**3GPP TSG-WG SA2 Meeting #143E e-meeting *S2-210xxxx***

**Elbonia, February 24 – March 09, 2021 (revision of S2-210xxxx)**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **23.288** | **CR** |  | **rev** | **0** | **Current version:** | **16.6.0** |  |
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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:*** | Principles, Procedures, Services of Bulked Data Collection in TS23.288 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | SA2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | eNA\_Ph2 | | | | |  | ***Date:*** | | | 24.02.2021 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-17 |
|  | *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-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Consolidates the conclusions from TR 23.700-91 related to the usage of bulked data services by NWDAF, DCCF, and DRF. In addition, define the services and procedures for data collection from NWDAF according with the definitions in conclusions:  In 8.11.1:  “- Make use of bulk data collection an option for data collection from NWDAF.”  In 8.11.4:  “- The DCCF provides the service for bulk data collection.  - For data collection from NWDAF following methods may be available:  - Event Exposure from NWDAF only for runtime mode.  - The DRF functionality shall be used to store data. When DRF is a standalone or collocated NF, then no bulk data service is needed from the NWDAF, only data retrieval from DRF is needed.  - If DRF is hosted inside NWDAF, then bulk data collection may be supported from NWDAF using a new data management service. All services handling bulk data retrieval either from NWDAF, directly from DRF or via DCCF/messaging framework mentioned in bullets below shall be aligned.  NOTE 5: The above need to be aligned with conclusions for Signalling reduction via parametrization and services changes.” | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | The principles of bulked data are included in section 4 of TS 23.288. The content of the bulked data is defined and finally the procedures for data collection from NWDAF in runtime mode and offline mode are also described based on the principles of Sol#58.  The following clarifications for alignment of services exposed by DCCF, DRF, NWDAF and alignment with Signalling reduction via parametrization and service changes from KI#11 are proposed:  For any runtime data collection the Event Exposure should be used by DCCF and NWDAF  For any historical data collection the dedicated management service with bulked data should be used by all DCCF, DRF and NWDAF  Bulked data can be collected via runtime mode (via Event Exposure) or historical mode (via data management service) | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Conclusions of KI#11 regarding bulked data services are not consolidated in R17 TS 23.288 | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 4.1, new 4.Y, 6.2.1, new 6.2.S, 7.1, new 7.X | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |

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

## 4.1 General

The NWDAF (Network Data Analytics Function) is part of the architecture specified in TS 23.501 [2] and uses the mechanisms and interfaces specified for 5GC in TS 23.501 [2] and OAM services (see clause 6.2.3.1).

The NWDAF interacts with different entities for different purposes:

- Data collection based on subscription to events provided by AMF, SMF, PCF, UDM, AF (directly or via NEF), and OAM;

- Retrieval of information from data repositories (e.g. UDR via UDM for subscriber-related information);

- Retrieval of information about NFs (e.g. from NRF for NF-related information);

- On demand provision of analytics to consumers, as specified in clause 6.

- Provision of bulked data to consumers, as specified in clause 6.

A single instance or multiple instances of NWDAF may be deployed in a PLMN. If multiple NWDAF instances are deployed, the architecture supports deploying the NWDAF as a central NF, as a collection of distributed NFs, or as a combination of both.

NOTE 1: When multiple NWDAFs exist, not all of them need to be able to provide the same type of analytics results, i.e., some of them can be specialized in providing certain types of analytics. An Analytics ID information element is used to identify the type of supported analytics that NWDAF can generate.

NOTE 2: NWDAF instance(s) can be collocated with a 5GS NF.

\* \* \* \* Next change - ALL NEW TEXT\* \* \* \*

## 4.y Dedicated Architecture for Data Collection

The dedicated data collection architecture is composed of services and/or NFs, such as DCCF and DRF, for supporting the data collection for both Model Training logical function and Analytics logical function that can be performed by NWDAF.

