TSG-SA Meeting #20 **SP-030312**
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Presentation of Specification to TSG-SA

Presentation to:	**TSG SA Meeting #<20>**
Document for presentation:	**TS 23.246, Multimedia Broadcast/Multicast Service (MBMS)**
Version	**1.0.0**
Presented for:	**Information**

Abstract of document:

The presented document TS 23.246 describes the stage 2 description (architectural solution and functionalities) for MBMS, which includes the elements necessary to realise the stage 1 requirements in 3GPP TS 22.146.

TS 23.246 is now more than 50% complete and is ready for presentation for information to SA.

TS 23.246 describes the architecture to support MBMS. A good overview of the architectures and procedures to support MBMS are shown.

Regarding the timescales of the MBMS work in SA2, It is intended to meet the current timescales for completion of the work and send the TS fro approval in September dependent on the outstanding issues being resolved.

Changes since last presentation to SA

Not Applicable /first presentation

Outstanding Issues:

There has been some discussion on RAN assumptions in TSG SA2, it is agreed that SA2 could not wait for RAN to progress the architecture instead SA2 should make assumptions and progress the work. It is understood that dependent on RAN decisions, the architecture may be impacted and may need to be revisited.

Contentious Issues:

None at present

3GPP TS 23.246 V.1.0.0 (2003-06)

Technical Specification

3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Multimedia Broadcast/Multicast Service (MBMS); Architecture and Functional Description (Release 6)

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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:

Version x.y.z

where:

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

1 Scope

The present document describes the stage 2 description (architectural solution and functionalities) for MBMS, which includes the elements necessary to realise the stage 1 requirements in 3GPP TS 22.146 [2].

The present document includes information applicable to network operators, service providers and manufacturers.

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: "3G Vocabulary".

[2] 3GPP TS 22.146: “MBMS; Stage 1”.

[3] 3GPP TS 23.107: “QoS Concept and Architecture”

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions defined in 3GPP TS 21.905 [1] and 3GPP TS 22.146 [2] and the following apply:

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

3.2 Abbreviations

For the purposes of the present document, the abbreviations in 3GPP TS 21.905 [1] and 3GPP TS 22.141 [2] and the following apply:

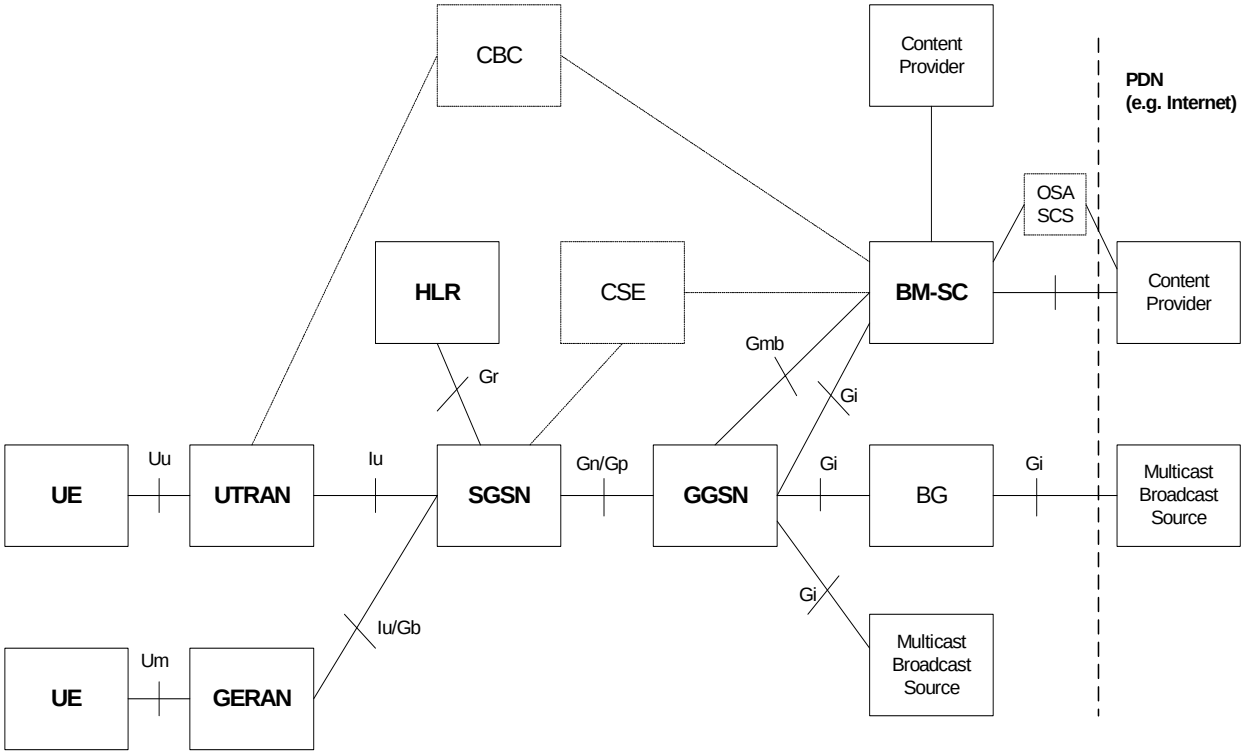
4 MBMS Architecture

4.1 Overview

Editor’s note : Here we put an introduction to MBMS architecture

4.2 Reference Architecture Model

Editors Note: Model taken directly form the TR



Note: dotted lines means functions / reference points that are FFS. Gp applies only when SGSN and GGSN are in different PLMN.

Figure 4.2-1: Reference architecture to support MBMS

4.3 MBMS Specific Reference points

Editors note: Probably only important to identify new reference points.

4.3.1 Gmb

4.4 MBMS Service Provision

4.4.1 MULTICAST MODE

Reception of an MBMS MULTICAST service is enabled by certain procedures that are illustrated in the Figure below.

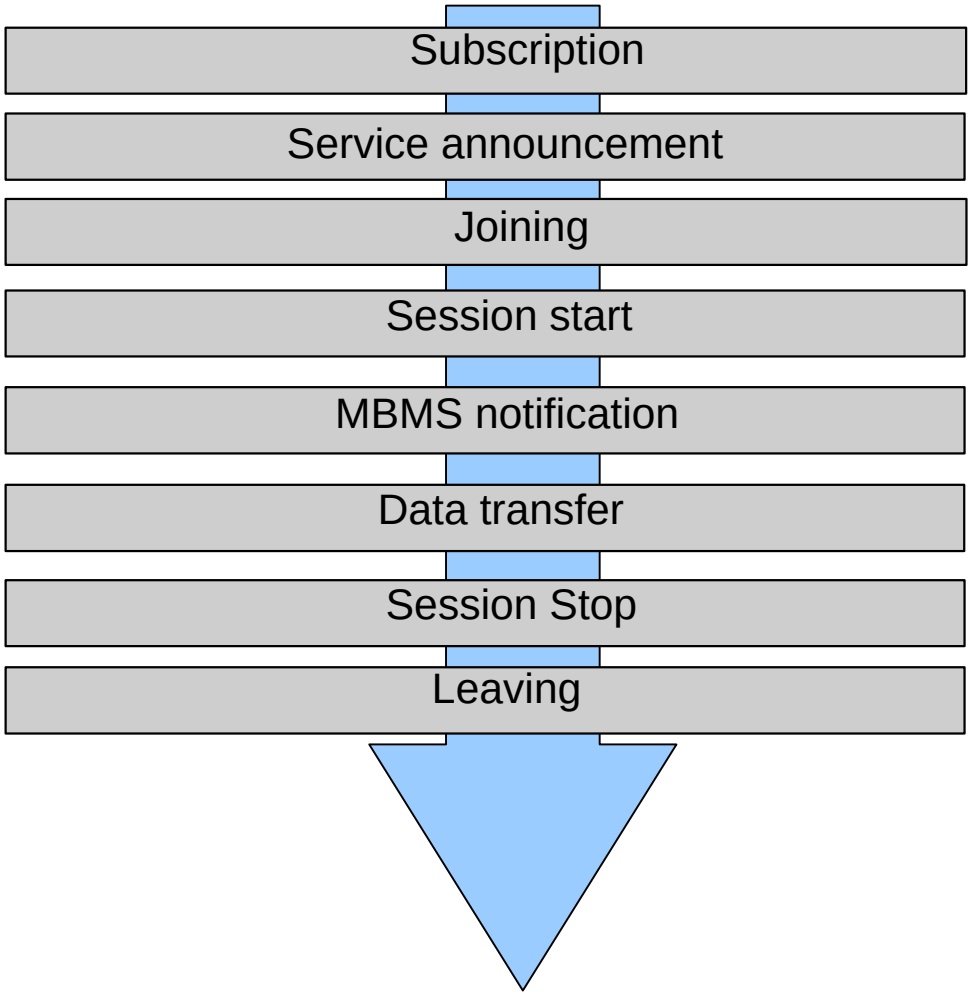


Figure 1: Phases of MBMS Multicast service provision

The phases subscription, joining and leaving are performed individually per user. The other phases are performed for a service, i.e. for all users interested in the related service. The sequence of phases may repeat, e.g. depending on the need to transfer data. Also subscription, joining, leaving, service announcement as well as MBMS notification may run in parallel to other phases.

