**GPP TSG-S4 Meeting #113-e *S4-210621***

**Online, , 6th–14th April 2021** revision of S4-210475

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| *CR-Form-v12.0* | | | | | | | | |
| **PSEUDO 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 |  | Radio Access Network |  | Core Network |  |

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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 can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | |  | |
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| ***Reason for change:*** | | Initial solutions to Key Issue #1, Scenarios #1 and #2. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | * Mapping architecture for Scenario #1. * Proposed architecture for interworking between the DVB-MABR reference model and the proposed 5MBS reference model. | | | | | | | | |
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| ***Consequences if not approved:*** | | Failure to progress the study of this Key Issue and requirements will not be fed into other aspects of solution design. | | | | | | | | |
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| ***Clauses affected:*** | | 7.2.2 | | | | | | | | |
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|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  |  | Other core specifications | | | |  | | |
| ***affected:*** | |  |  | Test specifications | | | |  | | |
| ***(show related CRs)*** | |  |  | O&M Specifications | | | |  | | |
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| ***Other comments:*** | |  | | | | | | | | |
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| ***This CR's revision history:*** | |  | | | | | | | | |

FIRST CHANGE

# 7 Potential Solutions

This clause provides potential solutions for the standardization areas identified in Clause 6.

## 7.1 General

(SNIPPED)

## 7.2 Key Issue #1: Support of multicast ABR in 5G Media Streaming Architecture

### 7.2.1 Mapping of DVB‑MABR and CableLabs MABR reference architectures to 5MBS reference architecture for Scenario #1

(SNIPPED)

#### 7.2.1.4 Mapping to Collaboration B0

Figure 7.2.1.4‑1 below shows how the DVB‑MABR reference model (blue functions and reference points) maps onto the 5MBS reference model proposed in the present document (green functions and reference points) and the 5MBS reference model for 5GC (grey functions and reference points) in the case of **Collaboration B0**.



Figure 7.2.1.4‑1: Mapping of the DVB‑MABR reference model onto the 5MBS reference model (Collaboration B0)

In this mapping:

1. The *Multicast server* function is realised by the MBSTF.

- Configuration at DVB‑MABR reference point **CMS** is achieved using xMB-C (Rel-17) MBS session provisioning procedures with the MBSF rather than using the DVB‑MABR multicast transport configuration. This results in configuration of the MBSTF via Nx2.

Editor’s Note: xMB-C (Rel‑17) may be redesignated Nmbsf/Nx4 following consultation with SA2.

- The Object delivery method is provisioned.

- Pull-based content ingest at reference point **Oin** is realised by provisioning xMB-U pull mode procedures.

- Push-based content at reference point **Pin′** is realised by provisioning xMB-U push mode procedures.

Editor’s Note: xMB-U may be redesignated Nmbstf/Nx5 following consultation with SA2.

2. Reference point **M** is realised by MBS‑4‑MC.

- The MBSTF generates a bitstream according to the specification of the Object delivery method.

3. The MBS session is announced to the 5MBS Client at MBS-5.

- The session descripion may be delivered via a 5MBS session announcement channel generated by the MBSTF at MBS‑4‑MC. This realises the DVB‑MABR multicast gateway configuration transport session.

- Alternatively, the 5MBS Client may retrieve the session description from the 5MBS AS via MBS‑4‑UC. This realises reference point **CMR** in the DVB‑MABR reference model.

In the UE:

3. The *Content playback* function and the *Multicast rendezvous service* are realised as a 5MBS-Aware Application.

4. The *Multicast gateway* function is realised by the 5MBS Client.

- New sessions are notified to the *Multicast rendezvous service* via MBS‑6 so that it can configure its redirect behaviour.

- The 5BMS Client provides object reassembly and repair functions in line with the 5MBS Object delivery method.

- The 5MBS Client implements dynamic adaptation between multicast transport sessions corresponding to different representations of the same adaptation set.

5. HTTP-based object repair at reference point **A** is realised by MBS‑4‑UC.

- The 5MBS AS may act as a unicast proxy for the external *Content hosting* function.

- Alternatively, the associated delivery procedures described in the 5MBS session announcement may direct the 5MBS Client to use the *Content hosting* function directly for HTTP-based object repair.

6. Reference point **L** is realised by MBS‑7.

- Intact playback delivery objects are exposed to the *Content playback* function, as required.

The following potential gaps merit study in relation to Collaboration B0:

1. What interface is used by the MBSF to publish session descriptions to the 5MBS AS?

2. How are multicast delivey sessions corresponding to different representations of the same adaptation set configured as part of a single 5MBS session description at xMB‑C (Rel‑17), Nx2 and MBS‑5?

