**SA WG2 Meeting #164 S2-2408283**

**19 - 23 August 2024, Maastricht, Netherlands**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  | **23.501** | **CR** | **5560** | **rev** | **-** | **Current version:** | **19.0.0** |  |
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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:***  | Clarification on network slice handling for Indirect Network Sharing |
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| ***Source to WG:*** | ZTE, Huawei, China Unicom |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** | TEI19\_NetShare |  | ***Date:*** | 2024-08-01 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-19 |
|  | *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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
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| ***Reason for change:*** | In last SA2 meeting it was agreed when the selected PLMN ID is EHPLMN ID which is not derived from SUPI, the serving AMF includes the EHPLMN S-NSSAIs with the mapping information to HPLMN S-NSSAIs in the Allowed NSSAI, Partially Allowed NSSAI, rejected S-NSSAIs and Configured NSSAI. There are two issues on this solution:1. When the UE requests HPLMN S-NSSAIs only during Registration procedure in the first time, the serving AMF cannot determine the EHPLMN S-NSSAIs that is mapped to the requested HPLMN S-NSSAI unless the serving AMF of the hosting operator is configured with the mapping between EHPLMN S-NSSAI and HPLMN S-NSSAI of the participating operator.
2. During PDU Session establishment procedure, the V-SMF only receives the VPLMN S-NSSAI and the HPLMN S-NSSAI, it cannot determine the EHPLMN S-NSSAIs that is mapped to the requested HPLMN S-NSSAI also.

In order to resolve these two issues, it is proposed in the case of Indirect Network Sharing, the EHPLMN S-NSSAI value for the broadcasted EHPLMN ID is equal to HPLMN S-NSSAI value. The serving AMF provides the selected PLMN ID to the V-SMF and V-SMF can differentiate the HPLMN ID/EHPLMN ID options. |
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| ***Summary of change:*** | It is proposed in the case of Indirect Network Sharing, the EHPLMN S-NSSAI value for the broadcast EHPLMN ID is equal to HPLMN S-NSSAI value. The serving AMF and V-SMF can differentiate the HPLMN ID/EHPLMN ID options based on the selected PLMN ID.Add other small clarifications. |
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| ***Consequences if not approved:*** | How does the AMF know the mapping EHPLMN S-NSSAI and HPLMN S-NSSAI of the participating operation is not resolved |
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| ***Clauses affected:*** | 5.18.1, 5.18.5 |
|  |  |
|  | **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:*** |  |

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

### 5.18.1 General concepts

A network sharing architecture shall allow multiple participating operators to share resources of a single shared network according to agreed allocation schemes. The shared network includes a radio access network. The shared resources include radio resources.

The shared network operator allocates shared resources to the participating operators based on their planned and current needs and according to service level agreements.

In this Release of the specification, the 5G Multi-Operator Core Network (5G MOCN) network sharing architecture, in which only the RAN is shared in 5G System, is supported. The 5G System may also support Indirect Network Sharing deployment between hosting operator (i.e. shared network operator) and participating operator (see clause 6.21 of TS 22.261 [2], Figure 5.18.1-2 and Annex R), in which the RAN is shared. The communication between the shared RAN and the core network of the participating operator is routed through the core network of the hosting operator that connects to the shared RAN.

5G MOCN for 5G System, including UE, RAN and AMF, shall support operators' ability to use more than one PLMN ID (i.e. with same or different country code (MCC) some of which is specified in TS 23.122 [17] and different network codes (MNC)) or combinations of PLMN ID and NID. 5G MOCN supports NG-RAN Sharing with or without multiple Cell Identity broadcast as described in TS 38.300 [27]. Indirect Network Sharing for 5G system, including UE, shared RAN and CP NFs of hosting operator, shall support participating operator to use more than one PLMN ID.