This is illustrated with the following example of timeline:

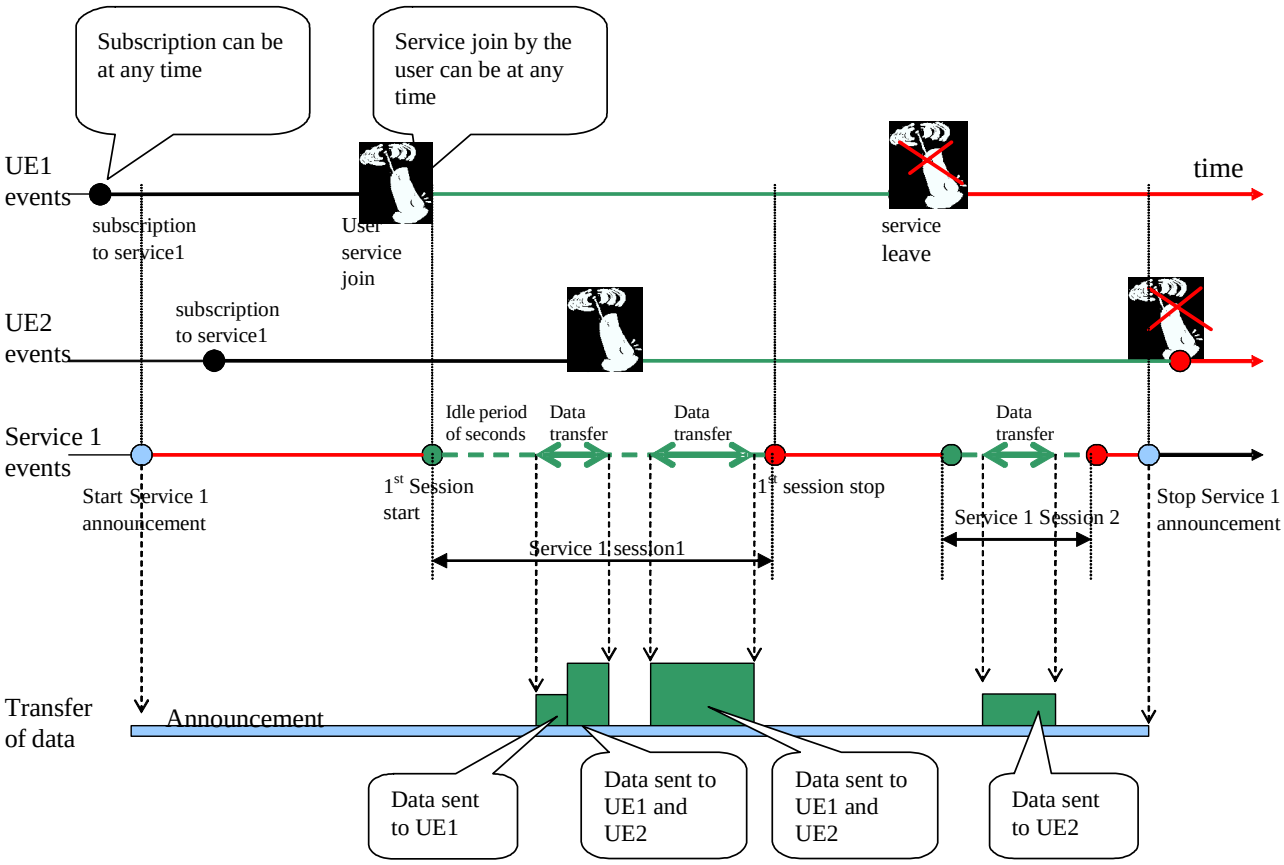


Figure 2: Timeline example

4.4.1.1 Subscription

Establishes the relationship between the user and the service provider, which allows the user to receive the related MBMS multicast service.

Service Subscription is the agreement of a user to receive service(s) offered by the operator. Subscription information is recorded in the appropriate database(s) in the operator's network.

4.4.1.2 Service announcement

MBMS service announcement/discovery mechanisms shall allow users to request or be informed about the range of MBMS services available. This includes operator specific MBMS services as well as services from content providers outside of the PLMN. Service announcement is used to distribute to users information about the service, parameters required for service activation (e.g. IP multicast address) and possibly other service related parameters (e.g. service start time).

Operators/service providers may consider several service discovery mechanisms. This could include standard mechanisms such as SMS, or depending on the capability of the terminal, applications that encourage user interrogation. The method chosen to inform users about MBMS services may have to account for the users location, (e.g. current cell, in the HPLMN or VPLMN). Users who have not already subscribed to a MBMS service should also be able to discover MBMS services.

The following could be considered useful for MBMS service ~~discovery~~ announcement mechanisms (not exhaustive): -

- CBS
- MBMS Broadcast mode to advertise MBMS Multicast and Broadcast Services

- MBMS Multicast mode to advertise MBMS Multicast Services
- PUSH mechanism (WAP, SMS-PP, MMS)
- ~~Web~~ URL (HTTP, FTP)

The details of the MBMS service announcement mechanisms are not specified, but MBMS shall allow the utilisation of solutions using IETF protocols.

4.4.1.3 Joining

Joining (i.e. MBMS multicast activation by the user) is the process by which a subscriber joins (becomes a member of) a multicast group, i.e. the user indicates to the network that he/she is willing to receive Multicast mode data of a specific service.

4.4.1.4 Session Start

Session Start is the point at which the BM-SC is ready to send data. This can be identified with the start of a "Multicast session" as defined in the Stage 1. Session Start occurs independently of activation of the service by the user – i.e. a given user may activate the service before or after Session Start. Session Start is the trigger for network resources establishment for MBMS data transfer.

4.4.1.5 MBMS notification

Informs the UEs about forthcoming (and potentially about ongoing) multicast data transfer.

4.4.1.6 Data transfer

Is the phase when MBMS data are transferred to the UEs. Arrival of the first packet at the GGSN may coincide with Session Start.

4.4.1.7 Session Stop

Is the point at which the BM-SC determines that there will be no more data to send for some period of time – this period being long enough to justify removal of network resources associated with the session. At Session Stop, the network resources are released.

4.4.1.8 Leaving

Leaving (i.e. MBMS multicast deactivation by the user) is the process by which a subscriber leaves (stops being a member of) a multicast group, i.e. the user no longer wants to receive Multicast mode data of a specific service.

4.4.2 Multicast Mode timeline

4.4.2.1 Period between Service Announcement and Session Start

The service announcement may contain a schedule of Session Start times and may be sent some time before the service is due to start. So, this time period could be hours, days or even weeks.

4.4.2.2 Period between Service Announcement and Service Subscription

Service Subscription can be done anytime before or after Service announcement.

4.4.2.3 Period between Service Announcement and Joining

The Joining time is chosen by the user possibly in response to a Service Announcement. Users will typically join at the time of their choosing so that the period between announcement and joining may be very long or very short.

4.4.2.4 Period between Joining and Session Start

Some services may be ‘always on’. In this case, Joining can take place starting immediately after Service Announcement and possibly many hours before, or after, Session Start.

In other cases, if a Session Start time is known, Joining may take place immediately before Session Start or after Session Start. For these services, the announcement may contain some indication of a time period within which users should choose a time to Join the service.

4.4.2.5 Period between Session Start and First Data Arrival

Session Start indicates that the transmission is about to start. The time delay between a Session Start indication and actual data should be long enough for the network actions required at Session Start to take place e.g. provision of service information to the UTRAN, establishment of the user plane.

Session Start may be triggered by an explicit notification from the BM-SC or by first data arrival at the GGSN. In the case of user-plane resources which are set-up after the start of session data transmission, the network is not required to buffer the session data and loss of data can be assumed.

4.4.2.6 Period between Session Start and Session Stop

When the BM-SC knows that there is no more data to be sent for a “long idle period”, it should indicate Session Stop to the network, causing the release of network resources. However, if this idle period with no data is short, this may not be appropriate as it brings more signalling and processing.

There is no absolute value on the duration of this “long idle period”. The order of magnitude (i.e. is it closer to 30 seconds or 30 minutes) is to be defined taking into account UTRAN constraints.

4.4.3 BROADCAST MODE

An example for the phases of MBMS broadcast service provision is described in the figure below.

