3GPP TS 29.520 V17.8.0 (2022-09)

Technical Specification

3rd Generation Partnership Project; Technical Specification Group Core Network and Terminals; 5G System; Network Data Analytics Services; Stage 3 (Release 17)

Keywords

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Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present specification provides the stage 3 definition of the Network Data Analytics Function Services of the 5G System.

The 5G System Architecture is defined in 3GPP TS 23.501 [2]. The stage 2 definition and related procedures for Network Data Analytics Function Services are specified in 3GPP TS 23.288 [17] and 3GPP TS 23.503 [4].

The 5G System stage 3 call flows are provided in 3GPP TS 29.552 [25] and 3GPP TS 29.513 [5].

The Technical Realization of the Service Based Architecture and the Principles and Guidelines for Services Definition are specified in 3GPP TS 29.500 [6] and 3GPP TS 29.501 [7].

The Network Data Analytics Function Services are provided by the Network Data Analytics Function (NWDAF).

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

[3] Void.

[4] 3GPP TS 23.503: "Policy and Charging Control Framework for the 5G System; Stage 2".

[5] 3GPP TS 29.513: "5G System; Policy and Charging Control signalling flows and QoS parameter mapping; Stage 3".

[6] 3GPP TS 29.500: "5G System; Technical Realization of Service Based Architecture; Stage 3".

[7] 3GPP TS 29.501: "5G System; Principles and Guidelines for Services Definition; Stage 3".

[8] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces; Stage 3".

[9] IETF RFC 7540: "Hypertext Transfer Protocol Version 2 (HTTP/2)".

[10] IETF RFC 8259: "The JavaScript Object Notation (JSON) Data Interchange Format".

[11] OpenAPI: "OpenAPI Specification Version 3.0.0", https://spec.openapis.org/oas/v3.0.0

[12] 3GPP TS 29.510: "5G System; Network Function Repository Services; Stage 3".

[13] 3GPP TS 33.501: "Security architecture and procedures for 5G system".

[14] IETF RFC 6749: "The OAuth 2.0 Authorization Framework".

[15] IETF RFC 7807: "Problem Details for HTTP APIs".

[16] 3GPP TR 21.900: "Technical Specification Group working methods".

[17] 3GPP TS 23.288: "Architecture enhancements for 5G System (5GS) to support network data analytics services".

[18] 3GPP TS 29.554: "5G System; Background Data Transfer Policy Control Service; Stage 3".

[19] 3GPP TS 29.122: "T8 reference point for Northbound APIs".

[20] 3GPP TS 29.523: "5G System; Policy Control Event Exposure Service; Stage 3".

[21] 3GPP TS 29.514: "5G System; Policy Authorization Service; Stage 3".

[22] 3GPP TS 29.517: "5G System; Application Function (AF) event exposure service".

[23] 3GPP TS 29.503: "5G System; Unified Data Management Services; Stage 3".

[24] 3GPP TS 29.531: "5G System; Network Slice Selection Services; Stage 3".

[25] 3GPP TS 29.552: "5G System; Network Data Analytics signalling flows; Stage 3".

[26] 3GPP TS 29.574: "5G System; Data Collection Coordination Services; Stage 3".

[27] 3GPP TS 29.575: "5G System; Analytics Data Repository Services; Stage 3".

[28] 3GPP TS 29.576: "5G System; Messaging Framework Adaptor Services; Stage 3".

[29] 3GPP TS 29.508: "5G System; Session Management Event Exposure Service; Stage 3".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

5QI	5G QoS Identifier
ADRF	Analytics Data Repository Function
AF	Application Function
AMF	Access and Mobility Management Function
AOI	Area of Interest
API	Application Programming Interface
CEF	Charging Enablement Function
DCCF	Data Collection Coordination Function
DNN	Data Network Name
GFBR	Guaranteed Flow Bit Rate
HTTP	Hypertext Transfer Protocol
JSON	JavaScript Object Notation
LADN	Local Area Data Network
MFAF	Messaging Framework Adaptor Function
ML	Machine Learning
MTLF	Model Training Logical Function
NEF	Network Exposure Function
NF	Network Function
NRF	Network Repository Function
NSSF	Network Slice Selection Function

NWDAF	Network Data Analytics Function
OAM	Operation, Administration, and Maintenance
PCF	Policy Control Function
SUPI	Subscription Permanent Identifier
S-NSSAI	Single Network Slice Selection Assistance Information
SMCC	Session Management Congestion Control
SMCCE	Session Management Congestion Control Experience
SMF	Session Management Function
UDM	Unified Data Management
UPF	User Plane Function
URI	Uniform Resource Identifier
UTC	Universal Time Coordinated

4 Services offered by the NWDAF

4.1 Introduction

The Nnwdaf services are used by the NWDAF to provide specific analytics information and ML models.

Analytics information is either statistical information of past events, or predictive information.

The following services are specified for the NWDAF:

Table 4.1-1: Services provided by NWDAF

Service Name	Description	Service Operations	Operation Semantics	Example Consumer(s)
Nnwdaf_EventsSubscription (NOTE 1)	This service enables the NF service consumers to subscribe to/unsubscribe from notifications for different analytics information from the NWDAF. It also enables the transfer of subscriptions between NWDAFs	Subscribe Unsubscribe Notify	Subscribe / Notify	PCF, NSSF, AMF, SMF, NEF, AF, OAM, CEF, NWDAF, DCCF
		Transfer	Request / Response	NWDAF
Nnwdaf_AnalyticsInfo	This service enables the NF service consumers to request and get specific analytics or context information related to analytics subscriptions from the NWDAF.	Request	Request / Response	PCF, NSSF, AMF, SMF, NEF, AF, OAM, NWDAF, DCCF
		ContextTransfer	Request / Response	NWDAF
Nnwdaf_DataManagement	This service enables the NF service consumers to subscribe to/unsubscribe from notifications when subscribed event(s) are detected or retrieve the subscribed data from the NWDAF.	Subscribe	Subscribe / Notify	NWDAF, DCCF, MFAF
		Unsubscribe		
		Notify		
		Fetch	Request / Response	NWDAF, DCCF, MFAF
Nnwdaf_MLModelProvision (NOTE 2)	This service enables the NF service consumers to subscribe to/unsubscribe from notifications when a ML model matching the subscription parameters becomes available.	Subscribe Unsubscribe Notify	Subscribe / Notify	NWDAF
NOTE 1: This service corresponds to the Nnwdaf_AnalyticsSubscription service defined in 3GPP TS 23.288 [17]. NOTE 2: This service implements also the Nnwdaf_MLModelInfo service as specified in 3GPP TS 23.288 [17] by using immediate and one-time reporting requirement.				

Table 4.1-2 summarizes the corresponding APIs defined in this specification.

Table 4.1-2: API Descriptions

Service Name	Clause	Description	OpenAPI Specification File	apiName	Annex
Nnwdaf_EventsSubscription	5.1	Nnwdaf Events Subscription Service.	TS29520_Nnwdaf_EventsSubscription.yaml	nnwdaf-eventssubscription	A.2
Nnwdaf_AnalyticsInfo	5.2	Nnwdaf Analytics Information Service	TS29520_Nnwdaf_AnalyticsInfo.yaml	nnwdaf-analyticsinfo	A.3
Nnwdaf_DataManagement	5.3	NWDAF Data Management Service	TS29520_Nnwdaf_DataManagement.yaml	nnwdaf-datamanagement	A.4
Nnwdaf_MLModelProvision	5.4	NWDAF ML Model Provision Service	TS29520_Nnwdaf_MLModelProvision.yaml	nnwdaf-mlmodelprovision	A.5

4.2 Nnwdaf_EventsSubscription Service

4.2.1 Service Description

4.2.1.1 Overview

The Nnwdaf_EventsSubscription service corresponding to Nnwdaf_AnalyticsSubscription service as defined in 3GPP TS 23.501 [2], 3GPP TS 23.288 [17] and 3GPP TS 23.503 [4], is provided by the Network Data Analytics Function (NWDAF).

This service:

- allows NF service consumers to subscribe to and unsubscribe from different analytics events;
- notifies NF service consumers with a corresponding subscription about observed events. and
- allows NF service consumers to request the transfer of subscriptions for analytics events.

The types of observed events include:

- Slice load level information;
- Network slice instance load level information;
- Service experience;
- NF load;
- Network performance;
- Abnormal behaviour;
- UE mobility;
- UE communication;
- User data congestion;
- QoS sustainability;
- Dispersion;
- Redundant transmission experience;
- SM congestion control experience;
- WLAN performance; and

- DN performence.

4.2.1.2 Service Architecture

The 5G System Architecture is defined in 3GPP TS 23.501 [2]. The Network Data Analytics Exposure architecture is defined in 3GPP TS 23.288 [17]. The Network Data Analytics signalling flows are defined in 3GPP TS 29.552 [25], the Policy and Charging related 5G architecture is also described in 3GPP TS 23.503 [4] and 3GPP TS 29.513 [5].

The Nnwdaf_EventsSubscription service is part of the Nnwdaf service-based interface exhibited by the Network Data Analytics Function (NWDAF).

Known consumers of the Nnwdaf_EventsSubscription service are:

- Policy Control Function (PCF)
- Network Slice Selection Function (NSSF)
- Access and Mobility Management Function (AMF)
- Session Management Function (SMF)
- Network Exposure Function (NEF)
- Application Function (AF)
- Operation, Administration, and Maintenance (OAM)
- Charging Enablement Function (CEF)
- Network Data Analytics Function (NWDAF)
- Data Collection Coordination Function (DCCF)

The PCF accesses the Nnwdaf_EventsSubscription service at the NWDAF via the N23 Reference point. The NSSF accesses the Nnwdaf_EventsSubscription service at the NWDAF via the N34 Reference point.

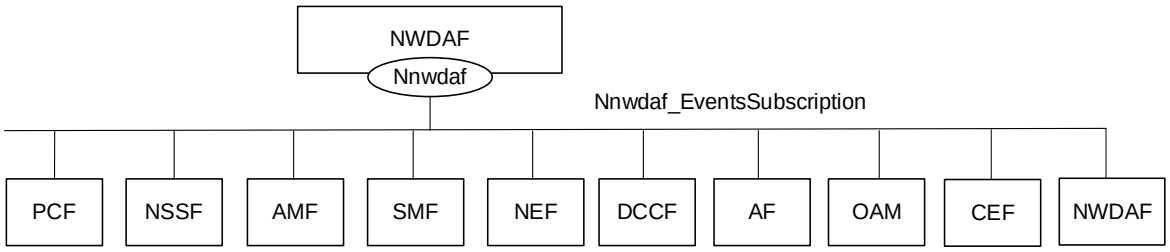

Figure 4.2.1.2-1: Reference Architecture for the Nnwdaf_EventsSubscription Service; SBI representation

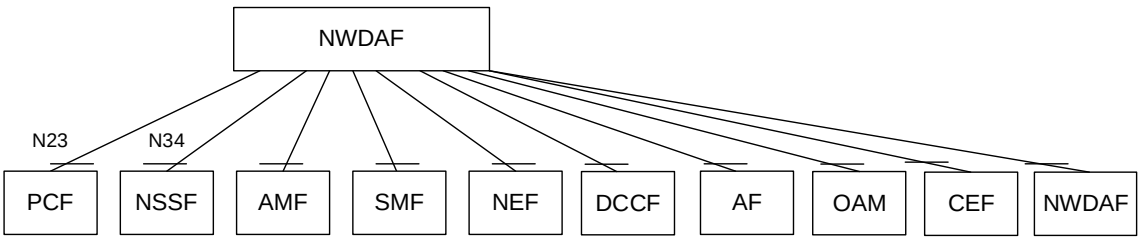

Figure 4.2.1.2-2: Reference Architecture for the Nnwdaf_EventsSubscription Service: reference point representation

4.2.1.3 Network Functions

4.2.1.3.1 Network Data Analytics Function (NWDAF)

The Network Data Analytics Function (NWDAF) provides analytics information for different analytics events to NF service consumers.

The Network Data Analytics Function (NWDAF) allows NF service consumers to subscribe to and unsubscribe from one-time, periodic notification or notification when an event is detected.

The Network Data Analytics Function (NWDAF) allows NF service consumers to request the transfer of subscriptions for analytics events.

4.2.1.3.2 NF Service Consumers

The Policy Control Function (PCF):

- supports (un)subscription to the notification of analytics information for slice load level information from the NWDAF;
- supports (un)subscription to the notification of analytics information for service experience related network data from the NWDAF;
- supports (un)subscription to the notification of analytics information for network performance from the NWDAF;
- supports (un)subscription to the notification of analytics information for abnormal UE behaviour from the NWDAF;
- supports (un)subscription to the notification of analytics information for UE mobility from the NWDAF;
- supports (un)subscription to the notification of analytics information for UE communication from the NWDAF;
- supports (un)subscription to the notification of analytics information for user data congestion from the NWDAF;
- supports (un)subscription to the notification of analytics information for dispersion from the NWDAF;
- supports (un)subscription to the notification of analytics information for WLAN performance from the NWDAF; and
- supports taking one or more above input from the NWDAF into consideration for policies on assignment of network resources and/or for traffic steering policies.

NOTE: How this information is used by the PCF is not standardized in this release of the specification.

The Network Slice Selection Function (NSSF):

- supports (un)subscription to the notification of analytics information for slice load level information or network slice instance load level information from the NWDAF to determine slice selection;
- supports (un)subscription to the notification of analytics information for service experience related network data from the NWDAF; and
- supports (un)subscription to the notification of analytics information for dispersion at the slice from the NWDAF.

The Access and Mobility Management Function (AMF):

- supports (un)subscription to the notification of analytics information for SMF load information from the NWDAF to determine SMF selection;
- supports (un)subscription to the notification of analytics information for expected UE behavioural information (UE mobility and/or UE communication) from the NWDAF to monitor UE behaviour;

- supports (un)subscription to the notification of analytics information for abnormal UE behaviour information from the NWDAF to determine adjustment of UE mobility related network parameters to solve the abnormal risk; and

- supports (un)subscription to the notification of analytics information for dispersion at the slice from the NWDAF.

The Session Management Function (SMF):

- supports (un)subscription to the notification of analytics information for UPF load information from the NWDAF to determine UPF selection;

- supports (un)subscription to the notification of analytics information for expected UE behavioural information (UE mobility and/or UE communication) from the NWDAF to monitor UE behaviour;

- supports (un)subscription to the notification of analytics information for abnormal UE behaviour information from the NWDAF to determine adjustment of UE communication related network parameters to solve the abnormal risk;

- supports (un)subscription to the notification of analytics information for slice load level information or network slice instance load level information from the NWDAF to determine slice selection.

- supports (un)subscription to the notification of analytics information for service experience related network data from the NWDAF;

- supports (un)subscription to the notification of analytics information for redundant transmission experience from the NWDAF to consider whether redundant transmission shall be performed, or (if it had been activated) shall be stopped; and

- supports (un)subscription to the notification of analytics information for DN performance from the NWDAF.

The Network Exposure Function (NEF):

- supports forwarding UE mobility information from the NWDAF to the AF when it is untrusted;

- supports forwarding UE communication information from the NWDAF to the AF when it is untrusted;

- supports forwarding expected UE behavioural information (UE mobility and/or UE communication) from the NWDAF to the AF when it is untrusted;

- supports forwarding abnormal behaviour information from the NWDAF to the AF when it is untrusted;

- supports forwarding user data congestion information from the NWDAF to the AF when it is untrusted;

- supports forwarding network performance information from the NWDAF to the AF when it is untrusted;

- supports forwarding QoS Sustainability information from the NWDAF to the AF when it is untrusted;

- supports forwarding Dispersion information from the NWDAF to the AF when it is untrusted;

- supports forwarding DN performance information from NWDAF to the AF when it is untrusted; and

- supports forwarding Observed Service Experience information from NWDAF to the AF when it is untrusted.

The Application Function (AF):

- supports receiving UE mobility information from NWDAF or via the NEF;

- supports receiving UE communication information from NWDAF or via the NEF;

- supports receiving expected UE behavioural information (UE mobility and/or UE communication) from NWDAF or via the NEF;

- supports receiving abnormal behaviour information from the NWDAF or via the NEF;

- supports receiving user data congestion information from the NWDAF or via the NEF;

- supports receiving network performance information from the NWDAF or via the NEF;

- supports receiving QoS Sustainability information from the NWDAF or via the NEF;
- supports receiving Dispersion information from the NWDAF or via the NEF;
- supports receiving DN performance information from NWDAF or via the NEF; and
- supports receiving Observed Service Experience information from NWDAF or via the NEF.

The Operation, Administration, and Maintenance (OAM):

- supports receiving observed service experience from the NWDAF;
- supports receiving NF load information from the NWDAF;
- supports receiving network performance information from the NWDAF;
- supports receiving UE mobility information from the NWDAF;
- supports receiving UE communication information from the NWDAF;
- supports receiving expected UE behaviour information (UE mobility and/or UE communication) from the NWDAF; and
- supports receiving abnormal UE behaviour information from the NWDAF.

The Charging Enablement Function (CEF):

- supports (un)subscription to the notification of analytics information for slice load level information from the NWDAF; and
- supports (un)subscription to the notification of analytics information for service experience statistics information from the NWDAF.

The Network Data Analytics Function (NWDAF):

- supports (un)subscription to the notification of analytics information for all types of network analytics from the NWDAF; and
- supports requesting the transfer of subscriptions to another NWDAF.

The Data Collection Coordination Function (DCCF):

- supports (un)subscription to the notification of analytics information for all types of network analytics from the NWDAF.

4.2.2 Service Operations

4.2.2.1 Introduction

Table 4.2.2.1-1: Operations of the Nnwdaf_EventsSubscription Service

Service operation name	Description	Initiated by
Nnwdaf_EventsSubscription_Subscribe	This service operation is used by an NF to subscribe or update subscription for event notifications of the analytics information. One-time, periodic notification or notification upon event detected can be subscribed.	NF service consumer (PCF, NSSF, AMF, SMF, NEF, AF, OAM, CEF, NWDAF, DCCF)
Nnwdaf_EventsSubscription_Unsubscribe	This service operation is used by an NF to unsubscribe from event notifications.	NF service consumer (PCF, NSSF, AMF, SMF, NEF, AF, OAM, CEF, NWDAF, DCCF)
Nnwdaf_EventsSubscription_Notify	This service operation is used by an NWDAF to notify NF service consumers about subscribed events.	NWDAF
Nnwdaf_EventsSubscription_Transfer	This service operation is used by an NWDAF to request the transfer of subscription(s) for analytics events.	NWDAF

4.2.2.2 Nnwdaf_EventsSubscription_Subscribe service operation

4.2.2.2.1 General

The Nnwdaf_EventsSubscription_Subscribe service operation is used by an NF service consumer to subscribe or update subscription for event notifications from the NWDAF.

4.2.2.2.2 Subscription for event notifications

Figure 4.2.2.2.2-1 shows a scenario where the NF service consumer sends a request to the NWDAF to subscribe for event notification(s) (as shown in 3GPP TS 23.288 [17]).

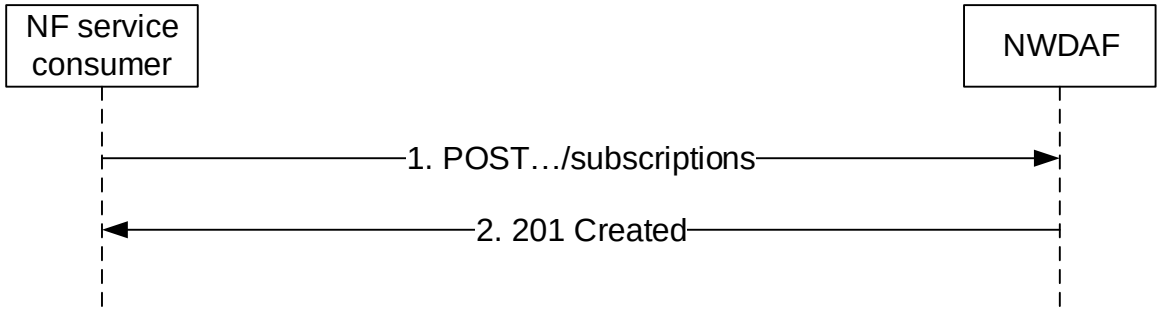

Figure 4.2.2.2.2-1: NF service consumer subscribes to notifications

The NF service consumer shall invoke the Nnwdaf_EventsSubscription_Subscribe service operation to subscribe to event notification(s). The NF service consumer shall send an HTTP POST request with "{apiRoot}/nnwdaf-eventssubscription/<apiVersion>/subscriptions" as Resource URI representing the "NWDAF Events Subscriptions", as shown in figure 4.2.2.2.2-1, step 1, to create a subscription for an "Individual NWDAF Event Subscription" according to the information in message body. The NnwdafEventsSubscription data structure provided in the request body shall include:

- an URI where to receive the requested notifications as "notificationURI" attribute; and
- a description of the subscribed events as "eventSubscriptions" attribute that, for each event, the EventSubscription data type shall include:

1) an event identifier as "event" attribute; and

2) if the event notification method "PERIODIC" is selected via the "notificationMethod" attribute, repetition period as "repetitionPeriod" attribute;

- and may include:

1) maximum number of objects in the "maxObjectNbr" attribute;

2) maximum number of SUPIs expected for an analytics report in the "maxSupiNbr" attribute;

3) identification of time window to which the subscription applies via identification of date-time(s) in the "startTs" and "endTs" attributes;

4) preferred level of accuracy of the analytics in the "accuracy" attribute;

5) identification of time when analytics information is needed in the "timeAnaNeeded" atribute if the feature "EneNA" is supported;

6) indication of which analytics metadata is requested to be delivered with the notification in the "anaMeta" attribute if the feature "Aggregation" is supported;

7) requested values for analytics metadata information to be used for the generation of the analytics in the "anaMetaInd" attribute if the feature "Aggregation" is supported;

8) offset period to the periodic reporting in the "offsetPeriod" attribute if the feature "EneNA" is supported. It may be present if the "repPeriod" attribute within the "evtReq" attribute is included; and/or

9) preferred accuracy level per analytics subset in the "accPerSubset" attribute if the "listOfAnaSubsets" attribute is present and the "EneNA" feature is supported.

The NnwdafEventsSubscription data structure provided in the request body may include:

- event reporting information as the "evtReq" attribute, which applies for each event and may contain the following attributes:

1) event notification method (periodic, one time, on event detection) in the "notifMethod" attribute;

2) maximum Number of Reports in the "maxReportNbr" attribute;

3) monitoring duration in the "monDur" attribute;

4) repetition period for periodic reporting in the "repPeriod" attribute;

5) immediate reporting indication in the "immRep" attribute;

6) percentage of sampling among impacted UEs in the "sampRatio" attribute;

7) partitioning criteria for partitioning the impacted UEs before performing sampling as "partitionCriteria" attribute if the "EneNA" feature is supported;

8) group reporting guard time for aggregating the reports for a group of UEs in the "grpRepTime" attribute; and/or

9) a notification flag (used for muting and retrieving notifications) as "notifFlag" attribute if the "EneNA" feature is supported;

NOTE 1: The notification method indicated as the "notifMethod" attribute and the periodic reporting time indicated as the "repPeriod" attributes within the event reporting information as the "evtReq" attribute provided in NnwdafEventsSubscription data type, if present, supersedes the event notification method as the "notificationMethod" attribute and repetition period as the "repetitionPeriod" attribute respectively in the EventSubscription data type.

- information of previous analytics subscription in the "prevSub" attribute if the "AnaCtxTransfer" feature is supported;

- the notification correlation identifier in the "notifCorrId" attribute, if the "EneNA" feature is supported; and/or

- analytics consumer information as "consNfInfo" attribute, if the "AnaSubTransfer" feature is supported.

NOTE 2: The "consNfInfo" attribute enables the NWDAF to determine whether an analytics subscription transfer procedure is applicable. Otherwise, if the "consNfInfo" attribute is not provided in a subscription and the NWDAF cannot serve anymore or transfer this subscription, the NWDAF can notify the analytics consumer with a Termination Request so that the analytics consumer can select a new target NWDAF.

For different event types, the "eventSubscriptions" attribute:

- if the event is "SLICE_LOAD_LEVEL", shall provide:

  1) network slice level load level threshold in the "loadLevelThreshold" attribute if the "notifMethod" attribute in "evtReq" attribute is set to "ON_EVENT_DETECTION" or the "notificationMethod" attribute in "eventSubscriptions" attribute is set to "THRESHOLD" or omitted; and

  2) identification of network slice(s) to which the subscription applies via identification of network slice(s) in the "snssais" attribute or any slices indication in the "anySlice" attribute;

- if the feature "NsiLoad" is supported and the event is "NSI_LOAD_LEVEL", shall provide:

  1) identification of network slice and the optionally associated network slice instance(s) if available, via the "nsiIdInfos" attribute or any slices indication in the "anySlice" attribute; and

NOTE 3: The network slice instance of a PDU session is not available in the PCF.

  2) the network slice or network slice instance load level thresholds in the "nsiLevelThrds" attribute if the "notifMethod" attribute in "evtReq" attribute is set to "ON_EVENT_DETECTION" or the "notificationMethod" attribute in "eventSubscriptions" attribute is set to "THRESHOLD" or omitted;

  and may include:

  1) a list of analytics subsets carried by "listOfAnaSubsets" attribute with value(s) only applicable to "NSI_LOAD_LEVEL" event, if the "EneNA" feature is supported; and/or

  2) identification of network area to which the subscription applies via identification of network area(s) by "networkArea" attribute, if the "NsiLoadExt" feature is supported.

- if the feature "NfLoad" is supported and the event is "NF_LOAD", shall provide:

  1) identification of target UE(s) to which the subscription applies by "supis" or "anyUe" in the "tgtUe" attribute; and

NOTE 4: Only NF instances of type AMF and SMF which are serving the UE can be determined using a SUPI in "supis" attribute.

NOTE 5: If a list of the NF Instance IDs (or respectively of NF Set IDs) is provided, the NWDAF needs to provide the analytics for each designated NF instance (or respectively for each NF instance belonging to each designated NF Set). In such case the target UE(s) of the Analytics Reporting need be ignored.

  2) NF load level thresholds in the "nfLoadLvlThds" attribute if the "notifMethod" attribute in "evtReq" attribute is set to "ON_EVENT_DETECTION" or the "notificationMethod" attribute in "eventSubscriptions" attribute is set to "THRESHOLD" or omitted;

- and may include:

  1) either list of NF instance IDs in the "nfInstanceIds" attribute or list of NF set IDs in the "nfSetIds" attribute if the identification of target UE(s) applies to all UEs;

  2) list of NF instance types in the "nfTypes" attribute;

  3) identification of network slice(s) by "snssais" attribute;

  4) a matching direction in the "matchingDir" attribute if the "nfLoadLvlThds" attribute is provided;

  5) optional area of interest by "networkArea" attribute, if the "NfLoadExt" feature is supported; and/or

6) an optional list of analytics subsets by "listOfAnaSubsets" attribute with value(s) only applicable to NF_LOAD event, if the "EneNA" feature is supported;

- if the feature "NetworkPerformance" is supported and the event is "NETWORK_PERFORMANCE", it shall provide:

  1) identification of target UE(s) to which the subscription applies by "supis", "intGroupIds" or "anyUe" attribute in the "tgtUe" attribute; and

  2) the network performance requirements via "nwPerfRequs" attribute;

  and may provide:

  1) identification of network area to which the subscription applies via identification of network area(s) by "networkArea" attribute (mandatory if "anyUe" attribute is set to true);

  2) a matching direction in the "matchingDir" attribute if the "nwPerfRequs" attribute is provided; and/or

  3) a list of analytics subsets carried by "listOfAnaSubsets" attribute with value(s) only applicable to "NETWORK_PERFORMANCE" event, if the "EneNA" feature is supported;

- if the feature "ServiceExperience" is supported and the event is "SERVICE_EXPERIENCE", shall provide:

  1) identification of target UE(s) to which the subscription applies by "supis", "intGroupIds" or "anyUe" attribute in the "tgtUe" attribute; and

  2) any slices indication in the "anySlice" attribute or identification of network slice(s) together with the optionally associated network slice instance(s) if available, via the "nsiIdInfos" attribute;

NOTE 6: The network slice instance of a PDU session is not available in the PCF.

- and may provide:

  1) identification of application to which the subscription applies via identification of application(s) by "appIds" attribute;

  2) identification of network area to which the subscription applies via identification of network area(s) by "networkArea" attribute (mandatory if "anyUe" attribute is set to true);

  3) identification of DNN to which the subscription applies via identification of application(s) by "dnns" attribute;

  4) identification of user plane access to DN(s) which the subscription applies as the "dnais" attribute;

  5) identification of a user plane access to one or more DN(s) where applications are deployed by "dnais" attribute;

  6) if "appIds" attribute is provided, the bandwidth requirement of each application by "bwRequs" attribute;

  7) indication of all the RAT types and/or all the frequencies that the NWDAF received for the application or specific RAT type(s) and/or frequency(ies) and the service experience threshold value(s) for the RAT Type(s) and/or Frequency value(s) where the UE camps on by "ratFreqs" attribute if the feature "ServiceExperienceExt" is also supported; and/or

  8) a list of analytics subsets carried by "listOfAnaSubsets" attribute with value(s) only applicable to "SERVICE_EXPERIENCE" event, if the "EneNA" feature is supported;

  9) the identification of the UPF as the "upfInfo" attribute if the feature "ServiceExperienceExt" is also supported; and/or

  10) IP address(s)/FQDN(s) of the Application Server(s) as the "appServerAddrs" attribute if the feature "ServiceExperienceExt" is also supported;

- if the feature "UeMobility" is supported and the event is "UE_MOBILITY", shall provide:

  1) identification of target UE(s) to which the subscription applies by "supis" or "intGroupIds" attribute in the "tgtUe" attribute;

2) if the feature "UeMobilityExt" is supported,

i) identification of LADN DNN in the "ladnDnns" attribute;

ii) Visited Area(s) of Interest as the "visitedAreas" attirbute.

NOTE 7: For LADN service, the consumer (e.g. SMF) provides the LADN DNN to refer the LADN service area as the AOI.

- and may provide:

1) identification of network area to which the subscription applies via identification of network area(s) by "networkArea" attribute;

- if the feature "UeCommunication" is supported and the event is "UE_COMM", shall provide:

1) identification of target UE(s) to which the subscription applies by "supis" or "intGroupIds" attribute in the "tgtUe" attribute;

- and may provide:

1) identification of the application in the "appIds" attribute;

2) identification of network area to which the subscription applies via identification of network area(s) by "networkArea" attribute;

3) an identification of DNN in the "dnns" attribute;

4) identification of network slice in the "snssais" attribute; and/or

5) a list of analytics subsets carried by "listOfAnaSubsets" attribute with value(s) only applicable to "UE_COMM" event, if the "EneNA" feature is supported;

- if the feature "QoSSustainability" is supported and the event is "QOS_SUSTAINABILITY", shall provide:

1) identification of network area to which the subscription applies via identification of network area by "networkArea" attribute;

2) the QoS requirements via "qosRequ" attribute;

3) QoS flow retainability threshold(s) by the "qosFlowRetThds" attribute for the 5QI of GBR resource type or RAN UE throughout threshold(s) by the "ranUeThrouThds" attribute for the 5QI of non-GBR resource type, if the "notifMethod" attribute in "evtReq" attribute is set to "ON_EVENT_DETECTION" or the "notificationMethod" attribute in "eventSubscriptions" attribute is set to "THRESHOLD" or omitted; and

4) identification of target UE(s) to which the subscription applies by "anyUe" in the "tgtUe" attribute;

- and may include:

1) identification of network slice(s) by "snssais" attribute; and/or

2) a matching direction in the "matchingDir" attribute if the "qosFlowRetThds" attribute or the "ranUeThrouThds" attribute is provided;

- if the feature "AbnormalBehaviour" is supported and the event is "ABNORMAL_BEHAVIOUR", shall provide:

1) identification of target UE(s) to which the subscription applies by "supis", "intGroupIds" or "anyUe" attribute in the "tgtUe" attribute; and

2) either the expected analytics type via "exptAnaType" attribute or a list of exception Ids with the associated thresholds via "excepRequs" attribute. If the expected analytics type via "exptAnaType" attribute is provided, the NWDAF shall derive the corresponding Exception Ids from the received expected analytics type as follows:

a) if "exptAnaType" attribute sets to "MOBILITY", the corresponding list of Exception Ids are "UNEXPECTED_UE_LOCATION", "PING_PONG_ACROSS_CELLS", "UNEXPECTED_WAKEUP" and "UNEXPECTED_RADIO_LINK_FAILURES";

b) if "exptAnaType" attribute sets to "COMMUN", the corresponding list of Exception Ids are "UNEXPECTED_LONG_LIVE_FLOW", "UNEXPECTED_LARGE_RATE_FLOW", "SUSPICION_OF_DDOS_ATTACK", "WRONG_DESTINATION_ADDRESS" and "TOO_FREQUENT_SERVICE_ACCESS"; and

c) if "exptAnaType" attribute sets to "MOBILITY_AND_COMMUN", the corresponding list of Exception Ids includes all above derived exception Ids.

The derived list of Exception Ids are used by the NWDAF to notify the NF service consumer when UE's behaviour is exceptional based on one or more Exception Ids within the list.

If the "anyUe" attribute in the "tgtUe" attribute sets to "true";

a) the expected analytics type via the"exptAnaType" attribute or the list of Exception Ids via "excepRequs" attribute shall not be requested for both mobility and communication related analytics at the same time;

b) if the expected analytics type via the"exptAnaType" attribute or the list of Exception Ids via "excepRequs" attribute is mobility related, at least one of identification of network area(s) by "networkArea" attribute and identification of network slice(s) by "snssais" attribute should be provided; and

c) if the expected analytics type via the"exptAnaType" attribute or the list of Exception Ids via "excepRequs" attribute is communication related, at least one of identification of network area(s) by "networkArea" attribute, identification of application(s) by "appIds" attribute, identification of DNN(s) in the "dnns" attribute and identification of network slice(s) by "snssais" attribute should be provided;

- and may provide:

1) expected UE behaviour via "exptUeBehav" attribute; and

- if the feature "UserDataCongestion" is supported and the event is "USER_DATA_CONGESTION", shall provide:

1) identification of target UE(s) to which the subscription applies by "supis", "gpsis" (if feature "UserDataCongestionExt" is supported) or "anyUe" attribute;

- and may include:

1) congestion threshold by the "congThresholds" attribute if the "notifMethod" attribute in "evtReq" attribute is set to "ON_EVENT_DETECTION" or the "notificationMethod" attribute in "eventSubscriptions" attribute is set to "THRESHOLD" or omitted;

2) identification of network area to which the subscription applies via identification of network area(s) by "networkArea" attribute (mandatory if "anyUe" attribute is set to true);

3) identification of network slice(s) by "snssais" attribute;

4) a matching direction in the "matchingDir" attribute if the "congThresholds" attribute is provided;

5) if the feature "UserDataCongestionExt" is also supported, request a list of top applications with maximum number that contribute the most to the traffic in uplink and/or downlink directions by the "maxTopAppUlNbr" attribute and/or the "maxTopAppDlNbr" attribute; and/or

6) a list of analytics subsets carried by "listOfAnaSubsets" attribute with value(s) only applicable to "USER_DATA_CONGESTION" event, if the "EneNA" feature is supported.

- if the feature "Dispersion" is supported and the event is "DISPERSION", shall provide:

1) identification of target UE(s) to which the subscription applies by "supis", "intGroupIds" or "anyUe" attribute in the "tgtUe" attribute, "anyUe" attribute is only supported in combination with "snssais" attribute, "networkArea" attribute and/or "disperClass" attribute;

and may include:

1) identification of network area to which the subscription applies via identification of network area by "networkArea" attribute, if the "supis" attribute or "intGroupIds" attribute is included in the "tgtUe" attribute;

2) identification of network slice(s) by "snssais" attribute;

3) application identifier(s) in "appIds" attribute;

4) dispersion analytics requirements in "disperReqs" attribute, which for the requested dispersion type may include dispersion class, preferred ordering requirements; and/or

5) an optional list of analytics subsets by "listOfAnaSubsets" attribute with value(s) only applicable to DISPERSION event, if the "EneNA" feature is supported.

- if the feature "RedundantTransmissionExp" is supported and the event is "RED_TRANS_EXP", shall provide:

  1) identification of target UE(s) to which the subscription applies by "supis", "intGroupIds" or "anyUe" attribute in the "tgtUe" attribute;

  and may include:

  1) identification of network area to which the subscription applies via identification of network area by "networkArea" attribute;

  2) identification of network slice(s) by "snssais" attribute;

  3) identification of DNN in the "dnns" attribute; and/or

  4) other redundant transmission experience analysis requirements in "redTransReqs" attribute, which may include preferred order of results for the list of Redundant Transmission Experience.

  5) an optional list of analytics subsets by "listOfAnaSubsets" attribute with value(s) only applicable to RED_TRANS_EXP event, if the "EneNA" feature is supported.

- if the feature "WlanPerformance" is supported and the event is "WLAN_PERFORMANCE", shall provide:

  1) identification of target UE(s) to which the subscription applies by "supis", "intGroupIds" or "anyUe" attribute in the "tgtUe" attribute. If "anyUe" attribute is included in the "tgtUe" attribute, then any of "networkArea" attribute, "ssIds" or "bssIds" attribute within "wlanReqs" attribute shall be present;

  and may include:

  1) identification of network area to which the subscription applies via identification of network area by "networkArea" attribute;

  2) other WLAN performance analytics requirements in "wlanReqs" attribute, which may include SSID(s), BSSID(s), preferred order of results for the list of WLAN performance information and/or accuracy per analytics subset; and/or

  3) an optional list of analytics subsets by "listOfAnaSubsets" attribute with value(s) only applicable to WLAN_PERFORMANCE event, if the "EneNA" feature is supported.

- if the feature "DnPerformance" is supported and the event is "DN_PERFORMANCE", shall provide:

  1) identification of target UE(s) to which the subscription applies by "supis", "intGroupIds" or "anyUe" attribute in the "tgtUe" attribute;

  and may include:

  1) identification of network area to which the subscription applies via identification of network area by "networkArea" attribute;

  2) identification of network slice(s) in the "snssais" attribute;

  3) identification of network slice and the optionally associated network slice instance(s) if available, via the "nsiIdInfos" attribute or any slices indication in the "anySlice" attribute;

  4) application identifier(s) in "appIds" attribute;

  5) an identification of DNN in the "dnns" attribute;

6) identification of a user plane access to one or more DN(s) where applications are deployed by "dnais" attribute;

7) the identification of the UPF as the "upfInfo" attribute;

8) IP address(s)/FQDN(s) of the Application Server(s) as the "appServerAddrs" attribute;

9) other DN performance analytics requirements in "dnPerfReqs" attribute, which may include the preferred order of results for the list of DN performance information and/or the reporting threshold of each analytics subset; and/or

10) an optional list of analytics subsets by "listOfAnaSubsets" attribute with value(s) only applicable to "DN_PERFORMANCE" event, if the "EneNA" feature is supported.

- if the feature "SMCCE" is supported and the event is "SM_CONGESTION", shall provide:

  1) an identification of DNN in the "dnns" attribute; and/or

  2) identification of network slice in the "snssais" attribute;

  3) identification of target UE(s) via "supis" attribute in the "tgtUe" attribute where the target UE(s) are one have the PDU Session for the DNN and/or S-NSSAI;

  and may include:

  1) an optional list of analytics subsets by "listOfAnaSubsets" attribute with value(s) only applicable to "SM_CONGESTION" event, if the "EneNA" feature is supported.

NOTE 8: The predictions are not applicable for Session Management Congestion Control Experience analytics.

Upon the reception of an HTTP POST request with: "{apiRoot}/nnwdaf-eventssubscription/<apiVersion>/subscriptions" as Resource URI and NnwdafEventsSubscription data structure as request body, the NWDAF shall:

- create a new subscription;
- assign an event subscriptionId; and
- store the subscription.

If the NWDAF created an "Individual NWDAF Event Subscription" resource, the NWDAF shall respond with "201 Created" status code with the message body containing a representation of the created subscription, as shown in figure 4.2.2.2.2-1, step 2. If not all the requested analytics events in the subscription are accepted, then the NWDAF may include the "failEventReports" attribute indicating the event(s) for which the subscription failed and the associated reason(s). The NWDAF shall include a Location HTTP header field. The Location header field shall contain the URI of the created subscription i.e. "{apiRoot}/nnwdaf-eventssubscription/<apiVersion>/subscriptions/{subscriptionId}". If the immediate reporting indication in the "immRep" attribute within the "evtReq" attribute sets to true in the event subscription, the NWDAF shall include the reports of the events subscribed, if available, in the HTTP POST response.

When the "notifFlag" attribute is included and set to "DEACTIVATE" in the request, the NWDAF shall mute the event notification and store the available events.

If the analytics target period provided in the body of the HTTP POST request includes the start time in the past and the end time in the future, the NWDAF shall reject the request with an HTTP "400 Bad Request" response including the "cause" attribute set to "BOTH_STAT_PRED_NOT_ALLOWED".

If the statistics in the past is requested but the necessary data to perform the service is unavailable, the NWDAF shall reject the request with an HTTP "500 Internal Server Error" response including the "cause" attribute set to "UNAVAILABLE_DATA".

4.2.2.2.3 Update subscription for event notifications

Figure 4.2.2.2.3-1 shows a scenario where the NF service consumer sends a request to the NWDAF to update the subscription for event notifications (see also 3GPP TS 23.288 [17]).

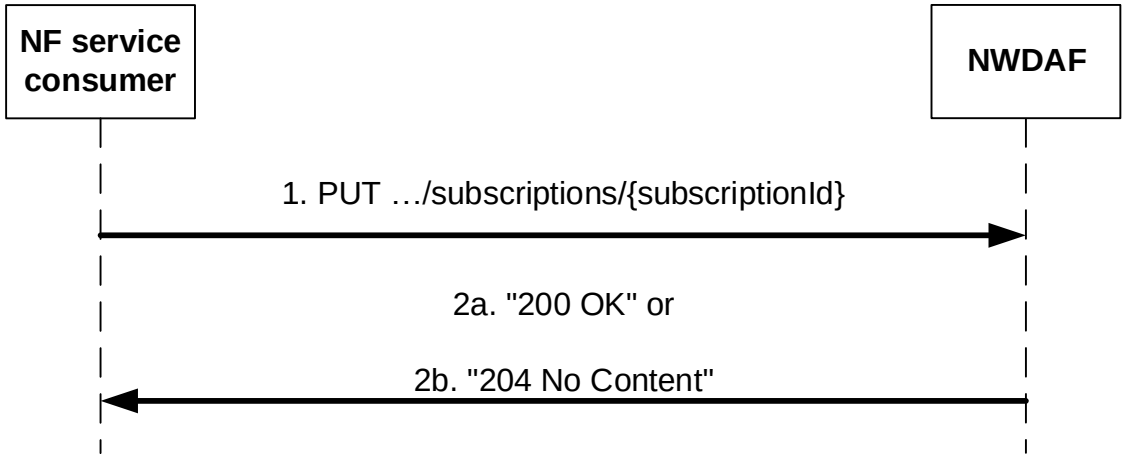

Figure 4.2.2.2.3-1: NF service consumer updates subscription to notifications

The NF service consumer shall invoke the Nnwdaf_EventsSubscription_Subscribe service operation to update subscription to event notifications. The NF service consumer shall send an HTTP PUT request with "{apiRoot}/nnwdaf-eventssubscription/<apiVersion>/subscriptions/{subscriptionId}" as Resource URI representing the "Individual NWDAF Event Subscription", as shown in figure 4.2.2.2.3-1, step 1, to update the subscription for an "Individual NWDAF Event Subscription" resource identified by the {subscriptionId}. The NnwdafEventsSubscription data structure provided in the request body shall include the same contents as described in clause 4.2.2.2.2:

Upon the reception of an HTTP PUT request with: "{apiRoot}/nnwdaf-eventssubscription/<apiVersion>/subscriptions/{subscriptionId}" as Resource URI and NnwdafEventsSubscription data structure as request body, the NWDAF shall:

- update the subscription of corresponding subscriptionId; and
- store the subscription.

NOTE: The "notificationURI" attribute within the NnwdafEventsSubscription data structure can be modified to request that subsequent notifications are sent to a new NF service consumer.

If the NWDAF successfully processed and accepted the received HTTP PUT request, the NWDAF shall update an "Individual NWDAF Event Subscription" resource, and shall respond with:

a) HTTP "200 OK" status code with the message body containing a representation of the updated subscription, as shown in figure 4.2.2.2.3-1, step 2a. If not all the requested analytics events in the subscription are modified successfully, then the NWDAF may include the "failEventReports" attribute indicating the event(s) for which the modification failed and the associated reason(s); or

b) HTTP "204 No Content" status code, as shown in figure 4.2.2.2.3-1, step 2b.

If errors occur when processing the HTTP PUT request, the NWDAF shall send an HTTP error response as specified in clause 5.1.7.

If the analytics target period provided in the body of the HTTP POST request includes the start time in the past and the end time in the future, the NWDAF shall reject the request with an HTTP "400 Bad Request" response including the "cause" attribute set to "BOTH_STAT_PRED_NOT_ALLOWED".

If the statistics in the past is requested but the necessary data to perform the service is unavailable, the NWDAF shall reject the request with an HTTP "500 Internal Server Error" response including the "cause" attribute set to "UNAVAILABLE_DATA".

If the feature "ES3XX" is supported, and the NWDAF determines the received HTTP PUT request needs to be redirected, the NWDAF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [6].

When the "notifFlag" attribute is included in the request with the value "DEACTIVATE", the NWDAF shall mute the event notification and store the available events; if it is set to the value "RETRIEVAL", the NWDAF shall send the stored events to the NF service consumer, mute the event notification again and store available events; if it is set to the value "ACTIVATE" and the event notifications are muted (due to a previously received "DECATIVATE" value), the NWDAF shall unmute the event notification, i.e. start sending again notifications for available events.

4.2.2.3 Nnwdaf_EventsSubscription_Unsubscribe service operation

4.2.2.3.1 General

The Nnwdaf_EventsSubscription_Unsubscribe service operation is used by an NF service consumer to unsubscribe from event notifications.

4.2.2.3.2 Unsubscribe from event notifications

Figure 4.2.2.3.2-1 shows a scenario where the NF service consumer sends a request to the NWDAF to unsubscribe from event notifications (see also 3GPP TS 23.288 [17]).

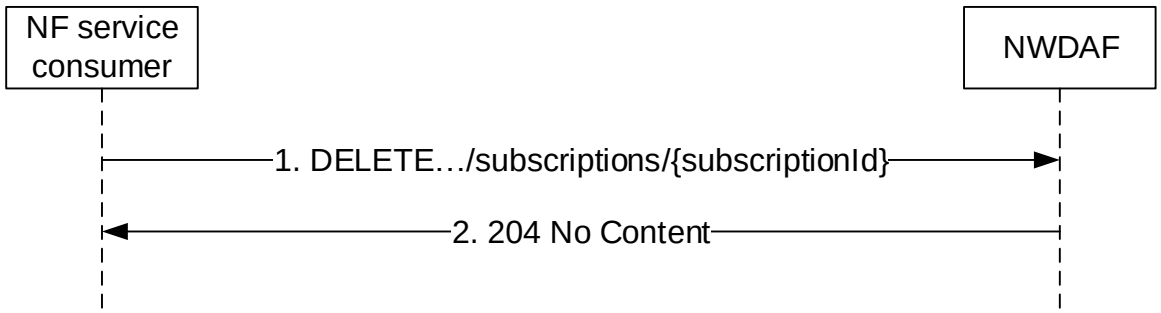

Figure 4.2.2.3.2-1: NF service consumer unsubscribes from notifications

The NF service consumer shall invoke the Nnwdaf_EventsSubscription_UnSubscribe service operation to unsubscribe to event notifications. The NF service consumer shall send an HTTP DELETE request with: "{apiRoot}/nnwdaf-eventssubscription/<apiVersion>/subscriptions/{subscriptionId}" as Resource URI, where "{subscriptionId}" is the event subscriptionId of the existing subscription that is to be deleted.

Upon the reception of an HTTP DELETE request with: "{apiRoot}/nnwdaf-eventssubscription/<apiVersion>/subscriptions/{subscriptionId}" as Resource URI, if the NWDAF successfully processed and accepted the received HTTP DELETE request, the NWDAF shall:

- remove the corresponding subscription; and
- respond with HTTP "204 No Content" status code.

If errors occur when processing the HTTP DELETE request, the NWDAF shall send an HTTP error response as specified in clause 5.1.7.

If the feature "ES3XX" is supported, and the NWDAF determines the received HTTP DELETE request needs to be redirected, the NWDAF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [6].

4.2.2.4 Nnwdaf_EventsSubscription_Notify service operation

4.2.2.4.1 General

The Nnwdaf_EventsSubscription_Notify service operation is used by an NWDAF to notify NF consumers about subscribed events or by the target NWDAF to notify the consumer of the successful analytics subscription transfer.

4.2.2.4.2 Notification about subscribed event

Figure 4.2.2.4.2-1 shows a scenario where the NWDAF sends a request to the NF service consumer to notify for event notifications (see also 3GPP TS 23.288 [17]).

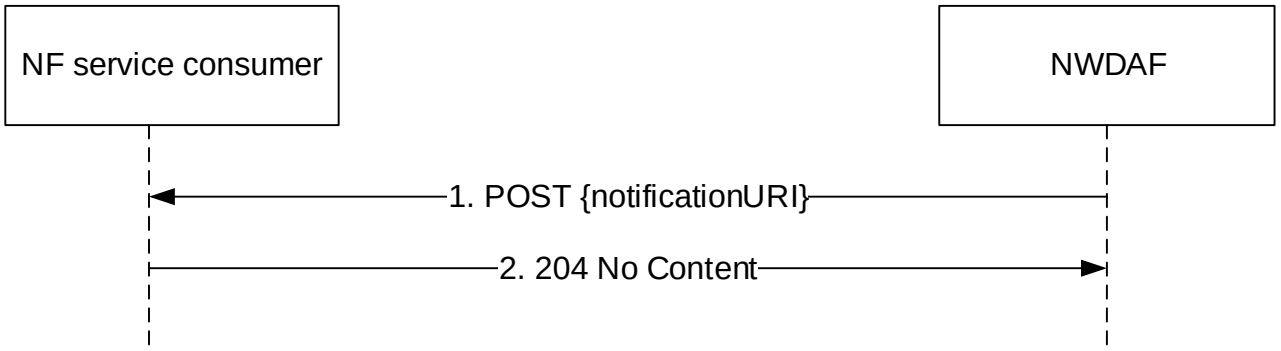

Figure 4.2.2.4.2-1: NWDAF notifies the subscribed event

The NWDAF shall invoke the Nnwdaf_EventsSubscription_Notify service operation to notify the subscribed event or the successful analytics subscription transfer. The NWDAF shall send an HTTP POST request with "{notificationURI}" received in the Nnwdaf_EventsSubscription_Subscribe service operation as Resource URI, as shown in figure 4.2.2.4.2-1, step 1.

If both the "repPeriod" attribute and the "offsetPeriod" attribute are present in the subscription request for periodical notification, the NWDAF shall produce a notification every repPeriod seconds, including the statistics in the past offset period if the "offsetPeriod" attribute value is negative, or including the prediction for the future offset period if the "offsetPeriod" attribute value is positive.

The NnwdafEventsSubscriptionNotification data structure provided in the request body shall include:

- If the notification is for notifying about subscribed events, a description of the notified event as "eventNotifications" attribute that for each event shall include:

  a) an event identifier as "event" attribute;

  b) network slice load level information in the "sliceLoadLevelInfo" attribute when subscribed event is "SLICE_LOAD_LEVEL";

  c) service experience information as "svcExps" attribute when subscribed event is "SERVICE_EXPERIENCE";

  d) UE mobility information in the "ueMobs" attribute when subscribed event is "UE_MOBILITY";

  e) UE communication information in the "ueComms" attribute when subscribed event is "UE_COMM";

  f) abnormal behaviour information in the "abnorBehavrs" attribute when subscribed event is "ABNORMAL_BEHAVIOUR";

  g) user data congestion information in the "userDataCongInfos" attribute when subscribed event is "USER_DATA_CONGESTION";

  h) QoS sustainability information in the "qosSustainInfos" attribute when subscribed event is "QOS_SUSTAINABILITY";

  i) NF load information in "nfLoadLevelInfos" attribute when subscribed event is "NF_LOAD";

  j) network performance information in the "nwPerfs" attribute when subscribed event is "NETWORK_PERFORMANCE";

  k) Load level information for the network slice(s) and the optionally associated network slice instance(s) in "nsiLoadLevelInfos" attribute when subscribed event is "NSI_LOAD_LEVEL";

  l) Dispersion information in the "disperInfos" attribute when subscribed event is "DISPERSION";

  m) Redundant transmission experience information in the "redTransInfos" attribute when subscribed event is "RED_TRANS_EXP";

  n) WLAN performance information in the "wlanInfos" attribute when subscribed event is "WLAN_PERFORMANCE";

o) DN performance information in the "DnPerformance" attribute when subscribed event is "DN_PERFORMANCE"; and

p) SMCCE performance information in the "smccExps" attribute when subscribed event is "SM_CONGESTION".

and may include:

a) information about analytics metadata required for aggregation of the analytics in the "anaMetaInfo" attribute if the feature "Aggregation" is supported;

- If the "EneNA" feature is supported and the notification is for changing the subscription identifier, the old subscription ID which was allocated by the source NWDAF during the analytics transfer procedure within the "oldSubscriptionId" attribute; and
- an event subscription Id as "subscriptionId" attribute.

and may include:

- the notification correlation identifier in the "notifCorrId" attribute, if the "EneNA" feature is supported.

If the feature "EneNA" is supported and the time when analytics information is needed has been provided (via the "timeAnaNeeded" attribute within the "extraReportReq" attribute) during the subscription for an event (via the "event" attribute within the EventSubscription data type), if the time when analytics information is needed is reached but the subscribed analytics information is not ready, the consumer does not need to wait for the analytics information any longer. In this case, the NWDAF may send an HTTP POST request as shown in step 1 of figure 4.2.2.4.2-1, which shall only provide (within the EventNotification data type in the NnwdafEventsSubscriptionNotification data type) an indication of the failure event via the "event" attribute and the corresponding failure reason via a "failNotifyCode" attribute, and may also provide a minimum time interval recommended by the NWDAF for the event via a "rvWaitTime" attribute which will be used by the NF service consumer to determine the time when analytics information is needed in similar future analytics subscriptions.

Upon the reception of an HTTP POST request with: "{notificationURI}" as Resource URI and NnwdafEventsSubscriptionNotification data structure as request body, if the NF service consumer successfully processed and accepted the received HTTP POST request, the NF service consumer shall:

- store the notification; and
- respond with HTTP "204 No Content" status code.

If errors occur when processing the HTTP POST request, the NF service consumer shall send an HTTP error response as specified in clause 5.1.7.

If the feature "ES3XX" is supported, and the NF service consumer determines the received HTTP POST request needs to be redirected, the NF service consumer shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [6].

4.2.2.5 Nnwdaf_EventsSubscription_Transfer service operation

4.2.2.5.1 General

The Nnwdaf_EventsSubscription_Transfer service operation is used by an NWDAF instance to request the transfer of analytics subscription(s) to another NWDAF instance. If the source NWDAF discovers that the analytics consumer may change concurrently to this procedure, the source NWDAF should not perform the procedure. In such a case, the source NWDAF may send a message to indicate to the analytics consumer that it will not serve this subscription anymore.

NOTE 1: To discover the possible change of analytics consumer, if the Analytics ID is UE related, the source NWDAF takes actions responding to external trigger (such as UE mobility), for example, checking if the Target of Analytics Reporting is still within the serving area of the analytics consumer, if the serving area information of the consumer is available.

NOTE 2: Handling of overload situation or preparation for a graceful shutdown are preferably executed inside an NWDAF Set, when available, therefore, not requiring an analytics subscription transfer as described in this clause.

4.2.2.5.2 Creation of request for analytics subscription transfer

Figure 4.2.2.5.2-1 shows a scenario where the NF Service Consumer (e.g. NWDAF) sends a request to the NWDAF to request the transfer of analytics subscription(s) from the NF Service Consumer to the NF Service Producer (see also 3GPP TS 23.288 [17]).

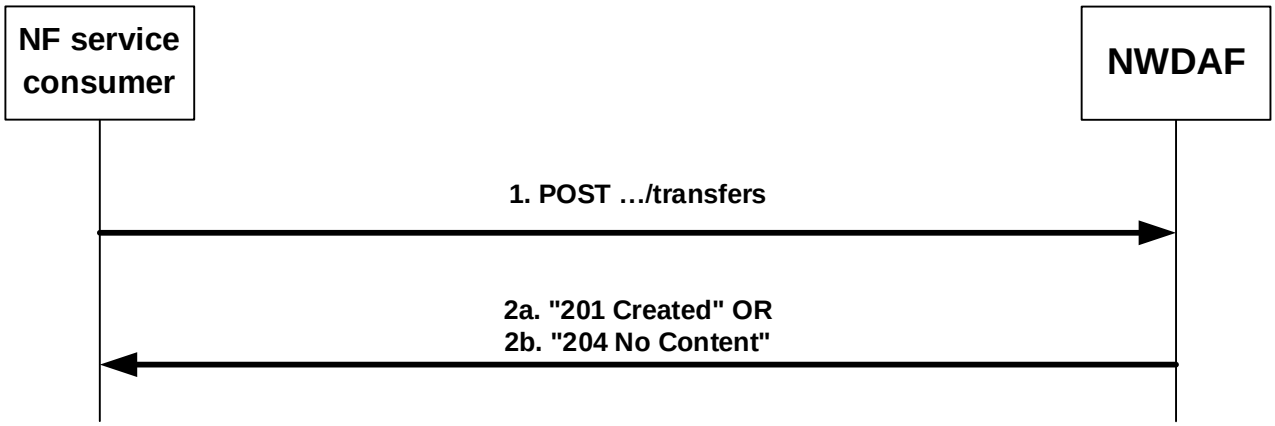

Figure 4.2.2.5.2-1: NF service consumer requests an analytics subscription transfer

The NF service consumer shall invoke the Nnwdaf_EventsSubscription_Transfer service operation to request the transfer of analytics subscription(s). The NF service consumer shall send an HTTP POST request with "{apiRoot}/nnwdaf-eventssubscription/<apiVersion>/transfers" as Resource URI representing the "NWDAF Event Subscription Transfers", as shown in figure 4.2.2.5.2-1, step 1, to create a request for an "Individual NWDAF Event Subscription Transfer" according to the information in the message body. The AnalyticsSubscriptionsTransfer data structure provided in the request body shall include:

- information about the subscription(s) transfer request as "subsTransInfos" attribute, which, for each subscription that is requested to be transferred, shall include:

  a) the type of the transfer request (i.e. if it is a request for transfer preparation or transfer execution) in the "transReqType" attribute;

  b) information about the analytics subscription in the "nwdafEvSub" attribute, its contents being as defined for the NnwdafEventsSubscription data structure in clause 4.2.2.2.2;

  c) the NF instance identifer of the consumer of the analytics subscription in the "consumerId" attribute;

  and may include:

  a) analytics context identifier information about the context that is available at the NF service consumer in the "contextId" attribute;

  b) NF instance identifer(s) of active data source(s) the NF service consumer is currently using for the analytics of this analytics subscription in the "sourceNfIds" attribute;

  c) NF set identifer(s) of active data source(s) the NF service consumer is currently using for the analytics of this analytics subscription in the "sourceSetIds" attribute;

  d) information identifying the ML model(s) that the NF service consumer is currently using for the analytics in the "modelInfos" attribute;

Upon the reception of an HTTP POST request with: "{apiRoot}/nnwdaf-eventssubscription/<apiVersion>/transfers" as Resource URI and AnalyticsSubscriptionsTransfer data structure as request body, in the successful case the NWDAF shall:

- if the "transReqType" attribute has the value PREPARE, perform the steps required for the preparation of an analytics subscription transfer as described in clause 5.4.3 of TS 29.552 [25], create a new Individual NWDAF Event Subscription Transfer resource and send an HTTP "201 Created" response with the URI for the created resource in the "Location" header field, as shown in figure 4.2.2.5.2-1, step 2a;

- if the "transReqType" attribute has the value TRANSFER, perform the steps required for the execution of an analytics subscription transfer as described in clause 5.4.2 of TS 29.552 [25], and send an HTTP "204 No Content" response, as shown in figure 4.2.2.5.2-1, step 2b.

