**3GPP TSG-WG SA2 Meeting #154-AH-E *S2-2300156***

**Electronic Meeting, Jan 16th – 20th**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  | **.548** | **CR** | **0084** | **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 | **X** |

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|  |
| ***Title:***  | Home Routed-Session Breakout (HR-SBO) support |
|  |  |
| ***Source to WG:*** | Samsung, Nokia, Nokia Shanghai Bell, Huawei, Hisilicon, CMCC |
| ***Source to TSG:*** | SA2 |
|  |  |
| ***Work item code:*** | EDGE\_Ph2 |  | ***Date:*** | 2023-01-06 |
|  |  |  |  |  |
| ***Category:*** | B |  | ***Release:*** | Rel-18 |
|  | *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-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | It was agreed to support Home Routed Session Breakout (HR-SBO) in Rel-18 to enable local traffic routing in VPLMN for Home Routed PDU Session.  |
|  |  |
| ***Summary of change:*** | It is proposed to modify the following changes:1. Remove the NOTE stating Edge Computing is only for non-roaming and LBO roaming (clause 4.1)
2. Reference architecture for HR-SBO is added (clause 4.2)
3. Update the procedure of PDU Session for supporting HR-SBO in VPLMN (clause 6.7.2)
4. EAS Discovery Procedure with V-EASDF for HR-SBO (new 6.7.2.3)
5. EAS Discovery Procedure with Local DNS for HR-SBO (new 6.7.2.4)
6. Update the Neasdf\_DNSContext Service (7.1.2)
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|  |  |
| ***Consequences if not approved:*** | HR-SBO is not supported |
|  |  |
| ***Clauses affected:*** | 4.1, 4.2, 6.7.2.1, 6.7.2.2, 6.7.2.3 (new), 6.7.2.4 (new), 7.1.2.1, 7.1.2.2, 7.1.2.3 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ….CR |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR’s revision history:*** |  |

\* \* \* \* 1st Changes \* \* \* \*

## 4.1 General

Edge Computing enables operator and 3rd party services to be hosted close to the UE's access point of attachment, so as to achieve an efficient service delivery through the reduced end-to-end latency and load on the transport network.

5GS supports Edge Hosting Environment (EHE) deployed in the DN beyond the PSA UPF. An EHE may be under the control of either the operator or 3rd parties.

The Edge Computing features defined in this specification are applicable to PLMN(s) and to SNPN(s).

The Local part of the DN in which EHE is deployed may have user plane connectivity with both a centrally deployed PSA and locally deployed PSA of same DNN. Edge Computing enablers as described in clause 5.13 of TS 23.501 [2], e.g. local routing and traffic steering, session and service continuity, AF influenced traffic routing, are leveraged in this specification.

Edge Computing in the serving network (e.g. for Local Break Out roaming scenario in case of PLMN access) is supported, but for AF guidance to PCF determination of URSP rules, the Serving network (e.g. VPLMN or serving SNPN) has no control on URSP, so cannot influence UE in selecting a specific Edge Computing related DNN and S-NSSAI.

\* \* \* \* 2nd Changes \* \* \* \*

## 4.2 Reference Architecture for Supporting Edge Computing

The reference architectures for supporting Edge Computing are based on the reference architectures specified in clause 4.2 of TS 23.501 [2]. The following reference architectures for non-roaming, LBO roaming and HR with Session Breakout (HR-SBO) roaming scenarios further depict the relationship between the 5GS and a DN where Edge Application Servers (EASs) are deployed in an EHE.

Figure 4.2-1 depicts 5GS architecture for non-roaming scenario supporting Edge Computing with UL CL/BP.



Figure 4.2-1: 5GS providing access to EAS with UL CL/BP for non-roaming scenario

Figure 4.2-2 depicts 5GS architecture for non-roaming scenario supporting Edge Computing without UL CL/BP.



Figure 4.2-2: 5GS providing access to EAS without UL CL/BP for non-roaming scenario

Figure 4.2-3 depicts 5GS architecture for LBO roaming scenario supporting Edge Computing with UL CL/BP.



Figure 4.2-3: 5GS providing access to EAS with UL CL/BP for LBO roaming scenario

Figure 4.2-4 depicts 5GS architecture for LBO roaming scenario supporting Edge Computing without UL CL/BP.



