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| Technical Report | |
| 3rd Generation Partnership Project;  Technical Specification Group Services and System Aspects;  Study on Interconnection and Migration Aspects for Railways;  (Release 18) | |
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# Foreword

This Technical Report has been produced bythe 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

# Introduction

The work done for interconnection and migration did not fully address the needs for railways, additional work is required. Before starting additional normative stage 2 work on certain aspects, a study is initiated to identify gaps in existing mechanisms on interconnection and on migration and to develop solutions for those gaps. The technical report provides recommendations for solutions which are candidates for normative work.

# 1 Scope

The present document studies solutions to satisfy interconnection and migration needs for railways. It identifies enhancements to be included in the technical specifications for MCPTT (3GPP TS 23.379 [2]), MCVideo (3GPP TS 23.281 [3]), MCData (3GPP TS 23.282 [4]) and in the common functional architecture (3GPP TS 23.280 [5]) to support mission critical communications.

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 23.379: "Functional architecture and information flows to support Mission Critical Push To Talk (MCPTT); Stage 2".

[3] 3GPP TS 23.281: "Functional architecture and information flows to support Mission Critical Video (MCVideo); Stage 2".

[4] 3GPP TS 23.282: "Functional architecture and information flows to support Mission Critical Data (MCData); Stage 2".

[5] 3GPP TS 23.280: "Common functional architecture to support mission critical services; Stage 2".

[6] 3GPP TR 23.744: "Study on location enhancements for mission critical services".

[7] 3GPP TS 33.180: "Security of the Mission Critical (MC) service".

# 3 Definitions of terms, symbols and abbreviations

## 3.1 Terms

For the purposes of the present document, the terms given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

**example:** text used to clarify abstract rules by applying them literally.

## 3.2 Symbols

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

<symbol> <Explanation>

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

<ABBREVIATION> <Expansion>

# 4 Scenarios

NOTE: No scenarios were identified.

# 5 Key issues

## 5.1 Key issue 1 - Optimize the connectivity between MC systems

The operation between multiple MC systems becomes for important and so the path of media and signalling needs to be re-considered. Optimisations on media and signalling routing may save transmission resources and may improve the quality of service.

List of key issues:

- Study and describe the existing mechanism of routing of media and signalling between MC systems.

- Investigate optimizations and develop solutions to improve media and signalling routing between MC service systems.

## 5.2 Key issue 2 - Functional alias handling

The use of functional aliases outside the own home MC system has not been considered by current specifications. Same applies for the use of a functional alias between interconnected MC systems, i.e. between a partner MC system and the home MC system as well as between two partner MC systems. Considerations on functional alias management procedures (activation, deactivation or group binding etc.), which are applied outside the own home MC system, are also missing in current specifications.

List of key issues:

- Describe the related procedures and elaborate the configuration needs for the use of functional alias in a partner MC system which was allocated by the home MC system.

- Describe the use of functional alias (allocated by the home MC system) used in multiple partner MC systems.

- Describe functional alias activation and deactivation procedures and configuration needs when the MC service user is migrated into a partner MC system.

- Elaborate how the transfer and the retrieval of functional alias binding with MC service groups is done when using a functional alias over multiple MC systems.

## 5.3 Key issue 3 - Group communication between MC systems

Group communications require further considerations when MC service users are spread to multiple MC systems or when MC service users re-locate to another MC system during an ongoing group communication.

List of key issues:

- Develop solutions which enable group communications that are spread to multiple MC systems.

- Develop solutions which allow migration to another MC system during an ongoing group communication.

- Elaborate security implications when MC service users are involved that belong to different MC systems.

## 5.4 Key issue 4 - Location information with multiple MC systems

The use of location related procedures when involving users of multiple MC service systems are not covered by current specifications.

List of key issues:

- Study current location information procedures and configuration data and elaborate its applicability when MC service users operating in multiple MC systems are involved.

- Develop solutions (incl. required configuration data) to support location information management procedures for operation in multiple MC systems.

- Elaborate any security related aspects when location information is exchanged and managed between multiple MC systems.

## 5.5 Key issue 5 - Quick migration towards another MC system

For railways there is a need to migrate from one MC system to another MC system (organization) at high speed with no loss of service (regular border crossing scenario).

List of key issues:

- Study current migration solutions and investigate possible improvements.

- If required, develop new solutions to support quick migration from one MC system to another MC system.

- Elaborate which configuration data is required to support quick migration.

- Elaborate if there are any security implications to support quick migration.

## 5.6 Key issue 6 - Call forwarding/transfer between MC systems

The use of supplementary services between interconnected MC systems, i.e. between a partner MC system and the home MC system as well as between two partner MC systems, has not been specified.

Solutions are needed to enable call forwarding and call transfer procedures between interconnected MC systems.

List of key issues:

- Develop solutions which enable call forwarding to MC service users in a different MC system.

- Develop solutions which enable call transfer involving MC service users in a different MC system.

## 5.7 Key issue 7 - IP connectivity between MC systems

IP connectivity related aspects that involve two MC systems needs further investigations. Point-to-point and group standalone transmissions are to be considered as well as scenarios when the MC service user is abroad and uses home breakout or local breakout.

List of key issues:

- Investigate and develop solutions for IP connectivity point-to-point transmissions that involves two MC systems (support home and local breakout).

- Investigate and develop solutions for IP connectivity group standalone transmissions that involves two MC systems (support home and local breakout).

## 5.8 Key issue 8 – Offline-Migration

Migration aspects in case there is no interconnection between two MC systems have not been considered by current specifications. Reasons for no interconnection between the MC systems may be, due to regulatory constraints, the use of tactical networks in e.g., remote areas and in the case of connection loss. Where cooperation is wanted, an authorized MC service user still needs to be enabled to obtain service from another MC system, where the primary and the partner MC systems are not interconnected.

List of key issues:

- Develop solutions which enable an MC service user to obtain service from another MC system, where there is no interconnection between primary and the partner MC systems.

- Elaborate if there are any security implications, to enable an MC service user to obtain MC services from another MC system, where there is no interconnection between the MC systems.

# 6 Architectural requirements

NOTE: No architectural requirements were identified.

# 7 Solutions

## 7.1 Solution on functional architecture enhancements to support location information

### 7.1.1 General

This solution addresses the key issue 4 described in clause 5.4 on defining a functional architecture when using multiple interconnected MC systems.

### 7.1.2 Solution description

#### 7.1.2.1 Functional architecture

The in 3GPP TR 23.744 [6] clause 6.14 described functional architecture of interconnected MC systems for the exchange of location information is used to support the following scenarios:

a. immediate location information requests and reports;

b. history location information requests and reports;

c. event triggered location information reports based on subscriptions;

d. configuration of event triggered location information reports; and

e. handling of location information subscriptions, e.g. subscription requests, cancellation of subscriptions.

#### 7.1.2.2 Reference points

The in 3GPP TR 23.744 [6] clause 6.14 described reference points between entities of interconnected MC systems for the exchange of location information are used to support following scenarios:

a. utilizing the connection of the MC gateway servers; and

b. utilizing the connection of the Location management servers.

### 7.1.3 Solution evaluation

The enhancements of the functional architecture described in 3GPP TR 23.744 [6] clause 6.14 fulfil the need for the exchange of location information in case of interconnection.

## 7.2 Solutions on providing location information

### 7.2.1 General

This solution addresses the key issue 4 described in clause 5.4 on defining the usage of the functional architecture when using multiple interconnected MC systems.

### 7.2.2 Solution description

#### 7.2.2.1 Immediate location information requests and reports

Building on 3GPP TR 23.744 [6] clause 6.15.2.7 as well as clause 6.15.2.8 the functional alias(es) may be included to the described information flows.

The on-demand request of location information procedure described in 3GPP TR 23.744 [6] clause 6.15.2.9 is utilized.

#### 7.2.2.2 History location information requests and reports

Building on 3GPP TS 23.280 [5] clauses 10.9.2.11, 10.9.2.12, 10.9.2.13, 10.9.2.14, 10.9.2.15 as well as clause 10.9.1.16 the functional alias(es) may be included to the described information flows.

Building on 3GPP TS 23.280 [5] clauses 10.9.3.9.2.2, 10.9.3.9.3.3 as well as clause 10.9.3.9.4.3 additional procedures are needed to cover cases of the interconnected MC systems.

#### 7.2.2.3 Event triggered location information reports based on subscriptions

Building on 3GPP TR 23.744 [6] clause 6.15.2.4 the functional alias(es) may be included to the described information flow.

The event-triggered location information notification procedure described in 3GPP TR 23.744 [6] clause 6.15.2.6 is utilized.

#### 7.2.2.4 Configuration of event triggered location information reports

Building on 3GPP TR 23.744 [6] clause 6.15.2.14 as well as clause 6.15.2.15 the functional alias(es) may be included to the described information flows.

The location reporting temporary configuration procedure described in 3GPP TR 23.744 [6] clause 6.15.2.16 is utilized.

#### 7.2.2.5 Handling of location information subscriptions

Building on 3GPP TR 23.744 [6] clauses 6.15.2.2, 6.15.2.3, 6.15.2.11 as well as clause 6.15.2.12 the functional alias(es) may be included to the described information flows.

The Location information subscription procedure described in 3GPP TR 23.744 [6] clause 6.15.2.5 is utilized.

The Location information cancel subscription procedure described in 3GPP TR 23.744 [6] clause 6.15.2.13 is utilized.

### 7.2.3 Solution evaluation

The following aspects of the key issue 4 - Location information with multiple MC systems is addressed with the above solution:

- The current available information flows and procedures in 3GPP TR 23.744 [6] and 3GPP TS 23.280 [5] are analysed for interconnected MC systems. Especially 3GPP TR 23.744 [6] is addressing a wide range of information flows and procedures required for the interconnected MC system use case.

- Missing procedures for the exchange of history location information are identified and require further investigation for the explicit need with the interconnected MC system use case.

