3GPP TSG-WG SA2 Meeting #147E e-meeting S2-2107546r01

Elbonia, October 18 – 22, 2021 (Revision of )

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **23.247** | **CR** | **0026** | **rev** | **-** | **Current version:** | **17.0.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network | **x** | Core Network | **x** |

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| ***Title:*** | Micellaneous corrections | | | | | | | | | |
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| ***Source to WG:*** | Huawei, HiSilicon, Ericsson, ZTE, Tencent, CATT, vivo | | | | | | | | | |
| ***Source to TSG:*** | SA2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | 5MBS | | | | |  | ***Date:*** | | | 2021-10-07 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | F |  | | | | | ***Release:*** | | | Rel-17 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | This document contains several corrections for current specification:   1. Remove TR 23.757 in the reference clause. 2. Term alignment: e.g., we use "5GC shared MBS traffic delivery" for some places, but in the other parts, "5GC Shared MBS traffic delivery" are also used, it is proposed to use "5GC Shared MBS traffic delivery" in this TS. For "5GC Individual MBS traffic delivery" and "5GC individual MBS traffic delivery", it is proposed to use the same paradigm. 3. MBS support: in this spec, we have several ways to denote "supporting MBS", e.g., "…not support MBS", "not supporting 5MBS", "… supports 5G MBS", although they are not technically incorrect, it is proposed to align those terms. Considering the number of the usage, the authors have a slight preference on "MBS". Note that for some cases, e.g., IWK for comparing eMBMS and 5MBS, keeping 5MBS would be acceptable. 4. Broadcast service timeline in 4.2.2: The last part, “data volume received by the UEs” is supposed to be modified, since for broadcast service, it is more worthwhile to specify that the data volume broadcasted in the air interface is free of the number of actual receiver. As such, it is proposed to replace the original wording with "data volume received by any UEs" to avoid confusion and modify the green box along the same line. 5. EN vs. Note: we mention somewhere in the spec that some aspects relies on the conclusion of other WGs, and use EN/NOTE to record those. However, using NOTE is not proper and it is suggest to replace them with EN. 6. (void) 7. Functionalities of MBSF: it is mentioned in 5.3.2.11 that MBSF is with the functionality of "Determination of sender IP multicast address for the MBS session if IP multicast address is sourced by MBSTF". However, the word "sender" is not clear and it is proposed to replace it with "destination". 8. Column order of clause 6.9.1 MBS Session Context: it is proposed to re-order the column of table 6.9.1-1 to reflect the actual order of the call-flow, i.e., 1) NG-RAN, 2) AMF, 3) SMF, 4) MB-SMF. 9. EN above Figure 5.1-2: such EN was once added because there was no consensus on whether the UDM will be used to store ther related parameters. It is proposed to remove this EN since it has been determined that in this release we will not define a dedicated NF to store the MBS parameters. 10. Service name corrections: including the one mentioned in clause 7.1.1.3, 7.2.3.3, and 9.3.3.2. 11. Remove unrelated ENs: including the ones in broadcast session management related clauses for service usage, and the ones for checking extra parameters in clause 7.3.5. 12. Correcting the step number: for clause 7.2.1.3, the step number is incorrect. It is proposed to correct them. For clause 7.2.3.2 two corrections on the step number are needed. 13. Join rejection: it is straightforward but not mentioned in the spec that what will SMF do if it needs to reject UE’s join request. It is proposed to clarify that SMF will only provide NAS container (PDU session modification rejection) to response AMF. 14. Title correction for local MBS: in the last meeting the terms used for local MBS was corrected, e.g., using local MBS and location-dependent MBS for the two cases. However, the titles of the related clauses are to-be-clarified. 15. Clarification of "local MBS service indication": local MBS service indication is assumed to be included in the service announcement in clause 7.2.4.3.2. However, such part is not aligned with service announcement clause (6.11). One can either modify 6.11 to include such indication, or simply remove this one in 7.2.4.3.2. 16. Hanging clause: there are some text between 8.1 and 8.1.1 without allocating clause number. Clarifiaction is needed. 17. Other issues: including 1) remove Nmb9 in clause 8.2 to align with the figure; 2) NBSF🡪 MBSF in clause 9.1.3.1; 3) MBSF/NEF or SMF 🡪 MBSF/NEF/AF in clause 9.1.3.1. 18. Wrong reference points: in clause 5.2, the reference points between MBSF and AF, as well as between MBSTF and AF are not correct. Nmb3, Nmb6 and Nmb4 should be Nmb5, Nmb10 and Nmb8 19. “MB service area”: it should be fixed to “MBS service area” in clause 5.3.2.15, 7.1.1.6, 9.1.3.4. “MBS service area” is the one defined in Terms. 20. Service operation name correction: in clause 7.2.2.2, fix service operation names to Nmbsmf\_MBSSession\_ContextUpdate and Nmbsmf\_MBSSession\_ContextStatusUnsubscribe to align with service operation definition in clause 9.1.3. And thus, NOTE1 and NOTE2 can be removed 21. Service operation name correction: in clause 7.1.1.4 and clause 7.1.1.5, fix service operation names to Nnef\_MBSSession\_Delete and Nmbsmf\_MBSSession\_Delete to align with service operation definition in clause 9.1.3 and 9.4.3. 22. In Clause 7.2.1.3 step 4 the description states that the MB-SMF checks the authorization of the user to join a multicast session, but the MB-SMF is not aware of users and the check is performed by the SMF. 23. Remove unused services: since we have "Namf\_MBSBroadcast\_ContextUpdate", so no need to introduce the service operation Namf\_MBSBroadcast\_ContextStatusNotify. 24. Clause 6.9.1 indicates that the AMF stores service area and service area ID for multicast, but no need to do so has been identified in procedures and call flows; in fact this information is passed by the AMF in transparent containers. Also removes the "MB-" for the MB-PCF. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | 1. Clause 2: Remove TR 23.757. 2. Clause 3.1: term alignment. 3. Clause 4.1: MBS support clarification. 4. Clause 4.2.2: Broadcast service timeline correction. 5. Clause 4.3: replace "NOTE" with "EN". Correct the clause reference for Multicast Session De-configuration procedure. 6. Clause 5.1: 1) remove EN above Figure 5.1-2; 2) MBS support clarification. 7. Clause 5.2: Update Nmb3, Nmb6 and Nmb4 to Nmb5, Nmb10 and Nmb8 8. Clause 5.3.2.1: MBS support clarification. 9. Clause 5.3.2.11: replace "sender" with "destination". 10. Clause 5.3.2.15: MBS support clarification. Replace “MB Service Area” with “MBS Service Area” 11. Clause 6.3.2: MBS support clarification. 12. (void). 13. Clause 6.6: term alignment. 14. Clause 6.9.1: reorder the column of clause 6.9.1 MBS Session Context. Remove service area and service area ID from AMF for multicast. 15. Clause 7.1.1.3: Service name corrections. 16. Clause 7.1.1.6: Replace “MB Service Area” with “MBS Service Area” 17. Clause 7.2.1.3: 1) Correcting the step number; 2) Term alignment; 3) clarify Join rejection; 4) correct step 4 to state that SMF checks the authorization of the user to join a multicast session. 18. Clause 7.1.1.4: fix service operation names to Nnef\_MBSSession\_Delete and Nmbsmf\_MBSSession\_Delete to align with service operation definition in clause 9.1.3 and 9.4.3. 19. Clause 7.1.1.5: fix service operation names to Nnef\_MBSSession\_Delete and Nmbsmf\_MBSSession\_Delete to align with service operation definition in clause 9.1.3 and 9.4.3. 20. Clause 7.2.2.2: fix service operation names to Nmbsmf\_MBSSession\_ContextUpdate and Nmbsmf\_MBSSession\_ContextStatusUnsubscribe to align with service operation definition in clause 9.1.3. Remove NOTE1 and NOTE2. 21. Clause 7.2.3: 1) MBS support clarification; 2) term alignment; 3) step number; 4) Service name corrections. 22. Clause 7.2.4.3: 1) Title correction for local MBS; 2) Clarification of "local MBS service indication". 23. Clause 7.3.1-7.3.3: 1) term alignment; 2) Remove unrelated ENs. 24. Clause 7.3.5: Remove unrelated EN. 25. Clause 8.1: 1) Hanging clause; 2) replace "NOTE" with "EN"; 3) clarify the NG-RAN node interacting with MB-SMF is with MBS capability. 26. Clause 8.2: remove Nmb9 to align with the figure. 27. Clause 9.1.3.1: 1) NBSF🡪 MBSF in clause 9.1.3.1; 2) MBSF/NEF or SMF 🡪 MBSF/NEF/AF in clause 9.1.3.1. 28. Clause 9.1.3.4: Replace “MB Service Area” with “MBS Service Area” 29. Clause 9.3.2.5: Remove unused services. 30. Clause 9.3.1: Remove unused services. 31. Clause 9.3.3.2: Service name correction. | | | | | | | | |
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| ***Consequences if not approved:*** | | Unclear specification description. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 2, 3.1, 4.1, 4.2.2, 4.3, 5.1, 5.2, 5.3.2.1, 5.3.2.11, 5.3.2.15, 6.3.2, 6.6, 6.9.1, 7.1.1.3, 7.1.1.6, 7.2.1.3, 7.1.1.4, 7.1.1.5, 7.2.2.2, 7.2.3, 7.2.4.3, 7.3.1, 7.3.2, 7.3.3, 7.3.5, 8.1, 8.2, 9.1.3.1, 9.1.3.4, 9.3.2.5, 9.3.1, 9.3.3.2 | | | | | | | | |
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|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **x** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
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| ***Other comments:*** | |  | | | | | | | | |
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| ***This CR's revision history:*** | |  | | | | | | | | |

