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# Foreword

This Technical Specification 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;

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.

In the present document, modal verbs have the following meanings:

**shall** indicates a mandatory requirement to do something

**shall not** indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

**should** indicates a recommendation to do something

**should not** indicates a recommendation not to do something

**may** indicates permission to do something

**need not** indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

**can** indicates that something is possible

**cannot** indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

**will** indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**will not** indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**might** indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

**might not** indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

**is** (or any other verb in the indicative mood) indicates a statement of fact

**is not** (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

# 1 Scope

The present document specifies architectural enhancements to the 5G system using NR to support multicast and broadcast communication services, complying to the requirements in TS 22.146 [2], TS 22.246 [3] and TS 22.261 [4]. This document encompasses support for functions such as how to deliver multicast and broadcast communications including support within certain location areas, mobility, MBS session management and QoS.

The present document also covers interworking with E-UTRAN and EPC based eMBMS for Public Safety (e.g. MCX services).

# 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 22.146: "Multimedia Broadcast/Multicast Service (MBMS); Stage 1".

[3] 3GPP TS 22.246: "Multimedia Broadcast/Multicast Service (MBMS) user services; Stage 1".

[4] 3GPP TS 22.261: "Service requirements for the 5G system".

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

[6] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".

[7] 3GPP TS 23.503: "Policy and charging control framework for the 5G System (5GS); Stage 2".

[8] 3GPP TS 23.246: "Multimedia Broadcast/Multicast Service (MBMS); Architecture and functional description".

[9] 3GPP TS 38.300: "NR; Overall description; Stage-2".

[10] 3GPP TS 23.468: "Group Communication System Enablers for LTE (GCSE\_LTE)".

[11] 3GPP TS 26.348: "Northbound Application Programming Interface (API) for Multimedia Broadcast/Multicast Service (MBMS) at the xMB reference point".

[12] 3GPP TS 23.003: "Numbering, Addressing and Identification".

[13] 3GPP TS 26.346: "MBMS: Protocols and Codecs".

[14] 3GPP TR 23.757: "Study on architectural enhancements for 5G multicast-broadcast services".

[15] 3GPP TS 38.413: "NG Application Protocol (NGAP)".

# 3 Definitions of terms and abbreviations

## 3.1 Terms

For the purposes of the present document, the terms and definitions defined in TR 21.905 [1] and the following apply:

**5GC Individual MBS traffic delivery**: 5G CN receives a single copy of MBS data packets and delivers separate copies of those MBS data packets to individual UEs via per-UE PDU sessions, hence for each such UE one PDU session is required to be associated with a multicast session.

**5GC shared MBS traffic delivery**: 5G CN receives a single copy of MBS data packets and delivers a single copy of those MBS data packets to a RAN node.

**Associated PDU Session:** A PDU Session associated to a multicast session that is used for 5GC Individual MBS traffic delivery method and for signalling related to a user's participation in a multicast session such as join and leave requests.

**Associated QoS Flow:** A unicast QoS Flow that belongs to the associated PDU Session and is used for 5GC Individual MBS traffic delivery method. The associated QoS Flow is mapped to a multicast QoS Flow in a multicast MBS session.

**Broadcast communication service:** A 5GS communication service in which the same service and the same specific content data are provided simultaneously to all UEs in a geographical area (i.e., all UEs in the broadcast coverage area are authorized to receive the data).

NOTE 1: For the broadcast communication service, the content provider and network may not be aware whether the authorized UEs are actually receiving the data being delivered.

**Broadcast MBS session:** An MBS session to deliver the broadcast communication service. A broadcast MBS session is characterised by the content to send and the geographical area where to distribute it.

**Broadcast service area:** The area within which data of one or multiple Broadcast session(s) are sent.

**MBS QoS Flow**: The finest granularity for QoS forwarding treatment for MBS data. Providing different QoS forwarding treatment requires separate MBS QoS Flows in 5GS supporting MBS.

**MBS Service Announcement:** Mechanism to allow users to be informed about the available MBS services.

**MBS session:** A multicast session or a broadcast session.

**Multicast communication service:** A 5GS communication service in which the same service and the same specific content data are provided simultaneously to a dedicated set of UEs (i.e., not all UEs in the multicast coverage are authorized to receive the data).

NOTE 2: For multicast communication service, the content provider and network can be aware whether the authorized UEs are actually receiving the data being delivered.

**Multicast MBS session:** An MBS session to deliver the multicast communication service. A multicast MBS session is characterised by the content to send, by the list of UEs that may receive the service and optionally by a multicast area where to distribute it.

**Multicast service area:** The area within which data of one or multiple Multicast session(s) may be sent.

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1], TS 23.501 [5] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

MBS Multicast/Broadcast Service.

MB-SMF Multicast/Broadcast Session Management Function.

MBSF Multicast/Broadcast Service Function.

MBSTF Multicast/Broadcast Service Transport Function.

# 4 General Concept

## 4.1 Principles of multicast and broadcast communication

Editor's note: It is FFS whether the text below will be moved to a different clause of the TS.

Multicast and Broadcast Service (MBS) is a point-to-multipoint service in which data is transmitted from a single source entity to multiple recipients.

There are two types of MBS session:

- Broadcast session;

- Multicast session.

The MBS architecture defined in clause 5 follows the 5G System architectural principles as defined in TS 23.501 [5]. The MBS architecture provides:

- Efficient usage of radio-network and core-network resources, with an emphasis on radio interface efficiency;

- Efficient transport for a variety of multicast and broadcast services.

The following service levels for the multicast communication service are defined:

NOTE 1: Transport Only mode and Full-Service mode of operation as defined in TS 23.246 [8] differ from the service levels defined here.

- **Basic service level**. The following requirements are defined:

- Media transported transparently through the 5GS.

- Request to receive the multicast service.

- Packet distribution from the 5GS ingress to NG-RAN node(s).

- Data delivery from NG-RAN node(s) to the UE.

- **Enhanced service level**, with additional requirements on top of basic service level. Different requirements out of the set below may be necessary to address each use case:

- Local MBS service.

- User authentication and authorization for multicast session.

NOTE 2: User authentication and authorization can be done by 5GS or AF or both, or even not needed for a multicast communication service.

- Explicit configuration of multicast session by application function including Group member management.

- Enhanced QoS support.

NOTE 3: 5GS can provide different QoS other than default QoS for different multicast groups.

MBS traffic is delivered from a single data source (e.g. Application Service Provider) to multiple UEs. Depending on many factors, there are several delivery methods which may be used to deliver MBS session traffic in the 5GS.

NOTE 4: For clarity, delivery methods are not referred to as unicast/multicast/broadcast but as described below. The term "unicast delivery" refers to a mechanism by which application data and signalling between the UE and the application server are delivered using PDU Session within the 3GPP network and using individual UE and application server addresses (e.g. IP addresses) between the 3GPP network and the application server. It is not equivalent to 5GC Individual MBS traffic delivery method defined in this clause.

Between 5GC and NG-RAN, there are two possible delivery methods to transmit the MBS data:

- 5GC Individual MBS traffic delivery method: This method is only applied for multicast MBS session. 5GC receives a single copy of MBS data packets and delivers separate copies of those MBS data packets to individual UEs via per-UE PDU sessions, hence for each such UE one PDU session is required to be associated with a multicast session.

- 5GC Shared MBS traffic delivery method: This method is applied for both broadcast and multicast MBS session. 5GC receives a single copy of MBS data packets and delivers a single copy of those MBS packets packet to a RAN node, which then delivers them to one or multiple UEs

The 5GC Shared MBS traffic delivery method is required in all 5G MBS deployments. The 5GC Individual MBS traffic delivery method is required to enable mobility when there is an NG-RAN deployment with non-homogeneous support of 5G MBS.

For the multicast session, if 5GC Individual MBS traffic delivery method is used, a same received single copy of MBS data packets by the CN may be delivered via both 5GC Individual MBS traffic delivery method for some UE(s) and 5GC Shared MBS traffic delivery method for other UEs.

Between NG-RAN and UE, two delivery methods are available for the transmission of MBS packet flows over radio:

- Point-to-Point (PTP) delivery method: a RAN node delivers separate copies of MBS data packet over radio to individual UE.

- Point-to-Multipoint (PTM) delivery method: a RAN node delivers a single copy of MBS data packets over radio to a set of UEs.

A RAN node may use a combination of PTP/PTM to deliver an MBS packet to UEs.

NOTE 5: The PTP and PTM delivery methods are defined in RAN WGs.

As depicted in the following figure, 5GC Shared MBS traffic delivery method (with PTP or PTM delivery) and 5GC Individual MBS traffic delivery method may be used at the same time for a multicast MBS session.



Figure 4.1‑1: Schematic showing delivery methods

For MBS broadcast service, only 5GC Shared MBS traffic delivery method with PTM delivery is applicable.

If the NG-RAN node supports MBS session, the network shall use the 5GC Shared MBS traffic delivery method for MBS session packet transmission.

NOTE 6: The exception is the mobility from NG-RAN node not supporting MBS (with 5GC Individual MBS traffic delivery method) to NG-RAN node supporting MBS, there is temporary co-existence between 5GC Shared MBS traffic delivery method and 5GC Individual MBS traffic delivery method. The detail refer clause 6.3.

The Switching between 5GC Shared MBS traffic delivery method and 5GC Individual MBS traffic delivery method is supported. The UE mobility between RAN nodes both supporting MBS, and between a RAN node supporting MBS and a RAN node not supporting MBS is supported, for details see clause 6.3.

The Switching between PTP and PTM delivery methods for 5GC Shared MBS traffic delivery shall be supported. NG-RAN is the decision point for switching between PTP and PTM delivery methods.

## 4.2 MB service provisioning

### 4.2.1 Multicast data provisioning

An example for the sequence of phases for multicast data provisioning is described in the figure below:



Figure 4.2.1-1: Phases of Multicast data provisioning

Editor's note: Whether the second UE Session Join/Leave and No Data Receiving in Figure 4.2.1-1 are needed is FFS.

Editor's note: It is FFS whether “multicast session activation" and "multicast session deactivation" in clause 4.3 need to be reflected.

The following phases are performed for a specific UE:

- UE Session Join: UE Session Join is the process by which a UE joins an MBS Session, i.e. the UE indicates to 5GC that such UE wants to receive Multicast data identified by a specific MBS Session ID.

- UE Session Leave: UE Session Leave is the process by which a UE leaves a MBS Session, i.e. the UE no longer wants to receive Multicast data identified by a specific MBS Session ID.

The following phases are performed for a specific service:

- MBS Session Configuration: It is the phase that multicast session begin to exist as described in clause 4.3. This step is optional.

- Service announcement: Service announcement is used to distribute information toward UEs about the service required for service reception (e.g., IP multicast address(es)) and possibly other service related parameters (e.g. service start time). This step is optional.

- Session Establishment: It is the phase that multicast session is established as described in clause 4.3.

- No data receiving: It is the phase when no multicast data is received by 5GC. This step is optional.

- Data transfer: It is the phase when Multicast data are transferred to the UEs.

- Session Release: It is the phase that multicast session is released as described in clause 4.3.

- Session De-configuration: It is the phase that multicast session will no longer exist as described in clause 4.3.

The phase of Multicast data provisioning is illustrated with the following example of timeline:



Figure 4.2.1-2: Multicast service timeline example

Editor's note: Details of the timeline is FFS.

### 4.2.2 Broadcast data provisioning

An example for the phases of broadcast data provisioning is described in the figure below:



Figure 4.2.2-1: Phases of Broadcast data provisioning

The following phases are performed for a specific service:

- MBS Session Configuration: MBS Session Configuration is used by the AF to configure the MBS Session towards 5GC, which may also include TMGI allocation procedure.

- Service announcement: Service announcement is used to distribute information towards UEs about the service required for service reception (e.g., IP multicast address(es)) and possibly other service related parameters (e.g. service start time). This step is optional.

- Session Establishment: Session Establishment is the point at which the transmission resources need to be established for transmitting the DL Broadcast data between 5GC and NG-RAN. Session Establishment follows Session Start, which is triggered by the request from AF.

- Data transfer: It is the phase when broadcast data are transferred in the air interface.

- Session Release: It is the point at which there will be no more need to transmit Broadcast data. At Session Release, the resources in 5GS are released.

The phase of Broadcast data provisioning is illustrated with the following example of timeline:



Figure 4.2.2-2: Broadcast service timeline

Editor's note: Details of the timeline is FFS.

## 4.3 Multicast session state model

The following illustrate the states for the multicast session:

**- Configured state**: Information about the multicast session (e.g. QoS information) is configured in 5GC NFs (e.g. MB-SMF) serving the multicast session, but no User Plane resources towards NG-RAN are reserved and no MBS data can be transmitted. A TMGI can be allocated for the multicast session. UEs may be allowed to join (subject to authorization check and configuration), but the first accepted UE join request will trigger the multicast session establishment towards the NG-RAN and the UE.

NOTE 1: The SMF is not involved in the multicast session while the multicast session is in configured state, but this state affects the MB-SMF.

NOTE 2: There may be several sub-states in the configured state, e.g. TMGI requested, or information about the multicast session provided.

- **Active state**: Multicast session is established and MBS data can be transmitted to the UEs that have joined the multicast session. UEs are allowed to join the multicast session (subject to authorization check). 5GC resources and radio resources for the multicast session are reserved for UEs that joined the multicast session.

- **Inactive state**: Multicast session is established but no MBS data are transmitted to the UEs that have joined the multicast session. UEs that joined the multicast session may be in CM CONNECTED or CM IDLE state. UEs are allowed to join the multicast session (subject to authorization check).

The following procedures are defined which result in transition of the multicast session state:

- **Multicast Session Configuration**: The AF provides information about the multicast session and optionally request the allocation of a TMGI. Alternatively, there is network-internal configuration of the multicast session. Only resources at MB-SMF, NEF and MB-UPF are reserved and no multicast data are transmitted. The configuration may indicate whether the multicast session may be established in active or inactive state and when a multicast session can become active. The AF may provide configuration in several steps, e.g. to first request TMGI and then provide full information about the multicast session and allow it to be established. Multicast session state transitions from NULL to Configured state.

NOTE 3: A multicast session can also be configured by the operator via OAM or be established without prior configuration.

Editor’s Note: How the procedure works if multicast session is configured by the operator or established without prior configuration is FFS.

- **Multicast Session Establishment**: When the join request of the first UE for the multicast session is accepted, the multicast session is established towards the NG-RAN node and the UE. Multicast session state transitions from NULL or Configured state to either Inactive or Active state.

- **Multicast Session Activation**: Triggered by the 5GC, the radio resources for the multicast session are established and multicast session data starts to be transmitted to the UE.UEs in CM-IDLE state and CM-CONNECTED with RRC Inactive state that joined the multicast session are notified. Activation can be triggered by AF request or data notification from the MB-UPF. Multicast session state transitions from Inactive state to Active state.

- **Multicast Session Deactivation**: Triggered by the 5GC, the radio resources for the multicast session are released and multicast session data stops to be transmitted to the UE. Deactivation can be triggered by AF request or no reception of multicast data by the MB-UPF. Multicast session state transitions from Active to Inactive state.

- **Multicast Session Release**: Triggered by the last UE leaving the multicast session, the resources for the multicast session are released in both 5GC nodes and RAN nodes. Multicast session state transitions from Active or Inactive state to Configured.

- **Multicast Session Deconfiguration**: All information about the multicast session is removed from the 5GC, and the TMGI for the multicast session (if allocated during Multicast Session Configuration) is deallocated. The deconfiguration may be triggered by an AF request. Multicast session state transitions from Configured, Active or Inactive state to NULL.

Editor’s Note: It is FFS when the multicast session is in configured state, whether AF can trigger Activation request or Deactivation request. And if AF is not allowed, it is FFS about the implications towards the AF.



Figure 4.3-1: Multicast session states and state transitions



Figure 4.3-2: Multicast session states and state transitions in MB-SMF (with Configured state)



Figure 4.3-4: Multicast session states and state transitions in NG-RAN

NOTE: Multicast session states and state transitions in NG-RAN is for illustration purpose, the final decision will be made by RAN WGs.



Figure 4.3-5: Multicast session states and state transitions in SMF

Editor's note: It is FFS whether to merge figure 4.3-1 into figure 4.3-2, and state model in NG-RAN and SMF still needs FFS.

# 5 Architecture model

## 5.1 General architecture

Figure 5.1-1 depicts the 5G MBS reference architecture. Service-based interfaces are used within the Control Plane.

Multicast-broadcast service for roaming is not supported in this release.

Interaction between multicast-broadcast service and support of deployments topologies with specific SMF Service Areas is not specified in this release.

Editor's note: It is FFS whether to document those limitations of this release in the scope or general clause instead.



Figure 5.1-1: 5G MBS system architecture

NOTE 1: The MBSF is optional and may be collocated with the NEF or AF/AS, and the MBSTF is an optional network function.

NOTE 2: The existing service based interfaces of Nnrf, Nudm, and Nsmf are enhanced to support 5G MBS. The existing service based interfaces of Npcf and Nnef are enhanced to support 5G MBS; their usage depends on deployment.

NOTE 3: xMB-C/MB2-C and xMB-U/MB2-U are intended for legacy AS. A 5G MBS AF uses either Nmbsf or Nnef to interact with the MBSF.

Editor's note: Which NF is used to store service parameters, including serving MB-SMF information will be updated in future versions.

Figure 5.1-2 depicts the 5G MBS system architecture using the reference point representation showing how various network functions interact with each other.



Figure 5.1-2: 5G MBS system architecture in reference point representation

NOTE 4: The existing reference points of N1, N2, N11 are enhanced to support 5G MBS.

## 5.2 Architecture for interworking with EPS

## 5.3 Reference point and functional entities

### 5.3.1 Reference point

The MBS System Architecture contains the following new reference points:

**N3mb**: Reference point between the (R)AN and the MB-UPF.

**N4mb**: Reference point between the MB-SMF and the MB-UPF.

**N6mb**: Reference point between the MB-UPF and the AF/AS.

**N7mb**: Reference point between the MB-SMF and the PCF.

**N11mb**: Reference point between the AMF and the MB-SMF.

**N16mb**: Reference point between the SMF and the MB-SMF.

**N19mb**: Reference Point between the UPF and the MB-UPF.

**N29mb**: Reference point between the MB-SMF and the NEF.

**Nmb1**: Reference point between the MB-SMF and the MBSF.

**Nmb2**: Reference point between the MBSF and the MBSTF.

**Nmb5**: Reference point between the MBSF and the NEF.

**Nmb8**: Reference point between the MBSTF and the AF.

**Nmb9**: Reference point between the MB-UPF and the MBSTF.

**Nmb10**: Reference point between the MBSF and the AF.

**Nmb12**: Reference point between the MBSF and the PCF.

**Nmb13**: Reference point between the MB-SMF and the AF.

Editor's note: The Nmb7 reference point is FFS.

