**3GPP TSG-SA2 Meeting #170 *S2-2506206***

**Stor-Göteborg, Sweden, 25th Aug 2025 - 29th Aug 2025**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **23.288** | **CR** | **1432** | **rev** | **2** | **Current version:** | **19.3.0** |  |
|  | | | | | | | | |
| *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:*** | AIML\_CN KI#4 Resolve issues for for event and analytics exposure | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** |  | | | | | | | | | |
| ***Source to TSG:*** | S2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** |  | | | | |  | ***Date:*** | | |  |
|  |  | | | |  | |  | | |  |
| ***Category:*** | F |  | | | | | ***Release:*** | | |  |
|  | *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 can be 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-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | 1. TS 23.502 contains the following:  5.2.5.7 Npcf\_EventExposure service  *5.2.5.7.1 General*  ***Service description:*** *This service enables an NF to subscribe and get notified about PCF events for a group of UE(s) or any UE accessing a combination of (DNN, S-NSSAI).*  *The events can be subscribed by a NF consumer are described in clause 6.1.3.18 of TS 23.503 [20].*  *When the consumer NF is the NWDAF, the event ID “Signalling Storm” including Request type and number of requests corresponding to the request type from NF, Unexpected operational status indicator, etc. is used to collect data for NF related information from PCF for Signalling Storm Analytics as specified in clause 6.x.2 of TS 23.288 [50].*  *….*  However, TS 23.288 still contains the following Note:  *NOTE 1: There is no data collected from the PCF by the NWDAF defined in this Release of the specification.*  2. In their incoming LS S2-2506107, CT3 raised concerns that that the SCP, the NRF, and the UDM, which are analytics consumers of the Signalling Storm analytics, do not appear in Table 8.1-1 and Table 9.1-1 as NF service consumers of the DCCF and the MFAF. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | 1. Remove Note that no input data to be collected from PCF are defined.  2. Update Table 8.1-1 and Table 9.1-1 to add SCP, NRF, and UDM as NF service consumers of the DCCF and the MFAF, respectively. | | | | | | | | |
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| ***Consequences if not approved:*** | | 1. Contradiction between specifications  2. Internal contraditions in TS 23.288 confuse downstream groups. | | | | | | | | |
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| ***Clauses affected:*** | | 6.2.2.1, 8.1, 9.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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 change

#### 6.2.2.1 General

The Data Collection from NFs and SCP is used by NWDAF to subscribe/unsubscribe at any 5GC NF to be notified for data on a set of events.

The Data Collection from NFs and SCP is based on the services of AMF, SMF, UDM, PCF, NRF, NSACF, UPF, LMF and AF (possibly via NEF):

- Event Exposure Service offered by each NF as defined in clause 4.15 and clause 5.2 of TS 23.502 [3].

- other NF services (e.g. Nnrf\_NFDiscovery and Nnrf\_NFManagement in NRF as defined in clause 4.17 of TS 23.502 [3])

This data collection service is used directly in order to retrieve behaviour data for individual UEs or groups of UEs (e.g. UE reachability) and also to retrieve global UE information (e.g. Number of UEs present in a geographical area).

Table 6.2.2.1-1: NF Services consumed by NWDAF for data collection

|  |  |  |
| --- | --- | --- |
| Service producer | Service | Reference in TS 23.502 [3] or other indicated specification |
| AMF | Namf\_EventExposure (NOTE 2) | 5.2.2.3  5.2.3.5 |
| SMF | Nsmf\_EventExposure (NOTE 2) | 5.2.8.3  5.2.3.5 |
| PCF | Npcf\_EventExposure (for a group of UEs identified by an Internal-Group-Id or any UE)  Npcf\_PolicyAuthorization\_Subscribe (for a specific UE) | 5.2.5.7 |
| UDM | Nudm\_EventExposure | 5.2.3.5 |
| NEF | Nnef\_EventExposure | 5.2.6.2 |
| AF | Naf\_EventExposure | 5.2.19.2 |
| NRF | Nnrf\_NFDiscovery | 5.2.7.3 |
|  | Nnrf\_NFManagement | 5.2.7.2 |
| NSACF | Nnsacf\_SliceEventExposure | 5.2.21.4 |
| UPF | Nsmf\_EventExposure or Nupf\_EventExposure | 5.2.8.3  5.2.26.2 |
| SCP | Nscp\_EventExposure Service | 5.2.28.2 |
| LMF | Nlmf\_DataExposure | Clause 8.3.4 of TS 23.273 [39] |

