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| Technical Report | |
| 3rd Generation Partnership Project;  Technical Specification Group Services and System Aspects;  Study of Gateway User Equipment (UE) function for  Mission Critical (MC) communications;  (Release 18) | |
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# Foreword

This Technical Report has been produced by the 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;

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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

An MC gateway UE has the functionality of providing service access with the MC service system for multiple MC service clients. The MC gateway UE enables MC service access for those MC service clients operating on devices that have no MC service capabilities (incl. 3GPP transport). This technical report identifies the key issues and corresponding solutions with recommendations for the normative work.

# 1 Scope

The present document studies solutions to satisfy the requirements for a Gateway UE function. It identifies enhancements to be included in the technical specifications for MCPTT, MCVideo, MCData and in the common functional architecture to support mission critical communications. Requirements for this study are taken from stage 1 requirements, including 3GPP TS 22.179 [2] and 3GPP TS 22.280 [3].

# 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 22.179: "Mission Critical Push to Talk (MCPTT); Stage 1".

[3] 3GPP TS 22.280: "Mission Critical Services Common Requirements (MCCoRe)".

[4] 3GPP TS 23.228: "IP Multimedia Subsystem (IMS); Stage 2".

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

[6] 3GPP TS 23.379: "Functional architecture and information flows to support Mission Critical Push To Talk (MCPTT); Stage 2".

[7] 3GPP TS 23.281: "Functional architecture and information flows to support Mission Critical Video (MCVideo); Stage 2".

[8] 3GPP TS 23.282: "Functional architecture and information flows to support Mission Critical Data (MCData); Stage 2".

[9] 3GPP TS 23.468: "Group Communication System Enablers for LTE (GCSE\_LTE); Stage 2".

[10] 3GPP TS 23.501: "System architecture for the 5G System (5GS)".

[11] 3GPP TS 29.244: "Interface between the Control Plane and the User Plane Nodes".

# 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].

**MC gateway UE:** A UE that can be simultaneously shared between multiple MC service clients using the same or different MC services.

**MC client:** A client that represents a set of clients (i.e. Group management client, Configuration management client, Identity management client, Key management client, Location management client and MC service client).

**MC server:** A server that represents a set of servers (i.e. MC service server and servers of the Common services core).

**Non-3GPP device:** A device that enables local connectivity towards an MC gateway UE using an access method not specified by 3GPP. A subset of these devices can host an MC client specified by 3GPP.

**CSC client:** A client that represents a set of clients for group management, configuration management, identity management, key management, and location management.

**CSC server:** A server that represents a set of servers for group management, configuration management, identity management, key management, and location management.

**MC gateway client:** A client on a non-3GPP device that requests connection authorisation with an MC gateway UE server.

**MC gateway UE server:** A server on an MC gateway UE that controls connection authorisation received from an MC gateway client.

## 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

## 4.1 MC gateway UE services and the relationship to MC service users/clients

### 4.1.1 General

The MC gateway UE service may provide the following necessary functions:

- Allowing an MC service client to connect to a MC gateway UE.

- Allowing an MC service client to choose between multiple Mc GW UEs for the required MC service capability.

- Support of MC service continuation while the MC service client changes the MC gateway UE association.

- Ensure that the content of communications between the MC system and MC service client connected to an MC gateway UE is unaltered.

- Ensure that the communication traffic attributes, e.g. priority and QoS, of an MC service client connected to an MC gateway UE remains independent from other MC service clients concurrently connected to the same MC gateway UE.

- Independent MC service client identification, authorisation and service profile association using the gateway MC UE functionality.

- Sharing of an MC gateway UE transport resources with multiple connected MC service clients.

- Indication of potential MC gateway UE anomalies sent towards the connected MC service clients.

- MC service client is serving an MC service user on a device which is connected to the MC gateway UE via non-3GPP transport.

# 5 Key issues

## 5.1 Key issue 1 – Functional Architecture for an MC gateway UE

The MC gateway UE may provide several sub-functions like an MC gateway UE user device connecting function, an MC gateway UE network function, an MC gateway UE user QoS handling function, an MC gateway UE exposure function, an MC gateway UE MBMS support function and other functions.

A functional architecture for the MC gateway UE may help to develop proper mechanisms and procedures.

List of key issues:

- Clarify the need to define a functional architecture for the MC gateway UE.

- Describe the overall functional architecture and the details of the single elements from that architecture.

## 5.2 Key issue 2 – Authorisation for connection of non-3GPP devices with an MC gateway UE

A control mechanism for connecting non-3GPP devices with an MC gateway UE is needed as not all devices should be connected with all MC gateway UEs. An authorized usage of an MC gateway UE by clients and users is needed as well as a control mechanism on how many MC gateway UEs can be used by the same MC service user/client. If a connection related temporary identifier and an explicit login procedure is required (e.g. for traffic routing) needs to be clarified.

List of key issues:

- Clarify how to authorize the use of non-3GPP devices by the MC gateway UE.

- Clarify how to control MC service user/client use of multiple MC gateway UEs and to control the related traffic aggregation.

- Clarify whether there is a need for an explicit login procedure and assignment of a connection related temporary non-3GPP device ID.

## 5.3 Key issue 3 – Identification of MC service users behind an MC gateway UE residing on non-3GPP devices

The mission critical user identity (or MC ID) is the identity that an MC service user presents to the identity management server during a user authentication transaction (not necessarily tied to a single mission critical service).

The MC service user identity (or MC service ID) is used as a globally unique identifier within the MC service that identifies an MC service user.

The MC ID and the MC service ID may be the same.

The SIP signalling control plane uses a private user identity to authenticate the signalling user agent and one or more public user identities for routing of signalling messages in the SIP core.

There are several relationships between the MC service ID(s) and the public user identity(ies).

List of key issues:

- Clarify whether the MC ID can be used on non-3GPP devices connected to the MC system via an MC gateway UE. Identify impacts to existing authentication procedures.

- Clarify whether the MC service ID can be used on non-3GPP devices connected to the MC system via an MC gateway UE. Identify impacts or limitations on existing procedures in the application plane.

- Elaborate how and if SIP signalling plane identities can be used by non-3GPP devices connected to the MC system via an MC gateway UE.

- Elaborate the impacts regarding the current relationships between SIP signalling plane identities and application plane identities.

- Investigate whether there is a need for additional application plane identities to support non-3GPP devices connected to network via an MC gateway UE.

## 5.4 Key issue 4 – MBMS support

If non-3GPP devices are connected to the MC system via an MC gateway UE, then MBMS support should be supported. MBMS support is required for both, MC service clients residing on a UE acting as MC gateway UE and for MC service clients residing on a non-3GPP device.

List of key issues:

- Clarify how MBMS transmissions can be supported for MC service clients operating on non-3GPP devices via an MC gateway UE.

- Clarify whether there any implications on switching between unicast and multicast.

- Clarify how the MC gateway UE forwards the MBMS downlink traffic to the corresponding MC service clients behind the MC gateway UE.

- Clarify whether the MBMS support for MC service client residing on a non-3GPP devices should be transparent for network, i.e. the network need not consider whether the MC service client residing on a non- 3GPP device is connected via an MC gateway UE or not while using MBMS bearers, to minimize the impact on the existing MC system.

## 5.5 Key issue 5 – User traffic handling

User data traffic and signalling information needs to be routed to/from user/clients residing on non-3GPP devices. The MC gateway UE needs to deal with multiple non-3GPP devices on one side and with multiple bearers (LTE) and 5G QFIs on the network side. The communication content should be unchanged, E2E encryption should be supported.

List of key issues:

- Clarify how the MC gateway UE routes and maps the traffic data and signalling information between non-3GPP devices and the network.

- Clarify whether there are any limitations in the MC gateway UE network connectivity aspects like max. number of PDU sessions, max. QFIs per PDU session etc.

- Elaborate how independent QoS and priority treatment of each communication per MC service client is enabled for a MC service user behind an MC gateway UE.

