context of this document the term application is used for communication and supporting services.
- 3.3.3 The list of applications is not exhaustive and it is expected that additional applications will be identified in the future.
- 3.3.4 Details of the applications themselves are not exhaustively described in this document. The applications in this document can be provided by the FRMCS system itself, or by other application systems where the FRMCS system only delivers the bearer service.
- 3.3.5 Network management, and the related tools to perform this management, are not within the scope of this document and therefore not mentioned. Ease of network management, maintenance, repair and upgrade is a business need and should be fulfilled.
- 3.3.6 The scope of this document is not to specify the end user equipment itself, although HMI aspects are mentioned in the URS where relevant. Ease of device management, maintenance, repair and upgrade is a business need and should be fulfilled.
- 3.3.7 Configurable items, like prioritisation, of the services and application was not considered in this version of the document and will be added in a later version.
- 3.3.8 The following users are those identified to be users within this document and may not be necessarily conclusive within FRMCS:
 - Driver(s)
 - Controller(s)
 - Train staff:
 - Train conductor(s)
 - Catering staff
 - Security staff
 - Trackside staff:
 - Trackside maintenance personnel
 - Shunting team member(s)
 - Railway staff (excl. all of above):
 - Engine scheduler(s)
 - RU operator(s)
 - Catering scheduler(s)
 - IM operator(s)
 - Engineering personnel

- Station manager(s)
 - Station personnel
 - Depot personnel
 - Etc.
- Public:
 - Passengers (on trains, on platforms, at stations, etc.)
 - Other persons (on platforms, at level crossings, etc.)
- Systems:
 - ATC on-board system
 - ATO on-board system
 - On-board system
 - Ground system
 - Trackside warning system
 - Trackside system
- Network operator
- Public emergency operator

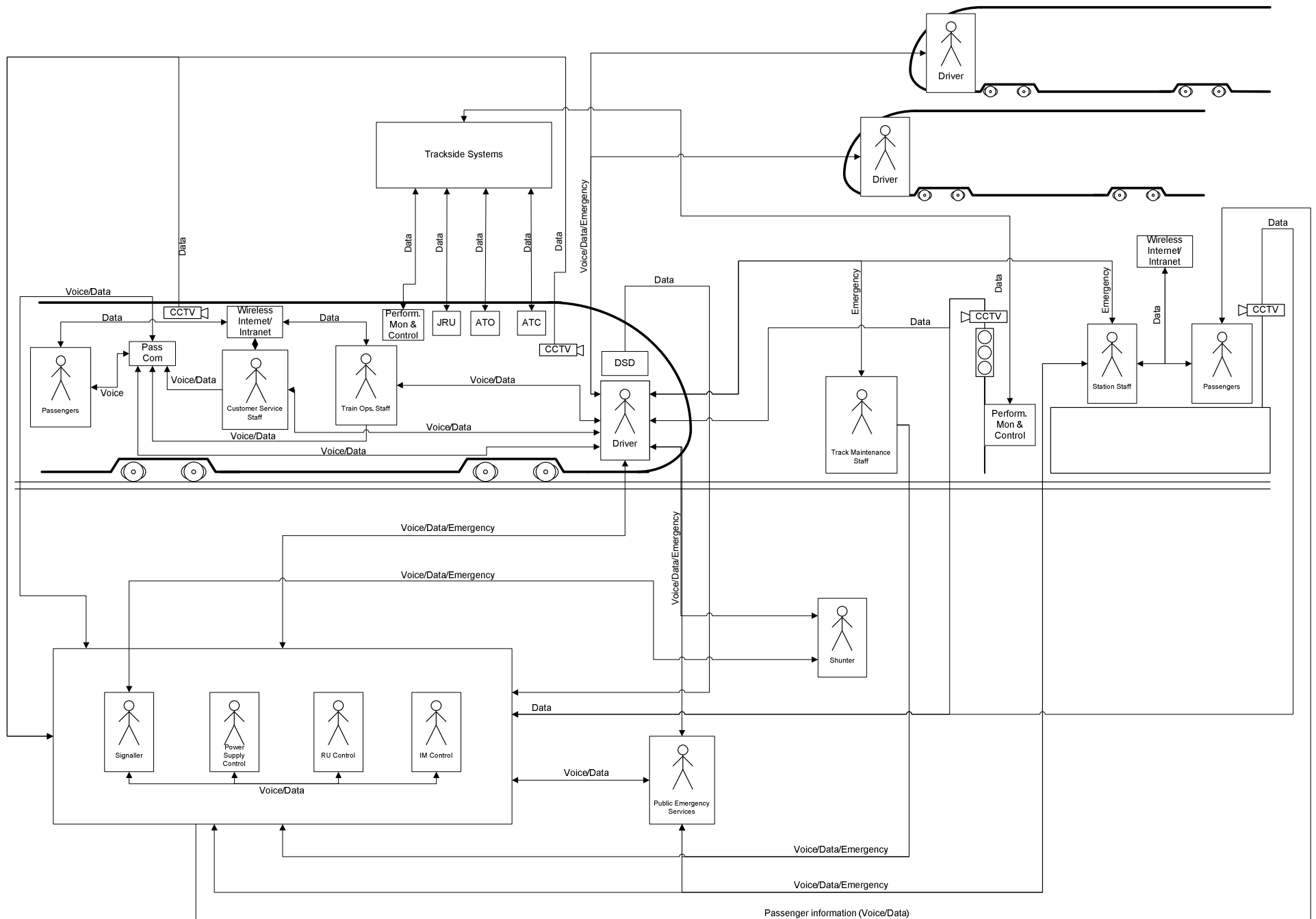


Figure 1: Application Layer Relationship Diagram

3.4 Fundamental principles

- 3.4.1 This section defines the fundamental principles (boxed text) that shall be considered throughout the development of voice and data applications defined in this document. The principles may not be relevant to all applications, but traceability between the principles and each application has been provided in the matrix contained in Appendix A.
- 3.4.2 Each fundamental principle (Prx clauses) is accompanied by guidance (GNx clauses) that is provided to further enhance the readers' understanding of the dimensions that have been considered throughout the development of this document.

Pr1.	The FRMCS shall satisfy the needs of the operational railway.
GN1.	Normal, degraded and emergency operating conditions.
GN2.	The system shall be scalable to cope with changes in train traffic and changes in the communication needs of the railways.
GN3.	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, volume of train journey commencing, frequency and likelihood of accidents and/or operational incidents (conflict points, level crossings etc...), may require different classes of service or even different communication bearers.
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 shall be equal-to or better-than legacy radio systems, for example GSM-R.
GN5.	The user expects a quality of communication (integrity, clarity, accuracy etc.) which is considered to be normal for the users by being equal to or better than what can be expected from a public service, and is sufficient to perform the railway operation.
GN6.	Ability to capitalise on true COTS (for both hardware and software) products, and make use of open and standardised interfaces (non-propriety).
GN7.	Communications shall be unaffected by environment or climatic conditions.
GN8.	The system shall be capable to co-exist (spectrum wise) and operate in parallel with other mobile communication systems without impacting the functionality.
GN9.	Information inside the FRMCS system can be made available to other external systems, such as traffic management systems, tracking systems, planning systems, etc.
GN10.	Harmonisation of different types of data for FRMCS internal and external railway use shall be considered (like location data, caller identity, etc.).
GN11.	The system shall provide all basic telephony features as commonly used (for example Call forwarding, call transfer, etc.).
GN12.	The FRMCS shall facilitate connectivity to and from public operators, both mobile and fixed networks.
GN13.	Communications shall be possible in the event of loss/lack of infrastructure. In this case it is acceptable for a limited number of applications to be made available.
GN14.	The system shall be flexible to support new created apps in the future.
Pr2.	The FRMCS shall support the automatic transition between bearer services or networks whilst continuing to support the voice and data applications that facilitate the operation of the railway.
GN15.	Automatic, and where required controlled, transition with no interaction required by the user.
GN16.	The user does not experience any interruption in the usage of the application during a transition between bearer services (seamless user experience).

- GN17. The user does not experience any interruption in the usage of the application during a transition between networks, e.g. at crossing a country or a network border (seamless user experience).
- GN18. Applications shall be able to interwork with GSM-R. Application alignment and mapping or application degradation may be required.

Pr3. The FRMCS shall place the human being at the centre of the design.

- GN19. Intuitive Human-Machine Interfaces.
- GN20. Human-Machine Interfaces shall be standardised where possible.
- GN21. Functionality/application shall remain consistent across all devices used.
- GN22. Operationally meaningful messaging.
- GN23. Automated data input to facilitate the operation of voice and data applications.
- GN24. Minimal interaction to initiate or accept voice communication.
- GN25. Tones and alerts that do not conflict with others within the operating environment.
- GN26. Based on the operational needs, the system will allow the user to switch between different modes of using the microphone and loudspeaker (e.g. handset, headset, hands-free, etc.).

Pr4. The FRMCS shall support the application of the harmonised operational rules and principles where available. For EU countries, these are defined in [OPE TSI].

- GN27. Issuing and revoking of movement authorities.
- GN28. Voice communication during operation.
- GN29. The passing of operational messages or information.

Pr5. The FRMCS shall support machine to machine (M2M) communication.

- GN30. Activities relating to the maintenance of on-board and infrastructure assets
- GN31. Remote monitoring.
- GN32. Over-the-air software updates, configuration changes, fault diagnosis and rectification.

Pr6. The FRMCS shall mitigate the risk of miscommunication.

- GN33. Caller identification.
- GN34. Train location information.
- GN35. A mechanism that prevents background noise being overheard by participants.
- GN36. A mechanism that facilitates the passing of confirmation data messages that can be used as a reference point by the user during a related activity.
- GN37. The system shall provide technical solutions to mitigate the risk of miscommunication in multi-user voice communication, like Push-to-Talk, voice detection, etc. Optionally this solution could be used in a user-to-user communication, based on operational rules.

Pr7. The re-use of installed base, for example GSM-R, shall be considered for FRMCS.

- GN38. Enable 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.
- GN39. Reduction in capital expenditure, whilst providing access to the benefits associated with the future radio mobile communication system during the migration phase.

Pr8.	The FRMCS shall provide precautionary measures to prevent unauthorised access.
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- GN40. To prevent unauthorised and potential malicious acts affecting the use of the communication system and any associated data.
- GN41. Certain applications require strong authentication, encryption and key management methods and the communication system shall support these when required.
- GN42. Access to applications shall be configured within the system and based upon the permissions associated with each authorised user.
- GN43. The system shall be able to mitigate (cyber) security threats.

4 Explanation of applications

4.1 Categorisation of Applications

- 4.1.1 The ordering of applications in the URS is as follows: First on type, second on use.
- 4.1.2 The Type of application is categorised as:
- Comms: communication application
 - Support: supporting application of communication application(s).
- 4.1.3 The use of application is categorised as:
- 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.
- 4.1.4 Chapters 5, 6 and 7 contain Communication applications as follows:
- 5: Critical communication applications
 - 6: Performance communication applications
 - 7: Business communication applications
- 4.1.5 Chapters 8, 9 and 10 contain Support applications as follows:
- 8: Critical support applications
 - 9: Performance support applications
 - 10: Business support applications

4.2 Application definitions

- 4.2.1 The characteristics of each of the applications are defined under the following headings:
- Description** – provides an overview of the intended purpose and use of the application.
 - Rationale** – provides justification for why the application is necessary.
 - Users** – identifies those users that are considered to require the use of the particular application either for sending and/or receiving information.
 - Functional attributes** – defines the identified functionality that the user requires from the application.
 - Usability criteria** – defines the criteria required of the application such that the specified users can use the application in support of their operational tasks effectively and efficiently.
 - Related application interfaces** – It is envisaged that the use of the particular application would be dependent on the applications listed in the table. Please note that applications may be a specific communication application or a supporting application.
 - Communication attributes** – In these tables the communication attributes and frequency of use is defined in different modes of operation for different locations. The purpose of these tables is to get an approximated idea on the use of an application. The detail and exact traffic calculation can be done mapping the application onto an actual operational situation.

4.2.2 The definition of the communication attributes table is defined as follows:

- ⇒ **Type:** the type of communication for voice or data¹:
- Bi-directional voice: like a user-to-user communication
 - Uni-directional voice: like a “broadcast” communication (e.g. PA)
 - Bi-directional data: like an application sending and receiving data
 - Uni-directional data: like an application sending or receiving data
- ⇒ **Symmetry Up/Down:** The ratio between the uplink traffic and the downlink traffic.
For example:
- 50/50 for bi-directional voice
 - 100/0 for uni-directional voice
 - 80/20 for internet use
 - N/A: an application which does not use the air interface.
- ⇒ **Distribution:**
- User-to-User: between two users, where a user can be a human or a system.
 - Multi-User: between a group of users, where a user can be a human or a system
 - N/A: an application which does not use the air interface.
- ⇒ **Latency:** The delay between action and reaction:
- Normal: there is no explicit requirement from the user, there is no need for immediate and the delay does not harm the use of the application by the user.
 - Low: immediate.
 - N/A: an application which does not use the air interface.
- ⇒ **Bandwidth:** a qualitative indication of the anticipated rate of data transfer when using the application.
- High
 - Medium
 - Low
 - N/A: an application which does not use the air interface.
- ⇒ **Reliability:** a qualitative indication of the availability required of the communications system when the application is in use.
- High
 - Normal
- ⇒ **Setup:** a qualitative indication of the time to establish a voice or data communication session with the application that would be acceptable to a user, and is sufficient to perform the railway operation.
- Normal: there is no explicit requirement from the user, there is no need for immediate and the delay does not harm the use of the application by the user.
 - Immediate
 - N/A: an application which does not use the air interface.
- ⇒ **Speed:** the speed that a user is travelling in, maximum value:
- Low <40 Km/h, including stationary users
 - Normal >40 Km/h, <250 Km/h
 - High >250 Km/h

¹ Data is considered to also include video.

4.2.3 The definition of the frequency of use table is defined as follows:

4.2.3.1 Horizontal: Operational modes:

- Normal: train services are operated according to the time table. Minor delays are considered under this normal scenario. This mode also includes unplanned movements and other routine activities, such as maintenance, that do not affect time table running.
- Degraded: Operation resulting from an unplanned event that prevents the normal delivery of train services according to time table. This leads to disruptions of train services and time table running. For example single train failure, speed restriction, passenger incidents, etc.
- Emergency: a dangerous situation which has life threatening or extreme loss implication and requires immediate attention. For example derailing, catenary failure, fire, etc. The emergency situation is significantly affecting train service and time table running. The resolving of the incident, including the resumption of normal time table running, is considered to be part of this mode.

4.2.3.2 Vertical: Type of area:

- Station: Railway station with platforms. This includes train movements to and from stations to depots.
- Yard: Rolling stock movements and related communication within the yard or depot area. At this location trains could be stored, cleaned, maintained or composed.
- Line: railway track(s) between two stations or between stations and yards.

4.2.3.3 Content: The values in the table reflects how often and/or the duration the application is used by an active user at a certain location in a certain operational situation:

- Not used: the application is not used at all.
- Low:
 - For voice: < 1 call per user per hour (average)
 - For data: < 1 active minutes per user per hour (average)
- Medium:
 - For voice: >1, <5 calls per user per hour (average)
 - For data: >1, <15 active minutes per user per hour (average)
- High:
 - For voice: >5 call per user per hour (average)
 - For data: >15 up to continuously in use, the application in always on and always used.

Please note that it is assumed that a voice call will have an average duration of 2 minutes, except for banking (continuous) and shunting (continuous).

5 Critical Communication Applications

5.1 On-train outgoing voice communication from the driver towards the controller(s) of the train

5.1.1 Description

- 5.1.1.1 The driver shall be able to initiate a voice communication to any controller that was, is, or will be responsible for the movement of the train.

5.1.2 Rationale

- 5.1.2.1 The driver may need to initiate a voice communication to a controller for operational reasons, for example upon reaching an End of Authority (EoA).
- 5.1.2.2 It may be necessary for the driver to communicate with a controller prior to entering that controller's area of responsibility, for example a freight train arriving earlier than planned.
- 5.1.2.3 It may also be necessary for a Driver to report back to a Controller on the condition of the infrastructure when they are out of the Controller's area of control.

5.1.3 Users

- 5.1.3.1 Driver(s), controller(s).

5.1.4 Functional attributes

- 5.1.4.1 The driver shall be able to initiate a voice communication to either a single controller or multiple controllers. However, both in the case of single user or multi-user communications the risk of miscommunication shall be mitigated.
- 5.1.4.2 Depending on driver input, the system shall automatically route voice communications to the controller responsible for the train movement, or to a specifically selected recipient.
- 5.1.4.3 Communication shall not be disrupted unless required by call arbitration process.

