**3GPP TSG- Meeting #**130 ***r02***

**, , -**  revision of S4aI240179

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
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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 |  | Core Network | **X** |

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| ***Title:***  |  |
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| ***Work item code:*** |  |  | ***Date:*** |  |
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| ***Category:*** |  |  | ***Release:*** |  |
|  | *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 canbe 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-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
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| ***Reason for change:*** | The MBS User Service architecture and protocol follows the modern design philosophies of the 5G System with separation of user services from transport, a service-based architecture and RESTful APIs. At the same time, eMBMS and enTV as used for LTE-based 5G Broadcast support a transparent delivery mode. While interworking in between MBMS and MBS is addressed in TS 23.247, interworking between these two systems at the User Service level is not addressed. In order for MBMS and LTE-based 5G broadcast to leverage MBS User Service technologies, a study is warranted to identify the gaps to fully support this functionality. |
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| ***Summary of change:*** | Addresses the work item objectives for this key issue* Documents the key issue in more detail, in particular how they relate to the 3GPP Media Delivery architecture and/or the MBS User Service architecture
* Studies collaboration scenarios between the Application Service Provider and the 5G System and for each of the key topics.
* Based on existing architectures, provides one or more deployment architectures that address the key topics and the collaboration models.
* Maps the key topics to basic functions and develop high-level call flows.
* Identifies the issues that need to be solved.
* Provides candidate solutions including call flows, protocols and APIs for each of the identified issues.

Identifies gaps and recommend potential normative work for stage-2 and stage-3, including which existing specifications would be impacted and/or if any new specifications would preferably be developed. |
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| ***Consequences if not approved:*** |  |
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| ***Clauses affected:*** | 2, 5.10 (new) |
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|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TR 26.802 CR 0001 |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** | Updated scope, references and abbreviations are in CR 0001**References**[103720] ETSI TS 103 720, 5G Broadcast System for linear TV and radio services; LTE-based 5G terrestrial broadcast system[23247] 3GPP TS 23.247, 3GPP TS 23.247: "Architectural enhancements for 5G multicast-broadcast services; Stage 2".[26502] 3GPP TS 26.502, 5G multicast-broadcast services; User service architecture**Abbrevations**:XXX XXXX |
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| ***This CR's revision history:*** |

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| [**S4aI240151**](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Docs/S4aI240151.zip) | [FS\_AMD] MBS User Service and Delivery Protocols for eMBMS | Qualcomm Germany | Thomas Stockhammer |

**E-mail Discussion**:**Revisions**:

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| icon | [S4aI240151r01.docx](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Inbox/Drafts/S4aI240151r01.docx) | 2024/10/18 12:42 | 568,6 KB |
| icon | [S4aI240151\_BBC.docx](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Inbox/Drafts/S4aI240151_BBC.docx) | 2024/10/16 19:41 | 569,5 KB |

**Presenter**: Thomas Stockhammer**Online Discussion**: October 18, 2024* Thomas presents version [r01](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Inbox/Drafts/S4aI240151r01.docx).
	+ Small online revisions

**Decision**:* October 18, 2024: r01 not presented, but revision is done. Revision is postponed

[S4aI240151](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Docs/S4aI240151.zip) is **revised** to [S4aI240179](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Docs/S4aI240179.zip).

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| [S4aI240179](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Docs/S4aI240179.zip) | [FS\_AMD] MBS User Service and Delivery Protocols for eMBMS | Qualcomm Germany | Thomas Stockhammer |

**Presenter**: Thomas Stockhammer**Online Discussion**: **Decision**:* October 18, 2024: postponed
* October 25, 2024: not treated => expect resubmission for SA4#130

[S4aI240179](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Docs/S4aI240179.zip) is **not treated**.This is a resubmission of 179. |

## ===== CHANGE =====

## 2 References

[15] 3GPP TS 26.348: "Northbound Application Programming Interface (API) for Multimedia Broadcast/Multicast Service (MBMS) at the xMB reference point"

[16] 3GPP TS 26.346: "Multimedia Broadcast/Multicast Service (MBMS); Protocols and Codecs",

…

[18] 3GPP TS 29.468: "Group Communication System Enablers for LTE (GCSE\_LTE); MB2 Reference Point; Stage 3".

[19] 3GPP TS 23.468: "Group Communication System Enablers for LTE (GCSE\_LTE); Stage 2".

…

[26] 3GPP TS 23.247: "Architectural enhancements for 5G multicast-broadcast services; Stage 2;" Release 17.

…

[26502] 3GPP TS 26.502: "5G multicast-broadcast services; User service architecture".

[103720] ETSI TS 103 720: "LTE-based 5G Broadcast System".