### 4.y.x Bulked Data Services

NWDAFs or DCCF or DRF shall provide bulked data to consumers as an alternative to individual data samples.

The bulked data is the set of data samples to be used for an analytics ID for a consumer of NWDAF, DCCF, or DRF. It can be used for the purpose of analytics inference or ML model training.

The bulked data is generated based on the set of raw collected data from NFs/OAM and the properties for the selection of such raw data for an analytics ID. Operators may define different rules for generation of bulked data for training or inference.

\* \* \* \*next change \* \* \* \*

### 6.2.1 General

The Data Collection feature permits NWDAF to retrieve data from various sources (e.g. NF such as AMF, SMF, PCF, and AF; OAM), as a basis of the computation of network analytics.

All available data encompass:

- OAM global NF data,

- Data available in NFs, e.g. behaviour data related to individual UEs or UE groups (e.g. UE reachability), and pre-computed metrics covering UE populations (e.g. number of UEs present in a geographical area), per spatial and temporal dimensions (e.g. per region for a period of time),

- NF data available in the 5GC (e.g. NRF),

- Data available in AF.

When DCCF, DRF, or NWDAF hosting DCCF or DRF are present the data collection follows the principles described in Clause 6.2.S.

The NWDAF shall use at least one of the following services:

- the Generic management services as defined in TS 28.532 [6], the Performance Management services as defined in TS 28.550 [7] or the Fault Supervision services as defined in TS 28.545 [9], offered by OAM in order to collect OAM global NF data.

- the Exposure services offered by NFs in order to retrieve data and other non-OAM pre-computed metrics available in the NFs.

- Other NF services in order to collect NF data (e.g. NRF)

The NWDAF shall obtain the proper information to perform data collection for a UE, a group of UEs or any UE:

- For an Analytics ID, NWDAF is configured with the corresponding NF Type(s) and/or event ID(s) and/or OAM measurement types.

- NWDAF shall determine which NF instance(s) of the relevant NF type(s) are serving the UE, the group of UEs or any UE, taking into account the S-NSSAI(s) and area of interest as defined in clause 7.1.3, TS 23.501 [2].

- NWDAF invokes Nnf\_EventExposure\_Subscribe services to collect data from the determined NF instance(s), and/or triggers the procedure in clause 6.2.3.2 to subscribe to OAM services to collect the OAM measurement.

The NWDAF performs data collection from an AF directly as defined in clause 6.2.2.2 or via NEF as defined in clause 6.2.2.3.

The NWDAF shall be able to discover the events supported by a NF.

Data collection procedures enables the NWDAF to efficiently obtain the appropriate data with the appropriate granularity.

When a request or subscription for statistics or predictions is received, the NWDAF may not possess the necessary data to perform the service, including:

- Data on the monitoring period in the past, which is necessary for the provision of statistics and predictions matching the Analytics target period.

- Data on longer monitoring periods in the past, which is necessary for model training.

Therefore, in order to optimize the service quality, the NWDAF may undertake the following actions:

- The NWDAF may return a probability assertion as stated in clause 6.1.3 expressing the confidence in the prediction produced. Prediction may be returned with zero confidence as described below. This confidence is likely to grow in the case of subscriptions.

- The value of the confidence depends on the level or urgency expressed by the parameter "preferred level of accuracy of the analytics" as listed in clause 6.1.3, the parameter "time when analytics information is needed" as listed in clause 6.1.3, and the availability of data. If no sufficient data is collected to provide an estimation for the requested level of accuracy before the time deadline, the service shall return a zero confidence. Otherwise, the NWDAF may wait until enough data is collected before providing a response or a first notification.

- In order to be prepared for future requests on analytics from NFs/OAM, the NWDAF, upon operator configuration, may collect data on its own initiative, e.g. on samples of UEs, and retain the data collected in the data storage.

NOTE 1: The NWDAF can send an error response to the analytics consumer to indicate that statistics are unavailable if the NWDAF was not prepared for future requests and did not collect data on its own initiative.