'If errors occur when processing the HTTP POST request, the NF service consumer shall send an HTTP error response as specified in clause 5.1.7.

4.2.2.5.3 Update a request for analytics subscription transfer

Figure 4.2.2.5.3-1 shows a scenario where the NF Service Consumer (e.g. NWDAF) sends a request to the NWDAF to update a request for the transfer of analytics subscription(s) from the NF Service Consumer to the NF Service Producer (see also 3GPP TS 23.288 [17]).

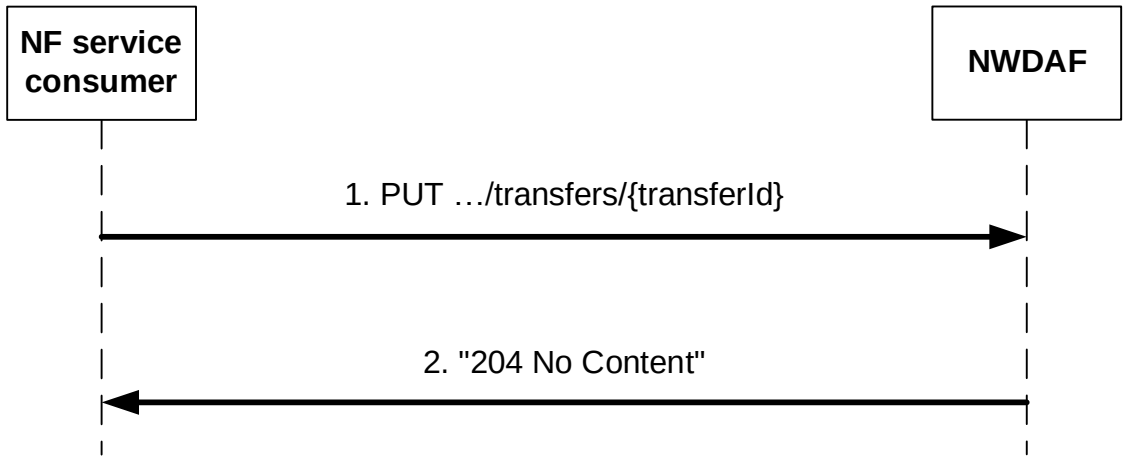

Figure 4.2.2.5.3-1: NF service consumer updates a request for an analytics subscription transfer

The NF service consumer shall invoke the Nnwdaf_EventsSubscription_Transfer service operation to update a request for the transfer of analytics subscription(s). The NF service consumer shall send an HTTP PUT request with "{apiRoot}/nnwdaf-eventssubscription/<apiVersion>/transfers/{transferId}" as Resource URI representing the "Individual NWDAF Event Subscription Transfer", as shown in figure 4.2.2.5.3-1, step 1, to update the "Individual NWDAF Event Subscription Transfer" resource identified by the {transferId}. The AnalyticsSubscriptionsTransfer data structure provided in the request body shall include the same contents as described in clause 4.2.2.5.2.

Upon the reception of an HTTP PUT request with: "{apiRoot}/nnwdaf-eventssubscription/<apiVersion>/transfers/{transferId}" as Resource URI and AnalyticsSubscriptionsTransfer data structure as request body, the NWDAF shall:

- if the "transReqType" attribute has the value PREPARE, perform the steps required for the preparation of an analytics subscription transfer as described in clause 5.4.3 of TS 29.552 [25], update the Individual NWDAF Event Subscription Transfer resource identified by "transferId", and send an HTTP "204 No Content" response, as shown in figure 4.2.2.5.3-1, step 2;

- if the "transReqType" attribute has the value TRANSFER, perform the steps required for the execution of an analytics subscription transfer as described in clause 5.4.3 of TS 29.552 [25], remove the Individual NWDAF Event Subscription Transfer resource identified by "transferId", and send an HTTP "204 No Content" response, as shown in figure 4.2.2.5.3-1, step 2.

'If errors occur when processing the HTTP PUT request, the NWDAF shall send an HTTP error response as specified in clause 5.1.7.

If the NWDAF determines the received HTTP PUT request needs to be redirected, the NWDAF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [6].

4.2.2.5.4 Cancel a request for analytics subscription transfer

Figure 4.2.2.5.4-1 shows a scenario where the NF service consumer (e.g. NWDAF) sends a request to the NWDAF to cancel a request for the transfer of analytics subscription(s) from the NF service consumer to the NF Service Producer (see also 3GPP TS 23.288 [17]).

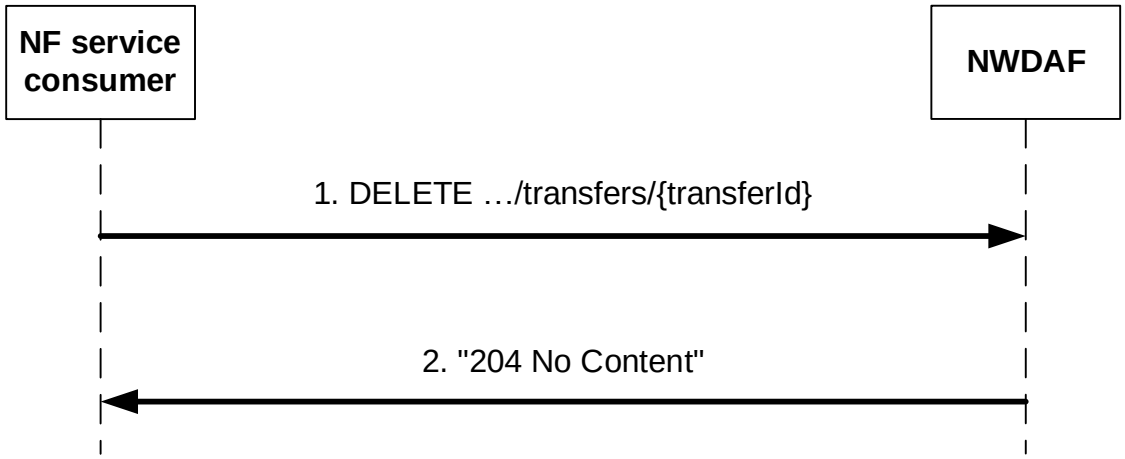

Figure 4.2.2.5.4-1: NF service consumer cancels a request for an analytics subscription transfer

The NF service consumer shall invoke the Nnwdaf_EventsSubscription_Transfer service operation to cancel a request for the transfer of analytics subscription(s). The NF service consumer shall send an HTTP DELETE request with "{apiRoot}/nnwdaf-eventssubscription/<apiVersion>/transfers/{transferId}" as Resource URI representing the "Individual NWDAF Event Subscription Transfer", as shown in figure 4.2.2.5.4-1, step 1, to cancel the "Individual NWDAF Event Subscription Transfer" resource identified by the {transferId}.

Upon the reception of an HTTP DELETE request with: "{apiRoot}/nnwdaf-eventssubscription/<apiVersion>/transfers/{transferId}" as Resource URI, if the NWDAF successfully processed and accepted the received HTTP DELETE request, the NWDAF shall:

- if applicable, delete any analytics data that is no longer needed and unsubscribe to entities for data collection or ML model acquisition, if the subscriptions are not needed for other active analytics subscriptions;
- remove the corresponding Individual NWDAF Event Subscription Transfer resource; and
- respond with HTTP "204 No Content" status code, as shown in figure 4.2.2.5.4-1, step 2.

'If errors occur when processing the HTTP DELETE request, the NWDAF shall send an HTTP error response as specified in clause 5.1.7.

If the NWDAF determines the received HTTP DELETE request needs to be redirected, the NWDAF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [6].

4.3 Nnwdaf_AnalyticsInfo Service

4.3.1 Service Description

4.3.1.1 Overview

The Nnwdaf_AnalyticsInfo service as defined in 3GPP TS 23.501 [2], 3GPP TS 23.288 [17] and 3GPP TS 23.503 [4], is provided by the Network Data Analytics Function (NWDAF).

This service:

- allows NF service consumers to request and get different type of analytic event information; and
- allows NF service consumers to request and get context information related to analytics subscriptions.

The types of observed events include:

- Slice load level information;
- Network slice instance load level information;
- Service experience;

- NF load;
- Network performance;
- Abnormal behaviour;
- UE mobility;
- UE communication;
- User data congestion;
- QoS sustainability;
- SM congestion control experience;
- Dispersion;
- Redundant transmission experience;
- WLAN performance; and
- DN performence.

4.3.1.2 Service Architecture

The 5G System Architecture is defined in 3GPP TS 23.501 [2]. The Network Data Analytics Exposure architecture is defined in 3GPP TS 23.288 [17]. The Network Data Analytics signalling flows are defined in 3GPP TS 29.552 [25], the Policy and Charging related 5G architecture is also described in 3GPP TS 23.503 [4] and 3GPP TS 29.513 [5].

The Nnwdaf_AnalyticsInfo service is part of the Nnwdaf service-based interface exhibited by the Network Data Analytics Function (NWDAF).

Known consumers of the Nnwdaf_AnalyticsInfo service are:

- Policy Control Function (PCF)
- Network Slice Selection Function (NSSF)
- Access and Mobility Management Function (AMF)
- Session Management Function (SMF)
- Network Exposure Function (NEF)
- Application Function (AF)
- Operation, Administration, and Maintenance (OAM)
- Network Data Analytics Function (NWDAF)
- Data Collection Coordination Function (DCCF)

The PCF accesses the Nnwdaf_AnalyticsInfo service at the NWDAF via the N23 Reference point. The NSSF accesses the Nnwdaf_AnalyticsInfo service at the NWDAF via the N34 Reference point.

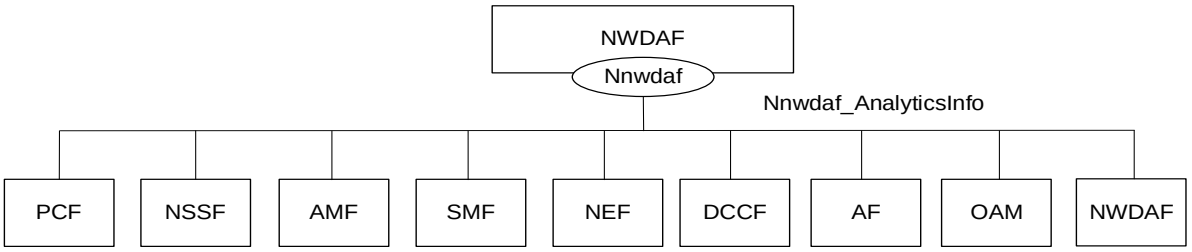

Figure 4.3.1.2-1: Reference Architecture for the Nnwdaf_AnalyticsInfo Service; SBI representation

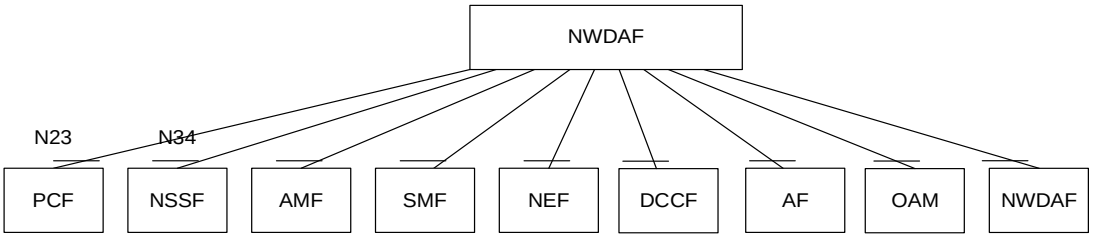

Figure 4.3.1.2-2: Reference Architecture for the Nnwdaf_AnalyticsInfo Service: reference point representation

4.3.1.3 Network Functions

4.3.1.3.1 Network Data Analytics Function (NWDAF)

The Network Data Analytics Function (NWDAF) provides specific analytics information for different analytic events and, if the "AnaCtxTransfer" feature is supported, context information related to analytics subscriptions to NF service consumers.

4.3.1.3.2 NF Service Consumers

The Policy Control Function (PCF):

- supports taking analytics information for slice load level information from the NWDAF;
- supports taking analytics information for service experience related network data from the NWDAF;
- supports taking analytics information for network performance from the NWDAF;
- supports taking analytics information for abnormal UE behaviour from the NWDAF;
- supports taking analytics information for dispersion from the NWDAF;
- supports taking analytics information for WLAN performance from the NWDAF; and
- supports taking one or more above input from NWDAF into consideration for policies on assignment of network resources and/or for traffic steering policies.

NOTE: How this information is used by the PCF is not standardized in this release of the specification.

The Network Slice Selection Function (NSSF):

- supports taking slice load level information or network slice instance load level information from the NWDAF into consideration for slice selection;
- supports taking analytics information for service experience related network data from the NWDAF; and
- supports taking analytics information for dispersion at the slice from the NWDAF.

The Access and Mobility Management Function (AMF):

- supports taking SMF load information from the NWDAF into consideration for SMF selection;

- supports taking expected UE behaviour information (UE mobility and/or UE communication) from the NWDAF into consideration for monitoring UE behaviour;
- supports taking abnormal UE behaviour information from the NWDAF into consideration for adjustment of UE mobility related network parameters to solve the abnormal risk;
- supports taking slice load level information or network slice instance load level information from NWDAF into consideration for slice selection;
- supports taking analytics information for service experience related network data from the NWDAF; and
- supports taking analytics information for dispersion at the slice from the NWDAF.

The Session Management Function (SMF):

- supports taking UPF load information from the NWDAF into consideration for UPF selection;
- supports taking expected UE behaviour information (UE mobility and/or UE communication) from the NWDAF into consideration for monitoring UE behaviour;
- supports taking abnormal UE behaviour information from the NWDAF into consideration for adjustment of UE mobility related network parameters to solve the abnormal risk;
- supports taking analytics information for SM congestion control experience from the NWDAF into consideration for determining back-off timer provided to UE;
- supports taking analytics information for redundant transmission experience from the NWDAF to consider whether redundant transmission shall be performed, or (if it had been activated) shall be stopped; and
- supports taking analytics information for DN performance from the NWDAF into consideration for user plane performance.

The Network Exposure Function (NEF):

- supports forwarding UE mobility information from the NWDAF to the AF when it is untrusted;
- supports forwarding UE communication information from the NWDAF to the AF when it is untrusted;
- supports forwarding expected UE behavioural information (UE mobility and/or UE communication) from the NWDAF to the AF when it is untrusted;
- supports forwarding abnormal behaviour information from the NWDAF to the AF when it is untrusted;
- supports forwarding user data congestion information from the NWDAF to the AF when it is untrusted;
- supports forwarding network performance information from the NWDAF to the AF when it is untrusted;
- supports forwarding QoS Sustainability information from the NWDAF to the AF when it is untrusted;
- supports forwarding Dispersion information from the NWDAF to the AF when it is untrusted;
- supports forwarding DN performance information from the NWDAF to the AF when it is untrusted; and
- supports forwarding Observed Service Experience information from NWDAF to the AF when it is untrusted.

The Application Function (AF):

- supports receiving UE mobility information from the NWDAF or via the NEF;
- supports receiving UE communication information from the NWDAF or via the NEF;
- supports receiving expected UE behavioural information (UE mobility and/or UE communication) from the NWDAF or via the NEF;
- supports receiving abnormal behaviour information from the NWDAF or via the NEF;
- supports receiving user data congestion information from the NWDAF or via the NEF;

- supports receiving network performance information from the NWDAF or via the NEF;
- supports receiving QoS Sustainability information from the NWDAF or via the NEF;
- supports receiving Dispersion information from the NWDAF or via the NEF;
- supports receiving DN performance information from NWDAF or via the NEF; and
- supports receiving Observed Service Experience information from NWDAF or via the NEF..

The Operation, Administration, and Maintenance (OAM):

- supports receiving observed service experience from the NWDAF;
- supports receiving NF load information from the NWDAF;
- supports receiving network performance information from the NWDAF;
- supports receiving UE mobility information from the NWDAF;
- supports receiving UE communication information from the NWDAF;
- supports receiving expected UE behaviour information (UE mobility and/or UE communication) from the NWDAF; and
- supports receiving abnormal UE behaviour information from the NWDAF.

The Network Data Analytics Function (NWDAF):

- supports receiving information for all types of network data analytics from the NWDAF; and
- supports receiving context information related to analytics subscriptions from the NWDAF.

The Data Collection Coordination Function (DCCF):

- supports receiving information for all types of network data analytics from the NWDAF.

4.3.2 Service Operations

4.3.2.1 Introduction

Table 4.3.2.1-1: Operations of the Nnwdaf_AnalyticsInfo Service

Service operation name	Description	Initiated by
Nnwdaf_AnalyticsInfo_Request	This service operation is used by an NF to request and get specific analytics from NWDAF.	NF consumer (PCF, NSSF, AMF, SMF, NEF, AF, OAM, NWDAF, DCCF)
Nnwdaf_AnalyticsInfo_ContextTransfer	This service operation is used by an NF to request and get context information related to analytics subscriptions from NWDAF.	NF consumer (NWDAF)

4.3.2.2 Nnwdaf_AnalyticsInfo_Request service operation

4.3.2.2.1 General

The Nnwdaf_AnalyticsInfo_Request service operation is used by an NF service consumer to request and get specific analytics information from the NWDAF.

4.3.2.2.2 Request and get from NWDAF Analytics information

Figure 4.3.2.2.2-1 shows a scenario where the NF service consumer (e.g. PCF) sends a request to the NWDAF to request and get from the NWDAF analytics information (as shown in 3GPP TS 23.288 [17]).

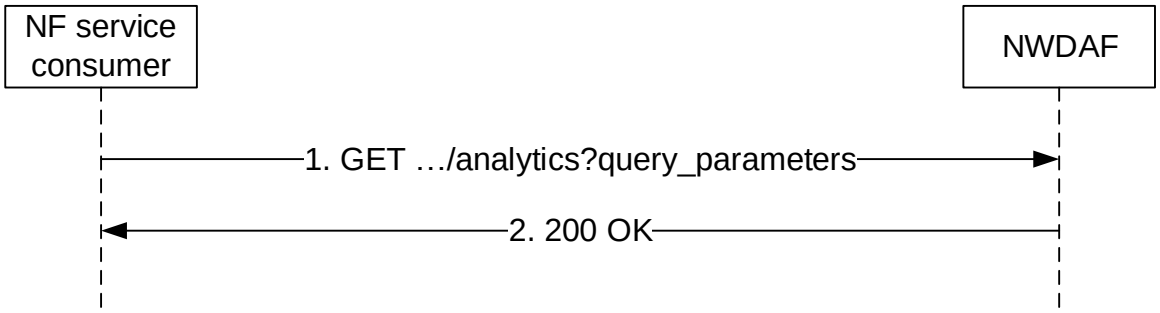

Figure 4.3.2.2.2-1: Requesting a NWDAF Analytics information

The NF service consumer (e.g. PCF) shall invoke the Nnwdaf_AnalyticsInfo_Request service operation when requesting the NWDAF analytics information. The NF service consumer shall send an HTTP GET request on the resource URI "{apiRoot}/nnwdaf-analyticsinfo/<apiVersion>/analytics" representing the "NWDAF Analytics" (as shown in figure 4.3.2.2.2-1, step 1), to request analytics data according to the query parameter value of the "event-id" attribute. In addition, the following information may be provided:

- common reporting requirement in the "ana-req" attribute as follows:

  1) identification of time window for the requested analytics data applies via identification of date-time(s) in the "startTs" and "endTs" attributes;

  2) preferred level of accuracy of the analytics in "accuracy" attribute;

  3) percentage of sampling among impacted UEs in the "sampRatio" attribute;

  4) maximum number of objects in the "maxObjectNbr" attribute;

  5) maximum number of SUPIs expected for an analytics report in the "maxSupiNbr" attribute;

  6) identification of time when analytics information is needed in the "timeAnaNeeded" attribute if the feature "EneNA" is supported;

  7) indication of which analytics metadata is requested to be delivered with the response in the "anaMeta" attribute if the feature "Aggregation" is supported;

  8) requested values for the analytics metadata information to be used for the generation of the analytics in the "anaMetaInd" attribute if the feature "Aggregation" is supported; and/or

  9) preferred accuracy level per analytics subset in the "accPerSubset" attribute if the "listOfAnaSubsets" attribute is present and the EneNA feature is supported.

For different event types:

- if the event is "LOAD_LEVEL_INFORMATION", it shall provide the event specific filter information within "event-filter" attribute including identification(s) of the network slice via:

  1) identification of network slice(s) in the "snssais" attribute; or

  2) any slices indication in the "anySlice" attribute.;

- if the feature "NsiLoad" is supported and the event is "NSI_LOAD_LEVEL", it shall provide the event specific filter information within "event-filter" attribute including identification(s) of the network slice via:

  1) identification of network slice(s) and the optionally associated instance(s) if available, in the "nsiIdInfos" attribute; or

NOTE 1: The network slice instance of a PDU session is not available in the PCF.

  2) any slices indication in the "anySlice" attribute;

  and may include:

1) a list of analytics subsets carried by "listOfAnaSubsets" attribute with value(s) only applicable to "NSI_LOAD_LEVEL" event, if the "EneNA" feature is supported.

- if the feature "NfLoad" is supported and the event is "NF_LOAD", it shall provide:

1) identification of target UE(s) to which the subscription applies by "supis" or "anyUe" in the "tgt-ue" attribute; and

NOTE 2: Only NF instances of type AMF and SMF which are serving the UE can be determined using a SUPI in "supis" attribute.

NOTE 3: If a list of the NF Instance IDs (or respectively of NF Set IDs) is provided, the NWDAF needs to provide the analytics for each designated NF instance (or respectively for each NF instance belonging to each designated NF Set). In such case the target UE(s) of the Analytics Reporting need be ignored.

- the "event-filter" attribute may provide:

a) either list of NF instance IDs in the "nfInstanceIds" attribute or list of NF set IDs in the "nfSetIds" attribute if the identification of target UE(s) applies to all UEs;

b) list of NF instance types in the "nfTypes" attribute;

c) identification of network slice(s) in the "snssais" attribute;

d) optional area of interest by "networkArea" attribute; and/or

e) an optional list of analytics subsets by "listOfAnaSubsets" attribute with value(s) only applicable to NF_LOAD event, if the "EneNA" feature is supported.

- if the feature "UeMobility" is supported and the event is "UE_MOBILITY", it shall provide:

1) identification of target UE(s) to which the subscription applies by "supis" or "intGroupIds" attribute in the "tgt-ue" attribute;

- and may provide:

1) event specific filter information in the "event-filter" attribute:

a) identification of network area to which the subscription applies via identification of network area by "networkArea" attribute; and/or

b) if the feature "UeMobilityExt" is supported,

i) identification of LADN DNN in the "ladnDnns" attribute;

ii) visited Area(s) of Interest as the "visitedAreas" attirbute.

NOTE 1: For LADN service, the consumer (e.g. SMF) provides the LADN DNN to refer the LADN service area as the AOI.

- if the feature "UeCommunication" is supported and the event is "UE_COMM", it shall provide:

1) identification of target UE(s) to which the subscription applies by "supis" or "intGroupIds" attribute in the "tgt-ue" attribute;

- and may provide:

1) event specific filter information in the "event-filter" attribute:

a) identification of the application as "appIds" attribute;

b) identification of network area to which the subscription applies via identification of network area by "networkArea" attribute;

c) identification of DNN in the "dnns" attribute;

d) identification of network slice(s) in the "snssais" attribute; and/or

e) a list of analytics subsets carried by "listOfAnaSubsets" attribute with value(s) only applicable to "UE_COMM" event, if the "EneNA" feature is supported.

- if the feature "NetworkPerformance" is supported and the event is "NETWORK_PERFORMANCE", it shall provide:

1) identification of target UE(s) to which the subscription applies by "supis", "intGroupIds" or "anyUe" attribute in the "tgt-ue" attribute;

2) event specific filter information in the "event-filter" attribute which shall provide:

a) the network performance types via "nwPerfTypes" attribute;

the "event-filter" attribute may provide:

a) identification of network area to which the subscription applies via identification of network area(s) by "networkArea" attribute (mandatory if "anyUe" attribute is set to true); and/or

b) a list of analytics subsets carried by "listOfAnaSubsets" attribute with value(s) only applicable to "NETWORK_PERFORMANCE" event, if the "EneNA" feature is supported.

- if the feature "ServiceExperience" is supported and the event is "SERVICE_EXPERIENCE", it shall provide:

1) identification of target UE(s) to which the subscription applies by "supis", "intGroupIds" or "anyUe" attribute in the "tgt-ue" attribute;

2) event specific filter information in the "event-filter" attribute which shall provide:

a) any slices indication in the "anySlice" attribute or identification of network slice(s) together with the optionally associated network slice instance(s) if available, via the "nsiIdInfos" attribute; and

NOTE 4: The network slice instance of a PDU session is not available in the PCF.

the "event-filter" attribute may provide:

a) identification of application(s) to which the subscription applies via "appIds" attribute;

b) identification of DNN via identification of Dnn(s) by "dnns" attribute;

c) identification of user plane accesses to one or more DN(s) where applications are deployed via "dnais" attribute;

d) identification of network area to which the subscription applies via identification of network area(s) by "networkArea" attribute (mandatory if "anyUe" attribute is set to true);

e) if "appIds" attribute is provided, the bandwidth requirement of each application by "bwRequs" attribute;

f) identication of all the RAT types and/or all the frequencies that the NWDAF received for the application or specific RAT type(s) and/or frequency(ies) and the service experience threshold value(s) for the RAT Type(s) and/or Frequency value(s) where the UE camps on by "ratFreqs" attribute if the feature "ServiceExperienceExt" is also supported;

g) a list of analytics subsets carried by "listOfAnaSubsets" attribute with value(s) only applicable to "SERVICE_EXPERIENCE" event, if the "EneNA" feature is supported;

h) the identification of the UPF as the "upfInfo" attribute if the feature "ServiceExperienceExt" is also supported; and/or

i) IP address(s)/FQDN(s) of the Application Server(s) as the "appServerAddrs" attribute if the feature "ServiceExperienceExt" is also supported.

- if the feature "QoSSustainability" is supported and the event is "QOS_SUSTAINABILITY", it shall provide:

1) event specific filter information in the "event-filter" attribute which shall provide:

a) identification of network area to which the subscription applies via identification of network area by "networkArea" attribute; and

b) QoS requirements via "qosRequ" attribute;

2) identification of target UE(s) to which the subscription applies by "anyUe" in the "tgt-ue" attribute;

the "event-filter" attribute may provide:

a) identification of network slice(s) by "snssais" attribute;

- if the feature "AbnormalBehaviour" is supported and the event is "ABNORMAL_BEHAVIOUR", it shall provide:

1) identification of target UE(s) to which the subscription applies by "supis", "intGroupIds" or "anyUe" attribute in the "tgt-ue" attribute; and

2) event specific filter information in the "event-filter" attribute which shall provide

a) either the expected analytics type via "exptAnaType" attribute or a list of exception Ids via "excepIds" attribute. If the expected analytics type via "exptAnaType" attribute is provided, the NWDAF shall derive the corresponding Exception Ids from the received expected analytics type as follows:

- if "exptAnaType" attribute sets to "MOBILITY", the corresponding list of Exception Ids are "UNEXPECTED_UE_LOCATION", "PING_PONG_ACROSS_CELLS", "UNEXPECTED_WAKEUP" and "UNEXPECTED_RADIO_LINK_FAILURES";

- if "exptAnaType" attribute sets to "COMMUN", the corresponding list of Exception Ids are "UNEXPECTED_LONG_LIVE_FLOW", "UNEXPECTED_LARGE_RATE_FLOW", "SUSPICION_OF_DDOS_ATTACK", "WRONG_DESTINATION_ADDRESS" and "TOO_FREQUENT_SERVICE_ACCESS";

- if "exptAnaType" attribute sets to "MOBILITY_AND_COMMUN", the corresponding list of Exception Ids includes all above derived exception Ids.

The derived list of Exception Ids are used by the NWDAF to notify the NF service consumer when UE's behaviour is exceptional based on one or more Exception Ids within the list.

If the "anyUe" attribute in the "tgt-ue" attribute sets to "true";

a) the expected analytics type via the"exptAnaType" attribute or the list of Exception Ids via "excepIds" attribute shall not be requested for both mobility and communication related analytics at the same time;

b) if the expected analytics type via the"exptAnaType" attribute or the list of Exception Ids via "excepIds" attribute is mobility related, at least one of identification of network area by "networkArea" attribute and identification of network slice(s) by "snssais" attribute should be provided; and

c) if the expected analytics type via the"exptAnaType" attribute or the list of Exception Ids via "excepIds" attribute is communication related, at least one of identification of network area by "networkArea" attribute, identification of application(s) by "appIds" attribute, identification of DNN(s) in the "dnns" attribute and identification of network slice(s) by "snssais" attribute should be provided;

the "event-filter" attribute may provide:

a) expected UE behaviour via "exptUeBehav" attribute;

- if the feature "UserDataCongestion" is supported and the event is "USER_DATA_CONGESTION", it shall provide one of the following attributes:

1) identification of target UE(s) via "supis" "gpsis" (if feature "UserDataCongestionExt" is supported) or "anyUe" attribute within "tgt-ue" attribute;

and may provide:

1) event specific filter information in the "event-filter" attribute which may provide:

a) identification of network slice(s) by "snssais" attribute;

b) identification of network area to which the subscription applies via identification of network area by "networkArea" attribute (mandatory if "anyUe" attribute is set to true); and/or

c) if the feature "UserDataCongestionExt" is also supported, request a list of top applications with maximum number that contribute the most to the traffic in uplink and/or downlink directions bythe "maxTopAppUlNbr" attribute and/or the "maxTopAppDlNbr" attribute; and/or

d) a list of analytics subsets carried by "listOfAnaSubsets" attribute with value(s) only applicable to "USER_DATA_CONGESTION" event, if the "EneNA" feature is supported.

- if the feature "SMCCE" is supported and the event is "SM_CONGESTION", it shall provide:

1) event specific filter information in the "event-filter" attribute which shall provide:

a) identification of DNN in the "dnns" attribute; and/or

b) identification of network slice(s) in the "snssais" attribute; and

2) identification of target UE(s) via "supis" attribute in the "tgt-ue" attribute where the target UE(s) are one have the PDU Session for the DNN and/or S-NSSAI indicated by the event specific filter information.

and may include:

1) a list of analytics subsets carried by "listOfAnaSubsets" attribute with value(s) only applicable to "SM_CONGESTION" event, if the "EneNA" feature is supported.

NOTE 5: The predictions are not applicable for Session Management Congestion Control Experience analytics.

- if the feature "Dispersion" is supported and the event is "DISPERSION", shall provide:

1) identification of target UE(s) applies by "supis", "intGroupIds" or "anyUe" attribute within "tgt-ue" attribute, "anyUe" attribute is only supported in combination with "snssais" attribute, "networkArea" attribute and/or "disperClass" attribute;

and may include:

1) identification of network area applies via identification of network area by "networkArea" attribute;

2) identification of network slice(s) by "snssais" attribute;

3) application identifier(s) in "appIds" attribute;

4) dispersion analytics requirements in "disperReqs" attribute, which for the requested dispersion type may include dispersion class, ranking, ordering and/or accuracy requirments; and/or

5) an optional list of analytics subsets by "listOfAnaSubsets" attribute with value(s) only applicable to DISPERSION event.

- if the feature "RedundantTransmissionExp" is supported and the event is "RED_TRANS_EXP", shall provide:

1) identification of target UE(s) applies by "supis", "intGroupIds" or "anyUe" attribute within "tgt-ue" attribute;

and may include:

1) identification of network area applies via identification of network area by "networkArea" attribute, if the "supis" attribute or "intGroupIds" attribute is included in the "tgtUe" attribute;

2) identification of network slice(s) by "snssais" attribute;

3) identification of DNN in the "dnns" attribute; and/or

4) other redundant transmission experience analysis requirements in "redTransReqs" attribute, which may include preferred order of results for the list of Redundant Transmission Experience.

5) an optional list of analytics subsets by "listOfAnaSubsets" attribute with value(s) only applicable to RED_TRANS_EXP event, if the "EneNA" feature is supported.

- if the feature "WlanPerformance" is supported and the event is "WLAN_PERFORMANCE", shall provide:

  1) identification of target UE(s) by "supis", "intGroupIds" or "anyUe" attribute in the "tgt-Ue" attribute. If "anyUe" attribute is included in the "tgt-Ue" attribute, then any of "networkArea" attribute, "ssIds" or "bssIds" attribute shall be present in the "wlanReqs" attribute;

  and may include:

  1) identification of network area to which the subscription applies via identification of network area by "networkArea" attribute;

  2) other WLAN performance analytics requirements in "wlanReqs" attribute, which may include SSID(s), BSSID(s), preferred order of results for the list of WLAN performance information and/or accuracy per analytics subset; and/or

  3) an optional list of analytics subsets by "listOfAnaSubsets" attribute with value(s) only applicable to WLAN_PERFORMANCE event, if the "EneNA" feature is supported.

- if the feature "DnPerformance" is supported and the event is "DN_PERFORMANCE", shall provide:

  1) identification of target UE(s) to which the subscription applies by "supis", "intGroupIds" or "anyUe" attribute in the "tgtUe" attribute;

  and may include:

  1) identification of network area to which the subscription applies via identification of network area by "networkArea" attribute;

  2) identification of network slice(s) in the "snssais" attribute;

  3) identification of network slice and the optionally associated network slice instance(s) if available, via the "nsiIdInfos" attribute or any slices indication in the "anySlice" attribute;

  4) application identifier(s) in "appIds" attribute;

  5) an identification of DNN in the "dnns" attribute;

  6) identification of a user plane access to one or more DN(s) where applications are deployed by "dnais" attribute;

  7) the identification of the UPF as the "upfInfo" attribute;

  8) IP address(s)/FQDN(s) of the Application Server(s) as the "appServerAddrs" attribute;

  9) DN performance analytics requirements in "dnPerfReqs" attribute, which may include the preferred order of results for the list of DN performance information and/or the reporting threshold of each analytics subset; and/or

  10) an optional list of analytics subsets by "listOfAnaSubsets" attribute with value(s) only applicable to "DN_PERFORMANCE" event, if the "EneNA" feature is supported.

Upon the reception of the HTTP GET request, the NWDAF shall:

- analyse the requested analytic data according to the requested event.

If the HTTP request message from the NF service consumer is accepted, the NWDAF shall respond with "200 OK" status code with the message body containing the analytics with parameters as relevant for the requesting NF service consumer. The AnalyticsData data structure in the response body shall include:

- analytics with the corresponding information as described in clause 4.2.2.4.2.

If the request NWDAF Analytics data does not exist, the NWDAF shall respond with "204 No Content" status code.

If the "timeAnaNeeded" attribute within EventReportingRequirement is provided during the request, if the time is reached but the requested analytics information is not ready, the consumer does not need to wait for the analytics information any longer, the NWDAF may send a "500 Internal Server Error" status code to the NF service consumer. In addition, if the EneNA feature is supported, the NWDAF may provide, within the

ProblemDetailsAnalyticsInfoRequestdata in the response, the corresponding failure reason via a "problemDetails" attribute with the "cause" attribute set to "UNSATISFIED_REQUESTED_ANALYTICS_TIME" and a minimum time interval recommended by the NWDAF via a "rvWaitTime" attribute which is used by the NF service consumer to determine the time when analytics information is needed in similar future analytics requests.

If the analytics target period provided in the body of the HTTP POST request includes the start time in the past and the end time in the future, the NWDAF shall reject the request with an HTTP "400 Bad Request" response including the "cause" attribute set to "BOTH_STAT_PRED_NOT_ALLOWED".

If the statistics in the past is requested but the necessary data to perform the service is unavailable, the NWDAF shall reject the request with an HTTP "500 Internal Server Error" response including the "cause" attribute set to "UNAVAILABLE_DATA".

4.3.2.3 Nnwdaf_AnalyticsInfo_ContextTransfer service operation

4.3.2.3.1 General

The Nnwdaf_AnalyticsInfo_ContextTransfer service operation is used by an NF service consumer to request and get context information related to analytics subscriptions from the NWDAF.

4.3.2.3.2 Request and get from NWDAF context of a subscription

Figure 4.3.2.3.2-1 shows a scenario where the NF service consumer (e.g. NWDAF) sends a request to the NWDAF to request and get from NWDAF context information related to analytics subscriptions (see also 3GPP TS 23.288 [17]).

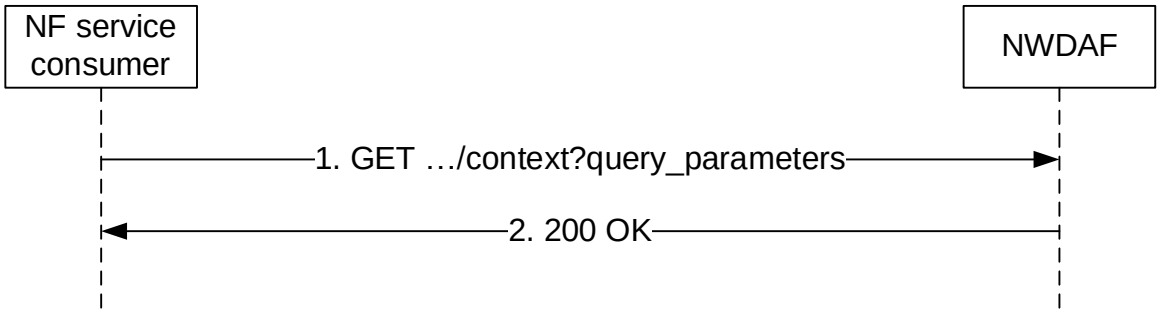

Figure 4.3.2.3.2-1: Requesting NWDAF context information related to analytics subscriptions

The NF service consumer (e.g. NWDAF) shall invoke the Nnwdaf_AnalyticsInfo_ContextTransfer service operation when requesting context information related to analytics subscriptions. The NF service consumer shall send an HTTP GET request on the resource URI "{apiRoot}/nnwdaf-analyticsinfo/<apiVersion>/context" representing the "NWDAF Context" (as shown in figure 4.3.2.3.2-1, step 1), to request context information related to analytics subscriptions according to the query parameter values of the attributes "context-ids" and "req-context".

Upon the reception of the HTTP GET request, the NWDAF shall retrieve the context information for the requested context identifiers.

If the HTTP request message from the NF service consumer is accepted, the NWDAF shall respond with "200 OK" status code with the message body containing the retrieved context information. The ContextData data structure in the response body shall include for each of the context elements contained in the "contextElems" attribute:

- the context identifier that this context element refers to in the "contextId" attribute, which indicates among others the analytics subscription that this context element is associated with.
- the pending output analytics for the indicated analytics subscription in the "pendAnalytics" attribute if such analytics are available and the NF service consumer has indicated the "PENDING_ANALYTICS" context type in the "req-context" attribute of the request.
- the historical output analytics for the indicated analytics subscription in the "histAnalytics" attribute if such analytics are available and the NF service consumer has indicated the "HISTORICAL_ANALYTICS" context type in the "req-context" attribute of the request.

- a timestamp of the last provided output analytics in the "lastOutputTime" if the NF service consumer has indicated the "PENDING_ANALYTICS" and/or "HISTORICAL_ANALYTICS" context type in the "req-context" attribute of the request and output analytics had been provided to the analytics consumer.
- information about aggregation related analytics subscriptions that the NWDAF has with other NWDAFs in the "aggrSubs" attribute if such subscriptions exist and the NF service consumer has indicated the "AGGR_SUBS" context type in the "req-context" attribute of the request.
- historical data related to the indicated analytics subscription in the "histData" attribute if such data exists and the NF service consumer has indicated the "DATA" context type in the "req-context" attribute of the request.
- identifier of ADRF instance in the "adrfId" attribute if the NWDAF stores data in the ADRF.
- the types of data stored in the ADRF in the "adrfDataTypes" attribute if the "adrfId" attribute is provided.
- identifiers of NWDAF instances used when aggregating multiple analytics subscriptions in the "aggrNwdafIds" if such information is available and the NF service consumer has indicated the "AGGR_INFO" context type in the "req-context" attribute of the request.
- information about used ML models in the "modelInfos" attribute if such information is available and the NF service consumer has indicated the "ML_MODELS" context type in the "req-context" attribute of the request.

If the requested context information does not exist, the NWDAF shall respond with "204 No Content" status code.

4.4 Nnwdaf_DataManagement Service

4.4.1 Service Description

4.4.1.1 Overview

The Nnwdaf_DataManagement Service as defined in 3GPP TS 23.288 [17] is provided by the Network Data Analytics Function (NWDAF).

This service:

- allows the NF service consumers to subscribe to and unsubscribe from data management related events;
- notifies the NF service consumers with the subscribed events which are detected by the NWDAF; and
- allows the NF service consumers to retrieve the subscribed data from the NWDAF.

4.4.1.2 Service Architecture

The 5G System Architecture is defined in 3GPP TS 23.501 [2]. The Network Data Analytics Exposure architecture is defined in 3GPP TS 23.288 [17]. The Network Data Analytics signalling flows are defined in 3GPP TS 29.552 [25].

The Nnwdaf_DataManagement service is part of the Nnwdaf service-based interface exhibited by the Network Data Analytics Function (NWDAF).

Known consumers of the Nnwdaf_DataManagement service are:

- Network Data Analytics Function (NWDAF)
- Data Collection Coordination Function (DCCF)
- Messaging Framework Adaptor Function (MFAF)
- Analytics Data Repository Function (ADRF)

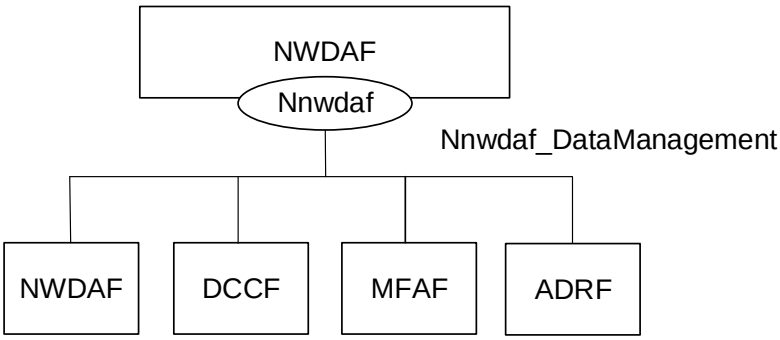

Figure 4.4.1.2-1: Reference Architecture for the Nnwdaf_DataManagement Service; SBI representation

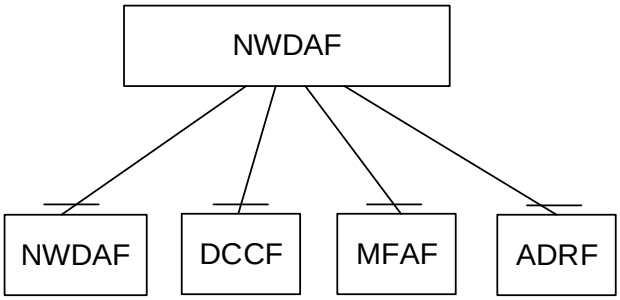

Figure 4.4.1.2-2: Reference Architecture for the Nnwdaf_DataManagement Service: reference point representation

4.4.1.3 Network Functions

4.4.1.3.1 Network Data Analytics Function (NWDAF)

The Network Data Analytics Function (NWDAF) provides requested data to NF consumers.

The Network Data Analytics Function (NWDAF) allows NF consumers to subcribe to and unsubscribe from the notification of detected event(s).

The Network Data Analytics Function (NWDAF) allows NF consumers to retrieve data that was collected based on their subscriptions.

4.4.1.3.2 NF Service Consumers

The Network Data Analytics Function (NWDAF):

- supports (un)subscription to the notification of data exposed by the NWDAF;
- supports retrieving data from the NWDAF.

The Data Collection Coordination Function (DCCF):

- supports (un)subscription to the notification of data exposed by the NWDAF;
- supports retrieving data from the NWDAF.

The Messaging Framework Adaptor Function (MFAF):

- supports receiving notifications of data provided by the NWDAF;

- supports retrieving data from the NWDAF.

The Analytics Data Repository Function (ADRF):

- supports receiving notifications of data provided by the NWDAF.
- supports retrieving data from the NWDAF.

4.4.2 Service Operations

4.4.2.1 Introduction

Table 4.4.2.1-1: Operations of the Nnwdaf_DataManagement Service

Service operation name	Description	Initiated by
Nnwdaf_DataManagement_Subscribe	This service operation is used by an NF service consumer to subscribe to data management related event(s) from NWDAF.	NF service consumer (NWDAF, DCCF, MFAF, ADRF)
Nnwdaf_DataManagement_Unsubscribe	This service operation is used by an NF service consumer to unsubscribe to data management related event(s).	NF service consumer (NWDAF, DCCF, MFAF, ADRF)
Nnwdaf_DataManagement_Notify	This service operation is used by the NWDAF to notify the detected event(s) to the NF service consumer instance which has subscribed to.	NWDAF
Nnwdaf_DataManagement_Fetch	This service operation is used by an NF service consumer to retrieve the subscribed data.	NF service consumer (NWDAF, DCCF, MFAF)

4.4.2.2 Nnwdaf_DataManagement_Subscribe service operation

4.4.2.2.1 General

The Nnwdaf_DataManagement_Subscribe service operation is used by an NF service consumer to create or update a subscription for data notifications from the NWDAF.

4.4.2.2.2 Subscription for data notifications

Figure 4.4.2.2.2-1 shows a scenario where the NF service consumer sends a request to the NWDAF to subscribe for data notification(s).

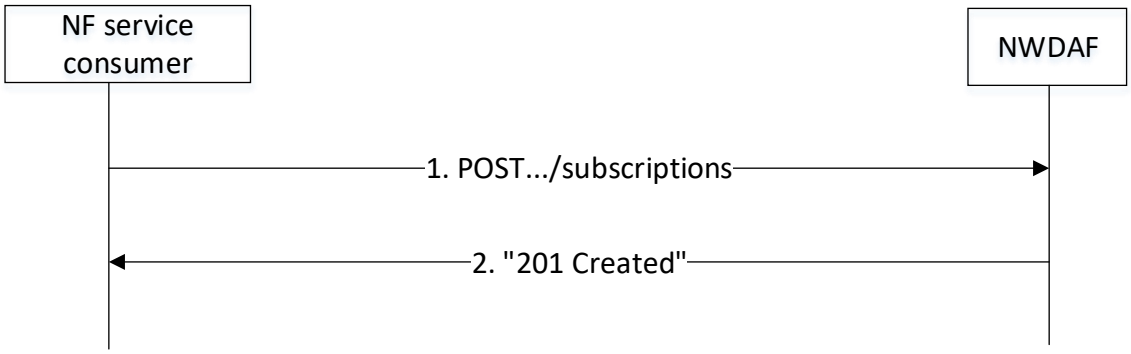

Figure 4.4.2.2.2-1: NF service consumer subscribes to data notifications

The NF service consumer shall invoke the Nnwdaf_DataManagement_Subscribe service operation to subscribe to data notification(s). The NF service consumer shall send an HTTP POST request with "{apiRoot}/nnwdaf-datamanagement/<apiVersion>/subscriptions" as Resource URI representing the "NWDAF Data Management Subscriptions", as shown in figure 4.4.2.2.2-1, step 1, to create a subscription for an "Individual NWDAF Data Management Subscription" according to the information in message body.

The NnwdafDataManagementSubsc data structure provided in the request body shall include:

- an URI where to receive the requested notifications as "notificURI" attribute;
- notification correlation identfier within the "notifCorrId" attribute; and
- one of the following:
  - analytics subscription information to be used for collecting related data within the "anaSub" attribute;
  - data subscription information within the "dataSub" attribute;

The NnwdafDataManagementSubsc data structure provided in the request body may include:

- formatting instructions within the "formatInstruct" attribute;
- processing instructions within the "procInstrct" attribute;
- one of the following identifiers related to the ADRF:
  - ADRF instance identifier within the "adrfId" attribute;
  - ADRF set identifier within the "adrfSetId" attribute;
- one of the following target identifiers:
  - NF instance identifier within the "targetNfId" attribute;
  - NF set identifier within the "targetNfSetId" attribute;
- time window of the occurrence of the requested data collection within the "timePeriod” attribute;
- the purpose of data collection within the "dataCollectPurposes" attribute.

Upon the reception of an HTTP POST request with: "{apiRoot}/nnwdaf-datamanagement/<apiVersion>/subscriptions" as Resource URI and NnwdafDataManagementSubsc data structure as request body, the NWDAF shall use the contents of the request to determine whether the subscription can already be served or interactions with the ADRF and/or data sources are required. If the NWDAF cannot use the contents of the request to determine this, the NWDAF shall send an HTTP "400 Bad Request" error response including the "cause" attribute set to "SUBSCRIPTION_CANNOT_BE_SERVED".

NOTE: The "SUBSCRIPTION_CANNOT_BE_SERVED" error can occur, for example, in the case where the "dataSub" or "anaSub" attributes are provided, when the request is syntactically valid and there is no NWDAF internal error, but the NWDAF can neither find an existing subscription to a data source nor construct one based on the received subscription contents.

If the NWDAF determines that the subscription can already be served (without requiring further interactions with ADRF and/or data sources) or a successful response from the ADRF and/or data sources is received for the creation or modification of subscription(s) to serve this subscription, the NWDAF shall:

- create a new subscription;
- assign a subscriptionId;
- store the subscription.

If the NWDAF created an "Individual NWDAF Data Management Subscription" resource, the NWDAF shall respond with "201 Created" with the message body containing a representation of the created subscription, as shown in figure 4.4.2.2.2-1, step 2. The NWDAF shall include a Location HTTP header field. The Location header field shall contain the URI of the created subscription i.e. "{apiRoot}/nnwdaf-datamanagement/<apiVersion>/subscriptions/{subscriptionId}". If an immediate reporting indication is provided in the subscription, the NWDAF shall include the reports of the events subscribed, if available, in the HTTP POST response.

If an error occurs when processing the HTTP POST request, the NWDAF shall send an HTTP error response as specified in clause 5.3.7.

4.4.2.2.3 Update subscription for data notifications

Figure 4.4.2.2.3-1 shows a scenario where the NF service consumer sends a request to the NWDAF to update the subscription for data notifications.

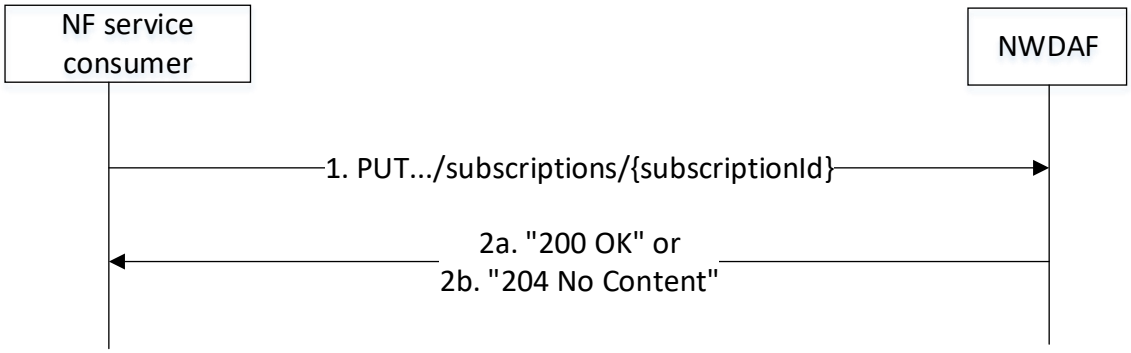

Figure 4.4.2.2.3-1: NF service consumer updates subscription to data notifications

The NF service consumer shall invoke the Nnwdaf_DataManagement_Subscribe service operation to update subscription to data notifications. The NF service consumer shall send an HTTP PUT request with "{apiRoot}/nnwdaf-datamanagement/<apiVersion>/subscriptions/{subscriptionId}" as Resource URI representing the "Individual NWDAF Data Management Subscription", as shown in figure 4.4.2.2.3-1, step 1, to update the subscription for an "Individual NWDAF Data Management Subscription" resource identified by the {subscriptionId}. The NnwdafDataManagementSubsc data structure provided in the request body shall include the same contents as described in clause 4.4.2.2.2.

Upon the reception of an HTTP PUT request with: "{apiRoot}/nnwdaf-datamanagement/<apiVersion>/subscriptions/{subscriptionId}" as Resource URI and NnwdafDataManagementSubsc data structure as request body, the NWDAF shall use the contents of the request to determine whether the updated subscription can already be served or interactions with the ADRF and/or data sources are required. If the NWDAF cannot use the contents of the request to determine this, the NWDAF shall send an HTTP "400 Bad Request" error response including the "cause" attribute set to "SUBSCRIPTION_CANNOT_BE_SERVED".

NOTE: The "SUBSCRIPTION_CANNOT_BE_SERVED" error can occur, for example, in the case when the "dataSub" or "anaSub" attributes are provided, when the request is syntactically valid and there is no NWDAF internal error, but the NWDAF can neither find an existing subscription to a data source nor construct one based on the received subscription contents.

If the NWDAF determines that the updated subscription can already be served (without requiring further interactions with the ADRF and/or data sources) or a successful response from the ADRF and/or data sources is received for the creation or modification of subscription(s) to serve this subscription, the NWDAF shall:

- update the subscription of corresponding subscriptionId; and
- store the subscription.

If the NWDAF successfully processed and accepted the received HTTP PUT request, the NWDAF shall update an "Individual NWDAF Data Management Subscription" resource, and shall respond with:

a) HTTP "200 OK" status code with the message body containing a representation of the updated subscription, as shown in figure 4.4.2.2.3-1, step 2a; or

b) HTTP "204 No Content" status code, as shown in figure 4.4.2.2.3-1, step 2b.

If errors occur when processing the HTTP PUT request, the NWDAF shall send an HTTP error response as specified in clause 5.3.7.

If the NWDAF determines the received HTTP PUT request needs to be redirected, the NWDAF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

4.4.2.3 Nnwdaf_DataManagement_Unsubscribe service operation

4.4.2.3.1 General

The Nnwdaf_DataManagement_Unsubscribe service operation is used by an NF service consumer to remove a subscription for data notifications from the NWDAF.

4.4.2.3.2 Unsubscribe from data notifications

Figure 4.4.2.3.2-1 shows a scenario where the NF service consumer sends a request to the NWDAF to unsubscribe from data notifications.

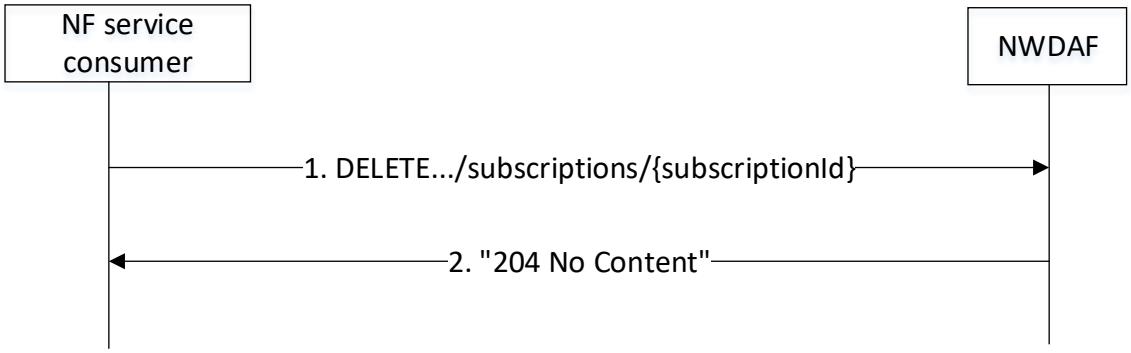

Figure 4.4.2.3.2-1: NF service consumer unsubscribes from data notifications

The NF service consumer shall invoke the Nnwdaf_DataManagement_Unsubscribe service operation to unsubscribe from data notifications. The NF service consumer shall send an HTTP DELETE request with: "{apiRoot}/nnwdaf-datamanagement/<apiVersion>/subscriptions/{subscriptionId}" as Resource URI, where "{subscriptionId}" is the identifier of the existing subscription that is to be deleted.

Upon the reception of an HTTP DELETE request, if the NWDAF successfully processed and accepted the received HTTP DELETE request, the NWDAF shall:

- remove the corresponding subscription;
- respond with HTTP "204 No Content" status.

If errors occur when processing the HTTP DELETE request, the NWDAF shall send an HTTP error response as specified in clause 5.3.7.

If the NWDAF determines the received HTTP DELETE request needs to be redirected, the NWDAF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

4.4.2.4 Nnwdaf_DataManagement_Notify service operation

4.4.2.4.1 General

The Nnwdaf_DataManagement_Notify service operation is used by the NWDAF to notify NF service consumers about subscribed events related to data.

4.4.2.4.2 Notification about subscribed data

Figure 4.4.2.4.2-1 shows a scenario where the NWDAF sends a request to the NF Service Consumer to notify it about data events.

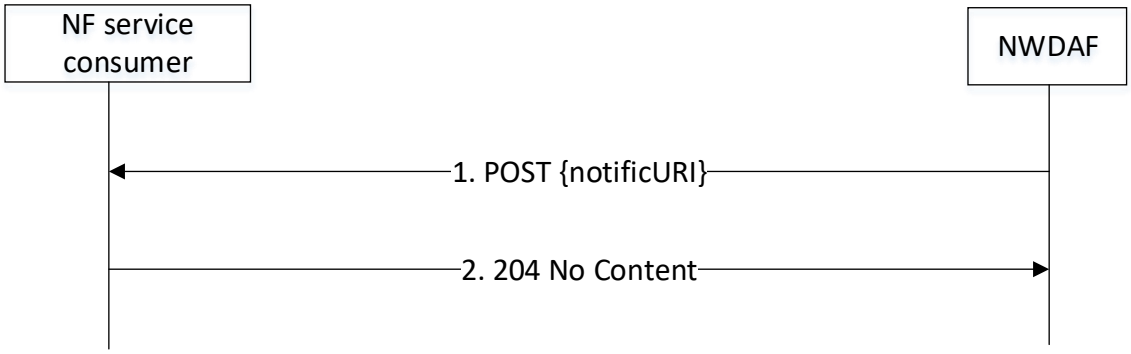

Figure 4.4.2.4.2-1: NWDAF notifies the subscribed event

The NWDAF shall invoke the Nnwdaf_DataManagement_Notify service operation to notify the subscribed event. The NWDAF shall send an HTTP POST request with "{notificURI}" received in the Nnwdaf_DataManagement_Subscribe service operation as Resource URI, as shown in figure 4.4.2.4.2-1, step 1.

The NnwdafDataManagementNotif data structure provided in the request body that shall include:

- the notification correlation identifier within the "notifCorrId" attribute;
- the timestamp of the notification within the "notifTimestamp" attribute;
- one of the following:
  - data collected from data sources (e.g. SMF, NEF) in the "dataNotification" attribute;
  - information for fetching the contents of the notification in the "fetchInstruct" attribute.

The NnwdafDataManagementNotif data structure provided in the request body may include:

- an indication that the NWDAF has requested a termination of the subscription within the "terminationReq" attribute.

Upon the reception of an HTTP POST request, if the NF service consumer successfully processed and accepted the received HTTP POST request, the NF Service Consumer shall store the notification and respond with HTTP "204 No Content" status code.