Editor’s Note: xMB-C (Rel‑17) may be redesignated Nmbsf/Nx4 following consultation with SA2.

3. How is dynamic adaptation achieved in the 5MBS Client between multicast transport sessions corresponding to different representations of the same adaptation set?

NEW SUBCLAUSE

### 7.2.2 Interworking of DVB‑MABR reference architecture with 5MBS reference architecture for Scenario #2

#### 7.2.2.1 Introduction

With reference to an external Multicast ABR system interworking with a 5MBS System as described in clause 5.2.3, a different arrangement of logical functions and reference points is needed from that of Scenario #1.

Multicast ABR Scenario #2 may be realised by the following deployment models outlined in clause 5.4 of the present document:

**- Collaboration C** (see clause 5.4.4) where all media-related functions are deployed in an External DN and a multicast packet stream (optionally encapsulated in a unicast tunnel) is injected directly into the MB‑UPF in the Trusted DN at reference point N6, as depicted in Figure 4.4.1.3‑1. The multicast packet stream may include AL‑FEC repair packets. Because the externally generated multicast packet stream emulates the candidate 5MBS Delivery Method for segmented media, the 5MBS Client can receive it and can perform AL‑FEC and unicast repair procedures on the packet payloads as needed.

In this collaboration, the *Provisioning* function plays the role of an externally hosted 5GMSd AF; the *Content hosting* function plays the role of an externally hosted 5GMSd AS and the *Multicast server* provides the “MBSTF-like” function. HTTP-based unicast repair operations use the *Content hosting* function in the External DN. The 5MBS-Aware Application resembles a 5GMSd Client, although the *Multicast rendezvous service* also needs to be provided as part of the former.

This collaboration is further described in clause 7.2.2.2 below.

- **Collaboration D** (see clause 5.4.5) which is the same as Collaboration C except that the externally generated multicast packet stream injected into the MB‑UPF at N6 is in an application-specific format that differs from the candidate 5MBS Delivery Method for segmented media, for example the DVB-MABR profile of ROUTE or the CableLabs profile of NORM. In this case, the 5MBS Client can receive the packet payloads, but cannot repair them using 5MBS AL‑FEC or 5MBS HTTP-based unicast repair procedures. The received packet payloads are instead delivered to a 5MBS-Aware Application at MBS‑7 that is responsible for media object reassembly, repair procedures and onward delivery to a media player.

In this collaboration, the DVB-MABR *Multicast gateway* function could, for example, play the role of the 5MBS-Aware Application.

This collaboration is further described in clause 7.2.2.3 below.

#### 7.2.2.2 Interworking architecture for Collaboration C

Figure 7.2.2.2‑1 below shows how the DVB‑MABR reference model (blue functions and reference points) integrates with the 5MBS reference model proposed in the present document (green functions and reference points) and the 5MBS reference model for 5GC (grey functions and reference points) in the case of Collaboration C.



Figure 7.2.2.2‑1: Interworking between the DVB‑MABR reference model and the 5MBS reference model (Collaboration C)

In the control plane of the end-to-end system:

1. An “MBSF-like” subfunction of the content provider’s *Provisioning* function in the External DN interworks with the MB‑SMF in the Trusted DN by invoking Nmbsmf APIs via the NEF. These are used to provision a transparent delivery session for each target DVB-MABR multicast transport session, plus an additional delivery session to convey the DVB-MABR multicast gateway configuration transport session.

As part of this interaction, the multicast address(es) to be used in the data plane are nominated by the MB‑SMF and returned to the “MBSF-like” subfunction.

2. The *Provisioning* function configures the DVB‑MABR multicast transport session(s) in the *Multicast server* as usual via CMS. (This replaces the notional Nx2 interface in this collaboration.)

NOTE 1: The multicast address(es) nominated by the MB‑SMF are included in the DVB-MABR multicast server configuration instance document passed at reference point CMS. (This includes the transport parameters for each multicast transport session, plus those for the multicast gateway configuration transport session.)

NOTE 2: This step is outside the scope of 3GPP standardisation.

3. The availability of the transport-only multicast delivery session(s) is advertised to the 5MBS Client in the conventional manner at reference point MBS‑5. This advertisement is realised in one of three different ways:

a. The “MBSF-like” subfunction of the Provisioning function publishes a session description to the 5MBS AS and then includes its URL in the session advertisement so that the 5MBS Client can fetch the advertisement via MBS‑4‑UC.

b. The “MBSTF-like” subfunction of the *Multicast server* derives a 5MBS-compliant session description from the configuration it has received at **CMS** and adds this to a 5MBS-compliant session announcement channel.

c. The *Multicast gateway* synthesises a 5MBS-compliant session description from the DVB‑MABR muticast gateway configuration it has received at reference point **M** and injects that into the 5MBS Client by invoking an API at MBS‑6.