The MBS System Architecture reuses the existing reference points of N1, N2, N10, N11, and N33 with enhancement to support 5G MBS.

### 5.3.2 Functional entities

Editor's Note: functional entities and functional requirement are not completed.

#### 5.3.2.1 PCF

The PCF performs the following functions to support MBS if dynamic PCC for 5MBS is needed:

- Supporting QoS handling for MBS Session.

- Providing policy information regarding the MBS Session to MB-SMF for authorizing the related QoS profiles.

- Interacting with UDR for QoS information retrieval.

- The PCF can receive MB service information from AF, NEF or MBSF, e.g. based on the different configuration options in Annex A.

#### 5.3.2.2 MB-SMF

The MB-SMF performs the following functions to support MBS:

- General for multicast and broadcast sessions:

- Supporting MBS session management (including QoS control).

- Configuring the MB-UPF for multicast and broadcast flows transport based on the policy rules for multicast and broadcast services from PCF or local policy.

- Allocating and de-allocating TMGIs.

- Specific for broadcast sessions:

- Interacting with RAN (via AMF) to control data transport using 5GC Shared MBS traffic delivery method.

- Specific for multicast sessions:

- Interacting with SMF to modify PDU Session associated with MBS.

- Interacting with RAN (via AMF and SMF) to establish data transmission resources between MB-UPF and RAN nodes for 5GC Shared MBS traffic delivery method.

- Controlling multicast data transport using 5GC Individual MBS traffic delivery method.

#### 5.3.2.3 SMF

The SMF performs the following functions to support MBS:

- Discovering MB-SMF for multicast session.

- Authorizing multicast session join operation if needed.

- Interacting with MB-SMF to obtain and manage multicast session context.

- Interacting with RAN for shared data transmission resource establishment.

NOTE: SMF and MB-SMF may be co-located or deployed separately.

#### 5.3.2.4 MB-UPF

The MB-UPF performs the following functions to support MBS:

- General for multicast and broadcast sessions:

- Packet filtering of incoming downlink packets for multicast and broadcast flows.

- QoS enforcement (MFBR) and counting/reporting based on existing means.

- Interaction with MB-SMF for receiving multicast and broadcast data.

- Delivery of multicast and broadcast data to RAN nodes for 5GC Shared MBS traffic delivery method.

- Specific for multicast sessions:

- Delivery of multicast data to UPF for 5GC Individual MBS traffic delivery method.

#### 5.3.2.5 UPF

The UPF performs the following functions to support MBS:

- Interacting with SMF for receiving multicast data from MB-UPF for 5GC Individual MBS traffic delivery method.

- Delivering multicast data to UEs via PDU Session for 5GC Individual MBS traffic delivery method.

NOTE: UPF and MB-UPF may be co-located or deployed separately.

#### 5.3.2.6 AMF

The AMF performs the following functions to support MBS:

- Signalling with NG-RAN and MB-SMF for MBS Session management.

- Selection of NG-RANs for notification of multicast session activation toward UEs in CM-IDLE state.

- Selection of NG-RANs for broadcast.

- Signalling with NG-RAN for NG-RAN MBS capability, or.

- May be configured with NG-RAN MBS capability.

#### 5.3.2.7 NG-RAN

The NG-RAN performs the following functions to support MBS:

- Management of MBS QoS flows via N2.

- Delivery of MBS data packets from 5GC shared for multiple UEs over radio using PTM or PTP.

- Configuration of UE for MBS QoS flow reception at AS layer.

- Control switching between PTM and PTP delivery per UE.

- Support for multicast sessions continuity during Xn Handover and N2 Handover.

- Support notification of multicast session activation over radio toward UEs in CM-IDLE state and CM-CONNECTED with RRC Inactive state.

- May report the MBS capability to AMF in NGAP setup procedure defined in TS 38.413 [15].

#### 5.3.2.8 UE

The UE may perform the following functions to support MBS:

- Reception of multicast data using PTM/PTP.

- Reception of multicast and broadcast data using PTM.

- Handling of incoming MBS QoS flows.

- Support of signalling for joining and leaving multicast session.

- MBS resource management support at AS layer.

- Reception of notification in CM-IDLE state and CM-CONNECTED with RRC Inactive state for multicast data transmission.

#### 5.3.2.9 AF

The AF performs the following functions to support MBS:

- Requesting multicast or broadcast service from the 5GC by providing service information including QoS requirement to 5GC.

- Instructing MBS session operation towards 5GC if needed.

- Interacting with NEF for MBS related service exposure.

#### 5.3.2.10 NEF

The NEF performs the following functions to support MBS:

- Providing an interface to AFs for MBS procedures including service provisioning, MBS session and QoS management.

- Interacting with AF and MB-SMF for MBS session operations, determination of transport parameters, and session transport.

- Selection of serving MB-SMF for an MBS Session.

#### 5.3.2.11 MBSF

The MBSF performs the following functions to support MBS:

- Service level functionality to support MBS, and interworking with LTE MBMS

- Interacting with AF and MB-SMF for MBS session operations, determination of transport parameters, and session transport.

- Selection of serving MB-SMF for an MBS Session.

- Controlling MBSTF if the MBSTF is used.

- Determination of sender IP multicast address for the MBS session if IP multicast address is sourced by MBSTF.

NOTE: MBSF functionality related to service and MBS data handling (e.g. encoding) is to be determined with SA WG4.

#### 5.3.2.12 MBSTF

The MBSTF performs the following functions to support MBS if deployed:

- Media anchor for MBS data traffic if needed.

- Sourcing of IP Multicast if needed.

- Generic packet transport functionalities available to any IP multicast enabled application such as framing, multiple flows, packet FEC (encoding).

- Multicast/broadcast delivery of input files as objects or object flows.

NOTE: MBSTF functionality related to MBS data handling (e.g. encoding) is to be determined with SA4.

#### 5.3.2.13 UDM

The UDM performs the following functions to support MBS:

- Support management of subscription for authorization for multicast sessions.

#### 5.3.2.14 UDR

The UDR performs the following functions to support MBS if deployed:

- Support management of UE authorization information for multicast session.

5.3.2.15 NRF

The NRF performs the following functions to support MBS:

- Support management of MB-SMF information serving multicast sessions.

# 6 Functionalities and features

## 6.1 Authorization to MBS service

6.1.1 AF/AS authorization to the service for multicast and broadcast

The AF/AS should be authorized by the 5GC for delivering MBS data to the 5GC and/or interacting with the 5GC. For signalling exchange with the 5GC, the NEF or MBSF perform authorization to the external AF for determination of whether the interaction with the 5GC is allowed or not.

6.1.2 UE authorization to the service for multicast

The UE authorization for multicast services may be at the following levels:

- Whether a UE is authorized to receive any Multicast MBS session data at all.

- Whether and how a UE is authorized to receive a particular multicast service:

- A Multicast MBS session may be open to any UEs and no authorization is needed;

NOTE 1: UE authorization for a specific Multicast MBS session can be implicitly performed when UE is configured for a specific Multicast MBS session, e.g. via Service Announcement for public safety use case.

NOTE 2: UE's authorization on whether it is authorized to receive any Multicast MBS session data takes precedence over the other authorization information, if any. E.g., if the UE is not authorized to receive Multicast MBS session data, network will not send the data to the UE even if the Multicast MBS session is open to any UEs.

- A Multicast MBS session requires the 5GS to authorize the UE based on authorization information, e.g. preconfigured, or provided by the AF (see clause 7.1.1).

Editor's note: Whether and how the 5GC supports authentication/authorization for the UE access the multicast services performed by a Content Provider is FFS.

The procedure for UE authorization is a part of UE join procedure and is described in clause 7.2.1.

## 6.2 Local MBS service

A Local MBS service is an MBS service provided in one or several MBS service area(s). An MBS service area is identified by a cell list or a tracking area list. Only UEs within the MBS service area may receive content data, while UEs outside the MBS service area are not allowed to receive location specific content. For multicast communication, UEs outside the MBS service area are not allowed to join the MBS service, and the network shall not deliver location specific content anymore to the UEs moved out of the MBS service area. The UE shall be able to obtain service area information of the local multicast service via MBS service announcement or via NAS signalling (UE Session Join Accept/Reject including Cell ID list or TAI list). If the UE Session Join procedure fails due to the UE being outside the multicast service area, the UE does not attempt to join the multicast session again until the UE moves inside the multicast service area. When the UE Session Join succeeds and if the multicast session is deactivated, the UE does not perform monitoring the session activation notification and any other information related to the multicast session identified by an MBS Session ID over the radio if outside the multicast service area.

A location dependent MBS is a local MBS that is provided in several MBS service areas. The location dependent MBS service enables distribution of different content data to different MBS service areas. The same MBS Session ID is used but a different Area Session ID is used for each MBS service area. The Area Session ID is used, in combination with MBS Session ID, to uniquely identify the service area specific part of the MBS service within 5GS. The network supports the location-dependent content distribution for the location dependent MBS services, while UEs are only aware of the MBS Session ID (i.e. UEs are not required to be aware of the Area Session IDs). When UEs move to a new MBS service area, content data from the new MBS service area shall be delivered to the UE, and the network ceases to deliver the content data from the old MBS service areas to the UE.

Information about different MBS service areas for a location dependent MBS service may be provided by one or several AFs or may be configured. Different ingress points for location dependent points for the MBS session are supported for different MBS service area dependent content of the MBS session; different MB-SMFs and/or MB-UPF may be assigned for different MBS service areas in an MBS session.

The Area Session ID is allocated by MB-SMF in MBS Session Establishment procedure. MB-SMF allocates Area Session ID for each MBS services area which is unique within the MBS session. MB-SMF needs to further ensure there is no MBS service area overlapping with other MBS service areas that share the same MBS session ID.

NOTE 1: In this release, deployments topologies with specific SMF Service Areas are not supported, as a result, location dependent service using multicast communication is not supported when a UE moves outside its SMF service area.

NOTE 2: For location dependent service provided in different MBS service areas within the same SMF service area, it is assumed that one MB-SMF is used for an MBS Session.

NOTE 3: An example of Location-dependent MBS is a nationwide weather forecast service with local weather reports.

NOTE 4: Area Session ID is equivalent to Flow ID as specified in TS 23.246 [8].

## 6.3 Mobility support of MBS service

6.3.1 Mobility of Multicast MBS session

The mobility of multicast MBS service is supported when:

- The UE moves from a NG-RAN node that supports MBS to a target NG-RAN node that supports MBS; or

- The UE moves from a NG-RAN node that supports MBS to a target NG-RAN node that does not support MBS and vice versa.

During the mobility from a NG-RAN node that supports MBS to a target NG-RAN node that supports MBS, or from a NG-RAN node that supports MBS to a target NG-RAN node that does not support MBS, minimization of data loss should be supported.

Editor's note: How to support the minimization of data loss is for RAN WG to decide.

To support Handover from NG-RAN node that supports MBS to a target NG-RAN node that supports MBS:

- If the shared delivery for the MBS session has not been established towards target NG-RAN, the target NG-RAN establishes the shared delivery for the MBS Session with MB-SMF and MB-UPF.

To support Handover from NG-RAN node that supports MBS to a target NG-RAN node that does not support MBS:

- mapping information about unicast QoS flows for multicast data transmission and the information of associated multicast QoS flows are provided to the NG-RAN node. This is already performed during the PDU session modification procedure for the PDU session associated with the MBS session when the UE Joins into the MBS Session;

- during the handover procedure, the delivery method is switched from 5GC Shared MBS traffic delivery method to 5GC Individual MBS traffic delivery method, i.e. the N3 tunnel of the PDU Session for 5GC Individual MBS traffic delivery needs to be activated towards the target NG-RAN node. The SMF realizes that the target NG-RAN node does not support MBS.

- the SMF and the MB-SMF shall activate the GTP tunnel between the UPF and the MB-UPF for 5GC Individual MBS traffic delivery method, if needed.

To support Handover from a NG-RAN node that does not support MBS to a target NG-RAN node that supports MBS:

- The PDU sessions, including the one associated with the MBS session and used for 5GC Individual MBS traffic delivery, are handed over to the target NG-RAN node.

Editor’s Note: It is FFS that if the shared delivery for the MBS session has not been established towards target NG-RAN, the target NG-RAN establishes the shared delivery for the MBS Session with MB-SMF and MB-UPF if it deduces the MBS Session from network configuration.

- The 5GC terminates the 5GC Individual MBS traffic delivery method after handover procedure.

6.3.2 Mobility of Broadcast MBS session

The UE receives the same Broadcast MBS service in the target NG-RAN if the same MBS session is established with 5GC Shared MBS traffic delivery method in the target NG-RAN node.

NOTE: When the UE moves out the Broadcast MBS service area, how the UE get the same content via application level is out scope of 3GPP.

## 6.4 Subscription to multicast services

The user's profile in the UDM contains the subscription information to give the user permission to use multicast services.

At any time, the operator may change the subscription for multicast services in user's profile in the UDM.

The user may have following subscription for multicast services:

- Allowed to join any multicast service;

- Allowed to join the indicated specific multicast service(s).

Editor`s note: It is FFS how to express that some multicast services are allowed to be accessed by any user and others only by a restricted set of users. It is ffs if the information about users allowed to join a multicast service should be organized per multicast service instead of per user.

The MBS subscription data is provided by the UDM to the SMF during PDU session establishment as defined in clause 4.3.2.2.1 of TS 23.502 [6] using Nudm\_SDM service for Subscription data type "UE context in SMF data".

The SMF selection subscription data is provided by the UDM to the AMF as described in clause 4.2.2.2 of TS 23.502 [6].

Editor`s note: It is FFS if the SMF selection subscription data need to be extended.

## 6.5 Identifiers

### 6.5.1 MBS Session ID

The MBS session ID is used to identify a MBS Multicast/Broadcast Session throughout the 5G system transport on external interface towards AF and between AF and UE, and towards the UE.

MBS Session ID may have the following types:

- TMGI (for MBS broadcast and MBS multicast Session);

- source specific IP multicast address (for MBS multicast Session).

If an MBS multicast session is provided within an SNPN, the MBS multicast session can still be identified by a (globally unique) source specific IP multicast address or TMGI. In 5GS internal signalling the PLMN ID, included in TMGI, is complemented with the NID to identify an SNPN.

Source specific IP multicast address or TMGI may be used as MBS Session ID in NAS messages exchange between a UE and a CN when the UE requests to join/leave a multicast session.

For MBS multicast sessions that the UE joined with a source specific IP multicast address, a TMGI is also allocated by 5GC and is sent to the UE and used in other signalling messages between RAN, CN and UE.

The UE shall be able to obtain at least one MBS Session ID via MBS service announcement.

For MBS multicast Session, a source specific IP multicast address can be assigned by 5GC or an external network.

### 6.5.2 Temporary Mobile Group Identity

TMGI (Temporary Mobile Group Identity) is defined in TS 23.003 [12] and is used to be able to identify a broadcast MBS Session or a multicast MBS Session.

In SNPN (Stand-alone Non-Public Network), TMGI is used together with NID (Network Identifier) in TS 23.003 [12] together identify an MBS Session.

6.5.3 Source Specific IP Multicast Address

The source specific IP multicast address is used to identify an MBS Multicast Session and consists of two IP addresses, one is an IP unicast address used as source address in IP packets for identifying the source of the multicast service (e.g. AF/AS), the other is an IP multicast address used as destination address in related IP packets for identifying a multicast service associated with the source.

## 6.6 QoS Handling for Multicast and Broadcast services

For MBS services, the network shall support QoS control per MBS session.

The 5G QoS model and parameters as defined in TS 23.501 [5] clause 5.7 also apply to MBS services with the following differences:

- Reflective QoS is not applicable;

- Wireline access network specific 5G QoS parameters do not apply to MBS services;

- Alternative QoS Profile is not applicable;

- QoS Notification Control is not applicable;

- UE AMBR is not applicable;

- Session-AMBR if provided is enforced at MB-UPF but not communicated to NG-RAN.

NOTE: Whether Session-AMBR is required in addition to the MBS service data flow bit rate is determined by operator policy and/or agreement with the service provider.

- For broadcast services, the QoS rule and associated QoS Flow level QoS parameters are not provided to UE.

The network shall support one or multiple QoS flows, which can be either GBR or non-GBR, for an MBS session.

If 5GC Individual MBS traffic delivery method is used to deliver multicast data packets, the network may use dedicated QoS Flows for multicast data packets in a PDU session.

NOTE 2: When there is a need to apply individual delivery, the Session AMBR of the PDU Session used for individual delivery can be configured with a sufficiently high value to cater for MBS Session-AMBR.

Editor´s Note: Whether any policy control at the SMF for individual delivery QoS flows is required is FFS.

The MB-SMF may obtain MBS QoS information in different ways depending on the deployment and use cases.

If dynamic PCC is deployed:

Editor’s note: The following description depends on the ongoing PCF discussion and needs revisit.

* When an MBS session is started, the MB-SMF is provided with service requirements including QoS information. The AF (directly or via the NEF) may provide MBS session description including possible QoS requirements to the MBSF (if MBSF is used) or to the PCF (if MBSF is not used). If the MBSF is used and the MBSF receives service description from the AF (or via the NEF) e.g. in the form of Service Description Protocol (SDP), the MBSF can derive the related QoS requirements (e.g. consider support for FEC, MBS media transcoding) and subsequently the MBSF provides the new MBS session description including possible QoS requirements to the PCF. The PCF receives the MBS QoS requirements from the AF or from the MBSF, and the PCF provides the 5G MBS policy rules to the MB-SMF. The MB-SMF determines the QoS profiles and QoS for N4 rules for the MBS session with QoS parameters of the MBS QoS flows, and provides related information to the RAN and the MB-UPF respectively.

If dynamic PCC is not deployed:

* When an MBS session is started, the MB-SMF is provided with service requirements including QoS information. If MBSF is not used, the service requirement is provided to the MB-SMF by the AF (directly or via the NEF). If the MBSF is used, the MBSF receives request from the AF (or via the NEF) and decides the related QoS requirements (e.g. considering support for FEC) and provides them to the MB-SMF. The MB-SMF determines the QoS profiles and QoS for N4 rules for the MBS session with QoS parameters of the MBS QoS flows, and provides related information to the RAN and the MB-UPF respectively.

NOTE: What information is included in the request from AF to MBSF requires collaboration with SA4.

## 6.7 User plane management

The MB-UPF acts as the MBS Session Anchor of an MBS session, and if the MBSTF is involved in the MBS session, then the MBSTF acts as the media anchor of the MBS traffic. The MB-UPF receives only one copy of MBS data packets from AF or MBSTF.

The user plane between MBSTF and MB-UPF, or between MB-UPF and AF, may use either multicast transport or unicast tunnel for the MBS session (depending on application and capabilities of control interface). If the transport network does not support multicast transport, the user plane uses unicast tunnel for the MBS Session. The user plane between MBSTF and AF may use unicast tunnel, multicast transport or other means (e.g., HTTP download from external CDN). Unicast tunnel is used for the MBS Session, after receiving the downlink MBS data, the MB-UPF forwards the downlink MBS data without the outer IP header and tunnel header information.

