**SA WG2 Meeting #156eS2-230**

**Elbonia, April 17th – 21st, 2023 (revision of S2-230138)**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **23.502** | **CR** |  | **rev** | **-** | **Current version:** | **18.1.0** |  |
|  |
| *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:***  | AMF/PCF interactions to support TNGF/N3IWF selection enhancement for support of S-NSSAI needed by UE |
|  |  |
| ***Source to WG:*** | Nokia, Nokia Shanghai Bell |
| ***Source to TSG:*** | SA2 |
|  |  |
| ***Work item code:*** | 5WWC\_Ph2 |  | ***Date:*** | 2023-04-09 |
|  |  |  |  |  |
| ***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)* |
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| ***Reason for change:*** | TR 23.700-17 conclusion states that:* The AMF may trigger the UE Policy Association Establishment procedure to provide the UE with updated WLANSP if the selected SSID (TNGF) does not support the slices requested by UE. The AMF requests the PCF to receive a notification when the PCF has completed the WLANSP update; once the AMF has received this notification from the PCF, the AMF can issue a registration reject.
* However, there is no such trigger case available for AMF to trigger PCF to update WLANSP or ANDSP rules

However, existing procedures need to be enhanced to align the specifications |
|  |  |
| ***Summary of change:*** | * *The Configured NSSAI (for the case of roaming) as optional input parameter in 23.502 clauses 5.2.5.6.2 and 5.2.5.6.5.*
* *The notification of successful UE Policy (ANDSP) delivery as optional input parameter in 23.502 clause 5.2.5.6.3*
* *The “ANDSP determination due to wrong TNGF” trigger in 23.503 Table 6.1.2.5-1.*
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| ***Consequences if not approved:*** | Fail to support AMF/PCF interactions to support TNGF/N3IWF selection enhancement for support of S-NSSAI needed by UE |
|  |  |
| ***Clauses affected:*** | 4.12a.2.2, 5.2.5.6.2, 5.2.5.6.3 |
|  |  |
|  | **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:*** | **Beware the text is based on V18.0.0** |

\* \* \* \* First change \* \* \* \*

#### 4.12a.2.2 Registration procedure for trusted non-3GPP access

The UE connects to a trusted non-3GPP Access Network (TNAN) and it also registers to 5GC over via this TNAN, by using the EAP-based procedure shown in the figure 4.12a.2.2. This procedure is very similar with the 5GC registration procedure over untrusted non-3GPP access in clause 4.12.2.2. The link between the UE and the TNAN can be any data link (L2) that supports EAP encapsulation, e.g. PPP, PANA, Ethernet, IEEE 802.3, IEEE 802.11, etc. The interface between the TNAP and TNGF is an AAA interface.



Figure 4.12a.2.2-1: Registration via trusted non-3GPP access

0. The UE which is not operating in SNPN access mode selects a PLMN and a TNAN for connecting to this PLMN by using the Trusted Non-3GPP Access Network selection procedure specified in clause 6.3.12 of TS 23.501 [2]. During this procedure, the UE discovers the PLMNs with which the TNAN supports trusted connectivity (e.g. "5G connectivity").

 The UE operating in SNPN access mode selects an SNPN and a TNAN for connecting to this SNPN by using the Trusted Non-3GPP Access Network selection procedure specified in clause 5.30.2.13 of TS 23.501 [2]. During this procedure, the UE discovers the SNPNs with which the TNAN supports trusted connectivity (e.g. "5G connectivity").

NOTE 1: In this Release, it is assumed that when the trusted non-3GPP access is a trusted WLAN access, the UE is configured (e.g. with the WLANSP rules defined in TS 23.503 [20]) to select an TNAN(SSID and TNGF) associated with a non-3GPP Tracking Area, which supports one or more of the UE's subscribed S-NSSAIs.

1. A layer-2 connection is established between the UE and the TNAP. In the case of IEEE Std 802.11 [48], this step corresponds to an 802.11 Association. In the case of PPP, this step corresponds to a PPP LCP negotiation. In other types of non-3GPP access (e.g. Ethernet), this step may not be required.