- The analysed information flows and procedures in 3GPP TR 23.744 [6] and 3GPP TS 23.280 [5] do not show additional security implications for the interconnected MC system use case.

## 7.3 Private call using functional alias towards a partner MC system

### 7.3.1 General

This solution addresses the key issue 2 described in clause 5.2 on functional alias handling.

The solution provides the possibility for an MCPTT user to initiate a private MCPTT call using a functional alias as target address towards an MCPTT user in a partner MCPTT system.

### 7.3.2 Solution description

#### 7.3.2.1 Principle

Allow the MCPTT server in the primary MC system, to send an MCPTT private call request to an MCPTT server in the partner MC system using a functional alias without incorporating the MCPTT ID of the called party.

Extend the MCPTT service configuration data so that the MC server in the primary MC system can identify that the functional alias belongs to a partner MC system. This is done by using certain formats for functional aliases belonging to the partner MC system towards the private call request is to be forwarded.

#### 7.3.2.2 Configuration

The MCPTT service configuration data is extended to contain the list of MC system identities and corresponding functional alias mask (e.g. \*.sbb.ch) information for all partner MCPTT systems. Based on the functional alias mask configured for all the partner MCPTT systems, the primary MCPTT server can route the request to the proper partner MCPTT system.

Proposed modifications in 3GPP TS 23.379 [2] Table A.5-2 MCPTT service configuration data (on-network):

Table 7.3.2.2-1: MCPTT service configuration data (on network)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | List of partner MCPTT systems where system specific configuration applies for interconnection |  |  |  |
|  | > MC system identity of partner MCPTT system | N | Y | Y |
|  | > Functional alias mask | N | Y | Y |

NOTE: The use of the same functional alias in multiple MC systems is not supported.

#### 7.3.2.3 Messages

The MCPTT private call request between MCPTT servers is modified to allow only using the functional alias as called party address, i.e. the MCPTT ID address is not resolved and not contained by the primary MCPTT server.

Proposed modifications in 3GPP TS 23.379 [2] Table 10.7.2.1.2-1: MCPTT private call request (MCPTT server to MCPTT server) information elements:

Table 7.3.2.3-1: MCPTT private call request (MCPTT server to MCPTT server) information elements

|  |  |  |
| --- | --- | --- |
| Information Element | Status | Description |
| MCPTT ID | M | The MCPTT ID of the calling party |
| Functional alias | O | The functional alias of the calling party |
| *MCPTT ID (see NOTE)* | *O* | *The MCPTT ID of the called party* |
| *Functional alias (see NOTE)* | *O* | *The functional alias of the called party* |
| Use floor control indication | M | This element indicates whether floor control will be used for the private call. |
| SDP offer | M | Media parameters of MCPTT client. |
| Requested commencement mode | O | An indication of the commencement mode to be used. |
| Implicit floor request | O | An indication that the user is also requesting the floor. |
| Requested priority | O | Priority level requested for the call. |
| Location information | O | Location of the calling party |
| NOTE: At least one identity must be present. | | |

#### 7.3.2.4 Procedure

The MCPTT private call setup procedure between MCPTT servers is modified to allow using the functional alias as called party address, i.e. the MCPTT ID address is not resolved by the primary MCPTT system, instead the primary MCPTT server uses the functional alias mask information configured in the MCPTT service configuration data to send the request towards the proper MCPTT system.

Proposed changes against 3GPP TS 23.379 [2] clause 10.7.2.3.1: Private call setup in automatic commencement mode - MCPTT users in multiple MCPTT systems:

NOTE: The changes are applicable when using manual commencement mode as well.



Figure 7.3.2.4-1: Private call setup in automatic commencement mode - users in multiple MCPTT systems

1./2. No change.

3. The MCPTT private call request contains the MCPTT ID or functional alias of invited user.

NOTE: End-to-end encryption requires the target MCPTT ID.

4./5. No change.

6. If the MCPTT private call request is initiated by using a functional alias as called party address, then the target MCPTT system is identified by help of configured functional alias mask in the MCPTT service configuration data.

7. If the MCPTT server private call request contains a functional alias as called party address, the MCPTT server resolves the MCPTT ID of the called MCPTT user by using the functional alias address.

8.-12. No change.

### 7.3.3 Solution evaluation

The solution describes a private MCPTT call setup using a functional alias as target address towards an MCPTT user in a partner MCPTT system. The solution relies on proper MCPTT service configuration data so that the MC server in the primary MC system can identify the partner MC system to which the call is to be routed.

The solution principle can be re-used for private MCVideo call and point-to-point MCData call scenarios.

## 7.4 Functional alias support for migrated users

### 7.4.1 General

This solution addresses the key issue 2 described in clause 5.2 on functional alias handling.

The solution provides the possibility to configure proper functional aliases for MC service users migrating to a partner MC system.

### 7.4.2 Solution description

#### 7.4.2.1 Principle

The solution relies on the existing procedure "MC service user receiving MC service from a partner MC system" described in 3GPP TS 23.280 [5] clause 10.1.4.3.2. The procedure can provide the list of functional aliases for use in the partner MC system as part of the migration MC service user profile.

#### 7.4.2.2 Procedure

A set of functional aliases for each primary MC system is configured in the partner MC system. After the MC user is migrated from the primary MC system into the partner MC system, the partner MC system provides the MC user profile for migration which includes a preconfigured set of functional aliases allowed to be used within the partner MC system.

The MC configuration management server provides the functional alias management server functionality as described in subclause 7.4.2.2.13 of 3GPP TS 23.280 [5]. The configuration management server functionality is extended with the configuration function for functional alias sets for different partner MC system.

NOTE: Different migrated MC users from different partner MC systems may need different functional alias sets; i.e. the configuration acts on MC partner system basis.

The procedure is described in 3GPP TS 23.280 [5] clause 10.1.4.3.2: MC service user receiving MC service from a partner MC system:



Figure 7.4.2.2-1: Retrieval of user profile in partner MC system

Within step 5 above the partner MC system has the option of modifying the MC user profile for migrated users. Step 5 is enhanced to support functional alias sets for use in the partner MC system.

After the MC service UE has received the MC service user profile in step 9, the MC service user is able to activate functional aliases within the partner MC system and use them for communication in the partner MC system.

NOTE: The use of the same functional alias in multiple MC systems is not supported.

#### 7.4.2.3 Configuration

The configuration management server in the primary MC system of the MC service user stores the list of allowed functional aliases and related information as part of the MC service user profile which can be differently configured for each partner MC system. The current specified user profile configuration data set can be used for that purpose. The partner MC system may modify the list of allowed functional aliases according to local configuration information, e.g. remove, add or modify functional aliases.

### 7.4.3 Solution evaluation

The solution describes that the existing procedure called MC service user receiving MC service from a partner MC system described in 3GPP TS 23.280 [5] can be used to provide a list of functional aliases to be used in the partner MC system. The solution is applicable to all MC services and call scenarios.

## 7.5 Migration during an ongoing group communication

### 7.5.1 General

This solution addresses the key issue 3 described in clause 5.3 on group communication between MC systems.

The solution provides the capability for an MC service user to migrate to another MC system during an ongoing group communication and to continue the group communication in the other MC system.

### 7.5.2 Solution description

#### 7.5.2.1 Procedure

The procedure is based on the following existing procedures:

- MC service group de-affiliation procedure as described in TS 23.280 [5] clause 10.8.4.2, or

- De-affiliation from MC service group(s) defined in partner MC service system and is described in TS 23.280 [5] clause 10.8.4.3.

- MC service user receiving MC service from a partner MC system as described in TS 23.280 [5] clause 10.1.4.3.2.

- MC service group affiliation procedure as described in TS 23.280 [5] clause 10.8.3.1, or

- Affiliation to MC service group(s) defined in partner MC system as described in TS 23.280 [5] clause 10.8.3.2 or clause 10.8.3.2a.

- Late entry pre-arranged group call as described in TS 23.379 [2] clause 10.6.2.3.1.1.4.

NOTE 1: The solution is about MCPTT group calls but is applicable for other services too.

Pre-conditions:

1. The MCPTT client is a receiving party in one or more ongoing group calls in the primary MC system.

2. The MCPTT UE detects the need to change the MC system.



Figure 7.5.2.1-1: Migration to partner MC system during an ongoing group calls

1. The MCPTT client requests de-affiliation from MCPTT groups. The MCPTT groups are either defined in the primary MC system (TS 23.280 [5] clause 10.8.4.2) or the partner MC system (TS 23.280 [5] clause 10.8.4.3). The MCPTT client de-authorizes from the primary MC System.

2. After migration to the partner MC system, the configuration management client triggers retrieval of the MC service user profile used within the partner MC system (TS 23.280 [5] clause 10.1.4.3.2).

NOTE 2: User authentication, service authorisation and signalling plane procedures are not shown.

3. The MCPTT client requests affiliation to MCPTT groups. The MCPTT groups are either defined in the primary MC system (TS 23.280 [5] clause 10.8.3.1) or the partner MC system (TS 23.280 [5] clause 10.8.3.2 or clause 10.8.3.2a).

4. If any of the received group calls are ongoing in the partner MC system, the partner MC system shall initiate a late-entry procedure towards the MCPTT client. If any of the received group calls are taken place in the primary MC system but not yet in the partner MC system, the affiliation by the migrated MCPTT UE triggers the late-entry procedure which then includes the MCPTT UE and the partner MC system into the group call.

The MCPTT client may indicate the successful migration of group communications to the MCPTT user.

### 7.5.3 Solution evaluation

The solution provides the capability for an MCPTT user to migrate to another MCPTT system during an ongoing MCPTT group communication and to continue the group communication in the partner MC system. The solution relies on existing procedures on group affiliation and group de-affiliation, user profile retrieval in the partner MC system and late entry for pre-arranged group calls.

The solution principle can be re-used for MCVideo and MCData group call scenarios, if needed.