The user plane from the MB-UPF to NG-RAN (for shared delivery) and the user plane from MB-UPF to UPFs (for individual delivery) may use multicast transport via a common GTP-U tunnel per MBS session, or use unicast transport via separate GTP-U tunnels at NG-RAN or at UPF per MBS session. If the user plane uses unicast transport, the transport layer destination is the IP address of the NG-RAN or UPF, each NG-RAN or UPF allocates the tunnel separately and multiple GTP-U tunnels are used for the MBS Session. If the user plane uses multicast transport, a common GTP-U tunnel is used for both RAN and UPF nodes, the GTP-U tunnel is identified by a common tunnel ID and an IP multicast address as the transport layer destination, both assigned by 5GC.

The above is depicted in Figure 6.7‑1.



Figure 6.7‑1: Schematic showing user plane data transmission

The MB-SMF configures the MB-UPF to receive packets related to an MBS session.

For shared delivery, if unicast transport over N3mb applies, the MB-SMF configures MB-UPF to replicate the received MBS packets and forward them towards multiple RAN nodes via separate GTP tunnel. For shared delivery, if multicast transport over N3mb applies, the MB-SMF configures the MB-UPF to replicate the received MBS data and forwards the data via a single GTP tunnel.

For individual delivery, the MBS data received by the MB-UPF is replicated towards the UPF(s) where individual delivery is performed in the following way:

- The MB-SMF configures the MB-UPF to receive packets related to an MBS session, to replicate those packets and forward them towards multiple UPFs via GTP tunnels if unicast transport over N19mb is applied, or via a single GTP tunnel if multicast transport over N19mb is applied.

- The SMF(s) configures the UPF to receive packets related to a multicast session from an MB-UPF over N19mb, to replicate those packets and to forward them in multiple PDU sessions.

Traffic replication and forwarding for an MBS session is realized by using for each MBS session an (MB-)UPF internal interface ("MBS internal") and a two-step detection and forwarding process. In the first step, the packets received from a single data source are forwarded by the (MB-)UPF to the (MB-)UPF internal interface (i.e. Destination Interface set to "MBS internal" and MBS session ID indicated as Network instance in an FAR). In the second step, PDRs installed at the (MB-)UPF internal interface (i.e. Source Interface set to "MBS internal" and MBS session ID indicated as Network instance) detect the packets and forward them to the respective outgoing interface.

Editor’s note: Whether a two-step approach for 5G VN group is needed thus whether new source/destination source types are needed for MBS traffic is FFS.

## 6.8 Interworking with MBMS over E-UTRAN for public safety services

In order to minimize the interruption of services, upon mobility from NR/5GC to E-UTRAN/EPC, the following applies:

- If the same multicast service is provided via eMBMS in target E-UTRAN, the session context for multicast service transferring is not handover to E-UTRAN during mobility from 5GS to EPS, i.e. the EPS bearer context associated with the MBS session is not transferred to EPS network. UE releases the related EPS bearer(s) and the associated MBS session context locally. After handover, the UE is connected to the target E-UTRAN, the UE starts to receive the service via eMBMS.

- If the same multicast service is not provided via eMBMS in target E-UTRAN, during handover from 5GS to EPS procedure, the 5GC shared MBS traffic delivery method is switched to Individual MBS traffic delivery over EPS. The unicast QoS flow(s) corresponding to the multicast QoS flow(s) of the MBS session are mapped to EPS bearer(s).

In order to minimize the interruption of services, upon mobility from E-UTRAN/EPC to NR/5GC, the following applies:

- Before EPS to 5GS mobility, the application may trigger the switching the service receiving from eMBMS to Individual MBS traffic delivery over EPS. The AF provides the MBS Session ID (i.e. the TMGI or multicast IP address) as part of service information to PCF to trigger EPS bearer resource allocation for the service. Based on the received MBS Session ID, the SMF+PGW-C link the established EPS bearer(s) with the indicated MBS session.

- If the UE receives the service via the Individual MBS traffic delivery over EPS, the Individual MBS traffic delivery over EPS is switched to 5GC Individual MBS traffic delivery method during handover from EPS to 5GS procedure. After handover, the SMF+PGW-C switches the 5GC Individual MBS traffic delivery method to 5GC shared MBS traffic delivery method if the target NG-RAN supports 5G MBS.

- If the UE receives the service via eMBMS in source E-UTRAN, after handover from EPS to 5GS, the UE may join the MBS Session directly without reporting the UE is out of eMBMS service to AF.

## 6.9 MBS Session and Service Context

6.9.1 MBS Session/Service Context

The MBS Session Context contains all information describing a particular MBS session in the 5GS and is created in each node involved in the delivery of the MBS data.

The content of the MBS Multicast Session Context is described in Table 6.9.1-1.

Editor’s note: Whether AMF needs to keep MBS Session Context is FFS.

Table 6.9.1-1: Multicast MBS Session context

| Parameter | Description | NG-RAN | MB-SMF | SMF |
| --- | --- | --- | --- | --- |
| State | State of MBS session ('Active multicast session' or 'Inactive multicast session' or 'Configured multicast session') | X  (note 2) | X | X  (note 2) |
| SSM (source specific IP multicast address) | IP multicast address identifying the MBS session. |  | X (note 1) | X (note 1) |
| TMGI | Temporary Mobile Group Identity allocated to the MBS Session. | X | X | x |
| Area Session Identifier | Used for MBS session with location dependent content. When present, the Area Session Identifier together with the TMGI uniquely identify the MBS Session in a specific MBS service area. | X (note 1) | X (note 1) | X (note 1) |
| MB-SMF | The MB-SMF that handles the MBS session. | X |  | X |
| QoS information | QoS information of the MBS session. | X | X | X |
| MBS Service Area | Area over which the MBS session data is distributed. | X (note 1) | X (note 1) | X (note 1) |
| AMF | The AMF(s) which are selected for the MBS session |  | X |  |
| IP multicast and source address for data distribution | IP addresses identifying the SSM user plane transport for shared delivery between MB-UPF and NG-RAN and for individual delivery between MB-UPF and UPF when the IP multicast transport is used. | X (note 1) | X (note 1) | X (note 1) |
| IP address for distribution | The IP addresses and TEID of NG-RAN used for the user plane between NG-RAN and MB-UPF and between MB-UPF and UPF when Point to Point tunnel is used. | X (note 1) | X (note 1) | X (note 1) |
| TEID for data distribution | The tunnel ID used for receiving the multicast data for shared delivery by NG-RAN and for individual delivery by UPF | X | X | X |
| NOTE 1: It is an optional parameter.  NOTE 2: The value 'Configured multicast session' is not applicable for NG-RAN and SMF. | | | | |

In Broadcast MBMS mode, an MBS Session Context is created in the NG-RAN, AMF, MB-SMF and MBSF as a result of the MBS Session Start procedure.

The content of the Broadcast MBS Session Context is described in Table 6.9.1-2.

Table 6.9.1-2: Broadcast MBS Session context

| Parameter | Description | NG-RAN | AMF | MB-SMF |
| --- | --- | --- | --- | --- |
| TMGI | Temporary Mobile Group Identity allocated to the MBS Session. | X | X | X |
| Area Session Identifier | Used for MBS session with location dependent content. When present, the Area Session Identifier together with the TMGI uniquely identify the MBS Session in a specific MBS service area. | X (note 1) | X (note 1) | X (note 1) |
| AMF | The AMF(s) which are selected for the MBS session |  |  | X |
| QoS information | QoS information for the MBS Session. | X |  | X |
| MBS Service Area | Area over which the MBS session data is distributed. | X | X | X |
| NG-RAN Node ID(s) | NG-RAN nodes which are selected for the broadcast session |  | X |  |
| IP multicast address for data distribution | IP addresses identifying the user plane transport used for shared delivery between MB-UPF and NG-RAN when the IP multicast transport is used. | X (note 1) |  | X (note 1) |
| NG-RAN IP Address for data distribution | The IP address of NG-RAN used for the user plane between NG-RAN and MB-UPF when Point to Point tunnel is used. | X (note 1) |  | X (note 1) |
| TEID for data distribution | The tunnel ID used for receiving the broadcast data for shared delivery by NG-RAN | X |  | X |
| List of cell ID(s) | Cell(s) for which the MBS service may be distributed. | X |  | X |
| NOTE 1: It is an optional parameter. | | | | |

## 6.10 Policy control for Multicast and Broadcast services

The policy and charging control framework as defined in TS 23.503 [7] applies to Multicast and Broadcast services in the following aspects:

- MBS Session binding: MBS Session binding is the association of an AF Session information to one and only one MBS Session. The PCF shall perform the session binding based on the MBS Session ID, i.e. TMGI or source specific IP multicast address.

- QoS Flow binding: For an MBS Session, QoS Flow binding is the association of a PCC rule to a QoS Flow within an MBS Session. The MB-SMF performs QoS Flow binding for an MBS Session in the same way as the SMF for a PDU Session.

Editor's note: It is FFS whether any other aspects or differences compared to existing PCC framework are required for MBS policy control.

## 6.11 Service Announcement

Service Announcement provides the UE with descriptions specifying the multicast or broadcast services to be delivered as part of MBS Session.

The Service Announcement includes the MBS Session ID(s), which is represented by TMGI or a Source Specific IP Multicast Address, for the service. When the MBS Session ID is Source Specific IP Multicast Address, the Service Announcement may include the PLMN ID of the PLMN in which the service is delivered.

The Service Announcement includes an MBS Session Type, which indicates whether the MBS Session for the service is multicast or broadcast.

NOTE 1: A Source Specific IP Multicast Address as MBS Session ID indicates a multicast session.

For local MBS service, the Service Announcement may include the MBS service area information.

If the MBS Session is multicast, the Service Announcement may include the DNN and S-NSSAI of the PDU Session to indicate which PDU Session is associated with the MBS Session.

NOTE 2: For multicast, AF or MBSF provides Service Announcement only after the MBS information is available to 5GC or the start time need be included, to avoid potential rejection sent by SMF of the MBS session join request.

Editor’s note: Other means to provide MBS session related information to UE, e.g. pre-configuration of default PLMN ID, DNN and S-NSSAI and possible additional information are FFS.

Editor's note: If DNN and S-NSSAI information is not provided in the service announcement or pre-configured, how UE determines the PDU session to join the MBS Session is FFS.

The Service Announcement may be provided to a UE by AF or MBSF, or may be retrieved by the UE from those entities.

Editor's note: Other entities that can send Service Announcement to UE is FFS.

Editor's note: The details of Service Announcement will be defined with coordination with SA4/SA6, including which information is aware by UE.

# 7 MBS procedures

## 7.1 Common procedure for Multicast and Broadcast

### 7.1.1 Configuration for MBS Session

Editor's note: The heading and content needs to be revisited.

#### 7.1.1.1 Initial MBS session configuration without PCC

Editor's note: It is FFS if a separate Clause without PCC is required or this can be covered in 7.1.1.2 Updates similar to agreed changes in Clause 7.1.1.2 are required.

This procedure is used by the AF to start the MBS Session towards 5GC and consist of TMGI allocation, and MBS session start procedures, and they apply to both multicast and broadcast communications unless otherwise stated.

For broadcast communication, MBS Session establishment/start consists of radio resource reservation towards the NG-RAN. For multicast communication, the radio resource reservation is performed when there is UE join.

For both broadcast and multicast communication, the TMGI allocation may be separated from the MBS Session Establishment/Start procedure.

For multicast communication, TMGI allocation procedure is applicable if TMGI is used as MBS Session ID.



Figure 7.1.1.1-1: Initial Configuration for MBS Session

Editor´s note: MBSTF could optionally be in the user plane and the call flow should be updated to also cover that possibility.

Editor's note: The services and messages used in this procedure are FFS.

Steps 1 to 5 are optional and only applicable if TMGI is used as MBS Session ID and required to be pre-allocated.

1. AF sends Allocate TMGI Request () message to NEF/MBSF to request allocation of a TMGI to identify a new MBS session.

NOTE 1: Depending on the configuration, MB-SMF may receive requests from AF directly, or via NEF, or via MBSF, or via NEF and MBSF.

2. NEF checks authorization of AF.

NOTE 2: NEF is not required if AF is in trusted domain.

3. NEF/MBSF discovers and selects an MB-SMF using NRF or based on local configuration, and then sends an Allocate TMGI Request () message to the MB-SMF.

4. MB-SMF allocates a TMGI and returns the TMGI to the NEF/MBSF.

5. The NEF or MBSF responds to the AF by sending an Allocate TMGI Response (TMGI) message.

6. The AF may perform a Service Announcement towards UEs. The AF informs UEs about MBS Session information with MBS Session ID, e.g., TMGI, source specific multicast address, and possibly other information e.g., MBS service area, session description information, etc.

The MBS service area information can be Cell ID list, TAI list, geographical area information or civic address information. Amongst them, Cell ID list and TAI list shall only be used by AFs who reside in trust domain, and when the AFs are aware of such information.

The UE needs to be aware if the service is broadcast or multicast to decide if JOIN is to be performed.

Editor's note: How to do service announcements requires SA WG4 /WG6 coordination.

7. AF of content provider may provide contents for an MBS session (possibly providing information for a previously allocated TMGI; e.g. service type of either multicast service or broadcast service) to NEF. If step 1-4 has not been executed before, the AF may provide a source specific multicast address or it may request that the network allocates an identifier for the MBS session (i.e., TMGI) and its service type of either multicast service or broadcast service. MBS information may further include QoS requirements, UE authorization information (e.g. a GPSI or an External Group Id or a UE ID to identify UEs authorized to join the multicast service), MBS service area (see step 6 for detail) identifying the service scope.

If geographical area information or civic address information was provided by the AF as MBS service area, NEF/MBSF translates the MBS service area to Cell ID list or TAI list.

Editor's note: What other information is to be sent by AF is FFS.

NEF/MBSF checks authorization of content provider.

8. NEF/MBSF discovers MB-SMF candidates and selects MB-SMF as ingress control node, possibly based on location area.

9. NEF/MBSF requests MB-SMF to reserve ingress resources for a MBS distribution session and provides MBS Session ID or request allocation, and indicate its service type (either multicast service or broadcast service). It also indicates if the allocation of an ingress transport address is requested.

The MBS service area is provided by NEF/MBSF to the MB-SMF if provided by the AF in step 7.

10. MB-SMF updates NF profile to NRF with the serving MBS Session ID.

11. The MB-SMF derives the required QoS parameters locally. MB-SMF selects the MB-UPF and requests it to reserve user plane ingress resources. If multicast transport of the MBS data towards RAN nodes is to be used, the MB-SMF also request the MB-UPF to reserve for the outgoing data a tunnel endpoint and the related identifiers (source IP address, source specific multicast address and GTP Tunnel ID) and to forward data received at the user plane ingress resource using that tunnel endpoint.

If ingress address is not requested, the MB-SMF configure MB-UPF to handle the multicast data distribution and request the MB-UPF to join the multicast tree towards the content provider. MB-UPF can also join the distribution tree of the content provider in the subsequent procedures e.g., session establishment procedure.

12. If requested, MB-UPF selects an ingress address (IP address and port) and a tunnel endpoint for the outgoing data and provides it to MB-SMF.

For broadcast communication, the MB-SMF continues the procedure towards the AMF and NG-RAN as specified in clause 7.3.1 before steps 13 and 14 are executed.

For multicast communication, depending on configuration the UE can join the MBS Session after steps 13, 14 and 15 are executed.

13. MB-SMF indicates the possibly allocated ingress address to the NEF/MBSF. MB-SMF may include TMGI if it is allocated in step 9. It also indicates the success or failure of reserving transmission resources.

14. The NEF/MBSF-C indicates the possibly allocated ingress address and other parameters (e.g. TMGI) to the AF.

15. Same as step 6. The AF may also perform a service announcement at this stage.

#### 7.1.1.2 Initial MBS session configuration with PCC

The configuration steps for MBS Session are used by the AF to start the MBS Session towards 5GC and consist of TMGI allocation and MBS session start procedures, and they apply to both multicast and broadcast communications unless otherwise stated. MBS session establishment/activation procedure may follow the MBS session configuration procedure per its service type (multicast or broadcast service) to reserve resources towards NG-RAN.

For broadcast communication, MBS Session establishment/start consists of radio resource reservation towards the NG-RAN. For multicast communication, the radio resource reservation is performed when there is UE join.

For both broadcast and multicast communication, the TMGI allocation may be separated from the MBS Session Establishment/Start procedure.

For multicast communication, TMGI allocation procedure is applicable if TMGI is used as MBS Session ID.



Figure 7.1.1.2-1: Configuration for MBS Session

Editor's note: The services and messages used in this procedure are FFS.

Steps 1 to 5 are optional and only applicable if TMGI is used as MBS Session ID and required to be pre-allocated.

1. AF sends Allocate TMGI Request () message to NEF/MBSF to request allocation of a TMGI to identify a new MBS session.

NOTE 1: Depending on the configuration, MB-SMF may receive requests from AF directly, or via NEF, or via MBSF, or via NEF and MBSF.

2. NEF/MBSF checks authorization of AF.

3. NEF/MBSF discovers and selects an MB-SMF using NRF or based on local configuration.

4. NEF/MBSF sends an Allocate TMGI Request () message to the MB-SMF.

5. MB-SMF allocates TMGI(s) and returns the TMGI(s) to the NEF/MBSF via Allocate TMGI Response (TMGI(s)).

6. The NEF or MBSF responds to the AF by sending an Allocate TMGI Response (TMGI(s)) message.

7. The AF may perform a Service Announcement towards UEs. The AF informs UEs about MBS Session information with MBS Session ID, e.g., TMGI, source specific multicast address, and possibly other information e.g., MBS service area, session description information, etc.

The MBS service area information can be Cell ID list, TAI list, geographical area information or civic address information. Amongst them, Cell ID list and TAI list shall only be used by AFs who reside in trust domain, and when the AFs are aware of such information.

The UE needs to be aware if the service is broadcast or multicast to decide if JOIN is to be performed.

Editor's note: How to do service announcements requires SA WG4 /WG6 coordination.

8. AF of content provider may provide description for an MBS session (possibly providing information for a previously allocated TMGI; e.g. service type of either multicast service or broadcast service) to NEF/MBSF by MBS Session Request ([MBS Session ID], service type, MBS information,) message. If step 1-4 has not been executed before, the AF may provide a source specific multicast address or it may request that the network allocates an identifier for the MBS session (i.e., TMGI) and its service type of either multicast service or broadcast service. MBS information may further include QoS requirements, MBS service area information (see step 6 for detail) identifying the service scope, start and end time of MBS. In addition, MBS information may also indicate whether the allocation of an ingress transport address is requested.

If geographical area information or civic address information was provided by the AF as MBS service area, NEF/MBSF translates the MBS service area to Cell ID list or TAI list.

Editor's note: What other information is to be sent by AF is FFS.