5.1.5 Usability criteria

- 5.1.5.1 The initiation of a voice communication shall be achieved with the minimum of interaction (for example, a single button press or selection from list). Where selection from a list is determined to be the preferred option, then the list shall be accessed with the minimum of interaction and be intuitive.
- 5.1.5.2 Users shall be presented with meaningful information when receiving a voice communication, for example:
- Functional identity of the originator.
 - Information relating to the location of the originator.
 - A simple description of incoming communication.
- 5.1.5.3 Users shall be presented with meaningful information when initiating a voice communication and during an ongoing communication, for example :
- Status of the intended recipient.
 - Functional identity of the currently connected user/s.
 - Information relating to the location of the currently connected user/s.
- 5.1.5.4 Where a functional identity is provided, it shall be consistent with the harmonised operational rules (where necessary).

5.1.6 Related application interfaces

- 5.1.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 1 included within their profile.

Ref	Title of related application
-----	------------------------------

7.1	Inviting-a-user messaging
8.2	Multi-user talker control
8.3	Role management and presence
8.4	Location services
8.5	Authorisation of voice communication
8.7	Authorisation of application
8.8	Prioritisation
5.19	Voice recording and access

Table 1: On-train outgoing voice communication from the driver towards the controller(s) of the train – Related application List

5.1.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
5.1	Bi-directional Voice	50/50	User-to-User/ Multi-user	Low	Low	High	Normal	High

Table 2: On-train outgoing voice communication from the driver towards the controller(s) of the train – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Medium	Medium	Medium
Line	Low	High	High

Table 3: On-train outgoing voice communication from the driver towards the controller(s) of the train – anticipated frequency of use

5.2 On-train incoming voice communication from the controller towards a driver

5.2.1 Description

5.2.1.1 An authorised controller shall be able to set up a voice communication to a driver.

5.2.2 Rationale

5.2.2.1 This application allows an entitled controller to establish voice communication with the driver of a specific train for operational purposes, for example to support the transfer of orders, to advise of delays, reporting of a disturbance, assault or staff security support.

5.2.3 Users

5.2.3.1 Driver(s), controller(s).

5.2.4 Functional attributes

5.2.4.1 The controller shall be able to initiate a voice communication to a single driver.

5.2.4.2 Depending on user input, the system shall automatically address voice communications to the intended recipient

5.2.4.3 Voice communication shall not be disrupted unless required by call arbitration process.

5.2.5 Usability criteria

5.2.5.1 The initiation of a voice communication shall be achieved with the minimum of interaction (for example a single button press or selection from list). Where selection from a list is determined to be the preferred option, then the list shall be accessed with the minimum of interaction and be intuitive.

5.2.5.2 Users shall be presented with meaningful information when receiving incoming voice communication, for example:

- Functional identity of the originator.
- Information relating to the location of the originator.
- A simple description of incoming communication.

5.2.5.3 Users shall be presented with meaningful information when initiating a voice communication and during an ongoing communication, for example :

- Status of the intended recipient.
- Functional identity of the currently connected user/s.
- Information relating to the location of the currently connected user/s.

5.2.5.4 Where a functional identity is provided, it shall be consistent with the harmonised operational rules (where necessary).

5.2.6 Related application interfaces

5.2.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 4 included within their profile.

Ref	Title of related application
7.1	Inviting-a-user messaging
8.3	Role management and presence
8.4	Location services
8.5	Authorisation of voice communication
8.7	Authorisation of application
8.8	Prioritisation
5.19	Voice recording and access

Table 4: On-train incoming voice communication from the controller towards a driver – related application list

5.2.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
5.2	Bi-directional Voice	50/50	User-to-User/	Low	Low	High	Normal	High

Table 5: On-train incoming voice communication from the controller towards a driver – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Medium	High
Yard	Medium	Medium	Medium
Line	Low	Medium	High

Table 6: On-train incoming voice communication from the controller towards a driver – anticipated frequency of use

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

5.3.1 Description

5.3.1.1 The driver shall be able to set up a voice communication with entitled ground user(s) and/or other drivers. A ground user shall be able to set up a voice communication with drivers and other entitled ground user(s). The selection could be based on the location of the train, on the track configuration, etc. using a functional identity. The voice communication can be bi-directional or uni-directional.

5.3.2 Rationale

5.3.2.1 In some operational situations, a controller has to provide vocal information to all the drivers located on the same track/line(s), on a same portion of a track/line or in a predefined area of the railway network, for example to provide confirmation that an emergency situation is closed and that trains are authorised to restart. In some cases it is needed that the communication is bi-directional and in some cases is it uni-directional (broadcast).

5.3.3 Users

5.3.3.1 Driver(s), controller(s), trackside staff, railway staff.

5.3.4 Functional attributes

- 5.3.4.1 A driver or a ground user shall be able to initiate multi-user voice communication, either bi-directional or uni-directional, that will be automatically connected to all drivers within an automatically configured area, which is based upon the originator's location and other operational characteristics for example complexity of route and maximum permissible line speed.
- 5.3.4.2 Selected trains/ground users entering an area where this type of communications has already been established shall automatically join the voice communication.
- 5.3.4.3 Selected trains/ground users exiting an area where this type of communications has already been established shall be provided with the opportunity to remain connected to the voice communication.
- 5.3.4.4 If the option to remain connected is not acknowledged, then the user shall automatically leave the multi-user voice communication after a predefined period of time.
- 5.3.4.5 Communication shall not be disrupted unless required by call arbitration process.

5.3.5 Usability attributes

- 5.3.5.1 The initiation of a multi-user voice communication shall be achieved with the minimum of interaction (for example a single button press or selection from list).
- 5.3.5.2 Where selection from a list is determined to be the preferred option, then the list shall be accessed with the minimum of interaction and be intuitive. Users shall be presented with meaningful information when receiving incoming multi-user voice communication for example:
 - Functional identity.
 - Information relating to the location of the originator.
 - A simple description of incoming communication.
- 5.3.5.3 Users shall be presented with meaningful information when initiating a voice communication and during an ongoing communication, for example :
 - Status of the intended recipient.
 - Functional identity of the currently connected user/s.
 - Information relating to the location of the currently connected user/s.
- 5.3.5.4 Where a functional identity is provided, it shall be consistent with the harmonised operational rules (where necessary).

5.3.6 Related application interfaces

- 5.3.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 7.

Ref	Title of related application
7.1	Inviting-a-user messaging
8.2	Multi-user talker control
8.3	Role management and presence
8.4	Location services
8.5	Authorisation of voice communication
8.7	Authorisation of application
8.8	Prioritisation
5.19	Voice recording and access

Table 7: Multi-Train voice communication for drivers including ground user(s) – related application list

5.3.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
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5.3	Bi-directional Voice	50/50	Multi-user	Low	Low	High	Normal	High
	Uni-directional Voice	0/100	Multi-user	Low	Low	High	Normal	High

Table 8: Multi-train voice communication for drivers including ground user(s) – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 9: Multi-Train voice communication for drivers including ground user(s) – anticipated frequency of use

5.4 Banking voice communication

5.4.1 Description

5.4.1.1 Drivers of different locomotives within the same train shall be able to set up voice communication. During the ongoing voice communication an entitled controller can join the communication without any action of the driver(s). The driver is able to invite an entitled controller to join the communication.

5.4.1.2 Note – the different locomotives within the same train may or may not be coupled mechanically and/or electrically.

5.4.2 Rationale

5.4.2.1 Banking is a commonly used term describing the situation where a locomotive or locomotives are used to assist trains over an uphill section of line incorporating a long or steep 'bank'. The assisting locomotives are commonly known as banking locomotives. At the end of the section where assistance is required, the banking locomotive will drop off without stopping the train and could return to the bottom of the bank to assist the next train.

5.4.2.2 In these situations communication is required between the banking engine driver and the assisted driver and/or controller.

5.4.2.3 This application could also be used for failure situations where a failed train is assisted from the rear.

5.4.3 Users

5.4.3.1 Driver(s), controller(s).

5.4.4 Functional attributes

5.4.4.1 The driver shall be able to initiate voice communication to other driver(s) involved in the banking operation.

5.4.4.2 The system shall automatically route voice communication to the selected driver(s) involved in the banking operation.

5.4.4.3 An entitled controller can join the voice communication without any action of the driver(s).

5.4.4.4 The voice communication could be a user-to-user or multi-user communication.

5.4.5 Usability criteria

5.4.5.1 The initiation of a voice communication shall be achieved with the minimum of interaction (for example a single button press or selection from list).

5.4.5.2 Where selection from a list is determined to be the preferred option, then the list shall be accessed with the minimum of interaction and be intuitive. Users shall be presented with meaningful information when receiving incoming voice communication for example:

- Functional identity.
- Information relating to the location of the originator.
- A simple description of incoming communication.

5.4.5.3 Users shall be presented with meaningful information when initiating a voice communication and during an ongoing communication, for example :

- Status of the intended recipient.
- Functional identity of the currently connected user/s.
- Information relating to the location of the currently connected user/s

- 5.4.5.4 Where a functional identity is provided, it shall be consistent with the harmonised operational rules (where necessary).
- 5.4.5.5 It shall be indicated to the controller that he is about to join an ongoing voice communication .
- 5.4.5.6 A clear indication shall be provided to the driver(s) that a controller has joined the voice communication.

5.4.6 Related application interfaces

- 5.4.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 10 included within their profile.

Ref	Title of related application
8.1	Secured Voice Communications
7.1	Inviting-a-user messaging
8.2	Multi-user talker control
8.3	Role management and presence
8.4	Location services
8.5	Authorisation of voice communication
8.7	Authorisation of application
8.8	Prioritisation
5.19	Voice recording and access

Table 10: Banking voice communication – related application list

5.4.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
5.4	Bi-directional Voice	50/50	User-to-User/Multi-user	Low	Low	High	Normal	Normal

Table 11: Banking voice communication – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 12: Banking voice communication – anticipated frequency of use

5.5 Trackside maintenance voice communication

5.5.1 Description

- 5.5.1.1 A trackside worker or controller shall be able to set up a voice communication with other authorised users. The voice communication can be bi-directional or uni-directional.

5.5.2 Rationale

- 5.5.2.1 Access to mobile communications is considered to be critical within the context of trackside maintenance, as it facilitates the effective creation, management and disposal of a safe systems of work, and can enable efficiencies to be realised. Therefore, it is essential for trackside workers to have access to a secure voice communication system that enables them to communicate with others, including controllers for example to enable a possession of the line to be taken and

subsequently given up once the maintenance activity is complete. In some cases it is needed that the communication is bi-directional and in some cases is it uni-directional (broadcast).

5.5.3 Users

5.5.3.1 Controller(s), trackside staff, railway staff.

5.5.4 Functional attributes

5.5.4.1 A user shall be able to initiate a voice communication to a single authorised user or multiple users, bi-directional or uni-directional. However, in the case of multi user voice communications the risk of miscommunication shall be mitigated.

5.5.4.2 The system shall automatically route voice communications to a predefined authorised user or group of users, except when the initiator has selected a different recipient.

5.5.4.3 The system shall be capable of routing voice communications based upon the location of the initiator, location of the maintenance activity or initiator functional identity.

5.5.5 Usability criteria

5.5.5.1 The initiation of a voice communications shall be achieved with the minimum of interaction (for example a single button press or selection from list). Where selection from a list is determined to be the preferred option, then the list shall be accessed with the minimum of interaction and be intuitive.

5.5.5.2 Users shall be presented with meaningful information when receiving incoming voice communication for example:

- Functional identity.
- Information relating to the location of the originator.
- A simple description of incoming communication.

5.5.5.3 Users shall be presented with meaningful information when initiating a voice communication and during an ongoing communication, for example :

- Status of the intended recipient.
- Functional identity of the currently connected user/s.
- Information relating to the location of the currently connected user/s.

5.5.5.4 Where a functional identity is provided, it shall be consistent with the harmonised operational rules (where necessary).

5.5.5.5 The design of the application shall take into consideration the target environment, and assume that users will be accessing functionality via adapted equipment (for example ruggedized handsets) that may be connected to remote headsets / microphones.

5.5.6 Related application interfaces

5.5.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 13 included within their profile.

Ref	Title of related application
8.1	Secured Voice Communications
7.1	Inviting-a-user messaging
5.18	Working alone
8.2	Multi-user talker control
8.3	Role management and presence
8.4	Location services
8.5	Authorisation of voice communication
8.7	Authorisation of application
8.8	Prioritisation
5.19	Voice recording and access

Table 13: Trackside maintenance voice communication – related application list

5.5.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
5.5	Bi-directional Voice	50/50	User-to-User/Multi-user	Low	Low	High	Normal	Normal
	Uni-directional Voice	0/100	User-to-User/Multi-user	Low	Low	High	Normal	Normal

Table 14: Trackside maintenance voice communication – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Medium	Medium	Medium
Yard	Medium	Medium	Medium
Line	Medium	Medium	Medium

Table 15: Trackside maintenance voice communication – anticipated frequency of use.

5.6 Shunting voice communication

5.6.1 Description

- 5.6.1.1 A shunting user shall be able to set up an uninterrupted voice communication with other shunting users and/or with entitled controller(s). The voice communication could be a user-to-user or multi-user communication. The entitled controller and other shunting users are addressed by the system automatically (for example, based on location, operational situation etc.).

5.6.2 Rationale

- 5.6.2.1 This application allows a shunting user to set up a voice communication with other shunting users and/or with the entitled controller(s) in order to provide information required to perform safe shunting movements of trains.

5.6.3 Users

- 5.6.3.1 Driver(s), controller(s), shunting team member.

5.6.4 Functional attributes

- 5.6.4.1 A shunting user shall be able to initiate a voice communication with other shunting users(s), driver and controller(s). However, in the case of multi-user communications the risk of miscommunication shall be mitigated.
- 5.6.4.2 Depending on user input, the system shall automatically address voice communications to the intended recipient(s).
- 5.6.4.3 The voice communication shall be secured by a mechanism that alerts users as soon as the communication is broken
- 5.6.4.4 Voice communication shall not be disrupted unless required by call arbitration process.

5.6.5 Usability criteria

- 5.6.5.1 The initiation of a voice communication shall be achieved with the minimum of interaction (for example, a single button press or selection from list). Where selection from a list is determined to be the preferred option, then the list shall be accessed with the minimum of interaction and be intuitive.
- 5.6.5.2 Users shall be presented with meaningful information when receiving voice communication, for example:
- Functional identity.
 - Information relating to the location of the originator.
 - A simple description of incoming communication.
- 5.6.5.3 Users shall be presented with meaningful information when initiating a voice communication and during an ongoing communication, for example :
- Status of the intended recipient.
 - Functional identity of the currently connected user/s.
 - Information relating to the location of the currently connected user/s.

- 5.6.5.4 Where a functional identity is provided, it shall be consistent with the harmonised operational rules (where necessary).
- 5.6.5.5 The user interface shall be adaptable to the work environment of trackside users (helmet with microphone, voice interaction).

5.6.6 Related application interfaces

- 5.6.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 16 included within their profile.

Ref	Title of related application
8.1	Secured voice communication
7.1	Inviting-a-user messaging
5.18	Working alone
8.2	Multi-user talker control
8.3	Role management and presence
8.4	Location services
8.5	Authorisation of voice communication
8.7	Authorisation of application
8.8	Prioritisation
5.19	Voice recording and access

Table 16: Shunting voice communication – related application list

5.6.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
5.6	Bi-directional Voice	50/50	User-to-User/Multi-user	Low	Low	High	Immediate	Low

Table 17: Shunting voice communication – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Medium	Medium	Medium
Yard	Medium	Medium	Medium
Line	Low	Low	Low

Table 18: Shunting voice communication – anticipated frequency of use

5.7 Public emergency call

5.7.1 Description

- 5.7.1.1 A user is able to make a public emergency call.

5.7.2 Rationale

- 5.7.2.1 This application allows any user to establish public emergency communication. In countries part of the EU a single European emergency call number, according to Council Decision (91/396/EEC), shall be used.

5.7.3 Users

- 5.7.3.1 Any authorised user excluding public, public emergency operator.

5.7.4 Functional attributes

- 5.7.4.1 A fast call set up time shall be guaranteed
- 5.7.4.2 Voice communication shall not be disrupted unless required by call arbitration process
- 5.7.4.3 Any returned call from an emergency operator or other user from the public shall avoid as far as possible any mis-routing of the communication.

