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**Title: KI#9, Update to Conclusion**

**Document for: Agreement**

**Agenda Item: 8.9.1**

**Work Item / Release: FS\_5MBS /Rel-17**

***Abstract of the contribution:*** *This contribution proposes to resolve the open issue at the KI#9 for the IWK between the eMBMS and 5MBS.*

# Introduction

The conclusion for KI #9 in clause 8.9 still have two open issues, this paper try to resolve it.

# 2 Discussion

In EPS network, when the UE is out of the eMBMS service area of the service, if dedicated EPS bearer needs to be established for the service, the AF (GCS server) sends service info to PCRF in order to allocate unicast bearer resource for the service. When the UE moves into eMBMS service area of the service, the AF will request the CN (PGW) to release unicast bearer resource via PCRF. In order to support interworking with 5GS, the PGW-C is collocated with SMF, and PCF replaces PCRF. In this case, the PGW-C+SMF interact with PCF via N7 and AF interacts with PCF via N5.The AF (GCS server) need be upgraded to support the N5 interface.

**Conclusion 1: In order to support interworking with 5GS, AF need be upgraded to support N5 interface.**

In TR 23.757, there are two EN in the TR conclusion in clause 8.10:

Editor’s note: If, in a later moment, the eMBMS service becomes available, it is FFS how the UE can trigger the switch from individual delivery over PDN connection to eMBMS delivery.

How can the UE trigger the switch from individual delivery to eMBMS delivery?

When the UE moves from 5GS to EPS, if the service is not provided via eMBMS, the 5GC shared delivery is switched to individual delivery during inter-system handover, and the service is transferred to UE via unicast bearer of the PDN connection.

The UE will monitor the service availability via the eMBMS based on the receiving TMGI information. If the UE detects that the service becomes available via eMBMS, the UE can start to receive the service via eMBMS.

During the UE handover from 5GC shared delivery to individual delivery via PDN connection, the AF hasn’t sent service info to PCF via AF session for allocation of the unicast bearer resource for the service. When the UE further changes from individual delivery via PDN connection to MBMS delivery, the radio resource for the individual delivery need be released. To release the radio resource, there are two possible solutions:

1. The AF is enhanced to send to SMF+ PGW-C an indication that UE is receiving service via eMBMS, the SMF+ PGW-C can based on the indication to release the unicast bearer resource for the service; The AF need provide such indication on N5 interface.
2. The UE initiates bearer resource modification procedure to inform SMF+PGW-C to release the related EPS bearer.

The second option requires UE to differentiate two cases, i.e. UE need decide whether notify AF as before or trigger the bearer release procedure. This add some burden to UE. From the UE view the first option kept same logic as before, i.e. when the eMBMS service is available, the AF is notified. Hence, to avoid introduce complexity at the UE side, it is proposed that AF will send an indication to the SMF+PGW-C when it receive information from UE that the service can be received via eMBMS. Based on the indication the SMF+PGW-C can release the 5GC individual delivery related EPS bearer.

**Conclusion 2: The AF sends an indication to SMF+PGW-C to assist the release of MBS session related EPS bearer when UE starts to receive service via eMBMS.**

Editor’s note: When UE camps in EPS network and unicast bearer is triggered to be established by Application Server, it is FFS whether those EPS bearer(s) can be associated with MBS session, i.e. used for 5MBS individual delivery.

Whether EPS bearer can be associated with MBS session, i.e. via individual delivery?

Per TS23.468 when the UE moves out of MBMS service area, the AF request the EPS to allocate resources for transferring the service via unicast bearer, i.e. unicast delivery. If the packets of the service are transmitted via unicast delivery at EPS network, and join the MBS Session later when the UE move to the 5G network, 5GS need map the MBS Session flow to the unicast PDU Session QoS flow if the MBS individual delivery mode is needed. Thus it establish a different set of unicast QoS flow for the same service packet. This introduce unnecessary signalling. Also the UE is required to notify the AF when the MBS delivery mode is established. Thus it is better from beginning when the unicast EPS bearer is to be established, it is linked with the MBS Session.

In solution #41, it has been clarified that when the AF indicates the EPS to allocate unicast bearer resource for the service, the AF also includes the multicast IP address (or TMGI) in the SDF descriptor of the service. Based on that information the PGW-C+SMF can detect that the requested service is related to a 5G MBS service. Then per UE capability and network policy PGW-C+SMF can decide to use individual delivery instead of unicast delivery.

Based on above analysis it is proposed to remove the related editor’s note and add description of this into the conclusion.

# 3 Proposal

The following changes are proposed to TR 23.757:

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Start Change \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

### 6.41.3 Procedures

#### 6.41.3.1 General

The procedures in 6.41.3 supports both Transport only mode and full service mode.

#### 6.41.3.2 Delivery switching from MBMS to 5G MBS



Figure 6.41.3.2-1: Procedure to support delivery switching from MBMS to 5G MBS

Before the service has started, the AS provides Multicast information of the service to core network as described in clause 6.3.2.2.2. The Multicast information includes Traffic Description information of the service, e.g. the multicast IP address used to deliver the service.