NOTE 1: The Nudm\_EventExposure can be used when NWDAF uses the procedures specified in clause 4.15.4.4 of TS 23.502 [3] to subscribe to AMF or SMF via UDM.

To retrieve data related to a specific UE, there are two cases:

- If no Area of interest is indicated by the consumer, the NWDAF shall first determine which NF instances are serving this UE as stated in table 6.2.2.1-2 unless the NWDAF has already obtained this information due to recent operations related to this UE.

- If an Area of interest is indicated, the NWDAF can:

- First determine the AMF serving the UE and subscribe UE location from the AMF. Once the UE is in or moves into the Area of interest, the NWDAF determines which NF instances are serving this UE as stated in table 6.2.2.1-2 unless the NWDAF has already obtained this information due to recent operations related to this UE; or

- Determine the NF instances of a given type of network function serving the Area of interest by querying NRF unless the NWDAF has already obtained this information due to recent operations related to this UE.

Table 6.2.2.1-2: NF Services consumed by NWDAF to determine which NF instances are serving a UE

| Type of NF instance (serving the UE) to determine | NF to be contacted by NWDAF | Service | Reference in TS 23.502 [3] |
| --- | --- | --- | --- |
| UDM | NRF | Nnrf\_NFDiscovery | 5.2.7.3 |
| AMF | UDM | Nudm\_UECM | 5.2.3.2 |
| SMF | UDM | Nudm\_UECM | 5.2.3.2 |
| BSF | NRF | Nnrf\_NFDiscovery | 5.2.7.3 |
| PCF | BSF | Nbsf\_Management | 5.2.13.2 |
| NEF | NRF | Nnrf\_NFDiscovery | 5.2.7.3 |
| NWDAF | NRF  UDM | Nnrf\_NFDiscovery  Nudm\_UECM | 5.2.7.3  5.2.3.2 |
| NSACF | NRF | Nnrf\_NFDiscovery | 5.2.7.3 |
| GMLC | NRF | Nnrf\_NFDiscovery | 5.2.7.3 |

The UDM instance should be determined using NRF as described in clause 4.17.4 of TS 23.502 [3] and factors to determine as described in clause 6.3.8 of TS 23.501 [2].

The AMF, SMF instances should be determined using a request to UDM providing the SUPI. To determine the SMF serving a PDU session, the NWDAF should in addition provide the DNN and S-NSSAI of this PDU Session; otherwise the NWDAF will obtain a list of possibly multiple SMFs (e.g. one per PDU session).

The BSF instance is discovered and selected according to TS 23.503 [4], clause 6.1.1.2.2.

The PCF instance serving UE PDU Session(s) should be determined using a request to BSF with the allocated UE address, DNN and S-NSSAI.

To collect data (e.g. current number of UEs registered in a network slice or current number of PDU Sessions established in a network slice) from NSACF, the NSACF instance is discovered and selected as specified in clause 6.3.22 of TS 23.501 [2].

When NWDAF receives a request addressed to an Internal Group ID from a consumer, NWDAF may need to initiate data collection from several 5GC NFs, such as AMF, SMF, UDM, PCF, AF (e.g. via NEF), etc. If an Area of interest is indicated by the consumer, NWDAF may first discover the instances of the required 5GC NFs deployed in the network, e.g. by querying NRF, otherwise:

- For discovering the UDM, NWDAF can query the NRF with the Internal Group ID as the target of the query.

- For discovering AMF, SMF, PCF, NEF and AF, NWDAF may need to discover all instances in the network by using the Nnrf\_NFDiscovery service.