- Clarify how the content of a MC service user/client communication beyond an MC gateway UE remains unchanged.

- Clarify how end-to-end encryption (E2EE) is enabled for MC service users/clients residing on non-3GPP devices.

## 5.6 Key issue 6 – Use of multiple MC gateway UEs

An MC service client can use multiple MC gateway UEs that are bound to the same MC system while using the associated MC service per gateway. Potential impacts to the functional architecture and/or the MC service client capabilities are to be studied to develop proper mechanisms and procedures.

List of key issues:

- Clarify the potential impact to the MC service client capabilities when using multiple MC gateway UEs.

- Clarify the potential impact to the MC gateway UE capabilities in a multi MC gateway UE environment.

- Describe the functional architecture supporting more than one MC gateway UE, as extension of the single MC gateway UE functional architecture.

5.7 Key issue 7 – 3GPP access network related location management by MC Clients

Location management server may not be aware whether the MC service clients are residing on 3GPP devices or non 3GPP-devices when providing the location reporting configuration and when requesting the location information from the location management client. The MC clients residing on the non-3GPP devices may get the Location reporting configuration containing the trigger criteria related to 3GPP access network related location parameters. There may be some issues if the MC clients detects that it cannot handle the location reporting trigger criteria related to the 3GPP access network information or if it cannot provide the requested location information related to the 3GPP access network.

List of key issues:

- Whether and how the 3GPP access network related location trigger criteria are handled

- Clarify how the 3GPP access network related location information of MC service clients residing on non-3GPP devices is known to the MC system when required.

# 6 Architectural requirements

NOTE: No architectural requirements were identified.

# 7 Solutions

## 7.1 Functional architecture

### 7.1.1 General

This solution addresses the key issue 1 described in clause 5.1 on defining a functional architecture when using an MC gateway UE.

### 7.1.2 Solution description

#### 7.1.2.1 Functional architecture

The MC gateway UE offers access to the MC server for several MC clients (see Figure 7.1.2-1). The MC clients can be either located in the MC gateway UE or in non-3GPP devices connected to the MC gateway UE via non-3GPP access.

For non-3GPP devices which can host an MC client, the MC gateway UE enables connectivity to the MC server. For non-3GPP devices which cannot host the MC client, the MC gateway UE hosts the instantiation of the MC client for the non-3GPP device.



Figure 7.1.2.1-1: Functional architecture

The MC gateway UE provides MC service capabilities and 3GPP access capabilities using 3GPP network credentials for authorized access with an MC server.

For non-3GPP devices which cannot host MC clients, the MC gateway UE shall control the access and manage the communication between the non-3GPP devices and the MC server. Upon reception of connection authorisation request from a non-3GPP device, the MC gateway UE instantiates an MC client, acting on behalf of the non-3GPP device, to provide the requested services (e.g. emergency call, group calls, short data messages services, etc.). The communication interworking and the definition of associated procedures between the MC client (initiated at the MC gateway UE) and the non-3GPP devices is out of scope of this document.

NOTE 1: MC clients residing on a non-3GPP device cannot use UICC credentials to perform authorisation with the 3GPP transport system.

For MC clients getting MC service access via the MC gateway UE, the MC gateway UE forwards (unmodified) signalling and media from the individual MC clients to the MC server and vice versa.

If the MC service user on the non-3GPP device utilizes multiple MC services simultaneously, the MC service access may also be provided by one or multiple MC gateway UEs (see figure 7.1.2.1-2) while restricting each MC service to one MC gateway UE (e.g. MCPTT via MC gateway UE1, MCData via MC gateway UE2).



Figure 7.1.2.1-2: Simultaneous multiple MC gateway UE use by a single non-3GPP device

NOTE 2: Even not shown in the above figure, the same principle of simultaneous use of multiple MC gateway UEs is applied for non-3GPP devices which cannot host an MC client.

#### 7.1.2.2 Reference points

For application level signaling between the MC client on the non-3GPP device and the MC gateway UE a new reference point called CSC-GW is introduced. The MC gateway UE uses existing reference points (CSC-n) toward the MC server.



Figure 7.1.2.2-1: Reference points

The reference points CSC-n belonging to the application plane and the reference points SIP-1 and HTTP-1 belonging to the signaling control plane are used by the MC client on the non-3GPP device towards the MC gateway UE and the MC gateway UE relays the application and control plane signaling further to the MC server.

CSC-n, SIP-1 and HTTP-1 reference points are specified in 3GPP TS 23.280 [5].

The corresponding MCX-n reference points are specified in 3GPP TS 23.379 [6], 3GPP TS 23.281 [7] and 3GPP TS 23.282 [8].

The CSC-GW reference point, which exists between the MC gateway client and the MC gateway UE client residing on the non-3GPP device and the MC gateway UE server residing on the MC gateway UE, is used for connection authorisation of non-3GPP devices with an MC gateway UE. For connection authorisation, the connection authorisation request will be forwarded by the MC gateway UE server via the corresponding MC service client residing on the MC gateway UE (see clause 7.3.4). CSC-GW is also used to request the forwarding of the media from the MC gateway UE by the MC client (see figure 7.1.2.3-1) using corresponding identifiers, e.g. TMGI, applicable for multicast/broadcast-based communication.

For signalling, the MC clients utilize the allocated resources (default bearer for EPS or QoS flow in 5GS) between MC gateway UE and MC server. The MC gateway UE maps the signaling traffic between MC clients and MC server.

#### 7.1.2.3 Media plane

On the media plane a communication between the MC client on the non-3GPP device and is distributed both via non-3GPP access and via 3GPP access. Traffic from multiple MC clients may be transferred on the 3GPP access branch, depending on how many MC clients are served by the MC gateway UE. For that, the MC gateway UE has a media distribution function to relay the traffic on the non-3GPP access and the 3GPP access branch for unicast and multicast communications and multiple MC clients properly.



Figure 7.1.2.3-1: Media plane

### 7.1.3 Solution evaluation

The functional architecture describes how non-3GPP devices, which are connected via non-3GPP access to an MC gateway UE, are connected to the MC system. One type of non-3GPP devices can host MC clients, where a second type cannot host MC clients and so the MC gateway UE hosts them for the non-3GPP device. The use of multiple MC gateway UEs simultaneously by an MC client is described.

The reference points for the signalling control plane and the media plane, including MBMS, are described.

## 7.2 Connection authorisation with the MC gateway UE

### 7.2.1 General

This solution addresses the key issue 2 described in clause 5.2 on authorisation for connection of non-3GPP devices with an MC gateway UE. The solution only applies to non-3GPP devices which can host an MC client.

With this procedure the MC gateway UE performs authorization for the use of the MC gateway UE by the MC client, i.e. the binding between the MC gateway UE and the MC client is authorized and controlled by the MC gateway UE. The solution implies that authorisation functionality is provided by the MC gateway UE.

### 7.2.2 Information flows

#### 7.2.2.1 Connection authorization request

Table 7.2.2.1-1 describes the information flow connection authorization request sent from the MC client, which resides on a non-3GPP device, to the MC gateway UE.

Table 7.2.2.1-1: Connection authorization request

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| GW MC service ID (see NOTE) | M | The GW MC service ID of the requesting MC service user. |
| NOTE: The GW MC service ID indicates for which MC service the connection is to be authorised. | | |

NOTE: The MC service ID used for MC service authorisation and the GW MC service ID used for connection authorization may have different values. Both identities are configured by the Mission Critical Organisation.

#### 7.2.2.2 Connection authorization response

Table 7.2.2.2-1 describes the information flow connection authorization response sent from the MC gateway UE to the MC client.

Table 7.2.2.2-1: Connection authorization response

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| GW MC service ID | M | The GW MC service ID of the requesting MC service user. |
| Response | M | Result of the connection authorization request, service feasibility, and connection evaluation. |

### 7.2.3 MC service UE configuration data

Table 7.2.3-1 describes the MC service UE configuration data which must be known by an MC service UE after MC service authorization.