If errors occur when processing the HTTP POST request, the NF service consumer shall send an HTTP error response as specified in clause 5.3.7.

If the NF service consumer determines the received HTTP POST request needs to be redirected, the NF service consumer shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

4.4.2.5 Nnwdaf_DataManagement_Fetch service operation

4.4.2.5.1 General

The Nnwdaf_DataManagement_Fetch service operation is used by an NF service consumer to retrieve data notifications indicated by fetch instructions from the NWDAF.

4.4.2.5.2 Retrieve data from the NWDAF

Figure 4.4.2.5.2-1 shows a scenario where the NF service consumer sends a request to the NWDAF to retrieve notified data.

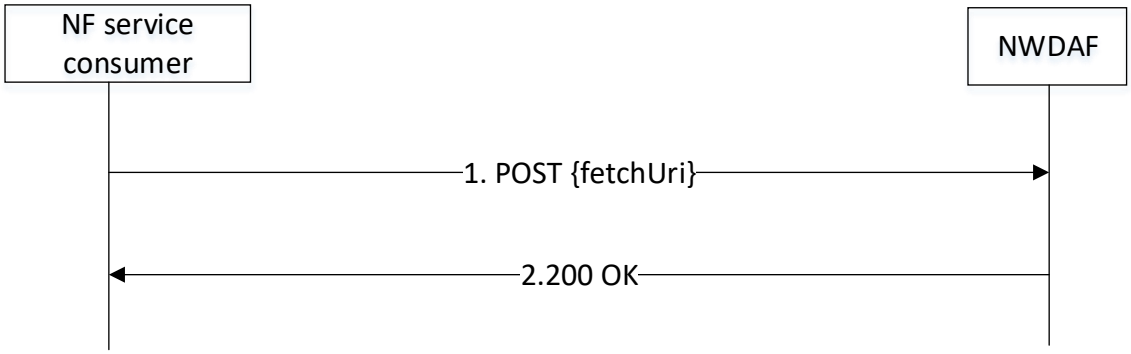

Figure 4.4.2.5.2-1: Requesting to retrieve notified data

The NF service consumer shall invoke the Nnwdaf_DataManagement_Fetch service operation to retrieve notified data. The NF service consumer shall send an HTTP POST request with "{fetchUri}" URI previously provided by the NWDAF in "fetchInstruct" attribute within NnwdafDataManagementNotif data type, as shown in figure 4.4.2.5.2-1, step 1, to fetch NWDAF data.The request body shall include fetch correlation identifiers, which was previously provided by the NWDAF in the "fetchCorrIds" attribute within fetchInstruction in the NWDAF notification.

Upon the reception of the HTTP POST request, the NWDAF shall:

- find the data according to the requested parameters.

If the requested data is found, the NWDAF shall respond with "200 OK" status code with the message body containing the NnwdafDataManagementNotif data structure. The NnwdafDataManagementNotif data structure in the response body shall include the data collected from data sources (e.g. SMF, NEF) in the "dataNotification" attribute.

If an error occurs when processing the HTTP POST request, the NWDAF shall send an HTTP error response as specified in clause 5.3.7.

If the NWDAF determines that the received HTTP POST request needs to be redirected, the NWDAF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [6].

4.5 Nnwdaf_MLModelProvision Service

4.5.1 Service Description

4.5.1.1 Overview

The Nnwdaf_MLModelProvision service as defined in 3GPP TS 23.501 [2] and 3GPP TS 23.288 [17], is provided by the Network Data Analytics Function (NWDAF) containing Model Training Logical Function (MTLF).

This service:

- allows the NF service consumers to subscribe to and unsubscribe from different ML model analytics events; and
- notifies the NF service consumers with a corresponding subscription about ML model information.

The types of analytics events include:

- Slice load level information;
- Network slice instance load level information;
- Service experience;
- NF load;
- Network performance;

- Abnormal behaviour;
- UE mobility;
- UE communication;
- Abnormal behaviour;
- User data congestion;
- QoS sustainability;
- Dispersion;
- SM congestion control experience;
- Redundant transmission experience; and
- WLAN performance.

NOTE: ML model provisioning is limited to a single vendor environment in this release of current specification.

4.5.1.2 Service Architecture

The 5G System Architecture is defined in 3GPP TS 23.501 [2]. The Network Data Analytics Exposure architecture is defined in 3GPP TS 23.288 [17]. The ML Model provisioning signalling flows are defined in 3GPP TS 29.552 [25].

The Nnwdaf_MLModelProvision service is part of the Nnwdaf service-based interface exhibited by the Network Data Analytics Function (NWDAF) containing Model Training Logical Function (MTLF).

Known consumers of the Nnwdaf_MLModelProvision service are:

- Network Data Analytics Function (NWDAF) containing Analytics logical function (AnLF)

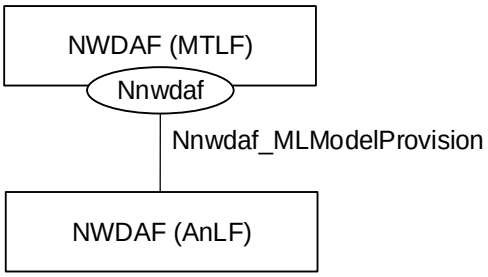

Figure 4.5.1.2-1: Reference Architecture for the Nnwdaf_MLModelProvision Service; SBI representation

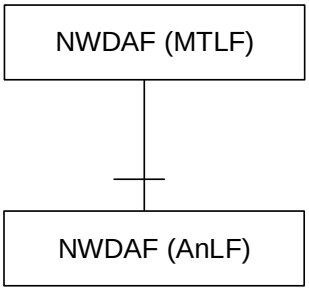

Figure 4.5.1.2-2: Reference Architecture for the Nnwdaf_MLModelProvision Service: reference point representation

4.5.1.3 Network Functions

4.5.1.3.1 Network Data Analytics Function (NWDAF)

The Network Data Analytics Function (NWDAF), containing Model Training Logical Function (MTLF), provides ML model information for different analytic events to NF service consumers.

The Network Data Analytics Function (NWDAF) allows NF service consumers to subscribe to and unsubscribe from one-time, periodic notification or notification when an event is detected.

4.5.1.3.2 NF Service Consumers

The Network Data Analytics Function (NWDAF) supports (un)subscription to the notification of different ML model information from the NWDAF which contains Model Training Logical Function (MTLF).

4.5.2 Service Operations

4.5.2.1 Introduction

Table 4.5.2.1-1: Operations of the Nnwdaf_MLModelProvision Service

Service operation name	Description	Initiated by
Nnwdaf_MLModelProvision_Subscribe	This service operation is used by an NF service consumer to subscribe to ML model provision from NWDAF.	NF service consumer (NWDAF)
Nnwdaf_MLModelProvision_Unsubscribe	This service operation is used by an NF service consumer to unsubscribe to ML model provision.	NF service consumer (NWDAF)
Nnwdaf_MLModelProvision_Notify	This service operation is used by the NWDAF to notify the ML model information to the NF service consumer instance which has subscribed to.	NWDAF

4.5.2.2 Nnwdaf_MLModelProvision_Subscribe service operation

4.5.2.2.1 General

The Nnwdaf_MLModelProvision_Subscribe service operation is used by an NF service consumer to subscribe or update subscription for event notifications from the NWDAF which contains Model Training Logical Function (MTLF).

4.5.2.2.2 Subscription for event notifications

Figure 4.5.2.2.2-1 shows a scenario where the NF service consumer sends a request to the NWDAF to subscribe for event notification(s) (as shown in 3GPP TS 23.288 [17]).

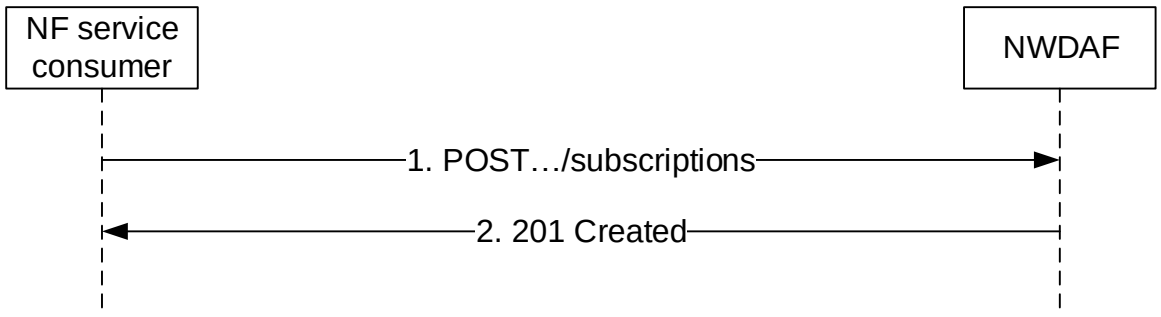

Figure 4.5.2.2.2-1: NF service consumer subscribes to notifications

The NF service consumer shall invoke the Nnwdaf_MLModelProvision_Subscribe service operation to subscribe to event notification(s). The NF service consumer shall send an HTTP POST request with "{apiRoot}/nnwdaf-mlmodelprovision/<apiVersion>/subscriptions" as Resource URI representing the "NWDAF ML Model Provision Subscriptions", as shown in figure 4.5.2.2.2-1, step 1, to create a subscription for an "Individual NWDAF ML Model Provision Subscription" according to the information in message body.

The NwdafMLModelProvSubsc data structure provided in the request body shall include:

- an URI where to receive the requested notifications as the "notifUri" attribute; and
- a description of the subscribed events as the "mLEventSubscs" attribute that, for each event, the MLEventSubscription data type shall include:

  1) an event identifier as the "mLEvent" attribute;

  2) event filter information as the "mLEventFilter" attirbute; and

  and may include:

  1) an identification of target UE information as the "tgtUe" attribute;

  2) a time interval during which the ML model shall be reported as the "mLTargetPeriod" attirbute; and

3) the time when the subscription expired as the "expiryTime" attirbute.The NwdafMLModelProvSubsc data structure provided in the request body may include:

- a notification correlation identifier assigned by the NF service consumer for the requested notifications as "notifCorreId" attribute; and
- the reporting requirement information of the subscription as the "eventReq" attribute.

For different event types, the "mLEventFilter" attribute within the MLEventSubscription data type:

- if the event is "SLICE_LOAD_LEVEL", shall provide:

  1) the S-NSSAI as the "snssais" attribute; and/or

  2) the identification(s) of Network Slice instance as the "nsiIdInfos" attribute;

  and may provide:

  1) an optional list of analytics subsets as the "listOfAnaSubsets" attribute.

- if the ServiceExperience feature is supported and the event is "SERVICE_EXPERIENCE", may provide:

  1) the identification of the application as the "appIds" attribute;

  2) the S-NSSAI as the "snssais" attribute;

  3) the identification(s) of Network Slice instance as the "nsiIdInfos" attribute;

  4) the Area of Interest (AOI) as the "networkArea" attribute;

  5) the identification of DNN as the "dnns" attribute;

  6) identification of user plane access to DN(s) which the subscription applies as the "dnais" attribute;

  7) identification of RAT type where the UE camps on by "ratTypes" attribute if the feature "ServiceExperienceExt" is also supported; and

  8) identification of frequency to UE's serving cell by "freqs" attribute if the feature "ServiceExperienceExt" is also supported.

- if the UeMobility feature is supported and the event is "UE_MOBILITY", may provide

  1) Area of Interest (AOI) as the "networkArea" attribute; and

- if the feature "UeMobilityExt" is supported and the event is "UE_MOBILITY", may provide

1) Visited Area(s) of Interest as the "visitedAreas" attirbute.

- if the UeCommunication feature is supported and the event is "UE_COMM", may provide

1) the S-NSSAI as the "snssais" attribute;
2) the identification of DNN as the "dnns" attribute;
3) the identification of the application as the "appIds" attribute;
4) the Area of Interest (AOI) as the "networkArea" attribute; and
5) an optional list of analytics subsets as the "listOfAnaSubsets" attribute.

- if the QoSSustainability feature is supported and the event is "QOS_SUSTAINABILITY", shall provide:

1) The QoS requirements via "qosRequ" attribute; and
2) Location information as "networkArea" attribute;

and may provide:

1) identification of network slice(s) by "snssais" attribute.

- if the AbnormalBehaviour feature is supported and the event is "ABNORMAL_BEHAVIOUR", may provide:

1) the S-NSSAI as the "snssais" attribute;
2) the identification of DNN as the "dnns" attribute;
3) the identification of the application as the "appIds" attribute;
4) the Area of Interest (AOI) as the "networkArea" attribute;
5) expected UE behaviour via "exptUeBehav" attribute; and
6) either the expected analytics type via "exptAnaType" attribute or a list of exception Ids with the associated thresholds via "excepRequs" attribute.

- if the UserDataCongestion feature is supported and the event is "USER_DATA_CONGESTION", shall provide:

1) the Area of Interest (AOI) as the "networkArea" attribute;
2) an optional list of analytics subsets as the "listOfAnaSubsets" attribute; and
3) the S-NSSAI as the "snssais" attribute.

- if the NfLoad feature is supported and the event is "NF_LOAD", may provide:

1) the S-NSSAI as the "snssais" attribute;
2) either list of NF instance IDs in the "nfInstanceIds" attribute or list of NF set IDs in the "nfSetIds" attribute;
3) list of NF instance types in the "nfTypes" attribute;
4) the Area of Interest (AOI) as the "networkArea" attribute; and
5) an optional list of analytics subsets as the "listOfAnaSubsets" attribute.

- if the NetworkPerformance feature is supported and the event is "NETWORK_PERFORMANCE", may provide:

1) Area of Interest (AOI) as the "networkArea" attribute; and
2) an optional list of analytics subsets as the "listOfAnaSubsets" attribute.

- if the NsiLoad feature is supported and the event is "NSI_LOAD_LEVEL", shall provide:

1) the S-NSSAI as the "snssais" attribute; and/or

2) the identification(s) of Network Slice instance as the "nsiIdInfos" attribute;

and may provide:

1) an optional list of analytics subsets as the "listOfAnaSubsets" attribute.

- if the SMCongestion feature is supported and the event is "SM_CONGESTION", shall provide:

  1) the S-NSSAI as the "snssais" attribute; and/or

  2) the identification of DNN as the "dnns" attribute;

  and may provide:

  1) an optional list of analytics subsets as the "listOfAnaSubsets" attribute.

- if the RedundantTransmission feature is supported and the event is "REDUNDANT_TRANSMISSION", may provide:

  1) the Area of Interest (AOI) as the "networkArea" attribute;

  2) the S-NSSAI as the "snssais" attribute; and

  3) the identification of DNN as the "dnns" attribute.

- if the WLANPerformance feature is supported and the event is "WLAN_PERFORMANCE", may provide:

  1) the Area of Interest (AOI) as the "networkArea" attribute;

  2) the SSID(s) and BSSID(s) as "wlanReqs" attribute; and

  3) an optional list of analytics subsets as the "listOfAnaSubsets" attribute.

- if the DnPerformance feature is supported and the event is "DN_PERFORMANCE", may provide

  1) the identification of the application as the "appIds" attribute;

  2) the S-NSSAI as the "snssais" attribute;

  3) the identification(s) of Network Slice instance as the "nsiIdInfos" attribute;

  4) the Area of Interest (AOI) as the "networkArea" attribute;

  5) the identification of the UPF as the "upfId" attribute;

  6) the identification of DNN as the "dnns" attribute;

  7) identification of user plane access to DN(s) which the subscription applies as the "dnais" attribute;

  8) IP address(s)/FQDN(s) of the Application Server(s) as the "appServerAddrs" attribute;

  9) an optional list of analytics subsets as the "listOfAnaSubsets" attribute.

- if the Dispersion feature is supported and the event is "DISPERSION", may provide:

  1) the Area of Interest (AOI) as the "networkArea" attribute;

  2) the S-NSSAI as the "snssais" attribute;

  3) the identification of the application as the "appIds" attribute;

  4) dispersion analytics requirements in "disperReqs" attribute;

  5) an optional list of analytics subsets as the "listOfAnaSubsets" attribute.

Upon the reception of an HTTP POST request with: "{apiRoot}/nnwdaf-mlmodelprovision/<apiVersion>/subscriptions" as Resource URI and NwdafMLModelProvSubsc data structure as request body, the NWDAF shall create a new subscription and store the subscription.

If the NWDAF created an "Individual NWDAF ML Model Provision Subscription" resource, the NWDAF shall respond with "201 Created" with the message body containing a representation of the created subscription, as shown in figure 4.5.2.2.2-1, step 2. The NWDAF shall include a Location HTTP header field. The Location header field shall contain the URI of the created subscription i.e. "{apiRoot}/nnwdaf-mlmodelprovision/<apiVersion>/subscriptions/{subscriptionId}".

If the immediate reporting indication in the "immRep" attribute within the "evtReq" attribute sets to true during the event subscription, the NWDAF shall include the reports of the subscribed events, if available, as the "mLEventNotifs" attribute in the HTTP POST response.

If there is no associated ML model available for all the listed "mLEvent" attribute, the NWDAF which contains MTLF shall send a "500 Internal Server Error" status code to the NF service consumer. Also, the corresponding failure reason via a "problemDetails" attribute with the "cause" attribute set to "UNAVAILABLE_ML_MODEL_FOR_ALLEVENTS". If errors occur when processing the HTTP POST request, the NWDAF shall send an HTTP error response as specified in clause 5.4.7.

4.5.2.2.3 Update subscription for event notifications

Figure 4.5.2.2.3-1 shows a scenario that the NF service consumer sends an HTTP PUT request to the NWDAF to modify an existing subscription (as shown in 3GPP TS 23.288 [17]).

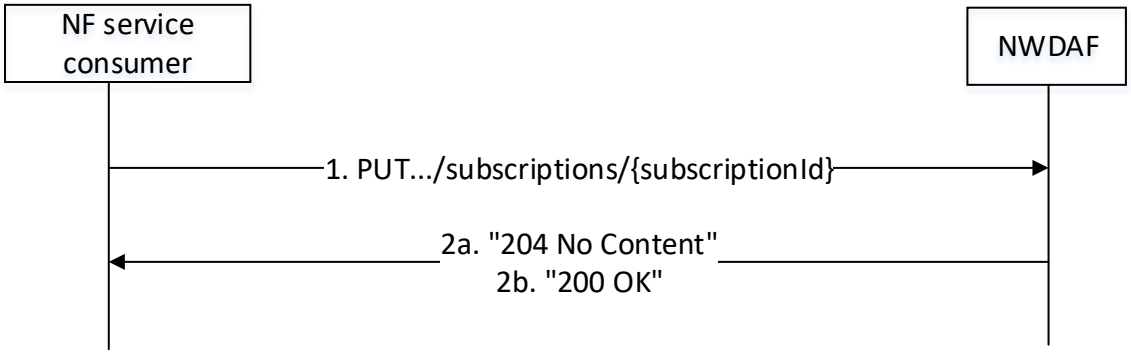

Figure 4.5.2.2.3-1: Modification of events subscription information using HTTP PUT

The NF service consumer shall invoke the Nnwdaf_MLModelProvision_Subscribe service operation to modify an existing ML Model subscription. The NF service consumer shall send an HTTP PUT request with: "{apiRoot}/nnwdaf-mlmodelprovision/<apiVersion>/subscriptions/{subscriptionId}" as Resource URI, where "{subscriptionId}" is the event subscriptionId of the existing subscription to be modified, to update an "Individual NWDAF ML Model Provision Subscription" according to the information in the message body. The NwdafMLModelProvSubsc data structure provided in the request body shall include the same contents as described in clause 4.5.2.2.2.

Upon receipt of an HTTP PUT request with: "{apiRoot}/nnwdaf-mlmodelprovision/<apiVersion>/subscriptions/{subscriptionId}" as Resource URI and NwdafMLModelProvSubsc data type as request body, if the request is successfully processed and accepted, the NWDAF shall:

- modify the concerned subscription; and
- store the subscription.

NOTE: The "notifUri" attribute within the NwdafMLModelProvSubsc data structure can be modified to request that subsequent notifications are sent to a new NF service consumer.

If the NWDAF successfully processed and accepted the received HTTP PUT request, the NWDAF shall update an "Individual NWDAF ML Model Provision Subscription" resource, and shall respond with:

- HTTP "204 No Content" response (as shown in figure 4.5.2.2.3-1, step 2a); or
- HTTP "200 OK" response (as shown in figure 4.5.2.2.3-1, step 2b) with a response body containing a representation of the updated subscription in the NwdafMLModelProvSubsc data type.

If errors occur when processing the HTTP PUT request, the NWDAF shall send an HTTP error response as specified in clause 5.4.7.

If the NWDAF determines that the received HTTP PUT request needs to be redirected, the NWDAF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [6].

4.5.2.3 Nnwdaf_MLModelProvision_Unsubscribe service operation

4.5.2.3.1 General

The Nnwdaf_MLModelProvision_Unsubscribe service operation is used by an NF service consumer to unsubscribe from event notifications.

4.5.2.3.2 Unsubscribe from event notifications

Figure 4.5.2.3.2-1 shows a scenario where the NF service consumer sends a request to the NWDAF to unsubscribe from event notifications (see also 3GPP TS 23.288 [17]).

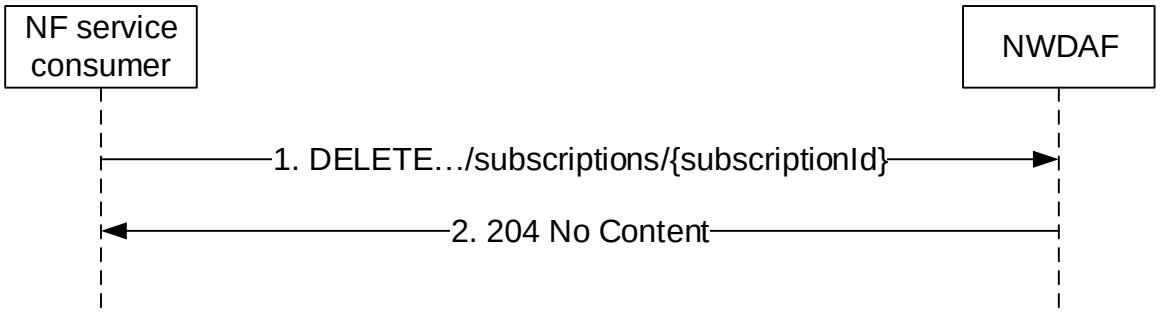

Figure 4.5.2.3.2-1: NF service consumer unsubscribes from notifications

The NF service consumer shall invoke the Nnwdaf_MLModelProvision_UnSubscribe service operation to unsubscribe to event notifications. The NF service consumer shall send an HTTP DELETE request with: "{apiRoot}/nnwdaf-mlmodelprovision/<apiVersion>/subscriptions/{subscriptionId}" as Resource URI, where "{subscriptionId}" is the event subscriptionId of the existing subscription that is to be deleted.

Upon the reception of an HTTP DELETE request, if the NWDAF successfully processed and accepted the received HTTP DELETE request, the NWDAF shall:

- remove the corresponding subscription; and
- respond with HTTP "204 No Content" status code.

If the NWDAF determines the received HTTP DELETE request needs to be redirected, the NWDAF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [6].

If errors occur when processing the HTTP DELETE request, the NWDAF shall send an HTTP error response as specified in clause 5.4.7.

4.5.2.4 Nnwdaf_MLModelProvision_Notify service operation

4.5.2.4.1 General

The Nnwdaf_MLModelProvision_Notify service operation is used by an NWDAF to notify NF consumers about subscribed events.

4.5.2.4.2 Notification about subscribed event

Figure 4.5.2.4.2-1 shows a scenario where the NWDAF sends a request to the NF Service Consumer to notify for event notifications (see also 3GPP TS 23.288 [17]).

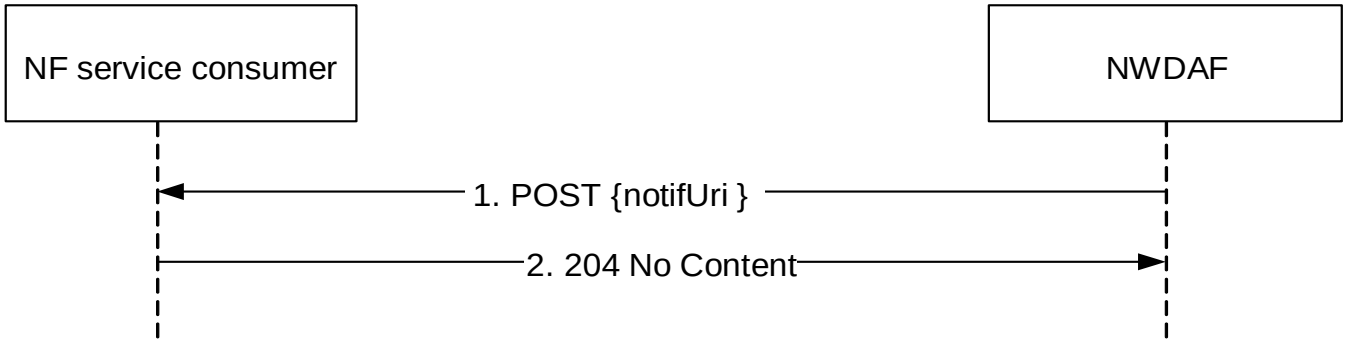

Figure 4.5.2.4.2-1: NWDAF notifies the subscribed event

The NWDAF shall invoke the Nnwdaf_MLModelProvision_Notify service operation to notify the subscribed event. The NWDAF shall send an HTTP POST request with "{notifUri}" received in the Nnwdaf_MLModelProvision_Subscribe service operation as Resource URI, as shown in figure 4.2.2.4.2-1, step 1. The NwdafMLModelProvNotif data structure provided in the request body that shall include:

- an event subscriptionId as "subscriptionId" attribute;
- and description of the notified event as "eventNotifs" attribute, that for each event, the MLEventNotif data type shall include an event identifier as the "event" attribute, an address (e.g. a URL or an FQDN) of the ML model file as the "mLFileAddr" attribute, and may include a notification correlation identifier as "notifCorreId" attribute and a time period when the provided ML model applies as the "validityPeriod" attribute and an area where the provided ML model applies as the "spatialValidity" attribute.

Upon the reception of an HTTP POST request, if the NF service consumer successfully processed and accepted the received HTTP POST request, the NF Service Consumer shall store the notification and respond with HTTP "204 No Content" status code.

If the NF service consumer determines the received HTTP POST request needs to be redirected, the NF service consumer shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [6].

If errors occur when processing the HTTP POST request, the NWDAF shall send an HTTP error response as specified in clause 5.4.7.

5 API Definitions

5.1 Nnwdaf_EventsSubscription Service API

5.1.1 Introduction

The Nnwdaf_EventsSubscription service shall use the Nnwdaf_EventsSubscription API.

The API URI of the Nnwdaf_EventsSubscription API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in each HTTP requests from the NF service consumer towards the NWDAF shall have the Resource URI structure defined in clause 4.4.1 of 3GPP TS 29.501 [7], i.e.:

{apiRoot}/<apiName>/<apiVersion>/<apiSpecificResourceUriPart>

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [7].
- The <apiName> shall be "nnwdaf-eventssubscription".

- The <apiVersion> shall be "v1".
- The <apiSpecificResourceUriPart> shall be set as described in clause 5.1.3.

5.1.2 Usage of HTTP

5.1.2.1 General

HTTP/2, IETF RFC 7540 [9], shall be used as specified in clause 5 of 3GPP TS 29.500 [6].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [6].

The OpenAPI [11] specification of HTTP messages and content bodies for the Nnwdaf_EventsSubscription is contained in Annex A.

5.1.2.2 HTTP standard headers

5.1.2.2.1 General

See clause 5.2.2 of 3GPP TS 29.500 [6] for the usage of HTTP standard headers.

5.1.2.2.2 Content type

JSON, IETF RFC 8259 [10], shall be used as content type of the HTTP bodies specified in the present specification as specified in clause 5.4 of 3GPP TS 29.500 [6]. The use of the JSON format shall be signalled by the content type "application/json".

"Problem Details" JSON object shall be used to indicate additional details of the error in a HTTP response body and shall be signalled by the content type "application/problem+json", as defined in IETF RFC 7807 [15].

5.1.2.3 HTTP custom headers

The Nnwdaf_EventsSubscription service API shall support the mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [6] and may support the optional HTTP custom header fields specified in clause 5.2.3.3 of 3GPP TS 29.500 [6].

In this release of the specification, no specific custom headers are defined for the Nnwdaf_EventsSubscription service API.

5.1.3 Resources

5.1.3.1 Resource Structure

This clause describes the structure for the Resource URIs, the resources and methods used for the service.

Figure 5.1.3.1-1 depicts the resource URIs structure for the Nnwdaf_EventsSubscription API.

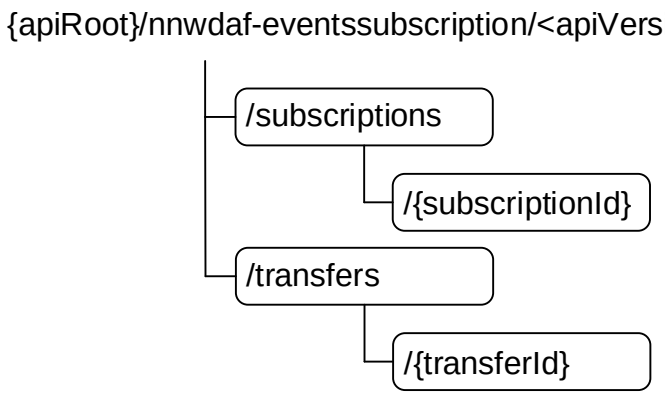

Figure 5.1.3.1-1: Resource URI structure of the Nnwdaf_EventsSubscription API

Table 5.1.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 5.1.3.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method or custom operation	Description
NWDAF Events Subscriptions	/subscriptions	POST	Creates a new Individual NWDAF Event Subscription resource.
Individual NWDAF Event Subscription	/subscriptions/{subscriptionId}	DELETE	Deletes an Individual NWDAF Event Subscription identified by subresource {subscriptionId}.
		PUT	Modifies an existing Individual Event Subscription subresource.
NWDAF Event Subscription Transfers	/transfers	POST	Provides information about the requested analytics subscription transfer(s), potentially creating a new Individual NWDAF Event Subscription Transfer resource.
Individual NWDAF Event Subscription Transfer	/transfers/{transferId}	DELETE	Deletes an Individual NWDAF Event Subscription Transfer resource identified by subresource {transferId}.
		PUT	Modifies an existing Individual NWDAF Event Subscription Transfer resource.

5.1.3.2 Resource: NWDAF Events Subscriptions

5.1.3.2.1 Description

The NWDAF Events Subscriptions resource represents all subscriptions to the Nnwdaf_EventsSubscription service at a given NWDAF. The resource allows an NF service consumer to create a new Individual NWDAF Event Subscription resource.

5.1.3.2.2 Resource definition

Resource URI: **{apiRoot}/nnwdaf-eventssubscription/<apiVersion>/subscriptions**

The <apiVersion> shall be set as described in clause 5.1.1.

This resource shall support the resource URI variables defined in table 5.1.3.2.2-1.

Table 5.1.3.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 5.1.1

5.1.3.2.3 Resource Standard Methods

5.1.3.2.3.1 POST

This method shall support the URI query parameters specified in table 5.1.3.2.3.1-1.

Table 5.1.3.2.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.1.3.2.3.1-2 and the response data structures and response codes specified in table 5.1.3.2.3.1-3.

Table 5.1.3.2.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
NnwdafEventsSubscription	M	1	Creates a new Individual NWDAF Event Subscription resource.

Table 5.1.3.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
NnwdafEventsSubscription	M	1	201 Created	The creation of an Individual NWDAF Event Subscription resource is confirmed and a representation of that resource is returned.
ProblemDetails	O	0..1	400 Bad Request	(NOTE 2)
ProblemDetails	O	0..1	500 Internal Server Error	(NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the POST method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] also apply. NOTE 2: Failure cases are described in clause 5.1.7.				

Table 5.1.3.2.3.1-4: Headers supported by the 201 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains the URI of the newly created resource, according to the structure: {apiRoot}/nnwdaf-eventssubscription/<apiVersion>/subscriptions/{subscriptionId}.

5.1.3.2.4 Resource Custom Operations

None in this release of the specification.

5.1.3.3 Resource: Individual NWDAF Event Subscription

5.1.3.3.1 Description

The Individual NWDAF Event Subscription resource represents a single subscription to the Nnwdaf_EventsSubscription service at a given NWDAF.

5.1.3.3.2 Resource definition

Resource URI: {apiRoot}/nnwdaf-eventssubscription/<apiVersion>/subscriptions/{subscriptionId}

The <apiVersion> shall be set as described in clause 5.1.1.

This resource shall support the resource URI variables defined in table 5.1.3.3.2-1.

Table 5.1.3.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 5.1.1.
subscriptionId	string	Identifies a subscription to the Nnwdaf_EventsSubscription service.

5.1.3.3.3 Resource Standard Methods

5.1.3.3.3.1 DELETE

This method shall support the URI query parameters specified in table 5.1.3.3.3.1-1.

Table 5.1.3.3.3.1-1: URI query parameters supported by the DELETE method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.1.3.3.3.1-2 and the response data structures and response codes specified in table 5.1.3.3.3.1-3.

Table 5.1.3.3.3.1-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 5.1.3.3.3.1-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful case: The Individual NWDAF Event Subscription resource matching the subscriptionId was deleted.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during Individual NWDAF Event Subscription deletion. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF (service) instance. Applicable if the feature "ES3XX" is supported.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during Individual NWDAF Event Subscription deletion. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF (service) instance. Applicable if the feature "ES3XX" is supported.
NOTE: The mandatory HTTP error status codes for the DELETE method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] also apply.				

Table 5.1.3.3.3.1-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NWDAF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

Table 5.1.3.3.3.1-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NWDAF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

5.1.3.3.3.2 PUT

This method shall support the URI query parameters specified in table 5.1.3.3.3.2-1.

Table 5.1.3.3.3.2-1: URI query parameters supported by the PUT method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.1.3.3.3.2-2 and the response data structures and response codes specified in table 5.1.3.3.3.2-3.

Table 5.1.3.3.3.2-2: Data structures supported by the PUT Request Body on this resource

Data type	P	Cardinality	Description
NnwdafEventsSubscription	M	1	Parameters to replace a subscription to NWDAF Event Subscription resource.

Table 5.1.3.3.3.2-3: Data structures supported by the PUT Response Body on this resource

Data type	P	Cardinality	Response codes	Description
NnwdafEventsSubscription	M	1	200 OK	The Individual NWDAF Event Subscription resource was modified successfully and a representation of that resource is returned.
n/a			204 No Content	The Individual NWDAF Event Subscription resource was modified successfully.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during Individual NWDAF Event Subscription modification. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF (service) instance. Applicable if the feature "ES3XX" is supported.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during Individual NWDAF Event Subscription modification. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF (service) instance. Applicable if the feature "ES3XX" is supported.
ProblemDetails	O	0..1	400 Bad Request	(NOTE 2)
ProblemDetails	O	0..1	500 Internal Server Error	(NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the PUT method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] also apply. NOTE 2: Failure cases are described in clause 5.1.7.				

Table 5.1.3.3.3.2-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NWDAF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

Table 5.1.3.3.3.2-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NWDAF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

5.1.3.3.4 Resource Custom Operations

None in this release of the specification.

5.1.3.4 Resource: NWDAF Event Subscription Transfers

5.1.3.4.1 Description

The NWDAF Event Subscription Transfers resource represents all requests to transfer subscription(s) of the Nnwdaf_EventsSubscription service at a given NWDAF. The resource allows an NF service consumer to provide information about analytics subscriptions that are requested to be:

- prepared for transfer, leading to the creation of a new Individual NWDAF Event Subscription Transfer resource, which can be later modified, removed, or requested to be transferred; and
- transferred, leading to the execution of the necessary steps for transferring the analytics subscription.

5.1.3.4.2 Resource definition

Resource URI: **{apiRoot}/nnwdaf-eventssubscription/<apiVersion>/transfers**

The <apiVersion> shall be set as described in clause 5.1.1.

This resource shall support the resource URI variables defined in table 5.1.3.4.2-1.

Table 5.1.3.4.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 5.1.1

5.1.3.4.3 Resource Standard Methods

5.1.3.4.3.1 POST

This method shall support the URI query parameters specified in table 5.1.3.4.3.1-1.

Table 5.1.3.4.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.1.3.4.3.1-2 and the response data structures and response codes specified in table 5.1.3.4.3.1-3.

Table 5.1.3.4.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
AnalyticsSubscriptionsTransfer	M	1	Information about analytics subscription(s) that are requested to be transferred or prepared for transfer.

Table 5.1.3.4.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
AnalyticsSubscriptionsTransfer	M	1	201 Created	The creation of an Individual NWDAF Event Subscription resource is confirmed and a representation of that resource is returned.
n/a			204 No Content	The receipt of the information about analytics subscription(s) that are requested to be transferred and the ability to handle this information (e.g. execute the steps required to transfer an analytics subscription directly) is confirmed.
NOTE: The mandatory HTTP error status codes for the POST method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] also apply.				

Table 5.1.3.4.3.1-4: Headers supported by the 201 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains the URI of the newly created resource, according to the structure: {apiRoot}/nnwdaf-eventssubscription/<apiVersion>/transfers/{transferId}.

5.1.3.4.4 Resource Custom Operations

None in this release of the specification.

5.1.3.5 Resource: Individual NWDAF Event Subscription Transfer

5.1.3.5.1 Description

The Individual NWDAF Event Subscription Transfer resource represents a single request to transfer subscription(s) of the Nnwdaf_EventsSubscription service at a given NWDAF.

5.1.3.5.2 Resource definition

Resource URI: {apiRoot}/nnwdaf-eventssubscription/<apiVersion>/transfers/{transferId}

The <apiVersion> shall be set as described in clause 5.1.1.

This resource shall support the resource URI variables defined in table 5.1.3.5.2-1.

Table 5.1.3.5.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 5.1.1.
transferId	string	Identifies a request to transfer subscription(s) of the Nnwdaf_EventsSubscription service.

5.1.3.5.3 Resource Standard Methods

5.1.3.5.3.1 DELETE

This method shall support the URI query parameters specified in table 5.1.3.5.3.1-1.

Table 5.1.3.5.3.1-1: URI query parameters supported by the DELETE method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.1.3.5.3.1-2 and the response data structures and response codes specified in table 5.1.3.5.3.1-3.

Table 5.1.3.5.3.1-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 5.1.3.5.3.1-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful case: The Individual NWDAF Event Subscription Transfer resource matching the transferId was deleted.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during Individual NWDAF Event Subscription Transfer deletion. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF (service) instance.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during Individual NWDAF Event Subscription Transfer deletion. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF (service) instance.
NOTE: The mandatory HTTP error status codes for the DELETE method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] also apply.				

Table 5.1.3.5.3.1-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NWDAF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

Table 5.1.3.5.3.1-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NWDAF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

5.1.3.5.3.2 PUT

This method shall support the URI query parameters specified in table 5.1.3.5.3.2-1.

Table 5.1.3.5.3.2-1: URI query parameters supported by the PUT method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.1.3.5.3.2-2 and the response data structures and response codes specified in table 5.1.3.5.3.2-3.

Table 5.1.3.5.3.2-2: Data structures supported by the PUT Request Body on this resource

Data type	P	Cardinality	Description
AnalyticsSubscriptionsTransfer	M	1	Parameters to replace in an Individual NWDAF Event Subscription Transfer resource.

Table 5.1.3.5.3.2-3: Data structures supported by the PUT Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The Individual NWDAF Event Subscription Transfer resource was modified successfully.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during Individual NWDAF Event Subscription Transfer modification. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF (service) instance.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during Individual NWDAF Event Subscription Transfer modification. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF (service) instance.
NOTE: The mandatory HTTP error status codes for the PUT method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] also apply.				

Table 5.1.3.5.3.2-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NWDAF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

Table 5.1.3.5.3.2-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NWDAF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

5.1.3.5.4 Resource Custom Operations

None in this release of the specification.

5.1.4 Custom Operations without associated resources

None in this release of the specification.

5.1.5 Notifications

5.1.5.1 General

Notifications shall comply with clause 6.2 of 3GPP TS 29.500 [6] and clause 4.6.2.3 of 3GPP TS 29.501 [7].

Table 5.3.3.4.1-1: Notifications overview

Notification	Callback URI	HTTP method or custom operation	Description (service operation)
Event Notification	{notificationURI}	POST	Reports one or several observed Events.

5.1.5.2 Event Notification

5.1.5.2.1 Description

The Event Notification is used by the NWDAF to report one or several observed Events to an NF service consumer that has subscribed to such Notifications via the Individual NWDAF Event Subscription Resource.

5.1.5.2.2 Operation Definition

Callback URI: **{notificationURI}**

The operation shall support the callback URI variables defined in table 5.1.5.2.2-1, the request data structures specified in table 5.1.5.2.2-2 and the response data structure and response codes specified in table 5.1.5.2.2-3.

Table 5.1.5.2.2-1: Callback URI variables

Name	Data type	Definition
notificationURI	Uri	The Notification Uri as assigned within the Individual NWDAF Event Subscription and described within the NnwdafEventsSubscription type (see table 5.1.6.2.2-1).

Table 5.1.5.2.2-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
array(NnwdafEventsSubscriptionNotification)	M	1..N	Provides Information about observed Events

Table 5.1.5.2.2-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The receipt of the Notification is acknowledged.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during the event notification. The response shall include a Location header field containing an alternative URI representing the end point of an alternative NF consumer (service) instance where the notification should be sent. Applicable if the feature "ES3XX" is supported.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during the event notification. The response shall include a Location header field containing an alternative URI representing the end point of an alternative NF consumer (service) instance where the notification should be sent. Applicable if the feature "ES3XX" is supported.
NOTE: The mandatory HTTP error status codes for the POST method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] also apply.				

Table 5.1.5.2.2-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected.

Table 5.1.5.2.2-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected.

5.1.6 Data Model

5.1.6.1 General

This clause specifies the application data model supported by the API.

Table 5.1.6.1-1 specifies the data types defined for the Nnwdaf_EventsSubscription service based interface protocol.

Table 5.1.6.1-1: Nnwdaf_EventsSubscription specific Data Types

Data type	Section defined	Description	Applicability
AbnormalBehaviour	5.1.6.2.15	Represents the abnormal behaviour information.	AbnormalBehaviour
Accuracy	5.1.6.3.5	Represents the preferred level of accuracy of the analytics.	
AdditionalMeasurement	5.1.6.2.26	Represents additional measurement information.	AbnormalBehaviour
AddressList	5.1.6.2.28	Represents a list of IPv4 and/or IPv6 addresses.	AbnormalBehaviour
AnalyticsContextIdentifier	5.1.6.2.43	Contains information about available analytics contexts.	AnaSubTransfer
AnalyticsMetadata	5.1.6.3.14	Represents the types of analytics metadata information that can be requested.	Aggregation
AnalyticsMetadataIndication	5.1.6.2.36	Contains analytics metadata values indicated to be used during analytics generation.	Aggregation
AnalyticsMetadataInfo	5.1.6.2.37	Contains analytics metadata information required for analytics aggregation.	Aggregation
AnalyticsSubscriptionsTransfer	5.1.6.2.40	Contains information about a request to transfer analytics subscriptions.	AnaSubTransfer
AnalyticsSubset	5.1.6.3.18	Analytics subset used to indicate the content of the analytics.	EneNA
AnySlice	5.1.6.3.2	Represents the any slices.	
ApplicationVolume	5.1.6.2.55	Application data volume per application Id.	Dispersion
AppListForUeComm	5.1.6.2.64	Represents the analytics of the application list used by UE.	UeCommunicationExt
BwRequirement	5.1.6.2.25	Represents bandwidth requirement.	ServiceExperience
ClassCriterion	5.1.6.2.51	Disperion class criterion.	Dispersion
CircumstanceDescription	5.1.6.2.29	Contains the description of a circumstance.	AbnormalBehaviour
CongestionInfo	5.1.6.2.18	Represents the congestion information	UserDataCongestion
CongestionType	5.1.6.3.8	Identification congestion analytics type.	UserDataCongestion
ConsumerNfInformation	5.1.6.2.49	Represents the analytics consumer NF Information.	AnaSubTransfer
DatasetStatisticalProperty	5.1.6.3.15	Dataset statistical properties of the data used to generate the analytics.	Aggregation
DnPerf	5.1.6.2.46	Represents DN performance information.	DnPerformance
DnPerfInfo	5.1.6.2.45	Represents DN performances for the application.	DnPerformance
DnPerfOrderingCriterion	5.1.6.3.25	Ordering criterion for the list of DN performance analytics.	DnPerformance
DnPerformanceReq	5.1.6.2.66	Represents DN performance analytics requirement.	DnPerformance
DispersionClass	5.1.6.3.20	Dispersion class.	Dispersion
DispersionCollection	5.1.6.2.54	Dispersion collections per UE location or or per slice.	Dispersion
DispersionInfo	5.1.6.2.53	Dispersion analytics	Dispersion

		information.	
DispersionRequirement	5.1.6.2.50	Dispersion analytics requirement.	Dispersion
DispersionType	5.1.6.3.19	Dispersion type.	Dispersion
DispersionOrderingCriterion	5.1.6.3.21	Ordering criterion for the list of Dispersion.	Dispersion
EventNotification	5.1.6.2.5	Describes Notifications about events that occurred.	
EventReportingRequirement	5.1.6.2.7	Represents the type of reporting the subscription requires.	
EventSubscription	5.1.6.2.3	Represents the subscription to a single event.	
Exception	5.1.6.2.16	Describes the Exception information.	AbnormalBehaviour
ExceptionId	5.1.6.3.6	Describes the Exception Id.	AbnormalBehaviour
ExceptionTrend	5.1.6.3.7	Describes the Exception Trend.	AbnormalBehaviour
ExpectedAnalyticsType	5.1.6.3.11	Represents expected UE analytics type.	AbnormalBehaviour
FailureEventInfo	5.1.6.2.35	Contains information on the event for which the subscription is not successful.	
IpEthFlowDescription	5.1.6.2.27	Contains the description of an Uplink and/or Downlink Ethernet flow.	AbnormalBehaviour
LoadLevelInformation	5.1.6.3.2	Represents load level information of the network slice and the optionally associated network slice instance.	
LocationInfo	5.1.6.2.11	Represents UE location information.	UeMobility
MatchingDirection	5.1.6.3.12	Defines the matching direction when crossing a threshold.	NfLoad, QoSSustainability, UserDataCongestion, NetworkPerformance Dispersion RedundantTransmissionExp WlanPerformance ServiceExperienceExt
ModelInfo	5.1.6.2.42	Contains information about an ML model.	AnaSubTransfer
NetworkPerfInfo	5.1.6.2.23	Represents the network performance information.	NetworkPerformance
NetworkPerfRequirement	5.1.6.2.22	Represents a network performance requirement.	NetworkPerformance
NetworkPerfType	5.1.6.3.10	Represents the network performance types.	NetworkPerformance
NfLoadLevelInformation	5.1.6.2.31	Represents load level information of a given NF instance.	NfLoad
NfStatus	5.1.6.2.32	Provides the percentage of time spent on various NF states.	NfLoad
NnwdafEventsSubscription	5.1.6.2.2	Represents an Individual NWDAF Event Subscription resource.	
NnwdafEventsSubscriptionNotification	5.1.6.2.4	Represents an Individual NWDAF Event Subscription Notification resource.	
NumberAverage	5.1.6.2.38	Represents average and variance information.	NsiLoadExt
NwdafEvent	5.1.6.3.4	Describes the NWDAF Events.	
NwdafFailureCode	5.1.6.3.13	Identifies the failure reason.	

NotificationMethod	5.1.6.3.3	Represents the notification methods that can be subscribed.	
NsiIdInfo	5.1.6.2.33	Represents the S-NSSAI and the optionally associated Network Slice Instance Identifier(s).	ServiceExperience NsiLoad DnPerformance
NsiLoadLevelInfo	5.1.6.2.34	Represents the load level information for an S-NSSAI and the optionally associated network slice instance.	NsiLoad
ObservedRedundantTransExp	5.1.6.2.70	Represents the observed Redundant Transmission Experience.	RedundantTransmissionExp
OutputStrategy	5.1.6.3.16	Represents the output strategy used for the reporting of the analytics.	Aggregation
PerfData	5.1.6.2.47	Represents DN performance information.	DnPerformance
PrevSubInfo	5.1.6.2.68	Information of the previous subscription.	AnaCtxTransfer
QosRequirement	5.1.6.2.20	Represents the QoS requirements.	QoSSustainability
QosSustainabilityInfo	5.1.6.2.19	Represents the QoS Sustainability information.	QoSSustainability
RankingCriterion	5.1.6.2.52	Ranking criterion.	Dispersion
RatFreqInformation	5.1.6.2.67	Represents the RAT type and/or Frequency information.	ServiceExperienceExt
RedTransExpOrderingCriterion	5.1.6.3.22	Ordering criterion for the list of Redundant Transmission Experience.	RedundantTransmissionExp
RedundantTransmissionExpInfo	5.1.6.2.57	Redundant transmission experience analytics information.	RedundantTransmissionExp
RedundantTransmissionExpPerTS	5.1.6.2.58	Redundant Transmission Experience per Time Slot.	RedundantTransmissionExp
RedundantTransmissionExpReq	5.1.6.2.56	Redundant transmission experience analytics requirement.	RedundantTransmissionExp
ResourceUsage	5.1.6.2.48	The current usage of the virtual resources assigned to the NF instances belonging to a particular network slice instance.	NsiLoadExt
RetainabilityThreshold	5.1.6.2.21	Represents a QoS flow retainability threshold.	QoSSustainability
ServiceExperienceInfo	5.1.6.2.24	Represents the service experience information.	ServiceExperience
ServiceExperienceType	5.1.6.3.24	Represents the type of Service Experience Analytics.	ServiceExperienceExt
SessInactTimerForUeComm	5.1.6.2.65	Represents the N4 Session inactivity timer.	UeCommunicationExt
SliceLoadLevelInformation	5.1.6.2.6	Represents the slices and their load level information.	
SubscriptionTransferInfo	5.1.6.2.41	Contains information about subscriptions that are requested to be transferred.	AnaSubTransfer
TargetUeInformation	5.1.6.2.8	Identifies the target UE information.	ServiceExperience NfLoad NetworkPerformance UserDataCongestion UeMobility UeCommunication AbnormalBehaviour

			QoSSustainability Dispersion RedundantTransmissionExp WlanPerformance DnPerformance
ThresholdLevel	5.1.6.2.30	Describe a threshold level.	UserDataCongestion NfLoad DnPerformance ServiceExperienceExt
TimeUnit	5.1.6.3.9	Represents the unit for the session active time.	QoSSustainability
TopApplication	5.1.6.2.39	Top application that contributes the most to the traffic.	UserDataCongestionExt
TrafficCharacterization	5.1.6.2.14	Identifies the detailed traffic characterization.	UeCommunication
TrafficInformation	5.1.6.2.63	Traffic information including UL/DL data rate and/or Traffic volume.	WlanPerformance
TransferRequestType	5.1.6.3.17	Represents the type of a request for analytics subscription transfer.	AnaSubTransfer
UeAnalyticsContextDescriptor	5.1.6.2.44	Contains information about available UE related analytics contexts.	AnaSubTransfer
UeCommunication	5.1.6.2.13	Represents UE communication information.	UeCommunication
UeMobility	5.1.6.2.10	Represents UE mobility information.	UeMobility
UserDataCongestionInfo	5.1.6.2.17	Represents the user data congestion information.	UserDataCongestion
WlanOrderingCriterion	5.1.6.3.23	Ordering criterion for the list of WLAN performance information.	WlanPerformance
WlanPerformanceReq	5.1.6.2.59	WLAN performance analytics requirement.	WlanPerformance
WlanPerformanceInfo	5.1.6.2.60	WLAN performance analytics information.	WlanPerformance
WlanPerSsIdPerformanceInfo	5.1.6.2.61	WLAN performance information per SSID of WLAN access points deployed in the Area of Interest.	WlanPerformance
WlanPerTsPerformanceInfo	5.1.6.2.62	WLAN performance information per Time Slot during the analytics target period.	WlanPerformance

Table 5.1.6.1-2 specifies data types re-used by the Nnwdaf_EventsSubscription service based interface protocol from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the Nnwdaf service based interface.

Table 5.1.6.1-2: Nnwdaf_EventsSubscription re-used Data Types

Data type	Reference	Comments	Applicability
5Qi	3GPP TS 29.571 [8]	Identifies the 5G QoS identifier	QoSSustainability
AddrFqdn	3GPP TS 29.517 [22]	Represents the IP address or FQDN of the Application Server.	DnPerformance ServiceExperienceExt
ApplicationId	3GPP TS 29.571 [8]	Identifies the application identifier.	ServiceExperience UeCommunication AbnormalBehaviour Dispersion DnPerformance
ArfcnValueNR	3GPP TS 29.571 [8]	Integer value indicating the ARFCN applicable for a downlink, uplink or bi-directional (TDD) NR global frequency raster. Minimum = 0. Maximum = 3279165.	ServiceExperienceExt
BitRate	3GPP TS 29.571 [8]	String representing a bit rate that shall be formatted as follows: pattern: "^\d+(\.\d+)? (bps|Kbps|Mbps|Gbps|Tbps)$" Examples: "125 Mbps", "0.125 Gbps", "125000 Kbps".	ServiceExperience QoSSustainability WlanPerformance DnPerformance
DateTime	3GPP TS 29.571 [8]	Identifies the time.	
Dnai	3GPP TS 29.571 [8]	Identifies a user plane access to one or more DN(s).	ServiceExperience DnPerformance
Dnn	3GPP TS 29.571 [8]	Identifies the DNN.	ServiceExperience AbnormalBehaviour UeCommunication DnPerformance SMCCE
DurationSec	3GPP TS 29.571 [8]		
EthFlowDescription	3GPP TS 29.514 [21]		UeCommunication AbnormalBehaviour
ExpectedUeBehaviourData	3GPP TS 29.503 [23]		AbnormalBehaviour
Float	3GPP TS 29.571 [8]		
FlowDescription	3GPP TS 29.514 [21]		UeCommunication AbnormalBehaviour
FlowInfo	3GPP TS 29.122 [19]		UserDataCongestionExt
Gpsi	3GPP TS 29.571 [8]	The GPSI for an UE.	UserDataCongestionExt
GroupId	3GPP TS 29.571 [8]	Identifies a group of UEs.	UeMobility UeCommunication NetworkPerformance AbnormalBehaviour ServiceExperience Dispersion RedundantTransmissionExp WlanPerformance
Ipv4Addr	3GPP TS 29.571 [8]		
Ipv6Addr	3GPP TS 29.571 [8]		
NetworkAreaInfo	3GPP TS 29.554 [18]	Identifies the network area.	ServiceExperience QoSSustainability AbnormalBehaviour UeMobility UserDataCongestion NetworkPerformance NsiLoadExt NfLoadExt Dispersion RedundantTransmissionExp

			WlanPerformance EneNA DnPerformance
NfInstanceId	3GPP TS 29.571 [8]	Identifies an NF instance.	NfLoad
NfSetId	3GPP TS 29.571 [8]	Identifies an NF Set instance.	NfLoad
NFType	3GPP TS 29.510 [12]	Indentifies a type of NF.	NfLoad
NsiId	3GPP TS 29.531 [24]	Identifies a Network Slice Instance.	ServiceExperience NsiLoad DnPerformance
PacketDelBudget	3GPP TS 29.571 [8]		QoSSustainability DnPerformance
PacketErrRate	3GPP TS 29.571 [8]		QoSSustainability
PacketLossRate	3GPP TS 29.517 [22]	Indicates Packet Loss Rate.	DnPerformance
PduSessionId	3GPP TS 29.571 [8]	Indentifies PDU Session	
ProblemDetails	3GPP TS 29.571 [8]	Used in error responses to provide more detailed information about an error.	
QosResourceType	3GPP TS 29.571 [8]	Identifies the resource type in QoS characteristics.	QoSSustainability
RatType	3GPP TS 29.571 [8]	Identifies the RAT type.	ServiceExperienceExt
RedirectResponse	3GPP TS 29.571 [8]	Contains redirection related information.	ES3XX
ReportingInformation	3GPP TS 29.523 [20]	Represents the type of reporting the subscription requires.	
SamplingRatio	3GPP TS 29.571 [8]		
ScheduledCommunicationTime	3GPP TS 29.122 [19]		UeMobility UeCommunication
SmcceInfo	5.2.6.2.12	Represents the analytics of Session Management Congestion Control Experience information.	SMCCE
Snssai	3GPP TS 29.571 [8]	Identifies the S-NSSAI (Single Network Slice Selection Assistance Information).	
Supi	3GPP TS 29.571 [8]	The SUPI for an UE.	ServiceExperience, NfLoad NetworkPerformance, UserDataCongestion UeMobility UeCommunication AbnormalBehaviour Dispersion RedundantTransmissionExp WlanPerformance
SupportedFeatures	3GPP TS 29.571 [8]	Used to negotiate the applicability of the optional features defined in table 5.1.8-1.	
SvcExperience	3GPP TS 29.517 [22]		ServiceExperience
Tai	3GPP TS 29.571 [8]	Tracking Area Information.	AnaSubTransfer
TimeWindow	3GPP TS 29.122 [19]		
Uinteger	3GPP TS 29.571 [8]	Unsigned Integer, i.e. only value 0 and integers above 0 are permissible.	
UpfInformation	3GPP TS 29.508 [29]	The information of the UPF serving the UE.	ServiceExperienceExt DnPerformance
Uri	3GPP TS 29.571 [8]		
UserLocation	3GPP TS 29.571 [8]		UeMobility Dispersion
Volume	3GPP TS 29.122 [19]		UeCommunication AbnormalBehaviour Dispersion WlanPerformance

5.1.6.2 Structured data types

5.1.6.2.1 Introduction

This clause defines the structures to be used in resource representations.

5.1.6.2.2 Type NnwdafEventsSubscription

Table 5.1.6.2.2-1: Definition of type NnwdafEventsSubscription

Attribute name	Data type	P	Cardinality	Description	Applicability
eventSubscriptions	array(EventSubscription)	M	1..N	Subscribed events.	
evtReq	ReportingInformation	O	0..1	Represents the reporting requirements of the event subscription. (NOTE 1, NOTE 2) If omitted, the default values within the ReportingInformation data type apply.	
notificationURI	Uri	C	0..1	Identifies the recipient of Notifications sent by the NWDAF. This parameter shall be supplied by the NF service consumer in the HTTP POST requests that create the subscriptions for event notifications and in the HTTP PUT requests that update the subscriptions for event notifications.	
notifCorrId	string	O	0..1	Notification correlation identifier.	EneNA
eventNotifications	array(EventNotification)	C	1..N	Notifications about Individual Events. Shall only be present if the immediate reporting indication in the "immRep" attribute within the "evtReq" attribute sets to true in the event subscription, and the reports are available.	
failEventReports	array(FailureEventInfo)	O	1..N	Supplied by the NWDAF. When available, shall contain the event(s) for which the subscription is not successful including the failure reason(s).	
consNfInfo	ConsumerNfInformation	O	0..1	Represents the analytics consumer NF Information.	AnaSubTransfer
prevSub	PrevSubInfo	O	0..1	Contains information about the previous analytics subscription that the NF service consumer had with the source NWDAF. (NOTE 3)	AnaCtxTransfer

supportedFeatures	SupportedFeatures	C	0..1	List of Supported features used as described in clause 5.1.8. This parameter shall be supplied by NF service consumer in the POST request that request the creation of an NWDAF Event Subscriptions resource, and shall be supplied by the NWDAF in the reply of corresponding request.	