## 7.6 Migration during an ongoing private communication

### 7.6.1 General

This solution addresses the key issue 5 described in clause 5.5 on quick migration towards another MC system.

The solution provides the capability for an MC service user to migrate to another MC system during an ongoing private communication and to continue the private communication in the other MC system without MC service user interaction.

### 7.6.2 Solution description

#### 7.6.2.1 Procedure

NOTE 1: The solution is about MCPTT private calls but is applicable for other services too.

Pre-conditions:

1. The MCPTT client has one or more ongoing private calls in the primary MC system.

2. The MCPTT UE detects the need to change the MC system.



Figure 7.6.2.1-1: Migration to partner MC system during an ongoing private call

1. MCPTT client 1 requests private call suspend to put the call into suspended state in MCPTT client 2. The call is cleared between MCPTT server 1 and MCPTT server 2, and knowledge of the suspended call is held by MCPTT client 1 and MCPTT client 2. The MCPTT users of MCPTT client 1 and MCPTT client 2 get an indication that the private call has been suspended. MCPTT client 1 and MCPTT client 2 start a timer to allow the call suspended state to be cleared if the call is not resumed within a predetermined time interval.

2. After migration to the other MC system, the configuration management client 1 triggers retrieval of the MC service user profile used within the partner MC system (TS 23.280 [5] clause 10.1.4.3.2).

NOTE 2: User authentication, service authorisation and signalling plane procedures are not shown.

3. MCPTT client 1 requests a new private call to MCPTT client 2, with the call resume indication to remove the call suspended state in MCPTT client 2. The MCPTT users of MCPTT client 1 and MCPTT client 2 get an indication that the private call has been resumed.

NOTE 3: Any local call restrictions are considered.

NOTE 4: If another private call request is sent to MCPTT client 1 or MCPTT client 2 before the call has resumed, the actions of the receiving MCPTT client are outside the scope of the present document and could include rejecting this new private call request.

The MCPTT client may indicate the successful migration of private call communications to the MCPTT user.

#### 7.6.2.2 Information flows

##### 7.6.2.2.1 MCPTT private call suspend request

Table 7.6.2.2.1-1 describes the information flow MCPTT private call suspend request from the MCPTT client to the MCPTT server, from the MCPTT server to the MCPTT server and from the MCPTT server to the MCPTT client.

Table 7.6.2.2.1-1: MCPTT private call suspend request information elements

|  |  |  |
| --- | --- | --- |
| Information Element | Status | Description |
| MCPTT ID | M | The MCPTT ID of the calling party |
| MCPTT ID | M | The MCPTT ID of the called party |

##### 7.6.2.2.2 MCPTT private call suspend response

Table 7.6.2.2.2-1 describes the information flow MCPTT private call suspend response from the MCPTT client to the MCPTT server, from the MCPTT server to the MCPTT server and from the MCPTT server to the MCPTT client.

Table 7.6.2.2.2-1: MCPTT private call suspend response information elements

|  |  |  |
| --- | --- | --- |
| Information Element | Status | Description |
| MCPTT ID | M | In the direction MCPTT client to MCPTT server this shall be the MCPTT ID of the responding MCPTT client.  In the direction MCPTT server to MCPTT client this shall be the MCPTT ID of the destination MCPTT client. |

##### 7.6.2.2.3 MCPTT private call resume request (MCPTT client to MCPTT server)

Table 7.6.2.2.3-1 describes the information flow MCPTT private call resume request from the MCPTT client to the MCPTT server.

Table 7.6.2.2.3-1: MCPTT private call resume request (MCPTT client to MCPTT server) information elements

|  |  |  |
| --- | --- | --- |
| Information Element | Status | Description |
| MCPTT ID | M | The MCPTT ID of the calling party |
| Functional alias | O | The functional alias of the calling party |
| MCPTT ID (see NOTE) | O | The MCPTT ID of the called party |
| Functional alias (see NOTE) | O | The functional alias of the called party |
| Use floor control indication | M | This element indicates whether floor control will be used for the private call. |
| SDP offer | O | Media parameters of MCPTT client. |
| Requested commencement mode | O | An indication that is included if the user is requesting a particular commencement mode |
| Implicit floor request | O | An indication that the user is also requesting the floor. |
| Location information | O | Location of the calling party |
| Requested priority | O | Application priority level requested for this call |
| Transfer indicator | O | Indicates that the MCPTT private call request is a result of a call transfer (true/false) |
| Forwarding indicator | O | Indicates that the MCPTT private call request is a result of a call forwarding (true/false) |
| NOTE: At least one identity must be present. | | |

##### 7.6.2.2.3a MCPTT private call resume request (MCPTT server to MCPTT server)

Table 7.6.2.2.3a-1 describes the information flow MCPTT private call resume request from the MCPTT server to the MCPTT server.

Table 7.6.2.2.3a-1: MCPTT private call resume request (MCPTT server to MCPTT server) information elements

|  |  |  |
| --- | --- | --- |
| Information Element | Status | Description |
| MCPTT ID | M | The MCPTT ID of the calling party |
| Functional alias | O | The functional alias of the calling party |
| MCPTT ID | M | The MCPTT ID of the called party |
| Functional alias | O | The functional alias of the called party |
| Use floor control indication | M | This element indicates whether floor control will be used for the private call. |
| SDP offer | M | Media parameters of MCPTT client. |
| Requested commencement mode | O | An indication of the commencement mode to be used. |
| Implicit floor request | O | An indication that the user is also requesting the floor. |
| Requested priority | O | Priority level requested for the call. |
| Location information | O | Location of the calling party |

##### 7.6.2.2.3b MCPTT private call resume request (MCPTT server to MCPTT client)

Table 7.6.2.2.3b describes the information flow MCPTT private call resume request from the MCPTT server to the MCPTT client.

Table 7.6.2.2.3b: MCPTT private call resume request (MCPTT server to MCPTT client) information elements

|  |  |  |
| --- | --- | --- |
| Information Element | Status | Description |
| MCPTT ID | M | The MCPTT ID of the calling party |
| Functional alias | O | The functional alias of the calling party |
| MCPTT ID | M | The MCPTT ID of the called party |
| Functional alias | O | The functional alias of the called party |
| Use floor control indication | M | This element indicates whether floor control will be used for the private call. |
| SDP offer | M | Media parameters of MCPTT client. |
| Requested commencement mode | O | An indication of the commencement mode to be used. |
| Implicit floor request | O | An indication that the user is also requesting the floor. |

##### 7.6.2.2.4 MCPTT private call resume response (MCPTT client to MCPTT server)

Table 7.6.2.2.4-1 describes the information flow MCPTT private call resume response from the MCPTT client to the MCPTT server.

Table 7.6.2.2.4-1: MCPTT private call resume response (MCPTT client to MCPTT server) information elements

|  |  |  |
| --- | --- | --- |
| Information Element | Status | Description |
| MCPTT ID | M | The MCPTT ID of the calling party |
| Functional alias | O | The functional alias of the calling party |
| MCPTT ID | O | The MCPTT ID of the called party |
| Functional alias | O | The functional alias of the called party |
| SDP answer | M | Media parameters selected |
| Requested commencement mode | O | An indication of the commencement mode to be used. |

##### 7.6.2.2.4a MCPTT private call resume response

Table 7.6.2.2.4a -1 describes the information flow MCPTT private call resume response from the MCPTT server to the MCPTT server and the MCPTT server to the MCPTT client.

Table 7.6.2.2.4a-1: MCPTT private call resume response information elements

|  |  |  |
| --- | --- | --- |
| Information Element | Status | Description |
| MCPTT ID | M | The MCPTT ID of the calling party |
| Functional alias | O | The functional alias of the calling party |
| MCPTT ID | O | The MCPTT ID of the called party |
| Functional alias | O | The functional alias of the called party |
| Acceptance confirmation | O | An indication whether the user has positively accepted the call. |
| SDP answer | M | Media parameters selected |

### 7.6.3 Solution evaluation

The solution provides the capability for an MCPTT user to migrate to another MCPTT system during an ongoing MCPTT private communication and to continue the private communication in the partner MC system. The solution relies on a new MCPTT private call suspend/resume procedure and an existing procedure for user profile retrieval in the partner MC system.

The solution principle can be re-use for MCVideo and MCData group call scenarios, if needed.

## 7.7 Optimize the connectivity between MC systems

### 7.7.1 General

This solution addresses the key issue 1 described in clause 5.1 on media and signalling routing. The aspect of the optimal routing of the media is of particular interest, so that delays especially in the media plane caused by the route involving the Home MC system can be eliminated. This is of elementary interest, especially used for data traffic in the process automation context. Also voice and video may benefit from the proposed approach in reducing latencies.

The solution addresses the aspect how to obtain the information about the association between MC service user and the partner MC system when MC service user was migrated to another MC system. The proposed new procedural elements will determine target MC service user migration status before the media gets routed to the target MC system.

### 7.7.2 Solution description

#### 7.7.2.1 Principle

The basic approaches with regard to migration, the necessary authentication and the migrated call handling have already been specified in 3GPP TS 23.280 [5]. For example, in the rail environment, more dynamic is anticipated because a train can use several partner organizations for its communication needs regardless of time during its mission (e.g., cargo trains commute between Rotterdam and Genoa). Terminating communication requirements are particularly affected and only the MC service server of the primary MC system has the current association with the respective partner MC system of its MC service client. Such information is decisive for the determination of the partner MC system to control the call routing accordingly. Accordingly, for each migrated MC service client call routing, a lookup to determine the currently visited partner organization need to be preceded.

#### 7.7.2.2 Procedure

The proposed MC system interrogation is a real time query to obtain current up-to-date status information of the corresponding MC service client. The resulting MC system interrogation status information of the MC service client will determine corresponding call routing, message delivery etc. towards the corresponding MC service user. In general, the MC system interrogation can be used for various purposes to obtain status information of a dedicated MC service client.