[23479] 3GPP TS 23.479: "UE MBMS APIs for Mission Critical Services".

## ===== CHANGE (new – presented w/o revision marks) =====

## 5.10 Key Issue #9: MBS User Service and Delivery Protocols for eMBMS

### 5.10.1 Description

The MBS User Service architecture and protocol follows the modern design philosophies of the 5G System with separation of user services from transport, a service-based architecture and RESTful APIs. At the same time, eMBMS and enTV (as used for LTE-based 5G Broadcast) support transparent delivery mode and group communication. While interworking between MBMS and MBS is addressed in clause 5.2 of TS 23.247 [26] and clause 4.9 of TS 26.502 [26502], interworking between these two systems at the User Service level is not addressed. In order for MBMS and LTE-based 5G broadcast as defined in ETSI TS 103 720 [103720] to leverage MBS User Service technologies, a study is warranted to identify the gaps to fully support this functionality.

Figure 5.10.1-1 reproduces the MBS–eMBMS interworking system architecture as documented in figure 4.9-1 of TS 26.502 [26502]. The functional elements that fall within the scope of [26502] are highlighted in green.



Figure 5.10.1‑1: MBS–eMBMS interworking system architecture (see TS 26.502 [26502], figure 4.9-1)

The interworking architecture defined in clause 4.9 of [26502] addresses the following functionalities:

1. Using MBS northbound interfaces at reference point Nmb10 for MBS, and using eMBMS northbound interfaces at reference point xMB-C or MB2-C for eMBMS.

2. Potential dynamic switching between MBS and eMBMS reception, if a UE implements both an MBS Client and an eMBMS Client.

3. Common ingest of content through reference point Nmb8/xMB-U, if these reference points are compatible.

4. Common MBS User Services distribution and eMBMS delivery methods such that the same ingested content can be delivered to an MBS Client and to an eMBMS Client. UEs supporting only eMBMS are served by this architecture as well.

However, there is no guarantee that 3 and 4 can generally be achieved in practice.

### 5.10.2 Collaboration scenarios and architecture mapping

#### 5.10.2.1 Joint BM-SC + MBSF functionality

A more common interest is the ability to deploy a system for which MBS User Services are distributed via eMBMS. This would allow a single, common User Service specification for MBS and eMBMS/5G Broadcast to be maintained going forward. A modification of the architecture is shown in figure 5.10.2-1 in which:

- Only the MBS northbound reference points Nmb10 and Nmb8 are exposed respectively by the MBSF and MBSTF. These are extended as required to support eMBMS transport (as those are extended, they are marked with an asterisk).

- The UE in the 5G System is extended to support eMBMS reception, for example an LTE-based 5G Broadcast profile as defined in ETSI TS 103 720 [103720]. Such an approach permits a single middleware client with unified APIs, etc. to be deployed in the UE that is capable of both MBS User Service reception and eMBMS User Service reception.



Figure 5.10.2‑1: MBS User Services on top of eMBMS

#### 5.10.2.2 MBS User Services feeding only eMBMS

A further variant of the architecture is shown in figure 5.10.2-2, in which case MBS radio delivery is not even in scope, but the MBS User Service is used to deliver only eMBMS traffic.



Figure 5.10.2‑2: MBS User Services on top of eMBMS

#### 5.10.2.3 MBS User Services on top of eMBMS using Group Communication

Another possible implementation architecture is shown in figure 5.10.2.3-1 where a subset of MB2 procedures and protocols is used southbound of the MBSF and MBSTF to communicate with the EPS via a function implementing the Group Communication functionality of a BM-SC. Such a deployment architecture may be of interest in order to address a combination of MBS User services with eMBMS radio delivery.

According to TS 26.346 [16], the Group Communication Service (GCS) AS as defined by TS 23.468 [19] uses the MBMS Group Communication delivery method on top of MBMS bearers for MBMS delivery. However, in general, the MBMS Group Communication delivery method is available for any application. In this case, the application interfaces to the BM-SC at reference point MB2. This carries control plane signalling (via reference point MB2-C) and user plane data (via reference point MB2-U) between the Application Server for Group Communication (GCS AS) and the BM-SC. The data transferred via MBMS bearer(s) is delivered from the BM-SC using the Group Communication delivery method as defined in TS 26.346 [16]. Stage 2 procedures between the GCS AS and the BM-SC at reference point MB2 are provided in TS 23 468. The stage 3 specification of the MB2 procedures and the protocol aspects of MB2-C and MB2-U are specified in TS 29.468 [18].