NEF/MBSF checks authorization of content provider.

9. NEF/MBSF discovers MB-SMF candidates and selects MB-SMF as ingress control node, possibly based on location area.

If TMGI is included in step 8, NEF/MBSF finds MB-SMF based on TMGI

10. NEF/MBSF sends MBS Session Create Request (MBS Session ID, service type, , TMGI allocation indication, MBS service area information, ingress transport address request indication) to MB-SMF, to request MB-SMF to reserve ingress resources for a MBS distribution session and provides MBS Session ID or request allocation, and indicate its service type (either multicast service or broadcast service). It also indicates if the allocation of an ingress transport address is requested.

The MBS service area information is provided by NEF/MBSF to the MB-SMF if provided by the AF in step 7.

11. If MB-SMF is selected by NEF/MBSF in step 9 and source specific multicast address is provided in step 10, MB-SMF allocates TMGI and MB-SMF may update NF profile to NRF with the serving MBS Session ID.

NOTE 1: If TMGI is used to represent an MBS Session, MB-SMF does not need to update NRF if the TMGI range(s) supported by an MB-SMF is already included in the MB-SMF profile when MB-SMF register itself into NRF.

12. [Optional] The MB-SMF sends SM MBS Policy Association Request (MBS Session ID) to PCF with the MBS Session ID.

Editor’s Note: How AF/NEF/MBSF know that PCF should be involved in the MBS Session is FFS.

13. [Optional] The PCF registers at the BSF that it handles the multicast session. It provides an identifier that the policy association is for multicast and the MBS Session ID, it own PCF ID and optionally its PCF set ID.

14. [Optional] The MB-PCF may retrieve preconfigured policy information for the MBS session from the UDR.

15. [Optional] The PCF responds with SM MBS Policy Association Response (MBS Policy,) with policies for the MBS Session ID.

Editor’s Note: What polices are provided by PCF is FFS.

16. If PCC is not used, The MB-SMF derives the required QoS parameters locally. MB-SMF selects the MB-UPF and requests it to reserve user plane ingress resources. If multicast transport of the MBS data towards RAN nodes is to be used, the MB-SMF also request the MB-UPF to reserve for the outgoing data a tunnel endpoint and the related identifiers (source IP address, source specific multicast address and GTP Tunnel ID) and to forward data received at the user plane ingress resource using that tunnel endpoint.

If ingress address is not requested, the MB-SMF configure MB-UPF to handle the multicast data distribution and request the MB-UPF to join the multicast tree towards the content provider. MB-UPF can also join the distribution tree of the content provider in the subsequent session establishment procedure.

Editor’s Note: Whether QoS info is to be included in step 14 and if included what QoS is included are FFS.

17. If requested, MB-UPF selects an ingress address (IP address and port) and a tunnel endpoint for the outgoing data and provides it to MB-SMF.

For broadcast communication, the MB-SMF continues the procedure towards the AMF and NG-RAN as specified in clause 7.3.1 before steps 17 is executed.

Editor’s Note: For dynamic PCC, It is ffs whether to defer those steps to wait for a policy update .

18. MB-SMF indicates the possibly allocated ingress address to the NEF/MBSF. MB-SMF may include TMGI if it is allocated in step 9. It also indicates the success or failure of reserving transmission resources.

19-20. [Optional] The NEF/MBSF uses the BSF Discovery service to discover the MB-PCF serving the MBS session with the MBS session ID.

Editor’s Note: It is FFS whether step 13, 19-20 are needed for the case when AF can get the ID of PCF selected by MB-SMF.

21. [Optional] The NEF/MBSF sends SM MBS Policy Association Request to MB-PCF with the MBS session ID and MBS information,

The PCF determines whether the request is authorized.

If the request is authorized, the PCF derives the required QoS parameters based on the information provided by the NEF and determines whether this QoS is allowed (according to the PCF configuration for this Application),.

If the request is not authorized or the required QoS is not allowed, the PCF indicates so in the response to the NEF

22. [Conditional] If the PCF determined updated policies for the MBS session in step 21, it update the policy information at the MB-SMF.

23. [Conditional] If required by the updated policies, the MB-SMF updates the MB-UPF accordingly.

24. [Optional] If the MBSF decides to use an MBSTF, the MBSF provides the received ingress address in step 18 towards the MBSTF as DL destination, and requests the MBSTF to allocate the user plane ingress resources.

NOTE 2: Whether MBSF interacting with MBSTF is before or after PCF interaction is FFS.

25. [Conditional on step 22] If requested, MBSTF selects an ingress address (IP address and port) and provides it to NEF/MBSF.

26. . The NEF/MBSF-C includes the ingress address if allocated and other parameters (e.g. TMGI) to the AF by MBS Session Response ([TMGI], [Allocated ingress address]) message. If MBS Session ID is not provided in step 8, or the MBS Session ID is source specific multicast address, the NEF/MBSF provides the allocated TMGI. If AF requests the allocation of an ingress transport address, the message also includes the allocated ingress address.

27. Same as step 6. The AF may also perform a service announcement at this stage.

For multicast communication, depending on configuration, UE join request can be accepted from this point onward.

#### 7.1.1.3 Removal of MBS session configuration without PCC

Editor's note: It is FFS if a separate Clause without PCC is required or this can be covered in 7.1.1.4.

This procedure is used by the AF to stop the MBS Session towards 5GC. This procedure may also consist of TMGI de-allocation. The procedures apply to both multicast and broadcast communications unless otherwise stated. This procedure releases the reserved resources in both 5GC and NG-RAN.



Figure 7.1.1.3-1: Removal of MBS Session configuration without PCC

Editor´s note: MBSTF could optionally be in the user plane and the call flow should be updated and aligned with the MBS session configuration procedure.

Editor's note: The services and messages used in this procedure are FFS.

Editor's note: Additional interaction between AF/NEF and PCF are FFS.

1. AF of content provider may request stop contents for the MBS session (MBS Session ID) to NEF.

2. NEF/MBSF requests MB-SMF to release ingress resources for the MBS distribution session.

2a. For broadcast session, the MB-SMF triggers resource release towards the AMFs as specified in clause 7.3.2. For multicast session, the MB-SMF triggers resource release towards the SMFs as specified in 7.2.2.3.

3/4. MB-SMF requests the MB-UPF to release user plane ingress resources.

5. [Conditional] If MB-SMF configured the profile with an MBS session ID when the MBS session was configured, the MB-SMF updates its NF profile at NRF to release the MBS Session ID.

6. MB-SMF responds to the NEF/MBSF.

7. The NEF/MBSF responds to the AF.

8/9. [Optional] AF requests NEF/MBSF to de-allocate TMGI(s), and NEF/MBSF forwards request to MB-SMF

NOTE 1: Depending on the configuration, MB-SMF may receive requests from AF directly, or via NEF, or via MBSF, or via NEF and MBSF.

10/11.The MB-SMF responds to the NEF or MBSF and to the AF by sending a de-allocate TMGI Response message.

#### 7.1.1.4 Removal of MBS session configuration with PCC

This procedure is used by the AF to stop the MBS Session towards 5GC. This procedure may also consist of TMGI de-allocation. The procedures apply to both multicast and broadcast communications unless otherwise stated. This procedure releases the reserved resources in both 5GC and NG-RAN.



Figure 7.1.1.4-1: Removal of configuration for MBS Session

Editor´s note: MBSTF could optionally be in the user plane and the call flow should be updated and aligned with the MBS session configuration procedure.

Editor's note: The services and messages used in this procedure are FFS.

Editor's note: Additional interaction between AF/NEF and PCF are FFS.

1. AF of content provider may request stop contents for the MBS session (MBS Session ID) to NEF.

If dynamic PCC is deployed, the steps 7, 8 and 10 are skipped, otherwise, the steps 2, 3, 4, 5 and 6 are skipped.

Editor’s Note: Whether MBS Policy Association Release Notify can be used to release the MBS Session is FFS, in another word, whether MB-SMF should terminate the MBS policy association regardless of dynamic PCC deployment is FFS.

2. The NEF/MBSF sends an MBS Session Stop Request (MBS Session ID) message to the PCF that handles the Policy of the MBS Session.

3. The PCF sends message to MB-SMF to release the MBS Policy Association.

3a. For broadcast session, the MB-SMF triggers resource release towards the AMFs as specified in clause 7.3.2. For multicast session, the MB-SMF triggers resource release towards the SMFs as specified in 7.2.2.3.

4. The MB-SMF sends the MBS Policy Association Release Notify Response (TMGI) message to the PCF.

5. The PCF de-registers at the BSF that it handles the multicast session.

6a/b. MB-SMF requests the MB-UPF to release user plane ingress resources.

7. NEF/MBSF requests MB-SMF to release ingress resources for the MBS distribution session.

8a/8b. MB-SMF requests the MB-UPF to release user plane ingress resources.

9. [Conditional] If MB-SMF configured the profile with an MBS session ID when the MBS session was configured, the MB-SMF updates its NF profile at NRF to release the MBS Session ID.

10. MB-SMF responds to the NEF/MBSF.

11. The NEF/MBSF responds to the AF.

12/13. [Optional] AF requests NEF/MBSF to de-allocate TMGI(s), and NEF/MBSF forwards request to MB-SMF

NOTE: Depending on the configuration, MB-SMF may receive requests from AF directly, or via NEF, or via MBSF, or via NEF and MBSF.

14/15. The MB-SMF responds to the NEF or MBSF and to the AF by sending a de-allocate TMGI Response message.

#### 7.1.1.5 MBS Session Update without PCC

This procedure is used by the AF to update the MB service area and/or update QoS of an MBS Session. Updating QoS of an MBS Session may lead to addition of new MBS QoS Flow(s). The procedure applies to both multicast and broadcast communications unless otherwise stated.



Figure 7.1.1.5-1: Update of MBS Session

1. AF initiates MBS Session Update, e.g. to update broadcast area and/or update service requirement.

2. NEF/MBSF forward the request to MB-SMF.

3-4. The MB-SMF derives the updated QoS parameters locally. MB-SMF may need to update MB-UPF, e.g. if new MBS QoS Flow is to be created, or existing MBS QoS Flow is to be deleted.

5. For broadcast communication, the MB-SMF continues the procedure towards the AMF and NG-RAN as specified in clause 7.3.3. For multicast communication, the MB-SMF continues the procedure towards the AMF and NG-RAN as specified in clause 7.2.2.

6-7. MB-SMF responds.

7.1.1.6 MBS session configuration Update with PCC



Figure 7.1.1.6-1: MBS session configuration update

1. AF of content provider may provide to a NEF/MBSF updated information for an MBS session (identified by MBS session ID) by sending MBS Session update request ([MBS Session ID], MBS information, AF Identifier). MBS information may include service requirements, MBS service area information, and media information. The service requirements adjustment may lead to addition of new MBS QoS Flow(s), removal of existing MBS QoS Flow(s) or update of existing MBS QoS Flow(s).

Editor's Note: this procedure will be aligned with S2-2103955, and detailed service operation is FFS.

2. NEF/MBSF may check authorization of the request.

3. NEF/MBSF updates the MBS policy Association to PCF and provides the input received from the AF, by sending Npcf\_MBSPolicy\_Association\_Update Request message (MBS Session ID, service requirement).

4. The PCF responds to NEF/MBSF the result of request with Npcf\_MBSPolicy\_Association\_Update Response message.

5. Based on the input received in step 3, the PCF may provide updated policy rules to the MB-SMF by issuing Npcf\_MBSPolicyControl\_UpdateNotify request message including the updated policy information about the MBS Session.

The MB-SMF may provide updated PCC rule to the MB-UPF, AMF, or SMF (for multicast only) based on the updated policy rules from PCF.

### 7.1.2 MB-SMF discovery and selection for multicast/broadcast session

To facilitate the MB-SMF discovery/selection for one multicast/broadcast session, the following mechanism is used:

- The MB-SMF registers its capability related to multicast/broadcast session management (e.g. S-NSSAI(s) and the associated NSI ID(s) (if available), DNN(s), TMGI range, service area) as part of its profile to the NRF by invoking Nnrf\_NFManagement\_NFRegister. In addition, when an multicast session is configured, and the MBS session ID is not yet included in the MB-SMF profile, the MB-SMF updates its profile towards the NRF with the MB Session ID (i.e. TMGI or source specific IP multicast address).

- When the UE joins the multicast session via PDU session modification procedures, the SMF serving the PDU session invokes the Nnrf\_NFDiscovery\_Request including the multicast session ID provided by the UE and optionally other information, i.e. the S-NSSAI and the associated NSI ID (if available), DNN, etc., to query the NRF for MB-SMF information. Based on the MBS session ID and other information for query, the NRF decides whether an MB-SMF serving the MBS session exists. If so, the NRF provides in Nnrf\_NFDiscovery\_Response the information of the MB-SMF currently serving the MBS session. The SMF serving the PDU session selects the MB-SMF currently serving the multicast MBS session, based on the MB-SMF information provided by the NRF. For local MBS services, the SMF takes MB-SMF service area, UE location into account when selecting the MB-SMF. If no MB-SMF serving the multicast session exists, the NRF provides MB-SMF profiles based on the other query information.

- When the multicast session context is deleted from the MB-SMF, e.g. due to MBS session release, the MB-SMF updates its profile towards the NRF, i.e., removing the MBS session ID which is no longer served by the MB-SMF.

- During MBS session configuration procedures, unless the MB-SMF information is available by other means, e.g. locally configured in the NEF/MBSF/AF, the NEF/MBSF/AF queries the NRF with information of the multicast/broadcast session (e.g. S-NSSAI(s) and the associated NSI ID(s) (if available), DNN(s)), and selects the MB-SMF(s) based on the MB-SMF information provided by the NRF. For local MBS services, the NEF/MBSF/AF takes MB-SMF service area into account when selecting the MB-SMF(s).

### 7.1.3 MB-UPF discovery and selection for multicast/broadcast session

The selection and reselection of the MB-UPF are performed by the MB-SMF by considering MB-UPF deployment. For the local broadcast/multicast MBS session and location-dependent MBS session, the service area is taken into consideration for MB-UPF selection.

MB-SMF may be locally configured with the information about the available MB-UPFs, e.g. by OA&M system when MB-UPF is instantiated or removed.

The MB-UPF selection functionality in the MB-SMF may optionally utilize the NRF to discover MB-UPF instance(s) which is similar with UPF selection with NRF defined in the TS 23.501 [5] clause 6.3.3.2.

## 7.2 MBS procedures for multicast Session

### 7.2.1 MBS join and Session establishment procedure

#### 7.2.1.1 General

Session Join procedure is used by UEs to inform the 5GC of the UE interest in an MBS Session. The user plane management is described in clause 6.6.

#### 7.2.1.2 Establishment of a PDU Session that can be associated with multicast session(s)

The PDU Session associated with multicast session(s) is established using the procedures as specified in TS 23.502 [6] clause 4.3.2.2 with the following differences:

NOTE: The DNN and S-NSSAI are used to establish the PDU session which can carry the Multicast operation, i.e. join/leave, and can be associated with multicast MBS session(s).

- In step 2, based on the DNN and S-NSSAI use for establishing a PDU Session associated with multicast session(s), and/or an indication that the user is requiring a MBS capable SMF in the UDM, the AMF selects an SMF capable of handling multicast sessions based on DNN and S-NSSAI, locally configured data or a corresponding SMF profile stored in the NRF. For indirect discovery, the AMF requests the SCP to select an SMF capable of handling multicast sessions.

Editor's note: Whether the indication in the UDM is needed or not is FFS.

Editor's note: What exact service operations will be used is FFS.

#### 7.2.1.3 Multicast session join and session establishment procedure

The following steps are executed before the UE requests to join the MBS session:

- The MBS Session may have has been configured (see clause 7.1.1 for details).

- The UE registers in the PLMN and establishes a PDU session.

- The UE has known at least the MBS Session ID of a multicast group that the UE can join, e.g. via service announcement.

**UE**

**NG-RAN**

**AMF**

**SMF**

**UPF**

**NRF**

**MB-SMF**

**MB-UPF**

**AF**

1a. UL NAS message (N1 SM container (PDU Session Modification Request))

1b. Nsmf\_PDUSession\_UpdateSMContext request

5. Nsmf\_PDUSession\_UpdateSMContext response

3. Nnrf\_NFDiscovery request/response

4. Nmbsmf\_ Information\_ request/response

6. N2 message request

13. Multicast data

14. Multicast data

15. Bear selection

16. Multicast data via PTP or PTM

Transmission via 5GC shared MBS traffic delivery

17. Multicast data

18. Multicast data via PDU Session

19. Multicast data via PDU Session

Transmission via 5GC Individual MBS traffic delivery

2. Authorization check, see clause 6.1.1

Establishment of resources for 5GC shared MBS traffic delivery

7a. N2 message

7b. Nmbsmf\_Reception request

7c. Configuration for Shared delivery

7d. Nmbsmf\_Reception response

7e. N2 message

9. N2 message response

10. Nsmf\_PDUSession\_UpdateSMContext request

Establishment of resources for 5GC Individual MBS traffic delivery

11a. Configuration for Individual delivery

11b. Nmbsmf\_Reception request

11c. Configuration for Individual delivery

11d. Nmbsmf\_Reception response

11e. Configuration for Individual delivery

8. RRC message (PDU Session Modification command)

12. Nsmf\_PDUSession\_UpdateSMContext response

Figure 7.2.1.3-1: PDU Session modification for UE joining multicast session

1. To join the multicast group, the UE sends a PDU Session Modification Request which contains one or several MBS Session ID(s) and join request. The MBS Session ID(s) indicate the multicast group(s) that UE wants to join.

2. [Conditional] Based on the received MBS Session ID and join request, the SMF determines this is MBS Session join request. The SMF authorizes MBS Session join request for each multicast group, see clause 6.1.1. If the Multicast MBS session is configured but the configuration indicates that the service requirements are not provided yet, the SMF may reject the MBS session join with appropriate cause value. If authorization check fails, the SMF indicates cause value in the PDU Session Modification Reject sent to the UE and proceeds with step 5.

3. [Conditional] If SMF has no information about MBS Session context for the indicated MBS Session ID, SMF discovers and selects an MB-SMF for the MBS Session via the NRF as described in clause 7.1.2. If no MB-SMF is assigned for the multicast session ID, the SMF may select an MB-SMF and request it configure the multicast session or the SMF may reject the join request.

Editor’s Note: How SMF requests MB-SMF configure the multicast session is FFS.

4. By using Nmbsmf\_Information\_Request request (MBS Session ID), SMF interacts with the MB-SMF to retrieve multicast QoS flow information of the indicated MBS session. For multicast transport between MB-UPF and content provider, if it is the first UE joining the multicast group, and MB-UPF has not joined the multicast tree in the MBS configuration procedure, the MB-SMF requests the MB-UPF to join the multicast tree towards the AF/MBSF, otherwise MB-SMF will not send the request to the MB-UPF.