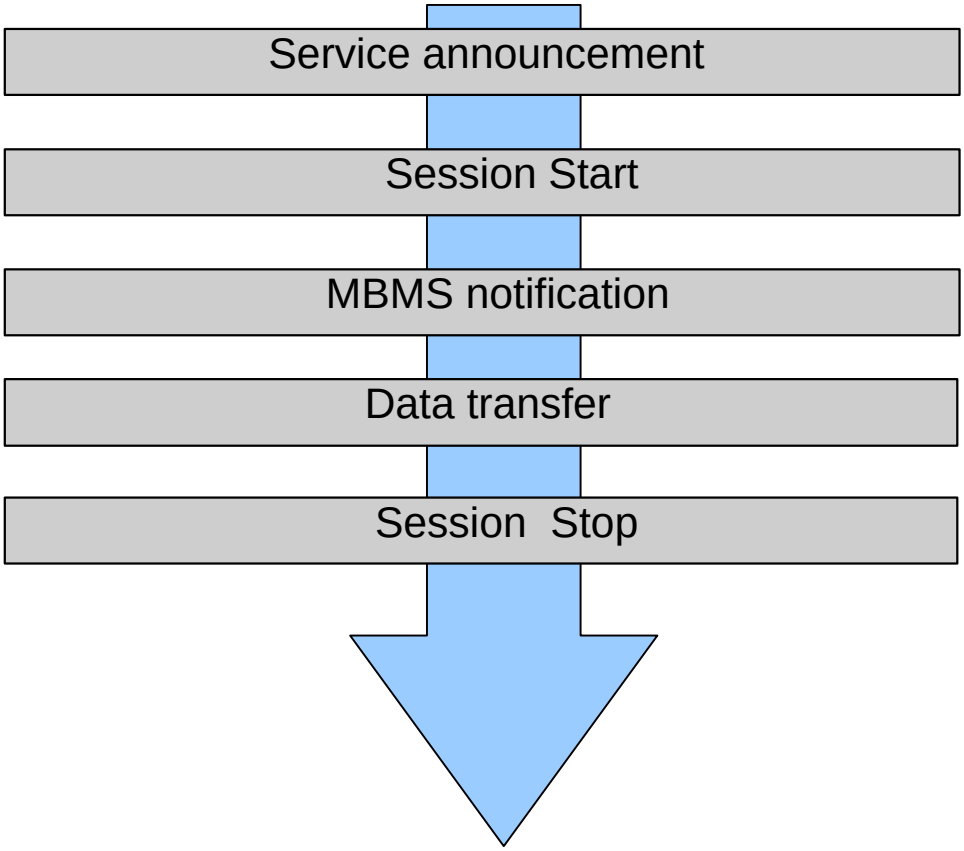


Figure 3: Phases of MBMS broadcast service provision

The sequence of phases may repeat, e.g. depending on the need to transfer data. It is also possible that the service announcement and MBMS notification phase may run in parallel with other phases, in order to inform UEs which have not yet received the related service.

4.4.3.1 Service announcement

Informs UEs about forthcoming services. Also see section on Multicast mode (4.4.1.2)

4.4.3.2 Session Start

Session Start is the point at which the BM-SC is ready to send data. This can be identified with the start of a “Broadcast session” as defined in the Stage 1. Session Start occurs independently of Service Activation by the user – i.e. a given user may activate the service before or after the start of the session. Session Start is the trigger for network resources establishment for MBMS data transfer.

4.4.3.3 MBMS notification

Informs the UEs about forthcoming (and potentially about ongoing) broadcast data transfer.

4.4.3.4 Data transfer

Is the phase when MBMS data are transferred to the UEs.

4.4.3.5 Session Stop

Is the point at which the MBMS application determines that there will be no more data to send for some period of time – this period being long enough to justify removal of network resources associated with the service. At Session Stop, the network resources are released.

4.4.4 Broadcast Mode timeline

4.4.4.1 Period between Service Announcement and Session Start

Same as for Multicast mode.

4.4.4.2 Period between Session Start and First Data Arrival

Same as for Multicast mode.

4.4.4.3 Period between Session Start and Session Stop

Same as for Multicast mode.

5 Functional Entities To Support MBMS

To provide MBMS services existing network components, GGSN, SGSN, RNC/BSC, perform several MBMS related functions and procedures, some of which are specific to MBMS. An MBMS specific network entity – Broadcast Multicast Service Centre (BM-SC) is used for service provisioning and delivery.

5.1 Broadcast-Multicast Service Centre (BM-SC)

The BM-SC is responsible for service provisioning and delivery. It may serve as an entry point for content provider MBMS transmissions, used to initiate MBMS transport bearers within the PLMN and can be used to schedule and deliver MBMS transmissions.

5.1.1 Content Provider Authentication, Authorization and Charging

The BM-SC shall be able to authenticate 3rd party content providers, providing content for MBMS transmissions.

3rd party content providers may wish to initiate an MBMS transmission . In such cases, the BM-SC shall be able to authorize content providers to transmit data over MBMS depending on operator policy.

The BM-SC shall be able to verify the integrity of data received from content providers.

The BM-SC shall be able to generate charging records for content provider transmitted data.

5.1.2 MBMS Transport

The BM-SC shall be able to provide the GGSN with transport associated parameters such as quality-of-service and multicast/broadcast area.

The BM-SC shall be able to initiate and terminate MBMS transport resources prior to and following transmission of MBMS data.

5.1.3 MBMS Transmissions

The BM-SC should be able to accept content from external sources and transmit it using error resilient schemes (e.g. specialized MBMS codecs).

Further, the BM-SC might be used to schedule MBMS transmissions, retrieve content from external sources and provide this content using MBMS transport resources.

5.1.4 Service Advertisement and Description

The BM-SC shall be able to provide service announcements for multicast and broadcast services.

The BM-SC shall be able to provide the UE with media descriptions specifying the ~~types of~~ media to be delivered as part of an MBMS (e.g. type of video and audio encodings).

The BM-SC shall be able to provide the UE with session descriptions specifying the sessions to be delivered as part of an MBMS (e.g. multicast service identification, addressing, time of transmission, etc.)

The BM-SC shall be able to deliver media and session descriptions by means of service announcements using IETF specified protocols over MBMS multicast and broadcast bearers

5.2 User Equipment

The UE shall support functions for the activation/deactivation of the MBMS service.

Once a particular MBMS service is activated, no further explicit user request is required to receive MBMS data although the user may be notified that data transfer is about to start.

The UE shall support security functions as appropriate for MBMS

The UE should, depending on terminal capabilities, be able to receive MBMS service announcements, paging information (non MBMS specific) or support simultaneous services (For example the user can originate or receive a call or send and receive messages whilst receiving MBMS video content). Reception of this paging or announcements may however, create losses in the MBMS data reception. The MBMS application should be able to cope with such losses.

Some UE depending upon terminal capability, may be able to store MBMS data. (This may involve DRM but this is out of scope of this specification)

5.3 UTRAN/GERAN

UTRAN/GERAN are responsible for efficiently delivering MBMS data to the designated multicast or broadcast service area.

Efficient delivery of MBMS data in multicast mode may require mechanisms in the UTRAN/GERAN. E.G. The number of users within a cell prior to and during MBMS transmission could be used to . choose an appropriate radio bearer.

MBMS transmissions may be initiated and terminated intermittently. The UTRAN/GERAN shall support the initiation and termination of MBMS transmissions by the core-network. Further, the UTRAN/GERAN shall be able to receive MBMS data from the core-network over Iu bearers shared by many UEs.

The UTRAN/GERAN shall support intra-RNC/BSC, inter-RNC/BSC mobility of MBMS receivers. Mobility is expected to cause limited data loss. Therefore, MBMS applications should be able to cope with potential data loss caused by UE mobility.

The UTRAN/GERAN shall be able to transmit MBMS service announcements, paging information (non MBMS specific) and support other services in parallel with MBMS (For example Depending on terminal capabilities the user could originate or receive a call or send and receive messages whilst receiving MBMS video content).

5.4 SGSN

The SGSN role within MBMS architecture is to perform user individual network control functions and to provide MBMS transmissions to RAN/GERAN.

The SGSN shall provide support for intra-SGSN and inter-SGSN mobility procedures. Specifically this requires the SGSN to store a user-specific MBMS context for each activated multicast service and to pass these contexts to the new SGSN during inter-SGSN mobility procedures.

The SGSN shall be able to generate charging data per multicast service for each user. Further, the SGSN may provide functions to support the charging of prepaid users

The SGSN shall be able to establish Iu and Gn bearers shared by many users on demand when data has to be transferred to the users. This shall be done upon notification from the GGSN. Likewise, when data is no longer available the SGSN shall be able to tear down these bearers upon notification from the GGSN.