**Table 7.2.3-1: UE configuration data (on network)**

|  |  |
| --- | --- |
| **Reference** | **Parameter description** |
| Subclause 5.15 of 3GPP TS 22.280 [3] | List of permitted GW MC service ID |
|  | > GW MC service ID |

### 7.2.4 Initial MC gateway UE configuration data

The initial MC gateway UE configuration data is essential to the MC gateway UE to successfully connect MC clients to the MC system. The initial MC gateway UE configuration data can be the same or different across MC gateway UEs.

Data in table 7.2.4-1 is provided to the MC gateway UE during the bootstrap process and can be configured on the MC gateway UE offline using the CSC-11 reference point or via other means.

Table 7.2.4-1: Initial MC gateway UE configuration data (on-network)

|  |  |
| --- | --- |
| Reference | Parameter description |
| Subclause 5.15 of 3GPP TS 22.280 [3] | List of permitted GW MC service IDs for MCPTT |
|  | > GW MC service ID |
| Subclause 5.15 of 3GPP TS 22.280 [3] | List of permitted GW MC service IDs for MCVideo |
|  | > GW MC service ID |
| Subclause 5.15 of 3GPP TS 22.280 [3] | List of permitted GW MC service IDs for MCData |
|  | > GW MC service ID |

NOTE: Configured MC service IDs indicate the support of an MC service.

### 7.2.5 Procedure

The procedure for connection authorisation with an MC gateway UE is shown in figure 7.2.5-1.

Pre-conditions

- The MC service user wishes to have access to MC services by using a non-3GPP device.

- The MC client has been configured with the necessary parameters needed for connectivity with the MC gateway UE.

- The MC client has been provided with an appropriate GW MC service ID.

- The MC gateway UE has performed service authorization for one or more MC services with the MC system.

- The MC service user has selected an MC gateway UE or alternatively, the MC client has performed a selection by internal criteria.

NOTE 1: The internal criteria are outside the scope of the present document.



Figure 7.2.5-1: Connection authorisation with the MC gateway UE

1. The MC client requests connection authorization with the MC gateway UE. The MC client of the MC service user provides the GW MC service ID.

2. The MC gateway UE performs an authorization check by using the provided GW MC service ID to verify that the MC service user is permitted to use the MC gateway UE to access an MC server.

In addition, the MC gateway UE checks whether:

- the requested MC service, as indicated by the GW MC service ID, is supported by the MC gateway UE;

- a network status information is available, the MC gateway UE should check if the resources and network coverage are sufficient for the requested service at the current location for the specific MC client sending the connection authorization request;

- a roaming scenario has been identified (e.g. switch between EPC and 5GC), then depending on operator policy, roaming agreements, and on national/regional regulatory requirements further check on the received request should be performed (e.g. a decision on how to handle the IP connectivity, the QoS Flows, etc.);

- the number of UEs present in a geographical area indicates that the maximum capacity is reached or a congestion status is occurred (i.e. in such situation pre-defined access control, access identities & access category rules will be used to handle the communication priority);

- the requested QoS can be provided under the current network operating conditions;

- a release mismatch is identified between the MC gateway UE and MC client or has been identified between the MC gateway UE and the MC server.

NOTE 2: The authorization check mechanism is outside the scope of the present document. Further checks, for example. could be based on a pre-configured list of users who are expected to request connection authorization with the MC gateway UE.

3. The MC gateway UE sends the connection authorization response to the MC client.

After successful connection with the MC gateway UE, the MC client has now access to an MC server and may continue with user authentication and service authorization.

If the MC service user wishes to have access to another MC service, the above procedure is repeated. The MC service user may select a different MC gateway UE for the new MC service, if multiple MC gateway UEs are available.

### 7.2.6 Solution evaluation

The authorization check performed by the MC gateway UE requires up to date information which must be pre-configured.

The MC gateway UE acts as an MC application connection node which enables and handles user signalling traffic and media plane traffic individually, i.e. on a per MC service user basis, between the MC client and the corresponding MC server.

## 7.3 Connection authorisation with an MC server via an MC gateway UE

### 7.3.1 General

This solution addresses the key issue 2 described in clause 5.2 on authorisation for connection of non-3GPP devices with an MC gateway UE. The solution only applies to non-3GPP devices which can host an MC client.

With this procedure the MC server performs authorization for the use of the MC gateway UE by the MC client, i.e. the binding between the MC gateway UE and the MC client is authorized and controlled by the MC server. The MC gateway UE is not acting as the authorisation instance which authenticates MC clients.

### 7.3.2 Information flows

#### 7.3.2.1 Connection authorization request

Table 7.3.2.1-1 describes the information flow connection authorization request sent from the MC client, which resides on a non-3GPP device, to the MC gateway UE, and from the MC gateway UE to the MC server.

Table 7.3.2.1-1: Connection authorization request

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| GW MC service ID | M | The GW MC service ID of the requesting MC service user. |
| NOTE: The GW MC service ID indicates for which MC service the connection is to be authorised. | | |

NOTE: The MC service ID used for MC service authorisation and the GW MC service ID used for connection authorization may have different values. Both identities are configured by the Mission Critical Organisation.

#### 7.3.2.2 Connection authorization response

Table 7.3.2.2-1 describes the information flow connection authorization response sent from the MC server to the MC gateway UE, and from the MC gateway UE to the MC client residing on a non-3GPP device.

Table 7.3.2.2-1: Connection authorization response

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| GW MC service ID | M | The GW MC service ID of the requesting MC service user. |
| Response | M | Result of the connection authorization request, service feasibility, and connection evaluation. |

### 7.3.3 MC server configuration data

Table 7.3.3-1 describes configuration data to be stored in the MC server to perform an authorization check to verify that access via the MC gateway UE is permitted.

Table 7.3.3-1: MC service configuration data (on‑network)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Reference | Parameter description | MC client | MC server | Configuration management server |
| Subclause 5.15 of 3GPP TS 22.280 [3] | List of permitted GW MC service ID(s) | N | Y | Y |
|  | > GW MC service ID | N | Y | Y |

### 7.3.4 Initial MC gateway UE configuration data

The initial MC gateway UE configuration data is essential to the MC gateway UE to successfully connect MC clients to the MC system. The initial MC gateway UE configuration data can be the same or different across MC gateway UEs.

Data in table 7.3.4-1 is provided to the MC gateway UE during the bootstrap process and can be configured on the MC gateway UE offline using the CSC-11 reference point or via other means.

Table 7.3.4-1: Initial MC gateway UE configuration data (on-network)

|  |  |
| --- | --- |
| Reference | Parameter description |
| Subclause 5.15 of 3GPP TS 22.280 [3] | List of permitted GW MC service IDs for MCPTT |
|  | > GW MC service ID |
| Subclause 5.15 of 3GPP TS 22.280 [3] | List of permitted GW MC service IDs for MCVideo |
|  | > GW MC service ID |
| Subclause 5.15 of 3GPP TS 22.280 [3] | List of permitted GW MC service IDs for MCData |
|  | > GW MC service ID |

NOTE: Configured MC service IDs indicate the support of an MC service.

### 7.3.5 Procedure

The procedure for connection authorisation via an MC gateway UE towards an MC server is shown in figure 7.3.5-1.

Pre-conditions

- The MC service user wishes to have access to MC services using a non-3GPP device.

- The MC client has been configured with the necessary parameters needed for connectivity with the MC gateway UE.

- The MC client has been provided with an appropriate GW MC service ID.

- The MC gateway UE has performed service authorization for one or more MC services with the MC system.

- The MC service user has selected an MC gateway UE or alternatively, the MC client has performed a selection by internal criteria.

NOTE: The internal criteria are outside the scope of the present document.



Figure 7.3.5-1: Connection authorisation with an MC server via an MC gateway UE

1. The MC client requests connection authorization via the MC gateway UE with an MC server. The client of the MC service user provides the GW MC service ID.

