**3GPP TSG-SA3 Meeting #98Bis-e *S3-200658***

**e-meeting, 14 – 17 April 2020** merge of S3-200781, S3-200786, S3-200788

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **33.501** | **CR** |  | **rev** | **-** | **Current version:** | 16.2.0 |  |
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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 | **x** | Radio Access Network |  | Core Network | **x** |

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|  |
| ***Title:***  |  Addressing ENs in security procedures for network slices |
|  |  |
| ***Source to WG:*** |  Huawei, HiSilicon, Nokia, Nokia Shanghai Bell, Ericsson, , Hewlett-Packard Enterprise, China Mobile, CATT |
| ***Source to TSG:*** | S3 |
|  |  |
| ***Work item code:*** | eNS-SEC |  | ***Date:*** | 16/1/2020 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | R16 |
|  | *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-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
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| ***Reason for change:*** | Address ENs in security procedures for network slices. |
|  |  |
| ***Summary of change:*** | X.x.2* removed EN (already addressed)

X.x.3: * “AUSF” service to Primary authentication is isolated from service to NSSAA involving AAA-S by introducing NSSAAF
* Editorial on “EAP ID” and removed EN

X.x.4* Aligned to X.x.3: 2 “AUSF” instances are used
* Editorial changes
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|  |  |
| ***Consequences if not approved:*** |  There are security issues. |
|  |  |
| ***Clauses affected:*** | X.X.2, X.X.3, X.X.4, X.X.5 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **n** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **n** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **n** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

### \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Start of changes \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

# x Security procedures for network slices

### x.x.1 General

This clause specifies the security procedures for network slices.

### x.x.2 Authorization for network slice access

This clause specifies the relationship between primary authentication (as described in Clause 6.1) and authorization for network slice access (as described in TS23.502 [8]) for a UE. Authorization from a home/serving PLMN is required for a UE to gain access to a network slice, identified by an S-NSSAI. An authorized S-NSSAI (i.e. allowed S-NSSAI) shall be granted to a UE only after the UE has completed successfully primary authentication. At the end of the primary authentication, the AMF and UE may receive a list of allowed S-NSSAI, which the UE is authorized to access.

For certain S-NSSAIs, additional Network Slice Specific Authentication and Authorization (NSSAA) is required. This clause in addition specifies the pre-requisite for NSSAA procedure that will be described in section x.x.3, with reference to the following figure x.x.2-1.



Figure x.x.2-1: Relationship between primary authentication and slice-specific authentication and authorization

1. UE sends a Registration Request with a list of S-NSSAIs. UE shall not include those S-NSSAIs for which SSAA is ongoing, regardless of access type (c.f. TS 23.501[2], clause 5.15.5.2.1 and TS 23.502[8], clause 4.2.2.2.2).
2. For an initial Registration Request, the AMF/SEAF shall invoke Primary authentication as described in clause 6.1.2 of the present document. For a subsequent Registration Request, the Primary authentication may be skipped if the UE has already been authenticated and the AMF has valid security context.
3. AMF shall determine whether slice-specific authentication and authorization is required for each of S-NSSAI, based on information stored locally or from UDM. For example, the network slice-specific authentication for an S-NSSAI may be omitted

1)if it is not required based on the subscription information,

2)if UE has previously performed network slice-specific authentication successfully, regardless of access type and the result is still valid, or

3)network slice-specific authentication for UE is ongoing

1. AMF sends UE the Registration Accept message and UE (c.f. TS 23.501[2], clause 5.15.5.2.1 and TS 23.502[8], clause 4.2.2.2.2, step 21). Optionally UE sends a Registration Complete.
2. EAP based slice-specific authentication and authorization procedure for each S-NSSAI if required, as determined in step 3 is executed in this step.

6. Based on the results of step 5, AMF sends UE Configuration Update to update the requested S-NSSAI status based on the slice-specific authentication results.

The procedure for step 5, i.e., the slice-specific authentication and authorizaiton procedure is specified in clause x.x.3.

### x.x.3 Network Slice specific authentication

This clause specifies the optional-to-use Network slice-specific authentication and authorization between a UE and an AAA server (AAA-S) which may be owned by an external 3rd party enterprise. Network slice-specific authentication and authorization uses a User ID and credentials, different from the 3GPP subscription credentials (e.g. SUPI and credentials used for PLMN access) and takes place after the primary authentication.

The EAP framework specified in RFC 3748 [27] shall be used for Network slice-specific authentication and authorization between the UE and the AAA server. The SEAF/AMF shall perform the role of the EAP Authenticator and communicates with the AAA-S via the NSSAA Function. The NSSAA Function undertakes any AAA protocol interworking with the AAA-S. Multiple EAP methods are possible for slice specific authentication.

To protect privacy of the EAP ID used for the EAP based Network Slice Specific Authentication and Authorizaation, a privacy-protection capable EAP method is recommended, if privacy protection is required.

The steps involved in network slice specific authentication and authorization are described below.