NOTE 2: It is assumed that all members of an Internal Group ID belong to the same UDM Group ID. NWDAF can select a UDM instance supporting the UDM Group ID of the Internal Group ID.

Then, if data needs to be collected from AMF, SMF, UDM and PCF, NWDAF may initiate the data collection with the Internal Group ID as the target, e.g. subscribing to the event exposure in all the instances of a given type of network function. This subscription to all the instances of required source of event exposure handles, e.g. mobility of UEs across AMFs, or initiation of new PDU sessions with different allocated SMFs.

For collecting data from AMF and SMF, NWDAF may collect the data directly from AMF and/or SMF, or indirectly via UDM, according to clause 4.15.4.4 of TS 23.502 [3]. The indirect method may be required if the event exposure subscription from NWDAF, for a UE identified by a SUPI or a group of UEs identified by an Internal-Group-Id, needs to survive the removal of UE context in the AMF including event exposure subscriptions, or upon the creation of new UE context in AMF or SMF serving the UE or group of UEs. In this case the UDM is responsible for (re)creating event exposure subscriptions in AMF and SMF, as specified in clause 4.15.4.4 of TS 23.502 [3].

The NWDAF determines to collect data from a trusted AF supporting specific Event ID(s) and serving specific application(s) based on internal configuration.

The NEF instance that is serving a specific network slices and/or applications of a UE should be determined using NRF using optional request parameters as defined in clause 6.3.14 of TS 23.501 [2]

If NWDAF needs to collect data from an AF deployed outside the operator's domain, the NWDAF shall contact NEF with a SUPI or Internal Group ID as the target of the data collection. NEF is responsible for translation of SUPI to GPSI, or internal to external group identifiers, by querying UDM, prior to contacting the AF.

NOTE 3: It is assumed that an AF is provisioned with the list of UE IDs (GPSIs or SUPIs) belonging to an External or Internal Group ID.

NWDAF may collect data directly from UPF for a specific UE identified by a SUPI, a group of UEs identified by an Internal-Group-Id or for any UEs as defined in clause 5.8.2 of TS 23.501 [2] and in clause 4.15.4.5 of TS 23.502 [3]. NWDAF may subscribe indirectly via SMF or directly to UPF for UPF data collection. The direct subscription to UPF event exposure service is only for data collection for any UE e.g., to collect user data usage information for NWDAF NF Load analytic, and if the subscription is not including any of the parameters described in Table 4.15.4.5.1-1 of TS 23.502 [3].

NOTE 4: To avoid causing high UPF load due to extensive reporting related to all traffic flows, the NWDAF can preferably subscribe for reporting for some UEs only.

To retrieve required data for any UE, the NWDAF may subscribe to events from the AMF and/or SMF instances or UPF instances it has determined, setting the target of event reporting to "any UE" and the event filter(s) according to the Analytics Filter Information. Alternatively, if the required data is communication related and for any UE within an Area of interest, the NWDAF can obtain from the AMF instances it has determined a list of UEs located within the Area of Interest. Based on the obtained UE list, for each UE in the list, the NWDAF retrieves the SMF serving the UE and the NWDAF subscribes to data from the relevant SMF per each specific UE. The indirect event exposure subscription to AMF or SMF via UDM is not available for "any UE" or "any UE within an Area of interest". If the required data is collected from UE via AF as described in clause 6.2.8 and the Target of Analytics Reporting received from consumer is "any UE", the NWDAF may either set the target of event reporting to "any UE" in the data collection request to the AF, or may determine a list of UEs from AMF and/or SMF based on the Analytics Filter Information and send the data collection request to the AF for the determined list of UEs.

NOTE 5: If NWDAF requires collecting data from either AMF or SMF for "any UE" or "any UE within an Area of Interest", NWDAF can use the direct Event Exposure subscription to AMF or SMF, since subscriptions to "any UE" or "any UE within an Area of Interest" are persistent by nature in AMF or SMF, due to not being linked to a UE context.