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* START OF CHANGES \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

# 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] void

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

[16] 3GPP TS 38.401: "NG-RAN; Architecture description".

[17] 3GPP TS 29.244: "Interface between the Control Plane and the User Plane Nodes; Stage 3".

[18] 3GPP TS 26.502: "5G Multicast-Broadcast User Service Architecture".

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGES \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

# 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 MBS 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.

**Area Session Identifier:** A unique identifier within an MBS Session used for an MBS session with location dependent content. When present the Area Session ID, together with the TMGI, is used to uniquely identify the data flow of an MBS Session in a specific MBS service area.

**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 from 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.

**MBS service area:** The area within which data of one Multicast or Broadcast MBS session may be sent. For location dependent MBS, the MBS service area is uniquely identified by the combination of Area Session ID and MBS Session ID and corresponds to the location dependent content data of the MBS Session ID.

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## 4.1 Overview of multicast and broadcast communication

Multicast and Broadcast Service (MBS) is a point-to-multipoint service in which data is transmitted from a single source entity to multiple recipients, either to all users in a broadcast service area, or to users in a multicast group as defined in TS 22.146 [2]. The corresponding types of MBS session are:

- Broadcast session

- Multicast session.

The MBS architecture defined in clause 5 follows the 5G System architectural principles as defined in TS 23.501 [5], enabling distribution of the MBS data from the 5GS ingress to NG-RAN node(s) and then to the UE. The MBS architecture provides:

- Efficient usage of RAN and CN resources, with an emphasis on radio interface efficiency;

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

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.

The MBS also provides functionalities such as local MBS service, authorization of multicast MBS and QoS differentiation. Refer to clause 6 for more details.

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 the MBS traffic in the 5GS.

NOTE 1: 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 to an NG-RAN node, which then delivers the packets to one or multiple UEs.

The 5GC Shared MBS traffic delivery method is required in all 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 MBS.

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

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

- Point-to-Point (PTP) delivery method: NG-RAN delivers separate copies of MBS data packets over radio interface to individual UE(s).

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

NG-RAN may use a combination of PTP/PTM to deliver an MBS data packets to UEs.

NOTE 2: 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: Delivery methods

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

For MBS multicast communication, if the NG-RAN node supports MBS, the network shall use the 5GC Shared MBS traffic delivery method for MBS data transmission.

NOTE 3: The exception is when the UE moves between NG-RAN node not supporting MBS (with 5GC Individual MBS traffic delivery method) and NG-RAN node supporting MBS, there is temporary co-existence between 5GC Shared MBS traffic delivery method and 5GC Individual MBS traffic delivery method. Refer to clause 6.3 for details.

For MBS multicast communication, 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.

For MBS multicast communication, 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.

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### 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. MBSC session configuration can occur in several steps (e.g. TMGI allocation, provisioning information about MBS session, request to activate the MBS session). The last step of the MBS session configuration triggers resource establishment for transmitting the DL Broadcast data between 5GC and NG-RAN.

NOTE: For broadcast communication, after MBS Session Configuration and Session Establishment, the established resources are not only between 5GC and NG-RAN, but also between the AF to 5GC.

- 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 can occur in parallel or after the MBS session configuration. However, TMGI allocation is required before. The information of the service announcement could be pre-configured at the UE side, see clause 7.3.1.

- 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.

- Session De-configuration: It is the phase that broadcast session will no longer exist.

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



Figure 4.2.2-2: Broadcast service timeline

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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. Only resources at MB-SMF, NEF and MB-UPF are reserved and no multicast data are 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, see clause 7.2.1.

NOTE 1: The SMF is not involved in the multicast session while the multicast session is in configured state.

NOTE 2: There may be several interim states in the configured state, e.g. TMGI requested, or information about the multicast session provided, but these interim states will not be specified in this release.

- **Active state**: Multicast session is established and MBS data can be transmitted to the UEs that have joined the multicast session. Radio resources for the multicast session are established. To receive multicast MBS session data, UEs that joined the multicast session shall be in CM-CONNECTED state for receiving data of 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 is transmitted to the UEs that have joined the multicast session. Radio resources for the multicast session are released, and the 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 requests the allocation of a TMGI, see clause 7.1.1.2 and 7.1.1.3. Alternatively, the information about the multicast session can be pre-configured in the network. 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, or to update the information whether the multicast session is to be in active or inactive state after establishment. 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, see clause 7.2.1. Multicast session state transitions from NULL or Configured state to either Inactive or Active state.

- **Multicast Session Activation**: See clause 7.2.5.2, 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.

NOTE 4: The AF could not be aware, and the NEF will not be aware, whether a session is in configured or established state. An AF may therefore update the session configuration to request the activation of a session prior to the establishment of the session, and this will determine that the session is subsequently established in active state when the first UE joins, but will not trigger the Multicast Session Activation state transition.

- **Multicast Session Deactivation**: See clause 7.2.5.3. 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 (see clause 7.2.2.2), or Multicast Session De-configuration procedure (7.1.1.4 or 7.1.1.5), the resources for the multicast session are released in both 5GC nodes and RAN nodes, see clause 7.2.2. Multicast session state transitions from Active or Inactive state to Configured.

- **Multicast Session De-configuration**: 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, see clause 7.1.1.4 or 7.1.1.5. The deconfiguration may be triggered by an AF request. Multicast session state transitions from Configured, Active or Inactive state to NULL.