The volume and maximum duration of data storage is also subject to operator configuration.

The NWDAF may decide to reduce the amount of data collected to reduce signalling load, by either prioritizing requests received from analytics consumers, or reducing the extent (e.g. duration, scope) of data collection, or modifying the sampling ratios.

The NWDAF may skip data collection phase when the NWDAF already has enough information to provide requested analytics.

The data which NWDAF may collect is listed for each analytics in input data clause and is decided by the NWDAF.

NOTE 2: NWDAF can skip data collection phase for some specific input data per the requested analytics e.g. when some of the data is already available at NWDAF for the requested analytics, or when NWDAF considers that some of the data is not needed at all to provide the requested analytics as per the analytics consumer request (e.g. based on preferred level of accuracy or based on the time when analytics are needed).

\* \* \* \* Next change – ALL NEW TEXT \* \* \* \*

### 6.2.S Dedicated Procedures for Data Collection

Data collection shall be performed via DCCF, DRF, or NWDAF (hosting DCCF and/or DRF).

DCCF, DRF, and NWDAF hosting DCCF and/or DRF shall use the same services listed in Clause 6.2.1 from OAM, and NFs (including AFs directly or via NEF) to collect data. Additionally the new services for data exposure from DCCF, DRF, and NWDAF shall also be used for data collection.

The NWDAF, DCCF, DRF shall obtain the proper information to perform data collection for a UE, a group of UEs or any UE following the principles of Clause 6.2.1.

Editor's note: The description of the proper information to obtain data collection shall be aligned with the enhancements for discovering and tracking of entities.

#### 6.2.S.1 Data Collection via Bulked Data Services

NWDAF, DCCF, or DRF, shall expose bulked data services.

The bulked data service shall be used for collecting data for analytics ID inference or analytics ID model training. NFs capable to expose bulked data have the following capabilities:

- Exposing runtime collected data (e.g., data from NFs/AFs/OAM retrieved via notification mechanisms), or historical collected data (e.g., data from NFs/AFs/OAM that were at some point collected, then stored), or both;

- Appling selection processes of data samples or processing mechanisms for the generation of the bulked data according to operator-defined rules. Such rules define the allowed and/or restricted properties or processes to be applied to the set of raw collected data to be used for the bulked data. Operators shall further define such rules per analytics ID, or per bulk data consumer, or per network slice, or a combination of them.

- Examples of properties are network slices; area of interest; statistical attributes such as averages, mean, skewness; aggregation levels, such as geographical per cell, per UEs, or temporal such as per hours or days.

- Examples of processes are: definition of data collection mode mechanisms; definition if raw collected data, or pre-processed data, or both can be used for composing the bulked data; applying anonymization of data fields in the bulked data to avoid exposing undesired information.

For the exposure of runtime bulked data the following shall be considered:

- DCCF and NWDAF shall expose runtime bulked data via event exposure.

For the exposure of historical bulked data the following shall be considered:

- When DRF is a standalone or collocated NF, then no bulk data service for historical data is needed from the NWDAF.

- When DRF is hosted inside NWDAF, then bulk data collection of historical data may be supported from NWDAF.

- DCCF, DRF, and NWDAF hosting DRF shall exposure historical bulked data via data management service.

##### 6.2.S.1.1 Content of Runtime Bulked Data Exposure

The service used by the NF exposing runtime bulked data is based on the Event Exposure framework defined in TS 23.502 [3] clause 4.15.

NWDAF or DCCF shall expose the Nnwdaf\_EventExposure\_Subscribe or Ndccf\_EventExposure\_Subscribe service operation with the following extensions of input parameters defined in TS 23.502 [3] Clause 4.15.1:

- Event ID(s) set to ''Bulked data'' event type;

- Target of Event Reporting including a tuple with analytics ID; type of requested bulked data, which can be set to ''raw data samples'' or ''pre-processed data samples'' or a combination of both; analytics stage (inference or training);

- Event Filter Information shall include:

- fields related to the analytics ID such as: target of analytics information (e.g., any UE, list of UEs, groups of UEs); analytics filter information (e.g., area of interest, DNN, Application, S-NSSAI). The analytics ID also determines the type of data to be collected and associated with the bulked data;

- feature type to be applied to the data samples in case the type of the requested bulk data includes ''pre-processed data samples''. Examples of feature type are maximum values, average values, etc.