2. The MC gateway UE checks whether:

- the requested MC service, as indicated by the GW MC service ID, is supported by the MC service gateway –

- a network status information is available; the MC gateway UE should check if the resources and network coverage are sufficient for the requested service at the current location for the specific MC client sending the connection authorization request;

- a roaming scenario has been identified (e.g. switch between EPC and 5GC), then depending on operator policy, roaming agreements, and on national/regional regulatory requirements further check on the received request should be performed (e.g. a decision on how to handle the IP connectivity, the QoS Flows, etc.);

- the number of UEs present in a geographical area indicates that the maximum capacity is reached or a congestion status is occurred (i.e. in such situation pre-defined access control, access identities & access category rules will be used to handle the communication priority);

- the requested QoS can be provided under the current network operating conditions;

- a release mismatch is identified between the MC gateway UE and MC client or has been identified between the MC gateway UE and the MC server.

If the MC service is supported, the procedure continues with step 3, otherwise the procedure proceeds with step 7.

3. The MC gateway UE sends the connection authorization request to the MC server.

4. The MC server performs an authorization check, to verify that access via the MC gateway UE is permitted.

5. The MC server sends the connection authorization response to the MC gateway UE.

6. The MC gateway UE marks the MC client as authorized to have MC service access via the MC gateway UE.

7. The MC gateway UE sends the connection authorization response to the MC client.

After successful connection with the MC gateway UE, the MC client has now access to the MC server and may continue with user authentication and service authorization.

If the MC service user wishes to have access to another MC service, the above procedure is repeated. The MC service user may select a different MC gateway UE for the new MC service, if multiple MC gateway UEs are available.

### 7.3.6 Solution evaluation

The MC gateway UE is not required to check whether the MC service user can have MC service access via the MC gateway UE.

The MC gateway UE acts as an MC application connection node which enables and handles user signalling traffic and media plane traffic individually, i.e. on per MC service user basis, between the MC client and the corresponding MC server.

## 7.4 Using IMS identities behind the MC gateway UE

### 7.4.1 General

This solution addresses the key issue 3 described in clause 5.3 on identification of MC service users behind an MC gateway UE residing on non-3GPP devices.

### 7.4.2 Solution description

The MC gateway UE offers access to the MC system for several MC service clients. The MC service clients can be either located in the MC gateway UE or in non-3GPP devices connected to the MC gateway UE via non-3GPP access. Simultaneous sharing of an MC gateway UE by various MC service clients requires a relationship between the MC service identities used by the MC service clients with media streams passing the MC gateway UE towards the MC system to share the network transport resources of the MC gateway UE.

It is assumed that the MC service user behind the MC gateway UE has no 3GPP transport access credentials (i.e. no UICC), whereas the MC system relies on IMS identities (i.e. IMPUs/IMPIs) needed for authorisation with the IMS. In addition, in MC systems there exist a one-to-one correspondence of MC service IDs with IMPUs for enabling routing of signalling traffic between the MC service server and the MC service client.

Taking the above into account two options are considered.

Option 1 (see figure 7.4.2-1) relies on MC service IDs provided by the MC gateway UE. The MC service clients behind the MC gateway UE share the credentials from the IMS subscription of the MC gateway UE. The number of MC service clients behind the MC gateway UE is determined by the number of subscribed MC service IDs that are associated with the IMS subscription of the MC gateway UE.



Figure 7.4.2-1: Sharing the MC gateway UE's IMS subscription

Option 2 (see figure 7.4.2-2) relies on the use of the IMS Credentials (IMC) application specified in 3GPP TS 23.228 [4]. The MC service clients behind the MC gateway UE use their own IMS subscription and do not rely on the IMS subscription from the MC gateway UE. The number of MC service clients behind the MC gateway UE is independent from the number of subscribed MC service IDs that are associated with the IMS subscription of the MC gateway UE.



Figure 7.4.2-2: Using independent IMS subscriptions

Both options support an unambiguous identification of MC service clients behind the MC gateway UE. Option 2 also has the degree of freedom that the user profiles associated with the devices behind the MC gateway UE are independent of the MC gateway user profile.

### 7.4.3 Solution evaluation

Both options support an unambiguous identification of MC service clients behind the MC gateway UE and multiple simultaneous MC gateway UE use. Option 2 offers the degree of freedom that the user profiles used on the non -3GPP devices behind the MC gateway UE are independent from those of the MC gateway user profile. Whereas the pre-configuration of IMPUs for option 1 is not very flexible and sharing of IMPUs between different MC clients might have additional implications (e.g. managing of available IMPUs between MC clients). Option 2 seems not to have any significant drawbacks, has less implications regarding pre-configuration and is more future proof (e.g. parallel use of multiple MC gateway UEs).

Option 2 is selected as way forward, i.e. on MC clients capable to host MC service clients separate IMS subscriptions are used, while for non-3GPP devices which cannot host MC client(s) the use IMS subscription(s) provided by the serving MC gateway UE(s) is applied.

## 7.5 Connection authorisation for non-3GPP devices that do not host an MC client

### 7.5.1 General

This solution addresses the key issue 2 described in clause 5.2 on authorisation for connection of non-3GPP devices with an MC gateway UE. The solution is applied to non-3GPP devices which cannot host an MC client.

With this procedure the MC server performs authorization for the use of the MC gateway UE by the MC client, i.e. the binding between the MC gateway UE and the MC client is authorized and controlled by the MC server.

NOTE: The interworking between the MC client hosted at the MC gateway UE and an MC service user is out of scope of the present document, nevertheless, the connection authorisation performed by the MC gateway UE shall enable the non-3GPP devices to get the access to MC services requested by the service user.

### 7.5.2 Information flows

#### 7.5.2.1 Connection authorization request

Table 7.5.2.1-1 describes the information flow connection authorization request sent from the MC client, which resides on a MC gateway UE, to the MC server.

Table 7.5.2.1-1: Connection authorization request

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| GW MC service ID | M | The GW MC service ID of the requesting MC service user. |
| NOTE: The GW MC service ID indicates for which MC service the connection is to be authorised. | | |

NOTE: The MC service ID used for MC service authorisation and the GW MC service ID used for connection authorization may have different values. Both identities are configured by the Mission Critical Organisation.

#### 7.5.2.2 Connection authorization response

Table 7.5.2.2-1 describes the information flow connection authorization response sent from the MC server to the MC client residing on the MC gateway UE.

Table 7.5.2.2-1: Connection authorization response

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| GW MC service ID | M | The GW MC service ID of the requesting MC service user. |
| Result | M | Success or failure of the connection authorization request (authorization successful/failed; service not supported). |

### 7.5.3 MC server configuration data

Table 7.5.3-1 describes configuration data to be stored in the MC server to perform an authorization check to verify that access via the MC gateway UE is permitted.

Table 7.5.3-1: MC service configuration data (on‑network)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Reference | Parameter description | MC client | MC server | Configuration management server |
| Subclause 5.15 of 3GPP TS 22.280 [3] | List of permitted GW MC service ID(s) | N | Y | Y |
|  | > GW MC service ID | N | Y | Y |

### 7.5.4 Initial MC gateway UE configuration data

The initial MC gateway UE configuration data is essential to the MC gateway UE to successfully connect MC clients to the MC system. The initial MC gateway UE configuration data can be the same or different across MC gateway UEs.

Data in Table 7.5.4-1 is provided to the MC gateway UE during the bootstrap process and can be configured on the MC gateway UE offline using the CSC-11 reference point or via other means.

Table 7.5.4-1: Initial MC gateway UE configuration data (on-network)

|  |  |
| --- | --- |
| Reference | Parameter description |
| Subclause 5.15 of 3GPP TS 22.280 [3] | List of GW MC service IDs for MCPTT |
|  | > GW MC service ID |
| Subclause 5.15 of 3GPP TS 22.280 [3] | List of GW MC service IDs for MCVideo |
|  | > GW MC service ID |
| Subclause 5.15 of 3GPP TS 22.280 [3] | List of GW MC service IDs for MCData |
|  | > GW MC service ID |

NOTE: Configured MC service IDs indicate the support of an MC service.