Editor's note: If MB-UPF’s join towards the multicast tree depends on the first UE join, it implies that MB-UPF should leave the multicast tree when the last UE leaves, in clause 7.2.2.2.

5. SMF responds to AMF through Nsmf\_PDUSession\_UpdateSMContext response (MBS Session ID, MB-SMF ID, N2 SM information (PDU Session ID, MBS Session ID, [updated PDU Session information],[mapping information between unicast QoS flow(s) and multicast QoS flow (s)]), N1 SM container (PDU Session Modification Command)) to:

- create an MBS session context for the indicated MBS session in the RAN, if it does not exist in the RAN already; and

- inform about the relation including the mapping information between the multicast context and the UE's PDU session context to RAN if RAN non-homogeneously support 5MBS for the MBS session.

Based on operator policy, the SMF may prepare for 5GC individual MBS traffic delivery fall-back. The SMF maps the received QoS information of the multicast QoS Flow into PDU Session's QoS Flow information, and includes the information of the QoS Flows and the mapping information about the QoS Flows in the SM information sent to RAN.

Editor's note: Details information included in N2 SM information will be aligned with RAN WG3.

Editor's note: Possible PCF interactions related to the multicast QoS flows are FFS.

6. The N2 message, which includes the multicast session information and PDU session modification information is sent to the NG-RAN.

If the MBS is not supported by NG-RAN, 5GC individual MBS traffic delivery may be used. Otherwise if the MBS is supported by NG-RAN, 5GC shared MBS traffic delivery is adopted.

If the NG-RAN supports MBS, the NG-RAN uses the MBS Session ID to determine that the PDU Session Modification procedures corresponds to the indicated multicast session.

If the multicast QoS information is received and the NG-RAN supports MBS, the associated unicast QoS flow information is not used to allocate the radio resource.

NOTE 1: It is NG-RAN that decides whether radio resource is allocated or not.

[Conditional] If shared tunnel has not been established for the MBS session, step 7 is used for establishing 5GC shared MBS traffic delivery. Step 7 is executed separately for each MBS session:

7a. The NG-RAN sends an N2 MBS Session request message (MBS Session ID, N2 SM information (MBS Session ID, [AN Tunnel Info])) towards AMF. MBS Session ID is included.

If the NG-RAN node uses a unicast transport for shared delivery, it allocates a downlink tunnel ID for the reception of MBS data and includes the downlink tunnel information as AN Tunnel Info in the request.

7b. AMF invokes Nmbsmf\_Reception\_Request (MBS Session ID, RAN Node ID, [AN Tunnel Info]) towards the MB-SMF indicated in step 5.

7c. If a downlink tunnel information is included in AN Tunnel Info of the Nmbsmf\_MBSSession\_Create request, MB-SMF configures MB-UPF to transmit the MBS data for multicast session towards NG-RAN using the downlink tunnel information.

If AN Tunnel Info is not included in the request 7b, and the MB-UPF is not yet configured to forward data for the multicast data using lower layer multicast transport, the MB-SMF request the MB-UPF to allocate a common DL tunnel ID and an Low Layer source specific multicast address (LL SSM) for multicast transport between the MB-UPF and NG-RAN.

7d. MB-SMF responds to AMF through Nmbsmf\_Reception\_Requestresponse (multicast QoS flow information, [common DL tunnel ID], [LL SSM]). If AN Tunnel Info is not included in the request 7b, the MB-SMF provides common DL tunnel ID and LL SSM.

Editor’s notes: How LL IP Multicast Address and common DL tunnel ID e are made available in NG-RAN is FFS. Such information can be sent to NG-RAN in step 6.

7e. AMF sends an N2 MBS Session response (MBS Session ID, N2 SM information (MBS Session ID, multicast QoS flow information, [common DL tunnel ID], [LL SSM])) to the NG-RAN node.

8. The NG-RAN performs AN specific signalling exchange with the UE to establish radio resource for the MBS session if not established yet. If the NG-RAN does not support MBS, radio resource are reconfigured for unicast transmission of the MBS data over the associated PDU session. As part of the AN specific signalling exchange, the N1 SM container (PDU Session Modification Command) is provided to the UE.

9. The NG-RAN sends the PDU session modification response.

If the MBS is not supported by NG-RAN, the accepted unicast QoS flow is included in the N2 SM response container.

10. The AMF invokes Nsmf\_PDUSession\_UpdateSMContext request to the SMF.

Per the accepted unicast QoS flow information, the SMF determines that 5GC individual MBS traffic delivery is used for multicast packet transferring.

NOTE 2: If the shared tunnel is used, the interaction with UPF is not needed for the indicated MBS session

[Conditional] Step 11 is used for 5GC Individual MBS traffic delivery, e.g. the related NG-RAN does not support multicast .If the shared tunnel between the UPF(PSA) and MB-UPF for individual delivery have not been established, step 11a to 11e are executed.

11a. If unicast transport for the multicast data between UPF and MB-UPF is to be used, SMF allocates a downlink tunnel endpoint and configures UPF. Or, SMF requests UPF to allocate a downlink tunnel ID.

11b. SMF invokes Nmbsmf\_Reception\_Request request (MBS Session ID, DL tunnel info) towards MB-SMF that includes MBS Session ID and downlink tunnel info of UPF, for establishing the multicast session distribution between MB-UPF and UPF.

11c. MB-SMF configures MB-UPF to transmit the multicast distribution session towards UPF using the received downlink tunnel ID.

11d. MB-SMF responds to SMF through Nmbsmf\_Reception\_Request response. For multicast transport between MB-UPF and UPF, it also indicates in the downlink tunnel information and the transport multicast address for the multicast session.

11e. For multicast transport between MB-UPF and UPF, SMF configures UPF to receive the multicast distribution session and forwards the data within unicast transport.

12. The SMF invokes Nsmf\_PDUSession\_UpdateSMContext response to the AMF.

13. MB-UPF receives multicast PDUs, either directly from the content provider or via the MBSTF that can manipulate the data.

Step 14 to 16 are for 5GC shared MBS traffic delivery:

14. MB-UPF sends multicast PDUs in the N3mb tunnel associated to the multicast distribution session to the RAN. There is only one tunnel per multicast distribution session and NG-RAN node, i.e., all associated PDU sessions share this tunnel.

15. The NG-RAN selects PTM or PTP radio bearers to deliver the multicast PDUs to UEs that joined the multicast group.

16. The NG-RAN performs the transmission using the selected radio bearer.

Step 17 to 19 are for 5GC individual MBS traffic delivery:

17. MB-UPF sends multicast PDUs in the N19mb tunnel associated to the multicast distribution session to UPF. There is only one tunnel per multicast distribution session and destination UPF, i.e., all associated PDU sessions share this tunnel.

18. UPF forwards the multicast data via unicast.

19. The NG-RAN forwards the multicast data via unicast.

NOTE 3: Details of the DL MBS data transmission are described in clause 6.7.

NOTE 4: When the MBSF is involved in the multicast MBS session, the tunnel between MBSTF and MB-UPF has been established in the configuration procedure.

#### 7.2.1.4 Establishment of shared delivery toward RAN node

Editor´s note: Message names are preliminary

In the following case, the shared delivery tunnel may be established between NG-RAN and MB-UPF:

* The first UE join the MBS session in the NG-RAN;
* MBS session activation.

Editor´s note: It is FFS whether inactive MBS Session still keeps the shared delivery resources, hence whether MBS Session activation is a case for the triggering is FFS.

* Handover to the target NG-RAN when the Shared delivery tunnel is not established in the target RAN node for this MBS session



Figure 7.2.1.4-1: Establishment of shared delivery toward RAN node.

1. A RAN node discovers that it needs to establish shared delivery for an MBS session because it serves at least one UE within the MBS session. For location dependent services, the RAN node needs to establish shared delivery for the location dependent contents of an MBS session if it serves at least one UE assigned to an MBS session ID and area session ID.

2. The RAN node sends a multicast distribution request to the AMF and provides the TMGI as MBS session ID. If the RAN node is configured to use unicast transport for the shared delivery, it allocates a GTP tunnel endpoint and provides that endpoint. For location dependent services, the RAN node also provides the area session ID.

3. The AMF discovers the MB-SMF serving the multicast session using the NRF discovery service. It sends a Multicast distribution request to the MB-SMF, passing the parameters received in message 2.

Editor's note: Whether AMF needs provides RAN id to MB-SMF, or it stores the information for the RAN nodes (e.g., RAN id) instead for the subsequent signaling is FFS.

4. If the MB-SMF received a GTP tunnel endpoint in message 3, it configures the MB-UPF to send multicast data for the multicast session (or location dependent content of the multicast session if an area session ID was received) towards that GTP tunnel endpoint via unicast transport.

5. The MB-SMF stores the AMF in the context of the multicast session (or location dependent part of the multicast session if an area session ID was received) to enable subsequent signalling towards that RAN node.

6. The MB-SMF sends a multicast distribution response to the AMF. If it did not receive a GTP tunnel endpoint in message 3, it provides a GTP tunnel endpoint for multicast transport of the shared delivery.

7. The AMF forwards the multicast distribution response to the RAN node. If the RAN node received a GTP tunnel endpoint for multicast transport of the shared delivery, it uses that information to join the multicast transport.

### 7.2.2 MBS leave and Session release procedure

#### 7.2.2.1 General

Session Leave procedure is used by UEs or Application to inform the 5GC of the UE leaving an MBS Session. The user plane management is described in clause 6.6.

#### 7.2.2.2 MBS session Leave

When the UE determines to leave the Multicast MBS Service, it shall send PDU session Modification request to inform the 5GC the leaving operation. The Fig 7.2.2.2-1 describes the procedure.



Figure 7.2.2.2-1: UE initiated multicast MBS session leave

1. The UE sends the PDU Session Modification Request when the UE determine to leave the Multicast MBS Service. The PDU Session Modification Request carries the MBS session ID which the UE want to leave.

2. The AMF invokes Nsmf\_PDUSession\_UpdateSMContext to SMF. The MBS session leaving information (i.e. leave indication, MBS session ID) is included.

3. [conditional] If the UE is the last UE served with 5GC Individual MBS traffic delivery method in this UPF for this MBS session, the SMF configures the UPF to stop receiving multicast data from the MB-UPF and invokes Nmbsmf\_MBSession\_Update Request (MBS session ID, [tunnel information]) to release the tunnel between UPF and MB-UPF for this MBS session.

If unicast transport is used, tunnel information is included to indicate the tunnel between UPF and MB-UPF.

4. [conditional] The MB-SMF request to MB-UPF to release the tunnel between UPF and MB-UPF for the MBS session.

5. [conditional] The MB-SMF responds to SMF for step 3.

6. [Optional] If individual delivery is applied, the SMF invokes an N4 Session Modification procedure with the UPF (PSA). The SMF reconfigures UPF to terminate the distribution of multicast data via the unicast PDU session and release the resources for the reception of the multicast data.

7. The SMF invokes the Nsmf\_PDUSession\_UpdateSMContext Response (PDU Session ID, N2 SM information (MBS Session ID), N1 SM container) service operation. In the N2 SM information, the SMF informs the NG-RAN to remove the UE from this MBS session if 5GC Shared MBS traffic delivery method is used.

In the N2 SM information, the SMF also informs the NG-RAN to release the mapped unicast QoS Flow(s), which carry or intend to carry the Multicast MBS traffic for 5GC individual MBS traffic delivery.

The mapped QoS Flow(s) are released as defined in TS 23.502 [6] clause 4.3.3.2.

8. The AMF send N2 message (N2 SM information, N1 SM container) to the NG-RAN

9. The NG-RAN performs the necessary AN-specific resource modification procedure toward the UE and transports the N1 SM container received in step 7 to the UE.

10. The NG-RAN remove the UE from this MBS session and sends a N2 message to the AMF.

11. The AMF transfers the N2 message received in step 9 to the SMF via the Nsmf\_PDUSession\_UpdateSMContext service operation.

The SMF removes the UE from the MBS Session. In addition, if dedicated QoS flow is used for the unicast transfer of the multicast data, the SMF also removes the unicast QoS flow information associated with the indicated MBS session form the UE SM context.12. If the UE is the last UE in this RAN node for this MBS session, the NG-RAN release MBS session between NG-RAN and MB-UPF.

#### 7.2.2.3 SMF removing joined UEs from MBS session

When the SMF receives the multicast session release request from the MB-SMF, the SMF initiated procedures to remove joined UEs from the MBS session.

NOTE: For the active MBS session, the MB-SMF can triggers Multicast Session Deactivation towards the NG-RAN via the AMF to release radio resources of the MBS session as specified in step 3 to step 7 in clause 7.2.5.3, prior to or in parallel with sending multicast session release request to the SMF.]

Editor's note: Whether the MB-SMF triggers radio resource release procedure is necessary is FFS, i.e. the radio resource release can also be done as part of the UE multicast session release procedure and not need be as an additional procedure.



Figure 7.2.2.3-1: SMF removing joined UEs from MBS session

0. The MB-SMF triggers the NG-RANs via the AMFs to release radio resources for the MBS session. Same procedure as defined in step 3-7 in clause 7.2.5.3 is used.

1. The SMF receives Multicast Session Release request from the MB-SMF with MBS Session ID. The SMF checks joined UEs. The SMF sends Multicast Session Release response to the MB-SMF.

2. The SMF triggers the UE to be reachable. Same procedure as defined in step 3-7 in clause 7.2.5.2 is used.

3. For each joined UEs, the SMF invokes Namf\_Communicate\_N1N2MessageTransfer to the AMF. The N1 SM container indicates MBS session release. In N2 SM information, the SMF informs the NG-RAN to remove the UE from the MBS session.

4. The AMF sends N2 Request to the NG-RAN.

5. The NG-RAN transports the N1 SM container (PDU Session Modification Command) to the UE.

6. The NG-RAN performs radio resource modification. If no joined UEs in the MBS session, the NG-RAN release the radio resources.

7. If no joined UEs in the MBS session, for unicast transport of N3mb, the NG-RAN initiates the DL tunnel release towards MB-UPF via AMF and MB-SMF. For multicast transportation of N3mb, the NG-RAN perform IGMP/MLD Leave for the MBS session.

8. The NG-RAN sends N2 Response to the AMF. If no joined UEs in the MBS session, the MBS Session context is removed from the NG-RAN.

9. The AMF transfers the N2 message received in step 8 to the SMF via the Nsmf\_PDUSession\_UpdateSMContext service operation. The SMF removes the UE from the MBS Session

#### 7.2.2.4 Release of shared delivery toward RAN node

Editor´s note: Message names are preliminary

Editor's note: Procedure could to be further studied

In the following case, the shared delivery tunnel may be released between NG-RAN and MB-UPF:

* The last UE leave the MBS session in the NG-RAN;
* Handover to the target NG-RAN when the UE is the last UE in the source RAN node for this MBS session
* MBS session de-configuration.
* Editor´s note: It is FFS whether inactive MBS Session still keeps the shared delivery resources, hence whether MBS Session deactivation is a case for the triggering is FFS.



Figure 7.2.2.4-1: Release of shared delivery toward RAN node

1. A RAN node discovers that it needs to release shared delivery for an MBS session, e.g. because it no longer serves at least one UE within the MBS session. For location dependent services, the RAN node may release shared delivery for the location dependent contents of an MBS session if it no longer serves at least one UE assigned to an MBS session ID and area session ID.

2. The RAN node sends a multicast distribution release request to the AMF and provides the TMGI as MBS session ID. For location dependent services, the RAN node also provides the area session ID.

3. The AMF sends a Multicast distribution release request to the MB-SMF, passing the parameters received in message 2.

4. If unicast transport was used towards the RAN node, the MB-SMF configures the MB-UPF to terminate sending multicast data for the multicast session (or location dependent content of the multicast session if an area session ID was received) towards that RAN node.

5. The MB-SMF removes the RAN node ID from storage in the context of the multicast session (or location dependent part of the multicast session if an area session ID was received).

Editor's note: Whether MB-SMF only store the AMF is FFS.

6. The MB-SMF sends a multicast distribution release response to the AMF.

7. The AMF forwards the multicast distribution release response to the RAN node. If the RAN node previously received a GTP tunnel endpoint for multicast transport of the shared delivery, it uses that information to leave the multicast transport. It releases local resources to receive the multicast data.

### 7.2.3 Mobility Procedures for MBS

#### 7.2.3.1 General

UE may move from one NG-RAN node to another NG-RAN node after UE has joined the MB Session. There are various mobility scenarios possible, depending on whether one of the involved NG-RAN nodes supports 5G MBS.

During an active MBS Session, mobility between an NG-RAN supporting 5G MBS and an NG-RAN node not supporting 5G MBS requires the mobility procedure to provide the appropriate MBS traffic delivery method at the target NG-RAN node.

#### 7.2.3.2 Xn based handover from MBS supporting NG-RAN node

Editor's Note: Details for Xn based handover will be aligned with RAN WGs.

This clause describes an Xn based handover with MBS traffic delivered to the UE at the source gNB supporting 5G MBS.



Figure 7.2.3.2-1: Xn based handover with MBS Session

The following additions apply compared to clause 4.9.1.2 of TS 23.502 [6]:

**Before Handover:**

The source NG RAN has been provided with MBS Session Resource information (including the MBS Session ID and multicast QoS flow information) and the UE Context information contains a mapping information within the PDU Session Resource associated with the MBS Session Resource, e.g. including mapped unicast QoS Flows associated with the multicast QoS flow(s) of the MBS Session Resource.

**Handover Preparation Phase:**

At Xn handover, the target NG-RAN is provided with information which causes:

- a 5G MBS non-supporting target NG-RAN node to prepare unicast resources according to unicast information;

‐ a 5G MBS supporting target NG-RAN node to allocate to the UE shared NG-RAN resources according to the MBS session information. Target NG-RAN triggers setup of the resources for the 5GC shared MBS traffic delivery.

1. Target NG-RAN to AMF: the target NG-RAN sends N2 Path Switch Request to AMF.

The N2 SM message includes sufficient information to allow the SMF to know whether the target NG-RAN node supports 5G MBS and whether MBS Session Resources (in case the target NG-RAN node supports 5G MBS) or PDU Session Resources to support 5GC individual MBS traffic delivery have been established in the target NG-RAN for the UE.

Editor's note: Details to be added, if necessary, during stage 3 phase in RAN WGs.

Based on the received N2 SM message, the SMF can differentiate two cases:

Case A) The target NG-RAN supports 5G MBS. Step 3 applies and steps 4~8 are skipped.

3. SMF to UPF: The SMF invokes N4 Session Modification procedure with the UPF (PSA) only for unicast PDU Session.

Case B) The target NG-RAN does not support 5G MBS and the UPF is not yet configured to forward multicast data via unicast, steps 4 to 8 apply.