- Event Reporting Information, in addition to the parameters defined in TS 23.502 [3] clause 4.15.1, the following parameters shall be included:

- interval of time for sample selection;

- data collection mode (DC mode) indicates the type of collection mechanisms to be used. This parameter can set to: ''runtime'', ''offline". "Runtime" indicates that the Event providers shall notify the Event consumer every time an event is ready. "Offline" indicates that event notifications from Event provider to Event Consumer should be muted. The Event Consumer shall fetch the events according to its internal policies. The default DC modes for inference and training stages are respectively, ''runtime" and ''offline";

- (optional) minimum and/or maximum number of samples to be included in the bulked data.

The output parameters of the Nnwdaf\_EventExposure\_Subscribe or Ndccf\_EventExposure\_Subscribe service operation comprise the subscription correlation ID, which identifies the requested bulked data.

The input parameters of Nnwdaf\_EventExposure\_Notify or Ndccf\_EventExposure\_Notify service operation shall contain the subscription correlation ID, and the generated bulked data which comprises:

- the dataset (i.e., the resulting set of raw data samples and/or set of pre-processed data samples) generated based on the parameters of bulked data request and operator's rules containing the data samples:

- if the type of bulked data is ''pre-processed data samples'' the data type (e.g., Event ID) and associated feature type (e.g., average values of Event ID) are included,

- data values (when ''raw data samples" type of bulk data is used) or feature values (when ''pre-processed data samples'' type of bulked data is used),

- timestamp when the data sample is associated with a bulked data.

##### 6.2.S.1.2 Content of Historical Bulked Data Exposure

The historical bulked data service shall allow three communication models: subscribe-notify; request-response; asynchronous request-response initiated by the service consumer. The asynchronous request-response initiated by the service consumer communication model allows for such consumer to send a request for bulked data creation and later when needed, fetch it. All three models of communication shall be used upon operator's decision.

Editor's note: The description of DCCF and DRF bulked data services shall be further aligned with the current definition of NWDAF bulked data services.

The consumers of the Nnwdaf\_DataManagement\_BulkedDataCreation or Ndccf\_DataManagement\_BulkedDataCreation or Ndrf\_DataManagement\_BulkedDataCreation service operations described in clause 7 provide the following input parameters listed below.

- Analytics ID;

- Target of Analytics Reporting as defined in Clause 6.1.3;

- Bulked Data Filter Information shall include:

- Analytics Filter Information as defined in Clause 6.1.3;

- type of bulked data, which can be set to ''raw data samples'' or ''pre-processed data samples" or a combination of both;

- feature type to be applied to the of data samples in case the type of the requested bulked data includes ''pre-processed data samples''. Examples of feature type are maximum values, average values;

- analytics stage (e.g., inference, training).

- Bulked data Reporting Information shall include:

- interval of time for sample association;

- data collection mode (DC mode) indicates the type of collection mechanisms to be used. This parameter is set to ''historical'' and determines that the data should be retrieved from some previous period in time. When the ''historical'' DC mode is included, the interval of the historical time window is also included as input parameter;

- (optional) minimum and/or maximum number of samples to be included in the bulked data;

- fetch flag, when set to true, it indicates that the bulked data needs to be generated and included in the response, when set to false, it indicates that bulked data will not be returned in the response message. The default value of fetch flag is false;

- bulked data deadline, which indicates the limit of time for providing the bulked data when the fetch flag is set to true.

- A Notification Target Address (+ Notification Correlation ID), where the Notification Correlation ID is the unique identification for the bulked data being generated for the requesting consumer.