To retrieve data related to "any UE" based on Analytics Filter Information, the NWDAF shall first determine which NF instances are matching the Analytics Filter Information (see clause 6.7.5.1) as stated in table 6.2.2.1-3 unless the NWDAF has already obtained this information due to recent operations related to this Analytics Filter Information.

Table 6.2.2.1-3: NF Services consumed by NWDAF to determine which NF instances are matching analytics filters

| Type of NF instance (matching analytics filters) to determine | NF to be contacted by NWDAF | Service | Reference in TS 23.502 [3] |
| --- | --- | --- | --- |
| AMF, SMF, UPF | NRF | Nnrf\_NFDiscovery | 5.2.7.3 |

To retrieve data related to Analytics IDs for "any UE" with Analytics Filter Information defining an area of interest in terms of TA or Cells and/or with specific S-NSSAIs, NWDAF requires the network slice association information to properly determine the AMFs to collect data from as well as the proper queries to OAM for data collection.

NOTE 6: Examples of Analytics ID requiring NWDAF to use network slice association information for data retrieval are: network performance clause 6.6.1; user data congestion clause 6.8.1; QoS Sustainability clause 6.9; Dispersion Analytics clause 6.10.1; observed service experience for a Network Slice clause 6.4.1; and slice load analytics clause 6.3.

The network slice association information comprises the TAs associated with each AMF and for each TAI its associated access type, cells and list of supported S-NSSAIs (including indication of S-NSSAIs restricted by AMF). Additionally, the mapping of cells per TAI and supported S-NSSAIs (including indication of S-NSSAIs restricted by AMF) for TAI for each AMF can change and NWDAF shall obtain this accurate information in order to properly retrieve data for analytics generation.

In order to derive the network slice association information, NWDAF may be configured with the mapping of cells per TAI and the S-NSSAIs per TAI. NWDAF may subscribe to the "S-NSSAIs per TAI mapping" event exposed by AMF. The NWDAF may use the configured information (when the analytics subscription or request is at cell granularity) and the area of interest in the analytics subscription or request to retrieve from AMF the list of supported S-NSSAIs (including indication of S-NSSAIs restricted by AMF) per TAI and access types per TAI for each AMF in the required area of interest. NWDAF consumes the "S-NSSAIs per TAI mapping" event exposed by AMF using, as target of event reporting, the list of TAIs based on the area of interest received in the Analytics Filter Information or identified by the mapping of the Cells per TAI matching to the Cell granularity included in the Analytics Filter Information. The AMF "S-NSSAIs per TAI mapping" event output contains, for each of the TAIs requested by NWDAF, its associated access type and the list of supported S-NSSAIs (including indication of S-NSSAIs restricted by AMF).

To retrieve data from SMFs for Analytics IDs subscription or requests for "any UE" including Analytics Filter Information with specific Applications, DNNs, DNAIs and area of interest per TA granularity, NWDAF shall first discover the SMF serving the area of interest via NRF.

NOTE 7: Examples of Analytics ID requiring NWDAF to collect data related to PDU sessions associated with an AoI with TA granularity are: network performance clause 6.6.1; user data congestion clause 6.8.1, QoS Sustainability clause 6.9.

NWDAF may directly consume events from the discovered and selected SMF using the event target set to "any PDU session" and event filters with the same parameters of the Analytics Filter Information, i.e. list of Application IDs and/or DNNs and/or DNAI and the area of interest related to the requested Analytics ID.

1. When SMF supports the exchange of UE Location parameter when SMF interacts with AMF via Nsmf\_PDUSession\_Create/Update/CreateSMContext/UpdateSMContext due to session establishment, modification, or release, service request, or handover procedures (as defined in clause 5.2.8.2 of TS 23.502 [3]), SMF can directly map the PDU sessions to an AoI with TA granularity.

If there are any changes in PDU sessions in the area of interest, for the Application ID and/or DNN and/or DNAI subscribed by NWDAF, SMF notifies the detected changes to NWDAF via Nsmf\_EventExposure\_Notify service operation, enabling NWDAF to keep an updated map of SMF and PDU sessions associated with the Analytics Filter Information in an area of interest.