**Figure X-1: Network Slice-Specific Authentication and Authorization procedure**

1. For S-NSSAIs that are requiring Network Slice-Specific Authentication and Authorization, based on change of subscription information, or triggered by the AAA-S, the AMF may trigger the start of the Network Slice Specific Authentication and Authorization procedure.

 If Network Slice Specific Authentication and Authorization is triggered as a result of Registration procedure, the AMF may determine, based on UE Context in the AMF, that for some or all S-NSSAI(s) subject to Network Slice Specific Authentication and Authorization, the UE has already been authenticated following a Registration procedure on a first access. Depending on Network Slice Specific Authentication and Authorization result (e.g. success/failure) from the previous Registration, the AMF may decide, based on Network policies, to skip Network Slice Specific Authentication and Authorization for these S-NSSAIs during the Registration on a second access.

 If the Network Slice Specific Authentication and Authorization procedure corresponds to a re-authentication and re-authorization procedure triggered as a result of AAA Server-triggered UE re-authentication and re-authorization for one or more S-NSSAIs, as described in clause 4.2.9.2 of TS 23.502 [8], or triggered by the AMF based on operator policy or a subscription change and if S-NSSAIs that are requiring Network Slice-Specific Authentication and Authorization are included in the Allowed NSSAI for each Access Type, the AMF selects an Access Type to be used to perform the Network Slice Specific Authentication and Authorization procedure based on network policies.

2. The AMF may request the UE User ID for EAP authentication (EAP ID) for the S-NSSAI in a NAS MM Transport message including the S-NSSAI.

3. The UE provides the EAP ID for the S-NSSAI alongside the S-NSSAI in an NAS MM Transport message towards the AMF.

4. The AMF sends the EAP ID to the NSSAAF which provides interface with the AAA,

in a Nssaaf\_NSSAA\_Authenticate Request (EAP ID Response, GPSI, S-NSSAI).

5. If the AAA-P is present (e.g. because the AAA-S belongs to a third party and the operator deploys a proxy towards third parties), the NSSAAF forwards the EAP ID Response message to the AAA-P, otherwise the NSSAAF forwards the message directly to the AAA-S. NSSAAF routes to the AAA-S based on the S-NSSAI. The NSSAAF/AAA-P forwards the EAP Identity message to the AAA-S together with S-NSSAI and GPSI. The AAA-S stores the GPSI to create an association with the EAP ID in the EAP ID response message so the AAA-S can later use it to revoke authorisation or to trigger reauthentication. The AAA-S uses the EAP-ID and S-NSSAI to identify for which UE and slice authorisation is requested.

6 -11. EAP-messages are exchanged with the UE. One or more than one iteration of these steps may occur.

12. EAP authentication completes. An EAP-Success/Failure message is delivered to the NSSAAF/AAA-P along with GPSI and S-NSSAI.

13. The NSSAAF/AAA-P sends the Nausf\_NSSAA\_Authenticate Response (EAP-Success/Failure, S-NSSAI, GPSI) to the AMF.

14. The AMF transmits a NAS MM Transport message (EAP-Success/Failure) to the UE.

15. Based on the result of Slice specific authentication (EAP-Success/Failure), if a new Allowed NSSAI or new Rejected NSSAIs needs to be delivered to the UE, or if the AMF re-allocation is required, the AMF initiates the UE Configuration Update procedure, for each Access Type, as described in clause 4.2.4.2 of TS 23.502 [8].

Editor’s Note: It is ffs whether S-NSSAIs can be sent to AAA-S.

Editor’s Note: The name of the NF (NSSAF) for interaction with AAA is pending alignment with other WGs.

Editor’s Note: Security requirements for NSSAF is FFS.

x.x.4 AAA Server triggered Network Slice-Specific Re-authentication and Re-authorization procedure

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**Figure X.X.4-1: AAA Server initiated Network Slice-Specific Re-authentication and Re-authorization procedure**

0. The UE is registered in 5GC via an AMF. The AMF ID is stored in the UDM.

1. The AAA-S requests the re-authentication and re-authorization for the Network Slice specified by the S-NSSAI in the Re-Auth Request message, for the UE identified by the GPSI in this message. This message is sent to an AAA-P, if the AAA-P is used (e.g. the AAA Server belongs to a third party), otherwise it may be sent directly to the NSSAAF. If an AAA-P is present, the AAA-P relays the Reauthentication Request to the NSSAAF.

2. The NSSAAF requests UDM for the AMF serving the UE using the Nudm\_UECM\_Get (GPSI, AMF Registration) service operation. The UDM provides the NSSAAF with the AMF ID of the AMF serving the UE.

3. The NSSAAF requests the relevant AMF to re-authenticate/re-authorize the S-NSSAI for the UE using the Nssaaf\_NSSAA\_Re-authenticationNotification service operation. The AMF acknowledges the notification of Re-authentication request.