Figure 4.3-1: Multicast session states and state transitions



Figure 4.3-2: Multicast session states and state transitions in MB-SMF



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

Editor's Note: Multicast session states and state transitions in NG-RAN is for illustration purpose, the details will be made by RAN WGs.



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

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

5.1 General architecture

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



Figure 5.1-1: 5G System architecture for Multicast and Broadcast Service.

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 MBS. The existing service based interfaces of Npcf and Nnef are enhanced to support MBS.

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

Figure 5.1-2 depicts the 5G system architecture for MBS using the reference point representation.



Figure 5.1-2: 5G System architecture for Multicast and Broadcast Service in reference point representation.

NOTE 4: The existing reference points of N1, N2, N4, N10, N11, N30 and N33 are enhanced to support MBS.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

## 5.2 General architecture for interworking with LTE

Interworking between MBS and eMBMS at service layer functionality applies in cases where the same Multicast/Broadcast service is provided via eMBMS and 5MBS. Figure 5.2-1 depicts the system architecture for interworking between E-UTRAN/EPC eMBMS and MBS at service layer, with collocated BM-SC and MBSF/MBSTF functionalities.



Figure 5.2-1: MBS-eMBMS interworking system architecture at service layer

The BM-SC+MBSF/MBSTF exposes common Nmb5/Nmb10/xMB-C/MB2-C and Nmb8/xMB-U/MB2-U reference points to the NEF and/or AF/AS. A common TMGI is used towards the AF/AS. The TMGI is also used as identifier for transport over E-UTRAN/EPC.

NOTE: MB2-C/U are both legacy reference points and 5GS reference points.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

5.3.2.1 PCF

In addition to the functions defined in TS 23.501 [5], the PCF performs the following functions to support MBS if dynamic PCC for MBS 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 MBS information from AF, NEF or MBSF, e.g. based on the different configuration options in Annex A.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

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 MB-SMF to serve an MBS Session.

- Controlling MBSTF if the MBSTF is used.

- Determination of destination 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.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

#### 5.3.2.15 NRF

##### 5.3.2.15.1 General

In addition to the functions defined in TS 23.501 [5], the NRF performs the following functions to support MBS:

- Support of new NF types MB-SMF and MBSF and their corresponding NF profiles.

- For both multicast and broadcast MBS Session, support of MB-SMF discovery based on parameters such as DNN, S-NSSAI and MBS service area, at MBS Session creation.

- For multicast MBS Session, support of MB-SMF discovery based on MBS Session ID by SMF serving the multicast Session at UE join.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

### 6.2.5 Update of multicast local MBS service and location dependent MBS service

If an MBS service area is updated via configuration for multicast communication, the MB-SMF provides the updated MBS service area to:

- SMFs,

- and AMF(s), and the AMF(s) forward this information to the relevant NG-RAN(s) that update the MBS service area.

NG-RAN node configures the UE not to receive the MBS data over air interface if it detects the UE was in the previous service area but is outside the updated MBS service area. NG-RAN node may release the tunnel for the shared delivery if none of the cells/TAs of the NG-RAN node belongs to the MBS service area any more. NG-RAN node configures the UE to receive the MBS data over air interface if it detects the UE was outside the previous service area but is inside the updated MBS service area, if part of cells/TAs of the NG-RAN node belongs to MBS service area and others outside the MBS service area.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

### 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, see clause 7.2.3.5 for details.

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 in 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.

- SMF triggers mode switch, i.e. from 5GC Individual MBS traffic delivery method to 5GC shared MBS traffic delivery method.

- When the MBS session context is given to the target NG-RAN node by the SMF, 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.

- The 5GC terminates the 5GC Individual MBS traffic delivery and changes to the 5GC shared MBS traffic delivery.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

### 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 into NG-RAN node not supporting MBS within the Broadcast MBS service area, how the UE get the same content via application level is out scope of this specification.







\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

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 multicast/broadcast communication 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;

NOTE 1: For multicast communication service, the UE-AMBR applies for associated PDU Session.

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

NOTE 2: 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 MBS session, the QoS rule and QoS Flow level QoS parameters are not provided to UE.

NOTE 3: For broadcast MBS session, the associated QoS Flow(s) are not applicable.

Editor's Note: For multicast MBS Session, whether UE needs to be aware that a QoS Flow within the PDU Session is mapped from MBS QoS Flow is FFS.

- For multicast MBS session, the handling of QoS rule and QoS Flow level QoS parameters of the associated QoS Flow(s) is the same as for other QoS Flow without UL in a PDU Session.

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 4: When there is a need to apply 5GC Individual MBS traffic delivery, the Session-AMBR of the associated PDU Session 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 QoS information for multicast and broadcast MBS session in different ways depending on the deployment and use cases.

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 5: What information is included in the request from AF to MBSF requires collaboration with SA WG4.

If dynamic PCC is deployed:

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

- It is the PCF that generates policy rules for MBS Session based on the received service requirement and provides the policy rules to the MB-SMF. The MB-SMF, based on the policy rules from the PCF, determines to create, and/or modify MBS QoS Flow(s) including providing QoS information to NG-RAN and MB-UPF, and providing packet detection and forwarding information to MB-UPF.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

### 6.9.1 MBS Session 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 Multicast MBS Session Context is described in Table 6.9.1-1.

Table 6.9.1-1: Multicast MBS Session context



| **Parameter** | **Description** | **NG-RAN** | **AMF** | **SMF** | **MB-SMF** |
| --- | --- | --- | --- | --- | --- |
| State | State of MBS session ('Active multicast session' or 'Inactive multicast session' or 'Configured multicast session') | X  (note 2) |  | X  (note 2) | X |
| 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 | 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 | X |  |
| QoS information | QoS information of the MBS session. | X |  | X | X |
| MBS Service Area | Area over which the MBS session data is distributed (i.e. Cell ID list or TAI list). | X (note 1) |  | X (note 1) | X (note 1) |
| NG-RAN Node ID(s) | NG-RAN nodes which are involved in the multicast session |  | X |  |  |
| AMF | The AMF(s) which are selected for the MBS session | X |  |  | 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) |
| SMF | The SMF(s) that manages the associated PDU session. |  |  |  | X |
| UE ID | ID identifying the UE that successfully join the Multicast MBS Session. For NG-RAN it is NGAP UE ID and for SMF it is SUPI. | X  (note 3) |  | X  (note 3) |  |
| 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 |
| PCF | The MB-PCF that provides policy control for the MBS session. |  |  |  | X (note 1) |
| NOTE 1: It is an optional parameter.  NOTE 2: The value 'Configured multicast session' is not applicable for NG-RAN and SMF.  NOTE 3: the UE ID is available within the UE Context which contains the MBS information. | | | | | |

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.

able 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 |  | X |
| QoS information | QoS information for the MBS Session, including the QoS parameters of QoS flows. | X |  | X |
| MBS Service Area | Area over which the MBS session data is distributed (i.e. Cell ID list or TAI list). | 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 |
| PCF | The PCF that provides policy control for the MBS session. |  |  | X (note 1) |
| NOTE 1: It is an optional parameter. | | | | |

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

7.1.1.2 Initial MBS session configuration without PCC

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

For multicast, MBS session establishment procedure triggered by UE join requests may follow the initial MBS session configuration procedure to reserve resources towards NG-RAN. For broadcast, the MBS session start procedure to reserve resources towards NG-RAN is triggered by the MBS session configuration procedure.

For both broadcast and multicast communication, the TMGI allocation may be separated from the MBS Session creation request.