5.7.5 Usability criteria

- 5.7.5.1 Upon voice communication initiation, the functional identity shall be displayed to the public emergency operator. (Although currently functional identity implemented for railways is not supported by public networks, this can be an aspiration for the future.
- 5.7.5.2 There shall be a clear distinction on the HMI display between this function and the railway emergency communication function.
- 5.7.5.3 Information relating to the location of the user shall be presented to the public emergency operator.

5.7.6 Related application interfaces

- 5.7.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 19 included within their profile.

Ref	Title of related application
8.4	Location services
8.8	Prioritisation
5.19	Voice recording and access

Table 19: Public emergency call - related applications list

5.7.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
5.7	Bi-directional Voice	50/50	User-to-User	Low	Low	High	Normal	High

Table 20: Public emergency call - communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 21: Public emergency call – anticipated frequency of use

5.8 Ground to ground voice communication

5.8.1 Description

- 5.8.1.1 A ground user shall be able to set up voice communication to another ground user.

5.8.2 Rationale

- 5.8.2.1 Voice communication is needed as it is not mentioned in other application in this URS, like:
 - Controller to controller
 - Controller to ground user, and vice versa.

5.8.3 Users

- 5.8.3.1 Any authorised user excluding public.

5.8.4 Functional attributes

- 5.8.4.1 The authorised user shall be able to initiate a voice communication to another entitled user.
- 5.8.4.2 Depending on user input, the system shall automatically address voice communications to the intended recipient
- 5.8.4.3 Voice communication shall not be disrupted unless required by call arbitration process.

5.8.5 Usability criteria

- 5.8.5.1 The initiation of a voice communication shall be achieved with the minimum of interaction (for example a single button press or selection from list). Where selection

from a list is determined to be the preferred option, then the list shall be accessed with the minimum of interaction and be intuitive.

5.8.5.2 Users shall be presented with meaningful information when receiving incoming voice communication, for example:

- Functional identity.
- Information relating to the location of the originator.
- A simple description of incoming communication.

5.8.5.3 Users shall be presented with meaningful information when initiating a voice communication and during an ongoing communication, for example :

- Status of the intended recipient.
- Functional identity of the currently connected user/s.
- Information relating to the location of the currently connected user/s.

5.8.5.4 Where a functional identity is provided, it shall be consistent with the harmonised operational rules (where necessary).

5.8.6 Related application interfaces

5.8.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 22 included within their profile.

Ref	Title of related application
7.1	Inviting a user messaging
8.3	Role management and presence
8.4	Location services
8.5	Authorisation of voice communication
8.7	Authorisation of application
8.8	Prioritisation
5.19	Voice recording and access

Table 22: Ground to ground voice communication – related application list

5.8.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
5.8	Bi-directional voice	50/50	User-to-user	Low	Low	Normal	Normal	Low

Table 23: Ground to ground voice communications – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Medium	High
Yard	Low	Medium	High
Line	Low	Medium	High

Table 24: Ground to ground voice communications - anticipated frequency of use

5.9 Automatic train control communication

5.9.1 Description

5.9.1.1 The provision of a reliable communication bearer to support the implementation of radio based ATC systems. The ATC system shall have a reliable communication bearer in order to ensure efficient data transfer between the on-board system and the ground system. (for example ETCS L2/L3). This application provides the communication bearer for this data,

5.9.2 Rationale

- 5.9.2.1 Some ATC systems require radio communication to interchange safety relevant data with the corresponding control center.
- 5.9.2.2 It is currently envisaged that some ATC systems may be used to supervise Automatic Train Operation (ATO) train movements, and as such the data required to support ATO may form an additional part of the ATC data. If this is the case, the information provided in section 5.10 shall be considered for Automatic Train Control communication as well.

5.9.3 Users

- 5.9.3.1 ATC on-board system, ground system.

5.9.4 Functional attributes

- 5.9.4.1 The ATC system shall be able to initiate and terminate the data communication with the appropriate ground system.
- 5.9.4.2 The FRMCS system shall automatically route the data communication to the appropriate ground system.
- 5.9.4.3 Automatic Train Control is a safety-critical application. Any risk associated with a failure or inability of the system to provide communications when required by the ATC system shall be mitigated by the ATC system.
- 5.9.4.4 The FRMCS system shall provide a standardised interface to allow the ATC system to use the communication service offered by this application.

5.9.5 Usability criteria

- 5.9.5.1 The communication initiation and termination shall not require any human user to trigger the application. This is expected to be achieved by the use of a standardised interface.
- 5.9.5.2 The application shall also provide the ATC system with meaningful information on the status of the communication bearer and shall support the exchange of maintenance data for the ATC system (e.g. logs, updates).

5.9.6 Related application interfaces

- 5.9.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 25 included within their profile.

Ref	Title of related application
5.10	Automatic Train Operation Communication
6.13	Real time video
8.6	Authorisation of data communication
8.7	Authorisation of application
8.8	Prioritisation
5.20	Data recording and access
6.20	Transfer of data
8.9	Key management communication

Table 25: Automatic train control communication – related application interfaces

5.9.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
5.9	Bi-directional Data	50/50	User-to-User	Normal	Low	High	Immediate	High

Table 26: Automatic train control communication – communication attributes

Type of area	Normal <small>(volume)</small>	Degraded <small>(volume)</small>	Emergency <small>(volume)</small>
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Station	High	High	High
Yard	High	High	High
Line	High	High	High

Table 27: Automatic train control communication – anticipated frequency of use

5.10 Automatic train operation communication

5.10.1 Description

5.10.1.1 The ATO system shall have a reliable communication bearer in order to ensure efficient data transfer between the on-board unit and the ground system. This application provides the communication bearer for this data.

5.10.2 Rationale

5.10.2.1 Automatic Train Operation (ATO) provides the capability to enhance the operation of a train service.

5.10.2.2 The automatic train control systems will be used in some cases to supervise ATO train movements.

5.10.3 Users

5.10.3.1 ATO on-board system, ground system.

5.10.4 Functional attributes

5.10.4.1 The ATO - system shall be able to initiate and terminate the data communication with the appropriate ground system.

5.10.4.2 The FRMCS system shall automatically route data communication to the appropriate ground system.

5.10.4.3 The FRMCS system shall provide a standardised interface to allow the ATO system to use the communication service offered by this application.

5.10.5 Usability criteria

5.10.5.1 The initiation and termination of data communication shall not require any human user action. This is expected to be achieved by the use of a standardised interface. The application shall also provide the ATO system with meaningful information on the status of the communication bearer and shall support the exchange of maintenance data for the ATO system (e.g. logs, updates).

5.10.6 Related application interfaces

5.10.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 28 included within their profile.

Ref	Title of related application
5.9	Automatic Train Control Communication
6.13	Real time video
8.6	Authorisation of data communication
8.7	Authorisation of application
8.8	Prioritisation
5.20	Data recording and access
6.20	Transfer of data

Table 28: Automatic train operation communication - related application list

5.10.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
5.10	Bi-directional Data	50/50	User-to-User	Normal	Low	High	Immediate	High

Table 29: Automatic train operation communication – communications attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	High	High	High
Yard	High	High	High
Line	High	High	High

Table 30: Automatic train operation communication – anticipated frequency of use

5.11 Data communication for Possession management

5.11.1 Description

5.11.1.1 The application shall support the processes involved in taking possession of an area of railway infrastructure for engineering purposes (for example for track maintenance).

5.11.2 Rationale

5.11.2.1 This application is intended to allow track side workers to remotely take control of infrastructure elements in order to perform safe engineering works on those elements. The application provides the communication bearer in a safe and secure way.

5.11.3 Users

5.11.3.1 Controller(s), trackside maintenance personnel, ground system.

5.11.4 Functional attributes

5.11.4.1 No specific railway functional attributes identified.

5.11.5 Usability criteria

5.11.5.1 Presentation of accurate location information

5.11.6 Related application interfaces

5.11.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 31 included within their profile.

Ref	Title of related application
5.18	Working alone
8.3	Role management and presence
8.4	Location services
8.6	Authorisation of data communications
8.7	Authorisation of application
8.8	Prioritisation
5.20	Data recording and access
6.20	Transfer of data

Table 31: Data communication for Possession management – related application list

5.11.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
5.11	Bi-directional Data	50/50	User-to-User	Normal	Low	High	Normal	Low

Table 32: Data communication for Possession Management – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 33: Data communication for Possession management – anticipated frequency of use.

5.12 Trackside maintenance warning system communication

5.12.1 Description

5.12.1.1 The trackside maintenance warning system shall be able to initiate data communication to trackside maintenance workers in the appropriate area.

5.12.2 Rationale

5.12.2.1 The trackside maintenance warning system shall be able to warn trackside maintenance workers of any approaching trains via an automatic alarm.

5.12.3 Users

5.12.3.1 Trackside maintenance personnel, trackside warning system.

5.12.4 Functional attributes

5.12.4.1 The trackside maintenance warning system shall be able to initiate a data communication to a single or multiple trackside maintenance workers on appropriate area.

5.12.4.2 The system shall automatically route data communication to the intended user(s).

5.12.4.3 Potential risk of system disfunction or misuse shall be compensated by technical implementation (for example e.g. if first communication fails, the system automatically retries).

5.12.5 Usability criteria

5.12.5.1 The beginning and end of the approaching train alarm shall be obvious for the trackside maintenance workers.

5.12.5.2 Trackside maintenance workers shall be able to easily determine if the communications link with the trackside maintenance warning system becomes inactive.

5.12.5.3 The initiation of data communication shall not require any human user action.

5.12.6 Related application interfaces

5.12.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 34 included within their profile.

Ref	Title of related application
6.13	Real time video
8.3	Role management and presence
8.4	Location services
8.6	Authorisation of data communication
8.7	Authorisation of application
8.8	Prioritisation
5.20	Data recording and access
6.20	Transfer of data

Table 34: Trackside maintenance warning system communication – related application list

5.12.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
5.12	Bi-directional Data	20/80	User-to-User/Multi-user	Low	Low	High	Immediate	Normal

Table 35: Trackside maintenance warning system communication – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	High	High	High
Yard	High	High	High

Line	High	High	High
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Table 36: Trackside maintenance warning system communication – anticipated frequency of use.

5.13 Remote control of engines

5.13.1 Description

- 5.13.1.1 It shall be possible to set up data communication between an engine and a ground based system in order to control the engine. The remote driver can operate the engine via the ground system.

5.13.2 Rationale

- 5.13.2.1 This application enables and allows remote controlled movement of trains typically for shunting operation in depots, shunting yards and/or for banking.

5.13.3 Users

- 5.13.3.1 Driver(s), on-board system, ground system.

5.13.4 Functional attributes

- 5.13.4.1 It shall be possible for a maintainer to prohibit remote control to facilitate the safe execution of maintenance procedures.
- 5.13.4.2 The system shall supervise the extent and speed of the movement.
- 5.13.4.3 The system shall facilitate the formation of trains, whilst mitigating the risks associated with derailment and collision.
- 5.13.4.4 It shall be possible for a remote driver to awaken an on-board system.
- 5.13.4.5 The on-board system shall provide regular updates for example position reports.
- 5.13.4.6 The system shall include mechanism that ensures accurate call routing.
- 5.13.4.7 The system shall enable an engine being controlled remotely to be stopped in an emergency.
- 5.13.4.8 Any loss of communications during remote control shall result in the effected engine being brought to a stand, and the movement will not restart until the communication session is re-established and authorised by the controller.

5.13.5 Usability criteria

- 5.13.5.1 A remote driver shall be made aware of the presence of an open desk or active maintainer override control if they attempt to remotely control the effected engine.
- 5.13.5.2 A maintainer shall be able to override the remote control feature with the minimum of interaction (for example single button press).
- 5.13.5.3 A remote driver shall be limited to the number of engines that can be under their control at any one time (for example no more than one moving at any one time).
- 5.13.5.4 A remote driver shall be able to select an engine to be controlled remotely with the minimum of interaction (for example selection from a list, asset number).
- 5.13.5.5 A remote driver shall be provided with accurate information about the engines under remote control (for example location, speed, direction of travel etc...).
- 5.13.5.6 Interruptions in communication sessions shall be indicated to the remote driver and associated with an audible alarm/tone.
- 5.13.5.7 In an emergency a remote driver shall be able to stop an engine, or all engines under their control with the minimum of interaction (for example a single button press).
- 5.13.5.8 Activation of the emergency control shall be communicated to all affected parties (for example shunters).

5.13.6 Related application interfaces

- 5.13.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 37 included within their profile.

Ref	Title of related application
8.3	Role management and presence
8.4	Location services

8.6	Authorisation of data communication
8.7	Authorisation of application
8.8	Prioritisation
5.20	Data recording and access
6.20	Transfer of data

Table 37: Remote control of engines – related application list

5.13.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
5.13	Bi-directional Data	50/50	User-to-User	Low	Low	High	Normal	Normal

Table 38: Remote control of engines – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	High	High	High
Yard	High	High	High
Line	High	High	High

Table 39: Remote control of engines – anticipated frequency of use

5.14 Monitoring and control of critical infrastructure

5.14.1 Description

5.14.1.1 It shall be possible to set up data communication between infrastructure systems and a ground based or train based system in order to monitor or control critical infrastructure such as train detection, signals and indicators, movable infrastructure, level crossing elements, including barrier controls vehicle sensors, lighting controls and alarms.

5.14.2 Rationale

5.14.2.1 Using wireless communication to monitor and control critical infrastructure systems reduces the need for a hardwired communications links with an associated reduction in initial installation costs and a potential reduction in faults and failures and train delays caused by cable damage or theft.

5.14.2.2 Additionally there is the potential to reduce the time required to respond to and rectify faults and failures due to wireless equipment being at discrete locations rather than being spread over long distances.

5.14.3 Users

5.14.3.1 Trackside system, ground system.

5.14.4 Functional attributes

5.14.4.1 No specific railway functional attributes identified.

5.14.5 Usability criteria

5.14.5.1 Any functionality used to control unintended intervention of the system shall be readily displayed and shall alert users of the system

5.14.5.2 The user shall be able to determine if the communications link becomes inactive.

5.14.6 Related application interfaces

5.14.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 40 included within their profile.

Ref	Title of related application
8.3	Role management and presence
8.4	Location services

8.6	Authorisation of data communication
8.7	Authorisation of application
8.8	Prioritisation
5.20	Data recording and access
6.20	Transfer of data

Table 40: Monitoring and control of critical infrastructure – related applications list

5.14.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
5.14	Bi-directional Data	50/50	User-to-User	Normal	Low	High	Normal	Low

Table 41: Monitoring and control of critical infrastructure – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	High	High	High
Yard	High	High	High
Line	High	High	High

Table 42: Monitoring and control of critical infrastructure – anticipated frequency of use

5.15 Railway emergency communication

5.15.1 Description

5.15.1.1 An authorised user shall be able to set up an emergency communication to other users within an automatically configured area or group, which is based upon the originator's location or characteristics and those users likely to be affected by the emergency

5.15.2 Rationale

5.15.2.1 If an authorised user becomes aware of a hazard that presents a risk to a moving train, it is critical for the user to be able to communicate the related details to those most likely to be affected or required to take avoiding action. Avoiding actions could include, for example, controllers required to revoke movement authorities or drivers required to slow or stop their train.

5.15.2.2 This application introduces the notion of intelligent infrastructure / trains, as it requires the system to automatically limit the operational impact of an emergency communication to only those likely to be affected by the emergency by automatically configuring areas or groups.

5.15.2.3 The emergency communication shall be optimised to provide an effective means of communication, and consider the use of both voice and data.

5.15.3 Users

5.15.3.1 Driver(s), controller(s) and other authorised users.

5.15.4 Functional attributes

5.15.4.1 An authorised user shall be able to initiate a railway emergency communication, either via voice or data or a combination of voice and data.

5.15.4.2 The system shall be intelligent and able to identify users that are most likely to be affected by the emergency situation, by taking into consideration the location or characteristics of the originator in relation to other users and the probability of them being exposed to risk as a consequence of the related incident. (for example if a user is within the same geographical area as the originator, but the distance between them is increasing due to direction of travel, then this user is unlikely to be affected and therefore does not need to be connected to the emergency communication).

5.15.4.3 The system shall not connect unaffected users to the emergency voice communication.

5.15.4.4 Users identified as likely to be affected shall be automatically connected to the emergency communication, including those entering the affected area or group.

5.15.4.5 If a user leaves the affected area or group, then the system shall provide the user with the option to remain connected to the emergency communication.