Figure 7.7.2.2-1 shows the procedure where an MC service client in MC system 1 initiates a private call to an MC service client which is migrated to MC system 3.

Preconditions:

- The corresponding MC systems are interconnected.

- MC service client belonging to primary MC system 2 migrated to partner MC system 3.

- Interconnected MC systems can derive the corresponding primary MC system of the targeted/migrated MC service users.

- Functional alias resolution is executed prior call request forwarding starts.



Figure 7.7.2.2-1: Interrogation to determine the MC system and MC service client association

1. MC service client associated with MC system 1 initiates a call request to a target MC service client belonging to MC system 2. MC system 1 need to figure out to which target MC system the call request needs to be forwarded. The called MC service ID is used to determine the primary MC system to request necessary MC user information to be able to route the communication/media.

2. Request MC user info is used to retrieve the current MC user migration status and to obtain relevant routing information of the corresponding MC system where the MC service client is currently located.

3. MC system 2 looks up MC service user information to figure out current MC service users to MC system association. In the illustrated case, the MC service user is migrated to MC system 3.

4. MC system 2 responds to the request with Response MC user info, which includes the MC service ID of MC service client 2, currently migrated to MC system 3

5. MC system 1 uses the received MC user information to forward the communication/media to MC system 3 addressing MC service client belonging to MC system 2.

6. The call response acknowledges the communication request toward MC service client of MC system 1.

7. Necessary media, if necessary, floor control and transmission control is established between the corresponding MC service client.

#### 7.7.2.3 Configuration

The corresponding primary MC service server needs to keep track about the migration status of its associated MC service user. This information gets looked up to route communications/media to the corresponding MC system who the MC service user is located. The information necessary for routing calls/communications towards a MC service user need to contain unique MC system identifier e.g., organisation identifier.

#### 7.7.2.4 Information flows

##### 7.7.2.4.1 General

The information flows address the aspect that various MC service communications may use the proposed flows to forward a communication directly to the target MC system without passing through the primary MC system of the migrated MC service user.

##### 7.7.2.4.2 Request MC user info

The MC system uses the flow to determine the primary MC system ID based on the targeted MC service user primary MC system association.

Table 7.7.2.4.2-1: Request MC user info - information elements

|  |  |  |
| --- | --- | --- |
| Information Element | Status | Description |
| MC node ID requesting MC system | M | MC service node identifier of the requesting MC system. |
| MC node ID queried MC system | M | MC service node identifier of the queried MC system ,e.g., MC gateway server. |
| MC service ID | M | MC service ID to be interrogated. |

##### 7.7.2.4.3 Response MC user info

The response MC user info is used to inform the requesting MC system about the migration status of the interrogated MC service user.

Table 7.7.2.4.3-1: Response MC user info - information elements

|  |  |  |
| --- | --- | --- |
| Information Element | Status | Description |
| MC node ID queried MC system | M | MC service node identifier of the queried MC system ,e.g., MC gateway server. |
| MC node ID requesting MC system | M | MC service node identifier of the requesting MC system. |
| MC service ID | M | Interrogated MC service ID. |
| MC system ID | M | Unique identifier of the MC system the migrated MC service user is associated during the query. |
| MC node ID | M | MC node ID the migrated MC service user is associated. |

### 7.7.3 Solution evaluation

The solution proposes a new procedure to allow flexibility in communication/media routing for the use case when MC service users enter during their whole mission multiple MC systems and those MC systems are interconnected. The MC user information retrieval allows real time lookup of current MC service user migration status and corresponding necessary routing information to reach migrated MC service users. The communication and the corresponding media can be directly routed towards the MC system where the migrated MC service resides bypassing the Primary MC system of the migrated MC service user.

This solution impacts current assumed call flow processing at the MC service server (MO side) where in the MC service server does not forward the call request to the home MC system of the addressed MC service user and the media routing is always directly between the originated MC system 1 (call originator) and the terminating MC system 3 (migrated MC service user).

The proposed procedure and corresponding flows can be used independent from the MC service.

## 7.8 Private call using functional alias towards a partner MC system

### 7.8.1 General

This solution addresses the key issue 2 described in clause 5.2 on functional alias handling.

The solution provides the possibility for an MCPTT user to initiate a private MCPTT call using a functional alias, defined in the partner MC system, as target address towards an MCPTT user in a partner MC system.

### 7.8.2 Solution description

#### 7.8.2.1 Principle

Allow the MCPTT functional alias controlling server in the primary MC system interworks with the MCPTT functional alias controlling server in the partner MC system to resolve the functional alias used for a private call towards a partner MC system using a functional alias.

In TS 3GPP TS 23.280 [5], clause 8.1.5 defines the functional alias as a form of a URI. As a common form of an URI it is represented as userinfo@host where the user info part can be the functional alias and the host part can be the domain that hosts the functional alias controlling server. With this clarification in 3GPP TS 23.280 [5], the functional alias shall identify where its MC service functional alias controlling server locates.

We have standardized how the functional alias is used in a private call in the same MC system in 3GPP TS 23.379 [2] clause 10.7.2.2 that includes end-to-end encryption security and the same mechanism is proposed to be used in a private call between 2 MC systems, i.e. the resolution of the called party functional alias (i.e. the MCPTT ID) shall be used by the originating party to setup the private call. Doing this the primary MCPTT FA controlling server shall query the partner MCPTT FA controlling server to resolve the called party functional alias for the private call.

#### 7.8.2.2 Functional alias clarification

To clarify the architectural requirement of the format of the functional alias, it is proposed to add clarification to the 3GPP TS 23.280 [5] clause 8.1.5 as:

- Functional alias provides a complementary, role-based user identification scheme which can be used by MC service users for operational purposes in the form of meaningful elements such as the function, the order number or vehicle identifications that can be used within any form of MC service communication. Functional alias takes a form of a URI where the host part of the URI shall identify the home MC system functional alias controlling server. The application addressing remains in its form and forms the foundation for the association with the corresponding functional alias. An MC service user can simultaneously activate several functional aliases but only one can be associated to a certain communication.

- Each functional alias is subject to the uniqueness principle within an organization and can be shared simultaneously by several MC service users, depending on the assignment. In this case, all assigned MC service users sharing a functional alias can be included in a communication.

- An MC service user can simultaneously use different functional aliases from multiple service organizations to allow the MC service user to be reachable by different organizations.

- The use of a functional alias always requires an association with the MC service ID. The MC service ID needs to be used to provide the security context for a communication.

#### 7.8.2.3 Functional alias resolution

When the MCPTT FA controlling server receives a request to resolve a functional alias and if the requested functional alias belongs to a different MC system, the MCPTT FA controlling server sends a request to the partner MC system's MCPTT FA controlling server for resolution. The partner MC system's MCPTT FA controlling server will resolve the functional alias with a terminating MCPTT ID and returns it to the requesting MCPTT FA controlling server.

The information flow in 3GPP TS 3GPP 23.379 [2] clause 10.7.2.1.8 is modified as:

##### 7.8.2.3.1 MCPTT functional alias resolution response

Table 7.8.2.3-1 describes the information flow MCPTT functional alias resolution response from the MCPTT functional alias controlling server to another MCPTT functional alias controlling server, the MCPTT functional alias controlling server to the MCPTT server and the MCPTT server to the MCPTT client.

Table 7.8.2.3-1: MCPTT functional alias resolution response information elements

|  |  |  |
| --- | --- | --- |
| Information Element | Status | Description |
| MCPTT ID | M | The MCPTT ID of the calling party |
| MCPTT ID | M | The corresponding MCPTT ID of the called functional alias. Return "NONE" if no one activates the targeted Functional Alias. |

##### 7.8.2.3.2 MCPTT functional alias resolution request

Table 7.8.2.3-2 describes the information flow MCPTT functional alias resolution request from the MCPTT server to the MCPTT functional alias controlling server and from the MCPTT functional alias controlling server to another MCPTT functional alias controlling server.

Table 7.8.2.3-2: MCPTT functional alias resolution request information elements

|  |  |  |
| --- | --- | --- |
| Information Element | Status | Description |
| MCPTT ID | M | The MCPTT ID of the calling party |
| Functional alias | O | The functional alias of the calling party |
| Functional alias | M | The functional alias of the called party |

#### 7.8.2.4 Procedure

The MCPTT private call setup procedure between MCPTT servers is modified to allow using the functional alias as called party address, i.e. the MCPTT ID address is resolved by the partner MC system through the primary MCPTT server and primary MCPTT functional alias controlling server.

Proposed changes against 3GPP TS 23.379 [2] clause 10.7.2.3.1: Private call setup in automatic commencement mode - MCPTT users in multiple MC systems with additional functional alias resolution steps similar to the mechanism used in TS 3GPP 23.379 [2] clause 10.7.2.2.1:

NOTE: The changes are applicable when using manual commencement mode as well.

Additional new pre-condition:

1. A secured connection has been established between the MCPTT functional alias controlling servers in different MC systems.



Figure 7.8.2.4-1: Private call setup in automatic commencement mode - users in multiple MC

systems

1-2. same as step 1-2 in 3GPP TS 23.379 [2] clause 10.7.2.3.1, no change.

3. The MCPTT private call request contains the MCPTT ID or functional alias of invited user.

4. If the MCPTT private call request contains a functional alias instead of an MCPTT ID as called party, the MCPTT server 1 shall resolve the functional alias to the corresponding MCPTT ID for which the functional alias is active using steps 5-8 below. The MCPTT server shall also check whether MCPTT client 1 can use the functional alias to setup a private call. If authorized, proceed to step 5.

Otherwise (using MCPTT ID for the MCPTT private call) the MCPTT server 1 checks whether the MCPTT user at MCPTT client 1 is authorized to initiate the private call to the MCPTT user at MCPTT client 2; if authorized proceed to step 11.

5-10 new additional steps as:

5. The MCPTT server 1 sends MCPTT functional alias resolution request message to the MCPTT FA controlling server 1 to resolve the functional alias of the called party.

