**SA WG2 Meeting #140E (e-meeting) S2-200xxxx**

**Aug 19 – Sep 01, 2020, Elbonia (revision of S2-200xxxx)**

**Source: CATT**

**Title: KI #1, Sol #16: Update to resolve ENs**

**Document for: Approval**

**Agenda Item: 8.9**

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

*Abstract of the contribution: This contribution proposes updates to solution #16 for Key Issue #1.*

1. Discussion
2. There are two Editor's notes in solution #16 for Key issue#1:

Editor's note: Whether the additional SMF functionalities are added to existing SMF services or defined as new services is FFS.

Editor's note: Whether the additional PCF functionalities are added to existing PCF services or defined as new services is FFS.

For the first Editor's note, to support MBS Sessions, new SMF services for MBS Session may be defined and used, e.g. Nsmf\_MBSSession\_CreateSMContext, Nsmf\_MBSSession\_UpdateSMContext, Nsmf\_MBSSession\_Create, Nsmf\_MBSSession\_Update.

For the second Editor's note, since the policy association for MBS session is similart to that for PDU session, the existig PCF services can be used, i.e. the SMF may perform an SM Policy Association Establishment or Modification procedure by invoking the Npcf\_SMPolicyControl\_Create or Npcf\_SMPolicyControl\_Update Request towards the PCF and receive the MBS related PCC Rules.

1. Solution #16 is based on Solution #3. In SA2#139e meeting Solution 3 is updated where two SMFs (SMF2 and SMF1) manage the MBS Session and associated PDU Session respectively. By comparing with the updated Solution 3, the follow updates to Solution #16 are also proposed:
* It is clarified that the SMF serving the PDU session (i.e. old SMF) is equivalent to SMF1, and the selected SMF for MBS session is equivalent to SMF2.
* There is no need for the selected SMF for MBS session to invoke the Nsmf\_PDUSession\_ContextRequest with the SMF serving the PDU session for transferring the SMF context as specified in TS 23.502 [8] clause 4.26.5.3. The AMF can send UE context for the MBS Session directly to the selected SMF, or the selected SMF can retrieve it from the UDM if needed.

2. Proposal

It is proposed to include the following changes in TR 23.757.

\*\*\*\*\* Start of 1st Change \*\*\*\*\*

## 6.16 Solution #16: MBS session joining via PDU session establishment and modification procedures

### 6.16.1 Functional description

This solution addresses Key Issue #1 "MBS session management" based on the baseline architecture 1 in clause A.1.

This solution is similar to Solution 3 in that the same concepts of integrated unicast and multicast session management, MBS session context (Multicast session context), etc. are used; while different from solution 3, this solution also proposes the following procedures and mechanisms:

- UE joining an MBS service via PDU session establishment procedure;

- SMF selection for an MBS session, where the SMF registers/updates its capability of supporting MBS as well as the information of MBS session(s) currently served by the SMF to the NRF and the AMF/SMF queries the NRF for SMF selection during PDU session establishment/modification procedure;

- Policy control for the MBS session, where the PCF provides MBS related policy in PCC rules to the SMF for MBS session management.

6.16.2 Procedures

#### 6.16.2.1 MBS session joining via PDU Session Establishment procedure

The UE has successfully registered to the PLMN and has the information of MBS service based on pre-configuration (e.g. installed application(s)), SIB or information from previous MBS sessions, etc. The UE may initiate MBS session join procedure via the PDU Session Establishment procedure, e.g. triggered by application layer request, as shown in Figure 6.16.2.1-1.

NOTE 1: In the procedure, instead of using the existing SMF services for PDU Session, new SMF services for MBS Session may be defined and used, e.g. Nsmf\_MBSSession\_CreateSMContext, Nsmf\_MBSSession\_UpdateSMContext, Nsmf\_MBSSession\_Create, Nsmf\_MBSSession\_Update, as shown in Figure 6.16.2.1-1.



Figure 6.16.2.1-1: MBS session joining via PDU Session Establishment procedure

1. The UE sends an UL NAS TRANSPORT (S-NSSAI(s), DNN, PDU Session ID, Request type, MBS information, N1 SM container (PDU Session Establishment Request) ) message to the AMF. The MBS information identifies the MBS service that the UE wants to join and can be a multicast address and/or TMGI.