7.5.5 Procedure

The procedure for connection authorisation of an MC client hosted by the MC gateway UE towards an MC server is shown in figure 7.5.5-1.

Pre-conditions

- The MC service user wishes to have access to MC services using a non-3GPP device, where the MC client is hosted by the MC gateway UE.

- The MC service user has selected an MC gateway UE or alternatively, the non-3GPP has performed a selection by internal criteria.

NOTE: The internal criteria are outside the scope of the present document.

- The MC client, which is hosted by the MC gateway UE, has been configured with the necessary parameters needed for connectivity with the MC gateway UE.

- The MC gateway UE has performed service authorization for one or more MC services with the MC system.



Figure 7.5.5-1: Connection authorisation of an MC client hosted by an MC gateway UE

1. The MC client, hosted by the MC gateway UE, requests connection authorization with an MC server by providing the GW MC service ID. The MC gateway UE sends the connection authorization request to the MC server.

2. The MC server performs an authorization check, to verify that access using the MC gateway UE is permitted.

3. The MC server sends the connection authorization response to the MC client residing on the MC gateway UE.

The MC client has now access to the MC server and may continue with user authentication and service authorization.

If the MC service user wishes to have access to another MC service, the above procedure is repeated. The MC service user may select a different MC gateway UE for the new MC service, if multiple MC gateway UEs are available.

### 7.5.6 Solution evaluation

The non-3GPP device is not required to host an MC client, instead the MC gateway UE hosts the MC client for the non-3GPP device.

The MC gateway UE acts as an MC application connection node which enables and handles user signalling traffic and media plane traffic individually, i.e. on per MC service user basis, between the non-3GPP device and the corresponding MC server.

## 7.6 3GPP access network related location information management

### 7.6.1 General

This solution addresses the key issue 7 described in the clause 5.7 on 3GPP access network related location management by MC clients. The solution only applies to non-3GPP devices which can host an MC client, and which cannot handle the location reporting configuration related to the 3GPP access network by itself.

With this procedure the MC client requests the MC gateway UE to handle the location reporting configuration related to the 3GPP access network. Also, MC clients can fetch the 3GPP access network related location information if it requires to report the same to the MC system.

### 7.6.2 Information flows

#### 7.6.2.1 MC GW Location reporting configuration

Table 7.6.2.1-1 describes the information flow from the MC client, which resides on a non-3GPP device, to the MC gateway UE for the location reporting configuration.

Table 7.6.2.1-1: MC GW Location reporting configuration

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| GW MC service ID | M | The GW MC service ID of the requesting MC service user |
| Requested location information | O (see NOTE 1) | Identifies what location information is requested |
| Triggering criteria | O (see NOTE 1) | Identifies when the location management client will send the location report (see NOTE 2) |
| Minimum time between consecutive reports | O (see NOTE 1) | Defaults to 0 if absent |
| NOTE 1: If none of the information elements is present, this represents a cancellation for location reporting, if configured.  NOTE 2: The triggering criteria contains only the events related to the 3GPP access network. | | |

#### 7.6.2.2 MC GW Location information report

Table 7.6.2.2-1 describes the information flow from the MC gateway UE to the MC client residing on a non-3GPP device for the location information reporting.

Table 7.6.2.2-1: MC GW Location information report

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| GW MC service ID | M | The GW MC service ID of the requesting MC service user |
| Triggering event | O | Identity of the event that triggered the sending of the report |
| Location information  (see NOTE) | O | Location information of the MC gateway UE |
| NOTE: The following location information elements which are related to 3GPP access network shall be present (configurable): Serving and neighbouring ECGI, MBMS SAIs, MBMSfnArea, PLMN ID. | | |

#### 7.6.2.3 MC GW Location information request

Table 7.6.2.3-1 describes the information flow from the MC client residing on a non-3GPP device to the MC gateway UE for requesting an immediate location information report.

Table 7.6.2.3-1: MC GW Location information request

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| GW MC service ID | M | The GW MC service ID of the requesting MC service user |

### 7.6.3 Procedure

#### 7.6.3.1 Event-triggered location reporting procedure

The procedure for how the MC clients residing on non-3GPP devices handling the location reporting configuration containing the trigger criteria related to the 3GPP access network related location information is shown in the figure 7.6.3.1-1.

Pre-conditions

- The MC service user wishes to have access to MC services by using a non-3GPP device.

- The MC client successfully completed service authorization via MC gateway UE.



Figure 7.6.3.1-1: Event-triggered location reporting procedure

1. MC client receives the location reporting configuration request from LMS which contains the triggering criteria of 3GPP access network related location information changes.

2. MC client sends the MC GW Location reporting configuration to the MC gateway UE containing the 3GPP access network related location information triggers and the requested location information. MC Gateway UE stores the location reporting configuration and starts monitoring for the triggers as received in the MC GW location reporting configuration.

3. A location reporting event occurs, triggering step 4.

4. MC gateway UE sends the MC GW Location information report containing the location information requested by the MC client.

5. MC client updates the locally available location information with the location information received from the MC gateway UE.

6. The MC client sends a location information report to the location management server, containing location information identified by the location management server and available to the MC client.

#### 7.6.4.2 On-demand location reporting procedure

The MC client may need to immediately send the location report to the location management sometimes and the requested location information may be related to the 3GPP access network. Under these circumstances the MC client can request the MC gateway UE to report its location information as described in the figure 7.6.4.2-1.

Pre-conditions

- The MC service user wishes to have access to MC services by using a non-3GPP device.

- The MC client successfully completed service authorization via MC Gateway UE.



Figure 7.6.4.2-1: On-demand location reporting procedure

1. MC client receives the location information request from LMS to send the location information immediately or any other events where it has to send the location report to the location management server immediately like initial login, group call etc. Requested location information includes the location information related to 3GPP access network.

2. MC service user is notified and asked for permission to share location information. MC service user can accept or deny the request.

3. MC client sends the MC GW Location information request to the MC Gateway requesting for the location information related to the 3GPP access network of the MC Gateway UE.

4. MC gateway UE sends the MC GW Location information report containing the location information requested by the MC client.

5. MC client updates the locally available location information with the location information received from the MC gateway UE.

6. The MC client sends a location information report to the location management server, containing location information identified by the location management server and available to the MC client.

#### 7.6.5.3 Location reporting cancel procedure

The location reporting cancel procedure reuses the information flow of location reporting configuration.

Pre-conditions

- The MC service user wishes to have access to MC services by using a non-3GPP device.

- The MC client successfully completed service authorization via MC gateway UE.

- The MC client no longer needs the location information report from MC gateway UE.



Figure 7.6.5.3-1: On-demand location reporting procedure

1. The location management client sends MC GW location reporting configuration without any information element to the MC gateway UE to stop location reporting from the MC gateway UE.

2. The MC gateway UE stops sending location information reports to the MC client.

### 7.6.4 Solution evaluation

This solution provides an additional information flows which are exchanged between the MC gateway UE and the MC clients residing on non‑3GPP devices to ensure that the MC clients can handle the location reporting configuration containing the triggering criteria related to the 3GPP access network information and also provide the location information related to the 3GPP access network when requested.

## 7.7 Routing of data and signalling by the MC gateway UE

### 7.7.1 General

This solution addresses the key issue 5 described in clause 5.5 on clarifying how the MC gateway UE routes and maps the traffic data and signalling information between non-3GPP devices and the network.

Two different options are envisaged.

### 7.7.2 MC client uses the IP address from the MC gateway UE

The connection authorization process takes place centrally with the inclusion of the MC service server (see clause 7.3). The MC gateway UE stores the correlation between the GW MC service ID and the IP address used by the MC client once it receives the connection authorisation request. The assigned IP address of the MC gateway UE (used for 3GPP transport) is used to forward the connection authorization request from the MC client to the MC server, since the MC client IP address is unknown to the MC system. The connection authorization response is sent back accordingly from the MC server towards the MC gateway UE, which then forwards it to the corresponding MC client. Subsequent procedures initiated by the MC client, i.e. SIP registration, user authentication and service authorisation, would also use the MC gateway UE's IP address. The MC gateway UE's IP address would then also be used in the case of local connection authorization (see clause 7.2).