The advertisement includes the address of the 5MBS AS to support interworking of HTTP-based unicast repair.

4. The DVB‑MABR *Rendezvous service* and *Multicast gateway* are notified by the 5MBS Client about the availability of transport-only multicast delivery sessions via the MBS‑6 API.

In the user plane of the end-to-end system:

5. Multicast packets produced by the *Multicast server* are likely conveyed between the External DN and the Trusted DN in a unicast tunnel.

6. The MB‑UPF transparently delivers these multicast packets to the 5MBS Client on the UE via MBS‑4‑MC, subject to traffic policing rules in the MB-UFP that protect the network from being flooded.

7. Using the notifications received from the 5MBS Client in step 4 above, the *Rendezvous service* configures itself such that presentation manifest requests made at reference point **B** are redirected to the *Multicast gateway* when the corresponding media is available from an advertised multicast delivery session.

8. Using the notifications received from the 5MBS Client in step 4 above, the combined *Multicast gateway* and 5MBS Client function subscribes to the desired multicast delivery session(s). Dynamic adaptation between multicast delivery sessions is achieved inside this function by making appropriate low-level API calls to unsubscribe from one and subscribe to another.

9. The 5MBS Client receives multicast packets at MBS‑4‑MC for subscribed multicast delivery sessions. Using the information in the session announcement received in step 3 above, the 5MBS Client applies AL‑FEC repair to the received packets.

For any unrecoverable packet payloads, the 5MBS Client performs HTTP-based unicast repair with the 5MBS AS via MBS‑4‑UC, using the relevant associated delivery procedures configuration from the session announcement received in step 3 above.

10. The 5MBS Client exposes intact playback delivery objects to the correct 5MBS-Aware Application (here, the *Content playback* function) via reference point MBS‑7. This realises DVB‑MABR reference point **L**.

A number of changes to the DVB‑MBAR reference architecture are required in order to support interworking according to Collaboration C:

1. The *Content provisioning* function needs to implement an additional “MBSF-like” subfunction in order to provision 5MBS transparent delivery services.

2. The *Multicast server* function needs to implement an additional “MBSTF-like” subfunction in order to generate at reference point **M** a multicast packet stream compliant with MBS‑4‑MC that is suitable for consumption by the 5MBS Client.

This may include generating a session announcement channel to convey 5MBS session description delivery objects derived from the multicast server configuration instance document provided via **CMS**. This session announcement channel effectively replaces the multicast gateway configuration transport session in this collaboration.

3.. The *Content hosting* function needs to implement a “5MBS AS-like” subfunction in order to provide HTTP-based file repair at MBS‑5. (Since this is so similar to DVB‑MABR reference point **A**, this is likely to be trivial.)

The “5MBS-like” subfunction may additionally need to host 5MBS session descriptions. These effectively replace the multicast gateway configuration instance document when it is delivered via **CMR**.

The following potential gaps merit study in relation to Collaboration C:

1. Is it possible to configure a transparent multicast delivery session configured at Nmbsmf in such a way that it can then be successfully advertised to a 5MBS Client in a session description?

2. How are multicast delivery sessions corresponding to different representations of the same adaptation set configured as part of a single 5MBS session description at Nmbsmf and MBS‑5?

3. How is dynamic adaptation achieved in the 5MBS Client between multicast delivery sessions corresponding to different representations of the same adaptation set?

4. How is a synthetic 5MBS session description best injected into a 5MBS Client at MBS‑6?

#### 7.2.2.3 Interworking architecture for Collaboration D

Figure 7.2.2.3‑1 below shows how the DVB‑MABR reference model (blue functions and reference points) integrates with the 5MBS reference model proposed in the present document (green functions and reference points) and the 5MBS reference model for 5GC (grey functions and reference points) in the case of Collaboration D.



NOTE: Because use of the unicast path is uncoordinated with 5MBS functions in this collaboration, reference point MB‑N9 between the MB-UPF and UPF is omitted.

Figure 7.2.2.3‑1: Interworking between the DVB‑MABR reference model and the 5MBS reference model (Collaboration D)

In the control plane of the end-to-end system:

1. The content provider’s *Provisioning* function in the External DN interworks with the MB‑SMF in the Trusted DN by invoking Nmbsmf APIs via the NEF. These are used to provision a transport-only multicast delivery session for each target DVB-MABR multicast transport session, plus an additional delivery session to convey the DVB-MABR multicast gateway configuration transport session.