4. SMF to UPF (PSA): The SMF invokes N4 Session Modification procedure with UPF (PSA), the SMF instructs the UPF (PSA) to forward the multicast data received from the MB-UPF via the mapped unicast QoS flow(s) of the PDU Session. The SMF provides the mapping information between the multicast QFI and the corresponding unicast QFI of the multicast QFI in the PDU Session to the UPF (PSA), the UPF (PSA) forwards the multicast data via the PDU session based on the mapping information. If the delivery tunnel for the MBS session from MB-UPF to UPF is not established yet, the SMF instructs the UPF (PSA) to allocate a tunnel endpoint for the reception of multicast data from the MB-UPF.

If delivery of the multicast data from MB-UPF to UPF needs to be configured, steps 5 to 8 apply.

5. SMF to MB-SMF: The SMF invokes a Nmbsmf\_MBSSession\_Update (MBS session ID, SMF ID, DL tunnel info) service operation to MB-SMF to establish the shared tunnel between the UPF(PSA) and MB-UPF.

6. MB-SMF to MB-UPF: The MB-SMF configures the MB-UPF with the received DL tunnel Info and instructs the MB-UPF to forward data of the MBS session to the UPF (PSA) via the tunnel. The MB-UPF starts to forward data of the MBS session to the UPF (PSA).

7. MB-SMF to SMF: The MB-SMF responds to SMF through Nmbsmf\_MBSSession\_Update response. If multicast data are transported via multicast, the MB-SMF provides endpoint information (e.g. the Common-TEID) including the transport multicast address.

8. SMF to UPF (PSA): The SMF invokes an N4 Session Modification procedure with the UPF (PSA). If multicast data are transported via multicast, the SMF provides endpoint information including the transport multicast address to the UPF (PSA) and the UPF (PSA) sends IGMP Join in order to receive data from the MB-UPF.

9.

Editor's note: Details on data forwarding, if applicable, needs to wait for RAN WGs.

11. SMF to AMF: The SMF responds to AMF through Nsmf\_PDUSession\_UpdateSMContext response.

12. AMF to target NG-RAN: The AMF sends the path switch Ack to target NG-RAN.

#### 7.2.3.3 N2 based handover from MBS supporting NG-RAN node

Editor's note: Details for N2 based handover should be aligned with RAN WG.

This clause describes the N2 based handover with the MBS Session established at the source 5G MBS-supporting NG-RAN.



Figure 7.2.3.3-1: N2 based handover with MBS Session

The following additions apply compared to clause 4.9.1.3 of TS 23.502 [6]):

2. Source NG-RAN to S-AMF: Handover Required (RAN container (associated PDU session information)).

4. SMF to T-AMF: The T-AMF is provided with associated PDU Session information and the MBS session related information.

5. T-AMF to Target NG-RAN: The Target NG-RAN prepares the radio resource based on the received information:

- If the target NG-RAN does not support 5G MBS, the MBS Session information is not used. The target NG-RAN uses the associated mapping PDU Session information to allocate resource to deliver MBS data. The MBS data are transmitted as one of the QoS flows within the unicast PDU Session.

- If the target NG-RAN supports 5G MBS, the target NG-RAN uses the MBS Session information to allocate resource to deliver the MBS data. If Target NG-RAN supports 5G MBS and the MBS delivery for the indicated MBS Session has not yet been established towards target NG-RAN, the target NG-RAN allocates the shared downlink tunnel information for receiving the MBS data from 5GC and steps 6 to 10 apply:

6. Target NG-RAN to AMF: Target NG-RAN node selects the AMF to reach MB-SMF and signals a multicast session distribution request towards AMF via the N2 Message (MBS Session ID). If the RAN node is configured to use a unicast transport for multicast distribution sessions, it allocates a downlink tunnel ID (an IP address and a GTP-U TEID) for the reception of the multicast distribution session and indicates the downlink tunnel information in the request.

7. AMF to MB-SMF: AMF invokes the Nmbsmf\_Reception\_Request Request (MBS session ID, [DL tunnel info], RAN node ID) Request towards the MB-SMF to establish resources for 5GC shared MBS traffic delivery towards the RAN node.

8. MB-SMF to MB-UPF: MB-SMF invokes the N4 Session Modification procedure with MB-UPF. For unicast transport of the multicast distribution session, MB-SMF configures MB-UPF to transmit the multicast distribution session towards target NG-RAN node (using the received IP address and a GTP-U TEID).

9. MB-SMF to AMF: MB-SMF responds to AMF through the Nmbsmf\_Reception\_Request Response. For multicast transport of the multicast distribution, it indicates the multicast transport address for the multicast session if requested by RAN.

10. AMF to Target NG-RAN: AMF provides multicast session distribution response to Target NG-RAN node via the N2 Message.

11. Target NG-RAN to T-AMF: The target NG-RAN sends Handover Request Ack to T-AMF.

The N2 SM message includes sufficient information to allow the SMF to know whether the target NG-RAN node supports 5G MBS and whether MBS Session Resources (in case the target NG-RAN node supports 5G MBS) have been established or PDU Session Resources to support 5GC individual MBS traffic delivery have been prepared in the target NG-RAN for the UE.

Editor's note: Details on data forwarding in step 18, if applicable, needs to wait for RAN WGs.

21. T-AMF to SMF: The AMF invokes Nsmf\_PDUSession\_UpdateSMContext request towards SMF, the message includes the received N2 SM message.

Based on the received N2 SM message, the SMF can differentiate two cases:

Case A) The Target NG-RAN supports 5G MBS. Step 22 applies and steps 23~29 are skipped.

22. SMF to UPF (PSA): The SMF invokes N4 Session Modification procedure with the UPF (PSA) only for unicast PDU Session. The SMF instructs the UPF to send the end marker packet towards the source NG-RAN and to send subsequent packets towards the target NG-RAN within the unicast PDU Session.

Case B) The target NG-RAN does not support 5G MBS. If the UPF (PSA) is not yet configured to forward multicast data via unicast, steps 23 to 29 apply.

23. SMF to UPF: The SMF may invokes N4 Session Modification procedure with UPF (PSA), the SMF instructs the UPF (PSA) to forward the multicast data received from the MB-UPF via the mapped unicast QoS Flow(s) of the PDU Session within the unicast PDU(i.e., 5GC Individual MBS traffic delivery method will be used). The SMF provides the mapping information between the multicast QFI and the corresponding mapped unicast QFI to the UPF (PSA), the UPF (PSA) forwards the multicast data via the PDU session based on the mapping information. If the delivery tunnel for the MBS session from MB-SMF to UPF is not established yet, the SMF instructs the UPF (PSA) to allocate a tunnel endpoint for the reception of multicast data from the MB-UPF.

If delivery of the multicast data from MB-UPF to UPF needs to be configured, steps 24 to 27 apply.

24. SMF to MB-SMF: The SMF invokes a Nmbsmf\_Reception\_Request (MBS session ID, SMF ID, DL tunnel info) request service operation to MB-SMF to establish the shared tunnel between the UPF(PSA) and MB-UPF.

25. MB-SMF to MB-UPF: The MB-SMF configures the MB-UPF with the received DL tunnel Info and instructs the MB-UPF to forward data of the MBS session to the UPF (PSA) via the tunnel. The MB-UPF starts to forward data of the MBS session to the UPF (PSA).

26. MB-SMF to SMF: The MB-SMF responds to SMF through Nmbsmf\_Reception\_Request response. If multicast data are transported via multicast, the MB-SMF provides endpoint information (e.g. the Common-TEID) including the transport multicast address.

27. SMF to UPF (PSA): The SMF invokes an N4 Session Modification procedure with the UPF (PSA). If multicast data are transported via multicast, the SMF provides endpoint information including the transport multicast address to the UPF (PSA) and the UPF (PSA) sends IGMP Join in order to receive data from the MB-UPF.

28./29.

Editor's note: Details on data forwarding, if applicable, needs to wait for RAN WGs.

#### 7.2.3.4 Xn/N2 based handover from non-MBS supporting NG-RAN node

When the UE has joined the MBS session and the source NG-RAN node does not support 5MBS, the 5GC Individual MBS traffic delivery method is used for the MBS session data delivery. When the Xn/N2 based handover procedure is triggered, the UE is handed over to the target NG-RAN node per existing Xn /N2 based handover procedure defined in TS23.502 [6].

The following applies for an Xn handover from an NG-RAN node not supporting MBS to an NG-RAN node supporting MBS:

* The source NG-RAN node requests the mapped QoS Flow(s) in the associated unicast PDU session to be handed over to the target NG-RAN node.
* After successful handover the SMF triggers modification of the PDU Session resources at NG-RAN including transfer of the MBS related information in N2 SM Info, i.e. the SMF changes the MBS session data delivery method from 5GC Individual MBS traffic delivery method to 5GC shared MBS traffic delivery method, and stops the multicast traffic forwarding at the UPF.

The following applies for an N2 handover from an NG-RAN node not supporting MBS to an NG-RAN node supporting MBS:

* During handover preparation phase, the SMF includes the MBS related information in N2 SM Information and sends it to target NG-RAN. The target NG-RAN indicates its support of MBS to SMF by including the MBS session information in N2 SM information. The NG-RAN node adds the UE into the MBS session context.

- After successful handover, the SMF stops the multicast traffic forwarding at the UPF i.e. individual delivery.

#### 7.2.3.5 Minimization of data loss

Editor's note: Details for how to minimize data loss between the source NG-RAN node and the target NG-RAN node should be aligned with 3GPP RAN WGs.

### 7.2.4 Support of Local multicast service

#### 7.2.4.1 General

The procedures for Local multicast service contains the ones for Local multicast service with the location-dependent content, and the ones for limited local multicast service distribution, as described in clause 6.2.

#### 7.2.4.2 Support of local multicast service with location-dependent content

##### 7.2.4.2.1 UE join location dependent multicast session and establishment procedure

Editor's note: Detailed additions to Multicast context and Multicast flow setup/modification via PDU Session Modification procedure are FFS.

Editor's note: It is FFS whether to store information about the location areas in NRF or UDM and how to handle preconfigured sessions.

The local multicast session join and establishment procedure is performed as defined in clause 7.2.1 with the following additions:

- The local multicast session is configured as described in clause 7.2.4.2.2.

- If SMF has no information about the multicast session context for the indicated MBS Session ID and Area Session ID, the SMF requests MB-SMF information via Nnrf\_NFDiscovery request (MBS Session ID), the NRF provides information about the MB-SMF(s) serving the MBS service area(s), via Nnrf\_NFDiscovery response (MB-SMF ID, Area Session ID, MBS service area). The SMF selects the MB-SMF based on the location area where the UE is residing and interacts with MB-SMF to retrieve QoS information of the multicast QoS flow(s) for the MBS Session ID and Area Session ID.

- SMF requests the AMF to transfer an N2 message to the RAN node using the Nsmf\_PDUSession\_UpdateSMContext response, to provide the NG-RAN with multicast session information which additionally includes the Area Session ID and MBS service area.

- The RAN uses the received MBS Session ID and Area Session ID to determine the local multicast session context and whether the user plane for the local multicast session is already established.

Editor's note: Services mentioned in this clause needs to be updated to match the agreements on clause 9 and other clauses.

Editor’s note: For an NG-RAN, whether all MBS service areas or only MBS service area that the NG-RAN belongs to is sent to the NG-RAN is FFS.

##### 7.2.4.2.2 Configuration for local MBS

Editor's note: Further details of are FFS.

For local MBS, the configuration procedure for the UE is optional and performed as defined in clause 7.1.1.1 with the following additions:

- Multiple AFs may start the same multicast session with different content in different MBS service areas. The NEF selects MB-SMF as ingress control node(s) for different MBS service areas.

- If presented, the NEF maps possible external identifiers for MBS service areas to network-internal identifiers (e.g. list of cells, TAIs).

- MB-SMF allocates Area Session ID, and updates its NF profile towards the NRF with the MBS Session ID and Area Session ID.

NOTE: For a location dependent service provided in different MBS service areas within the same SMF service area, it is assumed that one MB-SMF is used for an MBS Session. If the MBS Session ID is TMGI, the MB-SMF updating NF profile can be skipped.

- The policy of Multicast session is determined based on the service requirements per MBS service area.

- The MB-SMF may select the MB-UPF based on the MBS service area.

- The MBS service area(s) are indicated to the UE in the Service Announcement as defined in clause 6.11.

##### 7.2.4.2.3 Handover procedure

Editor's note: Further details for Handover procedure are FFS.

The Handover procedure for the UE is performed as defined in clause 7.2.3 with the following additions:

- Before the Handover, The UE is camping at Source RAN and receiving multicast data corresponding to the MBS Session ID and Area Session ID.

- Source RAN includes MBS Session ID, Area Session ID and location area to the Target RAN.

- Target RAN determines whether to establish the forwarding resources and multicast distribution for MBS Session ID and Area Session ID provided by Source RAN, based on MBS Session ID, Area Session ID and location area. To determine the forwarding resources for location-dependent contents delivery, Target RAN may only check whether or not the location area ID is the same if Target RAN already established the session context of the multicast session ID.

- Target RAN responses to Source RAN, with the accepted MBS Session ID and Area Session ID. When Target RAN supports multicast but the UE is no longer in the location area, Target RAN rejects to handover the multicast session with a cause indication.

#### 7.2.4.3 Support of multicast service available within a limited area

##### 7.2.4.3.1 Local MBS service area information provided by AF

For local multicast services, the AF provides MBS service area information to the UE and the 5GC as specified in clause 7.1.1.1 with the following differences and clarifications:

- For the Service Announcement, the AF provides MBS service area information to the UE.

- In step 7, the MBS service area information for a multicast session is provided by the AF.

##### 7.2.4.3.2 MBS join and Session establishment procedure for multicast service available within a limited area

For the case that the multicast service is only available within a limited area, the UEs outside the MBS service area are not allowed to join the multicast service.

The MBS join and Session establishment for multicast service available within a limited area are performed as specified in clause 7.2.1.3 with the following differences and clarifications:

- The local multicast session has been configured where the AF provided the MBS service area information as specified in clause 7.2.4.3.1.

- The UE has information about local multicast service including MBS service area and local MBS service indication via Service Announcement as specified in clause 7.2.4.3.1.

- In step 1, if the UE determines that it is in the MBS service area based on the information about local multicast service obtained via Service Announcement, the UE sends the PDU Session Modification Request (MBS Session ID) as a Join Request to join the multicast group. If the UE determines that it is outside the MBS service area, the UE does not send the Join Request.

- In step 4, the SMF obtains the MBS service area (i.e. Cell ID list or TAI list) of the indicated MBS session from the MB-SMF.

- In step 5, the SMF checks whether the UE is inside or outside the MBS service area.

- If the SMF detects that the UE is inside the MBS service area, the SMF continues the process of multicast session join as specified in clause 7.2.1.3. The SMF sends the UE a PDU Session Modification Command indicating a Join Accept as a response to the Join Request. The Joint Accept includes the MBS service area (i.e. Cell ID list or TAI list).

The multicast session information sent by the SMF to the NG-RAN includes the MBS service area (i.e. Cell ID list or TAI list).

- If the SMF detects that the UE is outside the MBS service area, the SMF rejects the multicast session join, so sends a Join Reject to the UE indicating that the MBS join is rejected. The Joint Reject includes the reject reason (outside of local service area) and the MBS service area (i.e. Cell ID list or TAI list).

In this case, the MBS Session establishment (i.e. resources establishment for MBS traffic delivery) for the UE is not performed.

NOTE 1: There may be the case that the UE determines that it is inside the MBS service area based on the geographical area information or civic address information as MBS service area information provided by the AF, so sends a Join Request but the UE is outside the MBS service area.

NOTE 2: Which SM NAS message is used to deliver the Join Reject (e.g. PDU Session Modification Reject) is defined in stage 3 specifications.

- For the UE that received the Join Reject from the SMF, later, if the UE detects that it is inside the MBS service area based on the MBS service area provided in the Join Reject, the UE sends the PDU Session Modification Request (MBS Session ID) to join the multicast group.

##### 7.2.4.3.3 Handover procedure with limited area MBS session

The Handover procedure for the UE is performed as defined in clause 7.2.3 with the following additions:

* Before the Handover, the UE is camping at Source RAN and receiving multicast data corresponding to the MBS Session ID.
* For Xn based handover in clause 7.2.3.2, Source RAN includes MBS Session ID and MBS service area to the Target RAN during Handover preparation phase. For N2 based handover in clause 7.2.3.3, this step corresponds to Handover Request and Handover Required message, respectively.
* For Xn based handover in clause 7.2.3.2, target RAN responses to Source RAN, with the accepted MBS Session ID. When Target RAN supports 5MBS but the UE is no longer in the MBS service area, Target RAN does not allocate RAN resources for the MBS Session to the UE. For N2 based handover in clause 7.2.3.3, this step corresponds to Handover Request acknowledge message.
* For Xn handover, if the UE is handed over to a target cell outside the MBS service area, the SMF does not provide the MBS session related information in N2 SM Info to the target RAN.
* For N2 handover, if the UE is handed over to a target cell outside to the MBS service area, the SMF does not provide the MBS session related information in N2 SM Info to the target RAN.

### 7.2.5 MBS session activation and deactivation

#### 7.2.5.1 General

MBS Session activation procedure is for multicast only. MBS Session activation procedure is triggered by MB-SMF, when it receives the notification from MB-UPF for the downlink MBS DL data, or when it receives the request directly from AF or via NEF. The MBS Session activation procedure is used for activating the resources for MBS data at NG-RAN node. The multicast session state transits from inactive to active after MBS Session activation procedure, see clause 4.3.

MBS Session deactivation procedure is for multicast only. MBS Session deactivation procedure is triggered by MB-SMF, when it receives the notification from MB-UPF in the case of no downlink data to be transmitted, or when it receives the request directly from AF or via NEF. The MBS Session deactivation procedure is used for deactivating the resources for MBS data at NG-RAN node. The multicast session state transits from active to inactive after MBS Session deactivation procedure, see clause 4.3.

#### 7.2.5.2 MBS session activation procedure

The following can trigger the MBS session activation procedure:

* AF requests MB-SMF to activate the MBS session;
* MB-UPF receives the multicast data and notifies MB-SMF.

**UE**

**RAN**

**AMF**

**SMF**

**MB-SMF**

2. Session activation ()

1. MB-SMF triggers session activation

3. MBS\_Session\_Notification request ()

5. AMF pages idle mode UEs

6. Service request ()

7. MBS\_Session\_Notification response ()

8. Namf\_Communication\_N1N2MessageTransfer ()

9. N2 request (N2 SM)

11. Session Activation (TMGI)

12. NGAP activation message (TMGI)

10. Steps 7a to 7e and 9 to 12 as defined in clause 7.2.1.3

4. MBS\_Session\_Notification response ()

Figure 7.2.5.2-1: MBS session activation procedure.

Editor's Note: How to set up individual delivery resource (which was released at MBS Session Deactivation) is FFS.

Editor's Note: service operations of messages are FFS.

1. The procedure may be triggered by the following events:

* When MB-UPF receives downlink data for a MBS session, MB-UPF sends MB-N4 Notification (N4 Session ID) to the MB-SMF for activating the MBS session.
* AF sends MBS Activation request (TMGI) to the MB-SMF directly or via NEF.

