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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

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

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  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

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

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

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

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

should indicates a recommendation to do something

should not indicates a recommendation not to do something

may indicates permission to do something

need not indicates permission not to do something

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

can indicates that something is possible

cannot indicates that something is impossible

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

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

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

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

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

In addition:

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

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

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

1 Scope

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

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

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

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

[2] 3GPP TS 22.146: "Multimedia Broadcast/Multicast Service (MBMS); Stage 1".

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

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

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

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

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

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

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

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

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

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

[13] Void.

[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".

[19] 3GPP TS 29.510: "Network Function Repository Services; Stage 3".

[20] 3GPP TS 33.501: "Security architecture and procedures for 5G system".

[21] 3GPP TS 23.289: "Mission Critical services over 5G System; Stage 2".

[22] 3GPP TS 26.517: "5G Multicast-Broadcast User Services; Protocols and Formats".

[23] 3GPP TS 29.281: "General Packet Radio System (GPRS) Tunnelling Protocol; User Plane (GTPv1-U)".

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 MBS session that is used for 5GC Individual MBS traffic delivery method and for signalling related to a user's participation in a multicast MBS 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 MBS 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 MBS session or a broadcast MBS session.

MBS service area: The area within which data of one Multicast or Broadcast MBS session may be sent. For location dependent MBS, for each MBS service area, an Area Session ID, which is unique per MBS Session ID, is allocated and the same location dependent content data for an MBS session is delivered to the UE(s) within an MBS service area.

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 coverage of the MBS service area 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 geographical area where to distribute it.

3.2 Abbreviations

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

CDN	Content Delivery Network
FEC	Forward Error Correction
FSA	Frequency Selection Area
LL SSM	Lower Layer SSM
MBMS	Multimedia Broadcast/Multicast Service
MBS	Multicast/Broadcast Service.
MBSF	Multicast/Broadcast Service Function.
MBSTF	Multicast/Broadcast Service Transport Function.
MB-SMF	Multicast/Broadcast Session Management Function.
MB-UPF	Multicast/Broadcast User Plane Function
MSK	MBS Service Key
MTK	MBS Traffic Key
PTM	Point To Multipoint
PTP	Point To Point
SSM	Source Specific IP Multicast address.
TMGI	Temporary Mobile Group Identity

4 General Concept

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 MBS session
- Multicast MBS 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 collection and reporting of MBS specific charging information are not specified in this Release.

The MBS also provides functionalities such as local MBS service and location dependent 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 sessions. 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 MBS session.

- 5GC Shared MBS traffic delivery method: This method is applied for both broadcast and multicast MBS sessions. 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 MBS 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.