NOTE 1: If the "evtReq" attribute (of data type ReportingInformation) is provided and contains the "notifMethod" attribute, the notification method indicated by the "notifMethod" attribute within the ReportingInformation data type takes preference over the notification method indicated by the "notificationMethod" attribute within the EventSubscription data type.

NOTE 2: If the "evtReq" attribute (of data type ReportingInformation) is provided and contains the "repPeriod" attribute, the periodic reporting time indicated by the "repPeriod" attribute in the ReportingInformation data type takes preference over the periodic reporting time indicated by the "repetitionPeriod" attribute in the EventSubscription data type.

NOTE 3: The "prevSub" attribute may be used by the NWDAF to derive analytics context identifier(s), which may be used in the Nnwdaf_AnalyticsInfo_ContextTransfer service operation invoked by the NWDAF.

5.1.6.2.3 Type EventSubscription

Table 5.1.6.2.3-1: Definition of type EventSubscription

Attribute name	Data type	P	Cardinality	Description	Applicability
anySlice	AnySlice	C	0..1	Default is "FALSE". (NOTE 1)	
appIds	array(ApplicationId)	C	1..N	Represents the Application Identifier(s) to which the subscription applies. The absence of appIds means subscription to all applications. (NOTE 8)	ServiceExperience UeCommunication AbnormalBehaviour Dispersion DnPerformance
dnns	array(Dnn)	C	1..N	Represents the DNN(s) to which the subscription applies. Each DNN is a full DNN with both the Network Identifier and Operator Identifier, or a DNN with the Network Identifier only. The absence of dnns means subscription to all DNNs. (NOTE 8)	ServiceExperience, AbnormalBehaviour UeCommunication RedundantTransmissionExp DnPerformance SMCCE
dnais	array(Dnai)	C	1..N	Represents the Data Network Access Identifier(s) of user plane access to DN(s) which the subscription applies.	ServiceExperience DnPerformance
event	NwdafEvent	M	1	Event that is subscribed.	
extraReportReq	EventReportingRequirement	O	0..1	The extra event reporting requirement information.	
ladnDnns	array(Dnn)	O	1..N	LADN DNN(s) to indicate the LADN service area(s) as the AoI(s).	UeMobilityExt
loadLevelThreshold	integer	C	0..1	Indicates that the NWDAF shall report the corresponding network slice load level to the NF service consumer where the load level of the network slice identified by snssais is reached. (NOTE 4) May be included when subscribed event is "SLICE_LOAD_LEVEL". Minimum = 0. Maximum = 100.	
matchingDir	MatchingDirection	O	0..1	A matching direction may be provided alongside a threshold. If omitted, the default value is CROSSED.	NfLoad, QoSSustainability, UserDataCongestion, NetworkPerformance
nfLoadLvlThds	array(ThresholdLevel)	C	1..N	Shall be supplied in order to start reporting when an average load level is reached. (NOTE 4)	NfLoad
networkArea	NetworkAreaInfo	C	0..1	Identification of network area to which the subscription applies. The absence of networkArea means subscription to all network areas. (NOTE 7, NOTE 8)	ServiceExperience UeMobility UeCommunication QoSSustainability AbnormalBehaviour UserDataCongestion

					NetworkPerformance NsiLoadExt NfLoadExt Dispersion RedundantTransmissionExp WlanPerformance DnPerformance
visitedAreas	array(NetworkAreaInfo)	O	1..N	Indicates the visited network area(s) which the UEs had previously been in at least one of the Visited Area(s) of Interest. (NOTE 10)	UeMobilityExt
maxTopAppUlNbr	Uinteger	O	0..1	Indicates the requested maximum number of top applications that contribute the most to the traffic in Uplink direction. Minimum = 1. May be included when one of the elements in the "listOfAnaSubsets" attribute is set to LIST_OF_TOP_APP_UL.	UserDataCongestionExt
maxTopAppDlNbr	Uinteger	O	0..1	Indicates the requested maximum number of top applications that contribute the most to the traffic in Downlink direction. Minimum = 1. May be included when one of the elements in the "listOfAnaSubsets" attribute is set to LIST_OF_TOP_APP_DL.	UserDataCongestionExt
nfInstanceIds	array(NfInstanceId)	O	1..N	Identification(s) of NF instance(s).	NfLoad
nfSetIds	array(NfSetId)	O	1..N	Identification(s) of NF instance set(s).	NfLoad
nfTypes	array(NFType)	O	1..N	Identification(s) of NF type(s). (NOTE 13)	NfLoad NsiLoadExt
notificationMethod	NotificationMethod	O	0..1	Indicate the notification method. (NOTE 2)	
nsiIdInfos	array(NsiIdInfo)	O	1..N	Each element identifies the S-NSSAI and the optionally associated network slice instance(s). May be included when subscribed event is "NSI_LOAD_LEVEL", "SERVICE_EXPERIENCE" or "DN_PERFORMANCE". (NOTE 1)	ServiceExperience NsiLoad DnPerformance
nsiLevelThrds	array(Uinteger)	O	1..N	Identifies the load threshold for each S-NSSAI or S-NSSAI and the optionally associated network slice instance identified by the "nsiIds" attribute within the "nsiIdInfos" attribute. (NOTE 4) Minimum = 0. Maximum = 100.	NsiLoad
qosRequ	QosRequirement	C	0..1	Indicates the QoS requirements. It shall be included when subscribed event is "QOS_SUSTAINABILITY".	QoSSustainability
qosFlowRetThds	array(RetainabilityThreshold)	C	1..N	Represents the QoS flow retainability thresholds. Shall be supplied for the 5QI ("5qi" in "qosRequ") or resource type ("resType" in "qosRequ") of	QoSSustainability

				GBR resource type. (NOTE 4)	
ranUeThrouThds	array(BitRate)	C	1..N	Represents the RAN UE throughput thresholds. Shall be supplied for the 5QI ("5qi" in "qosRequ") or resource type ("resType" in "qosRequ") of non-GBR resource type. (NOTE 4)	QoSSustainability
repetitionPeriod	DurationSec	C	0..1	Shall be supplied for notification method "PERIODIC" by the "notificationMethod" attribute.	
snssais	array(Snssai)	C	1..N	Identification(s) of network slice(s) to which the subscription applies. (NOTE 1, NOTE 8)	
tgtUe	TargetUeInformation	O	0..1	Identifies target UE information. (NOTE 3)	
congThresholds	array(ThresholdLevel)	C	1..N	Represents the congestion threshold levels. (NOTE 4)	UserDataCongestion
nwPerfRequs	array(NetworkPerfRequirement)	C	1..N	Represents the network performance requirements. This attribute shall be included when subscribed event is "NETWORK_PERFORMANCE". It may only be present if "appIds" attribute is provided	NetworkPerformance
bwRequs	array(BwRequirement)	O	1..N	Represents the bandwidth requirement for each application.	ServiceExperience
excepRequs	array(Exception)	C	1..N	Represents a list of Exception Ids with associated thresholds. May only be present when subscribed event is "ABNORMAL_BEHAVIOUR". (NOTE 5, NOTE 6, NOTE 8)	AbnormalBehaviour
exptAnaType	ExpectedAnalyticsType	C	0..1	Represents expected UE analytics type. It shall not be present if the "excepRequs" attribute is provided. (NOTE 6, NOTE 8)	AbnormalBehaviour
exptUeBehav	ExpectedUeBehaviourData	O	0..1	Represents expected UE behaviour.	AbnormalBehaviour
ratFreqs	array(RatFreqInformation)	O	1..N	Identification(s) of the RAT type(s) and/or frequency(ies) of UE's serving cell(s) which the subscriptiont applies. (NOTE 9)	ServiceExperienceExt
listOfAnaSubsets	array(AnalyticsSubset)	O	1..N	The list of analytics subsets can be used to indicate the content of the analytics.	EneNA
disperReqs	array(DispersionRequirement)	O	1..N	Represents the dispersion analytics requirements.	Dispersion
redTransReqs	array(RedundantTransmissionExpReq)	O	1..N	Represents the redundant transmission experience analytics requirements.	RedundantTransmissionExp
wlanReqs	array(WlanPerformanceReq)	O	1..N	Represents other WLAN performance analytics requirements. If the attribute contains no content, may take default handling action.	WlanPerformance
upfInfo	UpfInformation	O	0..1	Identifies the UPF. (NOTE 12)	ServiceExperienceExt DnPerformance
appServerAddrs	array(AddrFqdn)	C	1..N	Each element represents the Application Server Instance (IP address/FQDN of the Application Server). (NOTE 11)	ServiceExperienceExt DnPerformance
dnPerfReqs	array(DnPerformanceReq)	O	1..N	Represents the DN performance analytics requirements.	DnPerformance

NOTE 1: The "anySlice" attribute is not applicable to features "UeMobility" and "NetworkPerformance". The "snssais" attribute is not applicable to features "ServiceExperience", "NsiLoad", "UeMobility" and "NetworkPerformance". When subscribed event is "SLICE_LOAD_LEVEL", the identifications of network slices, either information about slice(s) identified by "snssais", or "anySlice" set to "TRUE" shall be included. When subscribed event is "QOS_SUSTAINABILITY", "NF_LOAD", "UE_COMM", "ABNORMAL_BEHAVIOUR", "USER_DATA_CONGESTION", "DISPERSION" or "RED_TRANS_EXP", the identifications of network slices identified by "snssais" is optional. When subscribed event is "NSI_LOAD_LEVEL", "SERVICE_EXPERIENCE" or "DN_PERFORMANCE", either the "nsiIdInfos" attribute or "anySlice" set to "TRUE" shall be included.
NOTE 2: When notificationMethod is not supplied, the default value is "THRESHOLD".
NOTE 3: Applicability is further described in the corresponding data type.
NOTE 4: This property shall be provided if the "notifMethod" in "evtReq" is set to "ON_EVENT_DETECTION" or "notificationMethod" in "eventSubscriptions" is set to "THRESHOLD" or omitted.
NOTE 5: Only "excepId" and "excepLevel" within the Exception data type apply to the "excepRequs" attribute within EventSubscription data type.
NOTE 6: Either "excepRequs" or "exptAnaType" shall be provided if subscribed event is "ABNORMAL_BEHAVIOUR".
NOTE 7: For "NETWORK_PERFORMANCE", "SERVICE_EXPERIENCE", "USER_DATA_CONGESTION" or "DN_PERFORMANCE" event, this attribute shall be provided if the event applied for all UEs (i.e. "anyUe" attribute set to true within the "tgtUe" attribute). For "QOS_SUSTAINABILITY", this attribute shall be provided.
NOTE 8: For "ABNORMAL_BEHAVIOUR" event with "anyUe" attribute in "tgtUe" attribute sets to true,
- at least one of the "networkArea" and the "snssais" attribute should be included, if the expected analytics type via the"exptAnaType" attribute or the list of Exception Ids via the "excepRequs" attribute is mobility related;
- at least one of the "networkArea", "appIds", "dnns" and "snssais" attribute should be included, if the expected analytics type via the"exptAnaType" attribute or the list of Exception Ids via the "excepRequs" attribute is communication related;
- the expected analytics type via the"exptAnaType" attribute or the list of Exception Ids via "excepRequs" attribute shall not be requested for both mobility and communication related analytics at the same time.

NOTE 9: If both the "allFreq" attribute and the "allRat" attribute are present within the RatFreqInformation data type, then only one instance of the RatFreqInformation data typeshall be present to indicate for all the RAT type and all the Frequency values the NWDAF has received for the application.
NOTE 10: If this attribute is provided, the analytics target period shall be a past time period (i.e. only statistics is supported).
NOTE 11: This parameter shall be provided when a consumer requires analytics for an edge application over a UP path.
NOTE 12: This parameter may be provided when a consumer requires analytics for an edge application over a UP path.
NOTE 13: When subscribed event is "NSI_LOAD_LEVEL" and the NsiLoadExt feature is supported, and the NF service consumer provides the "nfTypes" attribute, then the NWDAF accounts only for the resource usage of the NF types included in "nfTypes" to derive the output analytics. If the "nfTypes" attribute is not provided, then NWDAF accounts for the resource usage of all NF types.

NOTE: Care needs to be taken to avoid excessive signalling.

5.1.6.2.4 Type NnwdafEventsSubscriptionNotification

Table 5.1.6.2.4-1: Definition of type NnwdafEventsSubscriptionNotification

Attribute name	Data type	P	Cardinality	Description	Applicability
eventNotifications	array(EventNotification)	C	1..N	Notifications about Individual Events. (NOTE)	
subscriptionId	string	M	1	String identifying a subscription to the Nnwdaf_EventsSubscription service	
notifCorrId	string	O	0..1	Notification correlation identifier.	EneNA
oldSubscriptionId	string	C	0..1	Subscription ID which was allocated by the source NWDAF. This parameter shall be present if the notification is for informing the assignment of a new Subscription Id by the target NWDAF in the analytics transfer procedure. (NOTE)	EneNA
NOTE: Exactly one of "eventNotifications" and "oldSubscriptionId" attributes shall be provided.					

5.1.6.2.5 Type EventNotification

Table 5.1.6.2.5-1: Definition of type EventNotification

Attribute name	Data type	P	Cardinality	Description	Applicability
event	NwdafEvent	M	1	Event that is notified.	
start	DateTime	O	0..1	It defines the start time of which the analytics information will become valid. (NOTE 1)	
expiry	DateTime	O	0..1	It defines the expiration time after which the analytics information will become invalid. (NOTE 1)	
timeStampGen	DateTime	O	0..1	It defines the timestamp of analytics generation.	
failNotifyCode	NwdafFailureCode	C	0..1	Identifies the failure reason for the event notification. It shall only be included if the event notification is failed or the analytics information is not ready. (NOTE 2)	EneNA
rvWaitTime	DurationSec	O	0..1	Indicate a recommended time interval (in seconds) which is used to determine the time when analytics information is needed in similar future event subscriptions. It may only be included if the "failNotifyCode" attribute sets to "UNSATISFIED_REQUESTED_ANALYTICS_TIME".	EneNA
anaMetaInfo	AnalyticsMetadataInfo	C	0..1	Contains information about analytics metadata required to aggregate the analytics. It shall be present if the "anaMeta" attribute was included in the subscription, containing the information indicated by the "anaMeta" attribute.	Aggregation
nwPerfs	array(NetworkPerfInfo)	C	1..N	The network performance information. Shall be present when subscribed even is "NETWORK_PERFORMANCE".	NetworkPerformance
nfLoadLevelInfos	array(NfLoadLevelInformation)	C	1..N	The NF load level information. When subscribed event is "NF_LOAD", the nfLoadLevelInfos shall be included.	NfLoad
nsiLoadLevelInfos	array(NsiLoadLevelInfo)	C	1..N	Each element identifies the load level information for each S-NSSAI and the optionally associated network slice instance. Shall be included when subscribed event is "NSI_LOAD_LEVEL".	NsiLoad
qosSustainInfos	array(QosSustainabilityInfo)	C	1..N	The QoS sustainability information. When subscribed event is "QOS_SUSTAINABILITY", the qosSustainInfos shall be included.	QoSSustainability
sliceLoadLevelInfo	SliceLoadLevelInformation	C	0..1	The slices and the load level information. When subscribed event is "SLICE_LOAD_LEVEL", the sliceLoadLevelInfo shall be included.	

svcExps	array(ServiceExperienceInfo)	C	1..N	The service experience information. When subscribed event is "SERVICE_EXPERIENCE", the svcExps shall be included.	ServiceExperience
ueComms	array(UeCommunication)	C	1..N	The UE communication information. When subscribed event is "UE_COMM", the ueComms shall be included.	UeCommunication
ueMobs	array(UeMobility)	C	1..N	The UE mobility information. When subscribed event is "UE_MOBILITY", the ueMobs shall be included.	UeMobility
abnorBehavrs	array(AbnormalBehaviour)	C	1..N	The Abnormal Behaviour information. When subscribed event is "ABNORMAL_BEHAVIOUR", the abnorBehavrs shall be included.	AbnormalBehaviour
userDataCongInfos	array(UserDataCongestionInfo)	C	1..N	The location and user data congestion information. Shall be present if the subscribed event is "USER_DATA_CONGESTION".	UserDataCongestion
dnPerfInfos	array(DnPerfInfo)	C	1..N	The DN performance information. Shall be present if the subscribed event is "DN_PERFORMANCE".	DnPerformance
disperInfos	array(DispersionInfo)	C	1..N	The Dispersion information. When subscribed event is "DISPERSION", the "disperInfos" attribute shall be included.	Dispersion
redTransInfos	array(RedundantTransmissionExpInfo)	C	1..N	The redundant transmission experience related information. When subscribed event is "RED_TRANS_EXP", the "redTransInfos" attribute shall be included.	RedundantTransmissionExp
wlanInfos	array(WlanPerformanceInfo)	C	1..N	The WLAN performance related information. When subscribed event is "WLAN_PERFORMANCE", the "wlanInfos" attribute shall be included.	WlanPerformance
smccExps	array(SmcceInfo)	C	1..N	The Session Management Congestion Control Experience information. Shall be present when the requested event is "SM_CONGESTION".	SMCCE
NOTE 1: If the "start" attribute and the "expiry" attribute are both provided, the DateTime of the "expiry" attribute shall not be earlier than the DateTime of the "start" attribute. NOTE 2: The values of "UNAVAILABLE_DATA" and "BOTH_STAT_PRED_NOT_ALLOWED" of the NwdafFailureCode data type are not applicable for the "failNotifyCode" attribute.					

5.1.6.2.6 Type SliceLoadLevelInformation

Table 5.1.6.2.6-1: Definition of type SliceLoadLevelInformation

Attribute name	Data type	P	Cardinality	Description	Applicability
loadLevelInformation	LoadLevelInformation	M	1	Load level information which applies for each network slice identified by snssais.	
snssais	array(Snssai)	M	1..N	Identification(s) of network slice to which the subscription applies.	
NOTE: If the requested period identified by the "startTs" and "endTs" attributes in the "EventReportingRequirement" type is a future time period, which means the analytics result is a prediction. If no sufficient data is collected to provide the confidence of the prediction before the time deadline, the NWDAF shall return a zero confidence.					

NOTE: The functionality of the Slice Load Level Information is a subset of the functionality of the NSI Load Level Information, does not need to be used if the NsiLoadExt feature is supported, and is maintained only for backwards compatibility purposes.

5.1.6.2.7 Type EventReportingRequirement

Table 5.1.6.2.7-1: Definition of type EventReportingRequirement

Attribute name	Data type	P	Cardinality	Description	Applicability
accuracy	Accuracy	O	0..1	Preferred level of accuracy of the analytics. (NOTE 5)	
accPerSubset	array(Accuracy)	O	1..N	Each element indicates the preferred accuracy level per analytics subset. It may be present if the "listOfAnaSubsets" attribute is present in the subscription request when the subscription event is NF_LOAD, UE_COMM, DISPERSION, NETWORK_PERFORMANCE, WLAN_PERFORMANCE, DN_PERFORMANCE or SERVICE_EXPERIENCE. (NOTE 4, NOTE 5)	EneNA
startTs	DateTime	O	0..1	UTC time indicating the start time of the observation period. The absence of this attribute means subscription at the present time unless the "offsetPeriod" attribute is included. (NOTE 3)	
endTs	DateTime	O	0..1	UTC time indicating the end time of the observation period. If the start time is in the past, then the absence of this attribute means that the end time of the subscription is at the present time, unless the "offsetPeriod" attribute is included. If provided, it shall not be less than the start time. (NOTE 3)	
offsetPeriod	integer	O	0..1	Offset period in units of seconds to the reporting time, if the value is negative means statistics in the past offset period, otherwise a positive value means prediction in the future offset period. May be present if the "repPeriod" attribute is included within the "evtReq" attribute. (NOTE 3)	EneNA
sampRatio	SamplingRatio	O	0..1	Percentage of sampling (1%...100%) among impacted UEs. Applicable to event targeting a group of UEs or any UE. (NOTE 1)	
maxSupiNbr	Uinteger	O	0..1	Represents the maximum number of SUPIs expected in an object. Applicable for the event(s) providing a list of SUPIs during the analytics response.	
maxObjectNbr	Uinteger	O	0..1	Maximum number of objects expected for an analytics report. It's only applicable for the event(s) which may provide more than one entries or objects during event notification.	
timeAnaNeeded	DateTime	O	0..1	UTC time indicating the time when analytcs information is needed.	EneNA
anaMeta	array(AnalyticsMetadata)	O	1..N	List of analytics metadata that are requested to be included.	Aggregation

anaMetaInd	AnalyticsMetadataIndication	O	0..1	Contains values for the analytics metadata that the NF service consumer wants to be used for generating the analytics.	Aggregation

NOTE 1: The "sampRatio" attribute within EventReportingRequirement data type is not applicable for the Nnwdaf_EventsSubscription API.
NOTE 2: Void.
NOTE 3: When the "offsetPeriod" attribute is included, the "startTs" and "endTs" attributes shall not be included. If the analytics target period is indicated either by providing a "startTs" attribute and an "endTs" attribute that are equal, or by providing an "offsetPeriod" attribute equal to zero (which means there is no offset to the periodic reporting time indicated by the "repPeriod" attribute), then this is a request for analytics for a specific time of the same "startTs" attribute and "endTs" attribute or each specific time periodically indicated by the "repPeriod" attribute , rather than for a time interval. If none of the attributes "startTs", "endTs" and "offsetPeriod" is provided, the analytics target period starts at the present time and there is no specified end time.
NOTE 4: If multiple accuracy entries are included, the order of the entries of the "accPerSubset" attribute corresponds with the order of the entries of the "listOfAnaSubsets" attribute, i.e. the first entry of the "accPerSubset" attribute holds the requested accuracy for the analytics subset that is indicated by the first entry of the "listOfAnaSubsets" attribute, and so on.
NOTE 5: If both the "accuracy" attribute and "accPerSubset" attribute were provided in the request, the "accPerSubset" attribute takes precedence over the "accuracy" attribute.

5.1.6.2.8 Type TargetUeInformation

Table 5.1.6.2.8-1: Definition of type TargetUeInformation

Attribute name	Data type	P	Cardinality	Description	Applicability
anyUe	boolean	O	0..1	Identifies any UE when setting to true. (NOTE 3)	ServiceExperience NetworkPerformance NfLoad UserDataCongestion AbnormalBehaviour QoSSustainability Dispersion RedundantTransmissionExp WlanPerformance DnPerformance
supis	array(Supi)	O	1..N	Each element represents a SUPI for a UE. (NOTE 2)	UeMobility UeCommunication NetworkPerformance AbnormalBehaviour UserDataCongestion NfLoad ServiceExperience Dispersion RedundantTransmissionExp WlanPerformance SMCCE DnPerformance
gpsis	array(Gpsi)	O	1..N	Each element represents a GPSI for a UE. (NOTE 2)	UserDataCongestionExt DnPerformance
intGroupIds	array(GroupId)	O	1..N	Each element represents an internal group identifier and identifies a group of UEs. (NOTE 2)	UeMobility UeCommunication NetworkPerformance AbnormalBehaviour ServiceExperience Dispersion RedundantTransmissionExp WlanPerformance DnPerformance

NOTE 1: For an applicable feature or UserDataCongestion and UserDataCongestionExt features are both applicable, only one attribute identifying the target UE shall be provided.
NOTE 2: Only one element in the attribute shall be provided for the applicable events except the "SERVICE_EXPERIENCE" event, the "DISPERSION" event and/or the "SMCCE" event.
NOTE 3: For feature "Dispersion", any UE is only supported in combination with S-NSSAI, Area of Interest and/or Dispersion Class.

5.1.6.2.9 Void

5.1.6.2.10 Type UeMobility

Table 5.1.6.2.10-1: Definition of type UeMobility

Attribute name	Data type	P	Cardinality	Description	Applicability
ts	DateTime	C	0..1	This attribute identifies the timestamp when the UE arrives the location. (NOTE 1)	
recurringTime	ScheduledCommunicationTime	C	0..1	Identifies time of the day and day of the week which are valid within the observation period when the UE moves. (NOTE 1, NOTE 2)	
duration	DurationSec	M	1	This attribute identifies the time duration the UE stays in the location. If the analytics result applies for a group of UEs, it indicates the average duration for the group of UEs.	
durationVariance	Float	C	0..1	This attribute indicates the variance of the analysed durations for the group of UEs. It shall be provided if the analytics result applies for a group of UEs.	
locInfos	array(LocationInfo)	M	1..N	This attribute includes a list of UE location information during the time duration.	
NOTE 1: Either "ts" or "recurringTime" shall be provided. NOTE 2: If this attribute is present, it indicates the UE movement is periodic. This attribute is suitable to be present for a recurring mobility in a long observation time.					

5.1.6.2.11 Type LocationInfo

Table 5.1.6.2.11-1: Definition of type LocationInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
loc	UserLocation	M	1	This attribute contains the detailed location, the ueLocationTimestamp attribute in the 3GPP access type of UserLocation data type shall not be provided.	
ratio	SamplingRatio	C	0..1	This attribute contains the percentage of UEs with same analytics result in the group. Shall be present if the analytics result applies for a group of UEs.	
confidence	Uinteger	C	0..1	Indicates the confidence of the prediction. (NOTE) Shall be present if the analytics result is a prediction. Minimum = 0. Maximum = 100.	
NOTE: If the requested period identified by the "startTs" and "endTs" attributes in the "EventReportingRequirement" type is a future time period, which means the analytics result is a prediction. If no sufficient data is collected to provide the confidence of the prediction before the time deadline, the NWDAF shall return a zero confidence.					

5.1.6.2.12 Void

5.1.6.2.13 Type UeCommunication

Table 5.1.6.2.13-1: Definition of type UeCommunication

Attribute name	Data type	P	Cardinality	Description	Applicability
commDur	DurationSec	M	1	Identifies the duration of the communication. If the analytics result applies for a group of UEs, it indicates the average duration for the subset of UEs indicated by a given ratio in the group.	
commDurVariance	Float	C	0..1	This attribute indicates the variance of the analysed durations for the subset of UEs indicated by a given ratio in the group. It shall be provided if the analytics result applies for a group of UEs.	
perioTime	DurationSec	O	0..1	Identifies interval time of periodic communication, e.g. every 10 minutes or 1 hour. (NOTE 2) If the analytics result applies for a group of UEs, it indicates the average interval time of periodic communication for the subset of UEs indicated by a given ratio in the group.	
perioTimeVariance	Float	C	0..1	This attribute indicates the variance of the analysed intervals of periodic communication for the subset of UEs indicated by a given ratio in the group. It shall be provided if the analytics result applies for a group of UEs.	
ts	DateTime	C	0..1	Identifies the start time of the communication. (NOTE 1)	
tsVariance	Float	O	0..1	This attribute indicates the variance of the analysed start time for the subset of UEs indicated by a given ratio in the group. It may only be provided if the ts attribute is provided.	
recurringTime	ScheduledCommunicationTime	C	0..1	Identifies time of the day and day of the week which are valid within the observation period when the UE has communication. Providing the end time in ScheduledCommunicationTime data type is not required. (NOTE 1, NOTE 3)	
trafChar	TrafficCharacterization	M	1	Identifies the detailed traffic characterization.	
ratio	SamplingRatio	C	0..1	This attribute contains the percentage of UEs with same analytics result in the group. Shall be present if the analytics result applies for a group of UEs.	
perioCommInd	boolean	O	0..1	This attribute indicates whether the UE communicates periodically or not.	UeCommunicationExt
confidence	Uinteger	C	0..1	Indicates the confidence of the prediction. (NOTE 4) Shall be present if the analytics result is a prediction.	

				Minimum = 0. Maximum = 100.	
anaOfAppList	AppListForUeComm	C	0..1	Represents the analytics of the application list used by UE. Shall be present if one of the elements in the "listOfAnaSubsets" attribute was set to APP_LIST_FOR_UE_COMM.	UeCommunicationExt
sessInactTimer	SessInactTimerForUeComm	C	0..1	Represents the N4 Session inactivity timer. Shall be present if one of the element in the "listOfAnaSubsets" attribute was set to N4_SESS_INACT_TIMER_FOR_UE_COMM.	UeCommunicationExt

NOTE 1: Either "ts" or "recurringTime" shall be provided.
NOTE 2: If this attribute is present, it indicates the communication is periodic and its value shall be larger than the commDur value. If this attribute is present with the ts attribute, it indicates the periodic communication time valid within the observation period; if it is present with the recurringTime attribute, it indicates the periodic communication time valid within the day(s).
NOTE 3: If this attribute is present, it indicates the communication is periodic. This attribute is suitable to be present for a recurring communication in a long observation time.
NOTE 4: If the requested period identified by the "startTs" and "endTs" attributes in the EventReportingRequirement type is a future time period, which means the analytics result is a prediction. If no sufficient data is collected to provide the confidence of the prediction before the time deadline, the NWDAF shall return a zero confidence.

5.1.6.2.14 Type TrafficCharacterization

Table 5.1.6.2.14-1: Definition of type TrafficCharacterization

Attribute name	Data type	P	Cardinality	Description	Applicability
appId	ApplicationId	O	0..1	Contains the application identifier.	
dnn	Dnn	O	0..1	Identifies DNN, a full DNN with both the Network Identifier and Operator Identifier, or a DNN with the Network Identifier only. Shall be present if the "dnns" was provided within EventSubscription during the subscription for event notification procedure.	
snssai	Snssai	C	0..1	Identifies the network slice. Shall be present if the "snssais" was provided within EventSubscription during the subscription for event notification procedure.	
fDescs	array(IpEthFlowDescription)	O	1..2	Contains the flow description for the Uplink and/or Downlink flows.	
ulVol	Volume	C	0..1	Identifies the uplink traffic volume. (NOTE) If the analytics result applies for a group of UEs, it indicates the average uplink traffic volume for the subset of UEs indicated by a given ratio in the group.	
ulVolVariance	Float	C	0..1	This attribute indicates the variance of the uplink traffic volumes for the subset of UEs indicated by a given ratio in the group. It shall be provided if the analytics result applies for a group of UEs.	
dlVol	Volume	C	0..1	Identifies the downlink traffic volume. (NOTE) If the analytics result applies for a group of UEs, it indicates the average downlink traffic volume for the subset of UEs indicated by a given ratio in the group.	
dlVolVariance	Float	C	0..1	This attribute indicates the variance of the downlink traffic volumes for the subset of UEs indicated by a given ratio in the group. It shall be provided if the analytics result applies for a group of UEs.	
NOTE: At least one of "ulVol" or "dlVol" shall be provided.					

5.1.6.2.15 Type AbnormalBehaviour

Table 5.1.6.2.15-1: Definition of type AbnormalBehaviour

Attribute name	Data type	P	Cardinality	Description	Applicability
supis	array(Supi)	C	1..N	Each element identifies a UE which is affected with the Exception. Shall be present if the subscription request applies to more than one UE.	
dnn	Dnn	C	0..1	Identifies DNN, a full DNN with both the Network Identifier and Operator Identifier, or a DNN with the Network Identifier only. Shall be present if the "dnns" was provided within EventSubscription during the subscription for event notification procedure.	
excep	Exception	M	1	Contains the exception information.	
snssai	Snssai	C	0..1	Identifies the network slice information. Shall be present if the "snssais" was provided within EventSubscription during the subscription for event notification procedure.	
ratio	SamplingRatio	C	0..1	Contains the percentage of UEs with same analytics result in the group or among all UEs. Shall be present if the analytics result applies for a group of UEs or any UE.	
confidence	Uinteger	C	0..1	Indicates the confidence of the prediction. (NOTE) Shall be present if the analytics result is a prediction. Minimum = 0. Maximum = 100.	
addtMeasInfo	AdditionalMeasurement	O	0..1	Additional measurement.	
NOTE: If the requested period identified by the "startTs" and "endTs" attributes in the "EventReportingRequirement" type is a future time period, which means the analytics result is a prediction. If no sufficient data is collected to provide the confidence of the prediction before the time deadline, the NWDAF shall return a zero confidence.					

5.1.6.2.16 Type Exception

Table 5.1.6.2.16-1: Definition of type Exception

Attribute name	Data type	P	Cardinality	Description	Applicability
excepId	ExceptionId	M	1	Indicating the Exception ID.	
excepLevel	integer	O	0..1	Measured level, compared to the threshold	
excepTrend	ExceptionTrend	O	0..1	Measured trend	

5.1.6.2.17 Type UserDataCongestionInfo

Table 5.1.6.2.17-1: Definition of type UserDataCongestionInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
networkArea	NetworkAreaInfo	M	1	Identification of network area to which the subscription applies.	
congestionInfo	CongestionInfo	M	1	The congestion information of the specific location.	
snssai	Snssai	C	0..1	Identifies an S-NSSAI. Shall be present if the "snssais" was provided within EventSubscription during the subscription for event notification procedure.	

5.1.6.2.18 Type CongestionInfo

Table 5.1.6.2.18-1: Definition of type CongestionInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
congType	CongestionType	M	1	Identification congestion analytics type.	
timeIntev	TimeWindow	M	1	Represents the start time and the stop time to which requested for the congestion information applies.	
nsi	ThresholdLevel	M	1	Network Status Indication.	
confidence	Uinteger	C	0..1	Indicates the confidence of the prediction. (NOTE) Shall be present if the analytics result is a prediction. Minimum = 0. Maximum = 100.	
topAppListUl	array(TopApplication)	C	1..N	List of top applications in Uplink. Shall be present if one of the elements in the "listOfAnaSubsets" attribute was set to LIST_OF_TOP_APP_UL.	UserDataCongestionExt
topAppListDl	array(TopApplication)	C	1..N	List of top applications in Downlink. Shall be present if one of the elements in the "listOfAnaSubsets" attribute was set to LIST_OF_TOP_APP_DL.	UserDataCongestionExt

NOTE: If the requested period identified by the "startTs" and "endTs" attributes in the EventReportingRequirement type is a future time period, which means the analytics result is a prediction. If no sufficient data is collected to provide the confidence of the prediction before the time deadline, the NWDAF shall return a zero confidence.

5.1.6.2.19 Type QosSustainabilityInfo

Table 5.1.6.2.19-1: Definition of type QosSustainabilityInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
areaInfo	NetworkAreaInfo	M	1	Identification(s) of applicable location areas to which the subscription.	
startTs	DateTime	M	1	Represents the start time of the applicable observing period.	
endTs	DateTime	M	1	Represents the end time of the applicable observing period.	
qosFlowRetThd	RetainabilityThreshold	C	0..1	The reporting QoS Flow Retainability Threshold that are met or crossed for 5QI of GBR resource type. (NOTE 1)	
ranUeThrouThd	BitRate	C	0..1	The reporting RAN UE Throughput Threshold that are met or crossed for 5QI of non-GBR resource type. (NOTE 1)	
snssai	Snssai	C	0..1	Identifies an S-NSSAI. Shall be present if the "snssais" was provided within EventSubscription during the subscription for event notification procedure.	
confidence	Uinteger	C	0..1	Indicates the confidence of the prediction. (NOTE 2) Shall be present if the analytics result is a prediction. Minimum = 0. Maximum = 100.	

NOTE 1: Either "qosFlowRetThd" or "ranUeThrouThd" attribute shall be provided.
NOTE 2: If the requested period identified by the "startTs" and "endTs" attributes in the EventReportingRequirement type is a future time period, which means the analytics result is a prediction. If no sufficient data is collected to provide the confidence of the prediction before the time deadline, the NWDAF shall return a zero confidence.

5.1.6.2.20 Type QosRequirement

Table 5.1.6.2.20-1: Definition of type QosRequirement

Attribute name	Data type	P	Cardinality	Description	Applicability
5qi	5Qi	C	0..1	Represents a 5G QoS Identifier. It shall be included for standardized or preconfigured 5QIs. (NOTE)	
gfbrUl	BitRate	C	0..1	Indicates GFBR in the uplink. It shall be included for GBR 5QIs.	
gfbrDl	BitRate	C	0..1	Indicates GFBR in the downlink. It shall be included for GBR 5QIs.	
resType	QosResourceType	C	0..1	Resource type. Shall be provided for the non-standardized and non-preconfigured QoS characteristics. (NOTE)	
pdb	PacketDelBudget	O	0..1	Packet Delay Budget. May be supplied for the non-standardized and non-pre-configured QoS characteristics.	
per	PacketErrRate	O	0..1	Packet Error Rate. May be supplied for the non-standardized and non-pre-configured QoS characteristics.	
NOTE: Either 5QI within "5qi" attribute or the resource type within "resType" attribute shall be provided.					

5.1.6.2.21 Type RetainabilityThreshold

Table 5.1.6.2.21-1: Definition of type RetainabilityThreshold

Attribute name	Data type	P	Cardinality	Description	Applicability
relFlowNum	Uinteger	C	0..1	Represents the number of abnormally released QoS flows. (NOTE)	
relTimeUnit	TimeUnit	C	0..1	Represents the unit for the session active time, shall be present if relFlowNum is present. (NOTE)	
relFlowRatio	SamplingRatio	C	0..1	Represents the ratio of abnormally released QoS flows to the total released QoS flows, expressed in percentage. (NOTE)	
NOTE: Either "relFlowNum" and its associated "relTimeUnit" attributes or "relFlowRatio" attributes shall be provided. The "relFlowNum" and "relTimeUnit" attributes together represents the number of abnormally released QoS flows (i.e. relFlowNum) within the time unit (i.e. relTimeUnit).					

5.1.6.2.22 Type NetworkPerfRequirement

Table 5.1.6.2.22-1: Definition of type NetworkPerfRequirement

Attribute name	Data type	P	Cardinality	Description	Applicability
nwPerfType	NetworkPerfType	M	1	The type of the network performance.	
relativeRatio	SamplingRatio	C	0..1	The relative ratio expressed in percentage. (NOTE)	
absoluteNum	Uinteger	C	0..1	The absolute number (NOTE)	
NOTE: Either "relativeRatio" or "absoluteNum" shall be provided if the "notifMethod" in "evtReq" is set to "ON_EVENT_DETECTION" or "notificationMethod" in "eventSubscriptions" is set to "THRESHOLD" or omitted.					

5.1.6.2.23 Type NetworkPerfInfo

Table 5.1.6.2.23-1: Definition of type NetworkPerfInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
networkArea	NetworkAreaInfo	M	1	Identification of network area to which the subscription applies.	
nwPerfType	NetworkPerfType	M	1	The type of the network performance	
relativeRatio	SamplingRatio	C	0..1	The reported relative ratio expressed in percentage. (NOTE 1)	
absoluteNum	Uinteger	C	0..1	The reported absolute number (NOTE 1)	
confidence	Uinteger	C	0..1	Indicates the confidence of the prediction. (NOTE 2) Shall be present if the analytics result is a prediction. Minimum = 0. Maximum = 100.	

NOTE 1: Either "relativeRatio" or "absoluteNum" shall be provided.
NOTE 2: If the requested period identified by the "startTs" and "endTs" attributes in the EventReportingRequirement type is a future time period, which means the analytics result is a prediction. If no sufficient data is collected to provide the confidence of the prediction before the time deadline, the NWDAF shall return a zero confidence.

5.1.6.2.24 Type ServiceExperienceInfo

Table 5.1.6.2.24-1: Definition of type ServiceExperienceInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
svcExprc	SvcExperience	M	1	Service experience	
svcExprcVariance	Float	O	0..1	This attribute indicates the variance .	
supis	array(Supi)	O	1..N	Each element identifies a UE. May only be present if the subscription request applies to more than one UE. (NOTE 3)	
snssai	Snssai	C	0..1	Identifies an S-NSSAI. Shall be presented if the "snssais" was provided within EventSubscription during the subscription for event notification procedure.	
appId	ApplicationId	C	0..1	Identifies an application. Shall be present if the "appIds" was provided within EventSubscription during the subscription for event notification procedure.	
srvExpcType	ServiceExperienceType	O	0..1	Indicates the type of Service Experience analytics.	ServiceExperienceExt
ueLocs	array(LocationInfo)	C	1..N	This attribute includes a list of UE location information during the time duration. Shall be present if one of the element in the "listOfAnaSubsets" attribute was set to UE_LOCATION. (NOTE 2)	ServiceExperienceExt
upfInfo	UpfInformation	C	0..1	Represents the information of the UPF serving the UE. Shall be present if the "upfInfo" attribute was provided in the request or subscription.	ServiceExperienceExt
dnai	Dnai	C	0..1	Indicates the DN Access Identifier representing location of the service flow. Shall be present if the "dnais" attribute was provided in the request or subscription. Shall be present if the "dnais" attribute was provided in the request or subscription.	ServiceExperienceExt
appServerInst	AddrFqdn	C	0..1	Represents the Application Server Instance (IP address or FQDN of the Application Server). Shall be present if the "appServerAddrs" attribute was provided in the request or subscription.	ServiceExperienceExt
confidence	Uinteger	C	0..1	Indicates the confidence of the prediction. (NOTE 1) Shall be present if the analytics result is a prediction. Minimum = 0. Maximum = 100.	
dnn	Dnn	C	0..1	Identifies DNN, a full DNN with both the Network Identifier and Operator Identifier, or a DNN with the Network Identifier only. Shall be present if the "dnns"	

				was provided within EventSubscription during the subscription for event notification procedure.	
networkArea	NetworkAreaInfo	C	0..1	Identifies the network area where the service experience applies. Shall be presented if the "networkArea" was provided within EventSubscription during the subscription for event notification procedure.	
nsiId	NsiId	C	0..1	Identifies a network slice instance which is associated with the S-NSSAI identified by the "snssai" attribute. Shall be presented if the "nsiIds" was provided within the NsiIdInfo data in the EventSubscription data during the subscription.	
ratio	SamplingRatio	C	0..1	Contains the percentage of UEs with same analytics result in the group or among all UEs. Shall be present if the analytics result applies for a group of UEs or any UE. (NOTE 3)	
ratFreq	RatFreqInformation	C	0..1	Identification of the RAT type(s) and/or frequency(ies) of UE's serving cell(s) which the subscription/request applies. Shall be present if the "ratFreqs" was provided in the EventSubscription data during the subscription. When "allRat" and/or "allFreq" are included in the subscription, the NWDAF provides an instance of the Application service experience per combination of RAT Type(s) and/or Frequency value(s) having the same Service Experience.	ServiceExperienceExt

NOTE 1: If the requested period identified by the "startTs" and "endTs" attributes in the "EventReportingRequirement" type is a future time period, which means the analytics result is a prediction. If no sufficient data is collected to provide the confidence of the prediction before the time deadline, the NWDAF shall return a zero confidence.

NOTE 2: The "ueLocs" attribute shall only be included if the consumer analytics request is for a single UE or a list of UEs. Inclusion of such UE location requires user consent during the UE location data collection.

NOTE 3: The SUPI list and Ratio in the service experience information for an application may be omitted if the reported service experience information is provided and is assigned with the same value(s) for the slice instance which the application belongs to. Otherwise, the SUPI list and Ratio shall be provided for an application service experience.

5.1.6.2.25 Type BwRequirement

Table 5.1.6.2.25-1: Definition of type BwRequirement

Attribute name	Data type	P	Cardinality	Description	Applicability
appId	ApplicationId	M	1	Represents an application. (NOTE)	
marBwUl	BitRate	O	0..1	Maximum requested bandwidth for the Uplink.	
marBwDl	BitRate	O	0..1	Maximum requested bandwidth for the Downlink.	
mirBwUl	BitRate	O	0..1	Minimum requested bandwidth for the Uplink.	
mirBwDl	BitRate	O	0..1	Minimum requested bandwidth for the Downlink.	
NOTE: If the "appIds" attribute is provided within EventSubscription data, this attribute shall be indicated by the "appIds" attribute.					

5.1.6.2.26 Type AdditionalMeasurement

Table 5.1.6.2.26-1: Definition of type AdditionalMeasurement

Attribute name	Data type	P	Cardinality	Description	Applicability
unexpLoc	NetworkAreaInfo	C	0..1	The unexpected locations which the UE stays. It may only be present when the "excepId" within the Exception data sets to "UNEXPECTED_UE_LOCATION"	
unexpFlowTeps	array(IpEthFlowDescription)	C	1..N	Unexpected IP or Ethernet flow templates. It may only be present when the "excepId" within the Exception data sets to "UNEXPECTED_LONG_LIVE_FLOW" or "UNEXPECTED_LARGE_RATE_FLOW".	
unexpWakes	array(DateTime)	C	1..N	Unexpected wake up times. It may only be present when the "excepId" within the Exception data sets to "UNEXPECTED_WAKEUP".	
ddosAttack	AddressList	C	0..1	Victim's address list. It may only be present when the "excepId" within the Exception data sets to "SUSPICION_OF_DDOS_ATTACK".	
wrgDest	AddressList	C	0..1	Wrong destination address list. It may only be present when the "excepId" within the Exception data sets to "WRONG_DESTINATION_ADDRESS".	
circums	array(CircumstanceDescription)	C	1..N	The description of circumstances. It may only be present when the "excepId" within the Exception data sets to "TOO_FREQUENT_SERVICE_ACCESS", "UNEXPECTED_RADIO_LINK_FAILURES" or "PING_PONG_ACROSS_CELLS".	

5.1.6.2.27 Type IpEthFlowDescription

Table 5.1.6.2.27-1: Definition of type FlowDescription

Attribute name	Data type	P	Cardinality	Description	Applicability
ipTrafficFilter	FlowDescription	C	0..1	Identifies IP packet filter.(NOTE)	
ethTrafficFilter	EthFlowDescription	C	0..1	Identifies Ethernet packet filter.(NOTE)	
NOTE: Either "ipTrafficFilter" or "ethTrafficFilter" shall be provided.					

5.1.6.2.28 Type AddressList

Table 5.1.6.2.28-1: Definition of type AddressList

Attribute name	Data type	P	Cardinality	Description	Applicability
ipv4Addrs	array(Ipv4Addr)	O	1..N	Each element identifies an IPv4 address.	
ipv6Addrs	array(Ipv6Addr)	O	1..N	Each element identifies an IPv6 address.	
NOTE: At least one of "ipv4Addrs" or "ipv6Addrs" shall be provided.					

5.1.6.2.29 Type CircumstanceDescription

Table 5.1.6.2.29-1: Definition of type CircumstanceDescription

Attribute name	Data type	P	Cardinality	Description	Applicability
freq	Float	O	0..1	Communication frequency of the UE in units of MHz.	
tm	DateTime	O	0..1	Time when UE enters the location.	
locArea	NetworkAreaInfo	C	0..1	The location of the UE. It shall be present when the "excepId" within the Exception data sets to "UNEXPECTED_RADIO_LINK_FAILURES" or "PING_PONG_ACROSS_CELLS".	
vol	Volume	C	0..1	The traffic volume. It shall be present when the "excepId" within the Exception data sets to "TOO_FREQUENT_SERVICE_ACCESS" or "UNEXPECTED_LARGE_RATE_FLOW ".	

5.1.6.2.30 Type ThresholdLevel

Table 5.1.6.2.30 -1: Definition of type ThresholdLevel

Attribute name	Data type	P	Cardinality	Description	Applicability
congLevel	integer	C	0..1	Value of Congestion that triggers notification (NOTE 1)	UserDataCongestion
nfLoadLevel	integer	C	0..1	Value of NF Load that triggers notification (NOTE 2) Minimum = 0. Maximum = 100.	NfLoad
nfCpuUsage	integer	C	0..1	Value of NF CPU Usage that triggers notification (NOTE 2) Minimum = 0. Maximum = 100.	NfLoad
nfMemoryUsage	integer	C	0..1	Average usage of memory (NOTE 2) Minimum = 0. Maximum = 100.	NfLoad
nfStorageUsage	integer	C	0..1	Average usage of storage (NOTE 2) Minimum = 0. Maximum = 100.	NfLoad
avgTrafficRate	BitRate	C	0..1	Threshold level of average traffic rate. Shall be present if one of the elements in the "listOfAnaSubsets" attribute was set to AVG_TRAFFIC_RATE. (NOTE 3)	DnPerformance
maxTrafficRate	BitRate	C	0..1	Threshold level of maximum traffic rate. Shall be present if one of the elements in the "listOfAnaSubsets" attribute was set to MAX_TRAFFIC_RATE. (NOTE 3)	DnPerformance
avgPacketDelay	PacketDelBudget	C	0..1	Threshold level of average Packet Delay. Shall be present if one of the elements in the "listOfAnaSubsets" attribute was set to AVG_PACKET_DELAY. (NOTE 3)	DnPerformance
maxPacketDelay	PacketDelBudget	C	0..1	Threshold level of maximum Packet Delay. Shall be present if one of the elements in the "listOfAnaSubsets" attribute was set to MAX_PACKET_DELAY. (NOTE 3)	DnPerformance
avgPacketLossRate	PacketLossRate	C	0..1	Threshold level of average Loss Rate. Shall be present if one of the elements in the "listOfAnaSubsets" attribute was set to AVG_PACKET_LOSS_RATE. (NOTE 3)	DnPerformance
svcExpLevel	float	C	0..1	Service Experience MOS value. Shall be present when subscribed event is "SERVICE_EXPERIENCE".	ServiceExperienceExt

NOTE 1: This attribute shall be provided when subscribed event is "USER_DATA_CONGESTION".
NOTE 2: At least one attribute should be provided when subscribed event is "NF_LOAD".
NOTE 3: At least one attribute should be provided when subscribed event is "DN_PERFORMANCE".

5.1.6.2.31 Type NfLoadLevelInformation

Table 5.1.6.2.31-1: Definition of type NfLoadLevelInformation

Attribute name	Data type	P	Cardinality	Description	Applicability
nfType	NFType	M	1	Type of the NF instance	
nfInstanceId	NfInstanceId	M	1	Identification of the NF instance	
nfSetId	NfSetId	O	0..1	Identification of the NF instance set	
nfStatus	NfStatus	C	0..1	Availability status of the NF (NOTE 1)	
nfCpuUsage	integer	C	0..1	Average usage CPU (NOTE 1, NOTE 2) Minimum = 0. Maximum = 100.	
nfMemoryUsage	integer	C	0..1	Average usage of memory (NOTE 1, NOTE 2) Minimum = 0. Maximum = 100.	
nfStorageUsage	integer	C	0..1	Average usage of storage (NOTE 1, NOTE 2) Minimum = 0. Maximum = 100.	
nfLoadLevelAverage	integer	C	0..1	Average load information (NOTE 1, NOTE 2) Minimum = 0. Maximum = 100.	
nfLoadLevelPeak	integer	C	0..1	Peak load information (NOTE 1, NOTE 2) Minimum = 0. Maximum = 100.	
nfLoadAvgInAoi	integer	C	0..1	The average load of the NF instances over the area of interest. (NOTE 1, NOTE 2, NOTE 4) Minimum = 0. Maximum = 100.	NfLoadExt
snssai	Snssai	C	0..1	Identifies an S-NSSAI. Shall be present if the "snssais" was provided within EventSubscription during the subscription for event notification procedure.	
confidence	Uinteger	C	0..1	Indicates the confidence of the prediction. (NOTE 3) Shall be present if the analytics result is a prediction. Minimum = 0. Maximum = 100.	

NOTE 1: At least one value shall be provided. If the "listofAnaSubsets" attribute with value only applicable to NF_LOAD event is present in the subscription request, then only the corresponding attribute(s) shall be present.
NOTE 2: The values are percentages which are provided as estimated over a given period.
NOTE 3: If the requested period identified by the "startTs" and "endTs" attributes in the EventReportingRequirement type is a future time period, which means the analytics result is a prediction. If no sufficient data is collected to provide the confidence of the prediction before the time deadline, the NWDAF shall return a zero confidence.
NOTE 4: Applicable only to AMF load If the "networkArea" attribute is present in the subscription request.

5.1.6.2.32 Type NfStatus

Table 5.1.6.2.32-1: Definition of type NfStatus

Attribute name	Data type	P	Cardinality	Description	Applicability
statusRegistered	SamplingRatio	C	0..1	Percentage of time with status "registered" (NOTE)	
statusUnregistered	SamplingRatio	C	0..1	Percentage of time with status "unregistered" (NOTE)	
statusUndiscoverable	SamplingRatio	C	0..1	Percentage of time with status "undiscoverable" (NOTE)	

NOTE: The availability statuses of the NF on the Analytics target period are expressed as a percentage of time. The total of status values should be equal or lower than 100%. At least one value shall be provided.

5.1.6.2.33 Type NsiIdInfo

Table 5.1.6.2.33-1: Definition of type NsiIdInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
snssai	Snssai	M	1	Identification of network slice to which the subscription for event notification procedure applies.	
nsiIds	array(NsiId)	O	1..N	Identification of network slice instance(s) associated with the subscribed S-NSSAI identified by the "snssai" attribute. May be included when subscribed event is "NSI_LOAD_LEVEL" or "SERVICE_EXPERIENCE". (NOTE)	
NOTE: This attribute is not applicable when the NF service consumer is CEF or PCF.					

5.1.6.2.34 Type NsiLoadLevelInfo

Table 5.1.6.2.34-1: Definition of type NsiLoadLevelInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
loadLevelInformation	LoadLevelInformation	M	1	Load level information of the network slice identified by the "snssai" attribute and if provided, the associated NSI ID identified by the "nsiId" attribute.	
snssai	Snssai	M	1	Identification of network slice to which the subscription applies.	
nsiId	NsiId	C	0..1	Identification of network slice instance associated with the S-NSSAI identified by the "snssai" attribute. Shall be presented if the "nsiIds" attribute was provided within the NsiIdInfo data in the EventSubscription data during the subscription.	
resUsage	ResourceUsage	C	0..1	The current usage of the virtual resources assigned to the NF instances belonging to a particular network slice instance. Shall be present if one of the element in the "listOfAnaSubsets" attribute was set to RES_USAGE.	NsiLoadExt
numOfExceedLoadLevelThr	integer	C	0..1	Indicates the number of times the resource usage threshold of the network slice instance is reached or exceeded if a threshold value is provided by the consumer. Shall be present if one of the element in the "listOfAnaSubsets" attribute was set to NUM_OF_EXCEED_RES_USAGE_LOAD_LEVEL_THR.	NsiLoadExt
exceedLoadLevelThrInd	boolean	C	0..1	Indicates whether the Load Level Threshold is met or exceeded by the statistics value. Set to "true" if the Load Level Threshold is met or exceeded, otherwise set to "false". Shall be present if one of the element in the "listOfAnaSubsets" attribute was set to EXCEED_LOAD_LEVEL_THR_IND.	NsiLoadExt
networkArea	NetworkAreaInfo	O	0..1	Identification of network area to which the subscription or analytics request applies.	NsiLoadExt
timePeriod	TimeWindow	O	0..1	Indicates a start time and a stop time of the load level information identified by the "loadLevelInformation" attribute.	NsiLoadExt
resUsgThrCrossTimePeriod	array(TimeWindow)	O	1..N	Each element indicates the time elapsed between times each threshold is met or exceeded or crossed.	NsiLoadExt
numOfUes	NumberAverage	C	0..1	Indicates the number of UE registrations at the S-NSSAI and the optionally associated network slice instance. Shall be present if one of the element in the "listOfAnaSubsets" attribute was set to NUM_OF_UE_REG.	NsiLoadExt

numOfPduSess	NumberAverage	C	0..1	Indicates the number of PDU session establishments at the S-NSSAI and the optionally associated network slice instance. Shall be present if one of the element in the "listOfAnaSubsets" attribute was set to NUM_OF_PDU_SESS_ESTBL.	NsiLoadExt
confidence	Uinteger	C	0..1	Indicates the confidence of the prediction. (NOTE) Shall be present if the analytics result is a prediction. Minimum = 0. Maximum = 100.	NsiLoadExt
NOTE: If the requested period identified by the "startTs" and "endTs" attributes in the "EventReportingRequirement" type is a future time period, which means the analytics result is a prediction. If no sufficient data is collected to provide the confidence of the prediction before the time deadline, the NWDAF shall return a zero confidence.					

5.1.6.2.35 Type FailureEventInfo

Table 5.1.6.2.35-1: Definition of type FailureEventInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
event	NwdafEvent	M	1	Event that is subscribed.	
failureCode	NwdafFailureCode	M	1	Identifies the failure reason	

5.1.6.2.36 Type AnalyticsMetadataIndication

Table 5.1.6.2.36-1: Definition of type AnalyticsMetadataIndication

Attribute name	Data type	P	Cardinality	Description	Applicability
dataWindow	TimeWindow	O	0..1	Data time window of the data samples.	
dataStatProps	array(DatasetStatisticalProperty)	O	1..N	List of dataset statistical properties of the data to be used to generate the analytics.	
strategy	OutputStrategy	O	0..1	Output strategy to be used for the reporting of the analytics.	
aggrNwdafIds	array(NfInstanceId)	O	1..N	NWDAF identifiers of NWDAF instances used by the NWDAF service consumer when aggregating multiple analytics subscriptions.	

5.1.6.2.37 Type AnalyticsMetadataInfo

Table 5.1.6.2.37-1: Definition of type AnalyticsMetadataInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
numSamples	Uinteger	O	0..1	Number of data samples used for the generation of the output analytics.	
dataWindow	TimeWindow	O	0..1	Data time window of the data samples.	
dataStatProps	array(DatasetStatisticalProperty)	O	1..N	List of dataset statistical properties of the data used to generate the analytics.	
strategy	OutputStrategy	O	0..1	Output strategy used for the reporting of the analytics.	
accuracy	Accuracy	O	0..1	Level of accuracy reached for the analytics.	

5.1.6.2.38 Type NumberAverage

Table 5.1.6.2.38-1: Definition of type NumberAverage

Attribute name	Data type	P	Cardinality	Description	Applicability
number	Float	M	1	The average number.	
variance	Float	M	1	Identifies the variance.	
skewness	Float	O	0..1	Contains the skewness.	

5.1.6.2.39 Type TopApplication

Table 5.1.6.2.39-1: Definition of type TopApplication

Attribute name	Data type	P	Cardinality	Description	Applicability
appId	ApplicationId	C	0..1	Indicates an application identifier. (NOTE)	
ipTrafficFilter	FlowInfo	C	0..1	Identifies IP packet filter. (NOTE)	
ratio	SamplingRatio	O	0..1	The application's throughput as a percentage of the total throughput in the Area of Interest.	
NOTE: Either "appId" or "ipTrafficFilter" shall be provided.					

5.1.6.2.40 Type AnalyticsSubscriptionsTransfer

Table 5.1.6.2.40-1: Definition of type AnalyticsSubscriptionsTransfer

Attribute name	Data type	P	Cardinality	Description	Applicability
subsTransInfos	array(SubscriptionTransferInfo)	M	1..N	Contains information about the subscription(s) that are requested to be transferred.	

5.1.6.2.41 Type SubscriptionTransferInfo

Table 5.1.6.2.41-1: Definition of type SubscriptionTransferInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
transReqType	TransferRequestType	M	1	Indicates the type of the transfer request (i.e. if it is a request for transfer preparation or transfer execution)	
nwdafEvSub	NnwdafEventsSubscription	M	1	Contains information about the analytics subscription that is to be transferred. (NOTE)	
consumerId	NfInstanceId	M	1	NF instance identifer of the consumer of the analytics subscription that is to be transferred.	
contextId	AnalyticsContextIdentifier	O	0..1	Identifier of analytics context information available at the NF service consumer.	
sourceNfIds	array(NfInstanceId)	O	1..N	NF instance identifer(s) of active data source(s) the NF service consumer is currently using for the analytics of the subscription that is to be transferred.	
sourceSetIds	array(NfSetId)	O	1..N	NF set identifer(s) of active data source(s) the NF service consumer is currently using for the analytics of the subscription that is to be transferred.	
modelInfos	array(ModelInfo)	O	1..N	Contains information identifying the ML model(s) that the NF service consumer is currently using for the analytics.	
NOTE: The "nwdafEvSub" attribute shall contain the "notificationURI" attribute.					

5.1.6.2.42 Type ModelInfo

Table 5.1.6.2.42-1: Definition of type ModelInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
analyticsId	NwdafEvent	M	1	Type of analytics for which this ML model is used.	
mlModelInfos	array(MLModelInfo)	M	1..N	The information of the ML models which are applicable to the event indicated by "analyticsId" attribute.	