The output parameters for the service operation Nxxxx\_DataManagement\_BulkedDataCreation include:

- the bulked data identification, or

- the generated bulked data, if the fetch flag has been included in the service request.

When the request for Nxxxx\_DataManagement\_BulkedDataCreation has no fetch flag activated, the Nxxxxx\_DataManagement\_BulkedDataNotify shall be executed when the bulked data is ready to be delivered or when the bulked data deadline is reached. The input parameters of the service operation Nxxxxx\_DataManagement\_BulkedDataNotify include:

- the generated bulked data.

The input parameters for the service operation Nxxxxx\_DataManagement\_BulkedDataFetch include:

- the bulked data identification.

The output parameters for the service operation Nnwdaf\_DataManagement\_BulkedDataFetch include:

- the generated bulked data.

The exposed bulked data by the service operations Nxxxx\_ DataManagement\_BulkedDataCreation and Nxxxxx\_DataManagement\_BulkedDataNotify, Nnwdaf\_DataManagement\_BulkedDataFetch includes the following fields:

- bulked data identification,

- the dataset with the resulting set of raw data samples and/or set of pre-processed data samples generated based on the bulked data request and operator's rules, the data samples organized as tuples containing:

- if the type of bulked data is ''pre-processed data samples'' the data type (e.g., Event ID) and associated feature type (e.g., average values of Event ID) are included,

- data values (when ''raw data samples" type of bulk data is used) or feature values (when ''pre-processed data samples'' type of bulked data is used),

- timestamp when the data sample is associated with a bulked data.

#### 6.2.S.2 Procedure for Data Collection from NWDAF

NWDAF shall expose data via event exposure for the case of runtime data collection or via dedicated service for data management in case of historical data, e.g., when NWDAF hosts DRF.

##### 6.2.S.2.1 Runtime Data Collection via Event Exposure

The procedure in Figure 6.2.S.2.1-1 is used by NWDAF service consumer to subscribe/unsubscribe at NWDAFs in order to be notified for data collection on a related event (s), using Event Exposure Services exposed by NWDAF.

The NWDAF with Event Exposure services shall expose the Events IDs listed in Table 6.2.S.2.1-1:

Table 6.2.S.2.1-1: Event ID exposed by NWDAF

|  |  |  |
| --- | --- | --- |
| Event | Description | Example of Event ID |
| Bulked data | The NWDAF exposes the bulked data associated with one or more analytics ID | Bulked Data for Service Experience |
| NFs collected events | The NWDAF re-exposes the events collected from NFs within the NWDAF serving area | UE Location |

Editor's note: The list of event IDs exposed by NWDAF shall be completed according with further contributions.



**Figure 6.2.S.2.1-1: Data Collection from NWDAF via Event Exposure**

1. NWDAF service consumer (e.g, NWDAF, DCCF) identifies that further data from an NWDAF is required in order to perform some operation over an analytics ID. The triggers for further data collection are related to:

a) the local policies of NWDAF, DCCF, or DRF (e.g. preparation for future requests for analytics ID as specified in Clause 6.2.2.1);

b) a request for analytics generation requiring data not available or not directly reachable via the NWDAF service consumer (e.g. out of the serving area);

c) a request for model training;

d) a request for data collection that NWDAF service consumer cannot provide by itself.

Editor's note: The discovery of the appropriated NWDAF providing the data collection service and the type of data exposed by the NWDAF shall be aligned with the extensions of the NWDAF discovery description.

2. The NWDAF service consumer subscribes to or cancels subscription for a (set of) Event ID(s) by invoking the Nnwdaf\_EventExposure\_Subscribe / Nnf\_EventExposure\_Unsubscribe service operation.

NOTE 1: The Event ID (s) are defined in Table 6.2.S.2.1-1.

NOTE 2: The parameters defined for the Event Exposure Framework in TS 23.502 Clause 4.15.1 shall be used for the subscription to NWDAF event exposure.