5.5 GGSN

The GGSN role within the MBMS architecture is to serve as an entry point for IP multicast traffic as MBMS data. Upon notification from the BM-SC the GGSN shall be able to request the establishment of a user-plane for a broadcast or multicast MBMS transmission. Further, upon BM-SC notification the GGSN shall be able to tear down the established user plane. User-plane establishment for multicast services is carried out towards those SGSNs that have requested to receive transmissions for the specific multicast service

The GGSN shall be able to receive IP multicast traffic (whether from BM-SC or other data sources) and to route this data to the proper GTP tunnels set-up as part of the service.

Other functions to note here that GGSN may provide in support of MBMS service but not exclusive to MBMS are:

- Message Screening (not needed if the MBMS sources are internal in the PLMN)
- Charging Data Collection
- Service (QoS) negotiation

5.6 MBMS Data Sources and Content Provider

The reference point from the content provider to the BM-SC is not standardised

5.7 Optional Functional Element

Note: The following are FFS

5.7.1 CSE

The SGSN may use CAMEL to handle pre-paid services, e.g. credit checking for on-line charging.

5.7.2 CBC

The Cell Broadcast Centre (CBC) may be used to announce MBMS services to the users.

5.7.3 OSA-SCS

The BM-SC might use OSA-SCS to interact with third parties.

6 MBMS attributes and Parameters

Editors note: Seems like a good idea to have a section which deals with the sort of information needed such as QoS attributes, user details, things likely to be stored in O&M, HLR,BMSC etc.

6.1 MBMS UE Context

The MBMS UE Context contains UE-specific information related to a particular MBMS bearer that the UE has joined. An MBMS UE Context is created in the UE, SGSN and GGSN when the UE joins an MBMS bearer. In the SGSN, an MBMS UE Context is also created as a result of an inter-SGSN routing area update after the transfer of the MBMS UE Context from the old SGSN. It is FFS whether MBMS UE Contexts are created in the BM-SC and RNC

In the UE, SGSN and GGSN, the MBMS UE Context is stored as part of the MM Context for the UE. There is one MBMS UE Context per MBMS bearer that the UE has joined.

The content of the MBMS UE Context is described in Table 1.

Table 1: MBMS UE Context

Parameter	Description	UE	SGSN	GGSN	RNC	BM-SC
IP multicast address	IP multicast address identifying an MBMS bearer that the UE has joined.	X	X	X		
APN	Access Point Name on which this IP multicast address is defined.	X	X	X		
TMGI	Temporary Mobile Group Identity allocated to the MBMS bearer.	X	X	FFS	FFS	FFS
Linked NSAPI	NSAPI of the PDP context used by the UE to carry IGMP/MLD signalling.	X	X	X		
FFS	FFS					

6.2 MBMS Bearer Context

The MBMS Bearer Context, which is referred to as MBMS Service Context in RAN, contains all information describing a particular bearer of an MBMS service and is created in each node involved in the delivery of the MBMS data.

An MBMS Bearer Context is created in the SGSN and GGSN when the first MBMS UE Context is created in the node or when a downstream node requests it. The MBMS Bearer Context is statically configured in the BM-SC; how this is done is out of the scope of this specification. It is FFS when the MBMS Bearer Context is created in the RAN. Furthermore, it is FFS whether the state model described below is applicable as such to the RAN or whether it needs to be extended to cover the case of the RAN properly.

An MBMS Bearer Context, once created, can be in one of two states reflecting the activity status of the corresponding MBMS bearer.

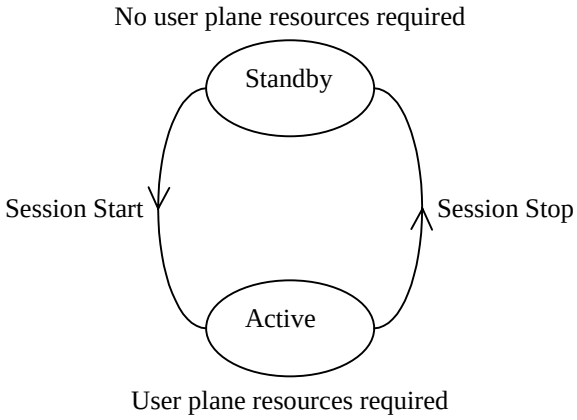


Figure 4: MBMS Bearer Context State Model

'Active' reflects the state of an MBMS Bearer Context in which user plane resources are required in the network for the transfer of MBMS data. This state is maintained as long as there is a corresponding MBMS session ongoing.

'Standby' reflects the state of an MBMS Bearer Context in which no user plane resources are required in the network for the transfer of MBMS data. This state is maintained as long as there is no corresponding MBMS session ongoing.

The content of the MBMS Bearer Context is described in Table 2.

Table 2: MBMS Bearer Context

Parameter	Description	RAN	SGSN	GGSN	BM-SC
IP multicast address	IP multicast address identifying the MBMS bearer described by this MBMS Bearer Context.	X	X	X	X
APN	Access Point Name on which this IP multicast address is defined.	X	X	X	FFS
TMGI	Temporary Mobile Group Identity allocated to the MBMS bearer.	X	X	FFS	FFS
State	State of activity of the MBMS bearer ('standby' or 'active')	FFS	X	X	X
QoS	Quality of Service required for the MBMS bearer.	X	X	X	X
MBMS Service Area	Area over which the MBMS service has to be distributed.	X	X	X	X
List of downstream nodes	List of downstream nodes that have requested the MBMS bearer and to which notifications and MBMS data have to be forwarded.		X	X	X
Number of UEs[1)] (FFS)	Number of UEs hosted by the node that have joined the multicast service.	FFS	X	X	FFS
FFS	FFS				

Editor's note 1: Number of UEs may be used to determine when the last UE leaves the node and/or for content-provider charging. The RAN knows how many UEs in RRC-CONNECTED mode are interested in a multicast service, however it does not know how many UEs in RRC-IDLE mode are interested in the service, hence the meaning and relevance of this parameter for the RAN are FFS.

6.3 Quality-of-Service

It shall be possible for the network to control quality-of-service parameters for multicast and broadcast sessions. All QoS parameters described in [3] shall be supported with the following changes:

- For **traffic class**, only the background and streaming classes shall be supported.

6.3.1 MBMS QoS distribution tree

MBMS data will be distributed to multiple users through a MBMS distribution tree that can go through many RNCs and many SGSNs. Furthermore some transport resources may be shared between many users accessing the same service in order to save resources. As a result, each branch of a MBMS distribution tree shall be established with the same QoS.

MBMS distribution tree shall have the same QoS for all its branches.

When a branch of the MBMS distribution tree has been created, it should not be possible for construction of another branch due to arrival of a new UE (or change of location of a UE with removal of a branch and addition of a new one) to impact the already established branches.

QoS value negotiation between UMTS network elements is not required. This imply that some branches may not be established if QoS requirement cannot be accepted by the concerned network node.

QoS re-negotiation feature in the RNC should not be allowed for MBMS service.

6.4 Temporary Mobile Group Identity

Temporary Mobile Group Identity (TMGI) is used for group notification purpose. It is FFS how TMGI is transmitted and it is also FFS which entity (RNC, SGSN, GGSN or BM-SC) will allocate or process TMGI.

8 MBMS Procedures

8.1 MBMS Notification

When a Session starts, UEs interested in the service (PMM-CONNECTED UEs and PMM-IDLE UEs) shall be notified.

Session attributes such as Service Id and the Multicast Area are made available in all interested RNCs during the Session Start procedure. Other parameters are FFS.

For radio efficiency reasons, the UTRAN may select on per cell basis whether to establish point-to-point or point-to-multipoint links for the distribution of MBMS data to the UEs.

In order to perform this selection, the UTRAN requests UEs to move to PMM-CONNECTED / RRC-CONNECTED state by means of MBMS group notification sent in the Multicast Area.

The fact that this group notification moves the UEs back to PMM-CONNECTED or to RRC-CONNECTED state is FFS, subject to RAN decision.

The exact number of UEs moved to PMM-CONNECTED / RRC-CONNECTED state is a decision of RAN node. It is not necessary for all UEs to move to PMM-CONNECTED/ RRC_CONNECTED in order for the RAN to decide to use point-to-multipoint, other UEs may remain in IDLE state. This is a UTRAN choice (based on RRM criteria…), FFS in RAN group.