As part of this interaction, the multicast address(es) to be used in the data plane are nominated by the MB‑SMF.

2. The *Provisioning* function configures the DVB‑MABR multicast transport session(s) in the *Multicast server* as usual via CMS.

NOTE 1: The multicast address(es) nominated by the MB‑SMF are included in the DVB-MABR multicast server configuration instance document passed at reference point CMS. (This includes the transport parameters for each multicast transport session, plus those for the multicast gateway configuration transport session.)

NOTE 2: This step is outside the scope of 3GPP standardisation.3. The availability of the transport-only multicast delivery session(s) is advertised to the 5MBS Client in the conventional manner at reference point MBS‑5. This advertisement is realised in one of two different ways:

a. The *Multicast server* derives a 5MBS-compliant session description from the configuration it has received at **CMS** and adds this to a 5MBS-compliant session announcement channel at MBS‑4‑MC.

b. The *Multicast gateway* synthesises a 5MBS-compliant session description from the multicast gateway configuration it has received at reference point **M** and injects that into the 5MBS Client by invoking an API at MBS‑6.

4. The DVB‑MABR *Rendezvous service* and *Multicast gateway* are notified by the 5MBS Client about the availability of transport-only multicast delivery sessions via the MBS‑6 API.

In the user plane of the end-to-end system:

5. Multicast packets produced by the *Multicast server* are likely conveyed between the External DN and the Trusted DN in a unicast tunnel.

6. The MB‑UPF transparently delivers these multicast packets to the 5BMS Client on the UE via MBS‑4‑MC, subject to traffic policing rules in the MB-UFP that protect the network from being flooded.

7. Using the notifications received from the 5MBS Client in step 4 above, the *Rendezvous service* configures itself such that presentation manifest requests made at reference point **B** are redirected to the *Multicast gateway* when the corresponding media is available from an advertised multicast delivery session.

8. Using the notifications received from the 5MBS Client in step 4 above, the *Multicast gateway* function subscribes to the multicast delivery sessions corresponding to the desired DVB‑MABR multicast transport sessions by invoking the appropriate MBS‑6 API call on the 5MBS Client. Dynamic adaptation between multicast transport sessions is achieved by making appropriate MBS‑6 API calls to unsubscribe from one and subscribe to another.

9. In particular, the *Multicast gateway* subscribes to the multicast gateway configuration transport session as soon as it is announced at MBS-6 in order to acquire the multicast gateway configuration instance document and any other multicast delivery objects provided on the multicast gateway configuration transport session, such as presentation manifests and/or initialisation segments.

10. The 5MBS Client receives multicast packets at MBS‑4‑MC for subscribed multicast delivery sessions and routes them to the correct 5MBS-Aware Application (here, the *Multicast gateway* function) via reference point MBS‑7.

NOTE 3: The 5MBS Client does not attempt to make good any missing or corrupted multicast packets in this collaboration scenario.

NOTE 4: The realisation of MBS‑7 in this collaboration is most likely a virtual network interface on the UE that supplies UDP packet payloads received by the modem directly to the 5MBS-Aware Application. The 5MBS Client remains in control and is responsible for passing the name of the appropriate virtual network interface to the 5MBS-Aware Application, but the user plane bypasses the 5BMS Client.

11. The *Multicast gateway* parses and reassembles received multicast packets into playback delivery objects, as normal. It may apply Application‑Level Forward Error Correction to repair missing packets, as configured in the multicast gateway configuration instance document received in step 9. It may also perform HTTP-based unicast repair at reference point A, as configured in the multicast gateway configuration instance document. Reference point A is realised via a conventional PDU Session.

NOTE 5: This step is outside the scope of 3GPP standardisation, beyond the use of a PDU Session.

12. Intact playback delivery objects are exposed to the *Content playback* function as normal at reference point L.

NOTE 6: This step is outside the scope of 3GPP standardisation.

A number of changes to the DVB‑MBAR reference architecture are required in order to support interworking according to Collaboration D:

1. The *Content provisioning* function needs to implement Nmbsmf in order to provision 5MBS transport-only delivery services.

2. The *Multicast server* function may need to generate a session announcement channel to advertise 5MBS transport-only session description delivery objects derived from the multicast server configuration instance document provided via **CMS**. (This session announcement channel is in addition to the multicast gateway configuration transport session.)

The following potential gaps merit study in relation to Collaboration D:

1. Is it possible to configure a transport-only multicast delivery session configured at Nmbsmf in such a way that it can then be successfully advertised to a 5MBS Client in a session description?

2. How is a synthetic 5MBS session description best injected into a 5MBS Client at MBS‑6?

END OF CHANGES