3. If NWDAF receives a subscription for data that is not available or not reachable by such NWDAF (e.g., out of serving area), NWDAF shall trigger further data collection using any of the available mechanisms in Clause 6.2.2 and Clause 6.2.S (e.g., recursively using data collection services from other needed NWDAFs).

4. When the data is ready to be notified, NWDAF notifies the NWDAF service consumer (e.g. with the event report) by invoking Nnwdaf\_EventExposure\_Notify service operation.

##### 6.2.S.2.2 Historical Bulked Data Collection via Data Management Service

The procedure in Figure 6.2.S.2.2-1 is used by NWDAF service consumer to invoke the data management services at NWDAFs in order to retrieve historical bulked data from NWDAF hosting DRF.



Figure 6.2.S.2.2-1: Data Collection from NWDAF via Data Management Service

1. NWDAF service consumer (e.g, NWDAF, DCCF) identifies that further data from an NWDAF is required in order to perform some operation related to analytics ID. The triggers for further data collection are related to:

a) the local policies of NWDAF (e.g. preparation for future requests for analytics ID as specified in Clause 6.2.2.1);

b) a request for analytics generation requiring data not available or not directly reachable via the NWDAF service consumer (e.g. out of the serving area);

c) a request for model training;

d) a request for data collection that NWDAF service consumer cannot provide by itself.

Editor's note: The discovery of the appropriated NWDAF providing the data collection service and the type of data exposed by the NWDAF shall be aligned with the extensions of the NWDAF discovery description.

2a. NWDAF service consumer invokes Nnwdaf\_DataManagement\_BulkedDataCreation service from NWDAF to request a bulked data. The input parameters of the service request include: the Analytics ID, Target of Analytics, Bulked data Filter Information, Bulked data Reporting Information, and a Notification Target Address (+ Notification Correlation ID) as defined in clause 6.2.S.1.2.

2b. Based on the received request, NWDAF creates a new bulked data for the requesting consumer.

In case NWDAF receives a request without the fetch flag activated, NWDAF immediately sends Nnwdaf\_DataManagement\_BulkedDataCreation service response with a confirmation of successful request and the bulked data identification. Enabling the NWDAF service consumer to either receive the requested bulked data via step 5 or step 6(a,b).

In case NWDAF receives a request with the fetch flag activated, NWDAF executes step 3 (a and/or b) before sending the Nnwdaf\_DataManagement\_BulkedDataCreation service.

NOTE 1: Bulked data identification (ID) allows the NWDAF service consumer to request to NWDAF any changes in the generation of a requested bulked data and to identify the received dataset to the actually requested bulked data.

3a. (Optional) If NWDAF receives a request for bulked data that is not available or not reachable by such NWDAF (e.g., out of serving area), NWDAF shall trigger further data collection using any of the available mechanisms in Clause 6.2.2 and Clause 6.2.S (e.g., recursively using data collection services from other needed NWDAFs, DRFs).

3b. Based on the properties of the received request and the rules for bulked data generation, NWDAF generates the bulked data including the available or collected data (e.g., from other NWDAFs or DRFs).

4. In case fetch flag is activated in Step2, NWDAF waits until the bulked data is generated and sends a Nnwdaf\_DataManagement\_BulkedDataCreation service response with a confirmation of successful request and the generated bulked data.

5. In case fetch flag is not activated is used in Step2, NWDAF waits until the bulked data is generated or the bulked data deadline expires sends a Nnwdaf\_DataManagement\_BulkedDataNotify service with a confirmation of successful request and the generated bulked data. The Notification Target Address is used by the Nnwdaf\_DataManagement\_BulkedDataNotify service operation to deliver the bulked data to the NWDAF service consumer.

6(a.b). Alternatively, in case fetch flag is not activated in Step 2, the NWDAF service consumer can request the Nnwdaf\_DataManagement\_BulkedDataFetch service from NWDAF and retrieve the bulked data.