- 5.15.4.6 If the option to remain connected is not acknowledged within a predefined time, then the system shall automatically disconnect the emergency communication.
- 5.15.4.7 The system shall allow a user to leave or re-join the emergency communication at any time, providing they remain within the affected area or group.
- 5.15.4.8 The operational rules shall define the circumstances under which the user can leave and/or re-join an established emergency communication.
- 5.15.4.9 An authorised user shall be able to terminate a railway emergency communication, either via voice or data or a combination of voice and data.
- 5.15.4.10 In the case of several communications of the same type overlapping, the system shall be able to merge communications or keep the communication sessions separated. For example, a user sets up a new emergency communication whilst in an ongoing emergency communication, both emergency communications can be merged.
- 5.15.4.11 If a user is addressed with emergency communication any ongoing voice communication is pre-empted.
- 5.15.4.12 The controller shall be able to add or remove a user from an emergency communication.

5.15.5 Usability attributes

- 5.15.5.1 The initiation of an emergency communication shall be achieved with the minimum of interaction (for example a single button press).
- 5.15.5.2 The risk of accidental use shall be mitigated without introducing unacceptable delays with regard to call set up times, or potential mechanisms that could create hazards on users actions in stress conditions.
- 5.15.5.3 A user shall be able to identify an incoming emergency communication, as the annunciation shall distinguish it from other tones and alerts within the target environment.
- 5.15.5.4 Users shall be presented with meaningful information when receiving incoming emergency communication, for example:
 - Functional identity of the originator.
 - Information relating to the location of the originator.
 - A simple description of type of incoming communication.
- 5.15.5.5 Where a functional identity is provided, it shall be consistent with the operational rules (where necessary).
- 5.15.5.6 The termination of an emergency communication shall be indicated to the user and shall be intuitive.

5.15.6 Related application interfaces

- 5.15.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 43 included within their profile.

Ref	Title of related application
8.3	Role management and presence
8.4	Location services
8.5	Authorisation of voice communication
8.6	Authorisation of data communication
8.7	Authorisation of application
8.8	Prioritisation
5.19	Voice recording and access
5.20	Data recording and access
6.20	Transfer of data

Table 43: Railway emergency communication – related application list

5.15.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
5.15	Bi-directional Voice	50/50	User-to-User/Multi-user	Low	Low	High	Immediate	High
	Bi-directional data	50/50	User-to-User/Multi-user	Low	Low	High	Immediate	High

Table 44: Railway emergency communication – communication attributes

Bi directional Voice

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Bi directional Data

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 45: Railway emergency communication – anticipated frequency of use

5.16 On-train safety device to ground communication

5.16.1 Description

5.16.1.1 Based on a critical situation in the train (for example, triggered by a Driver Safety Device (DSD)), a voice and/or data communication is automatically set up towards a ground user (controller or ground system).

5.16.2 Rationale

5.16.2.1 The controller needs to be alerted and to receive relevant information about the situation. The controller needs this information to initiate relevant action to mitigate the critical situation.

5.16.2.2 Further, this application allows the ground system to capture relevant data of an emergency situation on a train which can be used for post incident analyses.

5.16.3 Users

5.16.3.1 Controllers(s), on-board system, ground system.

5.16.4 Functional attributes

5.16.4.1 The system shall automatically route the voice communication to the intended recipient.

5.16.4.2 The system shall automatically route the data communication to the appropriate ground system.

5.16.4.3 Potential risk of system dysfunction shall be compensated by technical implementation (for example, with an e.g. if first communication fails, the system automatically retries).

5.16.5 Usability criteria

5.16.5.1 The communication initiation shall not require any human user trigger.

5.16.5.2 Users shall be presented with meaningful information when receiving incoming voice communication for example:

- Functional identity.
- Information relating to the location of the originator.
- A simple description of incoming communication.

5.16.5.3 Where a functional identity is provided, it shall be consistent with the harmonised operational rules (where necessary).

5.16.5.4 Beginning and end of an emergency situation shall be clearly indicated to the involved users.

5.16.6 Related application interfaces

5.16.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 46 included within their profile.

Ref	Title of related application
5.1	On train outgoing voice communications from the driver towards the controller of the train
8.3	Role management and presence
8.4	Location services
8.6	Authorisation of data communication
8.7	Authorisation of application
8.8	Prioritisation
5.20	Data recording and access
6.20	Transfer of data

Table 46: On-train safety device to ground communication - related application list

5.16.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
5.16	Bi-directional Voice	50/50	User-to-user	Low	Low	High	Immediate	High
	Bi-directional data	80/20	User-to-user	Low	Low	High	Immediate	High

Table 47: On-train safety device to ground communication – communication attributes

Bi directional Voice

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Bi directional Data

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 48: On-train safety device to ground communication – anticipated frequency of use

5.17 Platform/train interface alert

5.17.1 Description

5.17.1.1 This application allows any entitled user involved in train operations to alert, via a voice and/or data communication, the drivers of the concerned trains of a safety related incident in the vicinity of the platform environment, for example, a person falling from a platform or slipping between train and platform.

5.17.1.2 The controller of the affected track/line(s) shall also be made aware of the alert and shall be able to have voice communication with the alert initiator.

5.17.2 Rationale

5.17.2.1 A user involved in train arrival/departure operations, either train or ground staff, train, when noticing an incident in the vicinity of the platform environment, needs to have

access to a communication system that is able to alert the driver of a potential danger or risk to life.

5.17.3 Users

5.17.3.1 Driver(s), controller(s), authorised users responsible for monitoring the platform/train interface.

5.17.4 Functional attributes

5.17.4.1 The user responsible for monitoring the platform/train interface shall be able to initiate communication to the driver and/or controller(s).

5.17.4.2 When required, the system shall automatically route voice communication to the intended recipients.

5.17.5 Usability criteria

5.17.5.1 The initial alert mechanism shall be protected from accidental use.

5.17.5.2 When required, the initiation of voice communication shall be achieved with the minimum of interaction for example a single button press or a selection from list.

5.17.5.3 Where selection from a list is determined to be the preferred option, then the list shall be accessed with the minimum of interaction and be intuitive.

5.17.5.4 Users shall be presented with meaningful information when receiving incoming voice communication, for example:

- Functional identity.
- Information relating to the location of the originator.
- A simple description of incoming communication.

5.17.5.5 Where a functional identity is provided, it shall be consistent with the harmonised operational rules (where necessary).

5.17.6 Related application interfaces

5.17.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 49 included within their profile.

Ref	Title of related application
6.2	On-train incoming voice communication from a ground user towards train staff
5.8	Ground to ground voice communication
6.18	Train departure related communications
8.3	Role management and presence
8.4	Location services
8.6	Authorisation of data communication
8.7	Authorisation of application
8.8	Prioritisation
5.20	Data recording and access
6.20	Transfer of data

Table 49: Platform train interface alert – related application interfaces

5.17.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
5.17	Bi-directional Voice	50/50	User-to-User	Low	Low	High	Immediate	Normal

	Bi-directional data	50/50	User-to-User	Low	Low	High	Immediate	Normal
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Table 50: Platform train interface alert – communication attributes

Bi directional Voice

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Bi directional Data

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 51: Platform train interface alert – anticipated frequency of use

5.18 Working alone

5.18.1 Description

- 5.18.1.1 The system shall be able to monitor the status (location, movements, health, etc.) of a user working alone. Once the application is active, the system can trigger voice and/or data communication based on its status.

5.18.2 Rationale

- 5.18.2.1 The rail industry is a hazardous environment, particularly for those who regularly work alone and exposed to potential hazards for example moving trains. This application is intended to provide a mechanism for such users to be monitored remotely, so it is possible to identify their last reported location and, if contact is lost or cannot be established for any reason, to direct resources to that location. The application would also permit voice communication or data communication to be initiated to a user working alone based on their reported location. It is also needed to have the ability to communicate to the user working alone by another user based on the his/her status.

5.18.3 Users

- 5.18.3.1 Any user whose functional role requires them to regularly work alone, for example trackside staff, or to monitor trackside staff, for example controller(s).

5.18.4 Functional attributes

- 5.18.4.1 Activation of the application shall be automatic based upon definable criteria which could include functional identity and proximity of the user working alone to the railway.
- 5.18.4.2 It shall be possible for the user working alone to manually activate the application.
- 5.18.4.3 It shall be possible for the application to be activated remotely by an authorised user.
- 5.18.4.4 An authorised user shall be able to request the last known status of a user working alone.
- 5.18.4.5 When activated, the user working alone status shall be automatically reported at predefined intervals.
- 5.18.4.6 The triggering of the man-down alarm shall be configurable, according to the specific conditions of the work.
- 5.18.4.7 It shall be possible for an authorised user to use the last reported location to initiate a voice or data communication to the user working alone.

5.18.5 Usability criteria

- 5.18.5.1 The user working alone shall be able to activate/deactivate the application with the minimum of interaction with the HMI.
- 5.18.5.2 Changes in status of the application shall be displayed to the user working alone and any users responsible for monitoring the lone worker status.
- 5.18.5.3 Location information shall use coordinates that will facilitate the simple and accurate identification of the user working alone's location.
- 5.18.5.4 The monitoring user shall be able to quickly and easily disseminate location information to resources that are to be directed to that location.

5.18.6 Related application interfaces

5.18.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 52 included within their profile.

Ref	Title of related application
8.3	Role management and presence
8.4	Location services
8.5	Authorisation of voice communications
8.6	Authorisation of data communication
8.7	Authorisation of application
8.8	Prioritisation
5.19	Voice recording and access
5.20	Data recording and access
6.20	Transfer of data

Table 52: Working alone – related application list

5.18.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
5.18	Bi-directional Voice	50/50	User-to-user	Low	Low	High	Immediate	Low
	Bi-directional data	50/50	User-to-User	Low	Low	High	Immediate	Low

Table 53: Working alone – communication attributes

Bi directional Voice

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Bi directional Data

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 54: Working alone – anticipated frequency of use.

5.19 Voice recording and access

5.19.1 Description

5.19.1.1 It shall be possible to enable the recording of, and access to, communication content and the communication related data in order to support analysis.

5.19.2 Rationale

5.19.2.1 This application enables and allows recording of different types of voice communication for post-incident/accident analysis, training, operational improvement, staff supervision or any other purpose. Typically, all the voice communications related to the movement of the train shall be recorded.

5.19.3 Users

5.19.3.1 Any authorised user excluding public.

5.19.4 Functional attributes

- 5.19.4.1 Only the entitled users shall be able to access recorded communication.
- 5.19.4.2 Users shall only be able to access relevant information according to their entitlements.
- 5.19.4.3 It shall be possible to record all type of voice communications on the devices involved in the communication and/or in a centralized system.
- 5.19.4.4 All the railway operational data (for example train identity, engine identity, functional identity, location data etc.) shall be stored and linked to the recorded communication.
- 5.19.4.5 Sufficient storage retention of recorded voice communications shall be in place that allows the user access over a period of time deemed acceptable to the Infrastructure Manager and Railway Undertaking according to national legislation.

5.19.5 Usability criteria

- 5.19.5.1 Simple HMI interaction: possible to search efficiently among the thousands of records using different search criteria, for example location, phone number, functional identity, group identity, type of communication.
- 5.19.5.2 The appropriate (railway-oriented) metadata shall be associated to the call content in order to ease the search for users and in order to give a complete picture of the communication context

5.19.6 Related application interfaces

- 5.19.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 61 included within their profile.

Ref	Title of related application
8.7	Authorisation of application
6.20	Transfer of data

Table 55: Voice recording and access - related application list

5.19.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
5.19	Uni-directional Data	N/A	N/A	N/A	N/A	Normal	N/A	Low

Table 56: Voice recording and access – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 57: Voice recording and access – anticipated frequency of use

5.20 Data recording and access

5.20.1 Description

- 5.20.1.1 It shall be possible to enable the recording of, and access to, communication content and the communication related data in order to support analysis.

5.20.2 Rationale

- 5.20.2.1 This application enables and allows recording of data communication for post-incident/accident analysis, training, operational improvement, staff supervision or any other purpose. Typically, all the data communications related to the movement of the train shall be recorded.

5.20.3 Users

- 5.20.3.1 Any authorised user excluding public.

5.20.4 Functional attributes

- 5.20.4.1 Only entitled users shall be able to access recorded communication.
- 5.20.4.2 Data communications where practicable shall be recorded on the devices involved in the communication and/or in a centralized system.
- 5.20.4.3 All railway operational data (for example train identity, engine identity, functional identities, location data etc.) shall be stored and linked to the recorded communication.
- 5.20.4.4 Sufficient storage retention of recorded data communications shall be in place that allows the user access over a period of time deemed acceptable to the Infrastructure Manager and Railway Undertaking according to national legislation.

5.20.5 Usability criteria

- 5.20.5.1 National protocols and legislation shall be taken into account when defining the types of data communications that are required to be recorded.
- 5.20.5.2 It shall be possible to perform a direct search for specific categories of data with in a multi layered data storage system. (for example Location, functional identity, group identity, type of communication)

5.20.6 Related application interfaces

- 5.20.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 58 included within their profile.

Ref	Title of related application
8.7	Authorisation of application
6.20	Transfer of data

Table 58: Data recording and access – related application list

5.20.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
5.20	Uni-directional Data	N/A	N/A	N/A	N/A	Normal	N/A	Low

Table 59: Data recording and access – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 60: Data recording and access – anticipated frequency of use

5.21 Shunting data communication

5.21.1 Description

- 5.21.1.1 A shunting user (e.g. the shunting leader) shall be able to set up an uninterrupted data communication with other shunting users (e.g. the driver) and/or with entitled controller(s)/traffic control system. The purpose of this data communication is issuing request/commands and confirmations related to shunting operation. The entitled controller and other shunting users are addressed by the system automatically (for example, based on location, operational situation etc.).

5.21.2 Rationale

- 5.21.2.1 This application allows a shunting user to set up a data communication with other shunting users and/or with the entitled controller(s), in order to provide information required to perform safe shunting movements of trains, (e.g.issuing route requests, route confirmation, giving driving commands, confirmation for driving commands, etc.) without the need for voice communication and therefore reduce the amount of voice traffic towards shunting users and controllers.

5.21.3 Users

5.21.3.1 Driver(s), controller(s), shunting team member, ground system.

5.21.4 Functional attributes

5.21.4.1 A shunting user shall be able to initiate a data communication with other shunting users(s), driver and controller(s).

5.21.4.2 The data communication shall be secured by a mechanism that alerts users as soon as the communication is broken

5.21.4.3 For all data messages sent, a confirmation shall be returned to the sender upon successful reception of the message.

5.21.4.4 Data communication shall not be disrupted unless required by call arbitration process.

5.21.5 Usability criteria

5.21.5.1 The initiation of a data communication shall be achieved with the minimum of interaction (for example, a single button press or selection from list). Where selection from a list is determined to be the preferred option, then the list shall be accessed with the minimum of interaction and be intuitive.

5.21.5.2 Users shall be presented with meaningful information when receiving data communication, for example:

- Functional identity.
- Information relating to the location of the originator.
- A simple description of incoming communication.

5.21.5.3 Users shall be presented with meaningful information when initiating a data communication and during an ongoing communication, for example :

- Status of the intended recipient.
- Functional identity of the currently connected user/s.
- Information relating to the location of the currently connected user/s.

5.21.5.4 Where a functional identity is provided, it shall be consistent with the harmonised operational rules (where necessary).

5.21.5.5 The user interface shall be adaptable to the work environment of trackside users (helmet with microphone, voice interaction).

5.21.6 Related application interfaces

5.21.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 61 included within their profile.

Ref	Title of related application
5.18	Working alone
8.3	Role management and presence
8.4	Location services
8.6	Authorisation of data communication
8.7	Authorisation of application
8.8	Prioritisation
5.20	Data recording and access

Table 61: Shunting data communication – related application list

5.21.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
5.21	Bi-directional Data	50/50	User-to-User/Multi-user	Low	Low	High	Normal	Low

Table 62: Shunting data communication – communication attributes

Type of area	Normal <small>(volume)</small>	Degraded <small>(volume)</small>	Emergency <small>(volume)</small>
Station	Medium	Medium	Medium
Yard	Medium	Medium	Medium
Line	Low	Low	Low

Table 63: Shunting data communication – anticipated frequency of use

6 Performance Communication Applications

6.1 On-train outgoing voice communication from train staff towards a ground user

6.1.1 Description

6.1.1.1 The train staff shall be able to initiate a voice communication to any ground user.

6.1.2 Rationale

6.1.2.1 The train staff may need to initiate voice communication to any ground user for example for the following purposes:

- Catering.
- Access of information about connecting trains.
- Organise help on platform for persons of reduced mobility.
- Acquiring information needed for ticket inspection, for example to verify a passenger's identity.
- Violence reporting and staff security support.
 - Requesting help or alerting all other on-train staff members of an ongoing security or violence incident.
 - Reporting faults/defects of the train.