The drawback of the approach is when the IP address of the MC gateway UE changes, all active MC clients would be affected with their communication with the MC server.



Figure 7.7.2-1: MC client uses MC gateway UE's IP address

### 7.7.3 MC client uses an own IP address

For communications between the MC client and the MC server via an MC gateway UE, the MC client's IP address is also used for communications between the MC gateway UE and the MC server. For this, the IP address range must be known by the MC service environment beforehand to enable the MC client's host (non-3GPP device) routing. In addition, it requires a correlation between the MC client's IP address and the MC gateway UE's IP address as the next hop. The advantage would be the independence between an MC gateway UE IP address and the MC client IP address.



Figure 7.7.3-1: MC client uses local IP address

The approach below is referred to as routing behind the UE on an APN/DNN basis enables the routing of packets to IP addresses that do not belong to the PDN session or PDU session, but exist behind it. The routing behind (framed routing) the UE functionality enables the routing of packets to IP addresses that do not belong to the PDN/PDU session of the UE. The IP address of the MC client associated with the non-3GPP device can be different than the MC GW UE address.

The approach of framed routing (3GPP TS 23.501 [10], clause 5.6.14) in which the prefix, i.e. IPv6 prefix, of the route to the corresponding host IP adress is marked behind the UE. The corresponding UPF may indicate support of framed routing by setting the FRRT flag in accordance to 3GPP TS 29.244 [11].

### 7.7.4 Solution evaluation

The options described in clause 7.7.2. and clause 7.7.3 take different approaches. In the first approach, only the IP address of the MC gateway UE is used for CP and UP traffic of the MC clients in relation to the SIP core and the MC service servers. The MC gateway UE must provide additional functions for routing and address mapping. Another disadvantage is that when the MC gateway UE changes its IP address, all MC clients behind the MC gateway UE are always affected. The use of the MC gateway UE IP address also requires the detection of characteristics unique to a MC client, e.g. port mapping, in order to be able to differentiate between the MC clients.

The second approach, using framed routing, enables the MC clients to act independently of the MC gateway UE IP address. This also eliminates the necessary IP address mapping function in the MC gateway UE and any type of traffic, CP and UP, is uniquely associated with the MC client's IP address. This option has been available since Rel-15 and is available for the use of PDN session and PDU session.

## 7.8 MBMS Support for MC clients residing on non‑3GPP devices

### 7.8.1 General

This solution addresses the key issue #4 described in the clause 5.4 on MBMS support. This solution in particular addresses the MBMS support for the MC clients residing on the non-3GPP devices. The MC gateway UE learns the MBMS bearer details from the MC clients and starts listening on them. MC gateway UE forwards the data received over MBMS bearer to the MC clients residing on non‑3GPP access and have requested MC gateway UE to listen on the MBMS bearer.

With this procedure MBMS bearer can be supported for the MC clients residing on non-3GPP devices without requiring any changes at the MC system side. Changes required are confined to the interface between MC gateway UE and the MC clients residing on non‑3GPP devices. MC service server may rely on the location information received from the MC clients as defined in clause 7.6 while deciding to establish MBMS bearer.

### 7.8.2 Information flows

#### 7.8.2.1 MC GW MBMS bearer announcement

Table 7.8.2.1-1 describes the information flow from the MC client which resides on a non‑3GPP device to the MC gateway UE for sharing the details of MBMS bearer announcement received by the MC Client from the MC Service server.

Table 7.8.2.1-1: MC GW MBMS bearer announcement

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| MC GW service ID | M | The GW MC service ID of the requesting MC service user. |
| TMGI | M | TMGI information |
| List of service area identifier | M | A list of service area identifier for the applicable MBMS broadcast area. |
| Frequency | O | Identification of frequency if multi carrier support is provided |
| SDP information | M | SDP with media and floor control information applicable to groups that can use this bearer (e.g. codec, protocol id, FEC information) |
| Monitoring state | O | The monitoring state is used to control if the client is actively monitoring the MBMS bearer quality or not. |
| ROHC information | O | Indicate the usage of ROHC and provide the parameters of the ROHC channel to signal to the ROHC decoder. |

#### 7.8.2.2 MC GW MBMS listening status report

Table 7.8.2.2-1 describes the information flow from the MC gateway UE to the MC client which resides on a non‑3GPP device for the MC GW MBMS listening status report.

Table 7.8.2.2-1: MC GW MBMS listening status report

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| TMGI(s) | M | TMGI(s) information. |
| MBMS listening status(s) | M | The MBMS listening status per TMGI. |
| MBMS reception quality level | O | The reception quality level per TMGI |
| Non 3GPP transport channel establishment parameters (See NOTE) | O | This element contains the details of the non‑3GPP channel establishment parameters (IP address, Port etc.) which is used by the MC gateway UE to forward the MC service communication data received over 3GPP MBMS bearer to the MC client |
| NOTE: These parameters are implementation specific and are dependent on the non 3GPP transport mechanism used between the MC client and MC gateway UE. This parameter shall be present mandatorily if the MBMS bearer listening status is success. | | |

#### 7.8.2.3 MC GW MapGroupToBearer request

Table 7.8.2.3-1 describes the information flow from the MC client which resides on a non‑3GPP device to the MC gateway UE for sharing the details of MapGroupToBearer message received from the MC service server.

Table 7.8.2.3-1: MC GW MapGroupToBearer request

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| MC GW service ID | M | The GW MC service ID of the MC service user. |
| MCPTT group ID | M | This element identifies the MCPTT group, in which the call is started. |
| Media stream identifier | M | This element identifies the media stream of the SDP used for the group call (e.g. MBMS subchannel). |
| TMGI | M | The MBMS bearer identifier. |

#### 7.8.2.4 MC GW MapGroupToBearer response

Table 7.8.2.4-1 describes the information flow from the MC gateway UE to the MC client which resides on a non‑3GPP device for the MC GW MapGroupToBearer response.

Table 7.8.2.4-1: MC GW MapGroupToBearer response

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| MapGroupToBearer Status | M | Success or failure response |
| Non 3GPP transport channel establishment parameters (See NOTE) | M | This elements contains the details of the non 3GPP channel establishment parameters(IP address, Port etc.,) which is used by the MC gateway UE to forward the MC service Group communication data received over 3GPP MBMS bearer to the MC client |
| NOTE: These parameters are implementation specific and are dependent on the non 3GPP transport mechanism used between the MC client and MC gateway UE | | |

#### 7.8.2.5 MC GW MBMS bearer quality report

Table 7.8.2.5-1 describes the information flow from the MC gateway UE to the MC client which resides on a non‑3GPP device for the MC GW MBMS bearer quality report.

Table 7.8.2.5-1: MC GW MapGroupToBearer response

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| TMGI(s) | M | TMGI(s) information. |
| MBMS listening status(s) | M | The MBMS listening status per TMGI. |
| MBMS reception quality level | O | The reception quality level per TMGI |

#### 7.8.2.6 MC GW MBMS bearer suspension indication

Table 7.8.2.6-1 describes the information flow from the MC gateway UE to the MC client which resides on a non‑3GPP device for the MC GW MBMS bearer suspension indication.

Table 7.8.2.6-1: MC GW MBMS bearer suspension indication

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| TMGI(s) | M | TMGI(s) information. |
| MBMS suspension status(s) | M | The MBMS suspension status per TMGI. |

### 7.8.3 Procedure

#### 7.8.3.1 MBMS bearer announcement handling procedure

Whenever the MC clients residing on non-3GPP devices receives the MBMS bearer announcements from the MC system, the MC clients shares the details of the MBMS bearer received in MBMS bearer announcement to the MC gateway UE. This enables the MC gateway UE to start monitoring the MBMS bearer.