6. The MCPTT FA controlling server 1 determines that the function alias belongs to MCPTT service provider 2 and forwards the MCPTT functional alias resolution request message to MCPTT FA controlling server 2.

7. The MCPTT FA controlling server 2 resolve the functional alias and determines the corresponding MCPTT ID shall be used to terminate the call and returns it to the MCPTT FA controlling server 1 in the MCPTT functional alias resolution response message.

NOTE: Depending on implementation the MCPTT server can apply additional call restrictions and decide whether the call is allowed to proceed with the resolved MCPTT ID(s) (e.g. whether the MCPTT ID is within the allowed area of the functional alias). If the MCPTT server detects that the functional alias used as the target of the private call request is simultaneously active for multiple MCPTT users, then the MCPTT server can proceed by selecting an appropriate MCPTT ID based on some selection criteria. The selection of an appropriate MCPTT ID is left to implementation. This selection criteria can include rejection of the call, if no suitable MCPTT ID is selected.

8. The MCPTT FA controlling server 1 returns the corresponding MCPTT ID to MCPTT server 1 in the MCPTT functional alias resolution response message. The MCPTT server 1 shall check if MCPTT user at MCPTT client 1 is authorized to initiate the private call to the MCPTT user at MCPTT client 2. If not authorized stop the procedure, otherwise continue with step 9.

9. The MCPTT server 1 responds with a MCPTT functional alias resolution response message that contains the resolved MCPTT ID back to MCPTT client 1.

10. The MCPTT client 1 sends a new MCPTT private call request towards the resolved MCPTT ID.

11. same as step 6 in 3GPP TS 23.379 [2] clause 10.7.2.3.1, no change.

12. same as step 5 in 3GPP TS 23.379 [2] clause 10.7.2.3.1, no change.

13-15. same as step 7-9 in 3GPP TS 23.379 [2] clause 10.7.2.3.1, no change.

16. The receiving MCPTT client 2 accepts the private call automatically, and an acknowledgement is sent to the MCPTT server 2.

17. The MCPTT server 2 forwards the MCPTT private call response message to MCPTT server 1.

18-19. same as steps 11-12 in 3GPP TS 23.379 [2] clause 10.7.2.3.1, no change.

### 7.8.3 Solution evaluation

The solution describes a private MCPTT call setup using a functional alias as target address towards an MCPTT user in a partner MC system with end-to-end encryption security. The solution relies on new communications between the MCPTT functional alias controlling server between interconnected MC systems with similar functional alias resolution mechanism described in 3GPP TS 3GPP 23.379 [2] clause 10.7.2.2.1.

The solution principle can be re-used for private MCVideo call and point-to-point MCData call scenarios.

## 7.9 Solution on IP connectivity between MC systems

### 7.9.1 General

This solution addresses the key issue 7 described in clause 5.7 on IP connectivity between MC systems defining an alternative to the existing scheme in 3GPP TS 23.280 [5] applicable for IP communications to migrated MC services users bypassing primary MC system. The solution provides an alternative call processing approach bypassing the primary MC system of the migrated MC service user and can be used as a contribution to limited media plane delays.

### 7.9.2 Solution description

#### 7.9.2.1 Functional model

The common functional model in 3GPP TS 23.280 [5] and the functional model that corresponds to MCData in 3GPP TS 23.282 [4] already provides the necessary means for interconnection either using topology hiding using an MC gateway server or without topology hiding not using an MC gateway server.

#### 7.9.2.2 Reference points

The necessary reference points applicable for interconnection and migration in 3GPP TS 23.280 [5] and 3GPP TS 23.282 [4] apply for direct communications between MC systems bypassing the primary MC system associated with a migrated MC service user.

NOTE: MCPTT service and MCVideo service can also reuse defined reference points for interconnection.

#### 7.9.2.3 Procedures and flows

To determine the MC system of the migrated MC service user, the procedure and flow described in clause 7.7 is applied. For call processing applicable generic procedures for interconnection according to 3GPP TS 23.280 [5] applied.

### 7.9.3 Solution evaluation

The enhancements proposed in clause 7.7 allow the determination of the actual hosting MC system of the migrated MC service user. The response user data info contains necessary information about MC system identifier to route the call request directly towards target MC system without passing the primary MC system.

This solution is applicable when communication recording in the primary MC system is not required.

## 7.10 Solution on migration without interconnection between two MC systems

### 7.10.1 General

This solution addresses key issue 8 described in clause 5.8 on enabling an authorized MC service user to migrate to another MC system, where there is no interconnection between the primary and the partner MC systems.

As stated in 3GPP TS 23.280 [5], clause 5.2.9.1, "MC service interconnection needs to be provided between MC systems that wish to provide migration of their MC service users.". However, there are scenarios where an MC service user may need to migrate to an MC partner system (e.g., tactical networks, MC systems without interconnection due to regulatory constraint), where there is no interconnection between the MC systems.

### 7.10.2 Solution description

Pre-conditions

- The MC service user wishes to migrate to a partner MC system, even if there is no interconnetion to the primary MC system.

- The primary and partner Identity Management Server have been provisioned with signing certificates using an out of band mechanism, as specified in 3GPP TS 33.180 [X], clause 5.1.4.2.

- MC service user authentication and authorization has taken place in the primary MC system, which has supplied necessary credentials to the MC service client to permit service authorization to take place in the partner system.

- The MC service client has been configured with an MC service user profile, by the primary MC system, that contains the necessary parameters needed for connectivity with the partner MC system, including authorization for migration.

- The partner MC system has been provisioned with a user profile for the migrating MC service user.



Figure 7.10.2-1 Service authorization for migration to partner MC system

1. The MC service UE migrates to the partner MC system by using the available access information and credentials provided by the primary MC system and after establishing the local PLMN connectivity.

2. The partner MC system performs an authorization check to verify that the MC service user is permitted to migrate, using the inter-domain MC user service authorization procedures, as specified in 3GPP TS 33.180 [7].

### 7.10.3 Solution evaluation

The solution describes how an MC service user can migrate to another MC system, where there is no interconnection between the primary and partner MC systems.

The solution is applicable for all MC services and uses present security mechanisms, as described in 3GPP TS 33.180[7], clause 5.1.4.

## 7.11 Private call forwarding between MCPTT systems

### 7.11.1 General

This solution addresses the call forwarding related aspects of key issue 6 described in clause 5.6 on call forwarding/call transfer between MC systems.

The solution provides the possibility of forwarding MCPTT private calls between MCPTT users in different MCPTT systems.

### 7.11.2 Solution description

#### 7.11.2.1 Principle

Currently call forwarding for MCPTT private calls is defined within one MCPTT system. The following solution defines the necessary changes to allow call forwarding between MCPTT users in different MCPTT systems.

#### 7.11.2.2 Messages

The MCPTT private call forwarding related information flows are modified (and marked with highlighting) to cover necessary elements and messages between MCPTT servers to support MCPTT private call forwarding for users in different MCPTT systems.

Proposed modifications in 3GPP TS 23.379 [2] Table 10.7.2.1.2-1: MCPTT private call request (MCPTT server to MCPTT server) information elements:

NOTE 1: This information flow uses as a baseline Table 7.3.2.3-1.

Table 7.11.2.2-1: MCPTT private call request (MCPTT server to MCPTT server) information elements

|  |  |  |
| --- | --- | --- |
| Information Element | Status | Description |
| MCPTT ID | M | The MCPTT ID of the calling party |
| Functional alias | O | The functional alias of the calling party |
| *MCPTT ID (see NOTE)* | *O* | *The MCPTT ID of the called party* |
| *Functional alias (see NOTE)* | *O* | *The functional alias of the called party* |
| Use floor control indication | M | This element indicates whether floor control will be used for the private call. |
| SDP offer | M | Media parameters of MCPTT client. |
| Requested commencement mode | O | An indication of the commencement mode to be used. |
| Implicit floor request | O | An indication that the user is also requesting the floor. |
| Requested priority | O | Priority level requested for the call. |
| Transfer indicator | O | Indicates that the MCPTT private call request is a result of a call transfer (true/false) |
| Forwarding indicator | O | Indicates that the MCPTT private call request is a result of a call forwarding (true/false) |
| Location information | O | Location of the calling party |
| NOTE: At least one identity must be present. | | |

Proposed modifications in 3GPP TS 23.379 [2] Table 10.7.5.1.2-1: MCPTT private call forwarding request from the MCPTT client to the MCPTT server and from the MCPTT server to the MCPTT server.

Table 7.11.2.2-2: MCPTT private call forwarding request (MCPTT client to MCPTT server and MCPTT server to MCPTT server) information elements

|  |  |  |
| --- | --- | --- |
| Information Element | Status | Description |
| MCPTT ID | M | The MCPTT ID requesting the call forwarding |
| MCPTT ID | M | The MCPTT ID originating the MCPTT private call |
| MCPTT ID (see NOTE) | O | The target MCPTT ID of the call forwarding |
| Functional alias (see NOTE) | O | The target functional alias of the call forwarding |
| NOTE: One identity shall be present. | | |

Proposed modifications in 3GPP TS 23.379 [2] Table 10.7.5.1.5-1: MCPTT private call forwarding request from the MCPTT client to the MCPTT server and from the MCPTT server to the MCPTT server.

Table 7.11.2.2-3: MCPTT private call forwarding response (MCPTT client to MCPTT server and MCPTT server to MCPTT server) information elements

|  |  |  |
| --- | --- | --- |
| Information Element | Status | Description |
| MCPTT ID | M | The MCPTT ID of the party to be forwarded |
| MCPTT ID | M | The MCPTT ID of the target of the forwarding |
| Result | M | Result of the call forwarding request – success or fail |

#### 7.11.2.3 Procedure

##### 7.11.2.3.1 MCPTT private call forwarding with target of the MCPTT private call forwarding in partner MCPTT system

The procedure for MCPTT private call forwarding describes the case of an MCPTT users in a partner MCPTT system as target of the MCPTT private call forwarding.