5.1.6.2.43 Type AnalyticsContextIdentifier

Table 5.1.6.2.43-1: Definition of type AnalyticsContextIdentifier

Attribute name	Data type	P	Cardinality	Description	Applicability
subscriptionId	string	M	1	Identifies a subscription to the Nnwdaf_EventsSubscription Service.	
nfAnaCtxts	array(NwdafEvent)	O	1..N	List of analytics types for which NF related analytics contexts can be retrieved. (NOTE)	
ueAnaCtxts	array(UeAnalyticsContextDescriptor)	O	1..N	List of objects that indicate for which SUPI and analytics types combinations analytics context can be retrieved. (NOTE)	
NOTE: At least one of "nfAnaCtxts" and "ueAnaCtxts" shall be provided.					

5.1.6.2.44 Type UeAnalyticsContextDescriptor

Table 5.1.6.2.44-1: Definition of type UeAnalyticsContextDescriptor

Attribute name	Data type	P	Cardinality	Description	Applicability
supi	Supi	M	1	SUPI of the UE for which analytics context can be retrieved.	
anaTypes	array(NwdafEvent)	M	1..N	List of analytics types for which UE related analytics contexts can be retrieved.	

5.1.6.2.45 Type DnPerfInfo

Table 5.1.6.2.45-1: Definition of type DnPerfInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
appId	ApplicationId	C	0..1	Indicates an application identifier. Shall be present if the "appIds" attribute was provided in the request or subscription.	
dnn	Dnn	C	0..1	Identifies DNN, a full DNN with both the Network Identifier and Operator Identifier, or a DNN with the Network Identifier only. Shall be present if the "dnns" was provided in the request or subscription.	
snssai	Snssai	C	0..1	Identifies the network slice information. Shall be present if the "snssais" was provided in the request or subscription.	
dnPerf	array(DnPerf)	M	1..N	List of DN performances for the application.	
confidence	Uinteger	C	0..1	Indicates the confidence of the prediction. (NOTE 1) Shall be present if the analytics result is a prediction. Minimum = 0. Maximum = 100.	
NOTE 1: If the requested period identified by the "startTs" and "endTs" attributes in the "EventReportingRequirement" type is a future time period, which means the analytics result is a prediction. If no sufficient data is collected to provide the confidence of the prediction before the time deadline, the NWDAF shall return a zero confidence.					

5.1.6.2.46 Type DnPerf

Table 5.1.6.2.46-1: Definition of type DnPerf

Attribute name	Data type	P	Cardinality	Description	Applicability
appServerInsAddr	AddrFqdn	C	0..1	Represents the Application Server Instance (IP address/FQDN of the Application Server). Shall be present if the "appServerAddrs" attribute was provided in the request or subscription.	
upfInfo	UpfInformation	C	0..1	Identifies the UPF. Shall be present if the "upfInfo" attribute was provided in the request or subscription.	
dnai	Dnai	C	0..1	Indicates the DN Access Identifier representing location of the service flow. Shall be present if the "dnais" attribute was provided in the request or subscription.	
perfData	PerfData	M	1	Represents the performance data.	
spatialValidCon	NetworkAreaInfo	C	0..1	Represents the area where the DN performance analytics applies. Shall be present if "networkArea" attribute was provided in the request or subscription.	
temporalValidCon	TimeWindow	O	0..1	Represents the valid period for the DN performance analytics.	

5.1.6.2.47 Type PerfData

Table 5.1.6.2.47-1: Definition of type PerfData

Attribute name	Data type	P	Cardinality	Description	Applicability
avgTrafficRate	BitRate	O	0..1	Indicates average traffic rate.	
maxTrafficRate	BitRate	O	0..1	Indicates maximum traffic rate.	
avePacketDelay	PacketDelBudget	O	0..1	Indicates average Packet Delay.	
maxPacketDelay	PacketDelBudget	O	0..1	Indicates maximum Packet Delay.	
avgPacketLossRate	PacketLossRate	O	0..1	Indicates average Loss Rate.	

5.1.6.2.48 Type ResourceUsage

Table 5.1.6.2.48-1: Definition of type ResourceUsage

Attribute name	Data type	P	Cardinality	Description	Applicability
cpuUsage	Uinteger	O	0..1	Average usage of virtual CPU. (NOTE) Minimum=0. Maximum=100.	
memoryUsage	Uinteger	O	0..1	Average usage of memory. (NOTE) Minimum=0. Maximum=100.	
storageUsage	Uinteger	O	0..1	Average usage of storage. (NOTE) Minimum=0. Maximum=100.	
NOTE: The values are percentages which are provided as estimated over a given period.					

5.1.6.2.49 Type ConsumerNfInformation

Table 5.1.6.2.49-1: Definition of type ConsumerNfInformation

Attribute name	Data type	P	Cardinality	Description	Applicability
nfId	NfInstanceId	C	0..1	Identifies the analytics consumer NF instance. (NOTE)	
nfSetId	NfSetId	C	0..1	Identifies the analytics consumer NF set. (NOTE)	
taiList	array(Tai)	C	1..N	The list of TAIs the analytics consumer NF can serve. (NOTE)	
NOTE: Either "taiList" or one of "nfId", "nfSetId" shall be provided.					

5.1.6.2.50 Type DispersionRequirement

Table 5.1.6.2.50-1: Definition of type DispersionRequirement

Attribute name	Data type	P	Cardinality	Description	Applicability
disperType	DispersionType	M	1	Indicates the required dispersion analytics type.	
classCriters	array(ClassCriterion)	C	1..N	Indicates the dispersion mobility class criterion for fixed, camper and/or traveller UE, and/or the top-heavy UE dispersion class criterion.	
rankCriters	array(RankingCriterion)	O	1..N	Indicates the usage ranking criterion between the high, medium and low usage UE.	
dispOrderCriter	DispersionOrderingCriterion	O	0..1	Indicates the ordering criterion for the list of UE Dispersion Analytics information.	
order	MatchingDirection	O	0..1	Indicate the order: ascending or descending. May be present when the "dispOrderCriter" attribute is included. (NOTE)	
NOTE: "CROSSED" value in date type "MatchingDirection" is not applicable for the "order" attribute.					

5.1.6.2.51 Type ClassCriterion

Table 5.1.6.2.51-1: Definition of type ClassCriterion

Attribute name	Data type	P	Cardinality	Description	Applicability
disperClass	DispersionClass	M	1	Indicates the dispersion class.	
classThreshold	SamplingRatio	M	1	Indicates the dispersion class threshold.	
thresMatch	MatchingDirection	M	1	Indicates the dispersion class threshold matching direction. (NOTE)	
NOTE: "CROSSED" value in date type "MatchingDirection" is not applicable for the "thresMatch" attribute.					

5.1.6.2.52 Type RankingCriterion

Table 5.1.6.2.52-1: Definition of type RankingCriterion

Attribute name	Data type	P	Cardinality	Description	Applicability
highBase	SamplingRatio	M	1	Indicates the "high" ranking bottom baseline percentage.	
lowBase	SamplingRatio	M	1	Indicates the "low" ranking top baseline percentage.	
NOTE: UE is ranked high (i.e.value 1), medium (2) or low (3) when its data/transactions dispersed during the period of observation at the location/slice, is higher than "highBase" attribute value, within the range between the "highBase" attribute to "lowBase" attribute value or less than "lowBase" value, respectively.					

5.1.6.2.53 Type DispersionInfo

Table 5.1.6.2.53-1: Definition of type DispersionInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
tsStart	DateTime	M	1	Indicates the timestamp when the time slot starts during the Analytics target period.	
tsDuration	DurationSec	M	1	Indicates the time slot duration.	
disperCollects	array(Dispersion Collection)	M	1..N	Dispersion collections on UE location(s) and/or slice(s).	
disperType	DispersionType	M	1	Indicates the dispersion type. Only applicable to DVDA or TDA value.	

5.1.6.2.54 Type DispersionCollection

Table 5.1.6.2.54-1: Definition of type DispersionCollection

Attribute name	Data type	P	Cardinality	Description	Applicability
ueLoc	UserLocation	C	0..1	TA or cells where the UE or group of UEs dispersed its transactions and/or data. Shall be present if "networkArea" attribute is included in the event subscription or analytics request. (NOTE 1)	
snssai	Snssai	C	0..1	Slice where the UE or group of UEs disperse its transactions and/or data. Shall be present if "snssais" attribute is included in the event subscription or analytics request. (NOTE 1)	
supis	array(Supi)	C	1..N	Each element identifies a SUPI of an UE. May only be present if reporting inside 5GC and the event subscription or analytics request applies to more than one UE. (NOTE 2)	
gpsis	array(Gpsi)	C	1..N	Each element identifies a GPSI of an UE. May only be present if reused by the Nnef_AnalyticsExposure service reporting to external AF and the event subscription or analytics request applies to more than one UE. (NOTE 2)	
appVolumes	array(Application Volume)	O	1..N	Application data volumes. May be present if "appIds" attribute is included in the event subscription or analytics request (NOTE 6).	
disperAmount	Uinteger	C	0..1	Indicates the dispersion amount of the reported data volume or transaction dispersion type. Shall be present if one of the elements in the "listOfAnaSubsets" attribute was set to DISPER_AMOUNT. (NOTE 3)	
disperClass	DispersionClass	C	0..1	Indicates the UE dispersion mobility class: fixed, camper, traveller, and/or the top-heavy dispersion class. Shall be present if one of the elements in the "listOfAnaSubsets" attribute was set to DISPER_CLASS. (NOTE 3, NOTE 5).	
usageRank	integer	C	0..1	Usage ranked high (i.e.value 1), medium (2) or low (3). Shall be present if one of the elements in the "listOfAnaSubsets" attribute was set to RANKING. (NOTE 3, NOTE 6).	
percentileRank	SamplingRatio	C	0..1	Percentile ranking of the target UE in the Cumulative Distribution Function of data usage for the population of all UEs. Shall be present if one of the elements in the "listOfAnaSubsets" attribute was set to PERCENTILE_RANKING.	

				(NOTE 3, NOTE 6).	
ueRatio	SamplingRatio	C	0..1	Contains the percentage of UEs with same analytics result in the group or among all UEs. Shall be present if the analytics result applies for a group of UEs or any UE.	
confidence	Uinteger	C	0..1	Indicates the confidence of the prediction. (NOTE 4) Shall be present if the analytics result is a prediction. Minimum = 0. Maximum = 100.	
NOTE 1: One of "ueLoc" attribute or "snssai" attribute shall be provided. NOTE 2: When Target of Analytics Reporting is a UE group ID, or "Any UE" and a filter for Top-Heavy UEs, fixed, camper or traveller is included in the subscription, the NWDAF shall include the list of UEs matching the filter. This information element shall not be present when Target of Analytic Reporting is "Any UE" and no filter for Top-Heavy UEs, fixed, camper or traveller is included. NOTE 3: At least one value shall be provided. If the "listofAnaSubsets" attribute with value only applicable to "DISPERSION" event is present in the subscription request, then only the corresponding attribute(s) shall be present. NOTE 4: If the requested period identified by the "startTs" and "endTs" attributes in the EventReportingRequirement type is a future time period, which means the analytics result is a prediction. If no sufficient data is collected to provide the confidence of the prediction before the time deadline, the NWDAF shall return a zero confidence. NOTE 5: This parameter may only be provided when the Target of Analytics Reporting contains the "supis" attribute or the "gpsis" attribute in the "tgt-ue" attribute. NOTE 6: This parameter shall not be provided when the "anyUe" attribute in the "tgt-ue" attribute for the Target of Analytics Reporting was set to true.					

5.1.6.2.55 Type ApplicationVolume

Table 5.1.6.2.55-1: Definition of type ApplicationVolume

Attribute name	Data type	P	Cardinality	Description	Applicability
appId	ApplicationId	M	1	Application where the UE or group of UEs disperse its transactions and/or data. May be present if "appIds" attribute is included in the event subscription or analytics request.	
appVolume	Volume	M	1	Indicates the dispersion data volume per application in units of bytes.	

5.1.6.2.56 Type RedundantTransmissionExpReq

Table 5.1.6.2.56-1: Definition of type RedundantTransmissionExpReq

Attribute name	Data type	P	Cardinality	Description	Applicability
redTOrderCriter	RedTransExpOrderingCriterion	O	0..1	Indicates the ordering criterion for the list of UE Redundant Transmission Experience Analytics information. (NOTE 1)	
order	MatchingDirection	O	0..1	Indicate the order: ascending or descending. May be present when the "redTOrderCriter" attribute is included. (NOTE 1) (NOTE 2)	
NOTE 1: If no attribute or no value is provided, default ordering may be applied. NOTE 2: "CROSSED" value in date type "MatchingDirection" is not applicable for the "order" attribute.					

5.1.6.2.57 Type RedundantTransmissionExpInfo

Table 5.1.6.2.57-1: Definition of type RedundantTransmissionInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
spatialValidCon	NetworkAreaInfo	C	0..1	Area where the Redundant Transmission Experience applies. If "networkArea" attribute was provided in the request or subscription, shall be the requested network area.	
dnn	Dnn	C	0..1	Data Network Name associated for URLLC service. Shall be present if the "dnns" attribute was provided in the request or subscription.	
redTransExps	array(RedundantTransmissionExpPerTS)	M	1..N	Redundant Transmission Experiences.	

5.1.6.2.58 Type RedundantTransmissionExpPerTS

Table 5.1.6.2.58-1: Definition of type RedundantTransmissionExpPerTS

Attribute name	Data type	P	Cardinality	Description	Applicability
tsStart	DateTime	M	1	Indicates the timestamp when the time slot starts during the Analytics target period.	
tsDuration	DurationSec	M	1	Indicates the time slot duration.	
obsvRedTransExp	ObservedRedundantTransExp	M	1	Represents the observed Redundant Transmission Experience.	
redTransStatus	boolean	O	0..1	Redundant Transmission Status. Set to "true" if redundant transmission was activated, otherwise set to "false". Default value is "false" if omitted.	
ueRatio	SamplingRatio	O	0..1	Percentage on which UE, any UE, or UE group efficiently use the PDU session with redundant transmission.	
confidence	Uinteger	C	0..1	Indicates the confidence of the prediction. (NOTE) Shall be present if the analytics result is a prediction. Minimum = 0. Maximum = 100.	
NOTE: If the requested period identified by the "startTs" and "endTs" attributes in the "EventReportingRequirement" type is a future time period, which means the analytics result is a prediction. If no sufficient data is collected to provide the confidence of the prediction before the time deadline, the NWDAF shall return a zero confidence.					

5.1.6.2.59 Type WlanPerformanceReq

Table 5.1.6.2.59-1: Definition of type WlanPerformanceReq

Attribute name	Data type	P	Cardinality	Description	Applicability
ssIds	array(string)	O	1..N	SSIDs of WLAN access points.	
bssIds	array(string)	O	1..N	BSSIDs of WLAN access points.	
wlanOrderCriter	WlanOrderingCriterion	O	0..1	Indicates the ordering criterion for the list of WLAN performance information.	
order	MatchingDirection	O	0..1	Indicate the order: ascending or descending. May be present when the "wlanOrderCriter" attribute is included. (NOTE 1)	
NOTE 1: "CROSSED" value in date type "MatchingDirection" is not applicable for the "order" attribute.					

5.1.6.2.60 Type WlanPerformanceInfo

Table 5.1.6.2.60-1: Definition of type WlanPerformanceInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
networkArea	NetworkAreaInfo	C	0..1	A list of TAIs or Cell Ids as the Area of Interest where the WLAN performance analytics applies. Shall be present if the "networkArea" attribute is included in the event subscription or analytics request.	
wlanPerSsidInfos	array(WlanPerSsIdPerformanceInfo)	M	1..N	WLAN performance information for SSID(s) of WLAN access points deployed in the Area of Interest.	

5.1.6.2.61 Type WlanPerSsIdPerformanceInfo

Table 5.1.6.2.61-1: Definition of type WlanPerSsIdPerformanceInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
ssId	string	M	1	SSID of WLAN access point.	
wlanPerTsInfos	array(WlanPerTsPerformanceInfo)	M	1..N	WLAN performance information per Time Slot during the analytics target period.	

5.1.6.2.62 Type WlanPerTsPerformanceInfo

Table 5.1.6.2.62-1: Definition of type WlanPerTsPerformanceInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
tsStart	DateTime	M	1	Indicates the timestamp when the time slot starts during the Analytics target period.	
tsDuration	DurationSec	M	1	Indicates the time slot duration.	
rssi	integer	C	0..1	Indicated the RSSI in the unit of dBm. Shall be present if one of the elements in the "listOfAnaSubsets" attribute was set to RSSI. (NOTE 1)	
rtt	Uinteger	C	0..1	Indicates the RTT in the unit of millisecond. Shall be present if one of the elements in the "listOfAnaSubsets" attribute was set to RTT. (NOTE 1)	
trafficInfo	TrafficInformation	C	0..1	Traffic information including UL/DL data rate and/or Traffic volume. Shall be present if one of the elements in the "listOfAnaSubsets" attribute was set to TRAFFIC_INFO. (NOTE 1)	
numberOfUes	Uinteger	C	0..1	Number of UEs observed for the SSID. Shall be present if one of the elements in the "listOfAnaSubsets" attribute was set to NUMBER_OF_UES. (NOTE 1)	
confidence	Uinteger	C	0..1	Indicates the confidence of the prediction. (NOTE 2) Shall be present if the analytics result is a prediction. Minimum = 0. Maximum = 100.	

NOTE 1: At least one value shall be provided. If the "listOfAnaSubsets" attribute with value only applicable to WLAN event is present in the subscription request, then only the corresponding attribute(s) shall be present.
NOTE 2: If the requested period identified by the "startTs" and "endTs" attributes in the "EventReportingRequirement" type is a future time period, which means the analytics result is a prediction. If no sufficient data is collected to provide the confidence of the prediction before the time deadline, the NWDAF shall return a zero confidence.

5.1.6.2.63 Type TrafficInformation

Table 5.1.6.2.63-1: Definition of type TrafficInformation

Attribute name	Data type	P	Cardinality	Description	Applicability
uplinkRate	BitRate	C	0..1	Uplink data rate.	
downlinkRate	BitRate	C	0..1	Downlink data rate.	
uplinkVolume	Volume	C	0..1	Uplink traffic volume in unit of octet.	
downlinkVolume	Volume	C	0..1	Downlink traffic volume in unit of octet.	
totalVolume	Volume	C	0..1	Total data octets for both uplink and downlink traffic volume.	

NOTE: At least one of above attributes shall be present.

5.1.6.2.64 Type AppListForUeComm

Table 5.1.6.2.64-1: Definition of type AppListForUeComm

Attribute name	Data type	P	Cardinality	Description	Applicability
appId	ApplicationId	M	1	Identification of the application.	
startTime	DateTime	O	0..1	The time when the UE start to use the application.	
appDur	DurationSec	O	0..1	The length of time that the UE uses the application.	
occurRatio	SamplingRatio	O	0..1	In UE Communication Statistics, it represents the proportion of UE using the application in the requested time period. In UE Communication Predictions, it represents the probability that the UE uses the application.	
spatialValidity	NetworkAreaInfo	O	0..1	The area where the service behavior applies.	

5.1.6.2.65 Type SessInactTimerForUeComm

Table 5.1.6.2.65-1: Definition of type SessInactTimerForUeComm

Attribute name	Data type	P	Cardinality	Description	Applicability
n4SessId	PduSessionId	M	1	The identification of the N4 Session.	
sessInactiveTimer	DurationSec	M	1	The value of the N4 Session inactivity timer.	

5.1.6.2.66 Type DnPerformanceReq

Table 5.1.6.2.66-1: Definition of type DnPerformanceReq

Attribute name	Data type	P	Cardinality	Description	Applicability
dnPerfOrderCriter	DnPerfOrderingCriterion	O	0..1	Indicates the preferred order criterion of a list of Network Performance analytics results.	
order	MatchingDirection	O	0..1	Indicate the order: ascending or descending. May be present when the "dispOrderCriter" attribute is included. (NOTE 1)	
reportThresholds	array(ThresholdLevel)	C	1..N	Each of the element represents the reporting threshold of an analytics subset. (NOTE 2)	
NOTE 1: "CROSSED" value in data type "MatchingDirection" is not applicable for the "order" attribute. NOTE 2: The value of "reportThresholds" attribute match in sequence with the properties in the "listOfAnaSubsets" attribute. This property shall be provided if the "notifMethod" in "evtReq" is set to "ON_EVENT_DETECTION" or "notificationMethod" in "eventSubscriptions" is set to "THRESHOLD" or omitted.					

5.1.6.2.67 Type: RatFreqInformation

Table 5.1.6.2.67-1: Definition of type RatFreqInformation

Attribute name	Data type	P	Cardinality	Description	Applicability
allFreq	boolean	C	0..1	Set to "true" to indicate to handle all the frequencies the NWDAF received, otherwise set to "false" or omit. (NOTE 1)	
allRat	boolean	C	0..1	Set to "true" to indicate to handle all the RAT types the NWDAF received, otherwise set to "false" or omit. (NOTE 1)	
freq	ArfcnValueNR	C	0..1	Idenfication of the frequency of UE's serving cell(s) where the subscription/request applies. (NOTE 1)	
ratType	RatType	C	0..1	Identification of the RAT type where the subscription/request applies. (NOTE 1)	
svcExpThreshold	ThresholdLevel	C	0..1	Service Experience Threshold value. (NOTE 2).	
matchingDir	MatchingDirection	O	0..1	The matching direction may be provided alongside the service experience threshold. If omitted, the default value is CROSSED.	

NOTE 1: The "allFreq" attribute and the "freq" attribute are mutually exclusive. The "allRat" attribute and the "ratType" attribute are mutually exclusive. If both the "allFreq" attribute and the "allRat" attribute are present, then indicate all the RAT type(s) and Frequency(ies) values the NWDAFreceived.
NOTE 2: May be present in the subscription request as the service experience threshold value(s) for the RAT Type(s) and/or Frequency value(s). If not present means all the service experience analysis shall be reported.

5.1.6.2.68 Type PrevSubInfo

Table 5.1.6.2.68-1: Definition of type PrevSubInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
producerId	NfInstanceId	C	0..1	NWDAF instance identifier to which the NF service consumer has established this subscription. (NOTE)	
producerSetId	NfSetId	C	0..1	NWDAF set identifier to which the NF service consumer has established this subscription. (NOTE)	
subscriptionId	string	M	1	The identifier of the specific analytics subscription.	
nfAnaEvents	array(NwdafEvent)	O	1..N	List of analytics types for which NF related analytics contexts can be retrieved.	
ueAnaEvents	array(UeAnalyticsContextDescriptor)	O	1..N	List of objects that indicate for which SUPI and analytics types combinations analytics context can be retrieved.	

NOTE: One of "producerId" or "producerSetId" attributes shall be provided.

5.1.6.2.69 Type MLModelInfo

Table 5.1.6.2.69-1: Definition of type MLModelInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
mlFileAddrs	array(MLModelAddr)	O	1..N	Addresses of ML model files. May be included only when the source NWDAF itself provides the trained ML model(s) for the analytics subscription(s) being transferred	
modelProvId	NfInstanceId	C	0..1	NF instance identifer of the ML model provider NWDAF from which the NF service consumer currently subscribes to the ML model information. (NOTE)	
modelProvSetId	NfSetId	C	0..1	The Set ID of NWDAF(s) to which the current NWDAF subscribe the ML model. (NOTE)	
NOTE: One of the "modelProvId" and "modelProvSetId" attributes shall be provided.					

5.1.6.2.70 Type ObservedRedundantTransExp

Table 5.1.6.2.70-1: Definition of type ObservedRedundantTransExp

Attribute name	Data type	P	Cardinality	Description	Applicability
avgPktDropRateUl	PacketLossRate	C	0..1	Average uplink packet drop rate on GTP-U path on N3. Shall be present if one of the element in the "listOfAnaSubsets" attribute was set to AVG_UL_PKT_DROP_RATE.	
varPktDropRateUl	Float	C	0..1	Variance of uplink packet drop rate on GTP-U path on N3. Shall be present if one of the element in the "listOfAnaSubsets" attribute was set to VAR_UL_PKT_DROP_RATE.	
avgPktDropRateDl	PacketLossRate	C	0..1	Average downlink packet drop rate on GTP-U path on N3. Shall be present if one of the element in the "listOfAnaSubsets" attribute was set to AVG_DL_PKT_DROP_RATE.	
varPktDropRateDl	Float	C	0..1	Variance of downlink packet drop rate on GTP-U path on N3. Shall be present if one of the element in the "listOfAnaSubsets" attribute was set to VAR_DL_PKT_DROP_RATE.	
avgPktDelayUl	PacketDelBudget	C	0..1	Average uplink packet delay round trip on GTP-U path on N3. Shall be present if one of the element in the "listOfAnaSubsets" attribute was set to AVG_UL_PKT_DELAY.	
varPktDelayUl	Float	C	0..1	Variance uplink packet delay round trip on GTP-U path on N3. Shall be present if one of the element in the "listOfAnaSubsets" attribute was set to VAR_UL_PKT_DELAY.	
avgPktDelayDl	PacketDelBudget	C	0..1	Average downlink packet delay round trip on GTP-U path on N3. Shall be present if one of the element in the "listOfAnaSubsets" attribute was set to AVG_DL_PKT_DELAY.	
varPktDelayDl	Float	C	0..1	Variance downlink packet delay round trip on GTP-U path on N3. Shall be present if one of the element in the "listOfAnaSubsets" attribute was set to VAR_DL_PKT_DELAY.	

5.1.6.3 Simple data types and enumerations

5.1.6.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

5.1.6.3.2 Simple data types

The simple data types defined in table 5.1.6.3.2-1 shall be supported.

Table 5.1.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability
AnySlice	boolean	"FALSE" represents not applicable for all slices. "TRUE" represents applicable for all slices.	
LoadLevelInformation	integer	Load level information of the network slice and the optionally associated network slice instance. Minimum = 0. Maximum = 100.	

5.1.6.3.3 Enumeration: NotificationMethod

Table 5.1.6.3.3-1: Enumeration NotificationMethod

Enumeration value	Description	Applicability
PERIODIC	The subscription of NWDAF Event is peridodicly. The periodic of the notification is identified by repetitionPeriod defined in clause 5.1.6.2.3.	
THRESHOLD	The subscription of NWDAF Event is upon threshold exceeded.	

5.1.6.3.4 Enumeration: NwdafEvent

Table 5.1.6.3.4-1: Enumeration NwdafEvent

Enumeration value	Description	Applicability
NF_LOAD	Indicates that the event subscribed is NF Load.	NfLoad
QOS_SUSTAINABILITY	Indicates that the event subscribed is QoS sustainability.	QoSSustainability
SLICE_LOAD_LEVEL	Indicates that the event subscribed is load level information of Network Slice	
SERVICE_EXPERIENCE	Indicates that the event subscribed is service experience.	ServiceExperience
UE_MOBILITY	Indicates that the event subscribed is UE mobility information.	UeMobility
UE_COMM	Indicates that the event subscribed is UE communication information.	UeCommunication
ABNORMAL_BEHAVIOUR	Indicates that the event subscribed is abnormal behaviour information.	AbnormalBehaviour
USER_DATA_CONGESTION	Indicates that the event subscribed is user data congestion information	UserDataCongestion
NETWORK_PERFORMANCE	Indicates that the event subscribed is network performance information	NetworkPerformance
NSI_LOAD_LEVEL	Indicates that the event subscribed is load level information of Network Slice and the optionally associated Network Slice Instance	NsiLoad
DISPERSION	Indicates that the event subscribed is dispersion information.	Dispersion
RED_TRANS_EXP	Indicates that the event subscribed is redundant transmission experience.	RedundantTransmissionExp
WLAN_PERFORMANCE	Indicates that the event subscribed is WLAN performance.	WlanPerformance
DN_PERFORMANCE	Indicates that the event subscribed is DN performance information.	DnPerformance
SM_CONGESTION	Indicates the Session Management Congestion Control Experience information for specific DNN and/or S-NSSAI.	SMCCE

5.1.6.3.5 Enumeration: Accuracy

Table 5.1.6.3.5-1: Enumeration Accuracy

Enumeration value	Description	Applicability
LOW	Low accuracy.	
HIGH	High accuracy.	

5.1.6.3.6 Enumeration: ExceptionId

Table 5.1.6.3.6-1: Enumeration ExceptionId

Enumeration value	Description	Applicability
UNEXPECTED_UE_LOCATION	Unexpected UE location	
UNEXPECTED_LONG_LIVE_FLOW	Unexpected long-live rate flows	
UNEXPECTED_LARGE_RATE_FLOW	Unexpected large rate flows	
UNEXPECTED_WAKEUP	Unexpected wakeup	
SUSPICION_OF_DDOS_ATTACK	Suspicion of DDoS attack	
WRONG_DESTINATION_ADDRESS	Wrong destination address	
TOO_FREQUENT_SERVICE_ACCESS	Too frequent Service Access	
UNEXPECTED_RADIO_LINK_FAILURES	Unexpected radio link failures	
PING_PONG_ACROSS_CELLS	Ping-ponging across neighbouring cells	

5.1.6.3.7 Enumeration: ExceptionTrend

Table 5.1.6.3.7-1: Enumeration ExceptionTrend

Enumeration value	Description	Applicability
UP	Up trend of the exception level.	
DOWN	Down trend of the exception level.	
UNKNOWN	Unknown trend of the exception level.	
STABLE	Stable trend of the exception level.	

5.1.6.3.8 Enumeration: CongestionType

Table 5.1.6.3.8-1: Enumeration CongestionType

Enumeration value	Description	Applicability
USER_PLANE	The congestion analytics type is User Plane.	
CONTROL_PLANE	The congestion analytics type is Control Plane.	
USER_AND_CONTROL_PLANE	The congestion analytics type is User Plane and Control Plane.	

5.1.6.3.9 Enumeration: TimeUnit

Table 5.1.6.3.9-1: Enumeration TimeUnit

Enumeration value	Description	Applicability
MINUTE	Time unit is per minute.	
HOUR	Time unit is per hour.	
DAY	Time unit is per day.	

5.1.6.3.10 Enumeration: NetworkPerfType

Table 5.1.6.3.10-1: Enumeration NetworkPerfType

Enumeration value	Description	Applicability
GNB_ACTIVE_RATIO	Indicates the ratio of gNB active (i.e. up and running) number to the total number of gNB.	
GNB_COMPUTING_USAGE	Indicates gNodeB computing resource usage.	
GNB_MEMORY_USAGE	Indicates gNodeB memory usage.	
GNB_DISK_USAGE	Indicates gNodeB disk usage.	
NUM_OF_UE	Indicates number of UEs.	
SESS_SUCC_RATIO	Indicates ratio of successful setup of PDU sessions to total PDU session setup attempts.	
HO_SUCC_RATIO	Indicates Ratio of successful handovers to the total handover attempts.	

5.1.6.3.11 Enumeration: ExpectedAnalyticsType

Table 5.1.6.3.11-1: Enumeration ExpectedAnalyticsType

Enumeration value	Description	Applicability
MOBILITY	Mobility related abnormal behaviour analytics is expected by the consumer	
COMMUN	Communication related abnormal behaviour analytics is expected by the consumer	
MOBILITY_AND_COMMUN	Both mobility and communication related abnormal behaviour analytics is expected by the consumer	

5.1.6.3.12 Enumeration: MatchingDirection

Table 5.1.6.3.12-1: Enumeration MatchingDirection

Enumeration value	Description	Applicability
ASCENDING	Threshold is crossed in ascending direction.	
DESCENDING	Threshold is crossed in descending direction.	
CROSSED	Threshold is crossed either in ascending or descending direction.	

5.1.6.3.13 Enumeration: NwdafFailureCode

Table 5.1.6.3.13-1: Enumeration NwdafFailureCode

Enumeration value	Description	Applicability
UNAVAILABLE_DATA	Indicates the requested statistics information for the event is rejected since necessary data to perform the service is unavailable.	
BOTH_STAT_PRED_NOT_ALLOWED	Indicates the requested analysis information for the event is rejected since the start time is in the past and the end time is in the future, which means the NF service consumer requested both statistics and prediction for the analytics.	
UNSATISFIED_REQUESTED_ANALYTICS_TIME	Indicates that the requested event is rejected since the analytics information is not ready when the time indicated by the "timeAnaNeeded" attribute (as provided during the creation or modification of subscription) is reached.	EneNA
OTHER	Indicates the requested analysis information for the event is rejected due to other reasons.	

5.1.6.3.14 Enumeration: AnalyticsMetadata

Table 5.1.6.3.14-1: Enumeration AnalyticsMetadata

Enumeration value	Description	Applicability
NUM_OF_SAMPLES	Number of data samples used for the generation of the output analytics.	
DATA_WINDOW	Data time window of the data samples.	
DATA_STAT_PROPS	Dataset statistical properties of the data used to generate the analytics.	
STRATEGY	Output strategy used for the reporting of the analytics.	
ACCURACY	Level of accuracy reached for the analytics.	

5.1.6.3.15 Enumeration: DatasetStatisticalProperty

Table 5.1.6.3.15-1: Enumeration DatasetStatisticalProperty

Enumeration value	Description	Applicability
UNIFORM_DIST_DATA	Indicates the use of data samples that are uniformly distributed according to the different aspects of the requested analytics.	
NO_OUTLIERS	Indicates that the data samples shall disregard data samples that are at the extreme boundaries of the value range.	

5.1.6.3.16 Enumeration: OutputStrategy

Table 5.1.6.3.16-1: Enumeration OutputStrategy

Enumeration value	Description	Applicability
BINARY	Indicates that the analytics shall only be reported when the requested level of accuracy is reached within a cycle of periodic notification as defined in the analytics reporting information (i.e. in the ReportingInformation data type or the EventSubscription data type).	
GRADIENT	Indicates that the analytics shall be reported according with the periodicity defined in the analytics reporting information (i.e. in the ReportingInformation data type or the EventSubscription data type) irrespective of whether the requested level of accuracy has been reached or not.	

5.1.6.3.17 Enumeration: TransferRequestType

Table 5.1.6.3.17-1: Enumeration TransferRequestType

Enumeration value	Description	Applicability
PREPARE	Indicates that the request is for analytics subscription transfer preparation.	
TRANSFER	Indicates that the request is for analytics subscription transfer execution.	

5.1.6.3.18 Enumeration: AnalyticsSubset

Table 5.1.6.3.18-1: AnalyticsSubset

Enumeration value	Description	Applicability
NUM_OF_UE_REG	The number of UE registered. This value is only applicable to NSI_LOAD_LEVEL event.	
NUM_OF_PDU_SESS_ESTBL	The number of PDU sessions established. This value is only applicable to NSI_LOAD_LEVEL event.	
RES_USAGE	The current usage of the virtual resources assigned to the NF instances belonging to a particular network slice instance. This value is only applicable to NSI_LOAD_LEVEL event.	
NUM_OF_EXCEED_RES_USAGE_LOAD_LEVEL_THR	The number of times the resource usage threshold of the network slice instance is reached or exceeded if a threshold value is provided by the consumer. This value is only applicable to NSI_LOAD_LEVEL event.	
PERIOD_OF_EXCEED_RES_USAGE_LOAD_LEVEL_THR	The time interval between each time the threshold being met or exceeded on the network slice (instance). This value is only applicable to NSI_LOAD_LEVEL event.	
EXCEED_LOAD_LEVEL_THR_IND	Whether the Load Level Threshold is met or exceeded by the statistics value. This value is only applicable to NSI_LOAD_LEVEL event.	
LIST_OF_TOP_APP_UL	The list of applications that contribute the most to the traffic in the UL direction. This value is only applicable to USER_DATA_CONGESTION event.	
LIST_OF_TOP_APP_DL	The list of applications that contribute the most to the traffic in the DL direction. This value is only applicable to USER_DATA_CONGESTION event.	
NF_STATUS	The availability status of the NF on the Analytics target period, expressed as a percentage of time per status value (registered, suspended, undiscoverable). This value is only applicable to NF_LOAD event.	
NF_RESOURCE_USAGE	The average usage of assigned resources (CPU, memory, storage). This value is only applicable to NF_LOAD event.	
NF_LOAD	The average load of the NF instance over the Analytics target period. This value is only applicable to NF_LOAD event.	
NF_PEAK_LOAD	The maximum load of the NF instance over the Analytics target period. This value is only applicable to NF_LOAD event.	
NF_LOAD_AVG_IN_AOI	The average load of the NF instances over the area of interest. This value is only applicable to NF_LOAD event.	
DISPER_AMOUNT	Indicates the dispersion amount of the reported data volume or transaction dispersion type. This value is only applicable to DISPERSION event.	
DISPER_CLASS	Indicates the dispersion mobility class (fixed, camper or traveller) upon set its usage threshold, and/or the top-heavy class upon set its percentile rating threshold. This value is only applicable to DISPERSION event.	
RANKING	Data/transaction usage ranked high (i.e.value 1), medium (2) or low (3). This value is only applicable to DISPERSION event.	
PERCENTILE_RANKING	Percentile ranking of the target UE in the Cumulative Distribution Function of data usage for the population of all UEs. This value is only applicable to DISPERSION event.	
RSSI	Indicated the RSSI in the unit of dBm. This value is only applicable to WLAN_PERFORMANCE event.	
RTT	Indicates the RTT in the unit of millisecond. This value is only applicable to WLAN_PERFORMANCE event.	
TRAFFIC_INFO	Traffic information including UL/DL data rate and/or Traffic volume. This value is only applicable to WLAN_PERFORMANCE event.	
NUMBER_OF_UES	Number of UEs observed for the SSID. This value is only applicable to WLAN_PERFORMANCE event.	
APP_LIST_FOR_UE_COMM	The analytics of the application list used by UE. This value is only applicable to UE_COMM event.	
N4_SESS_INACT_TIMER_FOR_UE_COMM	The N4 Session inactivity timer. This value is only applicable to UE_COMM event.	
AVG_TRAFFIC_RATE	Indicates average traffic rate. This value is only applicable to DN_PERFORMANCE event.	

MAX_TRAFFIC_RATE	Indicates maximum traffic rate. This value is only applicable to DN_PERFORMANCE event.	
AVG_PACKET_DELAY	Indicates average Packet Delay. This value is only applicable to DN_PERFORMANCE event.	
MAX_PACKET_DELAY	Indicates maximum Packet Delay. This value is only applicable to DN_PERFORMANCE event.	
AVG_PACKET_LOSS_RATE	Indicates average Loss Rate. This value is only applicable to DN_PERFORMANCE event.	
UE_LOCATION	Indicates UE location information. This value is only applicable to SERVICE_EXPERIENCE event.	
LIST_OF_HIGH_EXP_UE	Indicates list of high experienced UE. This value is only applicable to SM_CONGESTION event.	
LIST_OF_MEDIUM_EXP_UE	Indicates list of medium experienced UE. This value is only applicable to SM_CONGESTION event.	
LIST_OF_LOW_EXP_UE	Indicates list of low experienced UE. This value is only applicable to SM_CONGESTION event.	
AVG_UL_PKT_DROP_RATE	Indicates average uplink packet drop rate on GTP-U path on N3. This value is only applicable to RED_TRANS_EXP event.	
VAR_UL_PKT_DROP_RATE	Indicates variance of uplink packet drop rate on GTP-U path on N3. This value is only applicable to RED_TRANS_EXP event.	
AVG_DL_PKT_DROP_RATE	Indicates average downlink packet drop rate on GTP-U path on N3. This value is only applicable to RED_TRANS_EXP event.	
VAR_DL_PKT_DROP_RATE	Indicates variance of downlink packet drop rate on GTP-U path on N3. This value is only applicable to RED_TRANS_EXP event.	
AVG_UL_PKT_DELAY	Indicates average uplink packet delay round trip on GTP-U path on N3. This value is only applicable to RED_TRANS_EXP event.	
VAR_UL_PKT_DELAY	Indicates variance uplink packet delay round trip on GTP-U path on N3. This value is only applicable to RED_TRANS_EXP event.	
AVG_DL_PKT_DELAY	Indicates average downlink packet delay round trip on GTP-U path on N3. This value is only applicable to RED_TRANS_EXP event.	
VAR_DL_PKT_DELAY	Indicates variance downlink packet delay round trip on GTP-U path on N3. This value is only applicable to RED_TRANS_EXP event.	

5.1.6.3.19 Enumeration: DispersionType

Table 5.1.6.3.19-1: Enumeration DispersionType

Enumeration value	Description	Applicability
DVDA	Data Volume Dispersion Analytics.	
TDA	Transactions Dispersion Analytics.	
DVDA_AND_TDA	Data Volume Dispersion Analytics and Transactions Dispersion Analytics.	

5.1.6.3.20 Enumeration: DispersionClass

Table 5.1.6.3.20-1: Enumeration DispersionClass

Enumeration value	Description	Applicability
FIXED	Dispersion class as fixed UE, its data or transaction usage at a location or a slice, is higher than its class threshold set for its all data or transaction usage.	
CAMPER	Dispersion class as camper UE, its data or transaction usage at a location or a slice, is higher than its class threshold and lower than the fixed class threshold set for its all data or transaction usage.	
TRAVELLER	Dispersion class as traveller UE, its data or transaction usage at a location or a slice, is lower than the camper class threshold set for its all data or transaction usage.	
TOP_HEAVY	Dispersion class as Top_Heavy UE, who's dispersion percentile rating at a location or a slice, is higher than its class threshold.	

5.1.6.3.21 Enumeration: DispersionOrderingCriterion

Table 5.1.6.3.21-1: Enumeration DispersionOrderingCriterion

Enumeration value	Description	Applicability
TIME_SLOT_START	Indicates the order of time slot start.	
DISPERSION	Indicates the order of data/transaction dispersion.	
CLASSIFICATION	Indicates the order of data/transaction classification.	
RANKING	Indicates the order of data/transaction ranking.	
PERCENTILE_RANKING	Indicates the order of data/transaction percentile ranking.	

5.1.6.3.22 Enumeration: RedTransExpOrderingCriterion

Table 5.1.6.3.22-1: Enumeration RedTransExpOrderingCriterion

Enumeration value	Description	Applicability
TIME_SLOT_START	Indicates the order of time slot start.	
RED_TRANS_EXP	Indicates the order of Redundant Transmission Experience.	

5.1.6.3.23 Enumeration: WlanOrderingCriterion

Table 5.1.6.3.23-1: Enumeration WlanOrderingCriterion

Enumeration value	Description	Applicability
TIME_SLOT_START	Indicates the order of time slot start.	
NUMBER_OF_UES	Indicates the order of number of UEs.	
RSSI	Indicates the order of RSSI.	
RTT	Indicates the order of RTT.	
TRAFFIC_INFO	Indicates the order of Traffic Information	

5.1.6.3.24 Enumeration: ServiceExperienceType

Table 5.1.6.3.24-1: Definition of type ServiceExperienceType

Enumeration value	Description	Applicability
VOICE	Indicates that the service experience analytics is for voice service.	
VIDEO	Indicates that the service experience analytics is for video service.	
OTHER	Indicates that the service experience analytics is for other service.	

5.1.6.3.25 Enumeration: DnPerfOrderingCriterion

Table 5.1.6.3.25-1: Enumeration DnPerfOrderingCriterion

Enumeration value	Description	Applicability
AVERAGE_TRAFFIC_RATE	Indicates the average traffic rate.	
MAXIMUM_TRAFFIC_RATE	Indicates the maximum traffic rate.	
AVERAGE _PACKET_DELAY	Indicates the average packet delay.	
MAXIMUM _PACKET_DELAY	Indicates the maximum packet delay.	
AVERAGE _PACKET_LOSS_RATE	Indicates the average packet loss rate.	

5.1.7 Error handling

5.1.7.1 General

HTTP error handling shall be supported as specified in clause 5.2.4 of 3GPP TS 29.500 [6].

For the Nnwdaf_EventsSubscription API, HTTP error responses shall be supported as specified in clause 4.8 of 3GPP TS 29.501 [7].

Protocol errors and application errors specified in table 5.2.7.2-1 of 3GPP TS 29.500 [6] shall be supported for an HTTP method if the corresponding HTTP status codes are specified as mandatory for that HTTP method in table 5.2.7.1-1 of 3GPP TS 29.500 [6].

In addition, the requirements in the following clauses shall apply.

5.1.7.2 Protocol Errors

In this Release of the specification, there are no additional protocol errors applicable for the Nnwdaf_EventsSubscription API.

5.1.7.3 Application Errors

The application errors defined for the Nnwdaf_EventsSubscription API are listed in table 5.1.7.3-1.

Table 5.1.7.3-1: Application errors

Application Error	HTTP status code	Description
BOTH_STAT_PRED_NOT_ALLOWED	400 Bad Request	For the requested observation period, the start time is in the past and the end time is in the future, which means the NF service consumer requested both statistics and prediction for the analytics.
UNAVAILABLE_DATA	500 Internal Server Error	Indicates the requested statistics in the past is rejected since necessary data to perform the service is unavailable.
NOTE: Including a "ProblemDetails" data structure with the "cause" attribute in the HTTP response is optional unless explicitly mandated in the service operation clauses.		

5.1.8 Feature negotiation

The optional features in table 5.1.8-1 are defined for the Nnwdaf_EventsSubscription API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [6].

Table 5.1.8-1: Supported Features

Feature number	Feature Name	Description
1	ServiceExperience	This feature indicates support for the event related to service experience.
2	UeMobility	This feature indicates the support of analytics based on UE mobility information.
3	UeCommunication	This feature indicates the support of analytics based on UE communication information.
4	QoSSustainability	This feature indicates support for the event related to QoS sustainability.
5	AbnormalBehaviour	This feature indicates support for the event related to abnormal behaviour information.
6	UserDataCongestion	This feature indicates support for the event related to user data congestion.
7	NfLoad	This feature indicates the support of the analytics related to the load of NF instances.
8	NetworkPerformance	This feature indicates the support of analytics based on network performance.
9	NsiLoad	This feature indicates the support of the event related to the load level of Network Slice and the optionally associated Network Slice Instance.
10	ES3XX	Extended Support for 3xx redirections. This feature indicates the support of redirection for any service operation, according to Stateless NF procedures as specified in clauses 6.5.3.2 and 6.5.3.3 of 3GPP TS 29.500 [6] and according to HTTP redirection principles for indirect communication, as specified in clause 6.10.9 of 3GPP TS 29.500 [6].
11	EneNA	This feature indicates support for the enhancements of network data analytics requirements.
12	UserDataCongestionExt	This feature indicates support for the extensions to the event related to user data congestion, including support of GPSI and/or list of Top applications. Supporting this feature also requires the support of feature UserDataCongestion.
13	Aggregation	This feature indicates support for analytics aggregation.
14	NsiLoadExt	This feature indicates support for the extensions to the event related to the load level of Network Slice and the optionally associated Network Slice Instance, including support of area of interest, NF load information and number of UE or number of PDU Session. Supporting this feature also requires the support of feature NsiLoad.
15	ServiceExperienceExt	This feature indicates support for the extensions to the event related to service experience, including support of RAT type and/or Frequency. Supporting this feature also requires the support of feature ServiceExperience.
16	DnPerformance	This feature indicates the support of the analytics related to DN performance.
17	NfLoadExt	This feature indicates support for the extensions to the event related to the load of NF instances, including NF load over area of interest. Supporting this feature also requires the support of feature NfLoad.
18	Dispersion	This feature indicates support of the analytics related to dispersion analytics information.
19	RedundantTransmissionExp	This feature indicates support of the analytics related to redundant transmission experience analytics information.
20	WlanPerformance	This feature indicates support of the analytics related to WLAN performance information.
21	UeCommunicationExt	This feature indicates the support of the analytics related to UE communication.
22	UeMobilityExt	This feature indicates support for extensions to the event related to UE mobility, including support of LADN DNN to refer the LADN service area as the AOI. Supporting this feature also requires the support of feature UeMobility.
23	AnaCtxTransfer	This feature indicates support for functionality related to Analytics Context Transfer.
24	AnaSubTransfer	This feature indicates support for Analytics Subscription Transfer initiated by the source NWDAF.

5.1.9 Security

As indicated in 3GPP TS 33.501 [13] and 3GPP TS 29.500 [6], the access to the Nnwdaf_EventsSubscription API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [14]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [12]) plays the role of the authorization server.

If OAuth2 is used, an NF service consumer, prior to consuming services offered by the Nnwdaf_EventsSubscription API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [12], clause 5.4.2.2.

NOTE: When multiple NRFs are deployed in a network, the NRF used as authorization server is the same NRF that the NF service consumer used for discovering the Nnwdaf_EventsSubscription service.

The Nnwdaf_EventsSubscription API defines a single scope "nnwdaf-eventssubscription" for the entire service, and it does not define any additional scopes at resource or operation level.

5.2 Nnwdaf_AnalyticsInfo Service API

5.2.1 Introduction

The Nnwdaf_AnalyticsInfo service shall use the Nnwdaf_AnalyticsInfo API.

The API URI of the Nnwdaf_AnalyticsInfo API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in each HTTP requests from the NF service consumer towards the NWDAF shall have the Resource URI structure defined in clause 4.4.1 of 3GPP TS 29.501 [7], i.e.:

{apiRoot}/<apiName>/<apiVersion>/<apiSpecificResourceUriPart>

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [7].
- The<apiName> shall be "nnwdaf-analyticsinfo".
- The <apiVersion> shall be "v1".
- The <apiSpecificResourceUriPart> shall be set as described in clause 5.2.3.

5.2.2 Usage of HTTP

5.2.2.1 General

HTTP/2, IETF RFC 7540 [9], shall be used as specified in clause 5 of 3GPP TS 29.500 [6].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [6].

The OpenAPI [11] specification of HTTP messages and content bodies for the Nnwdaf_AnalyticsInfo is contained in Annex A.

5.2.2.2 HTTP standard headers

5.2.2.2.1 General

See clause 5.2.2 of 3GPP TS 29.500 [6] for the usage of HTTP standard headers.

5.2.2.2.2 Content type

JSON, IETF RFC 8259 [10], shall be used as content type of the HTTP bodies specified in the present specification as specified in clause 5.4 of 3GPP TS 29.500 [6]. The use of the JSON format shall be signalled by the content type "application/json".

"Problem Details" JSON object shall be used to indicate additional details of the error in a HTTP response body and shall be signalled by the content type "application/problem+json", as defined in IETF RFC 7807 [15].

5.2.2.3 HTTP custom headers

The Nnwdaf_AnalyticsInfo Service API shall support the mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [6] and may support the optional HTTP custom header fields specified in clause 5.2.3.3 of 3GPP TS 29.500 [6].

In this release of the specification, no specific custom headers are defined for the Nnwdaf_AnalyticsInfo Service API.

5.2.3 Resources

5.2.3.1 Resource Structure

This clause describes the structure for the Resource URIs, the resources and methods used for the service.

Figure 5.2.3.1-1 depicts the resource URIs structure for the Nnwdaf_AnalyticsInfo API.

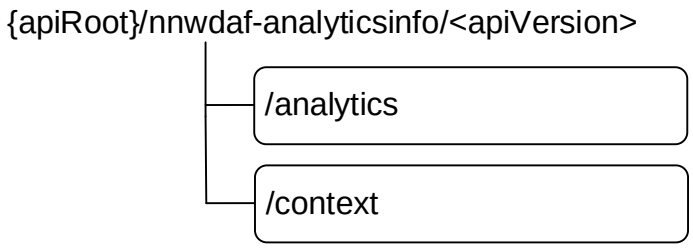

Figure 5.2.3.1-1: Resource URI structure of the Nnwdaf_AnalyticsInfo API

Table 5.2.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 5.2.3.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method or custom operation	Description
NWDAF Analytics	/analytics	GET	Retrieves the NWDAF analytics.
NWDAF Context	/context	GET	Retrieves the NWDAF context information related to analytics subscriptions.

5.2.3.2 Resource: NWDAF Analytics

5.2.3.2.1 Description

The NWDAF Analytics resource represents the analytics to the Nnwdaf_AnalyticsInfo service at a given NWDAF.

5.2.3.2.2 Resource definition

Resource URI: {apiRoot}/nnwdaf-analyticsinfo/<apiVersion>/analytics

The <apiVersion> shall be set as described in clause 5.2.1.

This resource shall support the resource URI variables defined in table 5.2.3.2.2-1.

Table 5.2.3.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 5.2.1

5.2.3.2.3 Resource Standard Methods

5.2.3.2.3.1 GET

This method shall support the URI query parameters specified in table 5.2.3.2.3.1-1.

Table 5.2.3.2.3.1-1: URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description
ana-req	EventReportingRequirement	O	0..1	Identifies the analytics reporting requirement information.
event-id	EventId	M	1	Shall be included to identify the analytics.
event-filter	EventFilter	C	0..1	Shall be included to identify the analytics when filter information is needed for the related event.
supported-features	SupportedFeatures	O	0..1	To filter irrelevant responses related to unsupported features.
tgt-ue	TargetUeInformation	O	0..1	Identifies the target UE information.

This method shall support the request data structures specified in table 5.2.3.2.3.1-2 and the response data structures and response codes specified in table 5.2.3.2.3.1-3.

Table 5.2.3.2.3.1-2: Data structures supported by the GET Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 5.2.3.2.3.1-3: Data structures supported by the GET Response Body on this resource

Data type	P	Cardinality	Response codes	Description
AnalyticsData	M	1	200 OK	Containing the analytics with parameters as relevant for the requesting NF service consumer
n/a			204 No Content	If the request NWDAF Analytics data does not exist, the NWDAF shall respond with "204 No Content ".
ProblemDetailsAnalyticsInfoRequest	O	0..1	500 Internal Server Error	The request is rejected by the NWDAF and more details (not only the ProblemDetails) are returned. (NOTE 2)
ProblemDetails	O	0..1	500 Internal Server Error	(NOTE 2)
ProblemDetails	O	0..1	400 Bad Request	(NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the GET method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] also apply. NOTE 2: Failure cases are described in clause 5.2.7.				

5.2.3.2.4 Resource Custom Operations

None in this release of the specification.

5.2.3.3 Resource: NWDAF Context

5.2.3.3.1 Description

The NWDAF Context resource represents the context information related to analytics subscriptions at the Nnwdaf_AnalyticsInfo service at a given NWDAF.

5.2.3.3.2 Resource definition

Resource URI: {apiRoot}/nnwdaf-analyticsinfo/<apiVersion>/context

The <apiVersion> shall be set as described in clause 5.2.1.

This resource shall support the resource URI variables defined in table 5.2.3.3.2-1.

Table 5.2.3.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 5.2.1

5.2.3.3.3 Resource Standard Methods

5.2.3.3.3.1 GET

This method shall support the URI query parameters specified in table 5.2.3.3.3.1-1.

Table 5.2.3.3.3.1-1: URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description
context-ids	ContextIdList	M	1	Identifies specific context information related to analytics subscriptions.
req-context	RequestedContext	O	0..1	Identfies the types of the analytics context information the consumer wishes to receive. Absence of this attribute means that the consumer wishes to receive available context information of all types.

This method shall support the request data structures specified in table 5.2.3.3.3.1-2 and the response data structures and response codes specified in table 5.2.3.3.3.1-3.

Table 5.2.3.3.3.1-2: Data structures supported by the GET Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 5.2.3.3.3.1-3: Data structures supported by the GET Response Body on this resource

Data type	P	Cardinality	Response codes	Description
ContextData	M	1	200 OK	Contains the context information corresponding with the context identifiers provided in the request.
n/a			204 No Content	If the requested context information does not exist, the NWDAF shall respond with "204 No Content".
NOTE: The mandatory HTTP error status codes for the GET method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] also apply.				

5.2.4 Custom Operations without associated resources

None in this release of the specification.

5.2.5 Notifications

None in this release of the specification.

5.2.6 Data Model

5.2.6.1 General

This clause specifies the application data model supported by the API.

Table 5.2.6.1-1 specifies the data types defined for the Nnwdaf_AnalyticsInfo service based interface protocol.

Table 5.2.6.1-1: Nnwdaf_AnalyticsInfo specific Data Types

Data type	Section defined	Description	Applicability
AdditionInfoAnalyticsInfoRequest	5.2.6.2.5	Contains more details (not only the ProblemDetails) in case an Nnwdaf_AnalyticsInfo request is rejected.	EneNA
AdrfDataType	5.2.6.3.5	Represents a type of data that is stored in the ADRF.	AnaCtxTransfer
AnalyticsData	5.2.6.2.2	Describes analytics with parameters indicated in the request.	
ContextData	5.2.6.2.6	Contains context information related to analytics subscriptions corresponding with one or more context identifiers.	AnaCtxTransfer
ContextElement	5.2.6.2.7	Contains context information corresponding with a specific context identifier.	AnaCtxTransfer
ContextIdList	5.2.6.2.8	Contains list of context identifiers of context information of analytics subscriptions.	AnaCtxTransfer
ContextType	5.2.6.3.4	Identfies the type of analytics context information.	AnaCtxTransfer
DnPerfInfo	5.1.6.2.45	Represents DN performance information	DnPerformance
DnPerformanceReq	5.1.6.2.66	Represents the DN performance requirements.	DnPerformance
EventFilter	5.2.6.2.3	Represents the event filters used to identify the requested analytics.	
EventId	5.2.6.3.3	Describes the type of analytics.	
HistoricalData	5.2.6.2.9	Contains historical data related to an analytics subscription.	AnaCtxTransfer
ProblemDetailsAnalyticsInfoRequest	5.2.6.4.1	Data type that extends ProblemDetails.	EneNA
RequestedContext	5.2.6.2.11	Contains types of analytics context information.	AnaCtxTransfer
SmcceInfo	5.2.6.2.12	Represents the analytics of Session Management congestion control experience information.	SMCCE
SmcceUeList	5.2.6.2.13	Represents the List of UEs classified	SMCCE

		based on experience level of Session Management congestion control.	
SpecificAnalyticsSubscription	5.2.6.2.10	Represents an existing subscription for a specific type of analytics to a specific NWDAF.	AnaCtxTransfer
SpecificDataSubscription	5.2.6.2.14	Represents an existing data collection subscription to a specific data source NF.	EneNA

Table 5.2.6.1-2 specifies data types re-used by the Nnwdaf_AnalyticsInfo service based interface protocol from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the Nnwdaf service based interface.

Re-used data types of clause 5.1.6 refer here to requests instead of subscriptions.

