**3GPP TSG-SA WG4 Meeting #126 S4-231788**

**Meeting, 13 – 17 November 2023**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  | **26.941** | **pCR** |  | **rev** | **01** | **Current version:** | **1.0.0** |  |
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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 | **x** | Radio Access Network |  | Core Network | **x** |

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| ***Title:***  | [FS\_MS\_NS\_Ph2]KI#5: Interoperability considerations for communication between AF instances  |
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| ***Source to WG:*** | Nokia  |
| ***Source to TSG:*** | S4 |
|  |  |
| ***Work item code:*** | FS\_MS\_NS\_Ph2 |  | ***Date:*** | 04-11-2023 |
|  |  |  |  |  |
| ***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:*** | Clause 6.5 containing the KI#5 of the latest version of TR 26.941 v 0.6.0 is left incomplete. |
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| ***Summary of change:*** | This pCR proposes a description and a candidate solution for key issue #5. This applies to scenarios needing harmonized time domain between multiple slices. This applies for instance to professional production scenarios (uplink) but also to collaborative downlink applications needed a proper synchronization between multiple UEs. To do so, it is expected that the AFs collaborate with each other to agree on a common time reference. |
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| ***Consequences if not approved:*** | TR 26.941 KI#5 will remain incomplete.  |
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| ***Clauses affected:*** | 6. 5.1.1 (new) and 6.5.2.1 (new) |
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|  | **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 ...  |
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| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

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| 1st Change |

## 6.5 Key Issue #5: Interoperability considerations

### 6.5.1 Description

#### 6.5.1.1 Communication between AF instances to support interoperability

Editor’s Note: Key issue to cover study objective of determining the need and describing methods for AF-to-AF communication to support interoperability if 5GMS instances from different vendors are deployed in the 5GMS system. Media services may have different types of AFs (provisioning AF, dynamic policy AF, DCAF etc.) due to slicing, edge service provisioning, reporting configuration etc., and this key issue will cover communication aspects between those AFs if the AFs are deployed by different vendors.

In general, AF-to-AF communication should be mediated through the Network Exposure Function (NEF), as shown in figure 6.5.1.1‑1 below [1]. The NEF is connected with other Network Functions (NFs) through the 5GC service bus. It also exposes a set of APIs to Application Functions deployed inside and outside the Trusted Doamin through a northbound interface at reference point N33 [2], [3]. When this API is used, the NEF is responsible for the proxying of the request and the translation of external processing information. After authorising the invocation, it completes the external request by invoking the target Network Function (e.g., PCF) on behalf of the AF.



Figure 6.5.1.1‑1: Communication between AF instances via NEF (source TS 29.517)

Time synchronization between multiple UEs is a well-known topic, for both uplink and downlink applications. For example:

* In the uplink direction, a production crew may provision a Network Slice in a media production environmentto meet its connectivity needs. Then, mechanisms are provided by the 5G System to deliver a clock to UEs in that Network Slice. This can be done using SIB9/RRC signals (the Access Stratum method)or alternatively by sending PTP messages in the user plane.
* In the downlink direction, content distribution to users inside an entertainment venue may in some cases require fine-grained synchronization, especially for collaborative and shared applications.

This works well if a single slice is used. For cases where multiple slices are used to address connectivity needs, the synchronization between multiple UEs can be lost. In this Key Issue, we consider the case highlighted in figure 5.4.1.3-1 where Network Slices on different PLMNs, each with their own 5GMSd AF, share the same external 5GMSd AS. In this case, the two 5GMSd AFs need to collaborate to ensure that the UEs, and hence the media streaming sessions, are properly synchronized.

This Key Issue considers mechanisms to ensure that UEs and media streaming sessions carried out on different slices and through different 5GMSd AFs can be efficiently synchronized together. If not addressed, the video sessions desynchronization would dramatically impact the QoE.

### 6.5.2 Candidate solutions

#### 6.5.2.1 Candidate solution #1

clause 4.15.9 of TS 23.502 [2], documents how the NEF can be leveraged to configure and access time synchronization mechanisms. In our case, the NEF is used by 5GMSd AFs in different PLMNs to configure a common production clock. The figure below describes a procedure enabling two mutually untrusted 5GMSd AFs to synchronize themselves based on the NEF of their respective PLMNs. This service provides:

1. Authorization of NF Service Consumer requests;

2. Time synchronization service exposure, as described in clause 5.27.1.8 of TS 23.501 [2], in which the NF Service Consumer creates or updates a time synchronization configuration as well as to activate and deactivate the time synchronization service. For this purpose, the NEF uses service operations provided by the Time Synchronization Function for Time-Sensitive Communication (TSCTSF) as described in clause 5.2.27 of TS 23.501 [2].