1. MB-SMF sends Session activation notification (TMGI) to SMF(s).

Based on the received TMGI, SMF finds the list of UEs that joined the MBS session identified by the TMGI. If SMF determines the user plane of the associated PDU session(s) of the UE(s) with respect to TMGI are activated already, step 3-9 will be skipped for those UE.

1. SMF sends MBS\_Session\_Notification Request to AMF, with including (UE list, TMGI).

After receiving the request, for each UE in the list, the AMF determines CM state of the UE: see step 4 – 7.

1. [Optional] If the UE involved in the MBS Session is in CM-CONNECTED state, the AMF responds the list of the UE involved in the MBS Session and in CM-CONNECTED state, using MBS\_Session\_Notification Response (UE list). Step 5-6 will not be executed for that UEs in the list.
2. [Optional] If AMF determines that there are any UEs in CM-IDLE state and involved in the MBS Session, and AMF figures out the paging area considering all the UE(s), which need be paged. The AMF sends a paging request message to the NG-RAN node(s) belonging to this Paging Area with the TMGI as the identifier to be paged if the related NG-RAN node(s) support the MBS session.

NOTE 1: The details of the paging are specified by the RAN WGs.

1. The UE in IDLE state sends Service Request message to AMF, see clause 4.2.3 of TS 23.502 [6].
2. After receiving the Service Request sent by the UE, the AMF responds to MB-SMF with MBS\_Session\_Notification Response (UE ID) message.
3. After receiving MBS\_Session\_Notification Response message, SMF determines the related UE is in CM-Connected State and sends Namf\_Communication\_N1N2MessageTransfer (N2 SM message (MBS Session identifier, associated QoS profiles) to AMF for the UE which is identified in step 3.
4. AMF sends N2 request message (N2 SM message (MBS Session identifier, associated QoS profiles) to the RAN node.
5. If the shared tunnel has not been established before, the shared tunnel is established at this step, as steps 7a to 7e defined in clause 7.2.1.3. In addition, NG-RAN responses to SMF, as steps 9 to 12 defined in clause 7.2.1.3. The NG-RAN configures UE with RRC messages if needed.
6. MB-SMF sends Session Activation (TMGI) to the AMF.

NOTE 2: The messages in step 10 and 11 is MBS-specific messages and it is possible that the AMF(s) in step 10 are not associate to any UEs involved in the MBS Session.

1. AMF sends NGAP activation message (TMGI) to the RAN nodes.

Editor's Note: It is FFS that if messages 11, 12 are sent only to the NG-RAN nodes for which the MB-N3 is setup at step 10.

Editor's Note: Whether it is the AMF or the MB-SMF that stores RAN ID for the interaction with RAN in step 11 needs to align with clause 7.2.1.

#### 7.2.5.3 MBS session deactivation procedure

**UE**

**RAN**

**AMF**

**SMF**

**MB-SMF**

1. MB-SMF triggers session deactivation

3. MBS Session deactivation request (TMGI)

5. RAN node sets the MBS session state to inactive

6. NGAP deactivation response message ()

4. NGAP deactivation request message (TMGI)

7. MBS Session deactivation response ()

2. MBS Session deactivation request (TMGI)

Figure 7.2.5.3-1: MBS session deactivation procedure.

Editor's Note: service operation of messages are FFS.

1. The procedure may be triggered by the following events:

* When MB-UPF detects there is no data receives for the MBS Session, MB-UPF sends MB-N4 Notification (N4 Session ID) to the MB-SMF for deactivating the MBS session.
* AF sends MBS Deactivation request (TMGI) to the MB-SMF directly or via NEF.

2. The MB-SMF sends MBS Session deactivation request (TMGI) to the SMFs.

For 5GC Individual MBS traffic delivery, the SMFs trigger the removal of the unicast QoS flows at NG-RAN node, which is used for the transmission of MBS session identified by the TMGI.

Editor's Note: How SMFs release resources for 5GC Individual MBS traffic delivery is FFS.

Editor's Note: How to handle the tunnels between UPFs and MB-UPF is FFS.

3. The MB-SMF sends MBS Session deactivation Request (TMGI) to the AMFs.

4. The AMF sends NGAP deactivation request message (TMGI) to the RAN nodes.

Editor's Note: Whether it is the AMF or the MB-SMF that stores RAN ID for the interaction with RAN in step 3 needs to align with clause 7.2.1.

5. NG-RAN sets the MBS session state with respect to TMGI to inactive. In this procedure, the NG-RAN will not release the MBS session context, and MB-N3 tunnel for the MBS session.

Editor's Note: Whether the NG-RAN removes the MBS Session Context or mark it as inactive requires RAN collaboration.

6. NG-RAN acknowledges the NGAP deactivation Response message.

7. The AMF invokes MBS Session deactivation Response to acknowledge the service for MB-SMF.

### 7.2.6 Multicast session update procedure

Multicast session update procedure is invoked by the AF to update the ARP for an ongoing multicast session. For the interaction between AF and MB-SMF, see clause 7.1.1.5 and 7.1.1.6.

**RAN**

**AMF**

**SMF**

**MB-SMF**

2. MBS Session update Request ()

3. NGAP Session update Request ()

7. Session update Request (TMGI)

5. NGAP Session update Response

6. MBS Session update Response

**UE**

8. PDU Session Modification procedure defined in TS 23.502

4. RAN updates MBS parameters.

1. MB-SMF triggers session update

Figure 7.2.6-1: Multicast session update procedure.

Editor's Note: names of messages are FFS.

1. This procedure is triggered by the MB-SMF receiving the updated policy for MBS, see clause 7.1.1.5 and 7.1.1.6.

2. The MB-SMF generates the QoS profile for the multicast, and sends MBS Session update Request (N2 SM message (TMGI, QoS profiles for multicast)) to the AMF(s).

3. The involved AMF forwards the N2 SM information received from MB-SMF to the RAN nodes via NGAP Session update Request (N2 SM message (TMGI, QoS profiles for multicast)) message.

Editor's Note: Whether it is the AMF or the MB-SMF that stores RAN ID for the interaction with RAN in step 3 needs to align with clause 7.2.1.

4. NG-RAN updates the MBS session context, and if only the ARP of QoS parameters is updated, NG-RAN node also updates the QoS parameters of the associating PDU Sessions.

Editor's Note: Updating the associated PDU Session’s QoS based on the update of MBS Session QoS by NG-RAN requires RAN WGs collaboration.

5. The NG-RAN acknowledges NGAP Session update Request by sending an NGAP Session update Response message to the AMF.

6. The AMF sends MBS Session update Response to the MB-SMF.

7. MB-SMF sends Session update Request (TMGI, QoS profiles for multicast) to SMF.

8. SMF determines the UE list regarding the TMGI included in the message. If the QoS parameters other than ARP needs to be updated, SMF triggers PDU Session Modification procedure for each UE as defined in TS 23.502 [6].

## 7.3 MBS procedures for broadcast Session

Editor's note: The content needs to be revisited.

Editor's note: The interactions between the MBSF, the MBSTF and the AF for file delivery and HTTP adaptive streaming requires input from SA4, which are FFS.

### 7.3.1 MBS Session Start for Broadcast

The Broadcast Session Start follows the common procedure specified in clause 7.1.1.1, which consist of TMGI Allocation and MBS Session Start. It is possible for AF to allocate TMGI once but start MBS Session for multiple times. A combined procedure to perform both TMGI allocation and MBS Session activation may be available.

The TMGI Allocation is used by AF to obtain the TMGI as MBS Session ID (i.e. TMGI) and perform service announcement towards UEs.

The MBS Session Start (with service type set to broadcast service) is used by the AF to start an broadcast session and start transmission of MBS data, so that resources for the MBS Session are set up in the MB-UPF and in the NG-RAN for shared MBS delivery. The MBS Session Start can be used if TMGI has not been allocated. In this case, MB-SMF will allocate a unique TMGI for the AF and then activate the MBS Session.

NOTE 1: When the multicast transport between NG-RAN and MB-UPF is described below, source specific multicasting is assumed. That is, the parameter "LL MC address" is assumed to be accompanied by a "Source host address" parameter in the descriptions below.

To receive the data of broadcast communication service, the UE is either preconfigured with needed configuration (e.g. USD) for the UE to receive MBS service, or provisioned with the configuration of broadcast session on application level (service announcement; the configuration may for instance be performed using SIP signalling, or methods described in TS 26.346 [13]). If the needed configuration is pre-configured, the UE does not need to interact with network.



Figure 7.3.1-1: MBS Session Establishment for Broadcast

Editor's note: The services and messages used in this procedure are FFS.

1. To establish broadcast session, the AF performs TMGI allocation and MBS session start as specified in clause 7.1.1.1. The AF needs to set the service type to be broadcast service. The NEF/MBSF may translate the broadcast area information to MBS service area, which includes cell IDs, TAI list, or RAN node IDs.

2. The MB-SMF may use NRF to discover the AMF(s) based on the MBS service area and select the appropriate one(s). Then the MB-SMF sends the MBS Session Resource Setup Request (TMGI, LL MC Address and source host address, 5G Authorized QoS Profile, MBS service area) messages to the selected AMF(s) in parallel if the service type is broadcast service.

3. The AMF transfers the MBS Session Resource Setup Request (TMGI, LL MC and source host address, 5G Authorized QoS Profile) message to all NG-RANs which support MBS in the MBS service area. The AMF may include the MBS service area.

4. NG-RAN creates an MBS Broadcast Session Context, stores the TMGI, the QoS Profile in the MBS Session Context. The LL MC Address and Source Host Address are optional parameters and only provided by MB-SMF to NG-RAN if N3mb multicast transport is configured to be used in the 5GC.

5. If NG-RAN prefers to use N3mb multicast transport (and if LL MC Address is available in NG-RAN), the NG-RAN joins the multicast group (i.e. LL MC Address).

If NG-RAN prefers to use N3mb point-to-point transport (or if the LL MC Address is not available in NG-RAN) between the NG-RAN and MB-UPF, NG-RAN provides its N3mb DL Tunnel Info.

6. The NG-RAN reports successful establishment of the MBS Session resources (which may include multiple MBS QoS Flows) by sending MBS Session Resource Setup Response (TMGI, N3mb DL Tunnel Info) message(s) to the AMF. N3mb DL Tunnel Info is only available when point-to-point transport applies between MB-UPF and NG-RAN.

Editor´s note: How to set up shared delivery potentially using commonalities with multicast signalling is FFS

7. The AMF transfers the MBS Session Start Response (TMGI, N3mb DL Tunnel Info) to the MB-SMF. The AMF should respond success when it receives the first success response form the NG-RAN(s). And if all NG-RAN(s) report failure, the AMF should respond failure. The MB-SMF store the AMF(s) which respond success.

8. If N3mb point-to-point transport is to be used (i.e. N3mb DL Tunnel Info is present in the MBS Session Start Response message from AMF), the MB-SMF sends a N4 Session Modification Request to the MB-UPF to allocate the N3mb point-to-point transport tunnel for a replicated MBS stream for the MBS Session. Otherwise, step 8 can be skipped.

9. NG-RAN advertises the TMGI representing the MBS service over radio interface. Step 9 can take place in parallel with step 6.

10. The AF starts transmitting the DL media stream to MB-UPF using the N6mb Tunnel, or optionally un-tunnelled i.e. as an IP multicast stream using the HL MC address.

11. The MB-UPF transmits the media stream to NG-RAN via N3mb multicast transport or point-to-point transport.

12. The NG-RAN transmits the received DL media stream using DL PTM resources.

### 7.3.2 MBS Session Release for Broadcast

The MBS Session Release for broadcast removal of MBS Session Configuration (e.g. TMGI De-allocation and MBS Session Stop) so that resource for shared MBS delivery is released. It is possible for AF to stop MBS Session but keep TMGI allocated.

The MBS Session Stop procedure is used to stop media delivery for an MBS session i.e. to all UEs in a group defined by a TMGI. The MBS session may start later again. The resources in the NG-RAN and 5GC are however released and the MBS Session Contexts in 5GC and NG-RAN are deleted.

The TMGI De-allocation procedure is used to release removal of MBS Session Configuration for AF. The TMGI De-allocation procedure can be used no matter whether the MBS Session has stopped or not. If the MBS Session has not been stopped yet, the MBS session will be stopped prior to the TMGI de-allocation.



Figure 7.3.2-1: MBS Session Release for Broadcast

Editor’s Note: The exact message names to be used are FFS.

1. The AF/AS may stop the media stream before sending the MBS Session Release Request (TMGI) message to the 3GPP network.

2. The AF/AS performs MBS Session Stop procedure to request release of MBS Session (step 1 ~10 in the figure 7.1.1.2-1).

3. MB-SMF sends an MBS Session Stop Request (TMGI) message to the AMF(s) that has been involved in the MBS Session.

4. The AMF sends an MBS Session Resource Release Request (TMGI) message to all RAN nodes that have been involved. If a NG-RAN node receives multiple MBS Session Resource Release Request messages for the same TMGI (e.g. from several AMFs the NG-RAN is connected to), NG-RAN only performs step 5 and step 6 once.

5. The NG-RAN stops the PTM transmission.

6. If N3mb multicast transport has been used, the NG-RAN sends a Leave message (LL MC Address) to stop the media stream to this NG-RAN node. If N3mb point-to-point transport has been used, the NG-RAN release its N3mb Tunnel Info. NG-RAN deletes its MBS Session Context.

7. The NG-RAN reports successful release of resources for the MBS Session by sending MBS Session Resource Release Response (TMGI) message(s) to the AMF(s).

8. The AMF sends MBS Session Stop Response (TMGI) to the MB-SMF.

9. The AF may start a TMGI de-allocation procedure (step 11~14 in the figure 7.1.1.2-1).

### 7.3.3 MBS Session Update for Broadcast

The MBS Session Update for broadcast is used by the AF to update the broadcast area or service requirements of the MBS Session which may lead to addition of new MBS QoS Flow(s), removal of existing MBS QoS Flow(s) or update of existing MBS QoS Flow(s).

Editor's note: The services and messages used in this procedure are FFS.



Figure 7.3.3-1: MBS Session Update for Broadcast

1. The AF starts MBS session update procedure by sending Modify MBS Session Request to the NEF/MBSF with TMGI (step 1~7 in the figure 7.1.1-3). The AF may adjust service requirement and/or broadcast area. The service requirements adjustment may lead to addition of new MBS QoS Flow(s), removal of existing MBS QoS Flow(s) or update of existing MBS QoS Flow(s).

Editor´s note: There are dependence on S2-2104190/S2-2104309 which introduce the MBS session update procedure in clause 7.1.1

2. The MB-SMF sends MBS Session Resource Update to the AMFs with TMGI, the updated 5G QoS Profile and the updated MBS service area. If the broadcast area is updated, the MB-SMF may use NRF to discover the AMF(s) based on the new broadcast area and select the appropriate one(s).

Depending on the change of the MBS service area, the MB-SMF may send MBS Session Start to some AMFs in the new MBS service area and MBS Session Stop to some other AMFs in the old MBS service area.

3. The AMF sends MBS Session Resource Update to NG-RANs with TMGI, the updated 5G QoS Profile and the updated MBS service area.

Depending on the change of the MBS service area, the AMF may send MBS Session Resource Setup to some NG-RANs in new MBS service area and MBS Session Resource Release to some other NG-RANs in old MBS service area.

4. The NG-RAN updates MBS Session Context.

5. The NG-RAN sends MBS Session Resource Update Response to the AMF.

6. The AMF sends MBS Session Resource Update Response to the MB-SMF.

7. The NG-RAN updates the MBS Session. It takes place in parallel with step 5 to step 6.

### 7.3.4 Support for Local Broadcast Service and Location-dependent Broadcast Service

Local broadcast service and location-dependent broadcast service are described in clause 6.2. For broadcast sessions, MBS service area is always required.

### 7.3.5 MBS Session Delivery Status Indication for Broadcast

The MBS Session Delivery Status Indication for broadcast is used by the MB-SMF to notify the AF/AS of conditions affecting the delivery of the MBS session (e.g. MBS session activated, MBS session terminated, etc.). The occurrence of the indicated condition may have been detected at the MB-SMF or may have been reported to the MB-SMF by other entities involved in the MBS session delivery.



Figure 7.3.5-1: MBS Session Delivery Status Indication for Broadcast

1. The external AF subscribes event for delivery status towards the NEF, and the NEF subscribes corresponding event towards the MB-SMF (step 1a), or the legacy AS request status report towards the MBSF, and the MBSF subscribes event for delivery status towards the MB-SMF(step 1b), or the internal AF subscribes event for delivery status towards the MB-SMF(step 1c).

2. The MB-SMF notifies the TMGI and the event towards the NEF, and the NEF notifies the TMGI and corresponding event towards the external AF (step 2a), or the MB-SMF notifies the TMGI and the event towards the MBSF, and the MBSF sends Delivery Status Indication to legacy AS with the TMGI and the corresponding event (step 2b), or the MB-SMF notifies the TMGI and the event towards the internal AF (step 2c).

Editor's note: Whether more events are needed in the delivery status notification are FFS.

## 7.4 MBS procedures for inter System Mobility

# 8 Control and user plane stacks

## 8.1 Control plane for Multicast and Broadcast services

The control plane protocol stacks for Multicast and Broadcast service are same with the control plane stack defined in the 23.501 [5] clause 8.2.

## 8.2 User plane for Multicast and Broadcast services

The User plane protocol stack for PDU session which handles the multicast operation is same with the PDU session user plane Protocol Stack defined in the 23.501 [5] clause 8.3.1.

Application

IP (multicast)/UDP

5G-AN Protocol Layers

UE

NG-RAN

MB-UPF

5G-AN Protocol Layers

Relay

GTP-U

UDP/IP

L2

L1

GTP-U

UDP/IP

L2

L1

N3mb

N6mb

Figure 8.2-1: User Plane Protocol Stack for MBS session

The figure 8.2-1 is the user plane protocol stack for the MBS session.

- **5G-AN Protocol Layers**: This set of protocols/layers depends on the AN:

- in this release, the 5G-AN is a 3GPP NR, these protocols/layers are defined in TS 38.401. The radio protocol between the UE and the 5G-AN node (gNodeB) is specified in TS 38.300 [9].

Editor's Note: The User Plane Protocol Stack with MBSTF involved is FFS.

# 9 Network Function Services

Editor's note: The NF and associating services are FFS.

## 9.1 MB-SMF Services

### 9.1.1 General

The following table illustrates the MB-SMF Services for MBS.