Figure 7.8.3.1-1 illustrates the procedure for handling the MBMS bearer announcement by the MC client and the MC gateway UE.

Pre-conditions:

1. The MC client has been configured with the necessary parameters needed for connectivity with the MC gateway UE.

2. The MC client successfully completed service authorization via MC gateway UE.



Figure 7.8.3.1-1: Handling of MBMS bearer announcement

1. The MC service server establishes the MBMS bearer(s) according to the procedures defined in 3GPP TS 23.468 [9]. Service description associated with the MBMS bearer(s) is returned from the BM-SC.

2. The MC service server provides service description information associated with the MBMS bearer to the MC client residing on non‑3GPP devices via MC gateway UE.

3. The MC client sends the MC GW MBMS bearer announcement to the MC Gateway UE containing the MBMS bearer related information.

4. The MC Gateway UE stores the information associated with the TMGI(s). The MC Gateway UE uses the TMGI and other MBMS bearer related information to activate the monitoring of the MBMS bearer.

5. The MC Gateway UE that enters or is in the service area of at least one announced TMGI notifies to the MC client that it can receive data over MBMS by sending the MC GW MBMS listening status report. The MC GW MBMS listening status report also contains the details of the non‑3GPP transport communication related parameters. The MC Gateway UE may choose to send the details of existing communication channel information as part of Non 3GPP transport channel establishment parameters IE if existing communication channel can be reused.

6. The MC client establishes the communication channel with the MC gateway UE based on the parameters received in step 5 to receive the MC service data from the MC gateway UE, if these parameters are not referring to any of the already established communication channel. The MC Gateway UE forwards the MC service data it received over the MBMS bearer from the MC service server to the MC client over this communication channel.

7. The MC Client sends the MBMS Listening Status Report to the MC Server indicating that it is able to receive the media over MBMS.

#### 7.8.3.2 Procedure for handling MapGroupToBearer message

Whenever the MC client detects that the data received from MC service server is MapGroupToBearer message and if the MC client participates in the group session or communication identified by the MapGroupToBearer message then it should inform the details contained in the MapGroupToBearer message to MC gateway UE. When the association of group call, MBMS bearer and the MC GW service ID of the MC client is known to the MC gateway UE, it can forward the data received over MBMS bearer accordingly.

Figure 7.8.3.2-1 illustrates the procedure for handling the MapGroupToBearer message by the MC client and the MC gateway UE.

Pre-conditions:

1. The MC client has been configured with the necessary parameters needed for connectivity with the MC gateway UE.

2. The MC client successfully completed service authorization via MC gateway UE.



Figure 7.8.3.2-1: Handling of MapGroupToBearer message

1. The MC service server sends a MapGroupToBearer message over a previously activated MBMS bearer to all users that will receive the call over an MBMS bearer. The MapGroupToBearer message includes association information between the group call and MBMS bearer. The MapGroupToBearer message includes MC service group ID and information about the media stream identifier of the activated MBMS bearer and may include the identifier (i.e. the TMGI) of the MBMS bearer broadcasting the call.

2. If the MC client is participating in the MC group communication identified by the MapGroupToBearer message, it sends the details contained in the MapGroupToBearer message to the MC gateway UE through MC GW MapGroupToBearer request message.

3. The MC gateway UE on receiving the MC GW MapGroupToBearer Request message from the MC client it maintains the association between the GW MC Service ID and the corresponding MBMS sub channel.

4. The MC gateway UE sends the MC GW MapGroupToBearer response message to the MC client which contains the details of the non‑3GPP transport communication related parameters.

5. The MC client establishes the communication channel with the MC gateway UE based on the parameters received in step 4 to receive the MC service group communication data from the MC gateway UE.

6. The MC service server sends the downlink media for the group communication session over the MBMS bearer.

7. The MC gateway UE checks which MC clients should receive the media of the MC group communication based on Step 3.

8. The MC gateway UE forwards the downlink media to the intended MC clients over the communication channel established as in step 5.

#### 7.8.3.3 Procedure for MBMS bearer suspension notification

The MC service server can choose to instruct some MC clients to send the MBMS bearer suspension report when notified by RAN. When the MC clients are residing on non‑3GPP devices, MC gateway UE would be the one listening on the MBMS bearers. When RAN decides to suspend the MBMS bearer it indicates the MC gateway UE. MC gateway UE to notify the MC clients it is serving so that MC clients can report the same to the MC service server. This procedure is applicable only if the MC client is instructed to report the MBMS bearer suspension. Irrespective of whether the MC clients need to send the MBMS bearer suspension report to the MC service server, MC gateway can choose to notify the MC clients it is serving whenever RAN suspends the MBMS bearer. MC clients can then decide to send the MBMS bearer suspension report to the MC service server only if they are instructed by the MC service server.

Figure 7.8.3.3-1 illustrates the procedure for MC clients residing on non-3GPP devices reporting the MC service server about the MBMS bearer suspension.



Figure 7.8.3.3-1: MBMS bearer suspension notification

#### 7.8.3.4 Procedure for reporting MBMS bearer quality

The MC Gateway UE listening on the MBMS bearer has to report the MBMS bearer quality to the MC clients so that MC clients can report the same to the MC service server. MC Gateway UE monitors an MBMS bearer to receive MC service media. Based on the received quality (e.g. radio level quality) the MC Gateway UE needs to inform the MC Clients which requested the MC Gateway UE to listen on MBMS bearer, whether it is able to receive the MC service media on the MBMS bearer with sufficient quality or not the MC Clients can inform the MC service server accordingly.

Figure 7.8.3.4-1 illustrates the procedure for MC clients residing on non‑3GPP devices reporting the MC service server about the MBMS bearer quality.

Pre-conditions:

1. There is an MBMS bearer activated and the MBMS bearer information is announced to the MC gateway UE.

2. The MC gateway UE is located in the MBMS broadcasting area

3. The MC gateway UE monitors SIB-13 (or SIB-20) and (SC-)MCCH to receive the modulation and coding scheme.

4. The MC gateway UE monitors the cell specific reference signal and when MBSFN transmission is used, the MBSFN specific reference signals.



Figure 7.8.3.4-1: Reporting MBMS bearer quality

1. The MC gateway UE follows the Step 1 of the procedure as described in 3GPP TS 23.280 [5] clause 10.7.3.6.2 for the MC service UE. Instead of reporting the bearer quality to the MC service server it has to inform all the MC clients which has asked the MC gateway UE to listen on the particular MBMS bearer.

2. If the MBMS bearer quality reaches a certain threshold, the MC gateway UE sends an MC GW MBMS Bearer Quality report to the MC Client. The threshold is used to define the MBMS listening status, which indicates if the MBMS bearer quality has been acceptable or not to receive a specific MC service media. If the MBMS bearer quality is mapped to a different MBMS reception quality level, the MC gateway UE may send an MBMS Bearer Quality report including the MBMS reception quality level to the MC Client.

3. The MC Client sends the MBMS listening status report to the MC Service server via MC Gateway UE containing the information received in the MC GW MBMS Bearer Quality report.

4. The MC service server may send additional proposal for measurements e.g. information about neighbouring MBMS bearers. This message may be an MBMS bearer announcement message.

### 7.8.4 Solution Evaluation

This solution provides additional information flows and procedures required to support MBMS transmissions for the MC service clients operating on non‑3GPP devices and accessing the MC system through MC gateway UE. Changes required to support MBMS transmissions are confined to the interface between the MC service clients and the MC gateway UE. Existing information flows and procedures which are defined for supporting the MBMS transmissions for the MC service clients operating on a 3GPP devices remains unaltered and same is re-used for MC service clients operating on a non‑3GPP devices.