2-3. An EAP procedure is initiated. EAP messages are encapsulated into layer-2 packets, e.g. into IEEE 802.3/802.1x packets, into IEEE 802.11/802.1x packets, into PPP packets, etc. The NAI provided by the UE not operating in SNPN access mode indicates that the UE requests "5G connectivity" to a specific PLMN (e.g. NAI = "<any\_username>@nai.5gc. mnc<MNC>.mcc<MCC>.3gppnetwork.org"). The NAI provided by the UE operating in SNPN access mode indicates that the UE request "5G connectivity" to a specific SNPN (e.g. NAI = "<any\_username>@nai.5gc. nid<NID>.mnc<MNC>.mcc<MCC>.3gppnetwork.org"). If the WLANSP rule contains information including TNGF ID to use for specific slices and the UE supports such information, the UE builds the realm of NAI taking the TNGF ID into account (e.g. NAI = "<any\_username>@ tngfid<TNGF ID>. nai.5gc. mnc<MNC>.mcc<MCC>.3gppnetwork.org"). This NAI triggers the TNAP to send an AAA request to a TNGF, which operates as an AAA proxy. Between the TNAP and TNGF the EAP packets are encapsulated into AAA messages. The AAA request also include the TNAP identifier, which can be treated as the User Location Information.

NOTE 2: In this Release, it is assumed that when the trusted non-3GPP access is a trusted WLAN access, the TNAP selects a TNGF based on the realm provided by the UE and also based on the SSID selected by the UE. In a deployment a TNGF may be reached over different SSID(s) where the TNGF supports a Tracking Area and be associated with a set of slices, or an SSID may provide access to one or more TNGF(s), where each of these TNGF(s) can support a different Tracking Area and a different set of slices.

4-10. An EAP-5G procedure is executed as the one specified in clause 4.12.2.2 for the untrusted non-3GPP access with the following modifications:

- The registration request may contain an indication that the UE supports TNGF selection based on the slices the UE wishes to use over trusted non-3GPP access (i.e., that the UE supports Extended WLANSP rule).

- A TNGF key (instead of an N3IWF key) is created in the UE and in the AMF after the successful authentication. The TNGF key is transferred from the AMF to TNGF in step 10a (within the N2 Initial Context Setup Request). The TNGF derives a TNAP key, which is provided to the TNAP. The TNAP key depends on the non-3GPP access technology (e.g. it is a Pairwise Master Key in the case of IEEE Std 802.11 [48]). How these security keys are created, it is specified in TS 33.501 [15].

- In step 5 the UE shall include the Requested NSSAI in the AN parameters only if allowed, according to the conditions defined in clause 5.15.9 of TS 23.501 [2], for the trusted non-3GPP access. The UE shall also include a UE Id in the AN parameters, e.g. a 5G-GUTI if available from a prior registration to the same PLMN or SNPN. If the UE in SNPN access mode performs the Registration procedure for UE onboarding, the UE shall include an indication in the AN parameters that the connection request is for onboarding.

- In the N2 message sent in step 6b, the TNGF includes a UE Location Information (ULI) that contains a "null" IP address (e.g. 0.0.0.0) because the UE is not yet assigned an IP address. After the UE is assigned an IP address, the TNGF includes this address in subsequent N2 messages. This N2 message also includes the Selected PLMN ID and optionally the Selected NID, and the Establishment cause.

NOTE 3: The Selected NID is present when the UE connects to an SNPN via Trusted non-3GPP access.

- If the UE in SNPN access mode performs the Registration procedure for UE onboarding, the interaction between AMF and AUSF (step 8a and step 8c in Figure 4.12a.2.2-1) is replaced with step 9-1 or step 9-2 or step 9-3 in Figure 4.2.2.2.4-1, depending on the 5GC architecture that is used for UE onboarding.

- After receiving the TNGF key from AMF in step 10a, the TNGF shall send to UE an EAP-Request/5G-Notification packet containing the "TNGF Contact Info", which includes the IP address of TNGF. After receiving an EAP-Response/5G-Notification packet from the UE in step 10c, the TNGF shall send message 10d containing the EAP-Success packet.