NOTE 2: It is also possible that instead of providing the dataset of the generated bulked data in Steps 4, 5, or 6b, the NWDAF provides a reference to where the dataset can be retrieved by the NWDAF service consumer.

\* \* \* \* Next change \* \* \* \*

## 7.1 General

The following table illustrates the NWDAF Services.

Table 7.1-1: NF services provided by NWDAF

|  |  |  |  |
| --- | --- | --- | --- |
| Service Name | Service Operations | Operation  Semantics | Example Consumer(s) |
| Nnwdaf\_AnalyticsSubscription | Subscribe | Subscribe / Notify | PCF, NSSF, AMF, SMF, NEF, AF, OAM, CEF |
|  | Unsubscribe |  | PCF, NSSF, AMF, SMF, NEF, AF, OAM, CEF |
|  | Notify |  | PCF, NSSF, AMF, SMF, NEF, AF, OAM, CEF |
| Nnwdaf\_AnalyticsInfo | Request | Request / Response | PCF, NSSF, AMF, SMF, NEF, AF, OAM, CEF |
| Nnwdaf\_DataManagement | BulkedDataCreation | Request / Response | NWDAF, DCCF |
| BulkedDataNotify | Request/Response | NWDAF, DCCF |
| BulkedDataFetch | Request / Response | NWDAF, DCCF |
| Nnwdaf\_EventExposure | Subscribe | Subscribe / Notify | NWDAF, DCCF |
| Unsubscribe | NWDAF, DCCF |
| Notify | NWDAF, DCCF |
| NOTE 1: How OAM consumes Nnwdaf services and which Analytics information is relevant is defined in TS 28.550 [7] Annex H. and out of the scope of this TS.  NOTE 2: How CEF consumes Nnwdaf services and which Analytics information is relevant is defined in TS 28.201 [21] and out of the scope of this TS. | | | |

The following table shows the analytics information provided by NWDAF service:

Table 7.1-2: Analytics information provided by NWDAF

|  |  |  |
| --- | --- | --- |
| Analytics Information | Request Description | Response Description |
| Slice Load level information | Analytics ID: load level information | Load level of a Network Slice Instance reported either as notification of crossing of a given threshold or as periodic notification (if no threshold is provided). |
| Observed Service experience information | Analytics ID: Service Experience | Observed Service experience statistics or predictions may be provided for a Network Slice or an Application. They may be derived from an individual UE, a group of UEs or any UE. For slice service experience, they may be derived from an Application, a set of Applications or all Applications on the Network Slice. |
| NF Load information | Analytics ID: NF load information | Load statistics or predictions information for specific NF(s). |
| Network Performance information | Analytics ID: Network Performance | Statistics or predictions on the load in an Area of Interest; in addition, statistics or predictions on the number of UEs that are located in that Area of Interest. |
| UE mobility information | Analytics ID: UE Mobility | Statistics or predictions on UE mobility. |
| UE Communication information | Analytics ID: UE Communication | Statistics or predictions on UE communication. |
| Expected UE behavioural parameters | Analytics ID: UE Mobility and/or UE Communication | Analytics on UE Mobility and/or UE Communication. |
| UE Abnormal behaviour information | Analytics ID: Abnormal behaviour | List of observed or expected exceptions, with Exception ID, Exception Level and other information, depending on the observed or expected exceptions. |
| User Data Congestion information | Analytics ID: User Data Congestion | Statistics or predictions on the user data congestion for transfer over the user plane, for transfer over the control plane, or for both. |
| QoS Sustainability | Analytics ID: QoS Sustainability | For statistics, the information on the location and the time for the QoS change and the threshold(s) that were crossed; or, for predictions, the information on the location and the time when a potential QoS change may occur and what threshold(s) may be crossed. |

\* \* \* \* Next change – ALL NEW TEXT \* \* \* \*

## 7.X Nnwdaf\_DataManagement Service

### 7.X.1 General

**Service Description**: This service enables the consumer to request the creation of bulked data and retrieve the generated bulked data.