# 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: Functional Architecture for an MC gateway UE | Solution #1: Functional architecture | Clause 7.1.3 | None |
| Key issue #2: Authorisation for connection of non-3GPP devices with an MC gateway UE | Solution #2: Connection authorisation with the MC gateway UE | Clause 7.2.6 | None |
| Solution #3: Connection authorisation with an MC server via an MC gateway UE | Clause 7.3.6 | None |
| Solution #5: Connection authorisation for non-3GPP devices that do not host an MC client | Clause 7.5.6 | None |
| Key issue #3: Identification of MC service users behind an MC gateway UE residing on non-3GPP devices | Solution #4: Using IMS identities behind the MC gateway UE | Clause 7.4.3 | None |
| Key issue #4: MBMS support | Solution #1: Functional architecture | Clause 7.1.3 | None |
| Solution #8: MBMS Support for MC clients residing on non 3GPP devices | Clause 7.8.4 | None |
| Key issue#5: User traffic handling | Solution #2: Connection authorisation with the MC gateway UE | Clause 7.2.6 | None |
| Solution #3: Connection authorisation with an MC server via an MC gateway UE | Clause 7.3.6 | None |
| Solution #7: Routing of data and signalling by the MC gateway UE | Clause 7.7.4 | None |
| Key issue #6: Use of multiple MC gateway UEs | Covered by solutions #1, #2, #3, #4 and #5 | Covered by the solution specific evaluation clauses | As stated by the specific solution |
| Key issue #7: 3GPP access network related location management by MC Clients | Solution #6: 3GPP access network related location information management | Clause 7.6.4 | None |

# 9 Conclusions

This technical report fulfills the objective to study solutions to satisfy the stage 1 requirements for a MC gateway UE function. It identifies enhancements to be included in the technical specifications for MCPTT, MCVideo, MCData and in the common functional architecture to support mission critical communications.

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

1) The functional architecture (clause 7.1) is used as starting point to develop a proper functional model to support the MC Gateway UE functionality.

2) The solution connection authorisation with an MC server via an MC gateway UE (clause 7.3) will be used to define the authorisation procedure for an MC client hosted by a non-3GPP device.

3) The solution connection authorisation for non-3GPP devices that do not host an MC client (clause 7.5) will be used to define the authorisation procedure for an MC client which cannot be hosted by a non-3GPP device.

4) Option 2 of solution on using IMS identities behind the MC gateway UE (clause 7.4) will be used, where MC clients capable to host MC service clients use dedicated IMS subscriptions, and non-3GPP devices which cannot host an MC client make use of the IMS subscription provided by the serving MC gateway UE.

5) The solution 3GPP access network related location information management (clause 7.6) will be used to define the 3GPP access network related location management procedures for MC clients hosted by non-3GPP devices.

6) The solution MC client uses an own IP address which relies on framed routing (clause 7.7.3) will be used to describe the mechanism for routing of data and signalling by the MC gateway UE.

7) The solution MBMS Support for MC clients residing on non-3GPP devices (clause 7.8) will be used to support MBMS bearers for MC clients residing on non-3GPP devices without requiring any changes at the MC system side.

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): Gateway UE requirements

The gateway requirements are captured in 3GPP TS 22.179 [2] clause 4.5.4 (see clause A.1) and 3GPP TS 22.280 [3] clause 5.15 (see clause A.2).

## A.1 Shareable McPTT UEs and gateway UEs

The conceptual model for shareable McPTT UEs is that of a pool of UEs, each UE being interchangeable with any other, and users randomly choosing one or more UEs from the pool, each user for his temporary exclusive use. A shareable MCPTT UE can be used by user who can gain access to the MCPTT client application stored on it and can become an authenticated MCPTT User. A shareable MCPTT UE can serve only one MCPTT User at a time. An MCPTT User who signs into a shareable MCPTT UE that is already in-use causes the sign-off of the previous MCPTT User.

An MCPTT User can simultaneously have several active McPTT UEs, which, from an MCPTT Service point of view, are addressable individually and/or collectively within the context of their association to the MCPTT User.

The conceptual model for a gateway UE is that of a UE capable of providing service to an MCPTT User employing a non-3GPP device. A gateway UE is usable simultaneously by multiple MCPTT Users. Unlike a shareable MCPTT UE, if a new person enters his valid credentials towards signing in the MCPTT Service, his successful signing in and becoming an MCPTT User does not affect the initial MCPTT Users already served by the gateway UE.

A gateway UE is typically installed in a vehicle (e.g., a police car, fire truck) and has wired and/or wireless connections to various devices in use by the MCPTT Users.

A gateway UE differs functionally from a ProSe relay node. In the ProSe paradigm, the relay node and the devices served by it are all (ProSe enabled) 3GPP UEs and are "visible" to the 3GPP system as UEs. In the gateway UE paradigm, only the gateway UE is an 3GPP device and only it is "visible" at the 3GPP network layer.

Figure A.1-1 shows schematically some of the relationships between MCPTT Users and McPTT UEs.



Figure A.1-1: Relationships between MCPTT Users and McPTT UEs

## A.2 Gateway requirements

[R-5.15-001] The MCX Service system shall be accessible via gateway MCX UEs by MCX Users.

[R-5.15-001a] The MCX Service system shall provide a mechanism to uniquely identify a gateway MCX UE.

[R-5.15-002] Gateway MCX UEs shall ensure that the content of communications between the MCX Service System and an MCX User attached to the gateway MCX UEs is unaltered.

[R-5.15-003] Gateway MCX UEs shall handle the communication traffic attributes, e.g. priority and QoS, of an MCX User attached to a gateway MCX UE independently of other MCX Users concurrently attached to the same gateway MCX UE.

[R-5.15-004] Multiple Gateway MCX UEs shall be able to operate within the same area (e.g., site of an incident or accident, overlapping coverage, adjacent cells, etc.).

[R-5.15-005] MCX Users shall be able to select gateway MCX UEs, in case multiple, accessible gateway MCX UEs are available.

[R-5.15-006] An MCX User shall be able to access multiple gateway MCX UEs simultaneously from a single device while restricting a MCX Service to one gateway (e.g., MCPTT on gateway UE 1, MCData and MCVideo on gateway UE 2).

# Annex B (informative): Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **Meeting** | **Tdoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2020-05 | SA6#37-e |  |  |  |  | TR skeleton | 0.0.0 |
| 2020-06 | SA6#37-e |  |  |  |  | S6-200655, S6-200656, S6-200657 | 0.0.1 |
| 2020-08 | SA6#38-e |  |  |  |  | S6-201195, S6-201196, S6-201257, S6-201198, S6-201199, S6-201200 | 0.1.0 |
| 2020-10 | SA6#39-BIS-e |  |  |  |  | S6-201738, S6-201888, S6-201889, S6-201890, S6-202022 | 0.2.0 |
| 2020-11 | SA6#40-e |  |  |  |  | S6-202138, S6-202236; S6-202237, S6-202238, S6-202239 | 0.3.0 |
| 2021-03 | SA6#42-e |  |  |  |  | S6-210401, S6-210410, S6-210411, S6-210413, S6-210415, S6-210416, S6-210582, S6-210583, S6-210584, S6-210585 | 0.4.0 |
| 2021-06 | SA6#43-e |  |  |  |  | S6-211184, S6-211185, S6-211186, S6-211187, S6-211188, S6-211189, S6-211190, S6-211191, S6- 211222, S6- 211394, S6-211413, S6-211414 | 0.5.0 |
| 2021-06 | SA#92-e | SP-210475 |  |  |  | Presentation for information at SA#92-e | 1.0.0 |
| 2021-07 | SA6#44-e |  |  |  |  | S6-211596, S6-211598, S6-211621, S6-211624, S6-211733, S6-211748, S6-211773, S6-211790 | 1.1.0 |
| 2021-09 | SA6#45-e |  |  |  |  | S6-211892, S6-211893, S6-211919, S6- 211921, S6-212059, S6-212106, S6-212143 | 1.2.0 |
| 2021-09 | SA#93-e | SP-210949 |  |  |  | Presentation for approval at SA#93-e | 2.0.0 |
| 2021-09 | SA#93-e | SP-210949 |  |  |  | MCC Editorial update for publication after TSG SA approval (SA#93) | 18.0.0 |