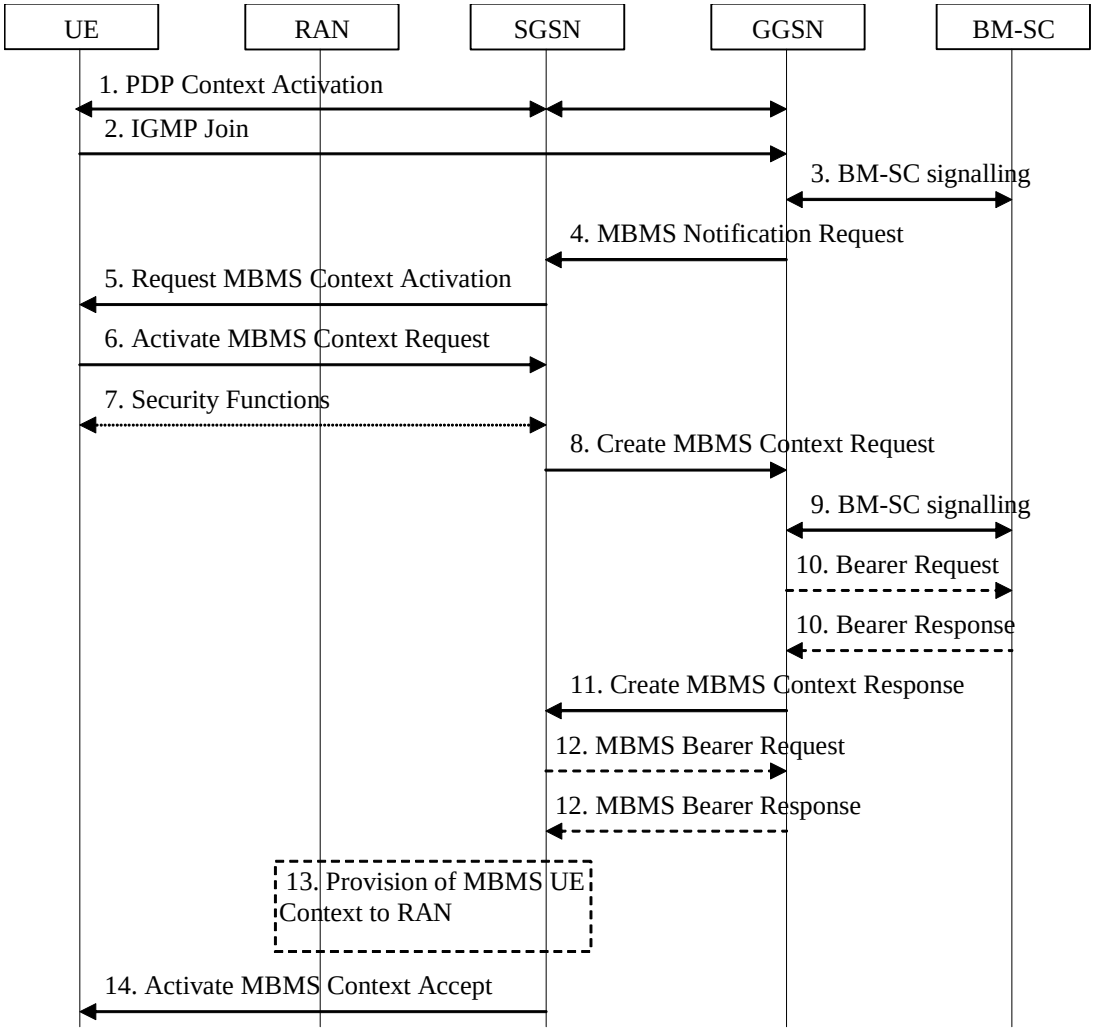
~~The exact number of UEs moved to CONNECTED state is an decission of RAN node.~~

Following the decision to set up point-to-point or point-to-multipoint links, the number of UEs that need to be maintained in CONNECTED state or moved to IDLE state for MBMS data reception is also an decision of a RAN node.

GERAN functionality is FFS.

8.2 MBMS Multicast Service Activation

The MBMS multicast service activation procedure registers the user in the network to enable the reception of data from a specific MBMS multicast service. The activation is a signalling procedure between the UE and the network. The procedure establishes MBMS UE contexts in UE, SGSN and GGSN and RNC (FFS) for each activated MBMS multicast service comparable to regular PDP contexts.


UE
RAN
SGSN
GGSN
BM-SC
1. PDP Context Activation
2. IGMP Join
3. BM-SC signalling
4. MBMS Notification Request
5. Request MBMS Context Activation
6. Activate MBMS Context Request
7. Security Functions
8. Create MBMS Context Request
9. BM-SC signalling
10. Bearer Request
10. Bearer Response
11. Create MBMS Context Response
12. MBMS Bearer Request
12. MBMS Bearer Response
13. Provision of MBMS UE Context to RAN
14. Activate MBMS Context Accept

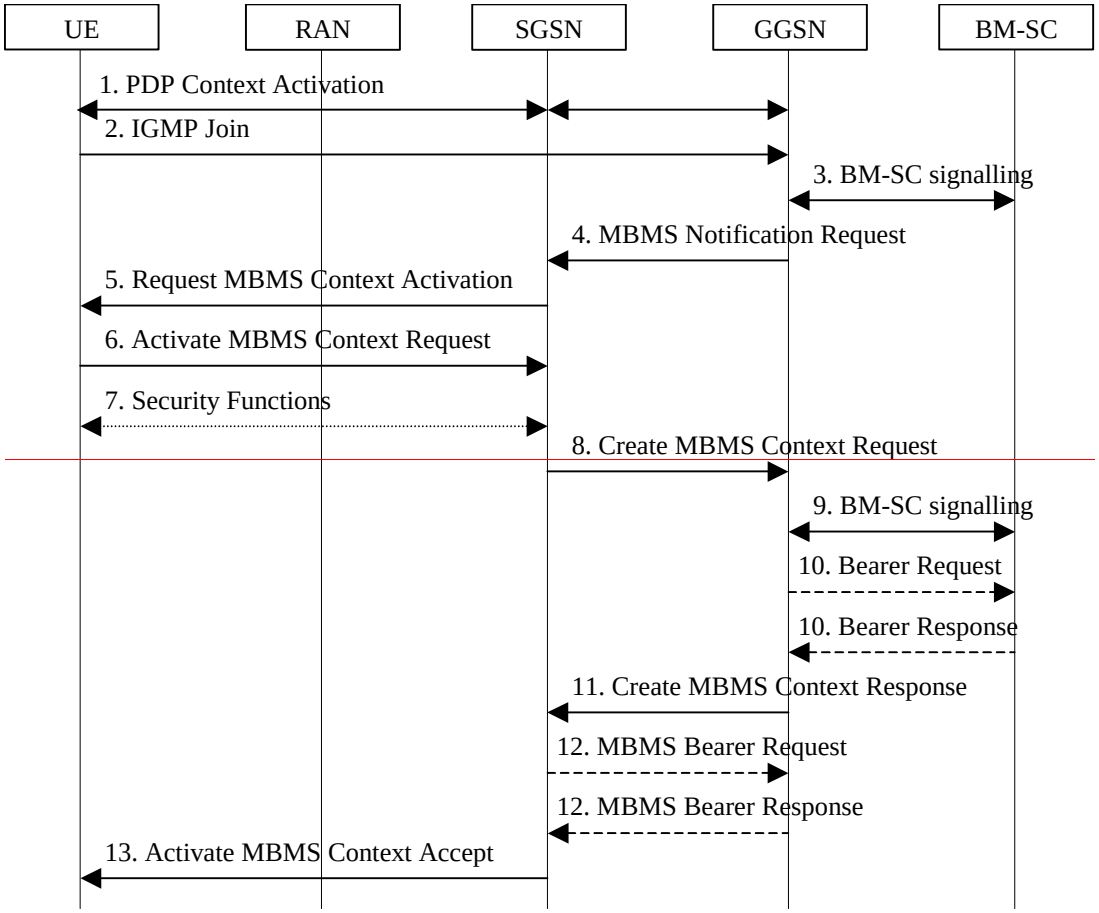


Figure 5. The activation of an MBMS multicast service

1. The UE activates a default, typically best-effort PDP context if not already established. This can be a PDP context used for basic IP services like WAP or Internet access, or it might be the signalling PDP context used for IMS access.

2. The UE sends an IGMP (IPv4) or MLD (IPv6) Join message over the default PDP context to signal its interest in receiving a particular multicast service identified by an IP multicast address.

3. This signalling between GGSN and BM-SC is FFS. It may be per user service access authorization.

4. The GGSN receives the IGMP/MLD Join request and sends an MBMS Notification Request (IP multicast address, APN, Linked NSAPI) to the SGSN. Linked NSAPI is set equal to the NSAPI of the PDP context over which the Join request was received. The IP multicast address is the one requested by the UE in the Join request. The APN may be different from the APN to which the default PDP context has been activated. In any case, the APN may resolve to a GGSN that is different from the GGSN receiving the IGMP/MLD Join request.

5. The SGSN sends a Request MBMS Context Activation (IP multicast address, APN, Linked NSAPI) to the UE to request it to activate an MBMS context. Linked NSAPI allows the UE to associate the MBMS Context with the PDP context over which it sent the IGMP/MLD Join message in step 2.