Figure 5.10.2.3-1: MBS User Services on top of eMBMS using Group Communication

In this deployment scenario, with reference to the interworking architecture defined in annex C of TS 23.247 [26], the MBS User Service is treated as an application on top of the Group Communication delivery method:

- The MBSF additionally implements the relevant subset of GCS AS control plane functionality, including MB2-C provisioning operations at a new reference point MB2′-C, allowing it to control a separate BM-SC that implements at least Group Communication functionality.

- The MBSTF additionally implements the relevant subset of GCS AS user plane functionality, including MB2-U protocols at a new reference point MB2′-U to exchange user plane data with a separate BM-SC that implements at least Group Communication functionality.

- A UE connecting to the E-UTRAN implements the relevant MBS User Service functionalities above suitable eMBMS middleware (MBMS Client) to support the reception of MBS User Services via the Group Communicaton API as defined in TS 23.479 [23479].

 The MBMS Client only includes the Access Stratum as well as the functionality to establish the group communication API.

Figure 5.10.2.3-2 provides an MBS/eMBMS interworking reference architecture for this purpose including the client architecture based on what is available in figure 4.9-2 of TS 26.502 [26502].



Figure 5.10.2.3-2: MBS–eMBMS interworking reference architecture on top of eMBMS
using Group Communication

In this case, the application only needs to have knowledge of MBS, but can use MBMS/GCS delivery. There is a *Joint MBS Client + MBMS-Aware Application* that can use GCS API to connect to MBMS delivery.

#### 5.10.2.4 MBS User Services on top of eMBMS using Transparent Delivery

Yet another possible architecture is shown in figure 5.10.2.4-1 where a subset of xMB provisioning procedures and protocols are used southbound of the MBSF and MBSTF to communicate with the EPS via a function implementing the Transparent Delivery functionality of the BM-SC.



Figure 5.10.24-1: MBS User Services on top of eMBMS using Transparent Delivery

NOTE: In a normative spec a client architecture diagram is expected to be provided.

In this scenario, with reference to the interworking architecture defined in annex C of TS 23.247 [26]:

- The MBSF additionally implements the relevant subset of Content Provider control plane functionality, including xMB-C provisioning operations at a new reference point xMB′-C, allowing it to control a separate BM-SC that implements at least Transparent Delivery functionality.

- The MBSTF additionally implements the relevant subset of Content Provider user plane functionality, including xMB-U protocols at a new reference point xMB′-U to exchange user plane data with a separate BM-SC that implements at least Transparent Delivery functionality.

- A UE connecting to the E-UTRAN would implement the relevant MBS User Service functionalities above suitable eMBMS middleware (MBMS Client) to support the reception of the MBS User Services via the transparent delivery mode API as defined in TS 26.347 [26347].

Figure 5.10.2.4-2 provides an MBS/eMBMS interworking reference architecture for this purpose including the client architecture based on what is available in figure 4.9-2 of TS 26.502 [26502].



Figure 5.10.2.4-2: MBS–eMBMS interworking reference architecture on top of eMBMS
using Transparent Mode

In this case, the application only needs to have knowledge of MBS, but can use MBMS transparent delivery. There is a *Joint MBS Client + MBMS-Aware Application* that can use MBMS-API to connect to MBMS delivery.

### 5.10.3 High-level call flows

#### 5.10.3.1 Joint BM-SC and MBSF Functionality

The extended high-level baseline procedures for MBS User Services for the architecture showing in figure 5.10.2-2 are shown in figure 5.10.3.1-1, highlighting in bold the extensions to the call flow in clause 5.2.1 of TS 26.502[26502].

Figure 5.10.3.1-1: MBS User Service high-level baseline procedures
with Joint BM-SC and MBSF Functionality

The same procedures as defined in clause 5.2 of TS 26.502 [26502], apply, but the distribution of content in steps 9 and 11 is via eMBMS. However, the detailed procedures documented in the remainder of clause 5 in TS 26.502 need further consideration to support eMBMS distribution.

In clauses 5.3, 5.3A, and 5.5 of TS 26.502, the communication with the MB-SMF to allocate TMGIs, create sessions, update sessions, or delete sessions is extended with a communication with the MBMS-GW at reference point SGmb, and the procedures defined in clause 8 of TS 23.246 [6] apply instead. In particular:

- The BM-SC sends a Session Start Request message to MBMS-GW to indicate the impending start of the transmission and to provide the session attributes (TMGI, Flow Identifier, QoS, MBMS service Area, list of cell IDs if available, Session identifier, estimated session duration, list of MBMS control plane nodes (MMEs, SGSNs) for MBMS GW, time to MBMS data transfer, MBMS data transfer start, access indicator, ...).