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



Figure 7.1.1.2-1: Initial Configuration for MBS Session without PCC

Steps 1 to 6 are optional and only applicable if TMGI is used as MBS Session ID and required to be pre-allocated.

1. AF sends Nnef\_TMGI\_Allocate Request (TMGI number) message to NEF/MBSF to request allocation of a TMGI(s) to identify new MBS session(s).

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,

4. NEF/MBSF sends an Nmbsmf\_TMGI\_Allocate Request (TMGI number) message to the MB-SMF.

5. MB-SMF allocates TMGI(s) and returns the TMGI(s) to the NEF/MBSF via the Nmbsmf\_TMGI\_Allocate response (TMGI(s), expiration time).

6. The NEF or MBSF responds to the AF by sending an Nnef\_TMGI\_Allocate Response (TMGI(s), expiration time).

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 of an for an MBS session (possibly providing information for a previously allocated TMGI to NEF via a Nnef\_MBSSession\_Create request (([MBS Session ID], service type, MBS information, [TMGI allocation indication]). If step 1-6 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). The AF provides the service type (i.e. either multicast service or broadcast service). MBS information may further include QoS requirements, for a multicast session MBS authorization information (e.g., or an indication that any UE may join), MBS service area, start and end time of the MBS session and MBS session state (active/inactive). 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.

9 NEF/MBSF checks authorization of content provider.

10. NEF/MBSF discovers MB-SMF candidates and selects MB-SMF as ingress control node, possibly based on MBS service area. If a TMGI is included in step 8, NEF/MBSF finds MB-SMF based on that TMGI.

11. NEF/MBSF sends Nmbsmf\_MBSSession\_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, The NEF/MBSF provides MBS Session ID or request allocation of a TMGI, and indicate the requested service type (either multicast service or broadcast service) and MBS session state (active/inactive). It also indicates that the allocation of an ingress transport address is requested if this was requested in step 8, or if the MBSF decides to insert an MBSTF into the user plane for the MBS session. If provided in step 8, the request includes the indication that any UE may join.

The MBS service area is provided by NEF/MBSF to the MB-SMF if provided by the AF in step 8.

12. If requested to do so, or if a source specific multicast is provided as MBS Session ID in step 11, the MB-SMF allocates a TMGI.

If a source specific multicast is provided as MBS Session ID in step 11, the MB-SMF updates its NF profile at the NRF with the serving MBS Session ID. If an MBS service area information was received in step 11, the MB-SMF updates its NF profile at the NRF with that information.

NOTE 3: 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.

13. The MB-SMF derives the required QoS parameters locally.

14 MB-SMF selects the MB-UPF. If the allocation of an ingress transport address was requested in step 11, the MB-SMF requests the MB-UPF 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 the allocation of an ingress transport address was not requested in step 11, the MB-SMF provides the source specific multicast address received as MBS session ID to the MB-UPF and requests the MB-UPF to join the corresponding multicast tree from the content provider. The MB-SMF may also defer the configuration to join the corresponding multicast tree e.g. based on information that the session is inactive, QoS requirements and MBS start/end time until receiving the first query for the MBS session as part of the establishment procedure in clause 7.2.1.3, or until receiving a request to activate the MBS session via the MBS Session Update procedure in clause 7.1.1.6 or 7.1.1.7..

15. 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.

16. For broadcast communication, the MB-SMF continues the procedure towards the AMF and NG-RAN as specified in clause 7.3.1.

17. 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.

18. [Optional] If the MBSF decides to use an MBSTF, the NEF/MBSF provides the ingress address received in step 14 towards the MBSTF as DL destination. If the allocation of an ingress transport address was requested in step 8, the MBSF requests the MBSTF to allocate the user plane ingress resources. If the allocation of an ingress transport address was not requested in step 8, the MBSF provides the source specific multicast address received as Multicast session ID in step 8 and requests the MBSTF to join the corresponding multicast tree from the content provider.

19. [Conditional on step 19] If requested, the MBSTF selects an ingress address (IP address and port) and provides it to NEF/MBSF.

20. The NEF/MBSF-C indicates the possibly allocated ingress address and other parameters (e.g. TMGI) to the AF via an Nnef\_MBSSession\_Create response ([TMGI], [Allocated ingress address])). 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

21. Same as step 7. The AF may also perform a service announcement at this stage.

22. For multicast communication, depending on configuration UEs can join the MBS Session as specified in clause 7.2.1.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

7.1.1.3 Initial MBS session configuration with PCC



Figure 7.1.1.3-1: Configuration for MBS Session with PCC

Steps 1 to 7 are optional and only applicable if TMGI is used as MBS Session ID and required to be pre-allocated.

1. to 10: Same as in Figure 7.1.1.2-1.

11. Same as step 11 in Figure 7.1.1.2-1. In addition, the NEF/MBSF decides based on local configuration or based on parameters received in step 8 (e.g. whether the session comprises several data flows) whether it will invoke the Npcf\_MBSPolicy Authorization service for the MBS session. If so, the NEF/MBSF indicates to the MB-SMF that it will also provide a policy authorization for the MBS session to the PCF.

12. Same as step 12 in Figure 7.1.1.2-1.

13. [Optional] If the NEF/MBSF indicated in step 11 that it will also provide a policy authorization for the broadcast session to the PCF, the MB-SMF selects a PCF and sends an Npcf\_MBSPolicyControl\_Create Request (MBS session ID) for the MBS session towards the PCF, and defers step 25 until receiving an Npcf\_MBSPolicyControl\_UpdateNotify for the MBS session. Otherwise the MB-SMF decides based on local configuration whether to invoke the Npcf\_MBSPolicyControl service.

14. [Conditional on step 13] The PCF registers at the BSF that it handles the MBS session by using Nbsf\_management\_Register Request (MBS Session ID, PCF ID).. It provides an identifier that the policy association is for MBS and the MBS Session ID, its own PCF ID and optionally its PCF set ID.

15. [Optional] The PCF may retrieve preconfigured policy information for the MBS session (e.g. applicable QoS, the MBS Session-AMBR and/or default 5QI) from the UDR.

16. [Conditional on step 13] The PCF responds with Npcf\_MBSPolicyControl\_Create Response (MBS Policy, see clause 6.10) with policies for the MBS Session ID. The MBS Policy may include the Session-AMBR for the MBS session and 5QI for the MBS QoS Flow.

Editor's Note: How PCF determines the MBS policy for MBS QoS Flow without service requirement in this case is FFS.

17.-18 Same as steps 14-15 in Figure 7.1.1.2-1.

19 Same as step 17 in Figure 7.1.1.2-1.

20-21. [Optional] The NEF/MBSF uses the BSF Discovery service to discover the PCF serving the MBS session with the MBS session ID by using Nbsf\_management\_Discovery operation.

22. [Optional] The NEF/MBSF sends an Npcf\_MBSPolicy Authorization\_Create Request to 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 (e.g. according to the policy input configuration in the UDR).

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

23. [Conditional] If the PCF determined updated policies for the MBS session in step 21, it update the policy information at the MB-SMF. When obtaining a request for the creation of a policy association (signal 21) for a broadcast session, for which it already performs policy control towards an MB-SMF, the PCF always provides a policy update to the MB-SMF; if no real policy update is required, the PCF repeats previous policies or sends an empty update message.

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

25. When obtaining an MBS policy control update from the PCF (signal 23) for a broadcast session, the MB-SMF continues the procedure towards the AMF and NG-RAN as specified in clause 7.3.1 to request the allocation of resources to for the transmission of the broadcast session.