Table 5.2.6.1-2: Nnwdaf_AnalyticsInfo re-used Data Types

Data type	Reference	Comments	Applicability
AbnormalBehaviour	5.1.6.2.15	Represents the abnormal behaviour information.	AbnormalBehaviour
AnalyticsContextIdentifier	5.1.6.2.43	Contains information about the available analytics contexts.	AnaCtxTransfer
AnalyticsMetadataInfo	5.1.6.2.37	Contains analytics metadata information required for analytics aggregation.	Aggregation
AnalyticsSubset	5.1.6.3.18	Contains information about the analytics subsets provided in the subscription request.	EneNA
AnySlice	5.1.6.3.2		
ApplicationId	3GPP TS 29.571 [8]	Identifies the application.	ServiceExperience UeCommunication AbnormalBehaviour DnPerformance
BwRequirement	5.1.6.2.25		ServiceExperience
DataNotification	3GPP TS 29.575 [27]	Describes Notifications about data collection events that occurred.	EneNA
DataSubscription	3GPP TS 29.575 [27]	Represents data subscription from data source (e.g. AMF, SMF, UDM, NEF, AF).	EneNA
DateTime	3GPP TS 29.571 [8]	Identifies the time.	
DispersionRequirement	5.1.6.2.50	Dispersion analytics requirement.	Dispersion
DispersionInfo	5.1.6.2.53	Dispersion analytics information.	Dispersion
Dnai	3GPP TS 29.571 [8]	Identifies a user plane access to one or more DN(s).	ServiceExperience DnPerformance
Dnn	3GPP TS 29.571 [8]	Identifies the DNN.	ServiceExperience AbnormalBehaviour UeCommunication SMCCE DnPerformance
DnPerfInfo	5.1.6.2.45	Represents DN performance information	DnPerformance
DnPerformanceReq	5.1.6.2.66	Represents the DN performance requirements.	DnPerformance
DurationSec	3GPP TS 29.571 [8]		
EventNotification	5.1.6.2.5	Describes Notifications about analytics events that occurred.	AnaCtxTransfer
EventReportingRequirement	5.1.6.2.7		
ExceptionId	5.1.6.3.6		AbnormalBehaviour
ExpectedUeBehaviourData	3GPP TS 29.503 [23]		AbnormalBehaviour
ExpectedAnalyticsType	5.1.6.3.11		AbnormalBehaviour
ModelInfo	5.1.6.2.42	The information of the ML models.	AnaCtxTransfer
NetworkAreaInfo	3GPP TS 29.554 [18]	The network area information.	UeMobility UeCommunication NetworkPerformance QoSSustainability ServiceExperience UserDataCongestion AbnormalBehaviour NsiLoadExt Dispersion

			RedundantTransmissionExp WlanPerformance DnPerformance
NetworkPerfInfo	5.1.6.2.23		NetworkPerformance
NetworkPerfType	5.1.6.3.10	Represents the network performance types.	NetworkPerformance
NfLoadLevelInformation	5.1.6.2.31	Represents load level information of a given NF instance.	NfLoad
NfInstanceId	3GPP TS 29.571 [8]	Identifies an NF instance	NfLoad
NfSetId	3GPP TS 29.571 [8]	Identifies an NF Set instance.	NfLoad
NFType	3GPP TS 29.510 [12]	Indentifies a type of NF.	NfLoad
NsiIdInfo	5.1.6.2.33	Identify the S-NSSAI and the associated Network Slice Instance(s).	ServiceExperience NsiLoad DnPerformance
NsiLoadLevelInfo	5.1.6.2.34	Represents the load level information for an S-NSSAI and the associated network slice instance.	NsiLoad
NnwdafEventsSubscription	5.1.6.2.2	Represents an Individual NWDAF Event Subscription resource.	AnaCtxTransfer
ProblemDetails	3GPP TS 29.571 [8]	Used in error responses to provide more detailed information about an error.	
QosRequirement	5.1.6.2.20		QoSSustainability
QosSustainabilityInfo	5.1.6.2.19		QoSSustainability
RatFreqInformation	5.1.6.2.67	Represents the RAT type and/or Frequency information	ServiceExperienceExt
RedundantTransmissionExpInfo	5.1.6.2.57	Redundant transmission experience analytics information.	RedundantTransmissionExp
RedundantTransmissionExpReq	5.1.6.2.56	Redundant transmission experience analytics requirement.	RedundantTransmissionExp
ServiceExperienceInfo	5.1.6.2.24		ServiceExperience
Supi	3GPP TS 29.571 [8]	Identifies the UE.	ServiceExperience, NfLoad NetworkPerformance UserDataCongestion UeMobility UeCommunication AbnormalBehaviour SMCCE Dispersion RedundantTransmissionExp WlanPerformance
SupportedFeatures	3GPP TS 29.571 [8]	Used to negotiate the applicability of the optional features defined in table 5.2.8-1.	
Snssai	3GPP TS 29.571 [8]		
SliceLoadLevelInformation	5.1.6.2.6		
TargetUeInformation	5.1.6.2.8	Identifies the target UE information.	ServiceExperience NfLoad NetworkPerformance UserDataCongestion UeMobility UeCommunication AbnormalBehaviour

			QoSSustainability Dispersion RedundantTransmissionExp WlanPerformance SMCCE DnPerformance
UeCommunication	5.1.6.2.13		UeCommunication
UeMobility	5.1.6.2.10		UeMobility
Uinteger	3GPP TS 29.571 [8]	Unsigned Integer, i.e. only value 0 and integers above 0 are permissible.	
UpfInformation	3GPP TS 29.508 [29]	The information of the UPF serving the UE.	ServiceExperienceExt DnPerformance
UserDataCongestionInfo	5.1.6.2.17		UserDataCongestion
WlanPerformanceInfo	5.1.6.2.60	WLAN performance analytics information.	WlanPerformance
WlanPerformanceReq	5.1.6.2.59	WLAN performance analytics requirement.	WlanPerformance

5.2.6.2 Structured data types

5.2.6.2.1 Introduction

This clause defines the structures to be used in resource representations.

5.2.6.2.2 Type AnalyticsData

Table 5.2.6.2.2-1: Definition of type AnalyticsData

Attribute name	Data type	P	Cardinality	Description	Applicability
start	DateTime	O	0..1	It defines the start time of which the analytics information will become valid. (NOTE 1)	
expiry	DateTime	O	0..1	It defines the expiration time after which the analytics information will become invalid. (NOTE 1)	
timeStampGen	DateTime	O	0..1	It defines the timestamp of analytics generation.	
anaMetaInfo	AnalyticsMetadataInfo	C	0..1	Contains information about analytics metadata required to aggregate the analytics. It shall be present if the "anaMeta" attribute was included in the request, containing the information indicated by the "anaMeta" attribute.	Aggregation
sliceLoadLevelInfos	array(SliceLoadLevelInformation)	C	1..N	The slices and the load level information. Shall be present when the requested event is "LOAD_LEVEL_INFORMATION".	
nsiLoadLevelInfos	array(NsiLoadLevelInfo)	C	1..N	Each element identifies the load level information for an S-NSSAI and the optionally associated network slice instance. Shall be presented when the requested event is "NSI_LOAD_LEVEL"	NsiLoad
nwPerfs	array(NetworkPerfInfo)	C	1..N	The network performance information. Shall be present when the requested event is "NETWORK_PERFORMANCE".	NetworkPerformance
nfLoadLevelInfos	array(NfLoadLevelInformation)	C	1..N	The NF load information. When the requestedevent is "NF_LOAD", the nfLoadLevelInfos shall be included.	NfLoad
qosSustainInfos	array(QosSustainabilityInfo)	C	1..N	The QoS sustainability informations in the certain geographic areas. It shall be present if the requested eventis "QOS_SUSTAINABILITY". (NOTE 2)	QoSSustainability
ueMobs	array(UeMobility)	C	1..N	The UE mobility information. When the requested event is "UE_MOBILITY", the "ueMobs" attribute shall be included.	UeMobility
ueComms	array(UeCommunication)	C	1..N	The UE communication information. When the requested event is "UE_COMM", the "ueComms" attribute shall be included.	UeCommunication
userDataCongInfos	array(UserDataCongestionInfo)	C	1..N	The user data congestion information. Shall be present when the requested event is "USER_DATA_CONGESTION".	UserDataCongestion
suppFeat	SupportedFeatures	C	0..1	List of Supported features used as described in clause 5.2.8. This parameter shall be supplied by NWDAF in the reply of GET	

				request that request the analytics resource, if the consumer includes "supported-features" in the GET request.	
svcExps	array(ServiceExperienceInfo)	C	1..N	The service experience information. Shall be present when the requested event is "SERVICE_EXPERIENCE".	ServiceExperience
abnorBehavrs	array(AbnormalBehaviour)	C	1..N	The abnormal behaviour information. Shall be present when the requested event is "ABNORMAL_BEHAVIOUR".	AbnormalBehaviour
smccExps	array(SmcceInfo)	C	1..N	The Session Management congestion control experience information. Shall be present when the requested event is "SM_CONGESTION".	SMCCE
disperInfos	array(DispersionInfo)	C	1..N	The Dispersion information. Shall be present when the requested event is "DISPERSION".	Dispersion
redTransInfos	array(RedundantTransmissionExpInfo)	C	1..N	The Redundant Transmission Experience analytics information. Shall be present when the requested event is "RED_TRANS_EXP".	RedundantTransmissionExp
wlanInfos	array(WlanPerformanceInfo)	C	1..N	The WLAN performance related information. When requested event is "WLAN_PERFORMANCE", the "wlanInfos" attribute shall be included.	WlanPerformance
dnPerfInfos	array(DnPerfInfo)	C	1..N	The DN performance information. Shall be present when the requested event is "DN_PERFORMANCE".	DnPerformance
NOTE 1: If the "start" attribute and the "expiry" attribute are both provided, the DateTime of the "expiry" attribute shall not be earlier than the DateTime of the "start" attribute. NOTE 2: The "qosFlowRetThd" and "ranUeThrouThd" attributes in QosSustainabilityInfo data type are not applicable.					

5.2.6.2.3 Type EventFilter

Table 5.2.6.2.3-1: Definition of type EventFilter

Attribute name	Data type	P	Cardinality	Description	Applicability
anySlice	AnySlice	C	0..1	Default is "FALSE". (NOTE 1)	
appIds	array(ApplicationId)	C	1..N	Represents the Application Identifier(s). The absence of appIds means applicable to all applications. (NOTE 4)	ServiceExperience UeCommunication AbnormalBehaviour Dispersion DnPerformance
dnns	array(Dnn)	C	1..N	Represents the DNN(s). Each DNN is a full DNN with both the Network Identifier and Operator Identifier, or a DNN with the Network Identifier only. The absence of dnns means applicable to all DNNs. (NOTE 4)	ServiceExperience UeCommunication AbnormalBehaviour SMCCE DnPerformance
dnais	array(Dnai)	C	1..N	Represents the Data Network Access Identifier(s) of user plane accesses to DN(s) where applications are deployed. It may be included when event-id is "SERVICE_EXPERIENCE" or "DN_PERFORMANCE".	ServiceExperience DnPerformance
ladnDnns	array(Dnn)	O	1..N	Represents the LADN DNN(s) to indicate the LADN service area(s) as the AoI(s).	UeMobilityExt
snssais	array(Snssai)	C	1..N	Identification(s) of network slice(s). (NOTE 1), (NOTE 4)	
nfInstanceIds	array(NfInstanceId)	O	1..N	Identification(s) of NF instance(s).	NfLoad
nfSetIds	array(NfSetId)	O	1..N	Identification(s) of NF instance set(s).	NfLoad
nfTypes	array(NFType)	O	1..N	Identification(s) of NF type(s). (NOTE 8)	NfLoad NsiLoadExt
networkArea	NetworkAreaInfo	C	0..1	This IE represents the network area where the NF service consumer wants to know the analytics result. (NOTE 2), (NOTE 4)	UeMobility UeCommunication NetworkPerformance QoSSustainability ServiceExperience UserDataCongestion AbnormalBehaviour NsiLoadExt NfLoadExt Dispersion RedundantTransmissionExp WlanPerformance DnPerformance
visitedAreas	array(NetworkAreaInfo)	O	1..N	Identification(s) of network area(s) which the UEs had previously been in at least one of the Visited Area(s) of Interest.	UeMobilityExt
maxTopAppUlNbr	Uinteger	O	0..1	Indicates the requested maximum number of top applications that contribute the most to the traffic in Uplink direction.	UserDataCongestionExt

				Minimum = 1. May be included when one of the elements in the "listOfAnaSubsets" attribute is set to LIST_OF_TOP_APP_UL.	
maxTopAppDlNbr	Uinteger	O	0..1	Indicates the requested maximum number of top applications that contribute the most to the traffic in Downlink direction. Minimum = 1. May be included when one of the elements in the "listOfAnaSubsets" attribute is set to LIST_OF_TOP_APP_DL.	UserDataCongestionExt
nsiIdInfos	array(NsiIdInfo)	O	1..N	Each element identifies the S-NSSAI and the optionally associated network slice instance(s). May be included when subscribed event is "NSI_LOAD_LEVEL", "SERVICE_EXPERIENCE" or "DN_PERFORMANCE". (NOTE 1)	ServiceExperience NsiLoad DnPerformance
nwPerfTypes	array(NetworkPerfType)	C	1..N	Represents the network performance types. This attribute shall be included when event-id is "NETWORK_PERFORMANCE".	NetworkPerformance
qosRequ	QoSRequirement	C	0..1	Represents the QoS requirements. This attribute shall be included when event-id is "QOS_SUSTAINABILITY".	QoSSustainability
bwRequs	array(BwRequirement)	O	1..N	Represents the media/application bandwidth requirement for each application. It may only be present if "appIds" attribute is provided.	ServiceExperience
excepIds	array(ExceptionId)	C	1..N	Represents a list of Exception Ids. (NOTE 3), (NOTE 4)	AbnormalBehaviour
exptAnaType	ExpectedAnalyticsType	C	0..1	Represents expected UE analytics type. (NOTE 3), (NOTE 4)	AbnormalBehaviour
exptUeBehav	ExpectedUeBehaviourData	O	0..1	Represents expected UE behaviour.	AbnormalBehaviour
ratFreqs	array(RatFreqInformation)	O	1..N	Identification(s) of the RAT type(s) and/or frequency(ies) of UE's serving cell(s) which the request applies. (NOTE 5)	
disperReqs	array(DispersionRequirement)	O	1..N	Represents the dispersion analytics requirements.	Dispersion
redTransReqs	array(RedundantTransmissionExpReq)	O	1..N	Represents the redundant transmission experience analytics requirements.	RedundantTransmissionExp
wlanReqs	array(WlanPerformanceReq)	O	1..N	Represents other WLAN performance analytics requirements. If the attribute contains no content, may take default handling action.	WlanPerformance
listOfAnaSubsets	array(AnalyticsSubset)	O	1..N	The list of analytics subsets used to indicate the content of the analytics.	EneNA
upfInfo	UpfInformation	O	0..1	Identifies the UPF. (NOTE 7)	ServiceExperienceExt DnPerformance
appServerAddrs	array(AddrFqdn)	C	1..N	Each element represents the Application Server Instance (IP address/FQDN of the Application Server). (NOTE 6)	ServiceExperienceExt DnPerformance
dnPerfReqs	array(DnPerformanceReq)	O	1..N	Represents the DN performance requirements. This attribute shall be included when event-id is "DN_PERFORMANCE".	DnPerformance
NOTE 1: The "anySlice" attribute is not applicable to features "UeMobility" and "NetworkPerformance". The					

"snssais" attribute is not applicable to features "ServiceExperience", "NsiLoad", "UeMobility" and "NetworkPerformance". When event-id in the request is "LOAD_LEVEL_INFORMATION", the identifications of network slices, either information about slice(s) identified by the "snssais" attribute, or "anySlice" set to "TRUE", shall be included. When subscribed event is "NSI_LOAD_LEVEL" or "SERVICE_EXPERIENCE", either the "nsiIdInfos" attribute or anySlice set to "TRUE" shall be included. When subscribed event is "QOS_SUSTAINABILITY", "NF_LOAD", "UE_COMM", "ABNORMAL_BEHAVIOUR", "USER_DATA_CONGESTION", "DISPERSION" or "RED_TRANS_EXP", the identifications of network slices identified by the "snssais" attribute is optional.

NOTE 2: For "NETWORK_PERFORMANCE", "SERVICE_EXPERIENCE" or "USER_DATA_CONGESTION" event, this attribute shall be provided if the event applied for all UEs (i.e. "anyUe" attribute set to true). For "QOS_SUSTAINABILITY", this attribute shall be provided.

NOTE 3: Either "excepIds" or "exptAnaType" shall be provided if event-id in the request is "ABNORMAL_BEHAVIOUR".

NOTE 4: For "ABNORMAL_BEHAVIOUR" event with "anyUe" attribute in "tgt-ue" attribute sets to true,

- at least one of the "networkArea" and the "snssais" attribute should be included, if the expected analytics type via the"exptAnaType" attribute or the list of Exception Ids via the "excepIds" attribute is mobility related;
- at least one of the "networkArea", "appIds", "dnns" and "snssais" attribute should be included, if the expected analytics type via the"exptAnaType" attribute or the list of Exception Ids via the "excepIds" attribute is communication related;
- the expected analytics type via the"exptAnaType" attribute or the list of Exception Ids via "excepIds" attribute shall not be requested for both mobility and communication related analytics at the same time.

NOTE 5: If both the "allFreq" attribute and the "allRat" attributes in RatFreqInformation data type are present, then the only one instance of the RatFreqInformation data type shall be present to indicate for all the RAT type and Frequency value the NWDAF has received for the application.

NOTE 6: This parameter shall be provided when a consumer requires analytics for an edge application over a UP path.

NOTE 7: This parameter may be provided when a consumer requires analytics for an edge application over a UP path.

NOTE 8: When event-id in the request is "NSI_LOAD_LEVEL" and the NsiLoadExt feature is supported, and the NF service consumer provides the "nfTypes" attribute, then the NWDAF accounts only for the resource usage of the NF types included in "nfTypes" to derive the output analytics.

NOTE: Care needs to be taken to avoid excessive signalling.

5.2.6.2.4 Void

5.2.6.2.5 Type AdditionInfoAnalyticsInfoRequest

Table 5.2.6.2.5-1: Definition of type AdditionInfoAnalyticsInfoRequest

Attribute name	Data type	P	Cardinality	Description	Applicability
rvWaitTime	DurationSec	O	0..1	Recommended minimum time interval (in seconds) to be used to determine the time when analytics information is needed in similar future requests. It may only be included if the "cause" attribute within the ProblemDetails data type is set to "UNSATISFIED_REQUESTED_ANALYTICS_TIME".	

5.2.6.2.6 Type ContextData

Table 5.2.6.2.6-1: Definition of type ContextData

Attribute name	Data type	P	Cardinality	Description	Applicability
contextElems	array(ContextElement)	M	1..N	List of items that contain context information corresponding with a context identifier.	

5.2.6.2.7 Type ContextElement

Table 5.2.6.2.7-1: Definition of type ContextElement

Attribute name	Data type	P	Cardinality	Description	Applicability
contextId	AnalyticsContextIdentifier	M	1	Context identifier of the context information contained in the rest of the attributes.	
pendAnalytics	array(EventNotification)	C	1..N	Contains output analytics for the analytics subscription this context element is associated with, which have not yet been sent to the analytics consumer. It shall be provided if such analytics are available and the NF service consumer has requested the "PENDING_ANALYTICS" context type.	
histAnalytics	array(EventNotification)	C	1..N	Contains historical output analytics for the analytics subscription this context element is associated with. It shall be provided if such analytics are available and the NF service consumer has requested the "HISTORICAL_ANALYTICS" context type.	
lastOutputTime	DateTime	C	0..1	Timestamp of the last output analytics provided to the analytics consumer. It shall be provided if output analytics had been provided and the NF service consumer has requested the "PENDING_ANALYTICS" and/or "HISTORICAL_ANALYTICS" context type. Absence of this attribute means that no output analytics had been sent.	
aggrSubs	array(SpecificAnalyticsSubscription)	C	1..N	Contains analytics subscription aggregation information, i.e. information about analytics subscriptions that the NWDAF has with other NWDAFs that collectively serve an analytics subscription. It shall be provided if such subscriptions exist and the NF service consumer has requested the "AGGR_SUBS" context type.	
histData	array(HistoricalData)	C	1..N	Contains historical data related to the analytics subscription this context element is associated with. It shall be provided if such data exists and the NF service consumer has requested the "DATA" context type.	
adrfId	NfInstanceId	O	0..1	Identifier of the ADRF in which the NWDAF stores analytics context information.	

adrfDataTypes	array(AdrfDataType)	C	1..N	Type(s) of data stored in the ADRF by the NWDAF. It shall be provided if the attribute "adrfId" is provided.	
aggrNwdafIds	array(NfInstanceId)	C	1..N	NWDAF identifiers of NWDAF instances used by the NWDAF service consumer when aggregating multiple analytics subscriptions. It shall be provided if such information is available and the NF service consumer has requested the "AGGR_INFO" context type.	
modelInfos	array(ModelInfo)	C	1..N	Contains information identifying the ML model(s) that the consumer NWDAF is currently subscribing for the analytics. It shall be provided if such information is available and the NF service consumer has requested the "ML_MODELS" context type.	

5.2.6.2.8 Type ContextIdList

Table 5.2.6.2.8-1: Definition of type ContextIdList

Attribute name	Data type	P	Cardinality	Description	Applicability
contextIds	array(AnalyticsContextIdentifier)	M	1..N	List of context identifiers of context information of analytics subscriptions.	

5.2.6.2.9 Type HistoricalData

Table 5.2.6.2.9-1: Definition of type HistoricalData

Attribute name	Data type	P	Cardinality	Description	Applicability
startTime	DateTime	O	0..1	Start of the time period during which the data was collected.	
endTime	DateTime	O	0..1	End of the time period during which the data was collected.	
subsWithSources	array(SpecificDataSubscription)	O	1..N	Information about subscriptions with the data sources.	
data	array(DataNotification)	M	1..N	Historical data related to the analytics.	

5.2.6.2.10 Type SpecificAnalyticsSubscription

Table 5.2.6.2.10-1: Definition of type SpecificAnalyticsSubscription

Attribute name	Data type	P	Cardinality	Description	Applicability
subscriptionId	string	M	1	The identifier of the specific analytics subscription.	
producerId	NfInstanceId	C	0..1	NWDAF instance identifier to which the NF service consumer has established this subscription. (NOTE)	
producerSetId	NfSetId	C	0..1	NWDAF set identifier to which the NF service consumer has established this subscription. (NOTE)	
nwdafEvSub	NnwdafEventsSubscription	M	1	Contains information about the analytics subscription.	
NOTE: Exactly One of "producerId" and "producerSetId" shall be included.					

5.2.6.2.11 Type RequestedContext

Table 5.2.6.2.11-1: Definition of type RequestedContext

Attribute name	Data type	P	Cardinality	Description	Applicability
contexts	array(ContextType)	M	1..N	Contains the types of the analytics context information the consumer wishes to receive.	

5.2.6.2.12 Type SmcceInfo

Table 5.2.6.2.12-1: Definition of type SmcceInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
dnn	Dnn	C	0..1	Identifies DNN, a full DNN with both the Network Identifier and Operator Identifier, or a DNN with the Network Identifier only. Shall be present if the "dnns" was provided in the event subscription or analytics request.	
snssai	Snssai	C	0..1	Identifies the network slice information. Shall be present if the "snssais" was provided in the event subscription or analytics request.	
smcceUeList	SmcceUeList	M	1	Contains the list of UEs classified based on experience level of SM congestion control.	

5.2.6.2.13 Type SmcceUeList

Table 5.2.6.2.13-1: Definition of type SmcceUeList

Attribute name	Data type	P	Cardinality	Description	Applicability
highLevel	array(Supi)	C	1..N	A list of UEs whose experience level of SMCC for specific DNN and/or S-NSSAI is high. Shall be present if one of the elements in the "listOfAnaSubsets" attribute was set with value as "LIST_OF_HIGH_EXP_UE". (NOTE 1) (NOTE 2)	
mediumLevel	array(Supi)	C	1..N	A list of UEs whose experience level of SMCC for specific DNN and/or S-NSSAI is medium. Shall be present if one of the elements in the "listOfAnaSubsets" attribute was set with value as "LIST_OF_MEDIUM_EXP_UE". (NOTE 1) (NOTE 2)	
lowLevel	array(Supi)	C	1..N	A list of UEs whose experience level of SMCC for specific DNN and/or S-NSSAI is low. Shall be present if one of the elements in the "listOfAnaSubsets" attribute was set with value as "LIST_OF_LOW_EXP_UE". (NOTE 1) (NOTE 2)	
NOTE 1: At least one of "highLevel", "mediumLevel" or "lowLevel" shall be provided. NOTE 2: If the "listOfAnaSubsets" attribute with value only applicable to SMCCE event is present in the request, then only the corresponding attribute(s) shall be present.					

5.2.6.2.14 Type SpecificDataSubscription

Table 5.2.6.2.14-1: Definition of type SpecificDataSubscription

Attribute name	Data type	P	Cardinality	Description	Applicability
subscriptionId	string	M	1	The identifier of the specific data subscription.	
producerId	NfInstanceId	C	0..1	NF instance identifier to which the NF service consumer has established this subscription. (NOTE)	
producerSetId	NfSetId	C	0..1	NF set identifier to which the NF service consumer has established this subscription. (NOTE)	
dataSub	DataSubscription	M	1	Contains information about the subscription with the data source.	
NOTE: One of "producerId" and "producerSetId" shall be included.					

5.2.6.3 Simple data types and enumerations

5.2.6.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

5.2.6.3.2 Simple data types

The simple data types defined in table 5.2.6.3.2-1 shall be supported.

Table 5.2.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability
n/a			

5.2.6.3.3 Enumeration: EventId

Table 5.2.6.3.3-1: Enumeration EventId

Enumeration value	Description	Applicability
LOAD_LEVEL_INFORMATION	Represents the analytics of load level information of corresponding network slice.	
NETWORK_PERFORMANCE	Represents the analytics of network performance information	NetworkPerformance
NF_LOAD	Represents the analytics of NF Load information.	NfLoad
QOS_SUSTAINABILITY	Represents the analytics of QoS sustainability in the certain area.	QoSSustainability
SERVICE_EXPERIENCE	Represents the analytics of service experience of corresponding application and/or network slice.	ServiceExperience
UE_MOBILITY	Represents the analytics of UE mobility.	UeMobility
UE_COMM	Represents the analytics of UE communication.	UeCommunication
USER_DATA_CONGESTION	Represents the analytics of the user data congestion in the certain area.	UserDataCongestion
ABNORMAL_BEHAVIOUR	Represents the analytics of abnormal behaviour information.	AbnormalBehaviour
NSI_LOAD_LEVEL	Represents the analytics of load level information of Network Slice and the optionally associated Network Slice Instance	NsiLoad
SM_CONGESTION	Represents the analytics of Session Management congestion control experience information for specific DNN and/or S-NSSAI.	SMCCE
DN_PERFORMANCE	Represents the analytics of DN performance.	DnPerformance
DISPERSION	Represents the analytics of dispersion.	Dispersion
RED_TRANS_EXP	Represents the analytics of Redundant Transmission Experience.	RedundantTransmissionExp
WLAN_PERFORMANCE	Represents the analytics of WLAN performance.	WlanPerformance

5.2.6.3.4 Enumeration: ContextType

Table 5.2.6.3.4-1: Enumeration ContextType

Enumeration value	Description	Applicability
PENDING_ANALYTICS	Represents context information that relates to pending output analytics.	
HISTORICAL_ANALYTICS	Represents context information that relates to historical output analytics.	
AGGR_SUBS	Represents context information about the analytics subscriptions that an NWDAF has with other NWDAFs that collectively serve an analytics subscription.	
DATA	Represents context information about historical data that is available.	
AGGR_INFO	Represents context information that is related to aggregation of analytics from multiple NWDAF subscriptions.	
ML_MODELS	Represents context information about used ML models.	

5.2.6.3.5 Enumeration: AdrfDataType

Table 5.2.6.3.5-1: Enumeration AdrfDataType

Enumeration value	Description	Applicability
HISTORICAL_ANALYTICS	Indicates that historical analytics are stored in the ADRF.	
HISTORICAL_DATA	Indicates that historical data are stored in the ADRF.	

5.2.6.4 Data types describing alternative data types or combinations of data types

5.2.6.4.1 Type ProblemDetailsAnalyticsInfoRequest

Table 5.2.6.4.1-1: Definition of type ProblemDetailsAnalyticsInfoRequest as a list of to be combined data types

Data type	Cardinality	Description	Applicability
ProblemDetails	1	Details of the problem as defined in TS 29.571 [8].	
AdditionInfoAnalyticsInfoRequest	1	Contains additional information why the analytics request is rejected.	

5.2.7 Error handling

5.2.7.1 General

HTTP error handling shall be supported as specified in clause 5.2.4 of 3GPP TS 29.500 [6].

For the Nnwdaf_AnalyticsInfo API, HTTP error responses shall be supported as specified in clause 4.8 of 3GPP TS 29.501 [7]. Protocol errors and application errors specified in table 5.2.7.2-1 of 3GPP TS 29.500 [6] shall be supported for an HTTP method if the corresponding HTTP status codes are specified as mandatory for that HTTP method in table 5.2.7.1-1 of 3GPP TS 29.500 [6]. In addition, the requirements in the following clauses shall apply.

5.2.7.2 Protocol Errors

In this Release of the specification, there are no additional protocol errors applicable for the Nnwdaf_AnalyticsInfo API.

5.2.7.3 Application Errors

The application errors defined for the Nnwdaf_AnalyticsInfo API are listed in table 5.2.7.3-1.

Table 5.2.7.3-1: Application errors

Application Error	HTTP status code	Description
BOTH_STAT_PRED_NOT_ALLOWED	400 Bad Request	For the requested observation period, the start time is in the past and the end time is in the future, which means the NF service consumer requested both statistics and prediction for the analytics.
UNAVAILABLE_DATA	500 Internal Server Error	Indicates the requested statistics in the past is rejected since necessary data to perform the service is unavailable.
UNSATISFIED_REQUESTED_ANALYTICS_TIME	500 Internal Server Error	Indicates that the requested event is rejected since the analytics information is not ready when the time indicated by the "timeAnaNeeded" attribute (as provided during the request) is reached.
NOTE: Including a "ProblemDetails" data structure with the "cause" attribute in the HTTP response is optional unless explicitly mandated in the service operation clauses.		

5.2.8 Feature negotiation

The optional features in table 5.2.8-1 are defined for the Nnwdaf_AnalyticsInfo API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [6].

Table 5.2.8-1: Supported Features

Feature number	Feature Name	Description
1	UeMobility	This feature indicates the support of analytics based on UE mobility information.
2	UeCommunication	This feature indicates the support of analytics based on UE communication information.
3	NetworkPerformance	This feature indicates the support of analytics based on network performance.
4	ServiceExperience	This feature indicates support for the event related to service experience.
5	QoSSustainability	This feature indicates support for the event related to QoS sustainability.
6	AbnormalBehaviour	This feature indicates support for the event related to abnormal behaviour information.
7	UserDataCongestion	This feature indicates the support of the analytics related on user data congestion.
8	NfLoad	This feature indicates the support of the analytics related to the load of NF instances.
9	NsiLoad	This feature indicates the support of the analytics related to the load level of Network Slice and the optionally associated Network Slice Instance.
10	EneNA	This feature indicates support for the enhancements of network data analytics requirements.
11	UserDataCongestionExt	This feature indicates support for the extensions to the event related to user data congestion, including support of GPSI and/or list of Top applications. Supporting this feature also requires the support of feature UserDataCongestion.
12	Aggregation	This feature indicates support for analytics aggregation.
13	NsiLoadExt	This feature indicates support for the extensions to the event related to the load level of Network Slice and the optionally associated Network Slice Instance, including support of area of interest, NF load information and number of UE or number of PDU Session. Supporting this feature also requires the support of feature NsiLoad.
14	ServiceExperienceExt	This feature indicates support for the extensions to the event related to service experience, including support of RAT type and/or Frequency. Supporting this feature also requires the support of feature ServiceExperience.
15	SMCCE	This feature indicates support for the event related to SM congestion control experience.
16	NfLoadExt	This feature indicates support for the extensions to the event related to the load of NF instances, including NF load over area of interest. Supporting this feature also required the support of feature NfLoad.
17	Dispersion	This feature indicates support for the event related to dispersion analytics information.
18	RedundantTransmissionExp	This feature indicates support for the event related to redundant transmission experience analytics information.
19	WlanPerformance	This feature indicates support of the event related to WLAN performance analytics information.
20	UeMobilityExt	This feature indicates support for extensions to the event related to UE mobility, including support of LADN DNN to refer the LADN service area as the AOI. Supporting this feature also requires the support of feature UeMobility.
21	DnPerformance	This feature indicates the support of the analytics related to DN performance.
22	AnaCtxTransfer	This feature indicates the support of analytics context transfer.

5.2.9 Security

As indicated in 3GPP TS 33.501 [13] and 3GPP TS 29.500 [6], the access to the Nnwdaf_AnalyticsInfo API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [14]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [12]) plays the role of the authorization server.

If OAuth2 is used, an NF service consumer, prior to consuming services offered by the Nnwdaf_AnalyticsInfo API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [12], clause 5.4.2.2.

NOTE: When multiple NRFs are deployed in a network, the NRF used as authorization server is the same NRF that the NF service consumer used for discovering the Nnwdaf_AnalyticsInfo service.

The Nnwdaf_AnalyticsInfo API defines a single scope "nnwdaf-analyticsinfo" for the entire service, and it does not define any additional scopes at resource or operation level.

5.3 Nnwdaf_DataManagement Service API

5.3.1 Introduction

The Nnwdaf_DataManagement service shall use the Nnwdaf_DataManagement API.

The API URI of the Nnwdaf_DataManagement API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in each HTTP requests from the NF service consumer towards the NWDAF shall have the Resource URI structure defined in clause 4.4.1 of 3GPP TS 29.501 [7], i.e.:

{apiRoot}/<apiName>/<apiVersion>/<apiSpecificResourceUriPart>

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [7].
- The<apiName> shall be "nnwdaf-datamanagement".
- The <apiVersion> shall be "v1".
- The <apiSpecificResourceUriPart> shall be set as described in clause 5.3.3.

5.3.2 Usage of HTTP

5.3.2.1 General

HTTP/2, IETF RFC 7540 [9], shall be used as specified in clause 5 of 3GPP TS 29.500 [6].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [6].

The OpenAPI [11] specification of HTTP messages and content bodies for the Nnwdaf_DataManagement is contained in Annex A.

5.3.2.2 HTTP standard headers

5.3.2.2.1 General

See clause 5.2.2 of 3GPP TS 29.500 [6] for the usage of HTTP standard headers.

5.3.2.2.2 Content type

JSON, IETF RFC 8259 [10], shall be used as content type of the HTTP bodies specified in the present specification as specified in clause 5.4 of 3GPP TS 29.500 [6]. The use of the JSON format shall be signalled by the content type "application/json".

"Problem Details" JSON object shall be used to indicate additional details of the error in a HTTP response body and shall be signalled by the content type "application/problem+json", as defined in IETF RFC 7807 [15].

5.3.2.3 HTTP custom headers

The Nnwdaf_DataManagement service API shall support mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [6] and may support HTTP custom header fields specified in clause 5.2.3.3 of 3GPP TS 29.500 [6].

In this release of the specification, no specific custom headers are defined for the Nnwdaf_DataManagement service API.

5.3.3 Resources

5.3.3.1 Resource Structure

This clause describes the structure for the Resource URIs, the resources and methods used for the service.

Figure 5.3.3.1-1 depicts the resource URIs structure for the Nnwdaf_DataManagement API.

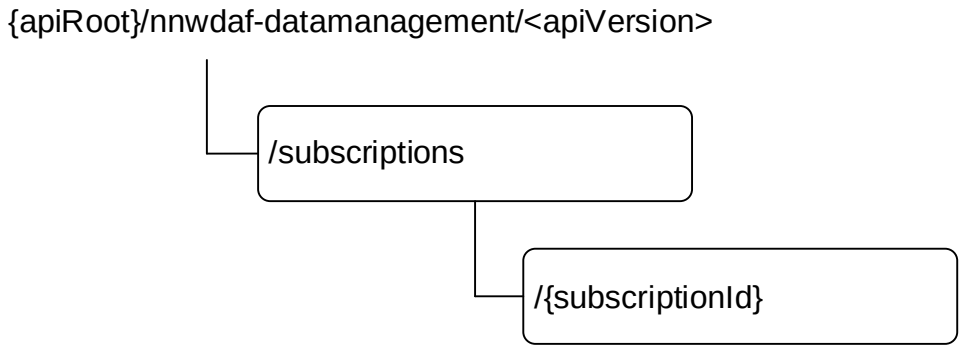

Figure 5.3.3.1-1: Resource URI structure of the Nnwdaf_DataManagement API

Table 5.3.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 5.3.3.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method or custom operation	Description
NWDAF Data Management Subscriptions	/subscriptions	POST	Creates a new Individual NWDAF Data Management Subscription resource.
Individual NWDAF Data Management Subscription	/subscriptions/{subscriptionId}	DELETE	Deletes an Individual NWDAF Data Management Subscription identified by subresource {subscriptionId}.
		PUT	Modifies an existing Individual NWDAF Data Management Subscription identified by subresource {subscriptionId}.

5.3.3.2 Resource: NWDAF Data Management Subscriptions

5.3.3.2.1 Description

The NWDAF Data Management Subscriptions resource represents all subscriptions to the Nnwdaf_DataManagement Service at a given NWDAF. The resource allows an NF service consumer to create a new Individual NWDAF Data Management Subscription resource.

5.3.3.2.2 Resource Definition

Resource URI: **{apiRoot}/nnwdaf-datamanagement/<apiVersion>/subscriptions**

The <apiVersion> shall be set as described in clause 5.3.1.

This resource shall support the resource URI variables defined in table 5.3.3.2.2-1.

Table 5.3.3.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 5.3.1

5.3.3.2.3 Resource Standard Methods

5.3.3.2.3.1 POST

This method shall support the URI query parameters specified in table 5.3.3.2.3.1-1.

Table 5.3.3.2.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.3.3.2.3.1-2 and the response data structures and response codes specified in table 5.3.3.2.3.1-3.

Table 5.3.3.2.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
NnwdafDataManagementSubsc	M	1	Create a new Individual NWDAF Data Management Subscription resource.

Table 5.3.3.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
NnwdafDataManagementSubsc	M	1	201 Created	The creation of an Individual NWDAF Data Management Subscription resource is confirmed and a representation of that resource is returned.
ProblemDetails	O	0..1	400 Bad Request	(NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the POST method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] also apply. NOTE 2: Failure cases are described in clause 5.3.7.				

Table 5.3.3.2.3.1-4: Headers supported by the 201 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains the URI of the newly created resource, according to the structure: {apiRoot}/nnwdaf-datamanagement/<apiVersion>/subscriptions/{subscriptionId}

5.3.3.2.4 Resource Custom Operations

None in this release of the specification.

5.3.3.3 Resource: Individual NWDAF Data Management Subscription

5.3.3.3.1 Description

The Individual NWDAF Data Management Subscription resource represents a single subscription to the Nnwdaf_DataManagement Service at a given NWDAF.

5.3.3.3.2 Resource definition

Resource URI: **{apiRoot}/nnwdaf-datamanagement/<apiVersion>/subscriptions/{subscriptionId}**

The <apiVersion> shall be set as described in clause 5.3.1.

This resource shall support the resource URI variables defined in table 5.3.3.3.2-1.

Table 5.3.3.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 5.3.1
subscriptionId	string	Identifies a subscription to the Nnwdaf_DataManagement Service

5.3.3.3.3 Resource Standard Methods

5.3.3.3.3.1 PUT

This method shall support the URI query parameters specified in table 5.3.3.3.3.1-1.

Table 5.3.3.3.3.1-1: URI query parameters supported by the PUT method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.3.3.3.3.1-2 and the response data structures and response codes specified in table 5.3.3.3.3.1-3.

Table 5.3.3.3.3.1-2: Data structures supported by the PUT Request Body on this resource

Data type	P	Cardinality	Description
NnwdafDataManagementSubsc	M	1	Parameters to replace a subscription to NWDAF Data Management Subscription resource.

Table 5.3.3.3.3.1-3: Data structures supported by the PUT Response Body on this resource

Data type	P	Cardinality	Response codes	Description
NnwdafDataManagementSubsc	M	1	200 OK	The Individual NWDAF Data Management Subscription resource was modified successfully and a representation of that resource is returned.
n/a			204 No Content	The Individual NWDAF Data Management Subscription resource was modified successfully.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during Individual NWDAF Data Management Subscription modification. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF (service) instance.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during Individual NWDAF Data Management Subscription modification. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF (service) instance.
ProblemDetails	O	0..1	400 Bad Request	(NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the PUT method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] also apply. NOTE 2: Failure cases are described in clause 5.3.7.				

Table 5.3.3.3.3.1-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NWDAF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected

Table 5.3.3.3.3.1-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NWDAF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected

5.3.3.3.3.2 DELETE

This method shall support the URI query parameters specified in table 5.3.3.3.3.2-1.

Table 5.3.3.3.3.2-1: URI query parameters supported by the DELETE method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.3.3.3.3.2-2 and the response data structures and response codes specified in table 5.3.3.3.3.2-3.

Table 5.3.3.3.3.2-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 5.3.3.3.3.2-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful case: The Individual NWDAF Data Management Subscription resource matching the subscriptionId was deleted.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during Individual NWDAF Data Management Subscription deletion. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF (service) instance.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during Individual NWDAF Data Management Subscription deletion. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF (service) instance.
NOTE: The mandatory HTTP error status codes for the DELETE method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] also apply.				

Table 5.3.3.3.3.2-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NWDAF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected

Table 5.3.3.3.3.2-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NWDAF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected

5.3.3.3.4 Resource Custom Operations

None in this release of the specification.

5.3.4 Custom Operations without associated resources

5.3.5 Notifications

5.3.5.1 General

Notifications shall comply with clause 6.2 of 3GPP TS 29.500 [6] and clause 4.6.2.3 of 3GPP TS 29.501 [7].

Table 5.3.5.1-1: Notifications overview

Notification	Callback URI	HTTP method or custom operation	Description (service operation)
Event Notification	{notificURI}	POST	Report one or several observed data or analytics.
Fetch Notification	{fetchUri}	POST	Fetch one or several notified data or analytics.

5.3.5.2 Event Notification

5.3.5.2.1 Description

The Event Notification is used by the NWDAF to report one or several observed data or analytics events to an NF service consumer that has subscribed to such Notifications.

5.3.5.2.2 Operation Definition

Callback URI: **{notificURI}**

The operation shall support the callback URI variables defined in Table 5.3.5.2.2-1, the request data structures specified in table 5.3.5.2.2-2 and the response data structure and response codes specified in Table 5.3.5.2.2-3.

Table 5.3.5.2.2-1: Callback URI variables

Name	Data type	Definition
notificURI	Uri	The Notification Uri is assigned within the Individual NWDAF Data Management Subscription Resource and described within the NnwdafDataManagementSubsc type (see table 5.3.6.2.2-1).

Table 5.3.5.2.2-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
NnwdafDataManagementNotif	M	1	Provides Information about observed data or analytics

Table 5.3.5.2.2-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The receipt of the Notification is acknowledged.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during the event notification. The response shall include a Location header field containing an alternative URI representing the end point of an alternative NF consumer (service) instance where the notification should be sent.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during the event notification. The response shall include a Location header field containing an alternative URI representing the end point of an alternative NF consumer (service) instance where the notification should be sent.
NOTE: The mandatory HTTP error status codes for the POST method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] also apply.				

Table 5.3.5.2.2-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected

Table 5.3.5.2.2-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected

5.3.5.3 Fetch Notification

5.3.5.3.1 Description

The Fetch Notification is used by the NF service consumer to retrieve data or analytics from the NWDAF.

5.3.5.3.2 Target URI

The Callback URI **"{fetchUri}"** shall be used with the callback URI variables defined in table 5.3.5.3.2-1.

Table 5.3.5.3.2-1: Callback URI variables

Name	Data type	Definition
fetchUri	Uri	Fetch Uri as assigned during the procedure of notification about the subscribed data or analytics within the FetchInstruction data type.

5.3.5.3.3 Standard Methods

5.3.5.3.3.1 POST

This method shall support the URI query parameters specified in table 5.3.5.3.3.1-1.

Table 5.3.5.3.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 5.3.5.3.3.1-2 and the response data structures and response codes specified in table 5.3.5.3.3.1-3.

Table 5.3.5.3.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
array(string)	M	1..N	Indicate the fetch correlation identifier(s).

Table 5.3.5.3.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
NwdafDataManagementNotif	M	1	200 OK	The stored data or analytics related to the "fetch-corr-ids".
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during subscription retrieval. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during subscription retrieval. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF.
NOTE: The manadatory HTTP error status code for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				

Table 5.3.5.3.3.1-4: Headers supported by the by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NWDAF.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

Table 5.3.5.3.3.1-5: Headers supported by the 308 response code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NWDAF.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

5.3.6 Data Model

5.3.6.1 General

This clause specifies the application data model supported by the API.

Table 5.3.6.1-1 specifies the data types defined for the Nnwdaf_DataManagement service based interface protocol.

Table 5.3.6.1-1: Nnwdaf_DataManagement specific Data Types

Data type	Clause defined	Description	Applicability
NnwdafDataManagementSubsc	5.3.6.2.2	Represents an Individual NWDAF Data Management Subscription resource.	
NnwdafDataManagementNotif	5.3.6.2.3	Represents a notification that corresponds with an Individual NWDAF Data Management Subscription resource.	

Table 5.3.6.1-2 specifies data types re-used by the Nnwdaf_DataManagement service based interface protocol from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the Nnwdaf_DataManagement service based interface.

Table 5.3.6.1-2: Nnwdaf_DataManagement re-used Data Types

Data type	Reference	Comments	Applicability
DataCollectionPurpose	3GPP TS 29.574 [26]	Represents the purpose for data collection, e.g. analytics or model training.	
DataNotification	3GPP TS 29.575 [27]	Represents data subscription notification from data source (e.g. AMF, SMF, UDM, NEF, AF).	
DataSubscription	3GPP TS 29.575 [27]	Represents data subscription from data source (e.g. AMF, SMF, UDM, NEF, AF).	
DateTime	3GPP TS 29.571 [8]	Identifies the time.	
FormattingInstruction	3GPP TS 29.574 [26]	DCCF formatting Instructions.	
FetchInstruction	3GPP TS 29.576 [28]	The fetch instruction indicates whether the data can be fetched by the consumer.	
NfInstanceId	3GPP TS 29.571 [8]	NF instance identifier.	
NfSetId	3GPP TS 29.571 [8]	NF set identifier.	
NnwdafEventsSubscription	5.1.6.2.2	Represents an NWDAF analytics subscription.	
ProcessingInstruction	3GPP TS 29.574 [26]	DCCF processing Instructions.	
SupportedFeatures	3GPP TS 29.571 [8]		
TimeWindow	3GPP TS 29.122 [19]	Represents a time window.	
Uri	3GPP TS 29.571 [8]	URI.	

5.3.6.2 Structured data types

5.3.6.2.1 Introduction

This clause defines the structures to be used in resource representations.

5.3.6.2.2 Type NnwdafDataManagementSubsc

Table 5.3.6.2.2-1: Definition of type NnwdafDataManagementSubsc

Attribute name	Data type	P	Cardinality	Description	Applicability
adrfId	NfInstanceId	O	0..1	Identifier of the ADRF to be used by the NWDAF. If the subscription is for runtime analytics (i.e. the "timePeriod" attribute is either absent or contains a time window in the future) then the NWDAF shall store the notifications in this ADRF. If the subscription is for historical analytics (i.e. the "timePeriod" attribute contains a time window in the past) then the NWDAF shall retrieve the data from this ADRF. (NOTE 2)	
adrfSetId	NfSetId	O	0..1	Identifier of the ADRF Set to be used by the NWDAF. If the subscription is for runtime analytics (i.e. the "timePeriod" attribute is either absent or contains a time window in the future) then the NWDAF shall store the notifications in this ADRF Set. If the subscription is for historical analytics (i.e. the "timePeriod" attribute contains a time window in the past) then the NWDAF shall retrieve the data from this ADRF Set. (NOTE 2)	
anaSub	NnwdafEventsSubscription	C	0..1	Subscribed analytics events. (NOTE 1)	
dataCollectPurposes	array(DataCollectionPurpose)	O	1..N	The purpose of data collection. This attribute may only be provided if the consumer has checked user consent.	
dataSub	DataSubscription	C	0..1	Subscribed data events. (NOTE 1)	
formatInstruct	FormattingInstruction	O	0..1	Formatting instructions to be used for sending event notifications.	
notifCorrId	string	M	1	Notification correlation identifier.	
notificURI	Uri	M	1	Notification target address.	
procInstruct	ProcessingInstruction	O	0..1	Processing instructions to be used for sending event notifications. This attribute may only be provided if the "dataSub" attribute is provided.	
suppFeat	SupportedFeatures	C	0..1	This IE represents a list of Supported features as described in clause 5.3.8. It shall be present if at least one feature defined in clause 5.3.8 is supported.	

targetNfId	NfInstanceId	O	0..1	NF instance identifier to which the NWDAF shall create the requested subscription. (NOTE 2)	
targetNfSetId	NfSetId	O	0..1	NF set identifier to which the NWDAF shall create the requested subscription. (NOTE 2)	
timePeriod	TimeWindow	O	0..1	Represents a start time and a stop time during which data was collected or is requested to be collected. If this attribute is included, then the internal attributes of the data subscription that indicate a subscription duration (e.g. the "targetPeriod" attribute of an "eventSubs" attribute of an "smfDataSub" attribute, or the "monDur" attribute of the ReportingInformation data type) shall not be provided. (NOTE 3)	
NOTE 1: Exactly one of these attributes shall be provided. NOTE 2: "targetNfId" and "targetNfSetId" are mutually exclusive. "adrfId" and "adrfSetId" are also mutually exclusive. NOTE 3: It includes the time period either in the past or in the future (i.e., start time as past time and stop time as future time is not allowed).					

5.3.6.2.3 Type NnwdafDataManagementNotif

Table 5.3.6.2.3-1: Definition of type NnwdafDataManagementNotif

Attribute name	Data type	P	Cardinality	Description	Applicability
dataNotification	DataNotification	C	0..1	List of data subscription notifications. (NOTE 1)	
notifCorrId	string	M	1	Notification correlation identifier.	
terminationReq	string	O	0..1	It indicates the termination of the data management subscription that requested by the NWDAF, i.e. NWDAF will not provide further notifications related to this subscription.	
fetchInstruct	FetchInstruction	C	0..1	The fetch instruction indicates whether the data are to be fetched by the Consumer. This attribute may not be present in the response of a Fetch request. (NOTE 1)	
notifTimestamp	DateTime	M	1	It represents time when NWDAF completes preparation of the requested data.	
NOTE 1: One of these attributes shall be provided.					

5.3.7 Error handling

5.3.7.1 General

HTTP error handling shall be supported as specified in clause 5.2.4 of TS 29.500 [6].

For the Nnwdaf_DataManagement API, HTTP error responses shall be supported as specified in clause 4.8 of TS 29.501 [7]. Protocol errors and application errors specified in table 5.2.7.2-1 of TS 29.500 [6] shall be supported for an HTTP method if the corresponding HTTP status codes are specified as mandatory for that HTTP method in table 5.2.7.1-1 of TS 29.500 [6]. In addition, the requirements in the following clauses shall apply.

5.3.7.2 Protocol Errors

In this Release of the specification, there are no additional protocol errors applicable for the Nnwdaf_DataManagement API.

5.3.7.3 Application Errors

The application errors defined for the Nnwdaf_DataManagement API are listed in table 5.3.7.3-1.

Table 5.3.7.3-1: Application errors

Application Error	HTTP status code	Description
SUBSCRIPTION_CANNOT_BE_SERVED	400 Bad Request	Indicates that the NWDAF cannot use the contents of the request to either a) determine whether the subscription can already be served or interactions with the ADRF and/or data sources are required or b) determine what interactions with the ADRF and/or data sources are required (if it has determined that they are required).
NOTE: Including a "ProblemDetails" data structure with the "cause" attribute in the HTTP response is optional unless explicitly mandated in the service operation clauses.		

5.3.8 Feature negotiation

The optional features in table 5.3.8-1 are defined for the Nnwdaf_DataManagement API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [6].

Table 5.3.8-1: Supported Features

Feature number	Feature Name	Description

5.3.9 Security

As indicated in TS 33.501 [13] and TS 29.500 [6], the access to the Nnwdaf_DataManagement API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [14]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see TS 29.510 [12]) plays the role of the authorization server.

If OAuth2 is used, an NF service consumer, prior to consuming services offered by the Nnwdaf_DataManagement API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in TS 29.510 [12], clause 5.4.2.2.

NOTE: When multiple NRFs are deployed in a network, the NRF used as authorization server is the same NRF that the NF service consumer used for discovering the Nnwdaf_DataManagement service.

The Nnwdaf_DataManagement API defines a single scope "nnwdaf-datamanagement" for the entire service, and it does not define any additional scopes at resource or operation level.

5.4 Nnwdaf_MLModelProvision Service API

5.4.1 Introduction

The Nnwdaf_MLModelProvision service shall use the Nnwdaf_MLModelProvision API.

The API URI of the Nnwdaf_MLModelProvision API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in each HTTP requests from the NF service consumer towards the NWDAF shall have the Resource URI structure defined in clause 4.4.1 of 3GPP TS 29.501 [7], i.e.:

{apiRoot}/<apiName>/<apiVersion>/<apiSpecificResourceUriPart>

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [7].
- The<apiName> shall be "nnwdaf-mlmodelprovision".
- The <apiVersion> shall be "v1".
- The <apiSpecificResourceUriPart> shall be set as described in clause 5.4.3.

5.4.2 Usage of HTTP

5.4.2.1 General

HTTP/2, IETF RFC 7540 [9], shall be used as specified in clause 5 of 3GPP TS 29.500 [6].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [6].

The OpenAPI [11] specification of HTTP messages and content bodies for the Nnwdaf_MLModelProvision is contained in Annex A.

5.4.2.2 HTTP standard headers

5.4.2.2.1 General

See clause 5.2.2 of 3GPP TS 29.500 [6] for the usage of HTTP standard headers.

5.4.2.2.2 Content type

JSON, IETF RFC 8259 [10], shall be used as content type of the HTTP bodies specified in the present specification as specified in clause 5.4 of 3GPP TS 29.500 [6]. The use of the JSON format shall be signalled by the content type "application/json".

"Problem Details" JSON object shall be used to indicate additional details of the error in a HTTP response body and shall be signalled by the content type "application/problem+json", as defined in IETF RFC 7807 [15].

5.4.2.3 HTTP custom headers

The Nnwdaf_MLModelProvision service API shall support mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [6] and may support HTTP custom header fields specified in clause 5.2.3.3 of 3GPP TS 29.500 [6].

In this release of the specification, no specific custom headers are defined for the Nnwdaf_MLModelProvision service API.

5.4.3 Resources

5.4.3.1 Resource Structure

This clause describes the structure for the Resource URIs and the resources and methods used for the service.

Figure 5.4.3.1-1 depicts the resource URIs structure for the Nnwdaf_MLModelProvision API.

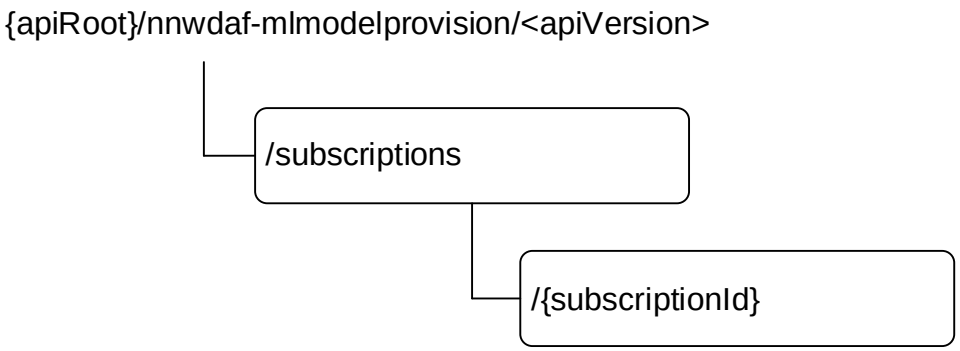

Figure 5.4.3.1-1: Resource URI structure of the Nnwdaf_MLModelProvision API

Table 5.4.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 5.4.3.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method or custom operation	Description
NWDAF ML Model Provision Subscriptions	/subscriptions	POST	Creates a new Individual NWDAF ML Model Provision Subscription resource.
Individual NWDAF ML Model Provision Subscription	/subscriptions/{subscriptionId}	DELETE	Deletes an Individual NWDAF ML Model Provision Subscription identified by subresource {subscriptionId}.
		PUT	Modifies an existing Individual NWDAF ML Model Provision Subscription identified by subresource {subscriptionId}.

5.4.3.2 Resource: NWDAF ML Model Provision Subscriptions

5.4.3.2.1 Description

The NWDAF ML Model Provision Subscriptions resource represents all subscriptions to the Nnwdaf_MLModelProvision service at a given NWDAF. The resource allows an NF service consumer to create a new Individual NWDAF ML Model Provision Subscription resource.

5.4.3.2.2 Resource definition

Resource URI: **{apiRoot}/nnwdaf-mlmodelprovision/<apiVersion>/subscriptions**

This resource shall support the resource URI variables defined in table 5.4.3.2.2-1.

Table 5.4.3.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 5.4.1

5.4.3.2.3 Resource Standard Methods

5.4.3.2.3.1 POST

This method shall support the URI query parameters specified in table 5.4.3.2.3.1-1.

Table 5.4.3.2.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.4.3.2.3.1-2 and the response data structures and response codes specified in table 5.4.3.2.3.1-3.

Table 5.4.3.2.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
NwdafMLModelProvSubsc	M	1	Creates a new Individual NWDAF ML Model Provision Subscription resource.

Table 5.4.3.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
NwdafMLModelProvSubsc	M	1	201 Created	The creation of an Individual NWDAF ML Model Provision Subscription resource is confirmed and a representation of that resource is returned.
ProblemDetails	O	0..1	500 Internal Server Error	(NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the POST method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] also apply. NOTE 2: Failure causes are described in subclause 5.4.7.3.				

Table 5.4.3.2.3.1-4: Headers supported by the 201 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains the URI of the newly created resource, according to the structure: {apiRoot}/nnwdaf-mlmodelprovision/<apiVersion>/subscriptions/{subscriptionId}

5.4.3.2.4 Resource Custom Operations

None in this release of the specification.

5.4.3.3 Resource: Individual NWDAF ML Model Provision Subscription

5.4.3.3.1 Description

The Individual NWDAF ML Model Provision Subscription resource represents a single subscription to the Nnwdaf_MLModelProvision service at a given NWDAF.

5.4.3.3.2 Resource definition

Resource URI: **{apiRoot}/nnwdaf-mlmodelprovision/<apiVersion>/subscriptions/{subscriptionId}**

The <apiVersion> shall be set as described in clause 5.4.1.

This resource shall support the resource URI variables defined in table 5.4.3.3.2-1.

Table 5.4.3.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 5.4.1.
subscriptionId	string	Identifies a subscription to the Nnwdaf_MLModelProvision service.

5.4.3.3.3 Resource Standard Methods

5.4.3.3.3.1 PUT

This method shall support the URI query parameters specified in table 5.4.3.3.3.1-1.

Table 5.4.3.3.3.1-1: URI query parameters supported by the PUT method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.4.3.3.3.1-2 and the response data structures and response codes specified in table 5.4.3.3.3.1-3.

Table 5.4.3.3.3.1-2: Data structures supported by the PUT Request Body on this resource

Data type	P	Cardinality	Description
NwdafMLModelProvSubsc	M	1	Parameters to replace a subscription to NWDAF ML Model Provision Subscription resource.

Table 5.4.3.3.3.1-3: Data structures supported by the PUT Response Body on this resource

Data type	P	Cardinality	Response codes	Description
NwdafMLModelProvSubsc	M	1	200 OK	The Individual NWDAF ML Model Provision Subscription resource was modified successfully and a representation of that resource is returned.
n/a			204 No Content	The Individual NWDAF ML Model Provision Subscription resource was modified successfully.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during Individual NWDAF ML Model Provision Subscription modification. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF (service) instance.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during Individual NWDAF ML Model Provision Subscription modification. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF (service) instance.
ProblemDetails	O	0..1	500 Internal Server Error	(NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the PUT method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] also apply. NOTE 2: Failure causes are described in subclause 5.4.7.3.				

Table 5.4.3.3.3.1-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NWDAF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected

Table 5.4.3.3.3.1-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NWDAF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected

5.4.3.3.3.2 DELETE

This method shall support the URI query parameters specified in table 5.4.3.3.3.2-1.

Table 5.4.3.3.3.2-1: URI query parameters supported by the DELETE method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.4.3.3.3.2-2 and the response data structures and response codes specified in table 5.4.3.3.3.2-3.