- The MBMS-GW responds with a Session Start Response message with information for BM-SC to send MBMS data to the MBMS-GW.

According to TS 23.247 [23247], a common TMGI for MBS and eMBMS is used towards the AF/AS and the TMGI is also used as identifier for transport over E-UTRAN/EPC.

In the user plane, the MBSTF distributes the received data to the MB-UPF at reference point Nmb9 and/or to the MBMS-GW at reference point SGi-mb, when supported by operator network configuration.

The session description document specified in clause 5.2.5 of TS 26.517 [26517] describes the parameters of the MBS distribution session using either:

- The session description for the MBS Object Distribution Method, as specified in clause 6.2.2 of TS 26.517, or

- The session description for the MBS Packet Distribution Method, as specified in clause 7.2.3 of TS 26.517.

In either case, the service type is restricted to Multicast MBS and Broadcast MBS as shown in clause 6.2.2.2 of TS 26.517. The use of the mbms-mode as defined in TS 26.346 [16] is not currently permitted in TS 26.517.

#### 5.10.3.2 MBSF/MBSTF southbound interface to BM-SC via MB2′

According to TS 23.468 [19], reference point MB2 offers access to the MBMS bearer service from an application. MB2 carries control plane signalling (MB2-C) and user plane traffic (MB2-U) between a Group Communication Application Server (GCS AS) and a BM-SC. Some relevant properties of MB2 are summarized as follows:

- MB2 is used by the GCS AS to interact with the BM-SC for MBMS bearer management.

- The application data transferred via MBMS bearer(s) by the GCS AS is transparent to the BM-SC.

- MB2 is a standardized secured interface to an GCS AS.

- The GCS AS needs to be configured with the IP addresses or a FQDN of the MB2-C endpoint on the BM‑SC. A separate MB2-C endpoint needs to be exposed by the BM‑SC per PLMN ID.

- The user plane transport information (e.g. IP address/UDP port) for delivering a Group Communication application data flow from the GCS AS to the BM-SC over reference point MB2-U is exchanged over reference point MB2-C.

Reference point MB2 provides the ability for the application to use the functionality of the MBMS System to deliver data to group members over MBMS. The procedures supported include:

- allocation of a set of TMGIs (TS 23.246 [3]) by the BM-SC at the request of the GCS AS (see clause 5.1.2.2.2 of TS 23.468 [19]),

- deallocation of a set of TMGIs by the BM-SC at the request of the GCS AS (see clause 5.1.2.2.3 of TS 23.468),

- activating an MBMS bearer in the BM-SC (see clause 5.1.2.3.2 of TS 23.468):

NOTE: This may include configuration requesting the BM-SC to apply Application Layer Forward Error Correction (AL-FEC) or Robust Header Compression (RoHC), or both, to the MBMS bearer.

- deactivating an active MBMS bearer in the BM-SC (see clause 5.1.2.3.3 of TS 23.468),

- modifying the characteristics of an active MBMS bearer in the BM-SC (see clause 5.1.2.4 of TS 23.468), and

- reporting of MBMS delivery status by the BM-SC to the GCS AS (see clause 5.1.2.5 of TS 23.468).

A session at reference point MB2 is established between the GCS AS and the BM-SC before any MB2 messages are exchanged between these two entities, and this session carries all MB2 messages between them for all MBMS bearers provisioned and used by the GCS AS. The TMGI/FlowID is the unique identifier used by the GCS AS and BM-SC to refer to the MBMS bearer.

The extended high-level baseline procedures for the MBS User Services architecture using Group Communication depicted in figure 5.10.2-3 are shown in figure 5.10.3.2-1, highlighting in bold the extensions to the call flow compared with that in clause 5.2.1 of TS 26.502 [26502].



Figure 5.10.3.2-1: MBS User Service high-level baseline procedures
using Group Communication enablers and APIs

The core extensions are:

- The Distribution Session provisioning, TMGI allocation and MBMS bearer allocation in steps 2, 3 and 4 are extended to address the allocation of the bearers on the MBMS distribution. The variant shown in the figure let’s MBSF handle the communicaton with MBSTF and BM-SC.

- In step 10, the MBSF Client provides information to the MBMS Client using the MC-MBMS-API in order to establish the MBMS bearer, involving also the MBSTF Client.

- In step 11, the MBMS Client activates the MBMS session to receive Group Communication data and the MBSTF Client activates the MBS User Services session to receive MBS data conveyed in the MBMS session.

- In step 13, MBS User Services session data is received through the MBMS bearer and directly provided to the MBSTF Client for relevant processing, for example FEC decoding, unicast repair determination and so on.