11. The TNAP key is used to establish layer-2 security between the UE and TNAP. In the case of IEEE Std 802.11 [48], a 4-way handshake is executed, which establishes a security context between the WLAN AP and the UE that is used to protect unicast and multicast traffic over the air.

12. The UE receives IP configuration from the TNAN, e.g. with DHCP.

13. At this point, the UE has successfully connected to the TNAN and has obtained IP configuration. The UE sets up a secure NWt connection with the TNGF as follows:

 The UE initiates an IKE\_INIT exchange using the IP address of TNGF received during the EAP-5G signalling, in step 10b. Subsequently, the UE initiates an IKE\_AUTH exchange and provides its identity. The identity provided by the UE in the IKEv2 signalling should be the same as the UE Id included in the AN parameters in step 5. This enables the TNGF to locate the TNGF key that was created before for this UE, during the authentication in step 8. The TNGF key is used for mutual authentication. NULL encryption is negotiated between the UE and the TNGF, as specified in RFC 2410 [49].

 In step 13c, the TNGF provides to UE (a) an "inner" IP address, (b) a NAS\_IP\_ADDRESS and a TCP port number and (c) a DSCP value. After this step, an IPsec SA is established between the UE and TNGF. This is referred to as the "signalling IPsec SA" and operates in Tunnel mode. Operation in Tunnel mode enables the use of MOBIKE [40] for re-establishing the IPsec SAs when the IP address of the UE changes during mobility events. All IP packets exchanged between the UE and TNGF via the "signalling IPsec SA" shall be marked with the above DSCP value. The UE and the TNAP may map the DSCP value to a QoS level (e.g. to an EDCA Access Class [48]) supported by the underlying non-3GPP Access Network. The mapping of a DSCP value to a QoS level of the non-3GPP Access Network is outside the scope of 3GPP.

 Right after the establishment of the "signalling IPsec SA", the UE shall setup a TCP connection with the TNGF by using the NAS\_IP\_ADDRESS and the TCP port number received in step 13c. The UE shall send NAS messages within TCP/IP packets with source address the "inner" IP address of the UE and destination address the NAS\_IP\_ADDRESS. The TNGF shall send NAS messages within TCP/IP packets with source address the NAS\_IP\_ADDRESS and destination address the "inner" IP address of the UE.

 This concludes the setup of the NWt connection between the UE and the TNGF. All subsequent NAS messages between UE and TNGF are carried over this NWt connection (i.e. encapsulated in TCP/IP/ESP).

14. After the NWt connection is successfully established, the TNGF responds to AMF with an N2 Initial Context Setup Response message.

15. The AMF determines the subset of the requested NSSAI that is allowed by the subscribed S-NSSAI(s); the AMF may detect that the TNGF used by the UE is not compatible with this subset and then proceed with steps 17-21. Otherwise, i.e., if the TNGF supports the subset of the requested NSSAI that is allowed by the subscribed S-NSSAI(s), the AMF proceeds with step 16 and steps 17-21 are skipped.

NOTE 4: the criteria for the AMF to determine that the TNGF used by the UE is not compatible with the subset of the requested NSSAI that is allowed by the subscribed S-NSSAI(s) is based on local AMF policies. For example the AMF can determine that the TNGF used by the UE is compatible as soon as there is one supported slice in common.

16. The NAS Registration Accept message is sent by the AMF and is forwarded to UE via the established NWt connection. Now the UE can use the TNAN (a) to transfer non-seamless offload traffic and (b) to establish one or more PDU Sessions.

Steps 17 to 21 correspond to the case where the AMF has detected that TNGF used by the UE is not compatible with the subset of the requested NSSAI that is allowed by the subscribed S-NSSAI(s).

17. If the UE Registration Request contains an indication that the UE supports TNGF selection based on the slices the UE wishes to use over trusted non-3GPP access, the AMF may trigger the UE PCF to update the UE policies related with trusted non-3GPP access selection. The AMF requests the PCF to receive a notification when the PCF has completed the WLANSP or ANDSP update.

The AMF triggers the UE PCF to update the UE policies related with trusted non-3GPP access selection by either indicating the request in Npcf\_UEPolicyControl\_Create or by issuing a Npcf\_UEPolicyControl\_Update indicating that the PCRT on “UE has connected to a wrong trusted non-3GPP access that does not match its subscribed S-NSSAI(s)”, as defined in Table 6.1.2.5-1 of TS 23.503 [20].