NOTE 1: The procedure shows manual commencement mode, but the changes are also applicable when using automatic commencement mode.

NOTE 2: The procedure focusses on the interaction between the MCPTT servers, which is independent of the condition for the call forwarding. Therefore, the procedure is generically applicable for all types of call forwarding.

Pre-conditions:

1. MCPTT client 2 is authorized to use call forwarding and has immediate call forwarding enabled with the destination MCPTT client 3.

2. MCPTT client 1 is authorized to make private calls to MCPTT client 2.

3. The redirection counter is below the limit.

4. MCPTT client 1 has the necessary security information to initiate a private call with MCPTT client 2 and MCPTT client 3 if end-to-end encryption is required for the private call.



Figure 7.11.2.3.1-1: Simplified private call setup with MCPTT private calls forwarding in manual commencement mode with forwarding target in the partner MCPTT system

1. MCPTT client 1 sends an MCPTT private call request towards MCPTT server 1.

NOTE 1: If the target of the MCPTT private call request is a functional alias, the procedure resolves the functional alias to the corresponding MCPTT ID for which the functional alias is active. For simplicity details are not described.

2. MCPTT server 1 detects that MCPTT client 2 has immediate call forwarding enabled to MCPTT client 3 which is registered in MCPTT system 2.

3. MCPTT server 1 sends an MCPTT private call forwarding request towards MCPTT client 1.

NOTE 2: If the target of the MCPTT private call forwarding is a functional alias, the procedure resolves the functional alias to the corresponding MCPTT ID for which the functional alias is active. For simplicity details of the resolution are not described.

4. The user at MCPTT client 1 is notified that a call forwarding is in process.

5. MCPTT client 1 sends an MCPTT call private forwarding response back to MCPTT server.

6. MCPTT client 1 sends an MCPTT private call request towards MCPTT server 1 that includes a call forwarding indication set to true.

7. MCPTT server 1 verifies that MCPTT client 1 is authorized to perform an MCPTT private call as a result of the MCPTT private call forwarding request. MCPTT server 1 verifies that the MCPTT private call request contains MCPTT client 3 that is the authorized target from step 3, and the forwarding indication is set to true.

8. MCPTT server 1 sends an MCPTT private call request towards MCPTT server 2.

9. MCPTT server 2 sends an MCPTT private call request towards MCPTT client 3.

NOTE 3: MCPTT server 2 detects that the private call request contains a forwarding indication is set to true and therefore skips the authorization checking.

10. Optionally MCPTT server 1 sends an MCPTT progress indication to MCPTT client 1.

11. The user at MCPTT client 3 is alerted. MCPTT client 3 sends an MCPTT ringing to MCPTT server 2. This step is not required in case of automatic commencement mode.

12. MCPTT server 2 sends an MCPTT ringing to MCPTT server 1. This step is not required in case of automatic commencement mode.

13. MCPTT server 1 sends an MCPTT ringing to MCPTT client 1. This step is not required in case of automatic commencement mode.

14. MCPTT client 3 sends an MCPTT private call response to MCPTT server 2. In manual commencement mode this occurs after the user at MCPTT client 3 has accepted the call.

15. MCPTT server 2 sends an MCPTT private call response to MCPTT server 1. In manual commencement mode this occurs after the user at MCPTT client 3 has accepted the call.

16. MCPTT server 1 sends an MCPTT private call response to MCPTT client 1 indicating that MCPTT client 3 has accepted the call.

17. The media plane for communication between MCPTT client 1 and MCPTT client 3 is established.

##### 7.11.2.3.2 MCPTT private call forwarding with MCPTT private call forwarding occurring in the partner MCPTT system

The procedure for MCPTT private call forwarding describes the case of an MCPTT private call forwarding occurring in the partner MCPTT system.

NOTE 1: The procedure shows manual commencement mode, but the changes are also applicable when using automatic commencement mode.

NOTE 2: The procedure focusses on the interaction between the MCPTT servers, which is independent of the condition for the call forwarding. Therefore, the procedure is generically applicable for all types of call forwarding.

Pre-conditions:

1. MCPTT client 3 is authorized to use call forwarding and has immediate call forwarding enabled with the destination MCPTT client 2.

2. MCPTT client 1 is authorized to make private calls to MCPTT client 3.

3. The redirection counter is below the limit.

4. MCPTT client 1 has the necessary security information to initiate a private call with MCPTT client 2 and MCPTT client 3 if end-to-end encryption is required for the private call.



Figure 7.11.2.3.2-1: Simplified private call setup with MCPTT private calls forwarding in manual commencement mode with forwarding in the partner MCPTT systems

1. MCPTT client 1 sends an MCPTT private call request towards MCPTT server 1 for establishing an MCPTT private call with MCPTT client 3 registered at MCPTT system 2.

NOTE 1: If the target of the MCPTT private call request is a functional alias, the procedure resolves the functional alias to the corresponding MCPTT ID for which the functional alias is active. For simplicity details are not described.

2. MCPTT server 1 sends an MCPTT private call request towards MCPTT server 2 for establishing an MCPTT private call with MCPTT client 3 registered at MCPTT system 2.

3. MCPTT server 2 detects that MCPTT client 3 has immediate call forwarding enabled to MCPTT client 2 registered at MCPTT system 1.

NOTE 2: If the target of the MCPTT private call forwarding is a functional alias, the procedure resolves the functional alias to the corresponding MCPTT ID for which the functional alias is active. For simplicity details of the resolution are not described.

4. MCPTT server 2 sends an MCPTT private call forwarding request towards MCPTT server 1.

5. MCPTT server 1 sends an MCPTT private call forwarding request towards MCPTT client 1.

6. The user at MCPTT client 1 is notified that a call forwarding is in process.

7. MCPTT client 1 sends an MCPTT call private forwarding response back to MCPTT server 1.

8. MCPTT server 1 sends an MCPTT call private forwarding response back to MCPTT server 2.

9. MCPTT client 1 sends an MCPTT private call request towards MCPTT server 1 that includes a call forwarding indication set to true.

10. MCPTT server 1 verifies that MCPTT client 1 is authorized to perform the MCPTT private call as a result of the MCPTT private call forwarding request. MCPTT server 1 verifies that the MCPTT private call request contains MCPTT client 3 that is the authorized target from step 5, and the forwarding indication is set to true.

11. MCPTT server 1 sends an MCPTT private call request towards MCPTT client 2.

12. Optionally MCPTT server 1 sends an MCPTT progress indication to MCPTT client 1.

13. The user at MCPTT client 2 is alerted. MCPTT client 2 sends an MCPTT ringing to MCPTT server 1. This step is not required in case of automatic commencement mode.

14. MCPTT server 1 sends an MCPTT ringing to MCPTT client 1. This step is not required in case of automatic commencement mode.

15. MCPTT client 2 sends an MCPTT private call response to MCPTT server 1. In manual commencement mode this occurs after the user at MCPTT client 3 has accepted the call.

16. MCPTT server 1 sends an MCPTT private call response to MCPTT client 1 indicating that MCPTT client 3 has accepted the call.

17. The media plane for communication between MCPTT client 1 and MCPTT client 3 is established.

### 7.11.3 Solution evaluation

The solution describes MCPTT private call forwarding for MCPTT users in different MCPTT systems. The solution defines enhanced communication between the interconnected MCPTT systems by combining functionality as defined in 3GPP TS 3GPP 23.379 [2] clause 10.7.2.3 and clause 10.7.5.

## 7.12 Private call transfer between MCPTT systems

### 7.12.1 General

This solution addresses the call transfer related aspects of key issue 6 described in clause 5.6 on call forwarding/call transfer between MC systems. The solution provides the possibility of transferring MCPTT private calls between MCPTT users in different MCPTT systems.

NOTE: This solution describes the procedures for announced private call transfer. Unannounced private call transfer does not require any additional functionality regarding interconnect, so it is covered in this solution as well.

### 7.12.2 Solution description

#### 7.12.2.1 Principle

Currently call transfer for MCPTT private calls is defined within one MCPTT system. The following solution defines the necessary changes to allow call transfer between MCPTT users in different MCPTT systems.

#### 7.12.2.2 Impact on information flows

The MCPTT private call transfer related information flows are modified (and marked with highlighting) to cover necessary elements and messages between MCPTT servers to support MCPTT private call transfer for users in different MCPTT systems. Below are the proposed modifications in 3GPP TS 23.379 [2] clause 10.7.6.1.1 and clause 10.7.6.1.3.

10.7.6.1.1 MCPTT private call transfer request ~~(MCPTT client – MCPTT server)~~

Table 10.7.6.1.1-1 describes the information flow MCPTT private call transfer request from the MCPTT client to the MCPTT server and from the MCPTT server to the MCPTT server.

Table 10.7.6.1.1-1: MCPTT private call transfer request (MCPTT client to MCPTT server and MCPTT server to MCPTT server) information elements

|  |  |  |
| --- | --- | --- |
| Information Element | Status | Description |
| MCPTT ID | M | The MCPTT ID of the party requesting the transfer |
| MCPTT ID (see NOTE) | O | The MCPTT ID of the target of the transfer |
| Functional alias (see NOTE) | O | The functional alias of the target of the transfer |
| NOTE: One identity shall be present. | | |

10.7.6.1.3 MCPTT private call transfer response ~~(MCPTT server – MCPTT client)~~

Table 10.7.6.1.3-1 describes the information flow MCPTT private call transfer response from the MCPTT server to the MCPTT client and from the MCPTT server to the MCPTT server.