4. The AMF triggers the Network Slice-Specific Authentication and Authorization procedure defined in clause X.X.3 for the UE identified by the GPSI and the Network Slice identified by the S-NSSAI received from the NSSAAF.

X.X.5 AAA Server triggered Slice-Specific Authorization Revocation

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**Figure 4.2.9.4-1: AAA Server-initiated Network Slice-Specific Authorization Revocation procedure**

0. The UE is registered in 5GC via an AMF. The AMF ID is stored in the UDM.

1. The slice specific AAA-S requests the revocation of authorization for the Network Slice identified by the GPSIin the AAA Protocol Revoke Authorization Request message,. This message is sent to NSSAF instance interfacing with AAA-S or AAA-P if it is used.

The AAA-P, if present, relays the request to the NSSAAF.

2. The AUSF requests UDM for the AMF serving the UE using the Nudm\_UECM\_Get (GPSI, AMF Registration) service operation. The UDM provides the AUSF with the AMF ID of the AMF serving the UE.

3. The NSSAAF request the relevant AMF to revoke the S-NSSAI authorization for the UE using the Nssaaf\_NSSAA\_RevocationNotification service operation.

The AMF acknowledges the Notification of Revocation request.

4. The AMF sends the UE Configuration Update message to revoke the S-NSSAI from the current Allowed NSSAI, for any Access Type for which Network Slice Specific Authentication and Authorization had been successfully run on this S-NSSAI.. The AMF provides a new Allowed NSSAI to the UE by removing the S-NSSAI for which authorization has been revoked. The AMF provides new rejected NSSAIs to the UE including the S-NSSAI for which authorization has been revoked. If no S-NSSAI is left in Allowed NSSAI for an access after the revocation, and a Default NSSAI exists that requires no Network Slice Specific Authentication or for which a Network Slice Specific Authentication did not previously fail over this access, then the AMF may provide a new Allowed NSSAI to the UE containing the Default NSSAI. If no S-NSSAI is left in Allowed NSSAI for an access after the revocation, and no Default NSSAI can be provided to the UE in the Allowed NSSAI or a previous Network Slice Specific Authentication failed for the Default NSSAI over this access, then the AMF shall execute the Network-initiated Deregistration procedure for the access as described in subclause 4.2.2.3.3 in TS 23.502 [8], and it shall include in the explicit De-Registration Request message the list of Rejected S-NSSAIs, each of them with the appropriate rejection cause value.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* End of 1st change \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

\*\*\* START OF 2nd CHANGES \*\*\*

## 14.X Services provided by NSSAAF

14.X.1 Nssaaf\_NSSAA services

The following table illustrates the security related services for Network Slice Specific Authentication and Authorisation that NSSAAF provides.

**Table 14.1.3-1: NF services for the NSSAA service provided by NSSAAF**

|  |  |  |  |
| --- | --- | --- | --- |
| **Service Name** | **Service Operations** | **Operation Semantics** | **Example Consumer(s)** |
| Nssaaf\_NSSAA | Authenticate | Request/Response | AMF |
| Re-AuthenticationNotification | Notify | AMF |
| RevocationNotification | Subscribe/Notify | AMF |

14.X.1.1 Nssaaf\_NSSAA\_Authenticate service operation

**Service operation name:** Nssaaf\_NSSAA\_Authenticate

**Description:** NF requester requires the NSSAAF to relay Network Slice specific authentication messages towards the corresponding AAA-S handling the Network Slice specific authentication for the requested S-NSSAI.

**Input, Required:**

1. In the initial NSSAA requests: EAP ID Response, GPSI, S-NSSAI
2. In subsequent NSSAA requests: EAP message, GPSI, S-NSSAI

**Input, Optional:** None

**Output, Required:** EAP message, GPSI, S-NSSAI

**Output, Optional:** None

14.X.1.2 Nssaaf\_NSSAA\_Re-AuthenticationNotification service operation

**Service operation name:** Nssaaf\_NSSAA\_Re-AuthenticationNotification

**Description:** NSSAAFnotifies the NF consumer to trigger a Network Slice specific reauthentication procedure for a given UE and S-NSSAI.

NOTE: The AMF is implicitly subscribed to receive Nssaaf\_NSSAA\_Re-authenticationNotification service operations.

**Input, Required:** GPSI, S-NSSAI

**Input, Optional:** None

**Output, Required:** None

**Output, Optional:** None

14.X.1.3 Nssaaf\_NSSAA\_RevocationNotification service operation

**Service operation name:** Nssaaf\_NSSAA\_RevocationNotification

**Description:** NSSAAFnotifies the NF consumer to trigger a Network Slice specific revocation procedure for a given UE and S-NSSAI.

NOTE: The AMF is implicitly subscribed to receive Nssaaf\_NSSAA\_RevocationNotification service operations.

**Input, Required:** GPSI, S-NSSAI

**Input, Optional:** None

**Output, Required:** None

**Output, Optional:** None

\*\*\* END OF 2nd CHANGE \*\*\*