26.-30 Same as steps 18-22 in Figure 7.1.1.2-1.

Editor's note: AF sends a create message in step 8 and get a response in step 26. How to avoid the potential procedure handling failure is FFS.

NOTE: Steps 26-27 can be executed in parallel to steps 20-25.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

7.1.1.4 Removal of MBS session configuration without PCC

This procedure is used by the AF to release the MBS Session. This procedure may also include 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 MBS Session configuration without PCC

1. AF of content provider may request to release the MBS session (MBS Session ID).

2/3. If an MBSTF was inserted into the user plane, the MBSF request the MBSTF to release user plane resources.

4. NEF/MBSF requests MB-SMF to release resources for the MBS session.

5. 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 clause 7.2.2.3.

6/7. MB-SMF requests the MB-UPF to release user plane resources.

8. [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.

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

10. The NEF/MBSF responds to the AF.

11. [Optional] AF requests NEF/MBSF to de-allocate TMGI(s),

12. [Conditional on step 11] NEF/MBSF forwards request to de-allocate TMGI(s) to MB-SMF.

13. [Conditional on step 12] The MB-SMF responds to the NEF or MBSF by sending a de-allocate TMGI Response message.

14. [Conditional on step 13] NEF or MBSF forwards de-allocate TMGI Response message to AF.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

7.1.1.5 Removal of MBS session configuration with PCC

This procedure is used by the AF to release the MBS Session. This procedure may also include 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 7.1.1.5-1: Removal of configuration for MBS Session with PCC

1-3 Same as in Figure 7.1.1.4-1

4. The NEF/MBSF sends an NMBSPolicyAuthorization\_Delete Request to the PCF that handles the Policy of the MBS Session.

5. The PCF sends an Npcf\_MBSPolicyControl\_UpdateNotify Request to MB-SMF to release the MBS Policy Control Association.

6-9. Same as steps 5-8 in Figure 7.1.1.4-1

10. The MB-SMF sends the Npcf\_MBSPolicyControl\_UpdateNotify Response to the PCF.

11. The PCF de-registers at the BSF that it handles the MBS session.

12. The PCF sends an NpcfMBSPolicyAuthorization\_Delete Response to the NEF/MBSF.

13-17. Same as steps 11-15 in Figure 7.1.1.4-1.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

7.1.1.6 MBS Session Update without PCC

This procedure is used by the AF to update the MBS 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 7.1.1.6-1: Update of MBS Session without PCC

1. AF of content provider initiates MBS Session Update to a NEF/MBSF, e.g. to update MBS service area and/or update service requirement, or to activate or deactivate an MBS session. AF may provide 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).

2. NEF checks authorization of AF.

3. NEF/MBSF forward the MBS Session Update request to MB-SMF.

4. The MB-SMF derives any updated QoS parameters locally.

5-6.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.

7. 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 7.2.5 (for service activation/deactivation), 7.2.6 (for QoS updates) and 7.2.x (for service area updates).

8. If an MBS service area is being updated, the MB-SMF stores the new service area in its profile at the NRF.

9. MB-SMF responds to the MBS Session Update.

10. NEF/MBSF responds to the MBS Session Update.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

### 7.2.1 MBS join and Session establishment procedure

#### 7.2.1.1 General

MBS Session Join procedure is used by UEs to inform the 5GC of the UE interest in joining a multicast MBS session. The first accepted UE join request will trigger the multicast MBS session establishment towards the NG-RAN and the UE.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

#### 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 in the 5GC (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.



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 additionally 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 checks whether the user is authorized to use the required multicast service.

3. [Conditional] If SMF has no information about MBS Session context for the indicated MBS Session ID(s), 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 MBS session ID, the SMF may select an MB-SMF and request it configure the multicast session or the SMF may reject the join request.

NOTE 1: Details how the SMF select an MB-SMF and request it configure the multicast session are left to SMF implementation.

4. Nmbsmf\_ MBSSession\_ContextStatusSubscribe request indicates the SMF want to subscribe the MBS session context. For each MBS session in step 1, by using Nmbsmf\_ MBSSession\_ContextStatusSubscribe request (MBS Session ID) with the immediately reporting flag. SMF interacts with the MB-SMF to retrieve information about the indicated multicast session context information (multicast QoS flow information (e.g., QoS profile(s) for multicast MBS session), [start time], [session status indication (active/inactive)], [MBS session authorization information (MBS session open for any user)], LL MC address]) and to subscribe to events notifications related to the multicast session.

If it is the first time for the MB-SMF to receive Nmbsmf\_ MBSSession\_ContextStatusSubscribe request of the indicated MBS Session from SMF, MB-SMF learns it is the first UE joining the multicast group. 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. The SMF determines whether the user is authorized to join the multicast session as follows: The SMF checks the user subscription data received from the UDM to determine whether the user is allowed to use any multicast service. If so, the SMF checks the received indication whether the multicast session is open for any user. If the multicast session is not open to any user, the -SMF checks the user subscription data received from the UDM to determine whether the MBS session ID is included. If a UE joins prior to the start time of the multicast session, the SMF may accept the join request in step 8 and indicate to the UE the start time, or it may reject the join request with appropriate error cause and possible back-off time. If a UE joins while the multicast session is inactive, the SMF accepts the join request in step 8. If authorization check fails, the SMF indicates cause value in the PDU Session Modification Reject sent to the UE and proceeds with step 8.

NOTE 2: The MB-SMF can answer the Nmbsmf\_ MBSSession\_ContextStatusSubscribe request either based on information received in the configuration procedures in Clause 7.1.1 or based on preconfigured information. The pre-configuration also includes information about the MBS session stored in the NRF. If the MB-SMF uses preconfigured information, the pre-configuration also include MB-UPF configuration.

5. SMF responds to AMF through Nsmf\_PDUSession\_UpdateSMContext response (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 the NG-RAN about the relation between the multicast context and the UE's PDU Session context by including the MBS session ID and the mapping between the multicast QoS flow(s) and associated QoS flow(s).

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 unicast 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.

NOTE 3: Detailed information included in N2 SM information will be aligned with by RAN WG3.

NOTE 4: A PDU Session UP activation is not triggered by message 5 if it only includes information related to the multicast session and associated QoS flows and is received by an MBS capable NG RAN node.

Editor's Note: The implication of not triggering PDU Session UP activation in NG-RAN when SMF informs the NG-RAN of UE join requires RAN collaboration.

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 identified by the PDU Session ID is associated with 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 and CN resource.

NOTE 5: It is NG-RAN that decides whether radio resource is allocated or not, and it is NG-RAN/UPF that decides whether multicast transport or unicast transport is used between the NG-RAN/UPF and the MB-UPF.

7. [Conditional] If shared tunnel has not been established for the MBS session towards the NG-RAN node, the procedures in clause 7.2.1.4 for the Establishment of shared delivery toward RAN node are executed. Step 9 is executed separately for each MBS session.

8. The NG-RAN node 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 node 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. If the MBS is supported by NG-RAN, the N2 SM response container includes the accepted multicast QoS flow.

10. The AMF invokes Nsmf\_PDUSession\_UpdateSMContext request ([N2 SM container]) to the SMF.

Per the accepted unicast QoS flow information, the SMF determines the delivery mode, i.e. whether 5GC Individual MBS traffic delivery is used for multicast data transmission.

NOTE 6: If the shared tunnel is used, no interaction with UPF is needed for the indicated MBS session

[Conditional] Step 11 is used for 5GC Individual MBS traffic delivery, if the related NG-RAN does not support multicast .If a shared tunnel between the UPF (PSA) and MB-UPF for 5GC Individual MBS traffic delivery has not yet been established by the SMF for the multicast session, steps 11a to 11e are executed. Step 11f is executed irrespective of that.