2. The AMF checks whether it has an MBS session context for the MBS service requested by the UE (i.e. an MBS session may have been established via the AMF for other UE(s) with the same MBS information) and if so, selects the SMF according to the MBS session context. Otherwise, the AMF queries the NRF for SMF discovery by issuing the Nnrf\_NFDiscovery\_Request including the MBS information and possibly other information, i.e. the S-NSSAI and the associated NSI ID (if available), DNN, service area information (TA(s)) based on UE location, etc. Based on the SMF information in the Nnrf\_NFDiscovery\_Request response from the NRF, the AMF selects the SMF serving the requested MBS session if exists, or an MBS-capable SMF.

3a. If the service area of the selected SMF includes the location where the UE camps, the AMF invokes the Nsmf\_PDUSession\_CreateSMContext Request (SUPI, S-NSSAI(s), DNN, PDU Session ID, AMF ID, Request Type, MBS information, UE location information, N1 SM container (PDU Session Establishment Request)) towards the selected SMF.

3b-1~3b-3. If the service area of the selected SMF does not include the location where the UE camps, the AMF selects an I-SMF that serves the area where UE camps. The AMF invokes the Nsmf\_PDUSession\_CreateSMContext Request (SUPI, S-NSSAI(s), DNN, PDU Session ID, AMF ID, Request Type, MBS information, UE location information, N1 SM container (PDU Session Establishment Request), identity of the selected SMF) towards the I-SMF. The I-SMF selects an I-UPF and performs N4 session establishment procedure. The I-SMF invokes the Nsmf\_PDUSession\_Create Request with the MBS information towards the selected SMF.

4. The SMF retrieves the Session Management Subscription data including MBS related subscription data from the UDM and also subscribes to be notified when this subscription data is modified for MBS service.

 The SMF checks the validity of the UE request for the MBS service, e.g. if the requested MBS corresponds to an MBS service area, whether the UE is located in the MBS service area based on UE location information.

 If the UE's request for the MBS service is valid, the SMF checks whether an MBS Session context exists for the MBS service requested by the UE based on the multicast address or TMGI. If such an MBS Session context exists, the SMF updates the MBS Session context and adds the UE as a member of the MBS session; otherwise the SMF creates an MBS session context for the MBS service requested by the UE and adds the UE as a member of the MBS session.

5. The SMF may perform an SM Policy Association Establishment or Modification procedure by invoking the Npcf\_SMPolicyControl\_Create or Npcf\_SMPolicyControl\_Update Request towards the PCF and get the MBS related PCC Rules.

6. The SMF sends an N4 Session Establishment/Modification Request to the UPF, to provide N4 rules (i.e. packet detection, QoS enforcement and reporting rules) to the UPF and establish/modify the N3/N9 tunnel for the MBS session.

7a. If the SMF serves the UE directly, the SMF invokes the Namf\_Communication\_N1N2MessageTransfer (PDU Session ID, MBS session context information, N2 SM information (PDU Session ID, MBS session context information, QFI(s), QoS Profile(s), CN Tunnel Info, S-NSSAI, PDU Session Type), N1 SM container (PDU Session Establishment Accept)) to the AMF.

7b-1~7b-2. If the SMF serves the UE via the I-SMF, the SMF invokes the Nsmf\_PDUSession\_Create Response (PDU Session ID, MBS session context information, CN Tunnel Info, QFI(s), QoS profile(s)) to the I-SMF. The I-SMF invokes the Namf\_Communication\_N1N2MessageTransfer (PDU Session ID, MBS session context information, N2 SM information (PDU Session ID, MBS session context information, QFI(s), QoS Profile(s), CN Tunnel Info, S-NSSAI, PDU Session Type), N1 SM container (PDU Session Establishment Accept)) to the AMF.

8. The AMF creates/updates the MBS session context and sends the N2 PDU Session Request to the NG-RAN.

9. The NG-RAN establishes/modifies the AN resources for the MBS session, i.e. selecting/updating the multicast or unicast radio bearers towards the UE, and also creates/updates the N3 tunnel information towards the UPF. The NG-RAN also forwards the NAS message containing PDU Session Establishment Accept to the UE.

10. The NG-RAN sends the N2 PDU Session Response to the AMF.

11a~13a. If the SMF serves the UE directly, the AMF invokes the Nsmf\_PDUSession\_UpdateSMContext Request to the SMF. The SMF initiates the N4 Session Modification procedure with the UPF to provide/update AN Tunnel Info as well as N4 rules. The SMF sends the Nsmf\_PDUSession\_UpdateSMContext Response to the AMF.

11b~13b. If the SMF serves the UE via the I-SMF, the AMF invokes the Nsmf\_PDUSession\_UpdateSMContext Request to the I-SMF. The I-SMF initiates the N4 Session Modification procedure with the I-UPF to provide/update AN Tunnel Info, CN Tunnel Info as well as N4 rules. The I-SMF sends the Nsmf\_PDUSession\_UpdateSMContext Response to the AMF.