6.1.3 Users

6.1.3.1 Controller(s), train staff, railway staff.

6.1.4 Functional attributes

6.1.4.1 The train staff shall be able to initiate a voice communication to either a single ground user or multiple ground users, from any location on-board the train.

6.1.4.2 When required, the system shall automatically route voice communication to the intended ground user(s).

6.1.5 Usability criteria

6.1.5.1 When required, the initiation of a voice communication shall be achieved with the minimum of interaction for example a single button press or a selection from list.

6.1.5.2 Where selection from a list is determined to be the preferred option, then the list shall be accessed with the minimum of interaction and be intuitive.

6.1.5.3 Users shall be presented with meaningful information when receiving voice communication, for example:

- Functional identity.
- Information relating to the location of the originator.
- A simple description of incoming communication.

6.1.5.4 Users shall be presented with meaningful information when initiating a voice communication and during an ongoing communication, for example :

- Status of the intended recipient.
- Functional identity of the currently connected user/s.
- Information relating to the location of the currently connected user/s.

6.1.5.5 Where a functional identity is provided, it shall be consistent with the harmonised operational rules (where necessary).

6.1.6 Related application interfaces

6.1.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 64 included within their profile.

Ref	Title of related application
7.1	Inviting-a-user messaging
8.2	Multi-user talker control
8.3	Role management and presence
8.4	Location services
8.5	Authorisation of voice communication
8.7	Authorisation of application
8.8.1	Prioritisation
5.19	Voice recording and access

Table 64: On-train outgoing voice communication from train staff towards a ground user – related application list

6.1.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
6.1	Bi-directional Voice	50/50	User-to-User/Multi-user	Low	Low	Normal	Normal	High

Table 65: On-train outgoing voice communication from train staff towards a ground user – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Medium
Yard	Low	Low	Low
Line	Low	Medium	Medium

Table 66: On-train outgoing voice communication from train staff towards a ground user – anticipated frequency of use

6.2 On-train incoming voice communication from a ground user towards train staff

6.2.1 Description

6.2.1.1 A ground user shall be able to initiate a voice communication to train staff.

6.2.2 Rationale

6.2.2.1 A ground user may need to communicate with member(s) of the train staff of one or a group of trains in order to exchange information (for example notification of delays or the provision of connecting train information).

6.2.3 Users

6.2.3.1 Driver(s), controller(s), train staff, railway staff.

6.2.4 Functional attributes

6.2.4.1 The voice communication is a user-to-user or multi-user communication.

6.2.4.2 The user could use a functional identity.

6.2.4.3 All voice communication shall be routed automatically to the intended recipient(s).

6.2.5 Usability criteria

6.2.5.1 The initiation of voice communication shall be achieved with the minimum of interaction (for example a single button press or selection from list).

6.2.5.2 Where selection from a list is determined to be the preferred option, then the list shall be accessed with the minimum of interaction and be intuitive.

6.2.5.3 Users shall be presented with meaningful information when receiving incoming voice communication for example:

- Functional identity.
- Information relating to the location of the originator.

- A simple description of incoming communication.
- 6.2.5.4 Users shall be presented with meaningful information when initiating a voice communication and during an ongoing communication, for example :
- Status of the intended recipient.
 - Functional identity of the currently connected user/s.
 - Information relating to the location of the currently connected user/s.
- 6.2.5.5 Where a functional identity is provided, it shall be consistent with the harmonised operational rules (where necessary).
- 6.2.6 [Related application interfaces](#)
- 6.2.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 67 included within their profile.

Ref	Title of related application
7.1	Inviting-a-user messaging
8.2	Multi-user talker control
8.3	Role management and presence
8.4	Location services
8.5	Authorisation of voice communication
8.7	Authorisation of application
8.8	Prioritisation
5.19	Voice recording and access

Table 67: On-train incoming voice communication from a ground user towards train staff – related application list

6.2.7 [Communication attributes](#)

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
6.2	Bi-directional Voice	50/50	User-to-User/Multi-user	Low	Low	Normal	Normal	High

Table 68: On-train incoming voice communication from a ground user towards train staff – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	medium	Medium
Yard	Low	Low	Low
Line	Low	Low	Medium

Table 69: On-train incoming voice communication from a ground user towards train staff – anticipated frequency of use

6.3 [Multi-train voice communication for drivers excluding ground user\(s\)](#)

6.3.1 [Description](#)

- 6.3.1.1 A driver shall be able to set up a voice communication to all drivers within an automatically configured area that is based upon the originator's location.

6.3.2 [Rationale](#)

- 6.3.2.1 There may be circumstances when a driver is required to pass or request relevant information to or from other drivers within an area with unknown functional identity.

6.3.3 [Users](#)

- 6.3.3.1 Driver(s).

6.3.4 Functional attributes

- 6.3.4.1 A driver shall be able to initiate a multi-user voice communication that will be automatically connected to all drivers within an automatically configured area, which is based upon the originator's location and other operational characteristics for example complexity of route and maximum permissible line speed.
- 6.3.4.2 A driver entering the voice communication area shall automatically join the multi-user voice communication.
- 6.3.4.3 A driver leaving the voice communication area shall be provided with the opportunity to remain connected to the multi-user voice communication.
- 6.3.4.4 If the option to remain connected is not acknowledged, then the user shall automatically leave the multi-user voice communication after a predefined period of time.
- 6.3.4.5 A driver connected to the multi-user voice communication shall be able to leave or re-join the communication at any time.

6.3.5 Usability attributes

- 6.3.5.1 The initiation of a multi-user voice communication shall be achieved with the minimum of interaction (for example a single button press or selection from list). Where selection from a list is determined to be the preferred option, then the list shall be accessed with the minimum of interaction and be intuitive.
- 6.3.5.2 Users shall be presented with meaningful information when receiving incoming voice communication for example:
- Functional identity.
 - Information relating to the location of the originator.
 - A simple description of incoming communication.
- 6.3.5.3 Users shall be presented with meaningful information when initiating a voice communication and during an ongoing communication, for example :
- Status of the intended recipient.
 - Functional identity of the currently connected user/s.
 - Information relating to the location of the currently connected user/s.

6.3.6 Related application interfaces

- 6.3.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 70 included within their profile

Ref	Title of related application
7.1	Inviting-a-user messaging
8.2	Multi-user talker control
8.3	Role management and presence
8.4	Location services
8.5	Authorisation of voice communication
8.7	Authorisation of application
8.8	Prioritisation
5.19	Voice recording and access

Table 70: Multi-Train voice communication for drivers excluding ground user(s) – related application list

6.3.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
6.3	Bi-directional	50/50	Multi-user	Low	Low	Normal	Normal	High

	Voice							
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Table 71: Multi-Train voice communication for drivers excluding ground user(s) – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 72: Multi-Train voice communication for drivers excluding ground user(s) - anticipated frequency of use

6.4 On-train voice communication

6.4.1 Description

- 6.4.1.1 A member of the train staff shall be able to initiate a voice communication with one or multiple other members of the train staff(of the same train).

6.4.2 Rationale

- 6.4.2.1 An on-train-user may need to initiate voice communication to one or multiple on-train-users for example for the following purposes:

- Exchange of information related to the train operation between driver and conductor (for example in case of change of train composition).
- Exchange of information between train staff members located in different coaches (driver excluded).
- Exchange of information between drivers or between driver and train conductor located in another driving cab.

6.4.3 Users

- 6.4.3.1 Driver(s), train staff.

6.4.4 Functional attributes

- 6.4.4.1 The on-train-user shall be able to initiate voice communication to either a single on-train-user or multiple on-train-users.
- 6.4.4.2 When required, the system shall automatically route voice communication to the intended on-train-user(s).

6.4.5 Usability criteria

- 6.4.5.1 When required, the initiation of a voice communication shall be achieved with the minimum of interaction for example a single button press or a selection from list. Where selection from a list is determined to be the preferred option, then the list shall be accessed with the minimum of interaction and be intuitive.
- 6.4.5.2 Users shall be presented with meaningful information when receiving voice communication for example:
- Functional identity of the originator.
 - Information relating to the location of the originator.
 - A simple description of incoming communication.
- 6.4.5.3 Users shall be presented with meaningful information when initiating a voice communication and during an ongoing communication, for example :
- Status of the intended recipient.
 - Functional identity of the currently connected user/s.
 - Information relating to the location of the currently connected user/s.
- 6.4.5.4 Where a functional identity is provided, it shall be consistent with the harmonised operational rules (where necessary).

6.4.6 Related application interfaces

- 6.4.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 73 included within their profile.

Ref	Title of related application
7.1	Inviting-a-user messaging

8.2	Multi-user talker control
8.3	Role management and presence
8.4	Location services
8.5	Authorisation of voice communication
8.7	Authorisation of application
8.8	Prioritisation
5.19	Voice recording and access

Table 73: On-train voice communication – related application list

6.4.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
6.4	Bi-directional Voice	50/50	Multi-user	Low	Low	Normal	Normal	High

Table 74: On-train voice communication – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Medium	Medium
Yard	Low	Low	Low
Line	Low	Medium	Medium

Table 75: On-train voice communication – anticipated frequency of use

6.5 Lineside telephony

6.5.1 Description

- 6.5.1.1 A user shall be able to set up a voice communication to an entitled controller via lineside telephony.

6.5.2 Rationale

- 6.5.2.1 This application allows the user to quickly and easily establish voice communication to the most appropriate controller in order to obtain information about the status of the infrastructure object concerned (for example level crossing).

6.5.3 Users

- 6.5.3.1 Any authorised user excluding public.

6.5.4 Functional attributes

- 6.5.4.1 The railway staff shall be able to initiate a voice communication to a controller.
6.5.4.2 The system shall automatically route voice communication to the intended controller.

6.5.5 Usability criteria

- 6.5.5.1 The initiation of a voice communication shall be achieved with the minimum of interaction for example a single button press or simply lifting the handset.

6.5.6 Related application interfaces

- 6.5.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 76 included within their profile.

Ref	Title of related application
8.3	Role management and presence
8.4	Location services
8.5	Authorisation of voice communication
8.7	Authorisation of application

8.8	Prioritisation
5.19	Voice recording and access

Table 76: Lineside fixed telephony – related application list

6.5.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
6.5	Bi-directional Voice	50/50	User-to-User/Multi-user	Low	Low	Normal	Normal	Low

Table 77: Lineside fixed telephony – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 78: Lineside fixed telephony – anticipated frequency of use

6.6 On-train voice communication towards passengers (public address)

6.6.1 Description

6.6.1.1 A user shall be able to broadcast voice information to all passengers of one or multiple trains.

6.6.1.2 The broadcasted information could be real-time or pre-recorded.

6.6.2 Rationale

6.6.2.1 The application permits authorised users to establish a voice communication to the public address systems of a train or multiple trains in order to provide information to passengers.

6.6.3 Users

6.6.3.1 Driver(s), controller(s), train staff, RU operator(s), IM operator(s), Passengers (as recipient).

6.6.4 Functional attributes

6.6.4.1 The train staff and/or driver shall be able to initiate voice communication to the public address system of their own train

6.6.4.2 The controllers, RU operator and IM operator shall be able to initiate voice communication to the public address system of one or multiple train

6.6.4.3 The system shall automatically route voice communication to the intended public address system(s).

6.6.5 Usability criteria

6.6.5.1 The initiation of a voice communication shall be achieved with the minimum of interaction for example a single button press or a selection from list.

6.6.5.2 Where selection from a list is determined to be the preferred option, then the list shall be accessed with the minimum of interaction and be intuitive.

6.6.5.3 In the case in-coach radio coverage is not guaranteed, re-use of legacy train communication bus shall be considered (e.g. UIC568 bus).

6.6.6 Related application interfaces

6.6.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 79 included within their profile.

Ref	Title of related application
8.3	Role management and presence

8.4	Location services
8.5	Authorisation of voice communication
8.7	Authorisation of application
8.8	Prioritisation
5.19	Voice recording and access

Table 79: On-train voice communication towards passengers (Public Address) – related application list

6.6.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
6.6	Uni-directional Voice	0/100	User-to-User/Multi-user	Low	Low	Normal	Normal	High

Table 80: On-train voice communication towards passengers (Public Address) – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Medium	Medium
Yard	Not used	Not used	Not used
Line	Low	Medium	High

Table 81: On-train voice communication towards passengers (Public Address) – anticipated frequency of use

6.7 Station public address

6.7.1 Description

- 6.7.1.1 A user shall be able to broadcast vocal information to all passengers at specific locations such as station concourses and platforms.
- 6.7.1.2 The broadcasted information could be real-time or pre-recorded.

6.7.2 Rationale

- 6.7.2.1 This application allows the entitled user to broadcast vocal information to passengers at designated location(s). This type of broadcast may contain information about delayed trains or exceptional arrangements including evacuation announcements.

6.7.3 Users

- 6.7.3.1 Railway staff, ground system, public (as recipient).

6.7.4 Functional attributes

- 6.7.4.1 Call routing to the appropriate user/s shall have a high level of accuracy.
- 6.7.4.2 Potential risk of system misuse shall be compensated by technical implementation

6.7.5 Usability criteria

- 6.7.5.1 The display to the user shall present a simple HMI interaction for voice communication initiation.

6.7.6 Related application interfaces

- 6.7.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 82 included within their profile.

Ref	Title of related application
8.3	Role management and presence
8.4	Location services
8.5	Authorisation of voice communication
8.7	Authorisation of application
8.8	Prioritisation

Table 82: Station public address – related application list

6.7.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
6.7	Uni-directional Voice	0/100	User-to-User	Low	Low	Normal	Normal	Low

Table 83: Station public address – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Medium	High	High
Yard	Not used	Low	Low
Line	Not used	Low	Low

Table 84: Station public address – anticipated frequency of use

6.8 Communication at stations and depots

6.8.1 Description

6.8.1.1 The station or depot user shall be able to set up a voice communication with other user(s).

6.8.2 Rationale

6.8.2.1 A station or depot user may need to communicate with other user(s) in order to exchange information (for example movement of trains, parking of trains, logistics in depots or stations, etc.).

6.8.3 Users

6.8.3.1 Controller(s), station personnel, depot personnel.

6.8.4 Functional attributes

6.8.4.1 The voice communication is a user-to-user or multi-user communication.

6.8.4.2 The user could use a functional identity.

6.8.4.3 All voice communication shall be routed automatically to the intended recipient(s).

6.8.5 Usability attributes

6.8.5.1 The initiation of voice communication shall be achieved with the minimum of interaction (for example a single button press or selection from list).

6.8.5.2 Where selection from a list is determined to be the preferred option, then the list shall be accessed with the minimum of interaction and be intuitive.

6.8.5.3 Users shall be presented with meaningful information when receiving incoming voice communication for example:

- Functional identity.
- Information relating to the location of the originator.
- A simple description of incoming communication.

6.8.5.4 Users shall be presented with meaningful information when initiating a voice communication and during an ongoing communication, for example :

- Status of the intended recipient.
- Functional identity of the currently connected user/s.
- Information relating to the location of the currently connected user(s).

6.8.5.5 Where a functional identity is provided, it shall be consistent with the harmonised operational rules (where necessary).

6.8.6 Related application interfaces

6.8.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 85 included within their profile.

Ref	Title of related application
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8.2	Multi-user talker control
8.3	Role management and presence
8.4	Location services
8.5	Authorisation of voice communication
8.7	Authorisation of application
8.8	Prioritisation
5.19	Voice recording and access

Table 85: Communication at stations and depots – Related application list

6.8.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
6.8	Bi-directional Voice	50/50	User-to-User/Multi-user	Low	Low	Normal	Normal	Low

Table 86: Communication at stations and depots – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Medium	Medium	High
Yard	Medium	Medium	Medium
Line	Not used	Not used	Not used

Table 87: Communication at stations and depots – anticipated frequency of use

6.9 On-train telemetry communications

6.9.1 Description

- 6.9.1.1 It shall be possible to set up data communication between on-train systems and/or a ground based system.

6.9.2 Rationale

- 6.9.2.1 Telemetry data from on-board train systems could be utilised by various systems employed by Railway Undertakings or Infrastructure Managers to increase performance or support the management of day-to-day operations. Examples of this include:

- Data on passenger counting, train loading etc. to support demand forecasting and response.
- Provision of service related information (live train running and connecting service updates etc.) to passenger facing on-board staff or on-board passenger information systems.
- Provision of real-time, suitably accurate train position information to support more accurate initiator context dependent addressing or more efficient incident response.
- The real-time transfer of health, status, vital parameter condition, and onset of fault condition data from intelligent on-train systems to train maintenance organisations.
- Transfer of infrastructure condition data from on-board sensors or cameras that monitor the condition of trackside infrastructure as the train moves along the track to infrastructure maintenance depots or operations control centres.
- Information on composition of the train.