6. The UE creates an MBMS UE context and sends an Activate MBMS Context Request (IP multicast address, APN) to the SGSN. The IP multicast address identifies the MBMS multicast service, which the UE wants to join/activate. An APN may indicate a specific GGSN.

7. Security Functions may be performed, e.g. to authenticate the UE.

8. It is FFS whether the SGSN performs a subscription check for the requested MBMS multicast service identified by the IP multicast address and APN or whether another network entity performs this check. The SGSN creates an MBMS UE context and sends a Create MBMS Context Requests (IP multicast address, APN) to the GGSN.

9. This signalling between GGSN and BM-SC is FFS. It may be per user service access authorization. Also the GGSN or another network entity may perform a subscription check for the requested MBMS multicast service identified by the IP multicast address and APN.

10. If the GGSN does not have the MBMS Bearer Context information for this MBMS service, the GGSN sends a Bearer Request to the BM-SC. See subclause "MBMS Bearer Request Procedure".

    The BM-SC responds with a Bearer Response containing the MBMS Bearer Context information for this MBMS service and adds the identifier of the GGSN to the "list of downstream nodes" parameter in its MBMS Bearer Context. See subclause "MBMS Bearer Request Procedure".

11. The GGSN creates an MBMS UE context and sends a Create MBMS Context Response to the SGSN.

12. If the SGSN does not have the MBMS Bearer Context information for this MBMS service, the SGSN sends a MBMS Bearer Request to the GGSN. See subclause "MBMS Bearer Request Procedure".

    The GGSN responds with a MBMS Bearer Response containing the MBMS Bearer Context information for this MBMS service and adds the identifier of the SGSN to the "list of downstream nodes" parameter in its MBMS Bearer Context. See subclause "MBMS Bearer Request Procedure".

13. It is FFS whether the SGSN provides RAN with the MBMS UE Context or if the RAN requires the MBMS UE context.

14 The SGSN sends an Activate MBMS Context Accept to the UE. The SGSN does not need to wait for step 12 to be completed before sending this message.

8.3 MBMS Session Start Procedure

The BM-SC initiates the MBMS Session Start procedure when it is ready to send data. This is a request to activate all necessary resources in the network for the transfer of MBMS data and to notify interested UEs of the imminent start of the transmission.

Through this procedure, session attributes such as QoS, Multicast Area (tracking/non-tracking area are FFS) are provided to the GGSN(s) and SGSN(s) that have previously requested the corresponding MBMS Bearer and to RNC(s) hosting interested UEs in PMM-IDLE or PMM-CONNECTED ~~mode~~state.

Session attributes are provided to SRNCs hosting UEs in PMM-CONNECTED mode and to RNCs of last known RA hosting UEs in PMM-IDLE mode via the Iu interface.

Session attributes are also provided to the DRNCs hosting UEs in PMM-CONNECTED mode. Interface used to transfer service information to DRNC is FFS (depending on ongoing work in RAN groups).

The overall Session Start procedure is presented in the following figure:

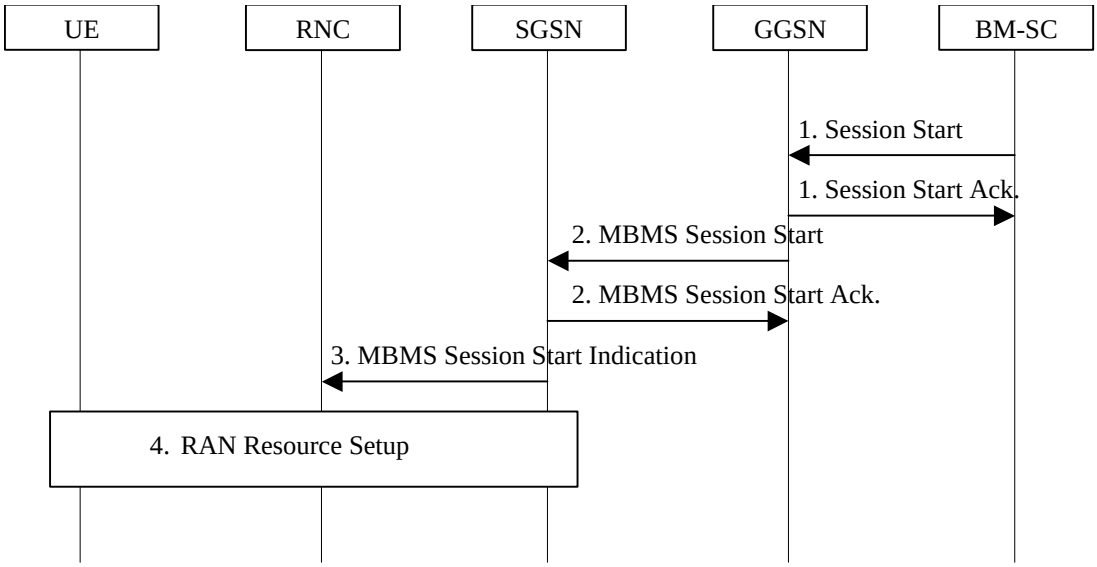


Figure 6 Session Start procedure

1. The BM-SC sends a Session Start message to indicate the impending start of the transmission and to provide the session attributes (QoS, Multicast Area…) to the GGSN(s) that have previously requested the corresponding MBMS Bearer.

2. The GGSN stores the session attributes in the MBMS Bearer Context and sends an MBMS Session Start message to the SGSNs that have requested the corresponding MBMS Bearer. The SGSN stores the session attributes in the MBMS Bearer Context and responds with an MBMS Session Start Acknowledge message providing the TEID for user plane that the GGSN shall use for forwarding the MBMS data.

3. The SGSN sends an MBMS Session Start Indication message including the session attributes to RNCs hosting interested UEs (in PMM-IDLE or PMM-CONNECTED mode). The exact nature of this message and the behaviour of the RNC when receiving this message are FFS depending on ongoing work in RAN groups.

4. The RNC stores the session attributes in the MBMS Service Context and the RAN establishes the necessary radio and Iu resources for the transfer of MBMS data to the interested UEs. The detailed procedures are FFS depending on ongoing work in RAN groups.

Note: The upstream node normally provides the session attributes once per MBMS session to each registered node. Due to SGSN in pool however, a RNC may receive the session attributes from several SGSNs.

8.4 MBMS Bearer Request Procedure

The MBMS Bearer Request is the procedure by which a downstream node informs an upstream node that it would like to receive a particular MBMS bearer in order to distribute it further downstream. This procedure builds up a distribution tree for the delivery of MBMS data from the BM-SC to the UEs interested in the service. This procedure results in the set-up of a corresponding MBMS Bearer Context in the nodes along the distribution tree, but it does not result in the establishment of user plane resources unless the transmission has already started.

The MBMS Bearer Request procedure is initiated:

- When the first MBMS UE Context for a particular MBMS service is created in the SGSN or GGSN (see subclause “MBMS UE Context”);

- When a request for a particular bearer is received from a downstream node but the corresponding MBMS Bearer Context is not established in the node; or

- When an RNC detects it is responsible for the distribution of MBMS data (see subclause “RAN Resource Setup).

NOTE: The terms 'downstream' and 'upstream' refer to the topological position of one node with respect to another and relative to the direction of the MBMS data flow, i.e. from BM-SC to UE.

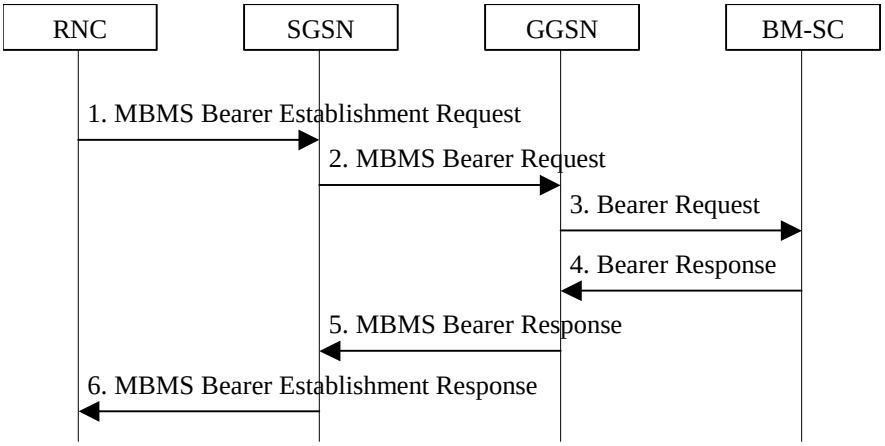


Figure 7: MBMS Bearer Request procedure

1. When the MBMS Service Context is established in the RAN and as UEs in PMM-CONNECTED mode move from an area currently receiving the MBMS data to an area not receiving it, the RNC responsible for the MBMS data distribution requests the establishment of the MBMS bearer to its parent SGSN if not already done (see subclause "RAN Resource Setup"). How the RNC determines its parent SGSN is a matter of implementation.