#### 6.16.2.2 MBS session joining via PDU Session Modification procedure

The UE has successfully registered to the PLMN and established an PDU session. The UE may get the information of MBS service based on pre-configuration (e.g. installed application(s)), SIB, information from previous MBS sessions, or via the application layer interactions over the user plane of the PDU session. Then the UE may initiate MBS session joining procedure via the PDU Session Modification procedure, as shown in Figure 6.16.2.2-1.

NOTE 1: In the procedure, compared with solution 3, the SMF serving the PDU session (i.e. old SMF) is equivalent to SMF1, and the selected SMF for MBS session is equivalent to SMF2.

NOTE 2: In the procedure, instead of using the existing SMF services for PDU Session, new SMF services for MBS Session may be defined and used, e.g. Nsmf\_MBSSession\_CreateSMContext, Nsmf\_MBSSession\_UpdateSMContext, Nsmf\_MBSSession\_Create, Nsmf\_MBSSession\_Update, as shown in Figure 6.16.2.2-1.



Figure 6.16.2.2-1: MBS session joining via PDU Session Modification procedure

0. The UE establishes a PDU session and may receive MBS service configuration information in application layer via the user plane of the PDU session. Later on, the UE requests to join an MBS session via the following Alternative 1 (User Plane signalling) or Alternative 2 (Control Plane signalling).

Steps 1a~2a for Alternative 1 (User Plane signalling)):

1a. The UE sends a multicast Join message (e.g. IGMP Join) via the User Plane of the PDU session. Upon detection of the multicast Join message, the UPF sends a notification including the information in the multicast Join message (i.e. MBS information which identifies the MBS service that the UE wants to join, e.g. a multicast address) to the SMF serving the PDU session.

2a. If the SMF serving the PDU session supports MBS service, the SMF checks the validity of the UE request for the MBS service based on e.g. MBS related subscription data of the UE, whether the UE is located in the MBS service area for the request MBS service. If the request is valid, the SMF checks whether it has an MBS session context for the MBS service requested by the UE (i.e. an MBS session may have been established via the SMF for other UE(s) with the same MBS information), and if so, the SMF updates the MBS Session context and adds the UE to the MBS session, and continues with step 5 or 6.

 If the SMF serving the PDU session does not support MBS service or has no MBS session context for the MBS service requested by the UE, the SMF queries the NRF for SMF discovery by issuing the Nnrf\_NFDiscovery\_Request including the MBS information and possibly other information, i.e. the S-NSSAI and the associated NSI ID (if available), DNN, service area information (TA(s)) based on UE location, etc. Based on the SMF information in the Nnrf\_NFDiscovery\_Request response from the NRF, the SMF selects the SMF serving the requested MBS session if exists, or an MBS-capable SMF if the SMF serving the PDU session does not support MBS service. The SMF invokes Nsmf\_PDUSession\_SMContextStatusNotify with the MBS Session ID and identity of selected SMF towards the AMF. The procedure continues with step 3.

 If the SMF serving the PDU session supports MBS service and no SMF serving the requested MBS session exists, the SMF creates an MBS session context for the MBS service requested by the UE and adds the UE to the MBS session, and continues with step 5.

Steps 1b~2b for Alternative 2 (Control Plane signalling)):

1b. The UE sends an UL NAS TRANSPORT (S-NSSAI(s), DNN, PDU Session ID, Request type, MBS information, N1 SM container (PDU Session Modification Request) ) message to the AMF. The MBS information identifies the MBS service that the UE wants to join and can be a multicast address and/or TMGI.

2b. The AMF checks whether it has an MBS session context for the MBS service requested by the UE (i.e. an MBS session may have been established via the AMF for other UE(s) with the same MBS information) and if so, selects the SMF serving the requested MBS session according to the MBS session context.

 If the AMF has no MBS session context for the MBS service requested by the UE, the AMF queries the NRF for SMF discovery by issuing the Nnrf\_NFDiscovery\_Request including the MBS information and possibly other information, i.e. the S-NSSAI and the associated NSI ID (if available), DNN, service area information (TA(s)) based on UE location, etc. Based on the SMF information in the Nnrf\_NFDiscovery\_Request response from the NRF, the AMF selects the SMF serving the requested MBS session if exists, or an MBS-capable SMF. If no SMF serving the requested MBS session exists and the SMF serving the PDU session supports MBS service, then the SMF serving the PDU session is selected.