For Indirect Network Sharing, the shared RAN is broadcasting multiple PLMN IDs, including the PLMN ID which represents the hosting operator and the PLMN IDs which represent participating operators. Multiple PLMN IDs are supported by the serving AMF (i.e. the AMF in the core network of the PLMN representing the hosting operator). A UE from a participating operator can select the PLMN ID representing the participating operator in the shared RAN area based on existing procedures specified in TS 23.122 [17]. The serving AMF selects core network functions in the PLMN of the participating operator for the UE, based on home routed roaming architecture principle as specified in clause 4.2.4. In addition, the serving AMF selects the SMF of participating operator possibly considering UE location information and also selects a V-SMF in its own network during the PDU session establishment procedure. The serving AMF determines the serving PLMN ID as follows:

- For procedures involving the Network Function in the participating operator network (e.g. AUSF), the AMF sets the serving PLMN ID to the selected PLMN ID.

- For procedures involving the Network Function only in the hosting operator network (e.g. PCF), the AMF sets the serving PLMN ID to the PLMN ID of the hosting operator.

Editor Note: It is FFS whether the above principles can be applicable for Nudm\_SubscriberDataManagement (SDM) service in the HPLMN ID/EHPLMN ID broadcast option.

NOTE 1: In this Release of specification, the Indirect Network Sharing is only applicable for NR with 5GC of hosting operator and 5GC of participating operator. There are maximum of two SMFs (V-SMF of the hosting operator and SMF of the participating operator) controlling a PDU session.

5G MOCN also supports the following sharing scenarios involving non-public networks, i.e.NG-RAN can be shared by any combination of PLMNs, PNI-NPNs (with CAG), and SNPNs (each identified by PLMN ID and NID).

NOTE 1: PNI-NPNs (without CAG) are not explicitly listed above as it does not require additional NG-RAN sharing functionality compared to sharing by one or multiple PLMNs.

In all non-public network sharing scenarios, each Cell Identity as specified in TS 38.331 [28] is associated with one of the following configuration options:

- one or multiple SNPNs;

- one or multiple PNI-NPNs (with CAG); or

- one or multiple PLMNs only.

NOTE 2: This allows the assignment of multiple cell identities to a cell and also allows the cell identities to be independently assigned, i.e. without need for coordination, by the network sharing partners, between PLMNs and/or non-public networks.

NOTE 3: Different PLMN IDs (or combinations of PLMN ID and NID) can also point to the same 5GC. When same 5GC supports multiple SNPNs (identified by PLMN ID and NID), it is up to the operator's policy whether they are used as equivalent SNPNs for a UE.

NOTE 4: There is no standardized mechanism to avoid paging collisions if the same 5G-S-TMSI is allocated to different UEs by different PLMNs or SNPNs of the shared network, as the risk of paging collision is assumed to be very low. If such risk is to be eliminated then PLMNs and SNPNs of the shared network needs to coordinate the value space of the 5G-S-TMSI to differentiate the PLMNs and SNPNs of the shared network.



Figure 5.18.1-1: A 5G Multi-Operator Core Network (5G MOCN) in which multiple CNs are
connected to the same NG-RAN



Figure 5.18.1-2: Indirect Network Sharing in which multiple participating operators' CNs connect to hosting operator's CN to share NR

NOTE 5: Not all interfaces between the hosting operator and the participating operator are depicted in the Figure 5.18.1-2 for simplicity.

NOTE 6: For the sake of clarity, SEPPs are not depicted in the Figure 5.18.1-2.

\* \* \* Next Change \* \* \*

### 5.18.5 Network Sharing and Network Slicing

As defined in clause 5.15.1, a Network Slice is defined within a PLMN or SNPN. Network sharing is performed among different PLMNs and/or SNPNs.

In the case of 5G MOCN, each PLMN or SNPN sharing the NG-RAN defines and supports its PLMN- or SNPN- specific set of slices that are supported by the common NG-RAN.

In the case of Indirect Network Sharing, the differences of Network Slicing handling is performed as the follows:

- If, in an Indirect Network Sharing area, the selected PLMN ID which is broadcasted by shared RAN is the HPLMN ID or EHPLMN ID (which is not derived from UE's SUPI) of the UE, from the network side, the network slicing handling shall be performed as defined in clause 5.15.6. The changes compared to baseline operations are as follows:

- During Registration procedure, the Requested NSSAI (optionally with the mapping of Requested NSSAI) only including the S-NSSAI(s) of participating operator from the UE is as described in TS 24.501 [47]. After receiving the Registration Request including the above information, the serving AMF determines the corresponding S-NSSAIs of hosting operator (i.e. VPLMN S-NSSAIs) based on the Subscribed S-NSSAIs and slice mapping information from the S-NSSAI(s) for selected PLMN ID (i.e. HPLMN S-NSSAIs or EHPLMN S-NSSAIs) to the VPLMN S-NSSAI(s) locally or acquires the slice mapping information from the NSSF of hosting operator's network. The serving AMF further checks whether the corresponding S-NSSAIs of hosting operator are supported by the shared RAN. If none of the corresponding S-NSSAIs of hosting operator is supported, the serving AMF rejects the Registration Request. Otherwise the serving AMF continues the Registration procedure and sends to the UE Allowed NSSAI, Partially Allowed NSSAI, Rejected S-NSSAIs and Configured NSSAI only containing the S-NSSAI(s) of participating operator, i.e. HPLMN S-NSSAI(s) without mapping information (i.e. when the selected PLMN ID is HPLMN ID) or EHPLMN S-NSSAI(s) with mapping information to HPLMN S-NSSAI(s) (i.e. when the selected PLMN ID is EHPLMN ID which is not derived from SUPI). The serving AMF creates a list of S-NSSAIs of the hosting operator corresponding to the S-NSSAIs included in the Allowed NSSAI sent to the UE and includes these S-NSSAIs in the Allowed NSSAI in the signalling to the shared RAN and to the PCF during the AM policy association establishment. The UE Context in the serving AMF shall retain the slice mapping information. The above AMF functionality is applied also during UE Configuration Update procedure.

- During PDU Session Establishment procedure, the UE includes the S-NSSAI(s) of participating operator in the PDU Session Establishment Request as described in TS 24.501 [47]. After receiving the S-NSSAI of participating operator from UE, the serving AMF uses the slice mapping information stored in the UE Context to determine the S-NSSAI of hosting operator (i.e. VPLMN S-NSSAI) to be used as "the S-NSSAI belonging to the Allowed NSSAI" as defined in clause 5.15.6. The serving AMF uses VPLMN S-NSSAI and HPLMN S-NSSAI for the following PDU Session Establishment Procedure. The serving AMF sends the serving PLMN ID, VPLMN S-NSSAI and HPLMN S-NSSAI to the V-SMF. If the serving PLMN ID is HPLMN ID, the V-SMF sends the HPLMN S-NSSAI in the PDU Session Establishment Accept message to the UE. If the serving PLMN ID is EHPLMN ID which is not derived from the SUPI, the V-SMF sends the HPLMN S-NSSAI and the mapping information of the EHPLMN S-NSSAI in the PDU Session Establishment Accept message to the UE. In the above descriptions, the V-SMF sends the VPLMN S-NSSAI (i.e. S-NSSAI of hosting operator) in the N2 SM information to the shared RAN.

NOTE 1: In the case of Indirect Network Sharing, if a EHPLMN ID is broadcasted by shared RAN, the EHPLMN S-NSSAI value for this EHPLMN ID is same as HPLMN S-NSSAI value as deployment requirement.

NOTE 1: If NSSF is involved in the above case, the AMF will send S-NSSAI(s) for selected PLMN ID to the NSSF to retrieve the slice mapping information from the S-NSSAI(s) for selected PLMN ID to the VPLMN S-NSSAI(s).

NOTE 2: In the case of Indirect Network Sharing, the shared RAN only needs to support the S-NSSAI of hosting operator and select the serving AMF as described in clause 5.15.5.2.1. Then, the shared RAN does not need to be provisioned with the slice mapping information . The serving AMF with the above functionality will be selected in this case.- For other cases, i.e. the broadcast PLMN ID which represents the participating operator is different from HPLMN ID or EHPLMN IDs of UE, the network slicing handling including UE and network shall comply with the roaming case as defined in clause 5.15.6. The applied S-NSSAI values for the PLMN ID selected by UE (i.e. the broadcast PLMN ID) are the S-NSSAI values of hosting operator.

NOTE 3: Which broadcast option to be used and whether to broadcast one or more PLMN ID(s) for each participating operator is determined based on the agreement between the hosting operator and participating operator.

\* \* \* End of Change \* \* \*