Figure 4.2-4: 5GS providing access to EAS without UL CL/BP for LBO roaming scenario

Figure 4.2-5 depicts 5GS architecture for HR-SBO roaming scenario supporting Edge Computing with UL CL/BP.



Figure 4.2-5: 5GS providing access to EAS with UL CL/BP for HR-SBO roaming scenario

NOTE 1: Only some of the 5GS NFs are shown in the above reference architecture figures. In the above figures, the split between the UPF acting as UL CL/BP and the UPF acting as local PSA is illustrative.

NOTE 2: Only the control plane of EASDF is depicted in the figure, the user plane between the EASDF and the UPF (i.e. over which the DNS messages are exchanged) is part of N6. Additionally, the EADSF may have direct connectivity with the local parts of one or more Data Networks.

NOTE 3: For the HR-SBO roaming scenario, there can be other UPF(s) located in VPLMN between the UPF acting UL CL/BP and the UPF acting as remote PSA.

\* \* \* \* 3rd Changes \* \* \* \*

## 6.7 Support of the local traffic routing in VPLMN for Home Routed PDU Session for roaming (HR-SBO)

### 6.7.1 General

When roaming, the UE establishes a Home Routed Session that is capable of supporting session breakout in V-PLMN based on the subscription. In this scenario, the Home PLMN and Visited PLMN have an agreement on the support of the local traffic routing (i.e. session breakout performed by V-SMF also called HR-SBO) in VPLMN for the home routed session.

After establishing the HR-SBO PDU Session, the UE can access EAS deployed in EHE in VPLMN while the UE can also access the data network in the Home PLMN.

The reference architecture supporting this scenario is depicted in Figure 4.2-5 in clause 4.2.

\* \* \* \* 4th Changes \* \* \* \*

#### 6.7.2.2 PDU Session for supporting HR-SBO in VPLMN



Figure 6.7.2.2-1: Procedure for PDU Session supporting HR-SBO in VPLMN

1. During the registration procedure, the AMF receives the HR-SBO allowed indication per DNN/S-NSNAI from the UDM in the step 14b of the procedure in the clause 4.2.2.2.2 of TS 23.502 [3].

2. During the PDU Session establishment procedure for Home-routed roaming as in clause 4.3.2.2.2 of TS 23.502 [3], if the AMF had received in SMF selection data from UDM the HR-SBO allowed indication for the DNN/S-NSSAI in the step 1, the AMF selects a V-SMF supporting HR-SBO and sends an HR-SBO allowed indication to the V-SMF in the step 2 and the step3a of the procedure in clause 4.3.2.2.2-1 of TS 23.502 [3].

Editor’s note: It is FFS how to route the DNS traffic between the UE and the V-EASDF where multiple private IP networks with the same IP address range are deployed in HPLMN.

 If the V-SMF supporting the HR-SBO receives the HR-SBO allowed indication from AMF, the V-SMF may

- select a V-EASDF,

- obtain the V-EASDF IP address based on local configuration, or invoke Neasdf\_DNSContext\_Create Request without including UE IP address to the V-EASDF but including the DNN, S-NSSAI and HPLMN ID to obtain the V-EASDF IP address (to be delivered to the Ue for that PDU session), and

- sends to the H-SMF the request for the establishment of the PDU Session supporting HR-SBO in VPLMN and the V-EASDF IP address in the Nsmf\_PDUSession\_Create Request in the step 6 of the procedure in the clause 4.3.2.2.2-1 of TS 23.502 [3].

The H-SMF authorizes the request for HR-SBO based on SM subscription data (i.e. HR-SBO authorization indication) in the step 7 of the procedure in the clause 4.3.2.2.2-1 of TS 23.502 [3].

If HR-SBO is allowed for the PDU session, the H-SMF provides in the Nsmf\_PDUSession\_Create Response in the step 13 of the procedure in the clause 4.3.2.2.2-1 of TS 23.502 [3] with the following information:

- optional VPLMN specific offloading policy

- the V-EASDF IP address as DNS server address to be sent to the UE via PCO and

- the DNS server address of HPLMN (to be used for DNS requests related with traffic not to be subject to HR-SBO)

- the HR-SBO authorization result (i.e. whether HR-SBO request is authorized or not).