1. UE establishes PDN connection. During PDN connection establishment procedure, the UE provides 5G MBS capability via PCO to PGW-C+SMF. UE sends service level signalling with AS via the PDN connection.

2. When UE moves to the edge of the MBMS coverage for the service, the UE sends a report to the AS as described in TS 23.468 [5].

3. The AS indicates the core network to deliver the service to UE via unicast bearer. If the service supports transmitted via 5MBS session, the AS includes TMGI (or MBS Session ID) of the service in the service information.

4. The PCF indicates the PGW-C+SMF to deliver the service to UE via unicast bearer. The PCF provides the TMGI (or MBS Session ID) of the service in the PCC rule to PGW-C+SMF.

If the UE support 5G MBS and the 5G MBS is supported at the network, the PGW-C+SMF determines that individual MBS traffic delivery method is used, i.e. the content is received from the MB-UPF not via the N6/SGi interface directly.

5. If the PGW-C+SMF does not have QoS flow information of the service, the PGW-C+SMF retrieves QoS flow information for the service from MB-SMF. If the PGW-C+SMF does not have MB-SMF info, it retrieves the MB-SMF info from the UDR based on the TMGI(or MBS Session ID) of the service.

6. The PGW-C+SMF maps the service into EPS bearer(s) based on the QoS flow information, and initiates the dedicated bearer modification/activation procedure to modify or activate EPS bearer for the service.

7. The PGW-C+SMF provides the mapping between the QFI and DL tunnel info of the EPS bearer(s) corresponding to the service to PGW-U+UPF, and the PGW-U+UPF maps packets received from the MB-UPF to the DL tunnel(s) of the EPS bearer(s) according to the mapping. If the tunnel from MB-UPF to PGW-U+UPF for the service has not been established yet, the PGW-C+SMF requests the PGW-U+UPF to allocate the DL tunnel for the service, and the PGW-U+UPF provides the DL tunnel info for the service to the PGW-C+SMF.

8. The PGW-C+SMF invokes Nsmf\_xxxx Request (DL Tunnel info for the service) to the MB-SMF.

9. The MB-SMF sends the DL Tunnel info for the service to the MB-UPF. The MB-UPF starts to forward the DL packets to PGW-U+UPF.

 The service is now transferred to UE via EPS bearer.

10. The MB-SMF sends Nsmf\_xxxx Response to PGW-C+SMF.

11. The PGW-C+SMF sends response to PCF. In the response, the PGW-C+SMF indicates that the individual MBS traffic delivery method is used.

12. The PCF sends response to AF. The individual MBS traffic delivery method is indicated in the response.

 After receiving the response, if the AF has not started to deliver the service using multicast address, the AF starts to send packets of the service using multicast address.

13. The UE moves to 5G NG-RAN cell, the handover procedure from EPS to 5GS is triggered. After handover procedure, the service is delivered via unicast PDU Session, i.e. individual delivery.

14. If the UE and the gNB supports 5G MBS, the PGW-C+SMF adds the UE into the MBS session as in steps 6 - 24 of figure 6.3.2-1.

15. PGW-C+SMF releases the unicast resource allocated for the service.

If the UE moves to 5GS earlier than it report out of MBMS coverage to AS, i.e. step 13 is earlier than step 2, the AS will indicate to 5GS to deliver the service via individual MBS delivery after the UE has handover to 5GS. This is similar as the step 3-12 with the difference that the EPS bearer is changed to the QoS flow.

The PGW-C+SMF adds the UE into the MBS session as in steps 6 - 24 of figure 6.3.2-1 if the UE and the gNB supports 5G MBS, otherwise, the PGW-C+SMF maps the service into PDU Session as in steps 25-38 of figure 6.3.2-1.

#### 6.41.3.3 Delivery switching from 5G MBS to MBMS



Figure 6.41.3.3-1 Procedure to support delivery switching from 5G MBS to MBMS

1. The UE has established a PDU Session with the PGW-C+SMF. During PDU session establishment procedure, the UE provides 5G MBS capability to PGW-C+SMF. UE sends service level signalling with AS via the PDU Session.

2. UE joins the 5G MBS Session to receive the service as in clause 6.3.2. During the procedure, the PGW-C+SMF receives QoS flow information of the service. If the service supports service continuity when interworking with EPS, the PGW-C+SMF maps the service to EPS bearer(s) and request the related EBI.

3. When UE hand over to EPS, the EPS bearer(s) context is sent to MME, and the EPS bearer(s) for the service is established in EPS as part of the intersystem handover procedure.

4. After UE has connected to the eNB, the PGW-C+SMF will receive Modify bearer request message, which provides the DL tunnel info of the SGW to the PGW-C+SMF. The PGW-C+SMF sends N4 modification request to the PGW-U+UPF and provides the mapping between the QFI and DL tunnel info of the EPS bearer(s) corresponding to the service to PGW-U+UPF, and the PGW-U+UPF maps packets received from the MB-UPF to the DL tunnel(s) of the EPS bearer(s) according to the mapping.