Table 5.4.3.3.3.2-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 5.4.3.3.3.2-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful case: The Individual NWDAF ML Model Provision Subscription resource matching the subscriptionId was deleted.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during Individual NWDAF ML Model Provision Subscription deletion. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF (service) instance.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during Individual NWDAF ML Model Provision Subscription deletion. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NWDAF (service) instance.
NOTE: The mandatory HTTP error status codes for the DELETE method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] also apply.				

Table 5.4.3.3.3.2-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NWDAF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected

Table 5.4.3.3.3.2-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NWDAF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected

5.4.3.3.4 Resource Custom Operations

None in this release of the specification.

5.4.4 Custom Operations without associated resources

None in this release of the specification.

5.4.5 Notifications

5.4.5.1 General

Notifications shall comply with clause 6.2 of 3GPP TS 29.500 [6] and clause 4.6.2.3 of 3GPP TS 29.501 [7].

Table 5.4.3.4.1-1: Notifications overview

Notification	Callback URI	HTTP method or custom operation	Description (service operation)
Event Notification	{notifUri}	POST	Report one or several observed Events.

5.4.5.2 Event Notification

5.4.5.2.1 Description

The Event Notification is used by the NWDAF to report one or several observed Events to a NF service consumer that has subscribed to such Notifications via the Individual NWDAF ML Model Provision Subscription Resource.

5.4.5.2.2 Operation Definition

Callback URI: **{notifUri}**

The operation shall support the callback URI variables defined in table 5.4.5.2.2-1, the request data structures specified in table 5.4.5.2.2-2 and the response data structure and response codes specified in table 5.4.5.2.2-3.

Table 5.4.5.2.2-1: Callback URI variables

Name	Data type	Definition
notifUri	Uri	The Notification Uri as assigned within the Individual NWDAF ML Model Provision Subscription and described within the NwdafMLModelProvSubsc type (see table 5.4.6.2.2-1).

Table 5.4.5.2.2-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
NwdafMLModelProvNotif	M	1..N	Provides Information about observed events

Table 5.4.5.2.2-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The receipt of the Notification is acknowledged.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during the event notification. The response shall include a Location header field containing an alternative URI representing the end point of an alternative NF consumer (service) instance where the notification should be sent.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during the event notification. The response shall include a Location header field containing an alternative URI representing the end point of an alternative NF consumer (service) instance where the notification should be sent.
NOTE: The mandatory HTTP error status codes for the POST method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] also apply.				

Table 5.4.5.2.2-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected

Table 5.4.5.2.2-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected

5.4.6 Data Model

5.4.6.1 General

This clause specifies the application data model supported by the API.

Table 5.4.6.1-1 specifies the data types defined for the Nnwdaf_MLModelProvision service based interface protocol.

Table 5.4.6.1-1: Nnwdaf_MLModelProvision specific Data Types

Data type	Section defined	Description	Applicability
FailureEventInfoForMLModel	5.4.6.2.7		
MLAnalyticsFilter	5.4.6.2.4		
MLEventNotif	5.4.6.2.6		
MLEventSubscription	5.4.6.2.3		
MLModelAddr	5.4.6.2.8		
NwdafMLModelProvNotif	5.4.6.2.5		
NwdafMLModelProvSubsc	5.4.6.2.2		

Table 5.4.6.1-2 specifies data types re-used by the Nnwdaf_MLModelProvision service based interface protocol from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the Nnwdaf_MLModelProvision service based interface.

Table 5.4.6.1-2: Nnwdaf_MLModelProvision re-used Data Types

Data type	Reference	Comments	Applicability
DateTime	3GPP TS 29.571 [8]	Identifies the time.	
EventFilter	5.2.6.2.3	Identifies the filter for the subscribed event.	
NetworkAreaInfo	3GPP TS 29.554 [18]	Identifies the network area.	
NwdafEvent	5.1.6.3.4		
RedirectResponse	3GPP TS 29.571 [8]		
ReportingInformation	3GPP TS 29.523 [20]	Represents the requirements of reporting the subscription.	
SupportedFeatures	3GPP TS 29.571 [8]		
TargetUeInformation	5.1.6.2.8		
TimeWindow	3GPP TS 29.122 [19]		
Uri	3GPP TS 29.571 [8]		

5.4.6.2 Structured data types

5.4.6.2.1 Introduction

This clause defines the structures to be used in resource representations.

5.4.6.2.2 Type NwdafMLModelProvSubsc

Table 5.4.6.2.2-1: Definition of type NwdafMLModelProvSubsc

Attribute name	Data type	P	Cardinality	Description	Applicability
mLEventSubscs	array(MLEventSubscription)	M	1..N	Each element identifies the subscription for each event.	
notifUri	Uri	M	1	Identifies the recipient of Notifications sent by the NWDAF.	
mLEventNotifs	array(MLEventNotif)	C	1..N	Notifications about Individual Events. Shall only be present if the immediate reporting indication in the "immRep" attribute within the "evtReq" attribute sets to true in the event subscription, and the reports are available.	
suppFeats	SupportedFeatures	C	0..1	List of Supported features used as described in clause 5.4.8. It shall be supplied by NF service consumer in the POST requests that request the creation of an NWDAF ML Model Provision Subscriptions resource, and shall be supplied by the NWDAF in the reply of corresponding request.	
notifCorreId	string	O	0..1	The value of Notification Correlation ID in the corresponding notification.	
eventReq	ReportingInformation	O	0..1	Reporting requirement information of the subscription. If omitted, the default values within the ReportingInformation data type apply.	
failEventReports	array(FailureEventInfoForMLModel)	O	1..N	Supplied by the NWDAF containing MTLF when available, shall contain the event(s) that the subscription is not successful including the failure reason(s).	

5.4.6.2.3 Type MLEventSubscription

Table 5.4.6.2.3-1: Definition of type MLEventSubscription

Attribute name	Data type	P	Cardinality	Description	Applicability
mLEvent	NwdafEvent	M	1..N	Identifies the subscribed event.	
mLEventFilter	EventFilter	M	1..N	Identifies the analytics filter for the subscribed event.	
tgtUe	TargetUeInformation	O	0..1	Identifies target UE information	
mLTargetPeriod	TimeWindow	O	0..1	Indicates the time interval during which the ML model shall be reported.	
expiryTime	DateTime	O	0..1	Indicates the time when the subscription expired.	

5.4.6.2.4 Void

5.4.6.2.5 Type NwdafMLModelProvNotif

Table 5.4.6.2.5-1: Definition of type NwdafMLModelProvNotif

Attribute name	Data type	P	Cardinality	Description	Applicability
eventNotifs	array(MLEventNotif)	M	1..N	Notifications about Individual Events	
subscriptionId	string	M	1	String identifying a subscription to the Nnwdaf_MLModelProvision Service	

5.4.6.2.6 Type MLEventNotif

Table 5.4.6.2.6-1: Definition of type MLEventNotif

Attribute name	Data type	P	Cardinality	Description	Applicability
event	NwdafEvent	M	1	Identifies the subscribed event.	
notifCorreId	string	O	0..1	Notification correlation ID used to identify the subscription to which the notification relates. It shall be set to the same value as the "notifCorreId" attribute of NwdafMLModelProvSubsc data type.	
mLFileAddr	MLModelAddr	M	1	Indicates the address (e.g. a URL or an FQDN) of the ML model file.	
validityPeriod	TimeWindow	O	0..1	Indicates the time period when the provided ML model applies.	
spatialValidity	NetworkAreaInfo	O	0..1	Indicates the area where the provided ML model applies.	

5.4.6.2.7 Type FailureEventInfoForMLModel

Table 5.1.6.2.7-1: Definition of type FailureEventInfoForMLModel

Attribute name	Data type	P	Cardinality	Description	Applicability
event	NwdafEvent	M	1	Event that is subscribed.	
failureCode	FailureCode	M	1	Identifies the failure reason.	

5.4.6.2.8 Type MLModelAddr

Table 5.4.6.2.8-1: Definition of type MLModelAddr

Attribute name	Data type	P	Cardinality	Description	Applicability
mLModelUrl	Uri	C	0..1	The URL of the ML Model file. (NOTE)	
mlFileFqdn	string	C	0..1	The FQDN of the ML Model file. (NOTE)	
NOTE: One of the "mLModelUrl" and "mlFileFqdn" attributes shall be provided.					

5.4.6.3 Simple data types and enumerations

5.4.6.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

5.4.6.3.2 Simple data types

The simple data types defined in table 5.1.6.3.2-1 shall be supported.

Table 5.4.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

5.4.6.3.3 Enumeration: FailureCode

Table 5.4.6.3.3-1: Enumeration FailureCode

Enumeration value	Description	Applicability
UNAVAILABLE_ML_MODEL	Indicates the requested ML model for the event is unavailable.	

5.4.7 Error handling

5.4.7.1 General

HTTP error handling shall be supported as specified in clause 5.2.4 of 3GPP TS 29.500 [6].

For the Nnwdaf_MLModelProvision API, HTTP error responses shall be supported as specified in clause 4.8 of 3GPP TS 29.501 [7].

Protocol errors and application errors specified in table 5.2.7.2-1 of 3GPP TS 29.500 [6] shall be supported for an HTTP method if the corresponding HTTP status codes are specified as mandatory for that HTTP method in table 5.2.7.1-1 of 3GPP TS 29.500 [6].

Protocol errors and application errors specified in table 5.2.7.2-1 of 3GPP TS 29.500 [6] for HTTP redirections shall be supported.

In addition, the requirements in the following clauses shall apply.

5.4.7.2 Protocol Errors

In this Release of the specification, there are no additional protocol errors applicable for the Nnwdaf_MLModelProvision API.

5.4.7.3 Application Errors

The application errors defined for the Nnwdaf_MLModelProvision API are listed in table 5.4.7.3-1.

Table 5.4.7.3-1: Application errors

Application Error	HTTP status code	Description
UNAVAILABLE_ML_MODEL_FOR_ALLEVENTS	500 Internal Server Error	Indicates the requested all events ML model is unavailable.
NOTE: Including a "ProblemDetails" data structure with the "cause" attribute in the HTTP response is optional unless explicitly mandated in the service operation clauses.		

5.4.8 Feature negotiation

The optional features in table 5.4.8-1 are defined for the Nnwdaf_MLModelProvision API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [6].

Table 5.4.8-1: Supported Features

Feature number	Feature Name	Description

5.4.9 Security

As indicated in 3GPP TS 33.501 [13] and 3GPP TS 29.500 [6], the access to the Nnwdaf_MLModelProvision API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [14]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [12]) plays the role of the authorization server.

If OAuth2 is used, a n NF Service Consumer, prior to consuming services offered by the Nnwdaf_MLModelProvision API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [12], clause 5.4.2.2.

NOTE: When multiple NRFs are deployed in a network, the NRF used as authorization server is the same NRF that the NF Service Consumer used for discovering the Nnwdaf_MLModelProvision service.

The Nnwdaf_MLModelProvision API defines a single scope "nnwdaf-mlmodelprovision" for the entire service, and it does not define any additional scopes at resource or operation level.

Annex A (normative): OpenAPI specification

A.1 General

The present Annex contains an OpenAPI [11] specification of HTTP messages and content bodies used by the Nnwdaf_EventsSubscription, the Nnwdaf_AnalyticsInfo, Nnwdaf_DataManagement and Nnwdaf_MLModelProvision APIs.

This Annex shall take precedence when being discrepant to other parts of the specification with respect to the encoding of information elements and methods within the API(s).

NOTE: The semantics and procedures, as well as conditions, e.g. for the applicability and allowed combinations of attributes or values, not expressed in the OpenAPI definitions but defined in other parts of the specification also apply.

Informative copies of the OpenAPI specification files contained in this 3GPP Technical Specification are available on a Git-based repository, that uses the GitLab software version control system (see clause 5B of the 3GPP TR 21.900 [16] and clause 5.3.1 of the 3GPP TS 29.501 [7] for further information).

A.2 Nnwdaf_EventsSubscription API

```
openapi: 3.0.0

info:
  version: 1.2.1
  title: Nnwdaf_EventsSubscription
  description: |
    Nnwdaf_EventsSubscription Service API.
    © 2022, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: 3GPP TS 29.520 V17.8.0; 5G System; Network Data Analytics Services.
  url: 'https://www.3gpp.org/ftp/Specs/archive/29_series/29.520/'

security:
  - {}
  - oAuth2ClientCredentials:
    - nnwdaf-eventssubscription

servers:
  - url: '{apiRoot}/nnwdaf-eventssubscription/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501.

paths:
  /subscriptions:
    post:
      summary: Create a new Individual NWDAF Events Subscription
      operationId: CreateNWDAFEventsSubscription
      tags:
        - NWDAF Events Subscriptions (Collection)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NnwdafEventsSubscription'
      responses:
        '201':
          description: Create a new Individual NWDAF Event Subscription resource.
          headers:
```

```
        Location:
          description: >
            Contains the URI of the newly created resource, according to the structure
            {apiRoot}/nnwdaf-eventssubscription/<apiVersion>/subscriptions/{subscriptionId}
          required: true
          schema:
            type: string
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NnwdafEventsSubscription'
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '411':
        $ref: 'TS29571_CommonData.yaml#/components/responses/411'
      '413':
        $ref: 'TS29571_CommonData.yaml#/components/responses/413'
      '415':
        $ref: 'TS29571_CommonData.yaml#/components/responses/415'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'
    callbacks:
      myNotification:
        '{$request.body#/notificationURI}':
          post:
            requestBody:
              required: true
              content:
                application/json:
                  schema:
                    type: array
                    items:
                      $ref: '#/components/schemas/NnwdafEventsSubscriptionNotification'
                    minItems: 1
            responses:
              '204':
                description: The receipt of the Notification is acknowledged.
              '307':
                $ref: 'TS29571_CommonData.yaml#/components/responses/307'
              '308':
                $ref: 'TS29571_CommonData.yaml#/components/responses/308'
              '400':
                $ref: 'TS29571_CommonData.yaml#/components/responses/400'
              '401':
                $ref: 'TS29571_CommonData.yaml#/components/responses/401'
              '403':
                $ref: 'TS29571_CommonData.yaml#/components/responses/403'
              '404':
                $ref: 'TS29571_CommonData.yaml#/components/responses/404'
              '411':
                $ref: 'TS29571_CommonData.yaml#/components/responses/411'
              '413':
                $ref: 'TS29571_CommonData.yaml#/components/responses/413'
              '415':
                $ref: 'TS29571_CommonData.yaml#/components/responses/415'
              '429':
                $ref: 'TS29571_CommonData.yaml#/components/responses/429'
              '500':
                $ref: 'TS29571_CommonData.yaml#/components/responses/500'
              '503':
                $ref: 'TS29571_CommonData.yaml#/components/responses/503'
              default:
                $ref: 'TS29571_CommonData.yaml#/components/responses/default'

  /subscriptions/{subscriptionId}:
    delete:
```

```
    summary: Delete an existing Individual NWDAF Events Subscription
    operationId: DeleteNWDAFEventsSubscription
    tags:
      - Individual NWDAF Events Subscription (Document)
    parameters:
      - name: subscriptionId
        in: path
        description: String identifying a subscription to the Nnwdaf_EventsSubscription Service
        required: true
        schema:
          type: string
    responses:
      '204':
        description: >
          No Content. The Individual NWDAF Event Subscription resource matching the subscriptionId
          was deleted.
      '307':
        $ref: 'TS29571_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29571_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '501':
        $ref: 'TS29571_CommonData.yaml#/components/responses/501'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  put:
    summary: Update an existing Individual NWDAF Events Subscription
    operationId: UpdateNWDAFEventsSubscription
    tags:
      - Individual NWDAF Events Subscription (Document)
    requestBody:
      required: true
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/NnwdafEventsSubscription'
    parameters:
      - name: subscriptionId
        in: path
        description: String identifying a subscription to the Nnwdaf_EventsSubscription Service
        required: true
        schema:
          type: string
    responses:
      '200':
        description: >
          The Individual NWDAF Event Subscription resource was modified successfully and a
          representation of that resource is returned.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NnwdafEventsSubscription'
      '204':
        description: The Individual NWDAF Event Subscription resource was modified successfully.
      '307':
        $ref: 'TS29571_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29571_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
```

```
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '411':
        $ref: 'TS29571_CommonData.yaml#/components/responses/411'
      '413':
        $ref: 'TS29571_CommonData.yaml#/components/responses/413'
      '415':
        $ref: 'TS29571_CommonData.yaml#/components/responses/415'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '501':
        $ref: 'TS29571_CommonData.yaml#/components/responses/501'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'

  /transfers:
    post:
      summary: Provide information about requested analytics subscriptions transfer and potentially
create a new Individual NWDAF Event Subscription Transfer resource.
      operationId: CreateNWDAFEventSubscriptionTransfer
      tags:
        - NWDAF Event Subscription Transfers (Collection)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/AnalyticsSubscriptionsTransfer'
      responses:
        '201':
          description: Create a new Individual NWDAF Event Subscription Transfer resource.
          headers:
            Location:
              description: >
                Contains the URI of the newly created resource, according to the structure
                {apiRoot}/nnwdaf-eventssubscription/<apiVersion>/transfers/{transferId}
              required: true
              schema:
                type: string
        '204':
          description: >
            No Content. The receipt of the information about analytics subscription(s) that are
            requested to be transferred and the ability to handle this information (e.g. execute the
            steps required to transfer an analytics subscription directly) is confirmed.
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'

  /transfers/{transferId}:
    delete:
      summary: Delete an existing Individual NWDAF Event Subscription Transfer
      operationId: DeleteNWDAFEventSubscriptionTransfer
      tags:
        - Individual NWDAF Event Subscription Transfer (Document)
      parameters:
        - name: transferId
```

```
      in: path
      description: >
        String identifying a request for an analytics subscription transfer to the
        Nnwdaf_EventsSubscription Service
      required: true
      schema:
        type: string
  responses:
    '204':
      description: >
        No Content. The Individual NWDAF Event Subscription Transfer resource matching the
        transferId was deleted.
    '307':
      $ref: 'TS29571_CommonData.yaml#/components/responses/307'
    '308':
      $ref: 'TS29571_CommonData.yaml#/components/responses/308'
    '400':
      $ref: 'TS29571_CommonData.yaml#/components/responses/400'
    '401':
      $ref: 'TS29571_CommonData.yaml#/components/responses/401'
    '403':
      $ref: 'TS29571_CommonData.yaml#/components/responses/403'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '429':
      $ref: 'TS29571_CommonData.yaml#/components/responses/429'
    '500':
      $ref: 'TS29571_CommonData.yaml#/components/responses/500'
    '501':
      $ref: 'TS29571_CommonData.yaml#/components/responses/501'
    '503':
      $ref: 'TS29571_CommonData.yaml#/components/responses/503'
    default:
      $ref: 'TS29571_CommonData.yaml#/components/responses/default'
put:
  summary: Update an existing Individual NWDAF Event Subscription Transfer
  operationId: UpdateNWDAFEventSubscriptionTransfer
  tags:
    - Individual NWDAF Event Subscription Transfer (Document)
  requestBody:
    required: true
    content:
      application/json:
        schema:
          $ref: '#/components/schemas/AnalyticsSubscriptionsTransfer'
  parameters:
    - name: transferId
      in: path
      description: >
        String identifying a request for an analytics subscription transfer to the
        Nnwdaf_EventsSubscription Service
      required: true
      schema:
        type: string
  responses:
    '204':
      description: >
        The Individual NWDAF Event Subscription Transfer resource was modified successfully.
    '307':
      $ref: 'TS29571_CommonData.yaml#/components/responses/307'
    '308':
      $ref: 'TS29571_CommonData.yaml#/components/responses/308'
    '400':
      $ref: 'TS29571_CommonData.yaml#/components/responses/400'
    '401':
      $ref: 'TS29571_CommonData.yaml#/components/responses/401'
    '403':
      $ref: 'TS29571_CommonData.yaml#/components/responses/403'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '411':
      $ref: 'TS29571_CommonData.yaml#/components/responses/411'
    '413':
      $ref: 'TS29571_CommonData.yaml#/components/responses/413'
    '415':
      $ref: 'TS29571_CommonData.yaml#/components/responses/415'
    '429':
      $ref: 'TS29571_CommonData.yaml#/components/responses/429'
```

```
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '501':
        $ref: 'TS29571_CommonData.yaml#/components/responses/501'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'

components:

  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            nnwdaf-eventssubscription: Access to the Nnwdaf_EventsSubscription API

  schemas:

    NnwdafEventsSubscription:
      description: Represents an Individual NWDAF Event Subscription resource.
      type: object
      properties:
        eventSubscriptions:
          type: array
          items:
            $ref: '#/components/schemas/EventSubscription'
          minItems: 1
          description: Subscribed events
        evtReq:
          $ref: 'TS29523_Npcf_EventExposure.yaml#/components/schemas/ReportingInformation'
        notificationURI:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        notifCorrId:
          type: string
          description: Notification correlation identifier.
        supportedFeatures:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
        eventNotifications:
          type: array
          items:
            $ref: '#/components/schemas/EventNotification'
          minItems: 1
        failEventReports:
          type: array
          items:
            $ref: '#/components/schemas/FailureEventInfo'
          minItems: 1
        prevSub:
          $ref: '#/components/schemas/PrevSubInfo'
        consNfInfo:
          $ref: '#/components/schemas/ConsumerNfInformation'
      required:
        - eventSubscriptions

    EventSubscription:
      description: Represents a subscription to a single event.
      type: object
      properties:
        anySlice:
          $ref: '#/components/schemas/AnySlice'
        appIds:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
          minItems: 1
          description: Identification(s) of application to which the subscription applies.
        dnns:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
          minItems: 1
          description: Identification(s) of DNN to which the subscription applies.
        dnais:
          type: array
```

```
    items:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnai'
    minItems: 1
  event:
    $ref: '#/components/schemas/NwdafEvent'
  extraReportReq:
    $ref: '#/components/schemas/EventReportingRequirement'
  ladnDnns:
    type: array
    items:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
    minItems: 1
    description: Identification(s) of LADN DNN to indicate the LADN service area as the AOI.
  loadLevelThreshold:
    type: integer
    description: >
      Indicates that the NWDAF shall report the corresponding network slice load level to the NF
      service consumer where the load level of the network slice identified by snssais is
      reached.
  notificationMethod:
    $ref: '#/components/schemas/NotificationMethod'
  matchingDir:
    $ref: '#/components/schemas/MatchingDirection'
  nfLoadLvlThds:
    type: array
    items:
      $ref: '#/components/schemas/ThresholdLevel'
    minItems: 1
    description: >
      Shall be supplied in order to start reporting when an average load level is reached.
  nfInstanceIds:
    type: array
    items:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
    minItems: 1
  nfSetIds:
    type: array
    items:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/NfSetId'
    minItems: 1
  nfTypes:
    type: array
    items:
      $ref: 'TS29510_Nnrf_NFManagement.yaml#/components/schemas/NFType'
    minItems: 1
  networkArea:
    $ref: 'TS29554_Npcf_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'
  visitedAreas:
    type: array
    items:
      $ref: 'TS29554_Npcf_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'
    minItems: 1
  maxTopAppUlNbr:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
  maxTopAppDlNbr:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
  nsiIdInfos:
    type: array
    items:
      $ref: '#/components/schemas/NsiIdInfo'
    minItems: 1
  nsiLevelThrds:
    type: array
    items:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
    minItems: 1
  qosRequ:
    $ref: '#/components/schemas/QosRequirement'
  qosFlowRetThds:
    type: array
    items:
      $ref: '#/components/schemas/RetainabilityThreshold'
    minItems: 1
  ranUeThrouThds:
    type: array
    items:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
    minItems: 1
```

```
    repetitionPeriod:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
    snssaia:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
      minItems: 1
      description: >
        Identification(s) of network slice to which the subscription applies. It corresponds to
        snssais in the data model definition of 3GPP TS 29.520.
    tgtUe:
      $ref: '#/components/schemas/TargetUeInformation'
    congThresholds:
      type: array
      items:
        $ref: '#/components/schemas/ThresholdLevel'
      minItems: 1
    nwPerfRequs:
      type: array
      items:
        $ref: '#/components/schemas/NetworkPerfRequirement'
      minItems: 1
    bwRequs:
      type: array
      items:
        $ref: '#/components/schemas/BwRequirement'
      minItems: 1
    excepRequs:
      type: array
      items:
        $ref: '#/components/schemas/Exception'
      minItems: 1
    exptAnaType:
      $ref: '#/components/schemas/ExpectedAnalyticsType'
    exptUeBehav:
      $ref: 'TS29503_Nudm_SDM.yaml#/components/schemas/ExpectedUeBehaviourData'
    ratFreqs:
      type: array
      items:
        $ref: '#/components/schemas/RatFreqInformation'
      minItems: 1
    listOfAnaSubsets:
      type: array
      items:
        $ref: '#/components/schemas/AnalyticsSubset'
      minItems: 1
    disperReqs:
      type: array
      items:
        $ref: '#/components/schemas/DispersionRequirement'
      minItems: 1
    redTransReqs:
      type: array
      items:
        $ref: '#/components/schemas/RedundantTransmissionExpReq'
      minItems: 1
    wlanReqs:
      type: array
      items:
        $ref: '#/components/schemas/WlanPerformanceReq'
      minItems: 1
    upfInfo:
      $ref: 'TS29508_Nsmf_EventExposure.yaml#/components/schemas/UpfInformation'
    appServerAddrs:
      type: array
      items:
        $ref: 'TS29517_Naf_EventExposure.yaml#/components/schemas/AddrFqdn'
      minItems: 1
    dnPerfReqs:
      type: array
      items:
        $ref: '#/components/schemas/DnPerformanceReq'
      minItems: 1
  required:
    - event

NnwdafEventsSubscriptionNotification:
  description: Represents an Individual NWDAF Event Subscription Notification resource.
```

```
    type: object
    properties:
      eventNotifications:
        type: array
        items:
          $ref: '#/components/schemas/EventNotification'
        minItems: 1
        description: Notifications about Individual Events
      subscriptionId:
        type: string
        description: String identifying a subscription to the Nnwdaf_EventsSubscription Service
      notifCorrId:
        type: string
        description: Notification correlation identifier.
      oldSubscriptionId:
        type: string
        description: >
          Subscription ID which was allocated by the source NWDAF. This parameter shall be present
          if the notification is for informing the assignment of a new Subscription Id by the
          target NWDAF.
    required:
      - subscriptionId
    oneOf:
      - required: [eventNotifications]
      - required: [oldSubscriptionId]

  EventNotification:
    description: Represents a notification on events that occurred.
    type: object
    properties:
      event:
        $ref: '#/components/schemas/NwdafEvent'
      start:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      expiry:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      timeStampGen:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      failNotifyCode:
        $ref: '#/components/schemas/NwdafFailureCode'
      rvWaitTime:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
      anaMetaInfo:
        $ref: '#/components/schemas/AnalyticsMetadataInfo'
      nfLoadLevelInfos:
        type: array
        items:
          $ref: '#/components/schemas/NfLoadLevelInformation'
        minItems: 1
      nsiLoadLevelInfos:
        type: array
        items:
          $ref: '#/components/schemas/NsiLoadLevelInfo'
        minItems: 1
      sliceLoadLevelInfo:
        $ref: '#/components/schemas/SliceLoadLevelInformation'
      svcExps:
        type: array
        items:
          $ref: '#/components/schemas/ServiceExperienceInfo'
        minItems: 1
      qosSustainInfos:
        type: array
        items:
          $ref: '#/components/schemas/QosSustainabilityInfo'
        minItems: 1
      ueComms:
        type: array
        items:
          $ref: '#/components/schemas/UeCommunication'
        minItems: 1
      ueMobs:
        type: array
        items:
          $ref: '#/components/schemas/UeMobility'
        minItems: 1
      userDataCongInfos:
        type: array
```

```
      items:
        $ref: '#/components/schemas/UserDataCongestionInfo'
      minItems: 1
    abnorBehavrs:
      type: array
      items:
        $ref: '#/components/schemas/AbnormalBehaviour'
      minItems: 1
    nwPerfs:
      type: array
      items:
        $ref: '#/components/schemas/NetworkPerfInfo'
      minItems: 1
    dnPerfInfos:
      type: array
      items:
        $ref: '#/components/schemas/DnPerfInfo'
      minItems: 1
    disperInfos:
      type: array
      items:
        $ref: '#/components/schemas/DispersionInfo'
      minItems: 1
    redTransInfos:
      type: array
      items:
        $ref: '#/components/schemas/RedundantTransmissionExpInfo'
      minItems: 1
    wlanInfos:
      type: array
      items:
        $ref: '#/components/schemas/WlanPerformanceInfo'
      minItems: 1
    smccExps:
      type: array
      items:
        $ref: 'TS29520_Nnwdaf_AnalyticsInfo.yaml#/components/schemas/SmcceInfo'
      minItems: 1
  required:
    - event

ServiceExperienceInfo:
  description: Represents service experience information.
  type: object
  properties:
    svcExprc:
      $ref: 'TS29517_Naf_EventExposure.yaml#/components/schemas/SvcExperience'
    svcExprcVariance:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Float'
    supis:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
      minItems: 1
    snssai:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
    appId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
    srvExpcType:
      $ref: '#/components/schemas/ServiceExperienceType'
    ueLocs:
      type: array
      items:
        $ref: '#/components/schemas/LocationInfo'
      minItems: 1
    upfInfo:
      $ref: 'TS29508_Nsmf_EventExposure.yaml#/components/schemas/UpfInformation'
    dnai:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnai'
    appServerInst:
      $ref: 'TS29517_Naf_EventExposure.yaml#/components/schemas/AddrFqdn'
    confidence:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
    dnn:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
    networkArea:
      $ref: 'TS29554_Npcf_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'
    nsiId:
```

```
      $ref: 'TS29531_Nnssf_NSSelection.yaml#/components/schemas/NsiId'
    ratio:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
    ratFreq:
      $ref: '#/components/schemas/RatFreqInformation'
  required:
    - svcExprc

BwRequirement:
  description: Represents bandwidth requirements.
  type: object
  properties:
    appId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
    marBwDl:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
    marBwUl:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
    mirBwDl:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
    mirBwUl:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
  required:
    - appId

SliceLoadLevelInformation:
  description: Contains load level information applicable for one or several slices.
  type: object
  properties:
    loadLevelInformation:
      $ref: '#/components/schemas/LoadLevelInformation'
    snssais:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
      minItems: 1
      description: Identification(s) of network slice to which the subscription applies.
  required:
    - loadLevelInformation
    - snssais

NsiLoadLevelInfo:
  description: >
       Represents the network slice and optionally the associated network slice instance and the
       load level information.
  type: object
  properties:
    loadLevelInformation:
      $ref: '#/components/schemas/LoadLevelInformation'
    snssai:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
    nsiId:
      $ref: 'TS29531_Nnssf_NSSelection.yaml#/components/schemas/NsiId'
    resUsage:
      $ref: '#/components/schemas/ResourceUsage'
    numOfExceedLoadLevelThr:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
    exceedLoadLevelThrInd:
      type: boolean
    networkArea:
      $ref: 'TS29554_Npcf_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'
    timePeriod:
      $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
    resUsgThrCrossTimePeriod:
      type: array
      items:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
      minItems: 1
      description: >
        Each element indicates the time elapsed between times each threshold is met or exceeded
        or crossed.
    numOfUes:
      $ref: '#/components/schemas/NumberAverage'
    numOfPduSess:
      $ref: '#/components/schemas/NumberAverage'
    confidence:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
  required:
```

```
    - loadLevelInformation
    - snssai

NsiIdInfo:
  description: Represents the S-NSSAI and the optionally associated Network Slice Instance(s).
  type: object
  properties:
    snssai:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
    nsiIds:
      type: array
      items:
        $ref: 'TS29531_Nnssf_NSSelection.yaml#/components/schemas/NsiId'
      minItems: 1
  required:
    - snssai

EventReportingRequirement:
  description: Represents the type of reporting that the subscription requires.
  type: object
  properties:
    accuracy:
      $ref: '#/components/schemas/Accuracy'
    accPerSubset:
      type: array
      items:
        $ref: '#/components/schemas/Accuracy'
      minItems: 1
      description: >
        Each element indicates the preferred accuracy level per analytics subset. It may be
        present if the "listOfAnaSubsets" attribute is present in the subscription request when
        the subscription event is NF_LOAD, UE_COMM, DISPERSION, NETWORK_PERFORMANCE,
        WLAN_PERFORMANCE, DN_PERFORMANCE or SERVICE_EXPERIENCE.
    startTs:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
    endTs:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
    offsetPeriod:
      type: integer
      description: >
        Offset period in units of seconds to the reporting time, if the value is negative means
        statistics in the past offset period, otherwise a positive value means prediction in the
        future offset period. May be present if the "repPeriod" attribute is included within the
        "evtReq" attribute.
    sampRatio:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
    maxObjectNbr:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
    maxSupiNbr:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
    timeAnaNeeded:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
    anaMeta:
      type: array
      items:
        $ref: '#/components/schemas/AnalyticsMetadata'
      minItems: 1
    anaMetaInd:
      $ref: '#/components/schemas/AnalyticsMetadataIndication'

TargetUeInformation:
  description: Identifies the target UE information.
  type: object
  properties:
    anyUe:
      type: boolean
    supis:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
      minItems: 1
    gpsis:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
      minItems: 1
    intGroupIds:
      type: array
```

```
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/GroupId'
      minItems: 1

  UeMobility:
    description: Represents UE mobility information.
    type: object
    properties:
      ts:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      recurringTime:
        $ref: 'TS29122_CpProvisioning.yaml#/components/schemas/ScheduledCommunicationTime'
      duration:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
      durationVariance:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Float'
      locInfos:
        type: array
        items:
          $ref: '#/components/schemas/LocationInfo'
        minItems: 1
    allOf:
      - required: [duration]
      - required: [locInfos]
      - oneOf:
        - required: [ts]
        - required: [recurringTime]
  LocationInfo:
    description: Represents UE location information.
    type: object
    properties:
      loc:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/UserLocation'
      ratio:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
      confidence:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
    required:
      - loc

  UeCommunication:
    description: Represents UE communication information.
    type: object
    properties:
      commDur:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
      commDurVariance:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Float'
      perioTime:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
      perioTimeVariance:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Float'
      ts:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      tsVariance:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Float'
      recurringTime:
        $ref: 'TS29122_CpProvisioning.yaml#/components/schemas/ScheduledCommunicationTime'
      trafChar:
        $ref: '#/components/schemas/TrafficCharacterization'
      ratio:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
      perioCommInd:
        type: boolean
      confidence:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
      anaOfAppList:
        $ref: '#/components/schemas/AppListForUeComm'
      sessInactTimer:
        $ref: '#/components/schemas/SessInactTimerForUeComm'
    allOf:
      - required: [commDur]
      - required: [trafChar]
      - oneOf:
        - required: [ts]
        - required: [recurringTime]
  TrafficCharacterization:
    description: Identifies the detailed traffic characterization.
```

```
    type: object
    properties:
      dnn:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
      snssai:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
      appId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
      fDescs:
        type: array
        items:
          $ref: '#/components/schemas/IpEthFlowDescription'
        minItems: 1
        maxItems: 2
      ulVol:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/Volume'
      ulVolVariance:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Float'
      dlVol:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/Volume'
      dlVolVariance:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Float'
    anyOf:
      - required: [ulVol]
      - required: [dlVol]

  UserDataCongestionInfo:
    description: Represents the user data congestion information.
    type: object
    properties:
      networkArea:
        $ref: 'TS29554_Npcf_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'
      congestionInfo:
        $ref: '#/components/schemas/CongestionInfo'
      snssai:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
    required:
      - networkArea
      - congestionInfo

  CongestionInfo:
    description: Represents the congestion information.
    type: object
    properties:
      congType:
        $ref: '#/components/schemas/CongestionType'
      timeIntev:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
      nsi:
        $ref: '#/components/schemas/ThresholdLevel'
      confidence:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
      topAppListUl:
        type: array
        items:
          $ref: '#/components/schemas/TopApplication'
        minItems: 1
      topAppListDl:
        type: array
        items:
          $ref: '#/components/schemas/TopApplication'
        minItems: 1
    required:
      - congType
      - timeIntev
      - nsi

  TopApplication:
    description: Top application that contributes the most to the traffic.
    type: object
    properties:
      appId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
      ipTrafficFilter:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/FlowInfo'
      ratio:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
    oneOf:
```

```
    - required: [appId]
    - required: [ipTrafficFilter]

QosSustainabilityInfo:
  description: Represents the QoS Sustainability information.
  type: object
  properties:
    areaInfo:
      $ref: 'TS29554_Npcf_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'
    startTs:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
    endTs:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
    qosFlowRetThd:
      $ref: '#/components/schemas/RetainabilityThreshold'
    ranUeThrouThd:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
    snssai:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
    confidence:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
  oneOf:
    - required: [qosFlowRetThd]
    - required: [ranUeThrouThd]

QosRequirement:
  description: Represents the QoS requirements.
  type: object
  properties:
    5qi:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/5Qi'
    gfbrUl:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
    gfbrDl:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
    resType:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/QosResourceType'
    pdb:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/PacketDelBudget'
    per:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/PacketErrRate'
  oneOf:
    - required: [5qi]
    - required: [resType]
ThresholdLevel:
  description: Represents a threshold level.
  type: object
  properties:
    congLevel:
      type: integer
    nfLoadLevel:
      type: integer
    nfCpuUsage:
      type: integer
    nfMemoryUsage:
      type: integer
    nfStorageUsage:
      type: integer
    avgTrafficRate:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
    maxTrafficRate:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
    avgPacketDelay:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/PacketDelBudget'
    maxPacketDelay:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/PacketDelBudget'
    avgPacketLossRate:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/PacketLossRate'
    svcExpLevel:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Float'

NfLoadLevelInformation:
  description: Represents load level information of a given NF instance.
  type: object
  properties:
    nfType:
      $ref: 'TS29510_Nnrf_NFManagement.yaml#/components/schemas/NFType'
    nfInstanceId:
```

```
      $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
    nfSetId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/NfSetId'
    nfStatus:
      $ref: '#/components/schemas/NfStatus'
    nfCpuUsage:
      type: integer
    nfMemoryUsage:
      type: integer
    nfStorageUsage:
      type: integer
    nfLoadLevelAverage:
      type: integer
    nfLoadLevelpeak:
      type: integer
    nfLoadAvgInAoi:
      type: integer
    snssai:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
    confidence:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
  allOf:
    - required: [nfType]
    - required: [nfInstanceId]
    - anyOf:
      - required: [nfStatus]
      - required: [nfCpuUsage]
      - required: [nfMemoryUsage]
      - required: [nfStorageUsage]
      - required: [nfLoadLevelAverage]
      - required: [nfLoadLevelPeak]

NfStatus:
  description: Contains the percentage of time spent on various NF states.
  type: object
  properties:
    statusRegistered:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
    statusUnregistered:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
    statusUndiscoverable:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
  anyOf:
    - required: [statusRegistered]
    - required: [statusUnregistered]
    - required: [statusUndiscoverable]

AnySlice:
  type: boolean
  description: >
    FALSE represents not applicable for all slices. TRUE represents applicable for all slices.

    LoadLevelInformation:
  type: integer
  description: >
    Load level information of the network slice and the optionally associated network slice
    instance.

AbnormalBehaviour:
  description: Represents the abnormal behaviour information.
  type: object
  properties:
    supis:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
      minItems: 1
    excep:
      $ref: '#/components/schemas/Exception'
    dnn:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
    snssai:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
    ratio:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
    confidence:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
    addtMeasInfo:
```

```
      $ref: '#/components/schemas/AdditionalMeasurement'
  required:
    - excep

Exception:
  description: Represents the Exception information.
  type: object
  properties:
    excepId:
      $ref: '#/components/schemas/ExceptionId'
    excepLevel:
      type: integer
    excepTrend:
      $ref: '#/components/schemas/ExceptionTrend'
  required:
    - excepId

AdditionalMeasurement:
  description: Represents additional measurement information.
  type: object
  properties:
    unexpLoc:
      $ref: 'TS29554_Npcf_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'
    unexpFlowTeps:
      type: array
      items:
        $ref: '#/components/schemas/IpEthFlowDescription'
      minItems: 1
    unexpWakes:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      minItems: 1
    ddosAttack:
      $ref: '#/components/schemas/AddressList'
    wrgDest:
      $ref: '#/components/schemas/AddressList'
    circums:
      type: array
      items:
        $ref: '#/components/schemas/CircumstanceDescription'
      minItems: 1

IpEthFlowDescription:
  description: Contains the description of an Uplink and/or Downlink Ethernet flow.
  type: object
  properties:
    ipTrafficFilter:
      $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/FlowDescription'
    ethTrafficFilter:
      $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/EthFlowDescription'
  oneOf:
    - required: [ipTrafficFilter]
    - required: [ethTrafficFilter]

AddressList:
  description: Represents a list of IPv4 and/or IPv6 addresses.
  type: object
  properties:
    ipv4Addrs:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv4Addr'
      minItems: 1
    ipv6Addrs:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv6Addr'
      minItems: 1

CircumstanceDescription:
  description: Contains the description of a circumstance.
  type: object
  properties:
    freq:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Float'
    tm:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
```

```
    locArea:
      $ref: 'TS29554_Npcf_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'
    vol:
      $ref: 'TS29122_CommonData.yaml#/components/schemas/Volume'

RetainabilityThreshold:
  description: Represents a QoS flow retainability threshold.
  type: object
  properties:
    relFlowNum:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
    relTimeUnit:
      $ref: '#/components/schemas/TimeUnit'
    relFlowRatio:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
  oneOf:
    - allOf:
      - required: [relFlowNum]
      - required: [relTimeUnit]
    - required: [relFlowRatio]

NetworkPerfRequirement:
  description: Represents a network performance requirement.
  type: object
  properties:
    nwPerfType:
      $ref: '#/components/schemas/NetworkPerfType'
    relativeRatio:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
    absoluteNum:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
  required:
    - nwPerfType

NetworkPerfInfo:
  description: Represents the network performance information.
  type: object
  properties:
    networkArea:
      $ref: 'TS29554_Npcf_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'
    nwPerfType:
      $ref: '#/components/schemas/NetworkPerfType'
    relativeRatio:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
    absoluteNum:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
    confidence:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
  allOf:
    - required: [networkArea]
    - required: [nwPerfType]
    - oneOf:
      - required: [relativeRatio]
      - required: [absoluteNum]

FailureEventInfo:
  description: Contains information on the event for which the subscription is not successful.
  type: object
  properties:
    event:
      $ref: '#/components/schemas/NwdafEvent'
    failureCode:
      $ref: '#/components/schemas/NwdafFailureCode'
  required:
    - event
    - failureCode

AnalyticsMetadataIndication:
  description: >
    Contains analytics metadata information requested to be used during analytics generation.
  type: object
  properties:
    dataWindow:
      $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
    dataStatProps:
      type: array
      items:
        $ref: '#/components/schemas/DatasetStatisticalProperty'
```

```
      minItems: 1
    strategy:
      $ref: '#/components/schemas/OutputStrategy'
    aggrNwdafIds:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
      minItems: 1

AnalyticsMetadataInfo:
  description: Contains analytics metadata information required for analytics aggregation.
  type: object
  properties:
    numSamples:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
    dataWindow:
      $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
    dataStatProps:
      type: array
      items:
        $ref: '#/components/schemas/DatasetStatisticalProperty'
      minItems: 1
    strategy:
      $ref: '#/components/schemas/OutputStrategy'
    accuracy:
      $ref: '#/components/schemas/Accuracy'
NumberAverage:
  description: Represents average and variance information.
  type: object
  properties:
    number:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Float'
    variance:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Float'
    skewness:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Float'
  required:
    - number
    - variance

AnalyticsSubscriptionsTransfer:
  description: Contains information about a request to transfer analytics subscriptions.
  type: object
  properties:
    subsTransInfos:
      type: array
      items:
        $ref: '#/components/schemas/SubscriptionTransferInfo'
      minItems: 1
  required:
    - subsTransInfos

SubscriptionTransferInfo:
  description: Contains information about subscriptions that are requested to be transferred.
  type: object
  properties:
    transReqType:
      $ref: '#/components/schemas/TransferRequestType'
    nwdafEvSub:
      $ref: '#/components/schemas/NnwdafEventsSubscription'
    consumerId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
    contextId:
      $ref: '#/components/schemas/AnalyticsContextIdentifier'
    sourceNfIds:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
      minItems: 1
    sourceSetIds:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/NfSetId'
      minItems: 1
    modelInfo:
      type: array
      items:
        $ref: '#/components/schemas/ModelInfo'
```

```
      minItems: 1
  required:
    - transReqType
    - nwdafEvSub
    - consumerId

ModelInfo:
  description: Contains information about an ML model.
  type: object
  properties:
    analyticsId:
      $ref: '#/components/schemas/NwdafEvent'
    mlModelInfos:
      type: array
      items:
        $ref: '#/components/schemas/MLModelInfo'
      minItems: 1
  required:
    - analyticsId
    - mlModelInfos
MLModelInfo:
  description: Contains information about an ML models.
  type: object
  properties:
    mlFileAddrs:
      type: array
      items:
        $ref: 'TS29520_Nnwdaf_MLModelProvision.yaml#/components/schemas/MLModelAddr'
      minItems: 1
    modelProvId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
    modelProvSetId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/NfSetId'
  oneOf:
    - required: [modelProvId]
    - required: [modelProvSetId]

AnalyticsContextIdentifier:
  description: Contains information about available analytics contexts.
  type: object
  properties:
    subscriptionId:
      type: string
      description: The identifier of a subscription.
    nfAnaCtxts:
      type: array
      items:
        $ref: '#/components/schemas/NwdafEvent'
      minItems: 1
      description: >
        List of analytics types for which NF related analytics contexts can be retrieved.
    ueAnaCtxts:
      type: array
      items:
        $ref: '#/components/schemas/UeAnalyticsContextDescriptor'
      minItems: 1
      description: >
        List of objects that indicate for which SUPI and analytics types combinations analytics
        context can be retrieved.
  allOf:
    - anyOf:
      - required: [nfAnaCtxts]
      - required: [ueAnaCtxts]
    - required: [subscriptionId]

UeAnalyticsContextDescriptor:
  description: Contains information about available UE related analytics contexts.
  type: object
  properties:
    supi:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
    anaTypes:
      type: array
      items:
        $ref: '#/components/schemas/NwdafEvent'
      minItems: 1
      description: >
        List of analytics types for which UE related analytics contexts can be retrieved.
```

```
    required:
      - supi
      - anaTypes

  DnPerfInfo:
    description: Represents DN performance information.
    type: object
    properties:
      appId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
      dnn:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
      snssai:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
      dnPerf:
        type: array
        items:
          $ref: '#/components/schemas/DnPerf'
        minItems: 1
      confidence:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
    required:
      - dnPerf

  DnPerf:
    description: Represents DN performance for the application.
    type: object
    properties:
      appServerInsAddr:
        $ref: 'TS29517_Naf_EventExposure.yaml#/components/schemas/AddrFqdn'
      upfInfo:
        $ref: 'TS29508_Nsmf_EventExposure.yaml#/components/schemas/UpfInformation'
      dnai:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnai'
      perfData:
        $ref: '#/components/schemas/PerfData'
      spatialValidCon:
        $ref: 'TS29554_Npcf_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'
      temporalValidCon:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
    required:
      - perfData

  PerfData:
    description: Represents DN performance data.
    type: object
    properties:
      avgTrafficRate:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
      maxTrafficRate:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
      avePacketDelay:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/PacketDelBudget'
      maxPacketDelay:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/PacketDelBudget'
      avgPacketLossRate:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/PacketLossRate'

  DispersionRequirement:
    description: Represents the dispersion analytics requirements.
    type: object
    properties:
      disperType:
        $ref: '#/components/schemas/DispersionType'
      classCriters:
        type: array
        items:
          $ref: '#/components/schemas/ClassCriterion'
        minItems: 1
      rankCriters:
        type: array
        items:
          $ref: '#/components/schemas/RankingCriterion'
        minItems: 1
      dispOrderCriter:
        $ref: '#/components/schemas/DispersionOrderingCriterion'
      order:
        $ref: '#/components/schemas/MatchingDirection'
```

```
    required:
      - disperType

  ClassCriterion:
    description: >
      Indicates the dispersion class criterion for fixed, camper and/or traveller UE, and/or the
      top-heavy UE dispersion class criterion.
    type: object
    properties:
      disperClass:
        $ref: '#/components/schemas/DispersionClass'
      classThreshold:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
      thresMatch:
        $ref: '#/components/schemas/MatchingDirection'
    required:
      - disperClass
      - classThreshold
      - thresMatch

  RankingCriterion:
    description: Indicates the usage ranking criterion between the high, medium and low usage UE.
    type: object
    properties:
      highBase:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
      lowBase:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
    required:
      - highBase
      - lowBase
  DispersionInfo:
    description: >
      Represents the Dispersion information. When subscribed event is "DISPERSION", the
      "disperInfos" attribute shall be included.
    type: object
    properties:
      tsStart:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      tsDuration:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
      disperCollects:
        type: array
        items:
          $ref: '#/components/schemas/DispersionCollection'
        minItems: 1
      disperType:
        $ref: '#/components/schemas/DispersionType'
    required:
      - tsStart
      - tsDuration
      - disperCollects
      - disperType

  DispersionCollection:
    description: Dispersion collection per UE location or per slice.
    type: object
    properties:
      ueLoc:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/UserLocation'
      snssai:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
      supis:
        type: array
        items:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        minItems: 1
      gpsis:
        type: array
        items:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
        minItems: 1
      appVolumes:
        type: array
        items:
          $ref: '#/components/schemas/ApplicationVolume'
        minItems: 1
      disperAmount:
```

```
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
    disperClass:
      $ref: '#/components/schemas/DispersionClass'
    usageRank:
      type: integer
      description: Integer where the allowed values correspond to 1, 2, 3 only.
      minimum: 1
      maximum: 3
    percentileRank:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
    ueRatio:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
    confidence:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
  allOf:
    - oneOf:
      - required: [ueLoc]
      - required: [snssai]
    - anyOf:
      - required: [disperAmount]
      - required: [disperClass]
      - required: [usageRank]
      - required: [percentileRank]

ApplicationVolume:
  description: Application data volume per Application Id.
  type: object
  properties:
    appId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
    appVolume:
      $ref: 'TS29122_CommonData.yaml#/components/schemas/Volume'
  required:
    - appId
    - appVolume

RedundantTransmissionExpReq:
  description: Represents other redundant transmission experience analytics requirements.
  type: object
  properties:
    redTOrderCriter:
      $ref: '#/components/schemas/RedTransExpOrderingCriterion'
    order:
      $ref: '#/components/schemas/MatchingDirection'

RedundantTransmissionExpInfo:
  description: >
    The redundant transmission experience related information. When subscribed event is
    "RED_TRANS_EXP", the "redTransInfos" attribute shall be included.
  type: object
  properties:
    spatialValidCon:
      $ref: 'TS29554_Npcf_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'
    dnn:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
    redTransExps:
      type: array
      items:
        $ref: '#/components/schemas/RedundantTransmissionExpPerTS'
      minItems: 1
  required:
    - redTransExps

RedundantTransmissionExpPerTS:
  description: The redundant transmission experience per Time Slot.
  type: object
  properties:
    tsStart:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
    tsDuration:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
    obsvRedTransExp:
      $ref: '#/components/schemas/ObservedRedundantTransExp'
    redTransStatus:
      type: boolean
      description: >
        Redundant Transmission Status. Set to "true" if redundant transmission was activated,
        otherwise set to "false". Default value is "false" if omitted.
```

```
    ueRatio:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
    confidence:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
  required:
    - tsStart
    - tsDuration
    - obsvRedTransExp
ObservedRedundantTransExp:
  description: Represents the observed redundant transmission experience related information.
  type: object
  properties:
    avgPktDropRateUl:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/PacketLossRate'
    varPktDropRateUl:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Float'
    avgPktDropRateDl:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/PacketLossRate'
    varPktDropRateDl:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Float'
    avgPktDelayUl:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/PacketDelBudget'
    varPktDelayUl:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Float'
    avgPktDelayDl:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/PacketDelBudget'
    varPktDelayDl:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Float'

WlanPerformanceReq:
  description: Represents other WLAN performance analytics requirements.
  type: object
  properties:
    ssIds:
      type: array
      items:
        type: string
      minItems: 1
    bssIds:
      type: array
      items:
        type: string
      minItems: 1
    wlanOrderCriter:
      $ref: '#/components/schemas/WlanOrderingCriterion'
    order:
      $ref: '#/components/schemas/MatchingDirection'

WlanPerformanceInfo:
  description: The WLAN performance related information.
  type: object
  properties:
    networkArea:
      $ref: 'TS29554_Npcf_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'
    wlanPerSsidInfos:
      type: array
      items:
        $ref: '#/components/schemas/WlanPerSsIdPerformanceInfo'
      minItems: 1
  required:
    - wlanPerSsidInfos

WlanPerSsIdPerformanceInfo:
  description: The WLAN performance per SSID.
  type: object
  properties:
    ssId:
      type: string
    wlanPerTsInfos:
      type: array
      items:
        $ref: '#/components/schemas/WlanPerTsPerformanceInfo'
      minItems: 1
  required:
    - ssId
    - wlanPerTsInfos

WlanPerTsPerformanceInfo:
```

```
    description: WLAN performance information per Time Slot during the analytics target period.
    type: object
    properties:
      tsStart:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      tsDuration:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
      rssi:
        type: integer
      rtt:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
      trafficInfo:
        $ref: '#/components/schemas/TrafficInformation'
      numberOfUes:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
      confidence:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
    required:
      - tsStart
      - tsDuration
    anyOf:
      - required: [rssi]
      - required: [rtt]
      - required: [trafficInfo]
      - required: [numberOfUes]

  TrafficInformation:
    description: Traffic information including UL/DL data rate and/or Traffic volume.
    type: object
    properties:
      uplinkRate:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
      downlinkRate:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
      uplinkVolume:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/Volume'
      downlinkVolume:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/Volume'
      totalVolume:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/Volume'
    anyOf:
      - required: [uplinkRate]
      - required: [downlinkRate]
      - required: [uplinkVolume]
      - required: [downlinkVolume]
      - required: [totalVolume]

  AppListForUeComm:
    description: Represents the analytics of the application list used by UE.
    type: object
    properties:
      appId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
      startTime:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      appDur:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
      occurRatio:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
      spatialValidity:
        $ref: 'TS29554_Npcf_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'
    required:
      - appId

  SessInactTimerForUeComm:
    description: Represents the N4 Session inactivity timer.
    type: object
    properties:
      n4SessId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/PduSessionId'
      sessInactiveTimer:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
    required:
      - n4SessId
      - sessInactiveTimer

  DnPerformanceReq:
    description: Represents other DN performance analytics requirements.
```

```
    type: object
    properties:
      dnPerfOrderCriter:
        $ref: '#/components/schemas/DnPerfOrderingCriterion'
      order:
        $ref: '#/components/schemas/MatchingDirection'
      reportThresholds:
        type: array
        items:
          $ref: '#/components/schemas/ThresholdLevel'
        minItems: 1

  RatFreqInformation:
    description: Represents the RAT type and/or Frequency information.
    type: object
    properties:
      allFreq:
        type: boolean
        description: >
          Set to "true" to indicate to handle all the frequencies the NWDAF received, otherwise
          set to "false" or omit. The "allFreq" attribute and the "freq" attribute are mutually
          exclusive.
      allRat:
        type: boolean
        description: >
          Set to "true" to indicate to handle all the RAT Types the NWDAF received, otherwise
          set to "false" or omit. The "allRat" attribute and the "ratType" attribute are mutually
          exclusive.
      freq:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/ArfcnValueNR'
      ratType:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/RatType'
      svcExpThreshold:
        $ref: '#/components/schemas/ThresholdLevel'
      matchingDir:
        $ref: '#/components/schemas/MatchingDirection'

  PrevSubInfo:
    description: Information of the previous subscription.
    type: object
    properties:
      producerId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
      producerSetId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/NfSetId'
      subscriptionId:
        type: string
        description: The identifier of a subscription.
      nfAnaEvents:
        type: array
        items:
          $ref: '#/components/schemas/NwdafEvent'
        minItems: 1
      ueAnaEvents:
        type: array
        items:
          $ref: '#/components/schemas/UeAnalyticsContextDescriptor'
        minItems: 1
    required:
      - subscriptionId
    oneOf:
      - required: [producerId]
      - required: [producerSetId]

  ResourceUsage:
    description: >
      The current usage of the virtual resources assigned to the NF instances belonging to a
      particular network slice instance.
    type: object
    properties:
      cpuUsage:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
      memoryUsage:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
      storageUsage:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'

  ConsumerNfInformation:
```

```
      description: Represents the analytics consumer NF Information.
      type: object
      properties:
        nfId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
        nfSetId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/NfSetId'
        taiList:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Tai'
          minItems: 1
      oneOf:
        - oneOf:
          - required: [nfId]
          - required: [nfSetId]
        - required: [taiList]

#
# ENUMERATIONS DATA TYPES
#
    NotificationMethod:
      anyOf:
      - type: string
        enum:
          - PERIODIC
          - THRESHOLD
      - type: string
        description: >
          This string provides forward-compatibility with future
          extensions to the enumeration but is not used to encode
          content defined in the present version of this API.
      description: |
        Possible values are:
        - PERIODIC: The subscribe of NWDAF Event is periodically. The periodic of the notification is
identified by repetitionPeriod defined in clause 5.1.6.2.3.
        - THRESHOLD: The subscribe of NWDAF Event is upon threshold exceeded.

    NwdafEvent:
      anyOf:
      - type: string
        enum:
          - SLICE_LOAD_LEVEL
          - NETWORK_PERFORMANCE
          - NF_LOAD
          - SERVICE_EXPERIENCE
          - UE_MOBILITY
          - UE_COMMUNICATION
          - QOS_SUSTAINABILITY
          - ABNORMAL_BEHAVIOUR
          - USER_DATA_CONGESTION
          - NSI_LOAD_LEVEL
          - DN_PERFORMANCE
          - DISPERSION
          - RED_TRANS_EXP
          - WLAN_PERFORMANCE
          - SM_CONGESTION
      - type: string
        description: >
          This string provides forward-compatibility with future
          extensions to the enumeration but is not used to encode
          content defined in the present version of this API.
      description: |
        Possible values are:
        - SLICE_LOAD_LEVEL: Indicates that the event subscribed is load level information of Network
Slice
        - NETWORK_PERFORMANCE: Indicates that the event subscribed is network performance
information.
        - NF_LOAD: Indicates that the event subscribed is load level and status of one or several
  Network Functions.
        - SERVICE_EXPERIENCE: Indicates that the event subscribed is service experience.
        - UE_MOBILITY: Indicates that the event subscribed is UE mobility information.
        - UE_COMMUNICATION: Indicates that the event subscribed is UE communication information.
        - QOS_SUSTAINABILITY: Indicates that the event subscribed is QoS sustainability.
        - ABNORMAL_BEHAVIOUR: Indicates that the event subscribed is abnormal behaviour.
        - USER_DATA_CONGESTION: Indicates that the event subscribed is user data congestion
information.
```

```
      - NSI_LOAD_LEVEL: Indicates that the event subscribed is load level information of Network
Slice and the optionally associated Network Slice Instance
      - DN_PERFORMANCE: Indicates that the event subscribed is DN performance information.
      - DISPERSION: Indicates that the event subscribed is dispersion information.
      - RED_TRANS_EXP: Indicates that the event subscribed is redundant transmission experience.
      - WLAN_PERFORMANCE: Indicates that the event subscribed is WLAN performance.
      - SM_CONGESTION: Indicates the Session Management Congestion Control Experience information
for specific DNN and/or S-NSSAI.

   Accuracy:
     anyOf:
     - type: string
       enum:
         - LOW
         - HIGH
     - type: string
       description: >
         This string provides forward-compatibility with future
         extensions to the enumeration but is not used to encode
         content defined in the present version of this API.
     description: |
       Possible values are:
       - LOW: Low accuracy.
       - HIGH: High accuracy.

   CongestionType:
     anyOf:
     - type: string
       enum:
         - USER_PLANE
         - CONTROL_PLANE
         - USER_AND_CONTROL_PLANE
     - type: string
       description: >
         This string provides forward-compatibility with future
         extensions to the enumeration but is not used to encode
         content defined in the present version of this API.
     description: |
       Possible values are:
       - USER_PLANE: The congestion analytics type is User Plane.
       - CONTROL_PLANE: The congestion analytics type is Control Plane.
       - USER_AND_CONTROL_PLANE: The congestion analytics type is User Plane and Control Plane.

   ExceptionId:
     anyOf:
     - type: string
       enum:
         - UNEXPECTED_UE_LOCATION
         - UNEXPECTED_LONG_LIVE_FLOW
         - UNEXPECTED_LARGE_RATE_FLOW
         - UNEXPECTED_WAKEUP
         - SUSPICION_OF_DDOS_ATTACK
         - WRONG_DESTINATION_ADDRESS
         - TOO_FREQUENT_SERVICE_ACCESS
         - UNEXPECTED_RADIO_LINK_FAILURES
         - PING_PONG_ACROSS_CELLS
     - type: string
       description: >
         This string provides forward-compatibility with future
         extensions to the enumeration but is not used to encode
         content defined in the present version of this API.
     description: |
       Possible values are:
       - UNEXPECTED_UE_LOCATION: Unexpected UE location
       - UNEXPECTED_LONG_LIVE_FLOW: Unexpected long-live rate flows
       - UNEXPECTED_LARGE_RATE_FLOW: Unexpected large rate flows
       - UNEXPECTED_WAKEUP: Unexpected wakeup
       - SUSPICION_OF_DDOS_ATTACK: Suspicion of DDoS attack
       - WRONG_DESTINATION_ADDRESS: Wrong destination address
       - TOO_FREQUENT_SERVICE_ACCESS: Too frequent Service Access
       - UNEXPECTED_RADIO_LINK_FAILURES: Unexpected radio link failures
       - PING_PONG_ACROSS_CELLS: Ping-ponging across neighbouring cells

   ExceptionTrend:
     anyOf:
     - type: string
       enum:
         - UP
```

```
        - DOWN
        - UNKNOW
        - STABLE
    - type: string
      description: >
        This string provides forward-compatibility with future
        extensions to the enumeration but is not used to encode
        content defined in the present version of this API.
    description: |
      Possible values are:
      - UP: Up trend of the exception level.
      - DOWN: Down trend of the exception level.
      - UNKNOW: Unknown trend of the exception level.
      - STABLE: Stable trend of the exception level.

  TimeUnit:
    anyOf:
    - type: string
      enum:
        - MINUTE
        - HOUR
        - DAY
    - type: string
      description: >
        This string provides forward-compatibility with future
        extensions to the enumeration but is not used to encode
        content defined in the present version of this API.
    description: |
      Possible values are:
      - MINUTE: Time unit is per minute.
      - HOUR: Time unit is per hour.
      - DAY: Time unit is per day.

  NetworkPerfType:
    anyOf:
    - type: string
      enum:
        - GNB_ACTIVE_RATIO
        - GNB_COMPUTING_USAGE
        - GNB_MEMORY_USAGE
        - GNB_DISK_USAGE
        - NUM_OF_UE
        - SESS_SUCC_RATIO
        - HO_SUCC_RATIO
    - type: string
      description: >
        This string provides forward-compatibility with future
        extensions to the enumeration but is not used to encode
        content defined in the present version of this API.
    description: |
      Possible values are:
      - GNB_ACTIVE_RATIO: Indicates that the network performance requirement is gNodeB active (i.e.
up and running) rate. Indicates the ratio of gNB active (i.e. up and running) number to the total
number of gNB
      - GNB_COMPUTING_USAGE: Indicates gNodeB computing resource usage.
      - GNB_MEMORY_USAGE: Indicates gNodeB memory usage.
      - GNB_DISK_USAGE: Indicates gNodeB disk usage.
      - NUM_OF_UE: Indicates number of UEs.
      - SESS_SUCC_RATIO: Indicates ratio of successful setup of PDU sessions to total PDU session
setup attempts.
      - HO_SUCC_RATIO: Indicates Ratio of successful handovers to the total handover attempts.

  ExpectedAnalyticsType:
    anyOf:
    - type: string
      enum:
        - MOBILITY
        - COMMUN
        - MOBILITY_AND_COMMUN
    - type: string
      description: >
        This string provides forward-compatibility with future
        extensions to the enumeration but is not used to encode
        content defined in the present version of this API.
    description: |
      Possible values are:
      - MOBILITY: Mobility related abnormal behaviour analytics is expected by the consumer.
      - COMMUN: Communication related abnormal behaviour analytics is expected by the consumer.
```

```
      - MOBILITY_AND_COMMUN: Both mobility and communication related abnormal behaviour analytics
is expected by the consumer.

   MatchingDirection:
     anyOf:
     - type: string
       enum:
         - ASCENDING
         - DESCENDING
         - CROSSED
     - type: string
       description: >
         This string provides forward-compatibility with future
         extensions to the enumeration but is not used to encode
         content defined in the present version of this API.
     description: |
       Possible values are:
       - ASCENDING: Threshold is crossed in ascending direction.
       - DESCENDING: Threshold is crossed in descending direction.
       - CROSSED: Threshold is crossed either in ascending or descending direction.

   NwdafFailureCode:
     anyOf:
     - type: string
       enum:
         - UNAVAILABLE_DATA
         - BOTH_STAT_PRED_NOT_ALLOWED
         - UNSATISFIED_REQUESTED_ANALYTICS_TIME
         - OTHER
     - type: string
       description: >
         This string provides forward-compatibility with future
         extensions to the enumeration but is not used to encode
         content defined in the present version of this API.
     description: |
       Possible values are:
       - UNAVAILABLE_DATA: Indicates the requested statistics information for the event is rejected
since necessary data to perform the service is unavailable.
       - BOTH_STAT_PRED_NOT_ALLOWED: Indicates the requested analysis information for the event is
rejected since the start time is in the past and the end time is in the future, which means the NF
service consumer requested both statistics and prediction for the analytics.
       - UNSATISFIED_REQUESTED_ANALYTICS_TIME: Indicates that the requested event is rejected since
the analytics information is not ready when the time indicated by the "timeAnaNeeded" attribute (as
provided during the creation or modification of subscription) is reached.
       - OTHER: Indicates the requested analysis information for the event is rejected due to other
reasons.

   AnalyticsMetadata:
     anyOf:
     - type: string
       enum:
         - NUM_OF_SAMPLES
         - DATA_WINDOW
         - DATA_STAT_PROPS
         - STRATEGY
         - ACCURACY
     - type: string
       description: >
         This string provides forward-compatibility with future
         extensions to the enumeration but is not used to encode
         content defined in the present version of this API.
     description: |
       Possible values are:
       - NUM_OF_SAMPLES: Number of data samples used for the generation of the output analytics.
       - DATA_WINDOW: Data time window of the data samples.
       - DATA_STAT_PROPS: Dataset statistical properties of the data used to generate the analytics.
       - STRATEGY: Output strategy used for the reporting of the analytics.
       - ACCURACY: Level of accuracy reached for the analytics.

   DatasetStatisticalProperty:
     anyOf:
     - type: string
       enum:
         - UNIFORM_DIST_DATA
         - NO_OUTLIERS
     - type: string
       description: >
         This string provides forward-compatibility with future
```

```
        extensions to the enumeration but is not used to encode
        content defined in the present version of this API.
    description: |
      Possible values are:
      - UNIFORM_DIST_DATA: Indicates the use of data samples that are uniformly distributed
according to the different aspects of the requested analytics.
      - NO_OUTLIERS: Indicates that the data samples shall disregard data samples that are at the
extreme boundaries of the value range.

  OutputStrategy:
    anyOf:
    - type: string
      enum:
        - BINARY
        - GRADIENT
    - type: string
      description: >
        This string provides forward-compatibility with future
        extensions to the enumeration but is not used to encode
        content defined in the present version of this API.
    description: |
      Possible values are:
      - BINARY: Indicates that the analytics shall only be reported when the requested level of
accuracy is reached within a cycle of periodic notification.
      - GRADIENT: Indicates that the analytics shall be reported according with the periodicity
irrespective of whether the requested level of accuracy has been reached or not.

  TransferRequestType:
    anyOf:
    - type: string
      enum:
        - PREPARE
        - TRANSFER
    - type: string
      description: >
        This string provides forward-compatibility with future
        extensions to the enumeration but is not used to encode
        content defined in the present version of this API.
    description: |
      Possible values are:
      - PREPARE: Indicates that the request is for analytics subscription transfer preparation.
      - TRANSFER: Indicates that the request is for analytics subscription transfer execution.

  AnalyticsSubset:
    anyOf:
    - type: string
      enum:
        - NUM_OF_UE_REG
        - NUM_OF_PDU_SESS_ESTBL
        - RES_USAGE
        - NUM_OF_EXCEED_RES_USAGE_LOAD_LEVEL_THR
        - PERIOD_OF_EXCEED_RES_USAGE_LOAD_LEVEL_THR
        - EXCEED_LOAD_LEVEL_THR_IND
        - LIST_OF_TOP_APP_UL
        - LIST_OF_TOP_APP_DL
        - NF_STATUS
        - NF_RESOURCE_USAGE
        - NF_LOAD
        - NF_PEAK_LOAD
        - NF_LOAD_AVG_IN_AOI
        - DISPER_AMOUNT
        - DISPER_CLASS
        - RANKING
        - PERCENTILE_RANKING
        - RSSI
        - RTT
        - TRAFFIC_INFO
        - NUMBER_OF_UES
        - APP_LIST_FOR_UE_COMM
        - N4_SESS_INACT_TIMER_FOR_UE_COMM
        - AVG_TRAFFIC_RATE
        - MAX_TRAFFIC_RATE
        - AVG_PACKET_DELAY
        - MAX_PACKET_DELAY
        - AVG_PACKET_LOSS_RATE
        - UE_LOCATION
        - LIST_OF_HIGH_EXP_UE
        - LIST_OF_MEDIUM_EXP_UE
```

```
          - LIST_OF_LOW_EXP_UE
          - AVG_UL_PKT_DROP_RATE
          - VAR_UL_PKT_DROP_RATE
          - AVG_DL_PKT_DROP_RATE
          - VAR_DL_PKT_DROP_RATE
          - AVG_UL_PKT_DELAY
          - VAR_UL_PKT_DELAY
          - AVG_DL_PKT_DELAY
          - VAR_DL_PKT_DELAY
      - type: string
        description: >
          This string provides forward-compatibility with future
          extensions to the enumeration but is not used to encode
          content defined in the present version of this API.
      description: |
        Possible values are:
        - NUM_OF_UE_REG: The number of UE registered. This value is only applicable to NSI_LOAD_LEVEL
event.
        - NUM_OF_PDU_SESS_ESTBL: The number of PDU sessions established. This value is only
applicable to NSI_LOAD_LEVEL event.
        - RES_USAGE: The current usage of the virtual resources assigned to the NF instances
belonging to a particular network slice instance. This value is only applicable to NSI_LOAD_LEVEL
event.
        - NUM_OF_EXCEED_RES_USAGE_LOAD_LEVEL_THR: The number of times the resource usage threshold of
the network slice instance is reached or exceeded if a threshold value is provided by the consumer.
This value is only applicable to NSI_LOAD_LEVEL event.
        - PERIOD_OF_EXCEED_RES_USAGE_LOAD_LEVEL_THR: The time interval between each time the
threshold being met or exceeded on the network slice (instance). This value is only applicable to
NSI_LOAD_LEVEL event.
        - EXCEED_LOAD_LEVEL_THR_IND: Whether the Load Level Threshold is met or exceeded by the
statistics value. This value is only applicable to NSI_LOAD_LEVEL event.
        - LIST_OF_TOP_APP_UL: The list of applications that contribute the most to the traffic in the
UL direction. This value is only applicable to USER_DATA_CONGESTION event.
        - LIST_OF_TOP_APP_DL: The list of applications that contribute the most to the traffic in the
DL direction. This value is only applicable to USER_DATA_CONGESTION event.
        - NF_STATUS: The availability status of the NF on the Analytics target period, expressed as a
percentage of time per status value (registered, suspended, undiscoverable). This value is only
applicable to NF_LOAD event.
        - NF_RESOURCE_USAGE: The average usage of assigned resources (CPU, memory, storage). This
value is only applicable to NF_LOAD event.
        - NF_LOAD: The average load of the NF instance over the Analytics target period. This value
is only applicable to NF_LOAD event.
        - NF_PEAK_LOAD: The maximum load of the NF instance over the Analytics target period. This
value is only applicable to NF_LOAD event.
        - NF_LOAD_AVG_IN_AOI: The average load of the NF instances over the area of interest. This
value is only applicable to NF_LOAD event.
        - DISPER_AMOUNT: Indicates the dispersion amount of the reported data volume or transaction
dispersion type. This value is only applicable to DISPERSION event.
        - DISPER_CLASS: Indicates the dispersion mobility class: fixed, camper, traveller upon set
its usage threshold, and/or the top-heavy class upon set its percentile rating threshold. This value
is only applicable to DISPERSION event.
        - RANKING: Data/transaction usage ranking high (i.e.value 1), medium (2) or low (3). This
value is only applicable to DISPERSION event.
        - PERCENTILE_RANKING: Percentile ranking of the target UE in the Cumulative Distribution
Function of data usage for the population of all UEs. This value is only applicable to DISPERSION
event.
        - RSSI: Indicated the RSSI in the unit of dBm. This value is only applicable to
WLAN_PERFORMANCE event.
        - RTT: Indicates the RTT in the unit of millisecond. This value is only applicable to
WLAN_PERFORMANCE event.
        - TRAFFIC_INFO: Traffic information including UL/DL data rate and/or Traffic volume. This
value is only applicable to WLAN_PERFORMANCE event.
        - NUMBER_OF_UES: Number of UEs observed for the SSID. This value is only applicable to
WLAN_PERFORMANCE event.
        - APP_LIST_FOR_UE_COMM: The analytics of the application list used by UE. This value is only
applicable to UE_COMM event.
        - N4_SESS_INACT_TIMER_FOR_UE_COMM: The N4 Session inactivity timer. This value is only
applicable to UE_COMM event.
        - AVG_TRAFFIC_RATE: Indicates average traffic rate. This value is only applicable to
DN_PERFORMANCE event.
        - MAX_TRAFFIC_RATE: Indicates maximum traffic rate. This value is only applicable to
DN_PERFORMANCE event.
        - AVG_PACKET_DELAY: Indicates average Packet Delay. This value is only applicable to
DN_PERFORMANCE event.
        - MAX_PACKET_DELAY: Indicates maximum Packet Delay. This value is only applicable to
DN_PERFORMANCE event.
        - AVG_PACKET_LOSS_RATE: Indicates average Loss Rate. This value is only applicable to
DN_PERFORMANCE event.
```

```
      - UE_LOCATION: Indicates UE location information. This value is only applicable to
SERVICE_EXPERIENCE event.
      - LIST_OF_HIGH_EXP_UE: Indicates list of high experienced UE. This value is only applicable
to SM_CONGESTION event.
      - LIST_OF_MEDIUM_EXP_UE: Indicates list of medium experienced UE. This value is only
applicable to SM_CONGESTION event.
      - LIST_OF_LOW_EXP_UE: Indicates list of low experienced UE. This value is only applicable to
SM_CONGESTION event.
      - AVG_UL_PKT_DROP_RATE: Indicates average uplink packet drop rate on GTP-U path on N3. This
value is only applicable to RED_TRANS_EXP event.
      - VAR_UL_PKT_DROP_RATE: Indicates variance of uplink packet drop rate on GTP-U path on N3.
This value is only applicable to RED_TRANS_EXP event.
      - AVG_DL_PKT_DROP_RATE: Indicates average downlink packet drop rate on GTP-U path on N3. This
value is only applicable to RED_TRANS_EXP event.
      - VAR_DL_PKT_DROP_RATE: Indicates variance of downlink packet drop rate on GTP-U path on N3.
This value is only applicable to RED_TRANS_EXP event.
      - AVG_UL_PKT_DELAY: Indicates average uplink packet delay round trip on GTP-U path on N3.
This value is only applicable to RED_TRANS_EXP event.
      - VAR_UL_PKT_DELAY: Indicates variance uplink packet delay round trip on GTP-U path on N3.
This value is only applicable to RED_TRANS_EXP event.
      - AVG_DL_PKT_DELAY: Indicates average downlink packet delay round trip on GTP-U path on N3.
This value is only applicable to RED_TRANS_EXP event.
      - VAR_DL_PKT_DELAY: Indicates variance downlink packet delay round trip on GTP-U path on N3.
This value is only applicable to RED_TRANS_EXP event.

    DispersionType:
      oneOf:
      - type: string
        enum:
          - DVDA
          - TDA
          - DVDA_AND_TDA
      - type: string
        description: >
          This string provides forward-compatibility with future
          extensions to the enumeration but is not used to encode
          content defined in the present version of this API.
      description: |
        Possible values are:
          - DVDA: Data Volume Dispersion Analytics.
          - TDA: Transactions Dispersion Analytics.
          - DVDA_AND_TDA: Data Volume Dispersion Analytics and Transactions Dispersion Analytics.

    DispersionClass:
      oneOf:
      - type: string
        enum:
          - FIXED
          - CAMPER
          - TRAVELLER
          - TOP_HEAVY
      - type: string
        description: >
          This string provides forward-compatibility with future
          extensions to the enumeration but is not used to encode
          content defined in the present version of this API.
      description: |
        Possible values are:
        - FIXED: Dispersion class as fixed UE its data or transaction usage at a location or a slice,
is higher than its class threshold set for its all data or transaction usage.
        - CAMPER: Dispersion class as camper UE, its data or transaction usage at a location or a
slice, is higher than its class threshold and lower than the fixed class threshold set for its all
data or transaction usage..
        - TRAVELLER: Dispersion class as traveller UE, its data or transaction usage at a location or
a slice, is lower than the camper class threshold set for its all data or transaction usage.
        - TOP_HEAVY: Dispersion class as Top_Heavy UE, who's dispersion percentile rating at a
location or a slice, is higher than its class threshold.

    DispersionOrderingCriterion:
      anyOf:
      - type: string
        enum:
          - TIME_SLOT_START
          - DISPERSION
          - CLASSIFICATION
          - RANKING
          - PERCENTILE_RANKING
      - type: string
```

```
      description: >
        This string provides forward-compatibility with future
        extensions to the enumeration but is not used to encode
        content defined in the present version of this API.
    description: |
      Possible values are:
      - TIME_SLOT_START: Indicates the order of time slot start.
      - DISPERSION: Indicates the order of data/transaction dispersion.
      - CLASSIFICATION: Indicates the order of data/transaction classification.
      - RANKING: Indicates the order of data/transaction ranking.
      - PERCENTILE_RANKING: Indicates the order of data/transaction percentile ranking.

  RedTransExpOrderingCriterion:
    anyOf:
    - type: string
      enum:
        - TIME_SLOT_START
        - RED_TRANS_EXP
    - type: string
      description: >
        This string provides forward-compatibility with future
        extensions to the enumeration but is not used to encode
        content defined in the present version of this API.
    description: |
      Possible values are:
      - TIME_SLOT_START: Indicates the order of time slot start.
      - RED_TRANS_EXP: Indicates the order of Redundant Transmission Experience.

  WlanOrderingCriterion:
    anyOf:
    - type: string
      enum:
        - TIME_SLOT_START
        - NUMBER_OF_UES
        - RSSI
        - RTT
        - TRAFFIC_INFO
    - type: string
      description: >
        This string provides forward-compatibility with future
        extensions to the enumeration but is not used to encode
        content defined in the present version of this API.
    description: |
      Possible values are:
      - TIME_SLOT_START: Indicates the order of time slot start.
      - NUMBER_OF_UES: Indicates the order of number of UEs.
      - RSSI: Indicates the order of RSSI.
      - RTT: Indicates the order of RTT.
      - TRAFFIC_INFO: Indicates the order of Traffic information.

  ServiceExperienceType:
    anyOf:
    - type: string
      enum:
        - VOICE
        - VIDEO
        - OTHER
    - type: string
      description: >
        This string provides forward-compatibility with future extensions to the enumeration but is
not used to encode content defined in the present version of this API.
    description: |
      Possible values are:
      - VOICE: Indicates that the service experience analytics is for voice service.
      - VIDEO: Indicates that the service experience analytics is for video service.
      - OTHER: Indicates that the service experience analytics is for other service.

  DnPerfOrderingCriterion:
    anyOf:
    - type: string
      enum:
        - AVERAGE_TRAFFIC_RATE
        - MAXIMUM_TRAFFIC_RATE
        - AVERAGE_PACKET_DELAY
        - MAXIMUM_PACKET_DELAY
        - AVERAGE_PACKET_LOSS_RATE
    - type: string
      description: >
```

```
        This string provides forward-compatibility with future extensions to the enumeration but
        is not used to encode content defined in the present version of this API.
      description: |
        Possible values are:
        - AVERAGE_TRAFFIC_RATE: Indicates the average traffic rate.
        - MAXIMUM_TRAFFIC_RATE: Indicates the maximum traffic rate.
        - AVERAGE_PACKET_DELAY: Indicates the average packet delay.
        - MAXIMUM_PACKET_DELAY: Indicates the maximum packet delay.
        - AVERAGE_PACKET_LOSS_RATE: Indicates the average packet loss rate.
```