#### 5.10.3.3 MBSF/MBSTF southbound interface with xMB to BM-SC

The call flow is similar to clause 5.10.3.2.

### 5.10.4 Gap analysis and requirements

#### 5.10.4.1 Joint BM-SC and MBSF Functionality

For the Joint BM-SC/MBSF Functionality, no specific architectural gaps are identified. However, additional stage-2 procedures are required to support communication with the MBMS-GW at reference point SGmb, and consequent additions to the domain model and baseline parameters may also be needed.

The following stage-3 gaps are identified:

- The session description for the *MBS Object Distribution Method* in TS 26.517 [26517] is restricted to describing MBS Sessions.

- The session description for the *MBS Packet Distribution Method* in TS 26.517 [26517] is restricted to describing MBS Sessions.

To support the Joint BM-SC/MBSF Functionality, the removal of the above restrictions is needed.

#### 5.10.4.2 MBSF/MBSTF southbound interface to BM-SC via MB2

In order to support the extended implementation in clause 5.10.3.2, in addition to the extensions documented in clause 5.10.4.1, the following extensions are needed:

- The MBSF and MBSTF need to be able to communicate with BM-SC using southbound instances of reference points MB2′-C and MB2′-U respectively based on what is presented in clause 5.10.3.2, figure 5.10.3.2-1, steps 2, 3 and 4.

Analysis of gaps in the MBS User Services client architecture is for future study.

#### 5.10.4.3 MBSF/MBSTF southbound interface to BM-SC via xMB

The gaps are similar to those documented in clause 5.10.4.2.

### 5.10.5 Candidate solutions

As a minimum change, full support of the Joint BM-SC and MBSF Functionality is expected. For this purpose, the gaps documented clause 5.10.4.1 needs to be addressed by:

1. Documenting additional procedures in TS 26.502 [26502], adding baseline parameters to the domain model as needed.

2. Permitting the signalling of MBMS sessions.

In an extended change:

3. It would be valuable to document in TS 26.502 [26502] the deployment architectures to run MBS User Services over Group Communication Services (GCS) or MBMS Transparent Delivery by interfacing with an externally deployed BM-SC at new reference points MB2′ and xMB′ respectively. As part of this, the client architectures in figures 5.10.2.3-2 and 5.10.2.4-2 would also need to be documented as well as corresponding call flows.

The normative addition of these reference points to the MBS reference architecture would require an extension to TS 23.247 [26]. This may also have consequences to northbound interfaces Nmb8 and Nmb10. This may be too impactful, and more study is needed.

In an alternative approach, the architectures in clause 5.10.2.3 and clause 5.10.2.4 may be documented informatively as potential deployment architectures in TS 26.502, for example in an informative annex, without specifying the reference points.

### 5.10.6 Summary and conclusions

The MBS User Service architecture and protocol follows the modern design philosophies of the 5G System with separation of user services from transport, a service-based architecture and RESTful APIs. At the same time, eMBMS and enTV (as used for LTE-based 5G Broadcast) support transparent delivery mode and group communication. Clause 5.2 of TS 23.247 [26] and clause 4.9 of TS 26.502 [26502] define interworking between these two systems. However, the architecture does not address deeper integration on User Service level. In this Key Issue, different deployment architectures are shown that allow the user services of MBMS and MBS to beneficially converge. In particular:

- A service provider can use MBS northbound reference points Nmb8 and Nmb10 to interface with both MBS and eMBMS delivery,

- In the network, a common MBSTF supports user plane delivery for both MBS and eMBMS. In the latter system, either the group communication or transparent delivery mode is used.

- In the UE, a common eMBMS-aware MBSTF Client can take advantage of User Service delivery via either MBS or eMBMS. This aspect is important also for future deployments and enhancements harmonisation between the MBMS and MBS delivery methods.

- Rather than requiring the application to be both MBMS and MBS aware, an application that is only MBS-aware may be implemented while still being able to leverage eMBMS delivery at the radio layer.

Based on this summary, it is recommended to:

- Fully specify support for the *Joint BM-SC and MBSF Functionality*. For this purpose, the gap identified in clause 5.10.4.1 of the present document needs to be addressed by documenting additional procedures and baseline parameters as required in TS 26.502 [26502] and permitting the signalling of MBMS sessions.

- Document in an informative annex to TS 26.502 [26502] the deployment architectures, client architectures and high-level call flows in clauses 5.10.2.3 and 5.10.2.4.

- Validate the approaches by implementation, for example in 5G-MAG Reference Tools, and identify if the functionality is fully supported or any further specification updates are needed.

- Going forward, ensure that enhancements to the MBSTF and delivery methods in MBS can also be leveraged and deployed for eMBMS.