Editor's note: It is FFS whether VPLMN specific offloading policy are received from the UDM and/or from H-PCF

Editor's note: The detailed information (e.g. FQDN range, IP range, AMBR for the local part of DN or charging policy) of VPLMN specific offloading policy is FFS.

NOTE: The VPLMN specific offloading policy can be prior configured in HPLMN based on the service level agreement between the VPLMN and HPLMN.

3. The V-SMF configures the V-EASDF with the DNS handling rules using the received VPLMN specific offloading policy and the DNS server address of HPLMN as a default DNS server, in the step 14 of the procedure in the clause 4.3.2.2.2-1 of TS 23.502 [3] if they are received from H-SMF in the step 2.

 If the V-SMF has interacted with the V-EASDF in step 2, then the V-SMF invokes Neasdf\_DNSContext\_Update Request including UE IP address to complete the configuration of the context in the V-EASDF.

 The V-SMF configures the V-UPF acting as UL CL/BP and local PSA or inserts a UL CL/BP and local PSA. The V-SMF configures the UL CL/BP to forward DNS messages to the local PSA and configures the local PSA to forward DNS messages between the V-EASDF and L-DN.

Editor's note: It is FFS how EAS re-discovery procedure for HR-SBO roaming scenario is performed.

4A. EAS Discovery procedure with V-EASDF is performed as described in 6.7.2.3.

4B. EAS Discovery procedure with Local DNS Server/Resolver is performed as described in 6.7.2.4

\* \* \* \* 5th Changes (all new text) \* \* \* \*

#### 6.7.2.3 EAS Discovery Procedure with V-EASDF for HR-SBO



Figure 6.7.2.3-1. Procedure for EAS Discovery with V-EASDF for HR-SBO roaming scenario

1. With the reference architecture as in Figure 4.2-5, the DNS query sent by the UE reaches the V-EASDF via the UL CL/BP and local PSA controlled by the V-SMF.

If the target FQDN of the DNS query is not part of the FQDN authorized by the H-SMF in step 2 of Figure 6.7.2.2-1, a) , or b) will be performed:

a) The V-EASDF proceeds to step 12 of Figure 6.2.3.2.2-1 where it sends the DNS request to the DNS server address of HPLMN received in step 2 of Figure 6.7.2.2-1 (to be used for DNS requests related with traffic not to be subject to HR-SBO) through N6. The DNS Query sent by the V-EASDF is destined to the DNS service of PLMN configured by V-SMF in the step 2. Upon receiving the DNSresponse, the procedure proceeds immediately to step 5.

b) The UL CL/BP UPF sends the DNS request to the DNS server address of HPLMN via V-UPF (if exists) and H-UPF (through N9), by modifying the packet's destination IP address (corresponding to V-EASDF) to that of the DNS server of HPLMN.

The rest of the procedure assumes the target FQDN of the DNS query is not of the FQDN authorized by the H-SMF in step 2 of Figure 6.7.2.2-1

1. The step 8 to 15 of the procedure in the Figure 6.2.3.2.2-1by replacing SMF and EASDF with V-SMF and V-EASDF respectively.
2. The V-SMF may perform insertion or change of UL CL/BP and local PSA in VPLMN.

If there are other V-UPF(s) located between the inserted UL CL/BP and the H-UPF, the V-SMF establishes the user plane between the (R)AN and UL CLBP in VPLMN, and between the UL CL/BP in VPLMN and V-UPF. This can refer to clause 4.3.5.4 of TS 23.502 [3] by replacing SMF with V-SMF.

If there are no other V-UPF(s) located between the inserted UL CL/BP and the H-UPF, the interaction between the V-SMF and the H-SMF for UL CL/BP and local PSA selection in VPLMN in step 16 of clause 6.2.3.2.2 can refer to descriptions in clause 4.23.9.1 of TS 23.502 [3] by replacing I-SMF with V-SMF and SMF with H-SMF.

NOTE: In the home routed roaming scenario, the V-UPF is deployed at the central area within VPLMN, therefore the V-UPF is located in the user plane path between ULCL/BP UPF in VPLMN and PSA-UPF in HPLMN. In a certain deployment, the ULCL/BP UPF can be collocated with the V-UPF.