2. Upon reception of an MBMS Bearer Establishment Request from an RNC requesting an MBMS bearer for which the SGSN has no corresponding MBMS Bearer Context, or when the first MBMS UE Context for a particular MBMS service is created in the SGSN, the SGSN sends an MBMS Bearer Request (IP multicast address, APN, TEID) message to the GGSN. How the SGSN selects a GGSN is a matter of implementation; it may for instance be based on prior signalling related to a particular UE or via APN resolution. The SGSN allocates a TEID that the GGSN shall use to forward MBMS data to the SGSN in case the transmission has already started (the TEID will be released in step 5 if this is not the case).

   If the SGSN already has an MBMS Bearer Context for the MBMS bearer requested, the SGSN jumps directly to step 6, i.e. it responds directly to the RNC with an MBMS Bearer Establishment Response message.

3. Upon reception of an MBMS Bearer Request from an SGSN requesting an MBMS bearer that is not already established in the GGSN, or when the first MBMS UE Context for a particular MBMS service is created in the GGSN, the GGSN sends a Bearer Request (IP multicast address, APN) message to the BM-SC. The exact nature of the signalling between GGSN and BM-SC is however FFS in general.

   If the GGSN already has an MBMS Bearer Context for the MBMS bearer requested, the GGSN jumps directly to step 5, i.e. it responds directly to the SGSN with an MBMS Bearer Response message.

4. Upon reception of a Bearer Request from a GGSN, the BM-SC adds the identifier of the GGSN to the "list of downstream nodes" parameter in its MBMS Bearer Context and responds with a Bearer Response (IP multicast address, APN, Session Attributes, State, FFS: TMGI) message. The Session Attributes are the QoS required for the bearer and the Multicast Area (other attributes such as tracking/non-tracking are FFS). The exact nature of the signalling between GGSN and BM-SC is however FFS is general.

   The GGSN creates an MBMS Bearer Context where it stores the information it has received about the MBMS bearer.

5. After creating the MBMS Bearer Context or if it was already available, the GGSN responds to the MBMS Bearer Request received from the SGSN in step 2 with an MBMS Bearer Response (IP multicast address, APN, Session Attributes, State, FFS: TMGI) message and adds the identifier of the SGSN to the "list of downstream nodes" parameter in its MBMS Bearer Context.

   The SGSN creates an MBMS Bearer Context where it stores the information it has received about the MBMS bearer. If the state of the MBMS Bearer Context is 'standby', i.e. the transmission has not started yet, the SGSN releases the TEID allocated in step 2.

6. The SGSN responds to the MBMS Bearer Establishment Request received from the RNC in step 1 with an MBMS Bearer Establishment Response containing the necessary information to establish the tunnel for the transport of MBMS data over the Iu interface (see subclause "RAN Resource Setup") and adds the identifier of the RNC to the "list of downstream nodes" parameter in its MBMS Bearer Context.

8.5 MBMS Session Stop Procedure

The BM-SC initiates the MBMS Session Stop procedure when it considers the session to be terminated. The session is typically terminated when there is no more MBMS data expected to be transmitted for a sufficiently long period of time to justify a release of user plane resources in the network. The procedure is propagated ~~along the MBMS data distribution tree formed by~~to all nodes that have requested the corresponding MBMS bearer and to SRNCs hosting interested UEs.

The overall MBMS Session Stop procedure is presented in the following figure:

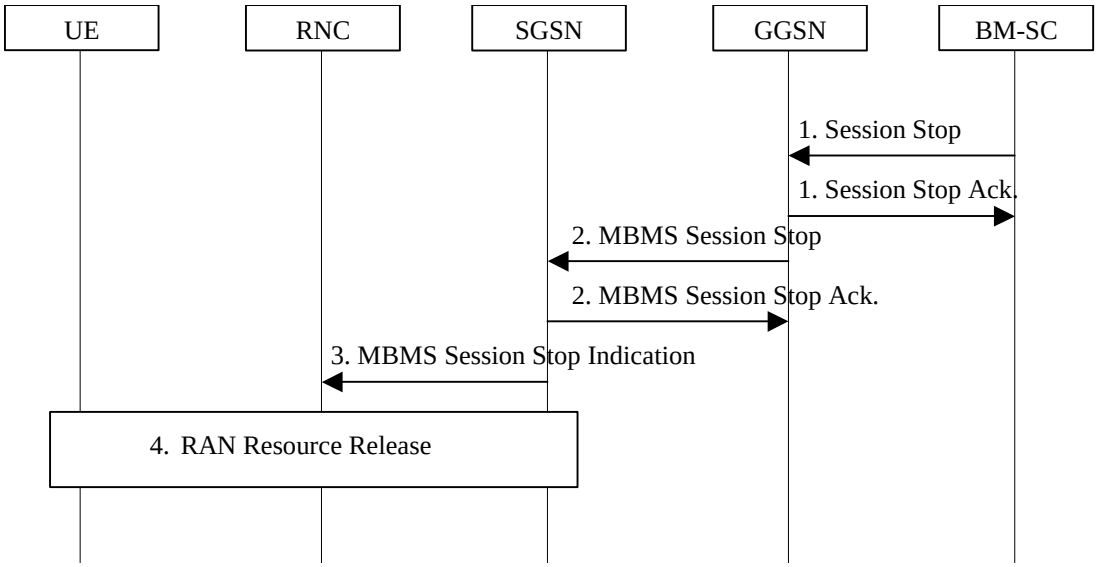


Figure 8 MBMS Session Stop procedure

1. The BM-SC sends a Session Stop message to all GGSNs that have previously requested the MBMS bearer to indicate that the session is terminated and the user plane resources can be released.

2. The GGSN sends an MBMS Session Stop message to all SGSNs listed in the "list of downstream nodes" parameter of the affected MBMS Bearer Context, releases the corresponding user plane resources towards these SGSNs and sets the state attribute of its MBMS Bearer Context to 'Standby'.

3. The SGSN releases the TEID and user plane resources on which it was receiving MBMS data from the GGSN for the affected MBMS bearer and sends an MBMS Session Stop Indication message to all the RNCs listed in the "list of downstream nodes" of the corresponding MBMS Bearer Context. The exact nature of this message and the behaviour of the RNC when receiving this message are FFS depending on ongoing work in RAN groups.

4. The RNC releases the affected radio and Iu resources. The detailed procedures are FFS depending on ongoing work in RAN groups.

8.6 MBMS Bearer Release Procedure

The MBMS Bearer Release is the procedure by which a downstream node informs an upstream node that it does not need a particular MBMS bearer anymore and therefore would like to be removed from the corresponding distribution tree.

The MBMS Bearer Release procedure is initiated:

- By the SGSN or GGSN when the last MBMS UE Context for a particular MBMS service is deleted from the node and the "list of downstream nodes" parameter in the corresponding MBMS Bearer Context is empty;
- By the SGSN or GGSN when the last node registered in the "list of downstream nodes" releases an MBMS bearer for which there is no corresponding MBMS UE Context; or
- By the RNC when it deletes the associated MBMS Service Context, or (FFS) when it detects that it is not responsible for the distribution of MBMS data for a particular MBMS service anymore (see subclause "RAN Resource Setup").