6.9.3 Users

- 6.9.3.1 On-board system, ground system.

6.9.4 Functional attributes

- 6.9.4.1 No specific railway functional attributes identified.

6.9.5 Usability criteria

6.9.5.1 No specific railway usability attributes identified.

6.9.6 Related application interfaces

6.9.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 88 included within their profile.

Ref	Title of related application
8.3	Role management and presence
8.4	Location services
8.6	Authorisation of data communication
8.7	Authorisation of application
8.8	Prioritisation
5.20	Data recording and access
6.20	Transfer of data

Table 88: On-train telemetry communications – related application list

6.9.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
6.9	Uni-directional Data	80/20	User-to-User	Normal	Medium	Normal	Normal	High

Table 89: On-train telemetry communications – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 90: On-train telemetry communications – anticipated frequency of use

6.10 Infrastructure telemetry communications

6.10.1 Description

6.10.1.1 It shall be possible to set up data communication between infrastructure systems and/or a ground based system (for example, to support demand forecasting and response, equipment supervision etc.).

6.10.1.2 Note: the data communication can be permanent or intermittent.

6.10.2 Rationale

6.10.2.1 Telemetry data from infrastructure systems could be utilised by various systems employed by Infrastructure managers to support the early detection or prediction of, and response to, infrastructure faults or failures.

6.10.3 Users

6.10.3.1 Trackside system, ground system.

6.10.4 Functional attributes

6.10.4.1 No specific railway functional attributes identified.

6.10.5 Usability criteria

6.10.5.1 No specific railway usability attributes identified.

6.10.6 Related application interfaces

6.10.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 91 included within their profile.

Ref	Title of related application
8.3	Role management and presence
8.4	Location services
8.6	Authorisation of data communication
8.7	Authorisation of application
8.8	Prioritisation
5.20	Data recording and access
6.20	Transfer of data

Table 91: Infrastructure telemetry communications – related application list

6.10.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
6.10	Uni-directional Data	80/20	User-to-User	Normal	Medium	Normal	Normal	Low

Table 92: Infrastructure telemetry communications – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 93: Infrastructure telemetry communications – anticipated frequency of use

6.11 On-train remote equipment control

6.11.1 Description

6.11.1.1 A ground based system shall be able to initiate a data communication to relevant on-train systems for control purposes, for example controlling heating or lighting, initiating power-up sequences etc.

6.11.2 Rationale

6.11.2.1 To optimise train preparation and to support train maintenance.

6.11.3 Users

6.11.3.1 Trackside staff, railway staff, on-board system, ground system.

6.11.4 Functional attributes

6.11.4.1 The ground system shall be able to initiate a data communication to a single or multiple On-train equipment of a train.

6.11.4.2 The system shall automatically route data communication to the intended train.

6.11.5 Usability criteria

6.11.5.1 The application shall provide the user with a proper indication of the status of the performed control action.

6.11.6 Related application interfaces

6.11.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 94 included within their profile.

Ref	Title of related application
8.3	Role management and presence
8.4	Location services

8.6	Authorisation of data communication
8.7	Authorisation of application
8.8	Prioritisation
5.20	Data recording and access
6.20	Transfer of data

Table 94: On-train remote equipment control – related application list

6.11.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
6.11	Bi-directional Data	50/50	User-to-User	Normal	Low	Normal	Normal	High

Table 95: On-train remote equipment control – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 96: On-train remote equipment control – anticipated frequency of use

6.12 Monitoring and control of non-critical infrastructure

6.12.1 Description

6.12.1.1 It shall be possible to set up data communication between non-critical infrastructure systems and a ground based system in order to monitor and control those infrastructure systems remotely.

6.12.2 Rationale

6.12.2.1 Using wireless communication to monitor and control non-critical infrastructure systems reduces the need for hardwired communications links with an associated reduction in initial installation costs and a potential reduction in faults and failures, and resulting train delays, caused by cable damage or theft.

6.12.2.2 Additionally there is the potential to reduce the time required to respond to and rectify faults and failures due to wireless equipment being at discrete locations rather than being spread over long distances.

6.12.3 Users

6.12.3.1 Trackside system, ground system

6.12.4 Functional attributes

6.12.4.1 No specific railway functional attributes identified.

6.12.5 Usability criteria

6.12.5.1 The user shall be able to determine if the communications link becomes inactive.

6.12.6 Related application interfaces

6.12.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 97 included within their profile.

Ref	Title of related application
8.3	Role management and presence
8.4	Location services
8.6	Authorisation of data communication
8.7	Authorisation of application

8.8	Prioritisation
5.20	Data recording and access
6.20	Transfer of data

Table 97: Monitoring and control of non-critical infrastructure – related application list

6.12.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
6.12	Bi-directional Data	50/50	User-to-User	Normal	Low	Normal	Normal	Low

Table 98: Monitoring and control of non-critical infrastructure – communications attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 99: Monitoring and control of non-critical infrastructure – anticipated frequency of use

6.13 Real time video

6.13.1 Description

6.13.1.1 This application facilitates the data communication for real time transmission of video images.

6.13.2 Rationale

6.13.2.1 Real time video images are considered to be an effective mitigation measure in relation to hazards that may not be detected by the train control system. In addition real time video images can enhance operational performance of the railway system when used to support the end user within the target environment. The video images can be used for:

- Supervision of platform and tunnels
- Generation of Alarms (e.g. supervision of railway track, doors, train, etc.)
- Smoke detection
- Passenger Information
- ATO and ATC
- Help Points
- Ticketing
- Prevention of vandalism
- Protection of passengers
- Etc.

6.13.3 Users

6.13.3.1 Driver(s), controller(s), railway staff.

6.13.4 Functional attributes

6.13.4.1 Ground based cameras (for example, cameras located on station platforms, level crossings, tunnels), on-train cameras (for example, front/rear/sideview facing external cameras, security cameras in the carriages).

6.13.4.2 The transmission of video images may be triggered by an event, e.g. emergency break or a fire alarm.

6.13.5 Usability criteria

6.13.5.1 The video image quality depends on the application needs .

6.13.6 Related application interfaces

6.13.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 100 included within their profile.

Ref	Title of related application
8.3	Role management and presence
8.4	Location services
8.6	Authorisation of data communication
8.7	Authorisation of application
8.8	Prioritisation
5.20	Data recording and access
6.20	Transfer of data

Table 100: Real time video – related application interfaces

6.13.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
6.13	Uni-directional Data	100/0	User-to-User	Normal	High	Normal	Normal	High

Table 101: Real time video – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	High	High	High
Yard	High	High	High
Line	High	High	High

Table 102: Real time video – anticipated frequency of use

6.14 Wireless on-train data communication for train staff

6.14.1 Description

6.14.1.1 Train staff shall be able to use intranet/internet services via a wireless connection in a train.

6.14.2 Rationale

6.14.2.1 On-board staff will require access to the intranet/internet for operational purposes, for example to access train running and/or passenger information.

6.14.3 Users

6.14.3.1 Driver(s), train staff.

6.14.4 Functional attributes

6.14.4.1 This shall not affect other applications used for railway operations.

6.14.5 Usability criteria

6.14.5.1 A minimum bandwidth per individual user (similar to what is achieved by mobile public operator) shall be provided to on-train staff.

6.14.5.2 A seamless operation is required for users moving from platform to on-train, and vice-versa, using the wireless internet applications.

6.14.6 Related application interfaces

6.14.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 103 included within their profile.

Ref	Title of related application
8.6	Authorisation of data communication
8.7	Authorisation of application

8.8	Prioritisation
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Table 103: Wireless on-train data communication for train staff – related application list

6.14.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
6.14	Bi-directional Data	20/80	User-to-User	Normal	High	Normal	Normal	High

Table 104: Wireless on-train data communication for train staff – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	High	High	High
Yard	High	High	High
Line	High	High	High

Table 105: Wireless on-train data communication for train staff – anticipated frequency of use

6.15 Wireless data communication for railway staff on platforms

6.15.1 Description

6.15.1.1 It shall be possible for railway staff to use intranet/internet services via a wireless connection in railway areas (for example platforms, station areas etc.).

6.15.2 Rationale

6.15.2.1 Railway staff will require access to the intranet/internet for operational purposes, for example to access train running and/or passenger information.

6.15.3 Users

6.15.3.1 Any authorised user excluding public.

6.15.4 Functional attributes

6.15.4.1 This shall not affect other applications used for railway operations.

6.15.5 Usability criteria

6.15.5.1 A minimum bandwidth per individual user (similar to what is achieved by mobile public operator) shall be provided for railway staff.

6.15.5.2 A seamless operation is required for users moving from platform to on-train, and vice-versa, using the wireless internet applications.

6.15.6 Related application interfaces

6.15.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 106 included within their profile.

Ref	Title of related application
8.6	Authorisation of data communication
8.7	Authorisation of application
8.8	Prioritisation

Table 106: Wireless internet for railway staff on platforms – related application list

6.15.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
6.15	Bi-directional Data	20/80	User-to-User	Normal	High	Normal	Normal	Low

Table 107: Wireless on-train data communication for train staff – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	High	High	High
Yard	High	High	High
Line	High	High	High

Table 108: Wireless on-train data communication for train staff – anticipated frequency of use

6.16 Driver advisory – safety related

6.16.1 Description

6.16.1.1 A controller shall be able to set up data communication to the train to instruct a driver or drivers about the usage of the infrastructure (for example speed advisory).

6.16.2 Rationale

6.16.2.1 This application enables a means to provide safety related instructions/information to the driver, for example

- inform the driver about the maximum authorised speed
- confirm the closure of an emergency situation
- confirm the readiness of the train to start
- level crossing instructions

6.16.3 Users

6.16.3.1 Driver(s), controller(s).

6.16.4 Functional attributes

6.16.4.1 The controller shall be able to initiate a data communication to a single train.

6.16.4.2 The system shall automatically route data communication to the intended on-train-user(s).

6.16.4.3 The controller shall be provided with a proper indication of the correct delivery of the information.

6.16.5 Usability criteria

6.16.5.1 The instructions for the driver shall be displayed on a dedicated HMI or on a multi-purpose HMI

6.16.5.2 The initiation of data communication shall be achieved with the minimum of interaction for example a single button press or a selection from list.

6.16.5.3 Where selection from a list is determined to be the preferred option, then the list shall be accessed with the minimum of interaction and be intuitive.

6.16.5.4 Users shall be presented with meaningful information when receiving incoming data communication, for example:

- Functional identity.
- Information relating to the location of the originator.
- A simple description of incoming communication.

6.16.5.5 Where a functional identity is provided, it shall be consistent with the harmonised operational rules (where necessary).

6.16.6 Related application interfaces

6.16.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 109 included within their profile.

Ref	Title of related application
8.3	Role management and presence
8.4	Location services
8.6	Authorisation of data communication
8.7	Authorisation of application
8.8	Prioritisation

5.20	Data recording and access
6.20	Transfer of data

Table 109: Driver advisory safety related – related application list

6.16.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
6.16	Bi-directional Data	50/50	User-to-User	Normal	Low	High	Normal	High

Table 110: Driver advisory safety related – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	High	High	High
Yard	High	High	High
Line	High	High	High

Table 111: Driver advisory safety related - anticipated frequency of use

6.17 Driver advisory - train performance

6.17.1 Description

- 6.17.1.1 A user or a ground system shall be able to set up data communication to provide advisory information to the driver in order to optimise the train journey (for example Driver Advisory System (DAS), Traffic management (TM), Power consumption management).
- 6.17.1.2 Providing the driver with advisory information in-cab can make a significant contribution to railway operations by delivering the following benefits:
- Train regulated to the working timetable - fewer restrictive signals.
 - Overall lower sectional running speeds.
 - Advance warning of locations where restrictions change speed.
 - Lower permanent speed restriction (PSR) / station approach speeds to PSRs / stations / known conflict points with extended coasting.
 - Reminder of next station calling point, thus reducing missed stations / run-overs.
 - Improved energy efficiency.
 - Reductions in train and infrastructure wear and tear due to reduced braking and lower running speeds.
 - Capability to optimise energy consumption based on locally available electrical power supply or power tariffs/budgets.
 - Speed recommendation

6.17.2 Users

- 6.17.2.1 Driver(s), controller(s), on-board system, ground system.

6.17.3 Functional attributes

- 6.17.3.1 A user or a ground system shall be able to initiate a data communication to a single train.
- 6.17.3.2 The system shall automatically route data communication to the intended on-train-user(s).
- 6.17.3.3 The user or the ground system shall be provided with a proper indication of the correct delivery of the information.

6.17.4 Usability criteria

- 6.17.4.1 The instructions for the driver shall be displayed on a dedicated HMI or on a multi-purpose HMI
- 6.17.4.2 The initiation of data communication shall be achieved with the minimum of interaction for example a single button press or a selection from list.

- 6.17.4.3 Where selection from a list is determined to be the preferred option, then the list shall be accessed with the minimum of interaction and be intuitive.
- 6.17.4.4 Users shall be presented with meaningful information when receiving incoming data communication, for example:
- Functional identity.
 - Information relating to the location of the originator.
 - A simple description of incoming communication.
- 6.17.4.5 Where a functional identity is provided, it shall be consistent with the harmonised operational rules (where necessary).

6.17.5 Related application interfaces.

- 6.17.5.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 112 included within their profile.

Ref	Title of related application
8.3	Role management and presence
8.4	Location services
8.6	Authorisation of data communication
8.7	Authorisation of application
8.8	Prioritisation
5.20	Data recording and access
6.20	Transfer of data

Table 112: Driver advisory train performance – related application list

6.17.6 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
6.17	Bi-directional data	50/50	User-to-User	Normal	Low	Normal	Normal	High

Table 113: Driver advisory train performance – communication attributes

Type of area	Normal <small>(volume)</small>	Degraded <small>(volume)</small>	Emergency <small>(volume)</small>
Station	High	High	High
Yard	High	High	High
Line	High	High	High

Table 114: Driver advisory train performance – anticipated frequency of use

6.18 Train departure related communications

6.18.1 Description

- 6.18.1.1 A user shall be able to set up data and/or voice communications with other involved users to support the station departure processes.

6.18.2 Rationale

- 6.18.2.1 Station departure and the platform/train interface is one of the biggest risk areas in railway operations today. Different countries implement various different processes for managing station departure with the aim of ensuring that passengers are safely on-board the train and that the train can safely depart the platform. This includes conductor to driver and driver to controller communication.

6.18.3 Users

- 6.18.3.1 Driver(s), controller(s), train staff, RU operator(s), IM operator(s), ground system.

6.18.4 Functional attributes

6.18.4.1 There are no functional requirements applicable for FRMCS for the internal RU communication required for the departure process.

6.18.4.2 Data communication (format and procedures) between driver and controller in countries in the EU shall be according to [OPE TSI], [TAP TSI] and [TAF TSI].

6.18.5 Usability criteria

6.18.5.1 There are no user criteria applicable for FRMCS for the internal RU communication required for the departure process.

6.18.6 Related application interfaces

6.18.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 115 included within their profile.

Ref	Title of related application
8.3	Role management and presence
8.4	Location services
8.5	Authorisation of voice communication
8.6	Authorisation of data communication
8.7	Authorisation of application
8.8	Prioritisation
5.19	Voice recording and access
5.20	Data recording and access
6.20	Transfer of data

Table 115: Train departure related communications – related application list

6.18.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
6.18	Bi-directional Voice	50/50	User-to-User	Low	Low	Normal	Normal	Low
	Bi-directional data	50/50	User-to-user	Normal	Low	Normal	Normal	Low

Table 116: Train departure related communications – communication attributes

Bi directional Voice

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Not used	Not used	Not used
Line	Not used	Not used	Not used

Bi directional Data

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 117: Train departure related communications – anticipated frequency of use

6.19 Messaging services

6.19.1 Description

6.19.1.1 A user shall be able to send and receive non-critical messages like text, recorded voice (for example voicemail), data, pictures, video. Messages can be exchanged on user-to-user or a user-to-multi user level.

6.19.2 Rationale

6.19.2.1 There is a need to exchange information among railway users like for example:

- Pictures or video from a track side maintenance employee to a controller.
- An instruction for an on-board maintenance employee.
- Exchange information among train staff about weather, traffic disturbances/limitations, logistics, etc.
- Leaving a voice mail if a user is not available.
- Information from a controller to a driver via a pre-recorded voice message.
- Customer information.

6.19.3 Users

6.19.3.1 Any authorised user excluding public.

6.19.4 Functional attributes

6.19.4.1 The user shall be able to create, send, receive, confirm, forward, etc messages, including predefined messages

6.19.4.2 The user shall be able to select the recipients of a message based on different characteristics such as role, location, status, etc.