2. When SMF does not support the exchange of UE Location parameter when SMF interacts with AMF but supports the mapping of PDU sessions per TA (as defined in clause 5.6.11 of TS 23.501 [2]), SMF may subscribe to UE mobility event notifications of AMF as described in clause 5.3.4.4 of TS 23.501 [2] using event ID "UE moving in or out of Area of Interest" and Event Filters as described in Table 5.2.2.3.1-1 from TS 23.502 [3] to retrieve the list of SUPIs (and GPSIs if available) in the area of interest. Based on the retrieved list of SUPIs in the area of interest, SMF identifies the PDU sessions in the area of interest.

3. When SMF does not support the exchange of UE Location parameter when SMF interacts with AMF nor supports the mapping of PDU sessions per TA (as defined in clause 5.6.11 of TS 23.501 [2]), SMF rejects the request from NWDAF. Upon the reject, NWDAF identifies the need to create the mapping of PDU sessions per TA. NWDAF subscribes to UE mobility event notifications of AMF as described in clause 5.3.4.4 of TS 23.501 [2] using event ID "UE moving in or out of Area of Interest" and Event Filters as described in Table 5.2.2.3.1-1 from TS 23.502 [3] to retrieve the list of SUPIs (and GPSIs if available) in the area of interest. Based on the retrieved list of SUPIs in the area of interest, NWDAF subscribes to the SMFs serving the UEs in the area of interest and derives the mapping of PDU sessions per TA.

To train an ML model or to do ML model performance monitoring for LMF-based AI/ML positioning, the NWDAF can collect input data from LMF as defined in clause 6.22.4 of TS 23.273 [39].

An NWDAF may require to discover and select other NWDAFs for UE related analytics. In this case, the NWDAF may discover from UDM if an NWDAF is already collecting data related to the UE, as specified in clauses 5.2 and 6.1C.

2nd change

## 8.1 General

Table 8.1-1 shows the DCCF services and DCCF service operations.

Table 8.1-1: NF services provided by DCCF

|  |  |  |  |
| --- | --- | --- | --- |
| Service Name | Service Operations | Operation Semantics | Example Consumer(s) |
| Ndccf\_DataManagement | Subscribe | Subscribe / Notify | NWDAF, PCF, NSSF, AMF, SMF, NEF, AF, ADRF, LMF, NRF, SCP, UDM |
|  | Unsubscribe |  | NWDAF, PCF, NSSF, AMF, SMF, NEF, AF, ADRF, LMF, NRF, SCP, UDM |
|  | Notify |  | NWDAF, PCF, NSSF, AMF, SMF, NEF, AF, ADRF, LMF, NRF, SCP, UDM |
|  | Fetch | Request / Response | NWDAF, PCF, NSSF, AMF, SMF, NEF, AF, ADRF, LMF, NRF, SCP, UDM |
|  | Transfer | Request / Response | DCCF |
| Ndccf\_ContextManagement | Register | Request / Response | NWDAF, ADRF |
|  | Update | Request / Response | NWDAF, ADRF |
|  | Deregister | Request / Response | NWDAF, ADRF |

3rd change

## 9.1 General

Table 9.1-1 shows the MFAF services and MFAF service operations.

Table 9.1-1: NF services provided by MFAF

|  |  |  |  |
| --- | --- | --- | --- |
| Service Name | Service Operations | Operation Semantics | Example Consumer(s) |
| Nmfaf\_3daDataManagement | Configure | Request / Response | DCCF, NWDAF (when hosting DCCF) |
|  | Deconfigure | Request / Response | DCCF, NWDAF (when hosting DCCF) |
| Nmfaf\_3caDataManagement | Notify | Subscribe / Notify | NWDAF, PCF, NSSF, AMF, SMF, NEF, AF, ADRF, LMF, NRF, SCP, UDM |
|  | Fetch | Request / Response | NWDAF, PCF, NSSF, AMF, SMF, NEF, AF, ADRF, LMF, NRF, SCP, UDM |
| Nmfaf\_ContextManagement | Transfer | Request / Response | MFAF |

End of changes