1. The step 17 to 18 of the procedure in the clause 6.2.3.2.2 by replacing SMF and EASDF with V-SMF and V-EASDF respectively.
2. V-EASDF sends the DNS Response to the UE.

\* \* \* \* 6th Changes (all new text) \* \* \* \*

#### 6.7.2.3 EAS Discovery Procedure with Local DNS for HR-SBO



Figure 6.7.2.4-1. Procedure for EAS Discovery with local DNS for HR-SBO roaming scenario

EAS Discovery procedure with local DNS are corresponding with the procedure Figure 6.2.3.2.3. The step 1 to the step 5 are the same as the step 1 to 6 of Figure 6.2.3.2.2 with following differences:

* SMF is replaced with V-SMF.
* UE, (R)AN, AMF, ULCL/BP UPF, L-PSA UPF, V-SMF, Local DNS Resolver/Server are located in VPLMN
* UPF, H-SMF, C-DNS are located in HPLMN
1. The HR-SBO PDU Session is established. See the procedure 6.7.2.2.

1, ULCL/BP insertion. See the step 1 of the procedure in Figure 6.2.3.2.3.

2, After ULCL/BP insertion is performed, the V-SMF sends new local DNS server address to the UE by performing PDU Session Modification procedure as in TS 23.502 clause 4.3.3.3 with following additions:

- V-SMF sends Local DNS Server/Resolver to the H-SMF in the step 1a of the procedure as in clause 4.3.3.3 of TS 23.502 [3].

- H-SMF sends the Local DNS Server/Resolver to be sent to the UE via PCO to the V-SMF in the step 3 of the procedure in clause 4.3.3.3 of TS 23.502 [3].

 3. See the step 4 of the procedure in Figure 6.2.3.2.3.

 4. See the step 5 of the procedure in Figure 6.2.3.2.3.

 5. See the step 6 of the procedure in Figure 6.2.3.2.3.

\* \* \* \* 7th Changes \* \* \* \*

### 7.1.2 Neasdf\_DNSContext Service

#### 7.1.2.1 General

**Service description:** This service enables the consumer to create, update, or delete DNS context in EASDF and to Subscribe to DNS message related reporting from EASDF.

DNS contexts in EASDF include rules on how EASDF is to handle DNS messages.

This service also can be supported by V-EASDF in VPLMN for HR scenario supporting HR-SBO.

\* \* \* \* 8th Changes \* \* \* \*

#### 7.1.2.2 Neasdf\_DNSContext\_Create Service Operation

**Service operation name:** Neasdf\_DNSContext\_Create

**Description:** Create a DNS context in EASDF.

**Input, Required:** DNN, S-NSSAI, Notification Endpoint.

**Input, Optional:** UE IP address, DNS message handling rules.

NOTE: In HR-SBO scenario, the V-SMF can invoke Neasdf\_DNSContext\_Create service without providing UE IP address to the V-EASDF. In that case the DNS context for the PDU session is not fully created as long as the V-SMF has not provided the UE IP address to the V-EASDF

DNS message detection and Actions(s) are specified in clause 6.2.3.2.2.

**Output, Required:** If successful, IP address of the EASDF, EASDF Context ID, Result Indication.

NOTE: For HR-SBO scenario, the EASDF IP address can be chosen by the V-SMF based on local configuration and sent to the H-SMF before sending Nsmf\_PDUSession\_Create request. In such a case, it is assumed that V-SMF receives in Neasdf\_DNSContext\_Create response the same EASDF IP address from V-EASDF with the one sent to the H-SMF.

**Output, Optional:** None.

\* \* \* \* 9th Changes \* \* \* \*

#### 7.1.2.3 Neasdf\_DNSContext\_Update Service Operation

**Service operation name:** Neasdf\_DNSContext\_Update

**Description:** Update the DNS context in EASDF, or indicate EASDF to forward the DNS Response to UE.

**Input, Required:** EASDF Context ID, updated DNS message handling rules.

**Input, Optional:** UE IP address.

NOTE: In HR-SBO scenario, the V-SMF can provide the UE IP address received from the H-SMF to the V-EASDF via this Service Operation.

**Output, Required:** Result Indication.

**Output, Optional:** None.

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