**Table 9.1.1-1: NF services provided by MB-SMF**

|  |  |  |  |
| --- | --- | --- | --- |
| **Service Name** | **Service Operations** | **Operation**  **Semantics** | **Example Consumer (s)** |
| Nmbsmf\_TMGI | Request | Request/Response | NEF, MBSF, AF |
| Release | Request/Response | NEF, MBSF, AF |
| Nmbsmf\_Reception | Request | Request/Response | AMF, SMF |
| Release | Request/Response | AMF, SMF |
| Nmbsmf\_Information | Request | Request/Response | SMF |
| Notify | Subscribe/Notify | SMF |
| Subscribe |  | SMF |
| Unsubscribe |  | SMF |
| Nmbsmf\_MBSSession | Create | Request/Response | MBSF, NEF, AF |
| Update | Request/Response | MBSF, NEF, AF |
| Release | Request/Response | MBSF, NEF, AF |

### 9.1.2 Nmbsmf\_TMGI service

Editor’s Note: Whether TMGI allocation/deallocation can be combined with Nmbsmf\_MBSSession service is FFS.

#### 9.1.2.1 General

**Service description:** NF Service Consumer can use this service to request the allocation of TMGIs and release allocated TMGIs.

Editor's note: Parameters of the service operations are FFS.

#### 9.1.2.2 Nmbsmf\_TMGI\_Request service operation

**Service operation name:** Nmbsmf\_ TMGI\_Request.

**Description:** NF Service Consumer can use this service to request the allocation of TMGIs.

**Inputs, Required:** Number of TMGIs

**Inputs, Optional:** None

**Outputs, Required:** TMGIs, Expiry Time

**Outputs, Optional:** None.

#### 9.1.2.3 Nmbsmf\_TMGI\_Release service operation

**Service operation name:** Nmbsmf\_TMGI\_Release.

**Description:** NF Service Consumer can use this service to request the release of TMGIs.

**Inputs, Required:** TMGIs

**Inputs, Optional:** FFS.

**Outputs, Required:** Success or not.

**Outputs, Optional:** None.

### 9.1.3 Nmbsmf\_Reception service

#### 9.1.3.1 General

**Service description:** NF Service Consumer can use this service to request the reception of MBS data or to to terminate the reception of MBS data.

Editor's note: Parameters of the service operations are FFS.

#### 9.1.3.2 Nmbsmf\_Reception\_Request service operation

**Service operation name:** Nmbsmf\_Reception\_Request.

**Description:** NF Service Consumer can use this service to request the reception of data of a multicast session

**Inputs, Required:** Multicast Session ID, if consumer is AMF: AMF ID and RAN node ID, if consumer is SMF: SMF ID

**Inputs, Optional:** Area Session ID, Unicast GTP Tunnel ID

**Outputs, Required:** Success or not

**Outputs, Optional:** Multicast GTP Tunnel ID

#### 9.1.3.3 Nmbsmf\_Reception\_Release service operation

**Service operation name:** Nmbsmf\_Reception\_Release.

**Description:** NF Service Consumer can use this service to request the termination of MBS data transmission

**Inputs, Required:** Multicast Session ID, if consumer is AMF: AMF ID and RAN node ID, if consumer is SMF: SMF ID.

**Inputs, Optional:** Area Session ID

**Outputs, Required:** Success or not

**Outputs, Optional:** None.

### 9.1.4 Nmbsmf\_Information service

Editor’s Note: Whether this service can be combined with Reception service is FFS

#### 9.1.4.1 General

**Service description:** NF Service Consumer can use this service to request or subscribe information about an MBS session.

The following are the key functionalities of this NF service:

- Allow consumer NFs to request for information (e.g. QoS information) of MBS Session(s);

- Allow consumer NFs to subscribe and unsubscribe for an Event ID on MBS Session(s); and

- Notifying events on the MBS Session to the subscribed NFs.

The following events can be subscribed by a consumer NF:

- QoS flow change: The event notification is sent when QoS flows within an MBS session change, e.g. adding/removing QoS flow(s).

- MBS Session status (activated, deactivated).

- MBS Session establishment and/or MBS Session release.

Editor's note: Parameters of the service operations are FFS.

#### 9.1.4.2 Nmbsmf\_Information\_Request service operation

**Service operation name:** Nmbsmf\_Information\_Request.

**Description:** Service Consumer NF can use this service to request information (e.g. QoS information) for an multicast session.

**Inputs, Required:** Multicast Session ID.

**Inputs, Optional:** Area Session ID.

**Outputs, Required:** QoS information for multicast session.

**Outputs, Optional:** None.

#### 9.1.4.3 Nmbsmf\_Information\_Notify service operation

**Service operation name:** Nmbsmf\_Information\_Notify

**Description:** Provided by the MB-SMF to notify NF consumers of the subscribed events.

**Inputs, Required:** Event ID, Notification Correlation Information.

**Inputs, Optional:** Event information.

**Outputs, Required:** Operation execution result indication.

**Outputs, Optional:** None.

#### 9.1.4.4 Nmbsmf\_Information\_Subscribe service operation

**Service operation name:** Nmbsmf\_Information\_Subscribe.

**Description:** Service Consumer NF subscribes to or modifies a subscription to notification of events about an multicast session.

**Inputs, Required:** Multicast Session ID, Event ID.

**Inputs, Optional:** Area Session ID, Subscription Correlation ID (in the case of modification of the event subscription).

**Outputs, Required:** When the subscription is accepted: Subscription Correlation ID.

**Outputs, Optional:** None

#### 9.1.4.5 Nmbsmf\_Information\_Unsubscribe service operation

**Service operation name:** Nmbsmf\_Information\_Unsubscribe

**Description:** Used by the consumer NF to explicitly unsubscribe to the notification of events about the multicast session.

**Inputs, Required:** Subscription Correlation ID.

**Inputs, Optional:** None.

**Outputs, Required:** Operation execution result indication.

**Outputs, Optional:** None*.*

### 9.1.5 Nmbsmf\_MBSSession Service

#### 9.1.5.1 General

**Service description:** This service operates on the multicast and broadcast sessions. The following are the key functionalities of this NF service:

- (between MBSF/NEF and MB-SMF) Create/Modification/Activation/Deactivation/Release of multicast sessions;

- (between MBSF/NEF and MB-SMF) Create/Modification/Start/Stop/Release of broadcast sessions;

Editor's note: Parameters of the service operations are FFS.

Editor´s note: Subscription for MBS Session Status and related notifications are ffs (and depend on the definition of related events).

#### 9.1.5.2 Nmbsmf\_MBSSession\_Create service operation

**Service operation name:** Nmbsmf\_MBSession\_Create.

**Description:** Create a new multicast session or broadcast session during MBS session configuration.

**Input, Required:** MBS Session ID (source specific multicast address or TMGI) or TMGI request

**Input, Optional:** DNN, S-NSSAI, , MBS service area, MBS activation time, MBS termination time, service description, , QoS flow information, Input Transport Address Request, session activity status (active/inactive).

**Output, Required:** Result Indication.

**Output, Optional:** TMGI, Cause, MB-UPF tunnel info.

#### 9.1.5.3 Nmbsmf\_MBSSession\_Update service operation

**Service operation name:** Nmbsmf\_MBSession\_Update.

**Description:** Update the established multicast session or broadcast session, e.g. QoS update.

**Input, Required:** MBS Session ID.

**Input, Optional:** QoS flow information, MBS service area, session activity status (active/inactive).

**Output, Required:** Result Indication.

**Output, Optional:** Cause.

#### 9.1.5.4 Nmbsmf\_MBSSession\_Release service operation

**Service operation name:** Nmbsmf\_MBSession\_Release.

**Description:** Release the multicast session or broadcast session.

**Input, Required:** MBS Session ID.

**Input, Optional:** None.

**Output, Required:** Result Indication.

**Output, Optional:** Cause.

## 9.2 PCF Services

### 9.2.1 General

The following table illustrates the PCF Services for MBS.

**Table 9.2.1-1: NF services provided by PCF for MBS**

|  |  |  |  |
| --- | --- | --- | --- |
| **Service Name** | **Service Operations** | **Operation**  **Semantics** | **Example Consumer (s)** |
| Npcf\_MBSPolicyControl | Create | Request/Response | MB-SMF |
| UpdateNotify | Subscribe/Notify | MB-SMF |
| Delete | Request/Response | MB-SMF |
| Npcf\_MBSPolicy Authorization | Create | Request/Response | AF, NEF, MBSF |
| Update | Request/Response | AF, NEF, MBSF |
| Delete | Request/Response | AF, NEF |

### 9.2.2 Npcf\_MBSPolicyControl service

#### 9.2.2.1 General

**Service description:** NF Service Consumer, e.g. MB-SMF can create and manage a MBS Policy Association in the PCF through which the NF Service Consumer receives policy information for a MBS Session.

As part of this service, the PCF may provide the NF Service Consumer, e.g. MB-SMF with policy information about the MBS Session that may contain:

- MBS Session related policy information.

- PCC rule information.

- Policy Control Request Trigger information. When a Policy Control Request Trigger condition is met the NF Service Consumer, e.g. MB\_SMF shall contact the PCF and provide information on the Policy Control Request Trigger condition that has been met.

Editor's note: Details of MBS Session related policy information, PCC rule information, and Policy Control Request Trigger information need to be defined in an appropriate location of the TS and referenced.

At MBS Session establishment the NF Service Consumer, e.g. MB-SMF requests the creation of a corresponding MBS Policy Association with the PCF (Npcf\_MBSSMPolicyControl\_Create) and provides relevant parameters about the MBS Session to the PCF.

- When the PCF has created the "MBS Policy Association", the PCF may provide policy information as defined above.

When a Policy Control Request Trigger condition is met the NF Service Consumer, e.g. MB-SMF requests the update (Npcf\_MBSPolicyControl\_Update) of the MBS Policy Association by providing information on the condition(s) that have been met. The PCF may provide updated policy information to the NF Service Consumer.

The PCF may at any time provide updated policy information (Npcf\_MBSPolicyControl\_UpdateNotify).

At MBS Session Release the NF Service Consumer, e.g. MB\_SMF requests the deletion of the corresponding MBS Policy Association.

Editor's note: Parameters of the service operations are FFS.

#### 9.2.2.2 Npcf\_MBSPolicyControl\_Create service operation

**Service operation name:** Npcf\_MBSPolicyControl\_Create.

**Description:** The NF Service Consumer can request the creation of a MBS Policy Association and provide relevant parameters about the MBS Session to the PCF.

**Inputs, Required:** MBS session ID, DNN, S-NSSAI.

**Inputs, Optional:** None.

**Outputs, Required:** Success or Failure. For Success MBS Policy Association ID.

**Outputs, Optional:** Policy information for the MBS.

#### 9.2.2.3 Npcf\_MBSPolicyControl\_UpdateNotify service operation

**Service operation name:** Npcf\_MBSPolicyControl\_UpdateNotify

**Description:** Provides to the NF Service Consumer, e.g. MB-SMF updated Policy information for the MBS Session.

**Inputs, Required:** MBS Policy Association ID.

**Inputs, Optional:** Policy information for the MBS Session.

**Outputs, Required:** Success or Failure.

**Outputs, Optional:** None.

#### 9.2.2.4 Npcf\_MBSPolicyControl\_Delete service operation

Editor's note: whether this service operation is needed or not is FFS.

**Service operation name:** Npcf\_MBSPolicyControl\_Delete

**Description:** The NF Service Consumer can request the deletion of the MBS Policy Association and of the associated resources.

**Inputs, Required:** MBS Policy Association ID.

**Inputs, Optional: None**.

**Outputs, Required:** Success or Failure.

**Outputs, Optional:** None.

### 9.2.3 Npcf\_MBSPolicyAuthorization Service

#### 9.2.3.1 General

**Service description:** This service is to authorise an AF / NEF / MBSF request for an MBS service and to create policies as requested by the authorized AF for the MBS Service. This service also allows the NF consumer to subscribe/unsubscribe the notification of events.

Editor's note: The Notify, Subscribe and Unsubscribe service operations and related events are FFS.

Editor's note: The parameters of the service operations are FFS.

#### 9.2.3.2 Npcf\_MBSPolicyAuthorization\_Create service operation

**Service operation name:** Npcf\_MBSPolicyAuthorization\_Create

**Description:** Authorize the request, and optionally determines and installs MBS Policy Control Data according to the information provided by the NF Consumer.

**Inputs, Required:** MBS session ID, identification of the application session context.

**Inputs, Optional:** DNN if available, S-NSSAI if available, Media type, Media format, bandwidth requirements, flow description, Application Identifier, AF Communication Service Identifier, Flow status, Priority indicator, emergency indicator Application service provider.

**Outputs, Required:** Success(application session context) or Failure (reason for failure).

**Outputs, Optional:** The service information that can be accepted by the PCF.

#### 9.2.3.3 Npcf\_MBSPolicyAuthorization\_Update service operation

**Service operation name:** Npcf\_MBSPolicyAuthorization\_Update

**Description:** Provides updated information to the PCF.

**Inputs, Required:** Identification of the application session context.

**Inputs, Optional:** Media type, Media format, bandwidth requirements, flow description, Application Identifier, AF Communication Service Identifier, Flow status, Priority indicator, Application service provider.

**Outputs, Required:** Success or Failure (reason for failure).

**Outputs, Optional:** The service information that can be accepted by the PCF.

Provides updated application level information and communicates with Npcf\_MBSPolicyControl service to determine and install the policy according to the information provided by the NF Consumer. Updates an application context in the PCF.

#### 9.2.3.4 Npcf\_MBSPolicyAuthorization\_Delete service operation

**Service operation name:** Npcf\_MBSPolicyAuthorization\_Delete

**Description:** Provides means for the NF Consumer to delete the context of application level session information.

**Inputs, Required:** Identification of the application session context.

**Inputs, Optional:** None.

**Outputs, Required:** None.

**Outputs, Optional:** None.

Annex A (normative):  
Configuration options at Service and/or Application for MBS

Figure A-1 provides the reference architecture with all configuration variants for Application Function interaction with 5G Core Network, usage of NEF or MBSF in the control plane, and usage of N6, MB2-U or xMB-U in user plane.

Transport

**Configuration 1:**

**No MBSF**

**Configuration 2:**

**With MBSF**

**N33 towards AF**

**Configuration 3:**

**With MBSF**

**MB2-C/xMB-C/Nmb10 towards AF**

AF/AS

NEF

N33

N6mb

N30

N29mb

Nmb2

Nmb5

Transport

AF/AS

NEF

N33

Nmb8/xMB-U/MB2-U

Nmb12

Nmb1

MBSTF

MBSF

Nmb9

Collocated NEF/

MBSF-C

Nmb2

Transport

AF/AS

Nmb8/xMB-U/MB2-U

Nmb12

Nmb1

MBSTF

MBSF

Nmb9

Nmb10/xMB-C/MB2-C

Figure A-1: Configuration options at Service and/or Application

The following characteristics describe each of the Configuration options:

- Configuration Option 1: No MBSF:

- This configuration is used for Transport Only Mode, when the Multicast service or Broadcast service does not require service layer interworking with LTE MBMS.

- The control plane entry point for the Application Function outside the trusted domain towards 5GC to request establishment of an MBS session is the NEF via N33.

- An application function within the trusted domain can directly use the N30 and N29mb service based interfaces. In this case some NEF functionality related to PCF and MB-SMF interaction is incorporated in AF.

NOTE 1: Application function within the trusted domain selects MB-SMF based on e.g. its local configuration, or query NRF based on location, etc.

- The user plane entry point for the Application Function towards 5GC is the MB-UPF via N6.

- Configuration Option 2: MBSF, N33 towards AF:

- This configuration may be used for Service Mode, or when interworking with LTE MBMS is required.

- The control plane entry point from the Application Function to request establishment of an MBS session is the NEF via N33.

- The user plane entry point for the Application Function towards 5GC is the MBSTF via MB2-U, xMB-U or Nmb8.

- The NEF and MBSF may be collocated.

- If the MBSF is not collocated with the NEF, the reference point between the NEF and MBSF is Nmb5.

- An application function within the trusted domain may be collocated with MBSF.

- Configuration Option 3: MBSF, MB2-C/xMB-C/Nmb10 towards AF:

- This configuration may be used for Service Mode (xMB-C or Nmb10), or when interworking with LTE MBMS is required (MB2-C or xMB-C).

- The control plane entry point from the Application Function to request establishment of an MBS session is the MBSF via MB2-C, xMB-C or Nmb10.

- The user plane entry point for the Application Function is the MBSTF via MB2-U, xMB-U or Nmb8.

For service mode, MBSF shall be used, i.e. either Configuration 2 or Configuration 3 shall be used. The MBSF may decide to service/transport layer changes on the MBS data (e.g. including the FEC or MBS data transcoding).

For Transport Only mode:

- If interworking with LTE MBMS at 5GC is required for the service, MBSF and MBSTF shall be used, i.e. either Configuration 2 or Configuration 3 shall be used.

NOTE 2: Interworking providing by AF is out of scope of this specification.

- If interworking with LTE MBMS is not required for the service, MBSF and MBSTF are optional.

MBSTF shall be used when MBSF is used.

Any particular deployment may support any combination of these configurations.

Annex B (informative):  
Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2021-03 | SA2#143E | S2-2101423 | - | - | - | TS skeleton approved at S2#143E | 0.0.0 |
| 2021-03 | SA2#143E |  |  |  |  | Inclusion of documents agreed in SA2#143E:  S2-2101424, S2-2101425, S2-2101426, S2-2101427, S2-2101113, S2-2101428, S2-2100381, S2-2101429, S2-2101430, S2-2101118, S2-2101431, S2-2101432, S2-2101433, S2-2101114, S2-2101120, S2-2101434, S2-2101435, S2-2101115 | 0.1.0 |
| 2021-04 | SA2#144E |  |  |  |  | Inclusion of documents agreed in SA2#144E:  S2-2103526, S2-2103527, S2-2103071, S2-2103529, S2-2103530, S2-2103531, S2-2103556, S2-2103532, S2-2103533, S2-2103557, S2-2103534, S2-2103535, S2-2103072, S2-2103538, S2-2103539, S2-2103540, S2-2103541, S2-2103073, S2-2103543, S2-2103544, S2-2102339, S2-2102388, S2-2103545, S2-2103546, S2-2103547, S2-2103548, S2-2102729, S2-2102730 | 0.2.0 |
| 2021-05 | SA2#145E |  |  |  |  | Inclusion of documents agreed in SA2#145E:  S2-2104200, S2-2104966, S2-2104967, S2-2104968, S2-2104969, S2-2104970, S2-2103949, S2-2105176, S2-2104971, S2-2104972, S2-2104973, S2-2104057, S2-2105212, S2-2104974, S2-2104975, S2-2104976, S2-2104977, S2-2104978, S2-2104179, S2-2104979, S2-2104980, S2-2104981, S2-2104982, S2-2104983, S2-2104984, S2-2104985, S2-2105191, S2-2104986, S2-2104987, S2-2104988, S2-2104989, S2-2104990, S2-2104991, S2-2104992, S2-2104993, S2-2105162, S2-2103955, S2-2105192, S2-2105163, S2-2105193, S2-2105164, S2-2105165, S2-2104426, S2-2105166, S2-2105167, S2-2105168, S2-2105169, S2-2105170, S2-2105171 | 0.3.0 |