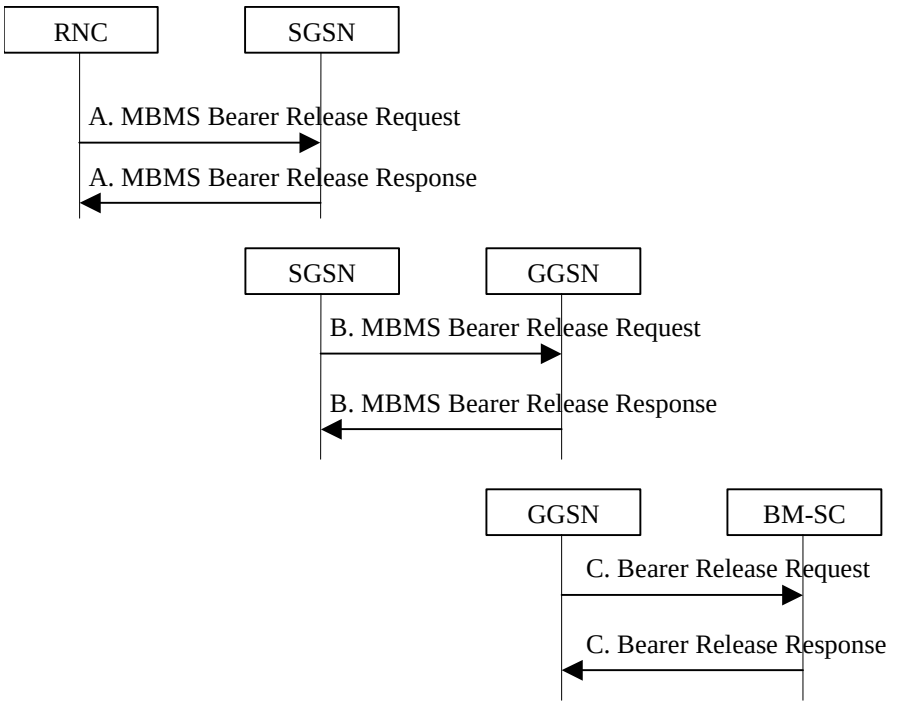


Figure 9: MBMS Bearer Release Procedure

A. When the MBMS Service Context is deleted from the RAN, which could be when the RNC no longer hosts any UE interested in that MBMS service, the RNC requests the release of the MBMS bearer to its parent SGSN. It is FFS whether when the responsibility for the MBMS data distribution to UEs in PMM-CONNECTED mode changes from the SRNC to the DRNC, or vice versa, the RNC that is not longer responsible for the MBMS data distribution requests the release of the MBMS bearer to its parent SGSN (see subclause "RAN Resource Setup" for more details). As an implementation option, the RNC may decide not to release the MBMS bearer immediately when these conditions are met, e.g. in order to avoid unnecessary signalling in the case where the RNC would again need the same MBMS bearer shortly after.

   The SGSN removes the identifier of the RNC from the "list of downstream nodes" parameter of the affected MBMS Bearer Context and confirms the operation by sending an MBMS Bearer Release Response message to the RNC.

B. When the "list of downstream nodes" of a particular MBMS Bearer Context in the SGSN becomes empty and the SGSN has no MBMS UE Contexts linked to that MBMS Bearer Context, the SGSN sends an MBMS Bearer Release Request (IP multicast address, APN) message to its upstream GGSN.

   The GGSN removes the identifier of the SGSN from the "list of downstream nodes" parameter of the affected MBMS Bearer Context and confirms the operation by sending an MBMS Bearer Release Response message to the SGSN.

C. When the "list of downstream nodes" of a particular MBMS Bearer Context in the GGSN becomes empty and the GGSN has no MBMS UE Contexts linked to that MBMS Bearer Context, the GGSN sends a Bearer Release Request (IP multicast address, APN) message to the BM-SC. The exact nature of the signalling between GGSN and BM-SC is however FFS in general.

The BM-SC removes the identifier of the GGSN from the "list of downstream nodes" parameter of the affected MBMS Bearer Context and confirms the operation by sending a Bearer Release Response message to the GGSN.

8.6.1 MBMS Bearer Release Procedure – Complete teardown

The MBMS Bearer Release Procedure is initiated by BM-SC when the specific MBMS service is terminated. This procedure tears down the distribution tree for the delivery of MBMS data. This procedure results in the releasing of all MBMS Bearer Contexts and associated MBMS UE Contexts in the nodes along the distribution tree.

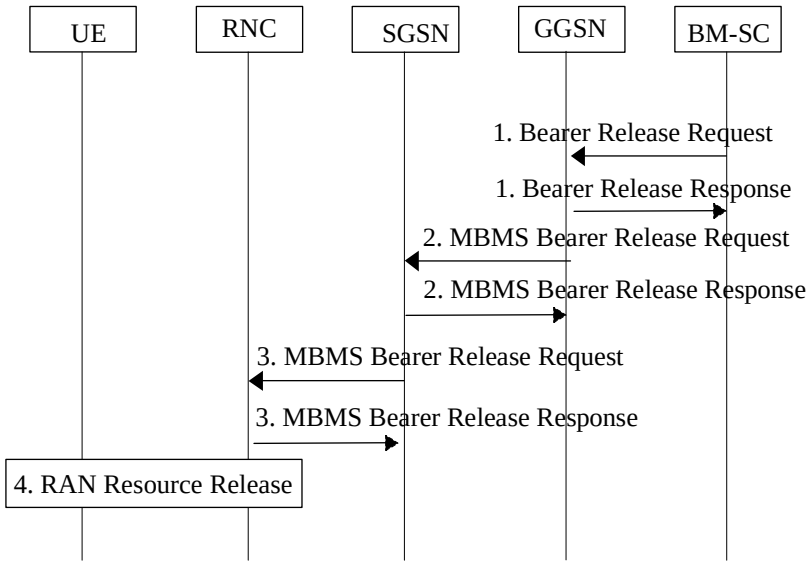


Figure 10: BM-SC initiated MBMS Bearer Release Procedure

1. The BM-SC sends a Bearer Release Request message to all GGSNs that have previously requested the MBMS bearer to indicate the session is terminate and the MBMS bearer resources can be released.

   The GGSN releases all MBMS UE Contexts and the affected MBMS Bearer Context and returns a Bearer Release Response message to the BM-SC. The BM-SC releases all MBMS UE Contexts and removes the identifier of the GGSN from the "list of downstream nodes".

2. The GGSN sends an MBMS Bearer Release Request message to all SGSNs listed in the "list of downstream nodes" parameter.

3. The SGSN releases all MBMS UE Contexts and the affected MBMS Bearer Context and returns a MBMS Bearer Release Response message to the GGSN. The SGSN sends an MBMS Bearer Release Request message to all RNCs listed in the "list of downstream nodes" parameter.

   RNC confirms the resource release by returning an MBMS Bearer Release Response message to the SGSN

4. The RNC releases the affected radio resources. The detailed procedures are FFS depending on ongoing work in RAN groups. RAN may notify the UEs that the service has being terminated, so that the UE can locally deactivate its MBMS UE context, detailed procedures are FFS~~Editor's note: This procedure has yet to be completed.~~

8.7 Multicast Service Deactivation

Editor's note: This procedure has yet to be completed.

8.8 Iu Bearer Plane release procedure

A RNC triggers the Iu Bearer Plane release procedure if the RNC has no further use for the user plane (i.e. no UEs left in the coverage area of the RNC or session stop) (hysterisis mechanisms can be used in the RNC to avoid continuous Bearer plane establishments and releases).

8.9 RAN Resource Setup

Editor's note: The content of this subclause is dependent on ongoing work in RAN groups. The main focus of this section should be on the externally observable behaviour of the RAN (as seen from the Iu interface) and aspects that have direct impact on CN procedures. This subclause should in particular describe which of the SRNC, DRNC or CRNC is responsible for MBMS data distribution depending on whether ptp or ptm distribution has been selected.]

9 Security

- A SIM or USIM shall be present in the UE to receive MBMS multicast services.
- MBMS multicast data transmission to the UEs shall be secured.
- MBMS security shall be provided by encryption and integrity protection between the UE and the BM-SC.
- The BM-SC shall be able to authenticate and authorize each MBMS content provider.
- The integrity of MBMS data received from the content provider shall be guaranteed.

Editors note: Probably need SA3 input, also linked to Key Issues on Key distribution etc..

10 Charging requirement

Editors note: What do we put here, what is SA5 involvement.

MBMS architecture shall support on-line and off-line charging.

It shall be possible to collect charging information for the multicast mode. It shall also be possible to collect charging information for MBMS services in visited networks.

MBMS shall collect charging information about the transmission of MBMS broadcast or multicast data that are provided by content or service providers (e.g. 3rd parties). This shall enable billing of broadcast and multicast content or service providers.

To enable billing of broadcast and multicast content providers, data shall be collected at the BM-SC.

Annex A (Informative): Information flows

A.1 General information flow

Annex B

Change history

It is usual to include an annex (usually the final annex of the document) for reports under TSG change control which details the change history of the report using a table as follows:

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2002-06					First Version		0.0.0
2002-09					Output from SA2 #27, inclusion of S2-023072		0.1.0
2002-11					Output from SA2 #28, inclusion of S2-023591, S2-023592, S2-023593, S2-023594, S2-023595, S2-023596 +S2-022967 From SA2#17	0.1.0	0.2.0
2002-12					Addition of official TS number	0.2.0	0.2.1
2003-02					Output from SA2#29 and e-mail approval: S2-030382, S2-030284, S2-030385rev4, S2-030386r1, S2-030387	0.2.1	0.3.0
2003-02					Output from SA#30, inclusion of S2-030626, S2-030647 an S2-030651	0.3.0	0.4.0
2003-04					Output from SA2#31, inclusion of S2-031236, S2-031238, S2-031237r2	0.4.0	0.5.0
					Output from SA2#32, inclusion of S2-031843, S2-031844, S2-031845, S2-031849, S2-031850, S2-032118, S2-032119	0.5.0	0.6.0