NOTE 5: The UE is assumed to inform PCF whether the UE supports Extended WLANSP or ANDSP as part of the UE policy update procedure. Details will be specified by CT1.

18. The PCF updates the UE policies related with trusted non-3GPP access selection per the procedure defined in figure 4.2.4.3-1.

19. When the update of UE policies related with trusted non-3GPP access selection is completed, the PCF notifies the AMF by invoking Npcf\_UEPolicyControl\_UpdateNotify.

20. The AMF sends via the TNGF a UE Registration Reject indicating that the selected TNGF was not appropriate for the requested slices that the UE is allowed to access to. The AMF may provide target TNAN information (SSID, TNGF ID) to the UE within the Registration Reject message indicating the UE to build the NAI based on the TNGF ID.

~~Editor's note: Whether to prevent the UE from loop of registration request and AMF reject for example in case of error in policy update, in UE policy provided, etc. is FFS.~~

NOTE 6: The AMF may determine a target TNGF that supports the subset of the requested NSSAI that is allowed by the subscribed S-NSSAI(s) based on the list of supported TAs and the corresponding list of supported slices for each TA obtained in N2 interface management procedures as specified in TS 38.413 [10].

21. If supported by the UE and if the UE received target TNAN information in step 20, the UE connects to the target TNAN, otherwise the UE may perform TNAN selection again using the updated WLANSP rule received in step 18. If the target TNAN information includes TNGF ID, the UE shall build the NAI based on TNGF ID. The UE uses the target TNAN information in the Registration Reject only for the TNAN selection directly following the rejected registration and UE shall not store it for future use.

\* \* \* \* Next changes \* \* \* \*

##### 5.2.5.6.3 Npcf\_UEPolicyControl\_UpdateNotify service operation

**Service operation name:** Npcf\_UEPolicyControl\_UpdateNotify

**Description:** Provides to the NF Service Consumer updated Policy information for the UE context evaluated based on the information previously provided by the PCF.

NOTE: This notification corresponds to an implicit subscription.

**Inputs, Required:** Notification endpoint, UE Policy Association ID.

**Inputs, Optional:** Policy Control Request Trigger of UE Policy Association. In the case of H-PCF is producer, UE Access and PDU session related information as defined in clause 5.2.5.1. indication of successful delivery of UE policies related with trusted non-3GPP access selection

NOTE: the indication of successful delivery of UE policies related with trusted non-3GPP access selection is used e.g. as defined in clause 4.12a.2.2

**Outputs, Required:** Success or failure.

**Outputs, Optional:** None\* \* \* \* Next changes \* \* \* \*

##### 5.2.5.6.2 Npcf\_UEPolicyControl\_Create service operation

**Service operation name:** Npcf\_UEPolicyControl\_Create

**Description:** NF Service Consumer can request the creation of a UE Policy Association by providing relevant parameters about the UE context to the PCF.

**Inputs, Required:** Notification endpoint, SUPI.

**Inputs, Optional:** H-PCF ID (if the NF service producer is V-PCF and AMF is NF service consumer), information provided by the AMF as define in clause 6.2.1.2 of TS 23.503 [20], such as Access Type, Permanent Equipment Identifier, GPSI, User Location Information, UE Time Zone, Serving Network (PLMN ID, or PLMN ID and NID, see clause 5.34 of TS 23.501 [2]), RAT type, UE policy information including the list of PSIs, OS id and Internal Group (see TS 23.501 [2]), Satellite Backhaul Category (see clause 5.43.2 of TS 23.501 [2]), request to update the UE policies related with trusted non-3GPP access selection, request to be notified when updated UE policies related with trusted non-3GPP access selection have been provided to the UE ,.

**Outputs, Required:** Success or Failure, UE Policy Association ID.

**Outputs, Optional:** Policy Control Request Trigger of UE Policy Association. In the case of H-PCF is producer, UE policy information (see clause 5.2.5.6.1).

\* \* \* \* End of changes \* \* \* \*