### 7.X.2 Nnwdaf DataManagement BulkedDataCreation service operation

**Service operation name:** Nnwdaf\_DataManagement BulkedDataCreation.

**Description:** Subscribes to NWDAF analytics with specific parameters.

**Inputs, Required:** (Set of) Analytics ID(s) defined in Table 7.1-2, Target of Analytics Reporting, Bulked Data Filter Information, Notification Target Address (+ Notification Correlation ID).

NOTE 1: Target of Analytics Reporting and Bulked Data Filter Information can be provided per individual Analytics ID in a set of Analytics IDs.

**Inputs, Optional:** Bulked Data Reporting Information, Bulked Data Identification (in the case of modification of requested bulked data).

NOTE 2: Bulked Data Reporting Information, Bulked Data Identification can be provided per individual Analytics ID in a set of Analytics IDs.

**Outputs Required:** When the subscription is accepted: Bulked Data Identification (required for management of the requested bulked data).

**Outputs, Optional:** Bulked data.

### 7.X.3 Nnwdaf DataManagement BulkedDataNotify service operation

**Service operation name:** Nnwdaf\_ DataManagement BulkedDataNotify.

**Description:** NWDAF notifies the consumer instance of the generated bulked data according to the request.

**Inputs, Required:** Bulked Data.

**Inputs, Optional:** None.

**Outputs, Required:** Operation execution result indication.

**Outputs, Optional:** None.

### 7.2.4 Nnwdaf DataManagement\_BulkedDataFetch service operation

**Service operation name:** Nnwdaf\_ DataManagement BulkedDataFetch.

**Description:** Consumer requests to NWDAF to retrieve the bulked data.

**Inputs, Required:** Set of the Bulked Data Identification.

**Inputs, Optional:** Set of Bulked Data.

**Outputs, Required:** Operation execution result indication.

**Outputs, Optional:** None.

\* \* \* \* Next change – ALL NEW TEXT \* \* \* \*

## 7.Y Nnwdaf\_ EventExposure Service

### 7.Y.1 General

**Service Description**: This service enables the consumer to subscribe/unsubscribe and be notified about events exposed by NWDAF.

### 7.Y.2 Nnwdaf\_EventExposure\_Subscribe operation

**Service operation name:** Nnwdaf\_EventExposure\_Subscribe

**Description:** the consumer subscribes to receive an event, or if the event is already defined in NWDAF, then the subscription is updated.

**Inputs, Required:** (Set of) Event ID(s) as specified in clause 6.2.S.2.1, Target of Event Reporting according with the type of Event ID, Event Reporting Information defined in Table 4.15.1-1, Notification Target Address (+ Notification Correlation ID).

**Inputs, Optional:** Event Filter Information, Subscription Correlation ID (in the case of modification of the event subscription), Expiry time.

**Outputs, Required:** When the subscription is accepted: Subscription Correlation ID, Expiry time (required if the subscription can be expired based on the operator's policy)*.*

**Outputs, Optional:** First corresponding event report is included, if available (see clause 4.15.1).

### 7.Y.3 Nnwdaf\_EventExposure\_Unsubscribe service operation

**Service operation name:** Nnwdaf\_EventExposure\_Unsubscribe

**Description:** the NF consumer deletes an event if already defined in NWDAF.

**Inputs, Required:** Subscription Correlation ID.

**Outputs, Required:** Operation execution result indication*.*

### 7.Y.4 Nnwdaf\_EventExposure\_Notify service operation

**Service operation name:** Nnwdaff\_EventExposure\_Notify

**Description:** NWDAF reports the event to the consumer that has previously subscribed.

**Inputs, Required:** Event ID, Notification Correlation Information, time stamp.

**Inputs, Optional:** Event information (defined on a per Event ID basis).

**Outputs, Required:** Operation execution result indication*.*

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