Table 10.7.6.1.3-1: MCPTT private call transfer response (MCPTT server to MCPTT client and MCPTT server to MCPTT server) information elements

|  |  |  |
| --- | --- | --- |
| Information Element | Status | Description |
| MCPTT ID | M | The MCPTT ID of the party requesting the transfer |
| MCPTT ID | M | The MCPTT ID of the target of the transfer |
| Result | M | Result of the transfer request – success or fail. |

#### 7.12.3.2 Procedures

##### 7.12.3.2.1 MCPTT private call announced transfer with target in partner MCPTT system

The procedure for MCPTT private call announced transfer covers the case where an MCPTT client requests an ongoing MCPTT private call (with or without floor control) to be transferred to another MCPTT user with prior announcement.

Figure 7.12.3.2.1-1 below illustrates the procedure for MCPTT private call announced transfer with target in partner MCPTT system.

NOTE 1: The procedure for MCPTT private call unannounced transfer is very similar, the only difference is that steps 2 to 6 are skipped.

Pre-conditions:

1. MCPTT client 2 is authorized to use call transfer.

2. MCPTT client 1 is authorized to make private calls to MCPTT client 2.

3. MCPTT client 2 is authorized to make private calls to MCPTT client 3.

4. MCPTT client 2 is authorized to transfer private calls to MCPTT client 3.

5. MCPTT client 2 supports simultaneous sessions for MCPTT private calls as described in 3GPP TS 23.379 [2] clause 10.8.

6. MCPTT client 1 has the necessary security information to initiate a private call with MCPTT client 2 and MCPTT client 3, and MCPTT client 2 has the necessary security information to initiate a private call with MCPTT client 3 if end2end encryption is required for the private call.



Figure 7.12.3.2.1-1: MCPTT private call announced transfer with target in partner MCPTT system

1. MCPTT client 1 initiates an MCPTT private call to MCPTT client 2 using the normal MCPTT call establishment as described in 3GPP TS 23.379 [2] clause 10.7.2.2. The user at MCPTT client 1 can talk with the user at MCPTT client 2. The user at MCPTT client 2 decides to transfer the call.

2. The MCPTT user at MCPTT client 2 puts the call with MCPTT user at MCPTT client 1 on hold.

3. MCPTT client 2 initiates an MCPTT private call to MCPTT client 3 using the normal MCPTT call establishment procedures as described in 3GPP TS 23.379 [2] clause 10.7.2.3.

NOTE 2: The solution for private call using functional alias towards a partner MC system is defined in clause 7.8.

4. The user at MCPTT client 2 can talk with the user at MCPTT client 3 and announces the call transfer.

5. The MCPTT client 2 releases the MCPTT private call with MCPTT client 3 using the normal MCPTT call release procedure as described in 3GPP TS 23.379 [2] clause 10.7.2.3. This step can occur at any time after step 4.

6. The MCPTT user at MCPTT client 2 puts the call with MCPTT client 1 off hold and confirms that the call will be transferred.

7. The MCPTT client 2 sends an MCPTT call transfer request to the MCPTT server 1.

8. The MCPTT server 1 verifies that MCPTT client 2 is authorized to transfer the MCPTT private call to MCPTT client 3. This check is based on entries in the user profile of the user at MCPTT client 2. First, the MCPTT server 1 checks the value of the "Allow private call transfer" entry. If it is false, the authorization check has failed, and the procedure continues with step 10. Otherwise, the MCPTT server 1 checks if the "Authorised to transfer private calls to any MCPTT user" entry is true. If this is the case the check has passed, and for target type of MCPTT ID the procedure continues with step 10 and for target ID type of functional alias the procedure continues with step 9. The subsequent checking depends on the type of target ID. If the target ID is a MCPTT ID, the MCPTT server 1 checks for a matching entry of the target MCPTT ID in the "List of MCPTT users that the MCPTT user is authorised to use as targets for call transfer" list. If a matching entry is found, the check has passed, if no matching entry is found the check has failed, for any outcome the procedure continues with step 10. If the target ID is a functional alias, the MCPTT server 1 checks for a matching entry of the target functional alias in the "List of functional aliases that the MCPTT user is authorised to use as targets for call transfer" list. If a matching entry is found, the check has passed, and the procedure continues with step 9. If no matching entry is found, the authorization check has failed, and the procedure continues with step 10.

9. If the target of the MCPTT private call transfer is a functional alias instead of an MCPTT ID the MCPTT server 1 resolves the functional alias to the corresponding MCPTT ID for which the functional alias is active.

NOTE 3: Depending on implementation the MCPTT server can apply additional call restrictions and decide whether the call is allowed to proceed with the resolved MCPTT ID(s) (e.g. whether the MCPTT ID is within the allowed area of the functional alias). If the MCPTT server detects that the functional alias used as the target of the MCPTT private call transfer is simultaneously active for multiple MCPTT users, then the MCPTT server can proceed by selecting an appropriate MCPTT ID based on some selection criteria. The selection of an appropriate MCPTT ID is left to implementation. The selection criteria can include rejection of the call, if no suitable MCPTT ID is selected.

10. If the authorization check has failed, or the target of the transfer is a functional alias that is not active, or the target of the transfer is a functional alias that is simultaneously active by multiple users and the outcome of the selection is a rejection, the MCPTT private call transfer is cancelled, and the MCPTT server 1 sends an MCPTT private call transfer response with result "fail" back to MCPTT client 2. The MCPTT private call between MCPTT client 1 and MCPTT client 2 remains up, and the procedure stops. Otherwise, the procedure continues.

11. The MCPTT server 1 sends an MCPTT call transfer request towards the MCPTT client 1.

12. The user at MCPTT client 1 is notified that a call transfer is in progress.

13. MCPTT client 1 sends an MCPTT private call request towards the MCPTT server 1 that includes a call transfer indication set to true.

14. The MCPTT server 1 verifies that MCPTT client 1 is authorized to perform the MCPTT private call as a result of the MCPTT private call transfer request based on the fact that the transfer indication is present and set to true in the MCPTT private call request.

NOTE 4: For call transfer the MCPTT server does not check if the initial originating MCPTT user at MCPTT client 1 is authorized to make an MCPTT private call to the final target MCPTT user at MCPTT client 3.

15. The MCPTT server 1 sends an MCPTT call request to MCPTT server 2.

16. The MCPTT server 2 sends an MCPTT call request to MCPTT client 3.

NOTE 5: MCPTT server 2 detects that the private call request contains a transfer indication set to true and therefore skips the authorization checking.

17. The user at MCPTT client 3 is notified about the incoming call.

18. MCPTT client 3 sends an MCPTT private call response back to the MCPTT server 2.

19. MCPTT server 2 sends an MCPTT private call response back to the MCPTT server 1.

20. The MCPTT server 1 forwards the MCPTT private call response towards MCPTT client 1.

21. MCPTT client 1 sends an MCPTT call transfer response back to MCPTT server 1.

22. The MCPTT server 1 forwards the MCPTT private transfer response towards MCPTT client 2.

23. MCPTT client 2 initiates release of the private call between MCPTT client 1 and MCPTT client 2 as described in subclause 10.7.2.3.

24. The media plane for communication between MCPTT client 1 and MCPTT client 3 is established.

##### 7.12.3.2.2 MCPTT private call announced transfer with transferring MCPTT user in partner MCPTT system

The procedure for MCPTT private call announced transfer covers the case where an MCPTT client requests an ongoing MCPTT private call (with or without floor control) to be transferred to another MCPTT user with prior announcement.

Figure 7.12.3.2.2-1 below illustrates the procedure for MCPTT private call announced transfer with transferring MCPTT user in partner MCPTT system.

NOTE 1: The procedure for MCPTT private call unannounced transfer is very similar, the only difference is that steps 2 to 6 are skipped.

Pre-conditions:

1. MCPTT client 3 is authorized to use call transfer.

2. MCPTT client 1 is authorized to make private calls to MCPTT client 3.

3. MCPTT client 3 is authorized to make private calls to MCPTT client 2.

4. MCPTT client 3 is authorized to transfer private calls to MCPTT client 2.

5. MCPTT client 3 supports simultaneous sessions for MCPTT private calls as described in 3GPP TS 23.379 [2] clause 10.8.

6. MCPTT client 1 has the necessary security information to initiate a private call with MCPTT client 2 and MCPTT client 3, and MCPTT client 3 has the necessary security information to initiate a private call with MCPTT client 2 if end2end encryption is required for the private call.



Figure 7.12.3.2.2-1: MCPTT private call announced transfer transferring MCPTT user in partner MCPTT system

1. MCPTT client 1 initiates an MCPTT private call to MCPTT client 3 using the normal MCPTT call establishment as described in 3GPP TS 23.379 [2] clause 10.7.2.3. The user at MCPTT client 1 can talk with the user at MCPTT client 3. The user at MCPTT client 3 decides to transfer the call.

NOTE 2: The solution for private call using functional alias towards a partner MC system is defined in clause 7.8.

2. The MCPTT user at MCPTT client 3 puts the call with MCPTT user at MCPTT client 1 on hold.

3. MCPTT client 3 initiates an MCPTT private call to MCPTT client 2 using the normal MCPTT call establishment procedures as described in 3GPP TS 23.379 [2] clause 10.7.2.3.

NOTE 3: The solution for private call using functional alias towards a partner MC system is defined in clause 7.8.

4. The user at MCPTT client 3 can talk with the user at MCPTT client 2 and announce the call transfer.

5. The MCPTT client 3 releases the MCPTT private call with MCPTT client 2 using the normal MCPTT call release procedure as described in 3GPP TS 23.379 [2] clause 10.7.2.3. This step can occur at any time after step 4.

6. The MCPTT user at MCPTT client 3 puts the call with MCPTT client 1 off hold and confirms that the call will be transferred.