6.19.4.3 The system shall automatically route the message to the desired user(s).

6.19.4.4 The user shall be able to retrieve the information from the received message.

6.19.4.5 The system shall be able to inform about the status of the messages (for example, notification of message delivered, message read, etc.).

6.19.5 Usability criteria

6.19.5.1 The selection of recipients of a message shall be achieved with the minimum of interaction (for example, a single button press or selection from list). Where selection from a list is determined to be the preferred option, then the list shall be accessed with the minimum of interaction and be intuitive.

6.19.5.2 For predefined message the selection of the message shall be achieved with the minimum of interaction (for example, a single button press or selection from list). Where selection from a list is determined to be the preferred option, then the list shall be accessed with the minimum of interaction and be intuitive.

6.19.5.3 Users receiving a message shall be presented with meaningful information about it, for example:

- Functional identity of the originator.
- Information relating to the location of the originator.
- A simple description of incoming communication.

6.19.5.4 Where a functional identity is provided, it shall be consistent with the harmonised operational rules (where necessary).

6.19.6 Related application interfaces

6.19.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 118 included within their profile.

Ref	Title of related application
8.3	Role management and presence
8.4	Location services
8.5	Authorisation of voice communication
8.6	Authorisation of data communications

8.7	Authorisation of application
8.8	Prioritisation
5.20	Data recording and access
6.20	Transfer of data

Table 118: Messaging services – related application list

6.19.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
6.19	Bi-directional data	50/50	User-to-User/Multi-user	Normal	Low	Normal	Normal	High

Table 119: Messaging services – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 120: Messaging services – anticipated frequency of use

6.20 Transfer of data

6.20.1 Description

6.20.1.1 Transfer of recorded data for post-accident/incident analysis (for example, CCTV, JRU, energy metering data), or any other data that requires to be transferred between users, for example, data from train staff, time table data.

6.20.2 Rationale

6.20.2.1 To support railway operations it is needed to have the capability to exchange data accurately and quickly.

6.20.2.2 In EU countries, the transfer of energy metering data shall be compliant to [ENE TSI].

6.20.3 Users

6.20.3.1 Any authorised user excluding public.

6.20.4 Functional attributes

6.20.4.1 Only authorised users shall be able to transfer recorded data.

6.20.4.2 All railway operational data (for example train identity, engine identity, functional identity, location data etc.) shall be able to be transferred together with the recorded data.

6.20.5 Usability criteria

6.20.5.1 National protocols and legislation shall be taken into account when defining the types of data communications that are required to be recorded and accessed.

6.20.5.2 Only authorised users shall be able to access recorded communication and transfer the data.

6.20.5.3 Sufficient retention of recorded communications shall be implemented in accordance with the Railway Undertaking's requirements that allow transfer at a later date.

6.20.6 Related application interfaces

6.20.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 121 included within their profile.

Ref	Title of related application
8.3	Role management and presence
8.4	Location services

8.6	Authorisation of data communication
8.7	Authorisation of application
8.8	Prioritisation

Table 121: Transfer of data – related application list

6.20.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
6.20	Bi-directional data	50/50	User-to-User	Normal	Medium	Normal	Normal	High

Table 122: Transfer of data – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	High	High	High
Yard	High	High	High
Line	High	High	High

Table 123: Transfer of data – anticipated frequency of use

6.21 Record and broadcast

6.21.1 Description

6.21.1.1 A user shall be able to record a voice or a video message that can subsequently be transmitted to selected users based on their role and/or location.

6.21.2 Rationale

6.21.2.1 There may be occasions when a controller is required to pass relevant operational information to trains within their area of responsibility for example to reduce workload during degraded operating conditions.

6.21.3 Users

6.21.3.1 Any authorised user excluding public.

6.21.4 Functional attributes

6.21.4.1 The controller shall be able to generate a message

6.21.4.2 The controller shall be able to store generated messages for future use.

6.21.4.3 The controller shall be able to define the number of occasions the message will be transmitted.

6.21.4.4 The controller shall be able to define the interval between broadcasts.

6.21.4.5 The system shall enable a controller to define the area over which the recorded message will be transmitted.

6.21.4.6 The controller shall be able to cancel the transmission of the recorded message at any time.

6.21.4.7 The controller shall be have the ability to establish trigger mechanisms to commence the broadcast.

6.21.4.8 The controller shall be able to determine the geographic area over which the recorded message will be transmitted. For example an entire area of responsibility, a sub-area within an area of responsibility, a defined train detection section or specific group of trains.

6.21.4.9 An option shall be provided to allow the driver to acknowledge a broadcast, and to allow the controller to receive the acknowledgement.

6.21.5 Usability criteria

6.21.5.1 The controller shall be able to listen to the generated message prior to it being transmitted.

6.21.5.2 The duration of the generated message shall be displayed to the controller.

6.21.6 Related application interfaces

6.21.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 124 included within their profile.

Ref	Title of related application
8.3	Role management and presence
8.4	Location services
8.5	Authorisation of voice communication
8.6	Authorisation of data communications
8.7	Authorisation of application
8.8	Prioritisation
5.19	Voice recording and access
5.20	Data recording and access

Table 124: Record and broadcast – related application list

6.21.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
6.21	Uni-directional Voice	0/100	User-to-User/ Multi-user	Low	Low	Normal	Normal	High

Table 125: Record and broadcast – controller to driver(s) – communication attributes

Type of area	Normal <small>(volume)</small>	Degraded <small>(volume)</small>	Emergency <small>(volume)</small>
Station	Low	Medium	Medium
Yard	Low	Low	Low
Line	Low	Medium	Medium

Table 126: Record and broadcast – controller to driver(s) – anticipated frequency of use

7 Business Communication Applications

7.1 Inviting-a-user messaging

7.1.1 Description

7.1.1.1 A user can send a message to another user inviting him to join the ongoing voice communication.

7.1.2 Rationale

7.1.2.1 The users of an ongoing voice communication may have a need for a controller or any other user to join (for example shunting teams, banking, etc.).

7.1.3 Users

7.1.3.1 Any user with a voice connection.

7.1.4 Functional attributes

7.1.4.1 The user shall be able to invite another user to join an ongoing communication.

7.1.4.2 The system shall automatically route the invitation message to the desired user.

7.1.4.3 It shall be possible to join ongoing user-to-user or multi users communication. The user-to-user communication will transfer into a multi user communication.

7.1.5 Usability criteria

7.1.5.1 The initiation of sending an invitation message shall be achieved with the minimum of interaction (for example a single button press or selection from list).

7.1.5.2 The status of the invitation message is presented to the inviting user in a clear and simple way (for example pending, rejected).

7.1.5.3 Where selection from a list is determined to be the preferred option, then the list shall be accessed with the minimum of interaction and be intuitive. Users shall be presented with meaningful information when receiving incoming voice communication for example:

- Functional identity.
- Information relating to the location of the originator.
- A simple description of incoming communication.

7.1.5.4 Where a functional identity is provided, it shall be consistent with the harmonised operational rules (where necessary).

7.1.6 Related application interfaces

7.1.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 127 included within their profile.

Ref	Title of related application
8.3	Role management and presence
8.4	Location services
8.7	Authorisation of application
8.8	Prioritisation

Table 127: Inviting-a-user messaging – related application list

7.1.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
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7.1	Uni-directional Data	50/50	User-to-user	Normal	Low	Normal	Normal	High
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Table 128: Inviting-a-user messaging – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 129: Inviting-a-user messaging – anticipated frequency of use

7.2 Emergency help point for public

7.2.1 Description

- 7.2.1.1 A member of the public shall be able to set up an emergency voice communication that will be automatically routed to the most appropriate ground user, train staff or driver.

7.2.2 Rationale

- 7.2.2.1 This application allows members of the public to quickly and easily establish voice communications with the most appropriate ground user for the purposes of reporting, and possibly taking instructions to support dealing with, an emergency situation. Emergency situations could include passenger-train interface issues, hazards to train operations at level crossings etc. The provision of this application on-board train is particularly relevant to automatic train operation, especially where no or limited train staff are available on-board.

7.2.3 Users

- 7.2.3.1 Public.

7.2.4 Functional attributes

- 7.2.4.1 The application shall be available on-train and at the trackside.
- 7.2.4.2 Accuracy of the call routing to the appropriate user.
- 7.2.4.3 Occurrence of an emergency situation shall be obvious for ground users.
- 7.2.4.4 Potential risk of system dysfunction or misuse shall be compensated by technical implementation (e.g. if first communication fails, the system automatically retries).

7.2.5 Usability criteria

- 7.2.5.1 The initiation of a voice communication shall be achieved with the minimum of interaction (for example a single button press).
- 7.2.5.2 Users shall be presented with meaningful information when receiving incoming voice communication for example:
- Information relating to the location of the originator.
 - A simple description of incoming communication.
- 7.2.5.3 The design of the application shall take into consideration the target environment, and assume that users have little or no knowledge of the environment.

7.2.6 Related application interfaces

- 7.2.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 130 included within their profile.

Ref	Title of related application
6.13	Real time video
8.3	Role management and presence
8.4	Location services
8.5	Authorisation of voice communication
8.7	Authorisation of application
8.8	Prioritisation

5.19 Voice recording and access

Table 130: Emergency help point for public – related application list

7.2.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
7.2	Bi-directional Voice	50/50	User-to-user	Low	Low	Normal	Normal	High

Table 131: Emergency help point for public – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Not used	Not used	Not used
Line	Low	Low	Low

Table 132: Emergency help point for public – anticipated frequency of use

7.3 Wireless internet on-train for passengers

7.3.1 Description

7.3.1.1 It shall be possible for passengers to use internet services via a wireless connection in a train.

7.3.2 Rationale

7.3.2.1 This application allows passengers to use public internet services via a wireless connection in a train.

7.3.3 Users

7.3.3.1 Passengers.

7.3.4 Functional attributes

7.3.4.1 Use of this application shall not affect other applications used for railway operations.

7.3.4.2 User identification.

7.3.5 Usability criteria

7.3.5.1 A minimum bandwidth per individual user (similar to what is achieved by mobile public operator) shall be provided to on-train passengers.

7.3.5.2 A seamless operation is required for users moving from platform to on-train, and vice-versa, using the wireless internet applications.

7.3.6 Related application interfaces

7.3.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 133 included within their profile.

Ref	Title of related application
8.6	Authorisation of data communication
8.7	Authorisation of application
8.8	Prioritisation

Table 133: Wireless internet on-train for passengers – related application list

7.3.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
7.3	Bi-directional	20/80	User-to-User	Normal	High	Normal	Normal	High

	Data							
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Table 134: Wireless internet on-train for passengers – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	High	High	High
Yard	High	High	High
Line	High	High	High

Table 135: Wireless internet on-train for passengers – anticipated frequency of use

7.4 Wireless internet for passengers on platforms

7.4.1 Description

7.4.1.1 It shall be possible for passengers to use internet services via a wireless connection in railway area(s) (for example platforms, station area(s) etc.).

7.4.2 Rationale

7.4.2.1 For an improved customer satisfaction, this application allows passengers to use public internet services via a wireless connection on railway area(s) (for example platforms, station area(s), etc.).

7.4.3 Users

7.4.3.1 Public.

7.4.4 Functional attributes

7.4.4.1 This shall not affect other applications used for railway operations.

7.4.5 Usability criteria

7.4.5.1 A minimum bandwidth per individual user (similar to what is achieved by mobile public operator) shall be provided to passengers located in stations and platforms.

7.4.5.2 A seamless operation is required for users moving from platform to on-train, and vice-versa, using the wireless internet applications.

7.4.6 Related application interfaces

7.4.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 136 included within their profile.

Ref	Title of related application
8.6	Authorisation of data communication
8.7	Authorisation of application
8.8	Prioritisation

Table 136: Wireless internet for passengers on platforms – Related application List

7.4.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
7.4	Bi-directional Data	20/80	User-to-User	Normal	High	Normal	Normal	Low

Table 137: Wireless internet for passengers on platforms – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	High	High	High
Yard	High	High	High
Line	High	High	High

Table 138: Wireless internet for passengers on platforms – anticipated frequency of use

8 Critical Support Applications

8.1 Secured voice communication

8.1.1 Description

- 8.1.1.1 The secured voice communication application shall provide a clear indication to the users as soon as an end-to-end voice communication link is broken or as long as the end-to-end communication link is active.²

8.1.2 Rationale

- 8.1.2.1 The secured voice communication shall be applied in those situations, where the users are at risk, when the communication is interrupted, for example in shunting communication during pushing movements.

8.1.3 Users

- 8.1.3.1 Any user involved in the voice communication requiring secured voice communication application.

8.1.4 Functional attributes

- 8.1.4.1 The application shall automatically warn the end users about the broken communication link (end-to-end) without any user action.
- 8.1.4.2 The supervision of the communication link shall be fail-safe
- 8.1.4.3 Either a positive confirmation indicating an intact communication link or an alarm in case of a broken link shall be given to all participants of communication.

8.1.5 Usability criteria

- 8.1.5.1 The application shall not require any human user action during the ongoing secured voice communication.

8.1.6 Related application interfaces

- 8.1.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 139 included within their profile.

Ref	Title of related application
8.7	Authorisation of application

Table 139: Secured voice communication – related application interfaces

8.1.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
8.1	Bi-directional Voice	50/50	User-to-User/Multi-user	Low	Low	High	Normal	Normal
	Bi-directional Data	50/50	User-to-User/Multi-user	Normal	Low	High	Normal	Normal

Table 140: Secured voice communication – communication attributes

Bi directional Voice			
Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)

² This application is not to be confused with cyber security.

Station	Medium	Medium	Medium
Yard	Medium	Medium	Medium
Line	Low	Low	Low

Bi directional Data

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	High	High	High
Yard	High	High	High
Line	High	High	High

Table 141: Secured voice communication data & Voice– anticipated frequency of use

8.2 Multi user talker control

8.2.1 Description

8.2.1.1 The system shall be able to limit the number of simultaneous talkers in a multi-user voice communication.

8.2.1.2 An entitled user shall be able to select and de-select user(s) being able to talk in a multi-user voice communication.

8.2.2 Rationale

8.2.2.1 There are occasions where it is needed to mitigate the risk of miscommunication. Use cases include, for example:

- Emergency communication
- Shunting communication
- Trackside worker communication

8.2.3 Users

8.2.3.1 Any authorised user excluding public.

8.2.4 Functional attributes

8.2.4.1 The network operator shall be able to predefine who is allowed to speak in a multi-user voice communication. The definition can be based on role, location, etc.

8.2.4.2 The entitled user shall be able to select and de-select user(s) from a list to allow the user to talk in a ongoing multi-user voice communication.

8.2.5 Usability criteria

8.2.5.1 It shall be indicated to the user if he is allowed to speak in the ongoing multi-user voice communication.

8.2.5.2 It shall be possible for a user to indicate the need to speak (raise the hand).

8.2.6 Related application interfaces

8.2.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 142 included within their profile.

Ref	Title of related application
8.3	Role management and presence
8.4	Location services
8.7	Authorisation of application

Table 142: Multi user talker control – related application list

8.2.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
8.2	Bi-directional data	50/50	User-to-User/Multi-user	Low	Low	High	Normal	High

Table 143: Multi user talker control – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 144: Multi user talker control – anticipated frequency of use

8.3 Role management and presence

8.3.1 Description

- 8.3.1.1 A user shall be able to register and deregister to one or more functional identity/ies. A user is able to see which other functional identities are present within a certain context (for example train, region, communication group, Railway Emergency Communication, etc.). Further it shall be possible for the user to identify at any time the function / person who is talking (for example driver, train staff, maintenance staff, platform staff, controller, etc.).
- 8.3.1.2 This application will be responsible for handling the railway role management of the users including the role registration and deregistration processes.

8.3.2 Rationale

- 8.3.2.1 This application enables the railway role management of the users including the role registration and deregistration processes, which will make railway communications more efficient. Some communications even require identification of the users by their role. This application shall also enable the routing based on the initiator functional identity.

8.3.3 Users

- 8.3.3.1 Any authorised user excluding public.

8.3.4 Functional attributes

- 8.3.4.1 A functional identity shall be unique and be reliably presented to the user
- 8.3.4.2 A unique functional identity may (if required), be assigned to more than one authorised user.
- 8.3.4.3 Registration and deregistration may be subject to restriction(s), based on the context.
- 8.3.4.4 An entitled user is able to unregister another user.
- 8.3.4.5 It shall be possible to provide the current status of a functional identity, for example available, busy, dealing with emergency situation, etc..