The NEF service operations of interest are as follows:

- Nnef\_TimeSynchronization\_ConfigCreate: The service consumer creates a time synchronization configuration and activates the time synchronization service with this configuration. The NEF authorizes the request and invokes the corresponding service operation on the TSCTSF (see [clause 5.2.27.2.2](https://www.tech-invite.com/3m23/toc/tinv-3gpp-23-502_zzzk.html%22%20%5Cl%20%22e-5-2-27-2-2) of [2]).

- Nnef\_TimeSynchronization\_ConfigUpdate: The service consumer updates the time synchronization configuration. The NEF authorizes the request and invokes the corresponding service operation on the TSCTSF (see [clause 5.2.27.2.3](https://www.tech-invite.com/3m23/toc/tinv-3gpp-23-502_zzzk.html%22%20%5Cl%20%22e-5-2-27-2-3) [2]).

- Nnef\_TimeSynchronization\_CapsSubscribe: The AF subscribes to receive notifications about time synchronization capabilities for a list of UE(s) or a group of UEs or any UEs using DNN/S-NSSAI combination. The NEF authorizes the request and invokes the corresponding service operation on the TSCTSF (see [clause 5.2.27.2.6](https://www.tech-invite.com/3m23/toc/tinv-3gpp-23-502_zzzk.html%22%20%5Cl%20%22e-5-2-27-2-6) [2]).



Figure 6.5.2.1-1: High-level call flow for communication between AF instances
to support interoperability

The steps are as follows:

1. AF-1 subscribes to the "UE availability for time synchronization" service and provides its Notification Target Address by sending an Nnef\_TimeSynchronization\_CapsSubscribe request to NEF‑1.

2. Similarly, AF-2 subscribes to the "UE availability for time synchronization" service and provides its associated Notification Target Address by sending an Nnef\_TimeSynchronization\_CapsSubscribe request to NEF‑2.

3. The NEF-1 responds to the AF-1 subscription on time synchronization service.

4. Similarly, NEF-2 responds to the AF-2 subscription on time synchronization service.

5. The AF-1 creates a time synchronization configuration and activates the time synchronization service with NEF-1.

6. The AF-2 creates a time synchronization configuration and activates the time synchronization service with NEF-2.

Note 1: The AF may provide the TSC Assistance Information (TSCAI) including the traffic pattern parameters such as Burst Arrival Time with reference to the ingress port, Periodicity, Flow Direction, Survival Time and Time domain to the NEF.

 Note 2 : If the AF is in a different trust domain from the 5G System, then it provides input via exposure framework, NEF API. If the AF is in the same trust domain as the 5G System, then it provides input directly via the Time Sensitive communication Time Synchronization function (TSCTSF).

7a. The NEF-1 forwards the received traffic pattern parameters to TSCTSF-1. TSCTSF-1 checks for subscriptions thus also authorizes the time sync requests.

7b. TSCTSF-1 forwards the received traffic pattern parameters to TSCTSF-2. TSCTSF-2 checks for subscriptions thus also authorizes the time sync requests.

7c. TSCTSF-2 forwards the received traffic pattern parameters to NEF-2. NEF-2 checks for subscriptions thus also authorizes the time sync requests.

7d. NEF-2 authorizes time sync requests to NEF-1 via TSCTSF-2 and TSCTSF-1.

8. Upon successful negotiation, AF-1 and AF-2 are time synchronised.

References:

[1]. 3GPP TS 29.517 version 16.1.0 Release 16 5G System; Application Function (AF) event exposure service; Stage 3

[2] 3GPP [TS 23.502](https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=3145" \t "_blank), Procedures for 5G System; Stage 2

[3] 3GPP TS 3GPP TS 29.522 version 16.4.0 Release 16 5G; 5G System; Network Exposure Function Northbound APIs; Stage 3.

[4] 3GPP [TS 23.501](https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=3144" \t "_blank), System Architecture for 5G System; Stage 2 (clauses 4.4.8, 5.27, 5.28)

[5] 3GPP [TS 23.503](https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=3334" \t "_blank), Policy and Charging Control Framework for the 5G System; Stage 2

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| End of change |