7. The MCPTT client 3 sends an MCPTT call transfer request to the MCPTT server 2.

8. The MCPTT server 2 verifies that MCPTT client 3 is authorized to transfer the MCPTT private call to MCPTT client 2. This check is based on entries in the user profile of the user at MCPTT client 3. First, the MCPTT server 2 checks the value of the "Allow private call transfer" entry. If it is false, the authorization check has failed, and the procedure continues with step 10. Otherwise, the MCPTT server 2 checks if the "Authorised to transfer private calls to any MCPTT user" entry is true. If this is the case the check has passed, and for target type of MCPTT ID the procedure continues with step 10 and for target ID type of functional alias the procedure continues with step 9. The subsequent checking depends on the type of target ID. If the target ID is an MCPTT ID, the MCPTT server 2 checks for a matching entry of the target MCPTT ID in the "List of MCPTT users that the MCPTT user is authorised to use as targets for call transfer" list. If a matching entry is found, the check has passed, if no matching entry is found the check has failed, for any outcome the procedure continues with step 10. If the target ID is a functional alias, the MCPTT server 2 checks for a matching entry of the target functional alias in the "List of functional aliases that the MCPTT user is authorised to use as targets for call transfer" list. If a matching entry is found, the check has passed, and the procedure continues with step 9. If no matching entry is found, the authorization check has failed, and the procedure continues with step 10.

9. If the target of the MCPTT private call transfer is a functional alias instead of an MCPTT ID the MCPTT server 2 resolves the functional alias to the corresponding MCPTT ID for which the functional alias is active.

NOTE 4: Depending on implementation the MCPTT server can apply additional call restrictions and decide whether the call is allowed to proceed with the resolved MCPTT ID(s) (e.g. whether the MCPTT ID is within the allowed area of the functional alias). If the MCPTT server detects that the functional alias used as the target of the MCPTT private call transfer is simultaneously active for multiple MCPTT users, then the MCPTT server can proceed by selecting an appropriate MCPTT ID based on some selection criteria. The selection of an appropriate MCPTT ID is left to implementation. The selection criteria can include rejection of the call, if no suitable MCPTT ID is selected.

10. If the authorization check has failed, or the target of the transfer is a functional alias that is not active, or the target of the transfer is a functional alias that is simultaneously active by multiple users and the outcome of the selection is a rejection, the MCPTT private call transfer is cancelled, and the MCPTT server 2 sends an MCPTT private call transfer response with result "fail" back to MCPTT client 3. The MCPTT private call between MCPTT client 3 and MCPTT client 2 remains up, and the procedure stops. Otherwise, the procedure continues.

11. The MCPTT server 2 sends an MCPTT call transfer request towards the MCPTT server 1.

12. The MCPTT server 1 sends an MCPTT call transfer request towards the MCPTT client 1.

13. The user at MCPTT client 1 is notified that a call transfer is in progress.

14. MCPTT client 1 sends an MCPTT call transfer response back to the MCPTT server 1.

15. MCPTT client 1 sends an MCPTT private call request towards the MCPTT server 1 that includes a call transfer indication set to true.

16. The MCPTT server 1 verifies that MCPTT client 1 is authorized to perform the MCPTT private call as a result of the MCPTT private call transfer request based on the fact that the transfer indication is present and set to true in the MCPTT private call request.

NOTE 5: For call transfer the MCPTT server does not check if the initial originating MCPTT user at MCPTT client 1 is authorized to make an MCPTT private call to the final target MCPTT user at MCPTT client 2.

17. The MCPTT server 1 sends an MCPTT call request to MCPTT client 3.

18. The user at MCPTT client 2 is notified about the incoming call.

19. MCPTT client 2 sends an MCPTT private call response back to the MCPTT server 1.

20. The MCPTT server 1 forwards the MCPTT private call response towards MCPTT client 1.

21. MCPTT client 1 sends an MCPTT call transfer response back to the MCPTT server 1.

22. The MCPTT server 1 sends an MCPTT call transfer response back to the MCPTT server 2.

23. The MCPTT server 2 sends an MCPTT call transfer response back to the MCPTT client 3.

24. MCPTT client 3 initiates release of the private call between MCPTT client 3 and MCPTT client 1 as described in 3GPP TS 23.379 [2] clause 10.7.2.3.

25. The media plane for communication between MCPTT client 1 and MCPTT client 2 is established.

7.12.3 Solution evaluation

The solution describes private call transfer MCPTT for MCPTT users in different MCPTT systems. The solution defines enhanced communication between the interconnected MCPTT systems by combining functionality as defined in 3GPP TS 3GPP 23.379 [2] clauses 10.7.2.3 and 10.7.6.

# 8 Overall evaluation

## 8.1 Key issue and solution evaluation

### 8.1.1 Introduction

All the key issues and solutions specified in this technical report are listed in table 8.1.2-1. It includes the mapping of the key issues (clause 5) to the solutions (clause 7) and corresponding solution evaluations.

In addition, table 8.1.2-1 lists the impacts to other working groups that will need consideration during the Rel-18 normative phase.

### 8.1.2 Results

Table 8.1.2-1: Key issues, solutions, and solution evaluations

|  |  |  |  |
| --- | --- | --- | --- |
| Key issues | Solution | Evaluation (clause reference) | Dependency on other working groups |
| Key issue 1 - Optimize the connectivity between MC systems | Clause 7.7 Optimize the connectivity between MC systems | Clause 7.7.3 | None |
| Key issue 2 - Functional alias handling | Clause 7.3 Private call using functional alias towards a partner MC system | Clause 7.3.3 | None |
| Clause 7.4 Functional alias support for migrated users | Clause 7.4.3 | None |
| Clause 7.8 Private call using functional alias towards a partner MC system | Clause 7.8.3 | None |
| Key issue 3 - Group communication between MC systems | Clause 7.5 Migration during an ongoing group communication | Clause 7.5.3 | None |
| Key issue 4 - Location information with multiple MC systems | Clause 7.1 Solution on functional architecture enhancements to support location information | Clause 7.1.3 | None |
| Clause 7.2 Solution on location information | Clause 7.2.3 | None |
| Key issue 5 - Quick migration towards another MC system | Clause 7.6 Migration during an ongoing private communication | Clause 7.6.3 | None |
| Key issue 6 - Call forwarding/transfer between MC systems | Clause 7.11 Private call forwarding between MCPTT systems | Clause 7.11.3 | None |
| Clause 7.12 Private call transfer between MCPTT systems | Clause 7.12.3 | None |
| Key issue 7 - IP connectivity between MC systems | Clause 7.9 Solution on IP connectivity between MC systems | Clause 7.9.3 | None |
| Key issue 8 – Offline-Migration | Clause 7.10 Solution on migration without interconnection between two MC systems | Clause 7.10.3 | None |

# 9 Conclusions

This technical report fulfills the objective to develop solutions for specific interconnection and migration needs for railways which were not satisfied yet. It identifies enhancements to be included in the technical specifications for MCPTT (3GPP TS 23.379 [2]), MCVideo (3GPP TS 23.281 [3]), MCData (3GPP TS 23.282 [4]) and in the common functional architecture (3GPP TS 23.280 [5]).

The results from the study will be considered for follow-up normative work in Rel-18 as follows:

1) The solution on functional architecture enhancements to support location information (clause 7.1) and the solution on providing location information (clause 7.2) may be used.

2) The solutions on private call using functional alias towards a partner MC system (clause 7.3 and clause 7.8) will be used as basis to define a proper mechanism.

3) The solutions describing migration during an ongoing communication (clause 7.4 and clause 7.5) will be used as basis to define proper procedures.

4) The solutions on addressing the connectivity between MC systems to optimize media and signalling routing (clause 7.7) and on IP connectivity between MC systems (clause 7.9) provides the necessary guidance to cover rail communication use cases excluding the primary MC system for communication routing in the migration context.

5) The solution on migration without interconnection between two MC systems (clause 7.10) will be used to enable an authorized MC service user to migrate to another MC system, where there is no interconnection between the primary and the partner MC system.

6) The solution on private call forwarding between MCPTT systems (clause 7.11) will be used to forward MCPTT private calls towards an MCPTT user in a different MCPTT system.

No dependencies to other 3GPP groups were identified in the overall evaluation (clause 8) which are required for fulfilling the solutions listed above.

Annex A (informative):  
Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2020-08 | SA6#39-e |  |  |  |  | S6-201345 (TR skeleton) | 0.0.0 |
| 2020-09 | SA6#39-e |  |  |  |  | S6-201346, S6-201347, S6-201351, S6-201352, S6-201353, S6-201355, S6-201356, S6-201357, S6-201565 | 0.1.0 |
| 2021-01 | SA6#41-e |  |  |  |  | S6-210092, S6-210093, S6-210204, S6-210205 | 0.2.0 |
| 2021-04 | SA6#42-bis-e |  |  |  |  | S6-210772, S6-210776, S6-210794, S6-210957, S6-210958, S6-210972 | 0.3.0 |
| 2021-07 | SA6#44-e |  |  |  |  | S6-211599, S6-211601, S6-211602, S6-211603, S6-211604, S6-211605, S6-211749 | 0.4.0 |
| 2021-07 |  |  |  |  |  | Correction of the cover page | 0.4.1 |
| 2021-09 | SA6#45-e |  |  |  |  | S6-211886, S6-211887, S6-211889 | 0.5.0 |
| 2021-09 | SA#93-e | SP-210950 |  |  |  | Presentation for information at SA#93-e | 1.0.0 |
| 2021-10 | SA6#45-bis-e |  |  |  |  | S6-212236, S6-212253, S6-212254, S6-212364, S6-212473 | 1.1.0 |
| 2021-11 | SA6#46-e |  |  |  |  | S6-212566, S6-212616, S6-212617, S6-212695, S6-212696, S6-212697 | 1.2.0 |
| 2022-02 | SA6#47-e |  |  |  |  | S6-220058, S6-220071, S6-220072, S6-220304 | 1.3.0 |
| 2022-03 | SA#95-e | SP-220092 |  |  |  | Presentation for approval at SA#95-e | 2.0.0 |
| 2022-03 | SA#95-e | SP-220092 |  |  |  | MCC Editorial update for publication after TSG SA approval (SA#95) | 18.0.0 |