A.3 Nnwdaf_AnalyticsInfo API

```
openapi: 3.0.0

info:
  version: 1.2.1
  title: Nnwdaf_AnalyticsInfo
  description: |
    Nnwdaf_AnalyticsInfo Service API.
    © 2022, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: 3GPP TS 29.520 V17.8.0; 5G System; Network Data Analytics Services.
  url: 'https://www.3gpp.org/ftp/Specs/archive/29_series/29.520/'

security:
  - {}
  - oAuth2ClientCredentials:
    - nnwdaf-analyticsinfo

servers:
  - url: '{apiRoot}/nnwdaf-analyticsinfo/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501.

paths:
  /analytics:
    get:
      summary: Read a NWDAF Analytics
      operationId: GetNWDAFAnalytics
      tags:
        - NWDAF Analytics (Document)
      parameters:
        - name: event-id
          in: query
          description: Identify the analytics.
          required: true
          schema:
            $ref: '#/components/schemas/EventId'
        - name: ana-req
          in: query
          description: Identifies the analytics reporting requirement information.
          required: false
          content:
            application/json:
              schema:
                $ref:
'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/EventReportingRequirement'
        - name: event-filter
          in: query
          description: Identify the analytics.
          required: false
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/EventFilter'
        - name: supported-features
          in: query
          description: To filter irrelevant responses related to unsupported features.
          schema:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
        - name: tgt-ue
          in: query
```

```
        description: Identify the target UE information.
        required: false
        content:
          application/json:
            schema:
              $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/TargetUeInformation'
    responses:
      '200':
        description: >
          Containing the analytics with parameters as relevant for the requesting NF service
          consumer.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/AnalyticsData'
      '204':
        description: No Content. The requested NWDAF Analytics data does not exist.
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        description: Indicates that the NWDAF Analytics resource does not exist.
        content:
          application/problem+json:
            schema:
              $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
      '406':
        $ref: 'TS29571_CommonData.yaml#/components/responses/406'
      '414':
        $ref: 'TS29571_CommonData.yaml#/components/responses/414'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        description: >
          The request is rejected by the NWDAF and more details (not only the ProblemDetails) are
          returned.
        content:
          application/problem+json:
            schema:
              $ref: '#/components/schemas/ProblemDetailsAnalyticsInfoRequest'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'

  /context:
    get:
      summary: Get context information related to analytics subscriptions.
      operationId: GetNwdafContext
      tags:
        - NWDAF Context (Document)
      parameters:
        - name: context-ids
          in: query
          description: Identifies specific context information related to analytics subscriptions.
          required: true
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/ContextIdList'
        - name: req-context
          in: query
          description: >
            Identfies the type(s) of the analytics context information the consumer wishes to receive.
          required: false
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/RequestedContext'
      responses:
        '200':
          description: >
            Contains context information related to analytics subscriptions corresponding with one or
            more context identifiers.
          content:
```

```
          application/json:
            schema:
              $ref: '#/components/schemas/ContextData'
      '204':
        description: >
          No Content. (\No context information could be retrieved for the requested context
          Identifiers.
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '406':
        $ref: 'TS29571_CommonData.yaml#/components/responses/406'
      '414':
        $ref: 'TS29571_CommonData.yaml#/components/responses/414'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'

components:

  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            nnwdaf-analyticsinfo: Access to the Nnwdaf_AnalyticsInfo API

  schemas:

    AnalyticsData:
      description: >
        Represents the description of analytics with parameters as relevant for the requesting NF
        service consumer.
      type: object
      properties:
        start:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        expiry:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        timeStampGen:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        anaMetaInfo:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/AnalyticsMetadataInfo'
        sliceLoadLevelInfos:
          type: array
          items:
            $ref:
'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/SliceLoadLevelInformation'
          minItems: 1
          description: The slices and their load level information.
        nsiLoadLevelInfos:
          type: array
          items:
            $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/NsiLoadLevelInfo'
          minItems: 1
        nfLoadLevelInfos:
          type: array
          items:
            $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/NfLoadLevelInformation'
          minItems: 1
        nwPerfs:
          type: array
          items:
            $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/NetworkPerfInfo'
          minItems: 1
        svcExps:
```

```
        type: array
        items:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/ServiceExperienceInfo'
        minItems: 1
      qosSustainInfos:
        type: array
        items:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/QosSustainabilityInfo'
        minItems: 1
      ueMobs:
        type: array
        items:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/UeMobility'
        minItems: 1
      ueComms:
        type: array
        items:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/UeCommunication'
        minItems: 1
      userDataCongInfos:
        type: array
        items:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/UserDataCongestionInfo'
        minItems: 1
      abnorBehavrs:
        type: array
        items:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/AbnormalBehaviour'
        minItems: 1
      smccExps:
        type: array
        items:
          $ref: '#/components/schemas/SmcceInfo'
        minItems: 1
      disperInfos:
        type: array
        items:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/DispersionInfo'
        minItems: 1
      redTransInfos:
        type: array
        items:
          $ref:
'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/RedundantTransmissionExpInfo'
        minItems: 1
      wlanInfos:
        type: array
        items:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/WlanPerformanceInfo'
        minItems: 1
      dnPerfInfos:
        type: array
        items:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/DnPerfInfo'
        minItems: 1
      suppFeat:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'

  EventFilter:
    description: Represents the event filters used to identify the requested analytics.
    type: object
    properties:
      anySlice:
        $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/AnySlice'
      snssais:
        type: array
        items:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
        minItems: 1
        description: Identification(s) of network slice.
      appIds:
        type: array
        items:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
        minItems: 1
      dnns:
        type: array
        items:
```

```
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
    minItems: 1
  dnais:
    type: array
    items:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnai'
    minItems: 1
  ladnDnns:
    type: array
    items:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
    minItems: 1
    description: Identification(s) of LADN DNN to indicate the LADN service area as the AOI.
  networkArea:
    $ref: 'TS29554_Npcf_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'
  visitedAreas:
    type: array
    items:
      $ref: 'TS29554_Npcf_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'
    minItems: 1
  maxTopAppUlNbr:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
  maxTopAppDlNbr:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
  nfInstanceIds:
    type: array
    items:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
    minItems: 1
  nfSetIds:
    type: array
    items:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/NfSetId'
    minItems: 1
  nfTypes:
    type: array
    items:
      $ref: 'TS29510_Nnrf_NFManagement.yaml#/components/schemas/NFType'
    minItems: 1
  nsiIdInfos:
    type: array
    items:
      $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/NsiIdInfo'
    minItems: 1
  qosRequ:
    $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/QosRequirement'
  nwPerfTypes:
    type: array
    items:
      $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/NetworkPerfType'
    minItems: 1
  bwRequs:
    type: array
    items:
      $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/BwRequirement'
    minItems: 1
  excepIds:
    type: array
    items:
      $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/ExceptionId'
    minItems: 1
  exptAnaType:
    $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/ExpectedAnalyticsType'
  exptUeBehav:
    $ref: 'TS29503_Nudm_SDM.yaml#/components/schemas/ExpectedUeBehaviourData'
  ratFreqs:
    type: array
    items:
      $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/RatFreqInformation'
    minItems: 1
  disperReqs:
    type: array
    items:
      $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/DispersionRequirement'
    minItems: 1
  redTransReqs:
    type: array
    items:
```

```
          $ref:
'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/RedundantTransmissionExpReq'
        minItems: 1
      wlanReqs:
        type: array
        items:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/WlanPerformanceReq'
        minItems: 1
      listOfAnaSubsets:
        type: array
        items:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/AnalyticsSubset'
        minItems: 1
      upfInfo:
        $ref: 'TS29508_Nsmf_EventExposure.yaml#/components/schemas/UpfInformation'

      appServerAddrs:
        type: array
        items:
          $ref: 'TS29517_Naf_EventExposure.yaml#/components/schemas/AddrFqdn'
        minItems: 1
      dnPerfReqs:
        type: array
        items:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/DnPerformanceReq'
        minItems: 1
    not:
      required: [anySlice, snssais]

  ProblemDetailsAnalyticsInfoRequest:
    description: >
      Extends ProblemDetails to indicate more details why the analytics request is rejected.
    allOf:
      - $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
      - $ref: '#/components/schemas/AdditionInfoAnalyticsInfoRequest'

  AdditionInfoAnalyticsInfoRequest:
    description: Indicates additional information why the analytics request is rejected.
    type: object
    properties:
      rvWaitTime:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'

  ContextData:
    description: >
      Contains context information related to analytics subscriptions corresponding with one or
      more context identifiers.
    type: object
    properties:
      contextElems:
        type: array
        items:
          $ref: '#/components/schemas/ContextElement'
        minItems: 1
        description: >
          List of items that contain context information corresponding with a context identifier.
    required:
      - contextElems

  ContextElement:
    description: Contains context information corresponding with a specific context identifier.
    type: object
    properties:
      contextId:
        $ref:
'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/AnalyticsContextIdentifier'
      pendAnalytics:
        type: array
        items:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/EventNotification'
        minItems: 1
        description: >
          Output analytics for the analytics subscription which have not yet been sent to the
          analytics consumer.
      histAnalytics:
        type: array
        items:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/EventNotification'
```

```
        minItems: 1
        description: Historical output analytics.
      lastOutputTime:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      aggrSubs:
        type: array
        items:
          $ref: '#/components/schemas/SpecificAnalyticsSubscription'
        minItems: 1
        description: >
          Information about analytics subscriptions that the NWDAF has with other NWDAFs to perform
          aggregation.
      histData:
        type: array
        items:
          $ref: '#/components/schemas/HistoricalData'
        minItems: 1
        description: Historical data related to the analytics subscription.
      adrfId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
      adrfDataTypes:
        type: array
        items:
          $ref: '#/components/schemas/AdrfDataType'
        minItems: 1
        description: Type(s) of data stored in the ADRF by the NWDAF.
      aggrNwdafIds:
        type: array
        items:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
        minItems: 1
        description: >
          NWDAF identifiers of NWDAF instances used by the NWDAF service consumer when aggregating
          multiple analytics subscriptions.
      modelInfo:
        type: array
        items:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/ModelInfo'
        minItems: 1
        description: >
          Contains information identifying the ML model(s) that the consumer NWDAF is currently
          subscribing for the analytics.
    required:
      - contextId

  ContextIdList:
    description: >
         Contains a list of context identifiers of context information of analytics subscriptions.
    type: object
    properties:
      contextIds:
        type: array
        items:
          $ref:
'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/AnalyticsContextIdentifier'
        minItems: 1
    required:
      - contextIds

  HistoricalData:
    description: Contains historical data related to an analytics subscription.
    type: object
    properties:
      startTime:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      endTime:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      subsWithSources:
        type: array
        items:
          $ref: '#/components/schemas/SpecificDataSubscription'
        minItems: 1
        description: Information about subscriptions with the data sources.
      data:
        type: array
        items:
          $ref: 'TS29575_Nadrf_DataManagement.yaml#/components/schemas/DataNotification'
        minItems: 1
```

```
      description: Historical data related to the analytics.
  required:
    - data

SpecificAnalyticsSubscription:
  description: >
    Represents an existing subscription for a specific type of analytics to a specific NWDAF.
  type: object
  properties:
    subscriptionId:
      type: string
    producerId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
    producerSetId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/NfSetId'
    nwdafEvSub:
      $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/NnwdafEventsSubscription'
  allOf:
    - oneOf:
      - required: [producerId]
      - required: [producerSetId]
    - required: [subscriptionId]
    - required: [nwdafEvSub]

RequestedContext:
  description: Contains types of analytics context information.
  type: object
  properties:
    contexts:
      type: array
      items:
        $ref: '#/components/schemas/ContextType'
      minItems: 1
      description: List of analytics context types.
  required:
    - contexts

SmcceInfo:
  description: Represents the Session Management congestion control experience information.
  type: object
  properties:
    dnn:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
    snssai:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
    smcceUeList:
      $ref: '#/components/schemas/SmcceUeList'
  required:
    - smcceUeList

SmcceUeList:
  description: >
    Represents the List of UEs classified based on experience level of Session Management
    congestion control.
  type: object
  properties:
    highLevel:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
      minItems: 1
    mediumLevel:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
      minItems: 1
    lowLevel:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
      minItems: 1
  anyOf:
    - required: [highLevel]
    - required: [mediumLevel]
    - required: [lowLevel]

SpecificDataSubscription:
  description: >
```

```
      Represents an existing subscription for data collection to a specific data source NF.
    type: object
    properties:
      subscriptionId:
        type: string
      producerId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
      producerSetId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/NfSetId'
      dataSub:
        $ref: 'TS29575_Nadrf_DataManagement.yaml#/components/schemas/DataSubscription'
    allOf:
      - oneOf:
        - required: [producerId]
        - required: [producerSetId]
      - required: [subscriptionId]
      - required: [dataSub]

  EventId:
    anyOf:
    - type: string
      enum:
        - LOAD_LEVEL_INFORMATION
        - NETWORK_PERFORMANCE
        - NF_LOAD
        - SERVICE_EXPERIENCE
        - UE_MOBILITY
        - UE_COMMUNICATION
        - QOS_SUSTAINABILITY
        - ABNORMAL_BEHAVIOUR
        - USER_DATA_CONGESTION
        - NSI_LOAD_LEVEL
        - SM_CONGESTION
        - DISPERSION
        - RED_TRANS_EXP
        - WLAN_PERFORMANCE
        - DN_PERFORMANCE
    - type: string
      description: >
        This string provides forward-compatibility with future
        extensions to the enumeration but is not used to encode
        content defined in the present version of this API.
    description: |
      Possible values are:
      - LOAD_LEVEL_INFORMATION: Represent the analytics of load level information of corresponding
network slice.
      - NETWORK_PERFORMANCE: Represent the analytics of network performance information.
      - NF_LOAD: Indicates that the event subscribed is NF Load.
      - SERVICE_EXPERIENCE: Represent the analytics of service experience information of the
specific applications.
      - UE_MOBILITY: Represent the analytics of UE mobility.
      - UE_COMMUNICATION: Represent the analytics of UE communication.
      - QOS_SUSTAINABILITY: Represent the analytics of QoS sustainability information in the
certain area.
      - ABNORMAL_BEHAVIOUR: Indicates that the event subscribed is abnormal behaviour information.
      - USER_DATA_CONGESTION: Represent the analytics of the user data congestion in the certain
area.
      - NSI_LOAD_LEVEL: Represent the analytics of Network Slice and the optionally associated
Network Slice Instance.
      - SM_CONGESTION: Represent the analytics of Session Management congestion control experience
information for specific DNN and/or S-NSSAI.
      - DISPERSION: Represents the analytics of dispersion.
      - RED_TRANS_EXP: Represents the analytics of Redundant Transmission Experience.
      - WLAN_PERFORMANCE: Represents the analytics of WLAN performance.
      - DN_PERFORMANCE: Represents the analytics of DN performance.

  ContextType:
    anyOf:
    - type: string
      enum:
        - PENDING_ANALYTICS
        - HISTORICAL_ANALYTICS
        - AGGR_SUBS
        - DATA
        - AGGR_INFO
        - ML_MODELS
    - type: string
      description: >
```

```
        This string provides forward-compatibility with future
        extensions to the enumeration but is not used to encode
        content defined in the present version of this API.
    description: |
      Possible values are:
      - PENDING_ANALYTICS: Represents context information that relates to pending output analytics.
      - HISTORICAL_ANALYTICS: Represents context information that relates to historical output
analytics.
      - AGGR_SUBS: Represents context information about the analytics subscriptions that an NWDAF
has with other NWDAFs that collectively serve an analytics subscription.
      - DATA: Represents context information about historical data that is available.
      - AGGR_INFO: Represents context information that is related to aggregation of analytics from
multiple NWDAF subscriptions.
      - ML_MODELS: Represents context information about used ML models.

  AdrfDataType:
    anyOf:
    - type: string
      enum:
        - HISTORICAL_ANALYTICS
        - HISTORICAL_DATA
    - type: string
      description: >
        This string provides forward-compatibility with future
        extensions to the enumeration but is not used to encode
        content defined in the present version of this API.
    description: |
      Possible values are:
      - HISTORICAL_ANALYTICS: Indicates that historical analytics are stored in the ADRF.
      - HISTORICAL_DATA: Indicates that historical data are stored in the ADRF.
```

A.4 Nnwdaf_DataManagement API

```
openapi: 3.0.0
info:
  title: Nnwdaf_DataManagement
  version: 1.0.1
  description: |
    Nnwdaf_DataManagement API Service.
    © 2022, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.
externalDocs:
  description: 3GPP TS 29.520 V17.8.0; 5G System; Network Data Analytics Services.
  url: 'https://www.3gpp.org/ftp/Specs/archive/29_series/29.520/'
servers:
  - url: '{apiRoot}/nnwdaf-datamanagement/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501
security:
  - {}
  - oAuth2ClientCredentials:
    - nnwdaf-datamanagement
paths:
  /subscriptions:
    post:
      summary: subscribe to notifications
      operationId: CreateIndividualSubcription
      tags:
        - Subscriptions (Collection)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NnwdafDataManagementSubsc'
      responses:
        '201':
          description: Success
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/NnwdafDataManagementSubsc'
          headers:
```

```
      Location:
        description: >
          Contains the URI of the newly created resource, according to the structure
          {apiRoot}/nnwdaf-datamanagement/<apiVersion>/subscriptions/{subId}.
        required: true
        schema:
          type: string
    '400':
      $ref: 'TS29571_CommonData.yaml#/components/responses/400'
    '401':
      $ref: 'TS29571_CommonData.yaml#/components/responses/401'
    '403':
      $ref: 'TS29571_CommonData.yaml#/components/responses/403'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '411':
      $ref: 'TS29571_CommonData.yaml#/components/responses/411'
    '413':
      $ref: 'TS29571_CommonData.yaml#/components/responses/413'
    '415':
      $ref: 'TS29571_CommonData.yaml#/components/responses/415'
    '429':
      $ref: 'TS29571_CommonData.yaml#/components/responses/429'
    '500':
      $ref: 'TS29571_CommonData.yaml#/components/responses/500'
    '503':
      $ref: 'TS29571_CommonData.yaml#/components/responses/503'
    default:
      $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  callbacks:
    myNotification:
      '{$request.body#/notificURI}':
        post:
          requestBody:
            required: true
            content:
              application/json:
                schema:
                  $ref: '#/components/schemas/NnwdafDataManagementNotif'
          responses:
            '204':
              description: No Content, Notification was succesfull
            '307':
              $ref: 'TS29571_CommonData.yaml#/components/responses/307'
            '308':
              $ref: 'TS29571_CommonData.yaml#/components/responses/308'
            '400':
              $ref: 'TS29571_CommonData.yaml#/components/responses/400'
            '401':
              $ref: 'TS29571_CommonData.yaml#/components/responses/401'
            '403':
              $ref: 'TS29571_CommonData.yaml#/components/responses/403'
            '404':
              $ref: 'TS29571_CommonData.yaml#/components/responses/404'
            '411':
              $ref: 'TS29571_CommonData.yaml#/components/responses/411'
            '413':
              $ref: 'TS29571_CommonData.yaml#/components/responses/413'
            '415':
              $ref: 'TS29571_CommonData.yaml#/components/responses/415'
            '429':
              $ref: 'TS29571_CommonData.yaml#/components/responses/429'
            '500':
              $ref: 'TS29571_CommonData.yaml#/components/responses/500'
            '503':
              $ref: 'TS29571_CommonData.yaml#/components/responses/503'
            default:
              $ref: 'TS29571_CommonData.yaml#/components/responses/default'
          callbacks:
            Fetch:
              '{request.body#/fetchInstruct/fetchUri}':
                post:
                  requestBody:
                    required: true
                    content:
                      application/json:
                        schema:
                          type: array
```

```
                        items:
                          type: string
                        minItems: 1
                        description: Indicate the fetch correlation identifier.
                  responses:
                    '200':
                      description: Expected response to a valid request
                      content:
                        application/json:
                          schema:
                            $ref: '#/components/schemas/NnwdafDataManagementNotif'
                    '307':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/307'
                    '308':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/308'
                    '400':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/400'
                    '401':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/401'
                    '403':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/403'
                    '404':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
                    '406':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/406'
                    '411':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/411'
                    '413':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/413'
                    '415':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/415'
                    '429':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/429'
                    '500':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/500'
                    '503':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/503'
                    default:
                      $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  /subscriptions/{subscriptionId}:
    put:
      summary: Update an existing Individual NWDAF Data Subscription.
      operationId: UpdateNWDAFDataSubscription
      tags:
        - Individual NWDAF Data Management Subscription (Document)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NnwdafDataManagementSubsc'
      parameters:
        - name: subscriptionId
          in: path
          description: Event Subscription ID
          required: true
          schema:
            type: string
      responses:
        '200':
          description: OK. Resource was succesfully modified and representation is returned
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/NnwdafDataManagementSubsc'
        '204':
          description: No Content. Resource was succesfully modified
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
```

```
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '411':
        $ref: 'TS29571_CommonData.yaml#/components/responses/411'
      '413':
        $ref: 'TS29571_CommonData.yaml#/components/responses/413'
      '415':
        $ref: 'TS29571_CommonData.yaml#/components/responses/415'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  delete:
    summary: unsubscribe from notifications
    operationId: DeleteNWDAFDataSubscription
    tags:
      - Individual NWDAF Data Management Subscription (Document)
    parameters:
      - name: subscriptionId
        in: path
        description: Event Subscription ID
        required: true
        schema:
          type: string
    responses:
      '204':
        description: No Content. Resource was succesfully deleted
      '307':
        $ref: 'TS29571_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29571_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'
components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            nnwdaf-datamanagement: Access to the Nnwdaf_DataManagement API
  schemas:
    NnwdafDataManagementSubsc:
      description: Represents an Individual NWDAF Data Management Subscription resource.
      type: object
      properties:
        adrfId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
        adrfSetId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/NfSetId'
        anaSub:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/NnwdafEventsSubscription'
        dataCollectPurposes:
          type: array
          items:
            $ref: 'TS29574_Ndccf_DataManagement.yaml#/components/schemas/DataCollectionPurpose'
          minItems: 1
          description: >
            The purposes of data collection. This attribute may only be provided if the consumer has
            checked user consent.
```

```
      dataSub:
        $ref: 'TS29575_Nadrf_DataManagement.yaml#/components/schemas/DataSubscription'
      formatInstruct:
        $ref: 'TS29574_Ndccf_DataManagement.yaml#/components/schemas/FormattingInstruction'
      notifCorrId:
        type: string
      notificURI:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
      procInstruct:
        $ref: 'TS29574_Ndccf_DataManagement.yaml#/components/schemas/ProcessingInstruction'
      suppFeat:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
      targetNfId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
      targetNfSetId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/NfSetId'
      timePeriod:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
    required:
      - notifCorrId
      - notificURI
    oneOf:
      - required: [anaSub]
      - required: [dataSub]
  NnwdafDataManagementNotif:
    description: Represents an Individual Notification.
    type: object
    properties:
      dataNotification:
        $ref: 'TS29575_Nadrf_DataManagement.yaml#/components/schemas/DataNotification'
      notifCorrId:
        type: string
        description: Notification correlation identifier.
      terminationReq:
        type: string
        description: >
          It indicates the termination of the data management subscription that requested by the
          NWDAF.
      fetchInstruct:
        $ref: 'TS29576_Nmfaf_3caDataManagement.yaml#/components/schemas/FetchInstruction'
      notifTimestamp:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
    required:
      - notifCorrId
      - notifTimestamp
    oneOf:
      - required: [dataNotification]
      - required: [fetchInstruct]
```

A.5 Nnwdaf_MLModelProvision API

```
openapi: 3.0.0
info:
  title: Nnwdaf_MLModelProvision
  version: 1.0.0
  description: |
    Nnwdaf_MLModelProvision API Service.
    © 2022, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.
externalDocs:
  description: 3GPP TS 29.520 V17.7.0; 5G System; Network Data Analytics Services.
  url: https://www.3gpp.org/ftp/Specs/archive/29_series/29.520/
servers:
  - url: '{apiRoot}/nnwdaf-mlmodelprovision/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501
security:
  - {}
  - oAuth2ClientCredentials:
    - nnwdaf-mlmodelprovision
paths:
  /subscriptions:
```

```
  post:
    summary: Create a new Individual NWDAF ML Model Provision Subscription resource.
    operationId: CreateNWDAFMLModelProvisionSubcription
    tags:
      - Subscriptions (Collection)
    requestBody:
      required: true
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/NwdafMLModelProvSubsc'
    responses:
      '201':
        description: Create a new Individual NWDAF ML Model Provision Subscription resource.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NwdafMLModelProvSubsc'
        headers:
          Location:
            description: >
              Contains the URI of the newly created resource, according to the structure
              {apiRoot}/nnwdaf-mlmodelprovision/v1/subscriptions/{subscriptionId}.
            required: true
            schema:
              type: string
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '411':
        $ref: 'TS29571_CommonData.yaml#/components/responses/411'
      '413':
        $ref: 'TS29571_CommonData.yaml#/components/responses/413'
      '415':
        $ref: 'TS29571_CommonData.yaml#/components/responses/415'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'
    callbacks:
      myNotification:
        '{$request.body#/notifUri}':
          post:
            requestBody:
              required: true
              content:
                application/json:
                  schema:
                    type: array
                    items:
                      $ref: '#/components/schemas/NwdafMLModelProvNotif'
                    minItems: 1
            responses:
              '204':
                description: No Content, Notification was succesfull
              '307':
                $ref: 'TS29571_CommonData.yaml#/components/responses/307'
              '308':
                $ref: 'TS29571_CommonData.yaml#/components/responses/308'
              '400':
                $ref: 'TS29571_CommonData.yaml#/components/responses/400'
              '401':
                $ref: 'TS29571_CommonData.yaml#/components/responses/401'
              '403':
                $ref: 'TS29571_CommonData.yaml#/components/responses/403'
              '404':
                $ref: 'TS29571_CommonData.yaml#/components/responses/404'
              '411':
                $ref: 'TS29571_CommonData.yaml#/components/responses/411'
```

```
            '413':
              $ref: 'TS29571_CommonData.yaml#/components/responses/413'
            '415':
              $ref: 'TS29571_CommonData.yaml#/components/responses/415'
            '429':
              $ref: 'TS29571_CommonData.yaml#/components/responses/429'
            '500':
              $ref: 'TS29571_CommonData.yaml#/components/responses/500'
            '503':
              $ref: 'TS29571_CommonData.yaml#/components/responses/503'
            default:
              $ref: 'TS29571_CommonData.yaml#/components/responses/default'
/subscriptions/{subscriptionId}:
  put:
    summary: update an existing Individual NWDAF ML Model Provision Subscription
    operationId: UpdateNWDAFMLModelProvisionSubcription
    tags:
      - Individual NWDAF ML Model Provision Subscription (Document)
    requestBody:
      required: true
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/NwdafMLModelProvSubsc'
    parameters:
      - name: subscriptionId
        in: path
        description: String identifying a subscription to the Nnwdaf_MLModelProvision Service.
        required: true
        schema:
          type: string
    responses:
      '200':
        description: >
          The Individual NWDAF ML Model Provision Subscription resource was modified successfully
          and a representation of that resource is returned.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NwdafMLModelProvSubsc'
      '204':
        description: >
          The Individual NWDAF ML Model Provision Subscription resource was modified successfully.
      '307':
        $ref: 'TS29571_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29571_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '411':
        $ref: 'TS29571_CommonData.yaml#/components/responses/411'
      '413':
        $ref: 'TS29571_CommonData.yaml#/components/responses/413'
      '415':
        $ref: 'TS29571_CommonData.yaml#/components/responses/415'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  delete:
    summary: Delete an existing Individual NWDAF ML Model Provision Subscription.
    operationId: DeleteNWDAFMLModelProvisionSubcription
    tags:
      - Individual NWDAF ML Model Provision Subscription (Document)
    parameters:
      - name: subscriptionId
        in: path
        description: String identifying a subscription to the Nnwdaf_MLModelProvision Service.
```

```
        required: true
        schema:
          type: string
      responses:
        '204':
          description: >
            No Content. The Individual NWDAF ML Model Provision Subscription matching the
            subscriptionId was deleted.
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'
components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            nnwdaf-mlmodelprovision: Access to the Nnwdaf_MLModelProvision API
  schemas:
    NwdafMLModelProvSubsc:
      description: Represents NWDAF Event Subscription resources.
      type: object
      properties:
        mLEventSubscs:
          type: array
          items:
            $ref: '#/components/schemas/MLEventSubscription'
          minItems: 1
          description: Subscribed events
        notifUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        mLEventNotifs:
          type: array
          items:
            $ref: '#/components/schemas/MLEventNotif'
          minItems: 1
        suppFeats:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
        notifCorreId:
          type: string
        eventReq:
          $ref: 'TS29523_Npcf_EventExposure.yaml#/components/schemas/ReportingInformation'
        failEventReports:
          type: array
          items:
            $ref: '#/components/schemas/FailureEventInfoForMLModel'
          minItems: 1
      required:
        - mLEventSubscs
        - notifUri
    MLEventSubscription:
      description: Represents a subscription to a single event.
      type: object
      properties:
        mLEvent:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/NwdafEvent'
        mLEventFilter:
          $ref: 'TS29520_Nnwdaf_AnalyticsInfo.yaml#/components/schemas/EventFilter'
        tgtUe:
```

```
        $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/TargetUeInformation'
      mLTargetPeriod:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
      expiryTime:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
    required:
      - mLEvent
      - mLEventFilter
  NwdafMLModelProvNotif:
    description: Represents notifications on events that occurred.
    type: object
    properties:
      eventNotifs:
        type: array
        items:
          $ref: '#/components/schemas/MLEventNotif'
        minItems: 1
        description: Notifications about Individual Events.
      subscriptionId:
        type: string
        description: String identifying a subscription to the Nnwdaf_MLModelProvision Service.
    required:
      - eventNotifs
      - subscriptionId
  MLEventNotif:
    description: Represents a notification related to a single event that occurred.
    type: object
    properties:
      event:
        $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/NwdafEvent'
      notifCorreId:
        type: string
      mLFileAddr:
        $ref: '#/components/schemas/MLModelAddr'
      validityPeriod:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
      spatialValidity:
        $ref: 'TS29554_Npcf_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'
    required:
      - event
      - mLFileAddr
  FailureEventInfoForMLModel:
    description: >
      Represents the event(s) that the subscription is not successful including the failure
      reason(s).
    type: object
    properties:
      event:
        $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/NwdafEvent'
      failureCode:
        $ref: '#/components/schemas/FailureCode'
    required:
      - event
      - failureCode

  MLModelAddr:
    description: Addresses of ML model files.
    type: object
    properties:
      mLModelUrl:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
      mlFileFqdn:
        type: string
        description: The FQDN of the ML Model file.
    oneOf:
       - required: [mLModelUrl]
       - required: [mlFileFqdn]

#
# ENUMERATIONS DATA TYPES
#
  FailureCode:
    anyOf:
    - type: string
      enum:
        - UNAVAILABLE_ML_MODEL
    - type: string
      description: >
```

```
    This string provides forward-compatibility with future extensions to the enumeration but
    is not used to encode content defined in the present version of this API.
description: >
  Possible values are
  - UNAVAILABLE_ML_MODEL: Indicates the requested ML model for the event is unavailable.
```

Annex B (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New**
2017-10						TS skeleton of Network Data Analytics Services.	0.0.0
2017-11	CT3#92					Inclusion of documents agreed in CT3#92 C3-175356.	0.1.0
2017-12	CT3#93					Inclusion of documents agreed in CT3#93 C3-176166, C3-176260, C3-176324, C3-176325, C3-176326, and C3-176327.	0.2.0
2018-01	CT3#94					Inclusion of documents agreed in CT3#94 C3-180252, C3-180253, C3-180254, C3-180255, C3-180256, C3-180257, C3-180344, C3-180345, C3-180346, C3-180323 and C3-180347.	0.3.0
2018-03	CT3#95					Inclusion of documents agreed in CT3#95 C3-181253, C3-181255, C3-181256, C3-181257, C3-181260, C3-181312, C3-181342 and C3-181343.	0.4.0
2018-03	CT3#96					Inclusion of documents agreed in CT3#96 C3-182379 and C3-182380.	0.5.0
2018-05	CT3#97					Inclusion of documents agreed in CT3#97 C3-183285, C3-183532, C3-183533, C3-183534 and C3-183535.	0.6.0
2018-06	CT#80	CP-181032				TS sent to plenary for approval	1.0.0
2018-06	CT#80	CP-181032				TS approved by plenary	15.0.0
2018-09	CT#81	CP-182015	0001	3	F	Clarification on mandatory HTTP error status codes	15.1.0
2018-09	CT#81	CP-182209	0002	4	B	OpenAPI for TS 29.520	15.1.0
2018-09	CT#81	CP-182015	0003	1	F	Description of Structured data types	15.1.0
2018-09	CT#81	CP-182015	0004	1	F	Resource structure presentation	15.1.0
2018-12	CT#82	CP-183205	0006		F	Default value for apiRoot	15.2.0
2018-12	CT#82	CP-183205	0007	2	F	Correct Nnwdaf service	15.2.0
2018-12	CT#82	CP-183205	0008	1	F	Cardinality	15.2.0
2018-12	CT#82	CP-183205	0009		F	API version	15.2.0
2018-12	CT#82	CP-183205	0010		F	ExternalDocs OpenAPI field	15.2.0
2018-12	CT#82	CP-183205	0011	1	F	Security	15.2.0
2018-12	CT#82	CP-183205	0012	1	F	Supported content types	15.2.0
2018-12	CT#82	CP-183205	0013	2	F	HTTP Error responses	15.2.0
2018-12	CT#82	CP-183205	0014	2	F	Correct NWDAF resource	15.2.0
2018-12	CT#82	CP-183205	0016	1	F	Adding HTTP status code "204 No Content"	15.2.0
2018-12	CT#82	CP-183205	0019		F	Location header field in OpenAPI	15.2.0
2019-03	CT#83	CP-190113	0020		F	Support of NSSF as the service consumer	15.3.0
2019-03	CT#83	CP-190113	0021	1	F	Formatting of structured data types in query	15.3.0
2019-03	CT#83	CP-190113	0022		F	OpenAPI info version update	15.3.0
2019-03	CT#83	CP-190213	0023	1	F	Correction of Location header in Nnwdaf_EventsSubscription OPenAPI	15.3.0
2019-06	CT#84	CP-191078	0024	1	F	Correction of Nnwdaf_EventsSubscription OpenAPI	15.4.0
2019-06	CT#84	CP-191078	0029	7	F	Corrections on TS 29.520	15.4.0
2019-06	CT#84	CP-191078	0035	1	F	Precedence of OpenAPI file	15.4.0
2019-06	CT#84	CP-191078	0037	1	F	Copyright Note in YAML files	15.4.0
2019-06	CT#84	CP-191090	0025	1	B	Reference update and service representation	16.0.0
2019-06	CT#84	CP-191090	0027	3	B	Support of more consumers	16.0.0
2019-06	CT#84	CP-191090	0028	1	B	Support of more analytic events	16.0.0
2019-06	CT#84	CP-191225	0031	9	B	Subscribing of service experience for the application	16.0.0
2019-06	CT#84	CP-191090	0033	2	B	Delete the subscription of service experience for the application	16.0.0
2019-06	CT#84	CP-191090	0034	5	B	Notification of service experience for the application	16.0.0
2019-06	CT#84	CP-191090	0039	2	F	Copyright Note in YAML files	16.0.0
2019-09	CT#85	CP-192146	0041	2	F	Correct cardinality in NnwdafEventsSubscription	16.1.0
2019-09	CT#85	CP-192157	0042	4	B	UE mobility and communication analytics	16.1.0
2019-09	CT#85	CP-192157	0043	2	B	Support of network performance analytics in Nnwdaf_AnalyticsInfo_Request	16.1.0
2019-09	CT#85	CP-192157	0047	1	B	OAM as service consumer	16.1.0
2019-09	CT#85	CP-192157	0048	1	B	Update Nnwdaf_EventSubscription service for service experience	16.1.0
2019-09	CT#85	CP-192261	0049	1	B	Enhance the Nnwdaf_AnalyticsInfo service to support service experience	16.1.0
2019-09	CT#85	CP-192177	0050	2	B	Enhance the Nnwdaf_EventsSubscription service to support QoS sustainability	16.1.0
2019-09	CT#85	CP-192177	0051	2	B	Enhance the Nnwdaf_AnalyticsInfo service to support QoS sustainability	16.1.0
2019-09	CT#85	CP-192173	0054	2	F	OpenAPI version update TS 29.520 Rel-16	16.1.0

2019-12	CT#86	CP-193198	0055	3	B	Abnormal behaviour analytics	16.2.0
2019-12	CT#86	CP-193198	0056	4	B	Enhance the Nnwdaf_EventsSubscription service to support User Data Congestion	16.2.0
2019-12	CT#86	CP-193198	0057	2	B	Enhance the Nnwdaf_AnalyticsInfo service to support user data congestion	16.2.0
2019-12	CT#86	CP-193198	0058	1	B	Definination of QoS sustainability information	16.2.0
2019-12	CT#86	CP-193198	0059	4	B	Inclusion of QoS requirements and thresholds for QoS Sustainability	16.2.0
2019-12	CT#86	CP-193198	0062	2	F	Clarify references to QoS sustainability analytics	16.2.0
2019-12	CT#86	CP-193198	0063	2	F	Clarifications on NWDAF generalities	16.2.0
2019-12	CT#86	CP-193267	0102	3	B	OpenAPI file Update for Nnwdaf_EventsSubscription API	16.2.0
2019-12	CT#86	CP-193198	0103		B	OpenAPI file Update for Nnwdaf_AnalyticsInfo API	16.2.0
2019-12	CT#86	CP-193198	0104	1	B	Slice identification for all analytics types	16.2.0
2019-12	CT#86	CP-193234	0106	2	B	NF Load analytics generalities	16.2.0
2019-12	CT#86	CP-193212	0107	1	F	Update of API version and TS version in OpenAPI file	16.2.0
2020-03	CT#87e	CP-200208	0109	1	B	Definition of QoS Requirement	16.3.0
2020-03	CT#87e	CP-200208	0110	1	B	Description of consumer functionalities	16.3.0
2020-03	CT#87e	CP-200208	0111	1	B	Update the types of analytics events	16.3.0
2020-03	CT#87e	CP-200207	0114		B	DNN Clarification	16.3.0
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