 If the selected SMF is the same as the SMF serving the PDU session, then the procedure continues with step 5 or 6; otherwise, the procedure continues with step 3.

The following steps are common for both Alternative 1 (User Plane) and Alternative 2 (Control Plane).

3a-1. Same as step 3a in Figure 6.16.2.1-1.

3b-1~3b-3. If the service area of the selected SMF does not include the location where the UE camps, the AMF selects the SMF serving the PDU session as an I-SMF. The AMF invokes the Nsmf\_PDUSession\_UpdateSMContext Request (SM Context ID, MBS information, UE location information, N1 SM container (PDU Session Modification Request), identity of the selected SMF) towards the I-SMF. The I-SMF reuses the existing UPF or selects a new I-UPF and performs N4 session modification/establishment procedure. The I-SMF invokes the Nsmf\_PDUSession\_Create Request with the MBS information towards the selected SMF.

4~13. Same as steps 4~13 in Figure 6.16.2.1-1, with the differences that the N1 SM container/NAS message to the UE contains PDU Session Modification Command instead of PDU Session Establishment Accept, and the UE acknowledges the PDU Session Modification Command by sending a NAS message containing PDU Session Modification Command Ack.

#### 6.16.2.3 SMF selection

When an MBS session is established for an MBS service, the MBS session contexts are created in the SMF, AMF, NG-RAN and UE. The SMF performs the MBS session management, and each MBS session context is managed by one SMF (with or without I-SMF).

To facilitate the SMF discovery/selection for one MBS session, the following mechanism is proposed:

- The SMF registers its capability of supporting MBS service as part of its profile to the NRF. In addition, when the first UE joins an MBS service, the SMF creates the MBS session context and registers the MBS session information, i.e. information that uniquely identifies the MBS service (e.g. multicast address and/or TMGI), towards the NRF.

- When other UEs joins the MBS session via PDU session establishment or modification procedures, the AMF or the SMF serving the PDU session invokes the Nnrf\_NFDiscovery\_Request including the MBS session information provided by the UE and possibly other information, i.e. the S-NSSAI and the associated NSI ID (if available), DNN, service area information (TA(s)) based on UE location, etc., to query the NRF for SMF information.

- Based on the MBS information and other information for query, the NRF decides whether an SMF serving the MBS session exists. If so, the NRF provides in Nnrf\_NFDiscovery\_Request response the information of the SMF currently serving the MBS session. Otherwise, the NRF provides in Nnrf\_NFDiscovery\_Request response the information of one or more SMFs which supports MBS service.

- The AMF or the SMF serving the PDU session selects the SMF currently serving the MBS session if exists, or an SMF which supports MBS service, based on the SMF information provided by the NRF. If no SMF serving the requested MBS session exists and the SMF serving the PDU session supports MBS service, then the SMF serving the PDU session is selected.

- When the MBS session context is deleted from the SMF, e.g. due to MBS session release, the SMF updates the MBS session information it currently serves towards the NRF, i.e., removing the MBS session information which is no longer served by the SMF.

### 6.16.3 Impacts on services, entities and interfaces

UE:

- The UE supports joining an MBS service/session via the PDU Session Establishment/Modification procedures, by including the MBS information in UL NAS TRANSPORT message or using an user plane multicast join message.

SMF:

- The SMF supports MBS session management, including creating, maintaining and releasing the MBS session context. The SMF registers/updates the information of the MBS session(s) it currently serves as well as MBS capability to the NRF. If the UE initiates MBS session joining via the User Plane using the PDU Session Modification procedure, the SMF serving the PDU session may query the NRF for the SMF currently serving the MBS session, and indicate this new SMF (as the selected SMF for the MBS session) to the AMF.

AMF:

- The AMF maintains an MBS session context including the information of SMF(s) and NG-RAN(s) involved in the MBS session. The AMF supports SMF selection for an MBS session by querying the NRF for the SMF currently serving the MBS session.

NRF:

- The NRF provides the information of the SMF currently serving an MBS session (if exists) or an SMF with MBS capability upon the request from the AMF/SMF.

PCF:

- The PCF provides MBS related PCC Rules to the SMF.

UPF:

- The UPF enforces the packet detection, QoS enforcement and reporting rules for the MBS session, and establishes/modifies the N3/N9 tunnel to support multicast transport.

NG-RAN:

- The NG-RAN establishes/modifies the AN resources for the MBS session, i.e. selecting/updating the multicast or unicast radio bearers towards the UE, and also creates/updates the N3 tunnel information for multicast transport towards the UPF.

\*\*\*\*\* End of Changes \*\*\*\*\*