8.3.5 Usability criteria

- 8.3.5.1 It shall be possible for the user to have the ability to change the status of the functional identity. However this could be restricted when user is involved in certain applications
- 8.3.5.2 Simple HMI interaction: presentation of functional identities shall be performed in a comprehensive way for example using text description of the functions instead of numbers
- 8.3.5.3 Registration and deregistration of functional identities shall be performed in a simple way
- 8.3.5.4 Automated functional registration of the on-board communication devices and mobile terminals based on operational conditions, like schedules when entering the train (for example by using Near Field Communication, SmartCard etc.), location, time, recent activity, etc.
- 8.3.5.5 When applicable, location information of the user shall be added besides the functional identity in the presented list of users.
- 8.3.5.6 Single sign on principle shall be implemented to allow users to access different applications by a single registration.
- 8.3.5.7 The list of displayed users shall automatically adapt the application used, the ongoing communication and the role registered by user.

8.3.6 Related application interfaces

- 8.3.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 145 included within their profile.

Ref	Title of related application
8.4	Location services
8.6	Authorisation of data communication
8.7	Authorisation of application
5.20	Data recording and Access

Table 145: Role management and presence – related application list

8.3.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
8.3	Bi-directional data	50/50	User-to-User/Multi-user	Normal	Low	High	Normal	High

Table 146: Role management and presence – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 147: Role management and presence – anticipated frequency of use

8.4 Location services

8.4.1 Description

8.4.1.1 The system shall be able to store and provide the location of the user(s) or devices.

8.4.2 Rationale

8.4.2.1 This application allows the correct identification of affected or involved users or devices where the establishment or routing of communication is dependent on location, for example for Railway Emergency Communications.

8.4.3 Users

8.4.3.1 Any authorised user excluding public.

8.4.4 Functional attributes

8.4.4.1 Location information shall be based on the most accurate available information, for example taking into account track position and running/moving direction. Location data provided by devices and external systems shall be supported.

8.4.5 Usability criteria

8.4.5.1 If available, it is always useful to display to the user or to the device his own location and the location related to other users. It could also be used for an controller to identify users in a specific (controller) area.

8.4.5.2 The non-availability of the location information shall not prevent other applications to work, for example with a default location or the last known location.

8.4.6 Related application interfaces

8.4.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 148 included within their profile.

Ref	Title of related application
8.3	Role management and presence
8.6	Authorisation of data communication
8.7	Authorisation of application
5.20	Data recording and Access

Table 148: Location services – related application list

8.4.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
8.4	Bi-directional data	80/20	User-to-User/Multi-user	Normal	Low	High	Normal	High

Table 149: Location services – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 150: Location services – anticipated frequency of use

8.5 Authorisation of voice communication

8.5.1 Description

- 8.5.1.1 The system shall be configurable, so that access to voice communications can be controlled through the use of, for example: role; identity; user; user-to-user; multi-user; location, etc.

8.5.2 Rationale

- 8.5.2.1 This application allows the network operators to control and regulate voice communications in order to avoid disruption/distraction to the users (for example drivers), preventing unauthorised communication and to minimise network load.

8.5.3 Users

- 8.5.3.1 Network operator.

8.5.4 Functional attributes

- 8.5.4.1 In the case a communication can't be established due to missing authorisation, the user shall be informed about the reason for, and be provided with information on how to deal with, the blocking.
- 8.5.4.2 The implementation shall reduce the risk of misconfiguration in order to avoid impact on applications.

8.5.5 Usability criteria

- 8.5.5.1 The way of defining the authorisation shall be as flexible as possible. The authorisation conditions shall be based on registered functional identities of the calling party and called party/ies, on dialled destination and eventually on the subscriber profile.
- 8.5.5.2 Authorised personnel shall be able to correct misconfigurations without delay.

8.5.6 Related application interfaces

- 8.5.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 151 included within their profile.

Ref	Title of related application
8.7	Authorisation of application

Table 151: Authorisation of voice communication – related application list

8.5.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
8.5	Bi-directional data	N/A	N/A	N/A	N/A	High	N/A	High

Table 152: Authorisation of voice communication – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 153: Authorisation of voice communication – anticipated frequency of use

8.6 Authorisation of data communication

8.6.1 Description

- 8.6.1.1 The system shall be configurable, so that access to data communications can be controlled through the use of, for example: role; identity; user; user-to-user; multi-user; location, etc.

8.6.2 Rationale

- 8.6.2.1 This application allows the network operators to control and regulate data communications in order to avoid disruption/distraction to the users (for example drivers), preventing unauthorised communication and to minimise network load.

8.6.3 Users

- 8.6.3.1 Network operator.

8.6.4 Functional attributes

- 8.6.4.1 In the case a communication can't be established due to missing authorisation, the user shall be informed about the reason of the blocking.
- 8.6.4.2 The implementation shall reduce the risk of misconfiguration in order to avoid impact on applications.

8.6.5 Usability criteria

- 8.6.5.1 The way of defining the authorisation shall be as flexible as possible, the authorisation conditions shall be based on registered functional identities involved users, on destination address and on subscriber profile

8.6.6 Related application interfaces

- 8.6.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 154 included within their profile.

Ref	Title of related application
8.7	Authorisation of application

Table 154: Authorisation of data communication – related application interfaces

8.6.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
8.6	Bi-directional data	N/A	N/A	N/A	N/A	High	N/A	High

Table 155: Authorisation of data communication – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 156: Authorisation of data communication – anticipated frequency of use

8.7 Authorisation of application

8.7.1 Description

- 8.7.1.1 The system shall be configurable, so that access to applications can be controlled through the use of, for example: role; identity; user; user-to-user; multi-user; location, etc. The system is able to authorize access to applications.

8.7.2 Rationale

- 8.7.2.1 This application allows the network operators to control the use of applications by users in order to avoid disruption/distraction to the users (for example drivers), preventing unauthorised usage and to minimise network load.

8.7.3 Users

- 8.7.3.1 Network operator.

8.7.4 Functional attributes

- 8.7.4.1 The implementation shall reduce the risk of misconfiguration in order to avoid impact on applications.

8.7.5 Usability criteria

- 8.7.5.1 Only authorised applications shall be presented to the user depending on his authorization and on the context.
- 8.7.5.2 In the case an application is relying on other applications, the provisioning of all required applications authorisation shall be managed by the system.

8.7.6 Related application interfaces

- 8.7.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 157 included within their profile.

Ref	Title of related application
	none

Table 157: Authorisation of application – related application list

8.7.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
8.7	Bi-directional data	50/50	User-to-User	Normal	Low	High	Normal	High

Table 158: Authorisation of application – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 159: Authorisation of application – anticipated frequency of use

8.8 Prioritisation

8.8.1 Description

- 8.8.1.1 The system shall be able to prioritise data or voice communication in order to enable pre-emption, precedence, call arbitration, etc. based on the context of the communication.

8.8.2 Rationale

- 8.8.2.1 This application allows to prioritise communications in order to ensure that eligible communication is able to be established when required.

8.8.3 Users

- 8.8.3.1 Network operator.

8.8.4 Functional attributes

- 8.8.4.1 The categorisation of priorities shall be apparent to all users.
- 8.8.4.2 The application shall be able to be adopted by any railway network.
- 8.8.4.3 Use of priorities shall allow precedence of high priority communications in the system and, when required, pre-emption of already allocated network resources and arbitration between communications.

8.8.5 Usability criteria

- 8.8.5.1 Allocation of priorities to communications shall be based on a combination of application, functional identities and the dialled destination.
- 8.8.5.2 Depending on the user needs and operational needs, an application can be used with different priorities, e.g. a driver-to-controller communication is able to have a “normal” and a “higher” priority.

8.8.6 Related application interfaces

- 8.8.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 160 included within their profile.

Ref	Title of related application
8.7	Authorisation of application

Table 160: Authorisation of application – related application list

8.8.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
8.8	Bi-directional data	50/50	N/A	N/A	N/A	High	N/A	High

Table 161: Authorisation of application – communication attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Low	Low	Low
Yard	Low	Low	Low
Line	Low	Low	Low

Table 162: Authorisation of application – anticipated frequency of use

8.9 Key management communication

8.9.1 Description

- 8.9.1.1 The applications on board shall be able to authenticate the source of the messages received as a trusted source, and shall be able to detect corruption of the messages received.

8.9.2 Rationale

- 8.9.2.1 When an equipment establishes a connection with another equipment (e.g. between an ETCS on board and an RBC), both must be able to authenticate the other equipment and verify that it is an authorised entity. That way, the authenticity and integrity of the information exchanged between them is also achieved.
- 8.9.2.2 The method for authenticating both communicating entities is based on an Identification and Authentication (I&A) dialogue. In order to ensure protection, this dialogue shall take place each time two entities start a new safe connection.

8.9.3 Users

- 8.9.3.1 On-board system, ground system.

8.9.4 Functional attributes

- 8.9.4.1 The on-board system shall be able to initiate data communication to the appropriate ground system.
- 8.9.4.2 The FRMCS system shall automatically route data communication to the appropriate ground system.
- 8.9.4.3 Access to application shall be configured within the system and based upon the permissions associated with each authorised user.
- 8.9.4.4 Data communication shall not be disrupted unless required by call arbitration process or when specifically required by the application.

8.9.5 Usability criteria

8.9.5.1 The initiation of data communication shall not require any human user action.

8.9.6 Related application interfaces

8.9.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 163 included within their profile.

Ref	Title of related application
5.9	Automatic Train Control Communication
5.10	Automatic Train Operation communication
8.6	Authorisation of data communication
8.7	Authorisation of application
8.8	Prioritisation
5.20	Data recording and access
6.20	Transfer of data

Table 163: Key Management communication - related application list

8.9.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
8.9	Bi-directional Data	50/50	User-to-User	Normal	Low	High	Immediate	High

Table 164: Key Management communication – communications attributes

Type of area	Normal (volume)	Degraded (volume)	Emergency (volume)
Station	Medium	Medium	Medium
Yard	Low	Low	Low
Line	Low	Low	Low

Table 165: Key Management communication – anticipated frequency of use

9 Performance Support Applications

9.1 Information help point for public

9.1.1 Description

9.1.1.1 A member of the public shall be able to set up a voice communication with the responsible ground user or train staff.

9.1.2 Rationale

9.1.2.1 A member of the public may desire to obtain railway-relevant information to assist his or her their interaction with the railway. This information could for example be train movement or ticketing related.

9.1.2.2 The provision of this application on-board train is particularly relevant to automatic train operation, especially where no or limited train staff is available on-board.

9.1.3 Users

9.1.3.1 Public.

9.1.4 Functional attributes

9.1.4.1 The system shall automatically route voice communication to the most appropriate ground user (for example based on location, intended operational use, RU identity etc.).

9.1.5 Usability criteria

9.1.5.1 The initiation of a voice communication shall be achieved by a single button press.

9.1.5.2 Users shall be presented with meaningful information when receiving voice communication for example:

- Information relating to the location of the originator.
- A simple description of incoming communication.

9.1.5.3 Where a functional identity is provided, it shall be consistent with the harmonised operational rules (where necessary).

9.1.6 Related application interfaces

9.1.6.1 This section provides information relating to the relationships that exist between this application and others. It is envisaged that a user profile that includes this application will also have all related applications shown in Table 166 included within their profile.

Ref	Title of related application
6.13	Real time video
8.3	Role management and presence
8.4	Location services
8.5	Authorisation of voice communication
8.7	Authorisation of application
8.8	Prioritisation
5.19	Voice recording and access

Table 166: Information help point for public – related application list

9.1.7 Communication attributes

URS Ref.	Type	Symmetry Up/Down	Distribution	Latency	Bandwidth	Reliability	Setup	Speed
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9.1	Bi-directional Voice	50/50	User-to-user	Low	Low	Normal	Normal	High
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Table 167: Information help point for public – communication attributes

Type of area	Normal <small>(volume)</small>	Degraded <small>(volume)</small>	Emergency <small>(volume)</small>
Station	Low	Low	Medium
Yard	Not used	Not used	Not used
Line	Low	Medium	Medium

Table 168: Information help point for public – anticipated frequency of use

10 Business Support Applications

None applicable.

11 References

- [ENE TSI]** Commission Regulation (EU) No 1301/2014 of 18 November 2014 on the technical specifications for interoperability relating to the 'energy' subsystem of the rail system in the Union
On-ground energy data collecting system 4.2.17, referring to LOC & PAS/TSI : On-board Energy measurement system 4.2.8.2.8
- [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.

Appendix A – Fundamental Principles Traceability

Traceability between the fundamental principles defined in section 3.4 and the applications is detailed in Table 169 below.

In the table, “R” indicates that the particular fundamental principle is considered relevant to the application.

		Fundamental Principles							
Applications		Pr1	Pr2	Pr3	Pr4	Pr5	Pr6	Pr7	Pr8
5.1	On-train outgoing voice communication from the driver towards the controller(s) of the train	R	R	R	R		R	R	R
5.2	On-train incoming voice communication from the controller towards the driver	R	R	R	R		R	R	R
5.3	Multi-train voice communication for drivers excluding ground user(s)	R	R	R			R	R	R
5.4	Banking voice communication	R	R	R			R	R	R
5.5	Trackside maintenance voice communication	R	R	R		R	R	R	R
5.6	Shunting voice communication	R	R	R	R		R	R	R
5.7	Public emergency call	R	R	R			R	R	R
5.8	Ground to ground voice communications	R		R			R		R
5.9	Automatic train control communication	R	R				R	R	R
5.10	Automatic train operation communication	R	R				R	R	R
5.11	Data communication for Possession management	R	R	R		R	R	R	R
5.12	Trackside maintenance warning system communication	R	R	R		R	R	R	R
5.13	Remote control of Engines	R					R		R
5.14	Monitoring and control of critical infrastructure	R				R	R		R
5.15	Railway emergency communication	R	R	R			R	R	R
5.16	On-train safety device to ground communication	R	R				R	R	R
5.17	Platform/train interface alert	R		R			R	R	R
5.18	Working alone	R	R	R		R	R		R

		Fundamental Principles							
Applications		Pr1	Pr2	Pr3	Pr4	Pr5	Pr6	Pr7	Pr8
5.19	Voice recording and access	R	R		R		R	R	R
5.20	Data recording and access	R	R		R	R	R	R	R
5.21	Shunting data communication	R	R	R	R		R	R	R
6.1	On-train outgoing voice communication from train staff towards a ground user	R	R	R	R		R	R	R
6.2	On-train incoming voice communication from a ground user towards train staff	R	R	R	R		R	R	R
6.3	Multi-train voice communication for drivers including ground user(s)	R	R	R			R	R	R
6.4	On-train voice communication	R	R	R			R		R
6.5	Lineside telephony	R		R	R		R		R
6.6	On-train voice communication towards passengers (Public Address)	R	R	R			R		R
6.7	Station public address	R		R			R		R
6.8	Communication at stations and depots	R	R	R		R	R	R	R
6.9	On-train telemetry communications	R	R			R	R		R
6.10	Infrastructure telemetry communications	R				R	R		R
6.11	On-train remote equipment control	R				R	R		R
6.12	Monitoring and control of non-critical infrastructure	R				R	R		R
6.13	Real time video	R	R			R	R		R
6.14	Wireless on-train data communication for train staff	R	R	R			R		R
6.15	Wireless internet for railway staff on platforms	R	R	R			R		R
6.16	Driver advisory – safety related	R	R				R		R
6.17	Driver advisory - train performance	R	R				R		R
6.18	Train departure related communications	R	R	R			R		R
6.19	Messaging services	R	R	R			R		R
6.20	Transfer of data	R	R			R	R	R	R
6.21	Record and broadcast	R	R	R			R	R	R
7.1	Inviting-a-user messaging	R	R	R			R	R	R
7.2	Emergency help point for public	R	R	R			R	R	R
7.3	Wireless internet on-train for passengers	R	R	R			R		R
7.4	Wireless internet for passengers on platforms	R	R	R			R		R
8.1	Secured voice communication	R	R	R			R	R	R
8.2	Multi-user talker control	R	R	R			R		R
8.3	Role management and	R	R	R			R	R	R

		Fundamental Principles							
Applications		Pr1	Pr2	Pr3	Pr4	Pr5	Pr6	Pr7	Pr8
	presence								
8.4	Location services	R	R	R			R	R	R
8.5	Authorisation of voice communication	R	R				R	R	R
8.6	Authorisation of data communication	R	R				R	R	R
8.7	Authorisation of application	R	R				R	R	R
8.8	Prioritisation	R	R				R	R	R
8.9	Key Management communication	R	R	R		R	R	R	R
9.1	Information help point for public	R	R	R			R	R	R

Table 169: Traceability between applications and fundamental principles