11a. The SMF contacts the UPF to request the creation of a tunnel and provides the MBS session ID. The UPF indicates to the SMF whether the tunnel for this MBS session is newly allocated (as there can be multiple SMFs interacting with the same UPF for the same MBS Session). If the UPF determines to use unicast transport over N19mb, the UPF allocates a DL N19mb Tunnel endpoint for the MBS session if the SMF request is the first one to allocate DL N19mb Tunnel endpoint for the MBS Session in the UPF. The UPF includes the DL Tunnel Info in the response to the SMF. The DL tunnel info includes the downlink tunnel ID and the UPF address. The UPF is now ready for receiving the MBS data from the MB-UPF and forwarding the data to the PDU session.

Editor's Notes: whether 11b to 11e can be skipped for multicast N10mb is FFS

11b. If the UPF indicates the DL N19mb Tunnel is newly allocated, the SMF invokes Nmbsmf\_MBSsession\_ ContextUpdate 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 transport between MB-UPF and UPF.

11c. If the DL tunnel info of the UPF is received, MB-SMF configures MB-UPF to transmit the multicast session data towards UPF using the possibly received downlink tunnel ID.

11d. MB-SMF responds to SMF through Nmbsmf\_MBSSession\_ ContextUpdate response (MBS Session ID, [multicast DL tunnel info]). If the UPF DL tunnel info for unicast transport is not received by the MB-SMF, multicast transport between MB-UPF and UPF is to be used, and the SMF includes the downlink tunnel information with the transport multicast address for the multicast session.

11e. For multicast transport between MB-UPF and UPF, SMF configures UPF to receive the multicast session data. If multicast transport over N19mb is used, the UPF joins the source specific multicast group of MB-UPF. The UPF forwards the data to the PDU session.

11f. The MB-SMF configures the MB-UPF to forward the received multicast session data within the PDU session. (This step may be combined with step 13a or 13e).

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.

Steps 14 to 16 are for 5GC Shared MBS traffic delivery:

14. MB-UPF sends multicast PDUs in the N3mb tunnel associated to the multicast session to the NG-RAN. There is only one tunnel per multicast session and NG-RAN node, i.e., all the UEs which have joined the multicast session via the NG-RAN node share this tunnel for reception of the multicast session data.

15. The NG-RAN selects PTM or PTP radio bearers to deliver the multicast PDUs to the UE(s) that have joined the multicast session.

16. The NG-RAN transmits the multicast session data to the UE(s) using the selected PTM or PTP radio bearer(s).

Steps 17 to 19 are for 5GC Individual MBS traffic delivery:

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

18. UPF forwards the multicast data towards the NG-RAN via unicast (i.e. in the N3 tunnel of the associated PDU Session).

19. The NG-RAN forwards the multicast session data to the UE via unicast (i.e. over the radio bearer(s) corresponding to the mapped unicast QoS flow(s) of the associated PDU Session).

NOTE 7: Details of the DL MBS data transmission are described in clause 6.7.

NOTE 8: When the MBSF is involved in the multicast MBS session, the tunnel between MBSTF and MB-UPF has been established in the configuration procedure.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

7.2.2.2 MBS Session Leave

When the UE determines to leave the multicast MBS Session, it shall send PDU session Modification request to inform the 5GC the leaving operation. The Figure 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 Session. The PDU Session Modification Request carries the MBS session ID which the UE want to leave.

2. The AMF invokes Nsmf\_PDUSession\_UpdateSMContext (N1 SM container (PDU Session Modification Request with the MBS session leaving information (i.e., leave indication, MBS session ID))) to SMF.

3a. [Conditional] If 5GC individual MBS traffic delivery is applied, the SMF sends an N4 Session Modification Request to the UPF (PSA). The SMF reconfigures UPF to terminate the distribution of multicast data via the PDU session and release the resources for the reception of the multicast data.

3b. The UPF (PSA) sends an N4 Session Modification Response to the SMF.

If there are no PDU sessions to receive the MBS session data in the UPF, and unicast transport is used over N19mb, the UPF releases the DL N19mb tunnel endpoint and informs the SMF.

If there are no PDU sessions to receive the MBS session data in the UPF, and multicast transport is used over N19mb, the UPF leaves the multicast distribution tree of MB-UPF.

4. [Conditional] If the UPF indicates the tunnel release, the SMF invokes Nmbsmf\_MBSession\_ContextUpdate Request (Release, 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.

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

6. [Conditional] The MB-SMF responds to SMF for step 4.

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 associated 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 node 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 node removes 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 updates the associated PDU session SM context, e.g., remove the MBS session ID from the SM context. 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.

11a. If the UE is the last joined one of the MBS session in the SMF, The SMF also indicates that the last UE served by the SMF leaves the Multicast MBS Session, the SMF unsubscribes the MBS session updates from the MB-SMF via Nmbsmf\_MBSSession\_ContextStatusUnsubscribe service operation. And the MB-SMF will no longer notify/invoke the SMF for the further updates of the MBS session (e.g., activation, deactivation, update, release, etc.). For multicast transport between MB-UPF and content provider, if it is the last remaining SMF that subscribed for MB-SMF information notify, i.e., if it is the last UE leaving the MBS session, the MB-SMF may request the MB-UPF to leave the multicast tree towards the AF/MBSF, if the MB-UPF joins the multicast tree when the first UE joins the MBS session.

12. If the UE is the last UE in this RAN node for this MBS session, the NG-RAN release shared delivery between NG-RAN and MB-UPF as described in clause 7.2.2.4.

If release of the PDU Session associated with an MBS session is triggered, corresponding procedures between UE, NG-RAN, AMF, and SMF are performed as described in clause 4.3.4 of TS 23.502 [6], and SMF triggers the UE leave the MBS session by performing steps 3-6 in Figure 7.2.2.2-1 for each MBS session(s) associated with the PDU Session, and UE considers as left the MBS session. If the UE deregistration procedure is executed, corresponding procedures between UE, NG-RAN, AMF, and SMF are performed as described in clause 4.2.2.3 of TS 23.502 [6], and SMF performs steps 3-6 in Figure 7.2.2.2-1 for all MBS sessions joined by the UE. When the PDU Session Release procedure or UE deregistration procedure is executed, according to the UE context, NG-RAN performs step 12 for each MBS session associated with the PDU Session.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

7.2.2.4 Release of shared delivery toward RAN node

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

- The last UE is excluded from the context of the MBS session in the NG-RAN;

- Handover to the target NG-RAN when the UE is the last UE for this MBS session in the source NG-RAN node during handover preparation phase known by the source NG-RAN node;

- Handover to the target E-UTRAN when the UE is the last UE for this MBS session in the source NG-RAN;

- MBS session de-configuration.

NOTE: When the MBS session is deactivated, the shared delivery is not release if there is at least one UE is in connected mode for this MBS session.



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

1. A RAN node decides 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 NG-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 NG-RAN node sends N2 MBS Session release request (MBS Session ID, [unicast GTP TEID], [Area Session ID]) to the AMF. For location dependent services, the NG-RAN node also provides the Area Session ID. The RAN node includes the unicast GTP TEID if unicast transport is used for the shared delivery.

3. The AMF invokes Nmbsmf\_MBSSession\_ContextUpdate request (MBS Session ID, N2 SM information) to the MB-SMF corresponding to the MB-SMF ID stored in the AMF for the MBS Session ID.