 Based on the UE capability and the multicast group UE join, the PGW-C+SMF determine that the individual MBS delivery is needed. If the DL tunnel from MB-UPF to PGW-U+UPF for the service has not been established yet, the PGW-C+UPF requests the PGW-U+UPF to allocate DL tunnel info. The PGW-U+UPF provides the DL tunnel info for the service to the PGW-C+SMF.

5. The PGW-C+SMF sends Nsmf\_xxxx Request (DL Tunnel info for the service) to the MB-SMF.

6. The MB-SMF sends the DL tunnel info to the MB-UPF. The MB-UPF starts to send packets to the PGW-U+UPF, and the PGW-U+UPF starts to send the DL packets of the service to UE via corresponding EPS bearer(s).

7. The MB-SMF sends Nsmf\_xxxx Response to PGW-C+SMF.

8. The UE detects detect the availability of the MBMS coverage for the corresponding service based on MBMS Scheduling Information over MCH and the data from the MBMS bearer corresponding to the TMGI over MTCH.

9. The UE reports that MBMS coverage is available for the service to AS, and the AS indicates the UE to receive the service via MBMS bearer.

10. The AS indicates the core network to release unicast resources for the indicated MBS service. To support this, the related MBS Session ID are also included in the request.

11. Based on the received indication, the PCF indicates the PGW-C+SMF to release unicast bearer associated with the indicated MBS Session..

12. The PGW-C+SMF initiates bearer modification/release to delete the resource allocated for the service. The PGW-C+SMF indicates the PGW-U+UPF stop sending packets of the service via corresponding EPS bearer.

 The PGW-C+SMF may release the tunnel from MB-UPF and PGW-U+UPF if there is no other UE receives the service via EPS bearer via the PGW-U+UPF.

In future, if UE moves out of MBMS coverage for the service, the UE reports to AS, and AS will indicate the core network to deliver the service via unicast bearer as described in steps 3 - 12 of clause 6.41.2.2-1.

### 6.41.4 Impacts on services, entities and interfaces

SMF:

- The SMF supports to transfer the service data to UE via unicast bearer or individual MBS delivery based on indication from AF.

- The SMF supports to change the delivery of the service data from via shared MBS delivery to via unicast bearer during the handover from 5GS to EPS.

- The SMF supports to indicate AF multicast IP address is used for deliver the service data via unicast bearer or individual MBS delivery.

- The SMF supports to release resource for service delivery via unicast bearer based on AF indication.

PCF:

- The PCF supports to indicate the SMF to transfer the service data via unicast bearer or individual MBS delivery based on request from AF, or indicate the SMF to release resources for service delivery via unicast bearer based on request from AF.

AF:

- The AF supports to transfer the service data via multicast IP address or unicast UE IP address based on SMF indication.

- The AF supports to indicate the 5GC to release resource for service delivery via unicast bearer.

- The AF supports to indicate the 5GC to transfer the service data via individual MBS delivery.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 2nd Change \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

## 8.9 Key Issue #9: Minimizing the interruption of public safety services upon transition between NR/5GC and E-UTRAN/EPC

For 5MBS multicast, in order to minimize the interruption of public safety services upon transition between NR/5GC and E-UTRAN/EPC the following applies:

For a 5MBS multicast session two scenarios are considered:

- the same service is provided via eMBMS and 5MBS. For this scenario Solution 43, which is a service based solution not needing the execution of an intermediate unicast handover, is adopted as baseline for the normative phase. This solution can be based on RRC release with redirection to redirect the UE towards the appropriate cells/frequency range.

NOTE 1: If the UE has other DRBs/QoS flows established before switching to EPS, the source RAN can also initiate handover.

NOTE 2: Solution 43 applies also to the 5MBS broadcast case.

- the same service is not provided via eMBMS and 5MBS. In this case, for the normative phase the following steps are adopted for 5MBS to EPS mobility:

- the 5MBS data shared delivery is switched to individual delivery during inter-system handover.

- the 5GS-EPS interworking solution of TS 23.501 clause 5.17.2 is executed with an inter-system handover with MBS QoS flow(s) mapped to unicast QoS flow(s) in its associated PDU Session.

- The PGW-C+SMF obtains the MBS session context when UE joins 5G MBS.

- After mobility, if the service is available via eMBMS in target location, the UE starts to receive the service via eMBMS and notifies the availability of the eMBMS to AF. The AF notify the PGW-C+SMF to release the unicast bearer resource allocated for the MBS service via PCF.

- After a possible subsequent EPS to 5MBS mobility, the PGW-C+SMF can again apply shared delivery to the UE.

For an eMBMS session started in EPS and subsequent EPS to 5MBS mobility, the following steps are adopted for the normative phase:

* Before EPS to 5MBS mobility, the application may trigger the switching the multicast data receiving from eMBMS to unicast bearer as defined in TS 23.468. The AF may provide the service info together with the MBS Session ID (i.e. TMGI or multicast IP address) to PCF, and the PGW-C+SMF may decide to transport the service via 5GC MBS individual delivery over the PDN connection.

- the 5GS-EPS interworking solution of TS 23.501 clause 5.17.2 is executed with an inter-system handover.

- the UE can join the 5MBS multicast service after EPS to 5MBS mobility.

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