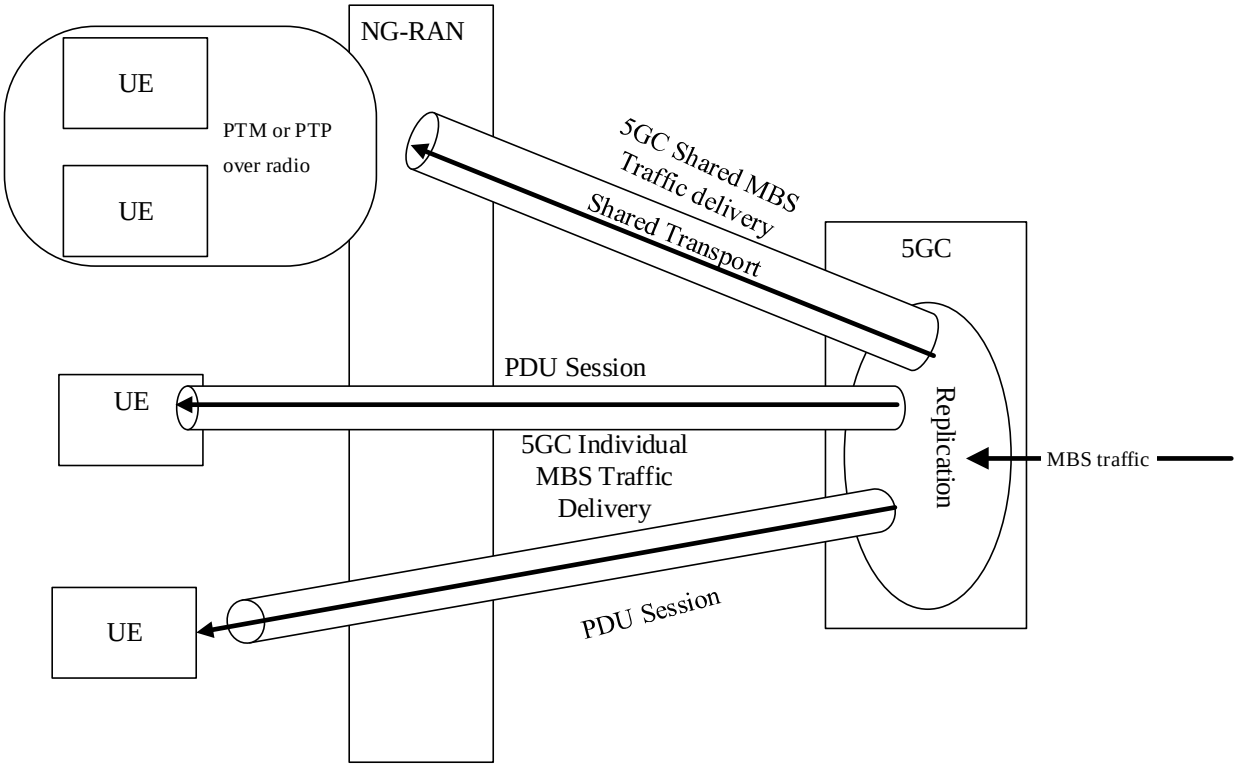

Figure 4.1-1: Delivery methods

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.

4.2 MB service provisioning

4.2.1 Multicast data provisioning

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

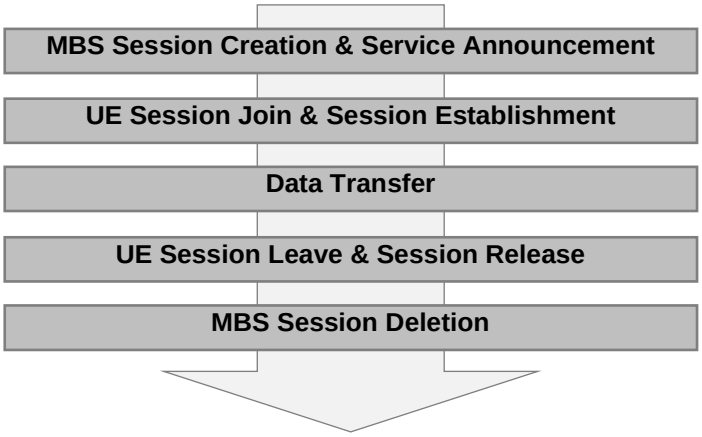

Figure 4.2.1-1: Phases of Multicast data provisioning example

The following phases are performed for a specific UE:

- UE Session Join: UE Session Join is the process by which a UE joins an MBS Session, i.e. the UE indicates to 5GC that such UE wants to receive Multicast data identified by a specific MBS Session ID.
- UE Session Leave: UE Session Leave is the process by which a UE leaves a MBS Session, i.e. the UE no longer wants to receive Multicast data identified by a specific MBS Session ID.

The following phases are performed for a specific service:

- MBS Session Creation: It is the phase that the information of Multicast MBS session is created as described in clause 4.3. This step is optional.
- Service announcement: Service announcement is used to distribute information toward UEs about the service required for service reception (e.g. IP multicast address(es)) and possibly other service related parameters (e.g. service start time). This step is optional.
- Session Establishment: It is the phase that Multicast MBS session is established as described in clause 4.3.
- No data receiving: It is the phase when no multicast data is received by 5GC. This step is optional.
- Data transfer: It is the phase when Multicast data are transferred to the UEs.
- Session Release: It is the phase that the resources for Multicast MBS session is released as described in clause 4.3.
- Session Deletion: It is the phase that Multicast MBS session is deleted as described in clause 4.3.

NOTE: After session establishment, Multicast MBS session state could be switched between Active and Inactive several times, triggered by AF or User Plane event, see clause 7.2.5. 5GC further updates Multicast MBS session state towards NG-RAN nodes after Session Establishment.

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