4. If unicast transport was used towards the NG-RAN node, the MB-SMF sends N4mb Session Modification to the MB-UPF to release the N3mb tunnel used for the multicast session (or location dependent content of the multicast session if an area session ID was received) towards that RAN node using the received GTP tunnel endpoint information.

5. The MB-SMF responses to the AMF. If there's no RAN node controlled by the AMF serving the multicast session, the MB-SMF also removes the AMF ID from the context of the multicast session.

6. The AMF 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).

7. The AMF sends an N2 MBS Session release response (MBS Session ID) to the RAN node. The NG-RAN node deletes the unicast GTP TEID (if unicast transport is used for the shared delivery) or sends IGMP/MLD leave message to leave the multicast transport if multicast transport is used for the shared delivery). The NG-RAN node releases local resources for the multicast session.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

### 7.2.1 MBS join and Session establishment procedure

#### 7.2.1.1 General

MBS Session Join procedure is used by UEs to inform the 5GC of the UE interest in joining a multicast MBS session. The first accepted UE join request will trigger the multicast MBS session establishment towards the NG-RAN and the UE.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

### 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 MBS.

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

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

7.2.3.2 Xn based handover from MBS supporting NG-RAN node

This clause describes an Xn based handover with MBS traffic delivered to the UE at the source NG-RAN node supporting 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 MBS session information by the source NG-RAN which causes:

- an MBS non-supporting target NG-RAN node to prepare the unicast resources according to associated QoS flow(s) information.

‐ an MBS supporting target NG-RAN node to allocate to the UE shared NG-RAN resources according to the MBS session information. If the 5GC Shared MBS traffic delivery for the indicated MBS Session has not been established in target NG-RAN, target NG-RAN triggers setup of the resources for the 5GC Shared MBS traffic delivery, see clause 7.2.1.4 for details.

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

The target NG-RAN node indicates whether it supports of MBS to SMF in N2 SM information. Per the received N2 SM information, the SMF knows whether the target NG-RAN node supports MBS and determines the delivery method, i.e., whether the 5GC Shared MBS traffic delivery is used for MBS data transferring.

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

Case A) The target NG-RAN supports 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 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 associated 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 an Nmbsmf\_MBSSession\_Update (MBS session 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) if unicast transport is applied. If multicast transport is applied, the MB-UPF return the endpoint information (e.g. the Common-TEID) including the transport multicast address to MB-SMF.

7. MB-SMF to SMF: The MB-SMF responds to SMF through Nmbsmf\_MBSSession\_Update response. If multicast data are transported via multicast transport, 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 transport, 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.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

7.2.3.3 N2 based handover from MBS supporting NG-RAN node

This clause describes the N2 based handover with MBS traffic delivered to the UE at the source NG-RAN node supporting MBS.



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 (MBS Session information, associated PDU session information, associated QoS flow information and corresponding multicast QoS flow 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 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 via the associated QoS flows within the associated PDU Session.

- If the target NG-RAN supports MBS, the target NG-RAN uses the MBS Session information to allocate resource to deliver the MBS data.

6. If Target NG-RAN supports MBS and the MBS delivery for the indicated MBS Session has not yet been established towards target NG-RAN, the target NG-RAN initiates the shared delivery establishment towards the MB-SMF. Details is defined in the clause 7.2.1.4.7.

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

The target NG-RAN node indicates whether it supports of MBS to SMF in N2 SM information. Per the received N2 SM information, the SMF knows whether the target NG-RAN node supports MBS and determines the delivery method, i.e. whether the 5GC Shared MBS traffic delivery is used for MBS data transferring.

17. 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 MBS. Step 18 applies and steps 19~23 are skipped.

18. 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 MBS. If the UPF (PSA) is not yet configured to forward multicast data via unicast, steps 19 to 23 apply.

19 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 associated QoS Flow(s) within the associated PDU Session (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 associated 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 20 to 23 apply.

20. SMF to MB-SMF: The SMF invokes an Nmbsmf\_MBSSession\_ContextUpdate (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.

21. 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).

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

23. 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.

24./25.

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

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

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

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

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 MBS session context for the indicated MBS Session ID, the SMF requests MB-SMF information via Nnrf\_NFDiscovery\_Request Request (MBS Session ID, UE location), the NRF provides information about the MB-SMF(s) serving the multicast session at the indicated location and service areas and service area IDs for the multicast session, via Nnrf\_NFDiscovery\_Request Response (MB-SMF profile(Area Session ID(s), MBS service area(s)). 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.

- 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(s) and MBS service area(s) that the NG-RAN node belongs to. The SMF provides all MBS service areas information (Area session ID, MBS service area) to NG-RAN.

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

##### 7.2.4.2.2 Configuration

For local MBS, the configuration procedure for the UE is optional and performed as defined in clause 7.1.1.2 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, session area 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

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.

- For the Xn Handover:

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

- Target RAN determines whether to establish the resources for multicast distribution for MBS Session ID and Area Session ID provided by Source RAN, based on MBS Session ID, Area Session ID and MBS service area.

NOTE: Data forwarding issue needs the feedback of RAN WGs

- Target RAN responses to Source RAN, with the accepted MBS Session ID, 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.

- For the N2 Handover:

- The SMF includes all MBS session area information (MBS Session ID, Area Session ID and MBS service area) to the Target RAN in Handover request.

- Target RAN determines whether to establish the resources for multicast distribution for MBS Session ID and Area Session ID provided by SMF, based on MBS Session ID, Area Session ID and location area. - If the target RAN determines the shared delivery is not established for the multicast session ID and area session ID, the target NG-RAN initiates the shared delivery establishment as specified in clause 7.2.1.4.

#### 7.2.4.3 Support of local MBS for multicast

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

For local multicast services, the MBS service area information is provided to the UE and the 5GC as specified in clauses 7.1.1.2 and 7.1.1.3 with the following differences and clarifications:

- For the Service Announcement, MBS service area information may be included.

- When performing the MBS session request to the 5GC, the MBS service area information for a multicast session may be provided by the AF.

##### 7.2.4.3.2 Multicast session join and session establishment procedure for local MBS

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 multicast session 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 may have information about local multicast service including MBS service area 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 e.g. 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, and the SMF determines the indicated MBS session corresponds to local multicast service based on the MBS service area.

- 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 with the following additions:

- 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.

- If the Join Request from the UE is accepted and 5GC Individual MBS traffic delivery is used, the SMF subscribes to the UE mobility event notification from the AMF (e.g. UE moving into or out of Area Of Interest, which is set by MBS service area), by invoking Namf\_EventExposure\_Subscribe service operation as specified in clause 5.2.2.3.2 of TS 23.502 [6].

- 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.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

### 7.3.1 MBS Session Start for Broadcast

The Broadcast Session Start follows the common procedure specified in clause 7.1.1.2, which consist of TMGI Allocation and MBS Session Create. It is possible for AF to allocate TMGI once but create the MBS Session for multiple times. A combined procedure to perform both TMGI allocation and MBS Session Create is 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 Create (with MBS service type set to broadcast service) is used by the AF to indicate the impending start of the transmission of MBS data, and to provide the session attributes , so that resources for the MBS Session are set up in the MB-UPF and in the NG-RAN for 5GC Shared MBS traffic delivery. The MBS Session Create can be used if TMGI has not been allocated. In this case, MB-SMF will allocate a unique TMGI for the AF and then start 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 as defined in TS 26.346 [13]) 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

1. To establish broadcast MBS session, the AF performs TMGI allocation and MBS session creation as specified in clause 7.1.1.2 or 7.1.1.3. The MBS service type indicates to be broadcast service.

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 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 Namf\_MBSBroadcast\_ContextCreate Request (TMGI, LL MC and source host address, N2 SM information (5G 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 a Broadcast MBS 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, N2 SM information (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.

7. The AMF transfers the Namf\_MBSBroadcast\_ContextCreate Response () to the MB-SMF. The AMF should respond success when it receives the first success response from 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 responds success in the MBS Session Context as the downstream nodes.

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 an N4mb 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.

NOTE 2: Step 6-8 and 2-4 are comparable to step 2-5 and 6-7 in clause 7.2.1.4, respectively.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

### 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).



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 (steps 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).

2. The MB-SMF sends Namf\_MBSBroadcast\_ContextUpdate Request 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 Namf\_MBSBroadcast\_ContextCreate to some AMFs in the new MBS service area, Namf\_MBSBroadcast\_ContextRelease 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 Namf\_MBSBraodcast\_ContextUpdate Response to the MB-SMF.

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

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

### 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).

## 8.1 Control plane for Multicast and Broadcast services

### 8.1.1 General

The control plane protocol stacks for Multicast and Broadcast service between NG-RAN and MB-SMF is defined in the clause 8.1.1 and the other control plane protocol stacks for Multicast and Broadcast service are defined in the TS 23.501 [5] clause 8.2.

The control plane protocols for N4mb reference point between MB-SMF and MB-UPF are defined in TS 29.244 [17].

Editor's Note: The control plane protocols for reference point Nmb2 between MBSF and MBSTF require collaboration with SA WG4, SA WG6 and CT WGs.

### 8.1.2 NG-RAN – MB-SMF



**Legend:**

- **N2 SM information:** This is the subset of NG-AP information that the AMF transparently relays between the NG-RAN and the MB-SMF, and is included in the NG-AP messages and the N11mb related messages, where the NG-RAN node has MBS capability, and in this Release the NG-RAN is a 3GPP NR.

Figure 8.1.1-1: Control Plane between the NG-RAN and the MB-SMF

## 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 TS 23.501 [5] clause 8.3.1.

The user plane protocol stack for MBS session in case of shared delivery is described in Figure 8.2-1 and Figure 8.2-2. In Figure 8.2-1, the UDP tunnel applies to N6mb and Nmb9, while in Figure 8.2-2, the plain IP multicast applies to N6mb. The user plane protocol stack for MBS session in case of individual delivery is described in Figure 8.2-3.



Figure 8.2-1: User Plane Protocol Stack for MBS session (UDP Tunnel)



Figure 8.2-2: User Plane Protocol Stack for MBS session (plain IP multicast)

- **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 [16]. The radio protocol between the UE and the 5G-AN node (gNodeB) is specified in TS 38.300 [9].

Figure 8.2-3: User Plane Protocol Stack for MBS session in case of Individual delivery

**Legend:**

- **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 [16]. The radio protocol between the UE and the 5G-AN node (gNodeB) is specified in TS 38.300 [9].

NOTE: In Figure 8.2-3, the User Plane Protocol Stack between MB-UPF and AF/MBSTF is shown in Figure 8.2-1 and Figure 8.2-2.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

#### 9.1.3.1 General

**Service description:** The following are the key functionalities of this NF service:

- (between AMF or SMF and MB-SMF) For multicast, NF Service Consumer can use this service to request the reception of MBS data or to terminate the reception of MBS data;

- (between SMF and MB-SMF) For multicast, allow consumer NFs to query information (e.g. QoS information) about MBS Session(s). This service will be invoked by SMF for UE join event;

- (between SMF (only for multicast) or MBSF/NEF and MB-SMF) Allow consumer NFs to subscribe and unsubscribe for an Event ID on MBS Session(s);

- (between SMF (only for multicast) or MBSF/NEF and MB-SMF) Notifying events on the MBS Session to the subscribed NFs;

- (between MBSF/NEF/AF and MB-SMF) Creation/Modification/Activation/Deactivation/Release of multicast sessions; and

- (between MBSF/NEF and MB-SMF) Creation/Modification/Start/Stop/Release of broadcast sessions.

The following events related to MBS session context can be subscribed by SMF as consumer NF:

- (between SMF and MB-SMF, only for multicast) QoS change: The event notification is sent when QoS within a multicast session changes, e.g. adding/removing QoS flow(s);

- (between SMF and MB-SMF only for multicast) multicast session status (activated, deactivated);

- (between SMF and MB-SMF only for multicast) multicast session service area change;

- (between SMF and MB-SMF only for multicast) multicast session release.

The following events related to MBS session can be subscribed by MBSF, NEF, or AF as consumer NF:

- (between MBSF/NEF/AF and MB-SMF) MBS session release due to TMGI expiry;

- (between MBSF/NEF/AF and MB-SMF) Broadcast delivery status.

NOTE: Whether event IDs are needed can be determined by stage 3.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

#### 9.1.3.4 Nmbsmf\_MBSSession\_ContextStatusNotify service operation

**Service operation name:** Nmbsmf\_ MBSSession\_ContextStatusNotify

**Description:** This service operation, which is applicable to multicast MBS session, is used by the MB-SMF to notify its consumers about events of an MBS Session.

**Inputs, Required:** MBS Session ID, Event ID, Notification Correlation Information.

**Inputs, Optional:** Event information (QoS information of MBS Session, MBS service area).

**Outputs, Required:** Operation execution result indication.

**Outputs, Optional:** Cause.

#### 9.1.3.5 Nmbsmf\_MBSSession\_ContextStatusUnsubscribe service operation

**Service operation name:** Nmbsmf\_MBSSession\_ContextStatusUnsubscribe

**Description:** This service operation, which is applicable to multicast MBS session, is used by the consumer to unsubscribe to notifications about MBS context events.

**Inputs, Required:** Subscription Correlation ID.

**Inputs, Optional:** None.

**Outputs, Required:** Operation execution result indication.

**Outputs, Optional:** None*.*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

#### 9.1.3.8 Nmbsmf\_MBSSession\_Delete service operation

**Service operation name:** Nmbsmf\_MBSSession\_Delete

**Description:** Release the multicast session or broadcast session. The session is deleted and a possible subscription to notifications is terminated.

**Input, Required:** MBS Session ID.

**Input, Optional:** None.

**Output, Required:** Result Indication.

**Output, Optional:** Cause.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

### 9.3.1 General

The Namf\_MT\_EnableGroupReachability service operation is defined in TS 23.502 [6].

The following table illustrates the new AMF Service for broadcast communication.

Table 9.3.1-1: NF services provided by AMF

|  |  |  |  |
| --- | --- | --- | --- |
| Service Name | Service Operations | Operation  Semantics | Example Consumer (s) |
| **Namf\_MBSBroadcast** | ContextCreate | Request/Response | MB-SMF |
|  | ContextUpdate | Request/Response | MB-SMF |
|  | ContextRelease | Request/Response | MB-SMF |
| **Namf\_MBSCommunication** | N2MessageTransfer | Request/Response | MB-SMF |

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* NEXT CHANGE \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

#### 9.3.3.2 Namf\_MBSCommunication\_N2MessageTransfer service operation

**Service operation name:** Namf\_MBSCommunication\_N2MessageTransfer

**Description:** This service operation is used by the NF Consumer to request the AMF to transfer the MBS related N2 message to the NG-RAN nodes serving the MBS multicast session.

**Input, Required:** MBS Session ID, N2 SM information.

**Input, Optional:** MBS area session ID.

**Output, Required:** Result Indication.

**Output, Optional:** Cause.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* END OF CHANGES \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*