**3GPP TSG-CT WG3 Meeting #108-eC3-201400**

**E-Meeting, 19th – 28th February 2020 revision of C3-201330**

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| --- |
| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **29.520** | **CR** | **0136** | **rev** | **1** | **Current version:** |  |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **X** |

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| --- |
|  |
| ***Title:***  | Support of NF Load analytics |
|  |  |
| ***Source to WG:*** | Orange |
| ***Source to TSG:*** | C3 |
|  |  |
| ***Work item code:*** |  |  | ***Date:*** | 2019-11-02 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-16 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)Rel-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
|  |  |
| ***Reason for change:*** | The NF Load analytics is defined in §4.2.1, but the API specification and the data types are left undefined. |
|  |  |
| ***Summary of change:*** | New paragraphs on load analytics : on subscription parameters, notifications on request parameters, data types, event subscription, event filters, on feature negotiation. |
|  |  |
| ***Consequences if not approved:*** | No NF load analytics |
|  |  |
| ***Clauses affected:*** | 4.2.2.2.2; 5.1.6.1; 5.1.6.2.3; 5.1.6.2.5; 5.1.6.2.x (new), 5.1.5.6.y (new), 5.1.6.2.z (new), 5.2.6.1; 5.2.6.2.2; 5.2.6.2.3; 5.2.6.3.3;A.2;A.3 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS/TR 23.288 CR 0113 |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ... |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** | This CR introduces backward compatible feature to OpenAPI files for Nnwdaf\_EventsSubscription API and Nnwdaf\_AnalyticsInfo API. |
|  |  |
| ***This CR's revision history:*** |  |

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

##### 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/v1/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;

- list of supported features by the service consumer as "supportedFeatures" attribute; and

- a description of the subscribed events as "eventSubscriptions" attribute that for each event shall include

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

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

and may include:

- event reporting requirement information as "evtReq" attribute, which applies for all events in a subscription 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) group reporting guard time for aggregating the reports for a group of UEs in the "grpRepTime" attribute;

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

9) preferred level of accuracy of the analytics in the "accuracy" attribute.

NOTE: The event reporting information provided in NnwdafEventsSubscription data type, if present, supersedes the event notification method and repetition period in the EventSubscription data type.

For different event types:

- if the event is "SLICE\_LOAD\_LEVEL", it shall provide:

1) if the event notification method "THRESHOLD" on specific event level load level threshold in the "loadLevelThreshold" attribute; 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 "NfLoad" is supported and the event is "NF\_LOAD", it shall provide:

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

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) maximum number of analytics entries expected for an analytics report in the "maxAnaEntry" attribute; and

4) a load level threshold in the "nfLoadLvlThd" 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;

- if the feature "ServiceExperience" is supported and the event is "SERVICE\_EXPERIENCE", it may provide:

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

Editor's note: Whether identification of application is mandatory is FFS. Whether the event subscription can be applied to all applications is FFS.

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

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

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

and may include

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

Editor's note: Inclusion of Media/application bandwidth is FFS.

- if the feature "UeMobility" is supported and the event is "UE\_MOBILITY", it may provide:

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

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

3) maximum number of analytics entries expected for an analytics report in the "maxAnaEntry" attribute;

- if the feature "UeCommunication" is supported and the event is "UE\_COMM", it shall provide:

1) identification of the application in the "applicationIds" attribute; and

2) identification of target UE(s) to which the subscription applies by "supi" or "intGroupId" attribute in the "tgtUe" attribute; and

 and may provide:

1) maximum number of analytics entries expected for an analytics report in the "maxAnaEntry" attribute.

Editor's note: It is FFS whether any UE can apply for "UE\_MOBILITY" and "UE\_COMM" events.

- if the feature "QoSSustainability" is supported and the event is "QOS\_SUSTAINABILITY", it 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 by the "qosFlowRetainThresholds" attribute for the 5QI of GBR resource type or RAN UE throughout threshold by the "ranUeThroughputThresholds" attribute for the 5QI of non-GBR resource type.

 and may include:

1) 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 "supi" or "intGroupId".

 and may provide:

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

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

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

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

Editor's note: Whether the expected UE behaviour, expected analytics type or list of Exception IDs with associated thresholds should be provided are FFS.

- if the feature "UserDataCongestion" is supported and the event is "USER\_DATA\_CONGESTION", it shall provide:

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

2) identification of a specific UE via "supi" attribute;

and may include:

3) congestion threshold by the "congThresholds" attribute.

Upon the reception of an HTTP POST request with: "{apiRoot}/nnwdaf-eventssubscription/v1/subscriptions" as Resource URI and NnwdafEventsSubscription data structure as request body, the NWDAF shall:

- create a new subscription;

- assign an event subscriptionId;

- store the subscription.

If the NWDAF created an "Individual NWDAF Event Subscription" resource, the NWDAF shall respond with "201 Created" with the message body containing a representation of the created subscription, as shown in figure 4.2.2.2.2-1, 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-eventssubscription/v1/subscriptions/{subscriptionId}".

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

#### 5.1.6.1 General

This subclause 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 |
| Accuracy | 5.1.6.3.5 | Represents the preferred level of accuracy of the analytics. |  |
| AnySlice | 5.1.6.3.2 | Represents the any slices. |  |
| Communication | 5.1.6.2.13 |  |  |
| CongestionInfo | 5.1.6.2.18 |  |  |
| 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. |  |
| LoadLevelInformation | 5.1.6.3.2 | Represents load level information of the network slice instance |  |
| LocationInfo | 5.1.6.2.11 |  |  |
| MatchingDirection | 5.1.6.3.x | Defines the matching direction when crossing a threshold | NfLoad, QoSSustainability, UserDataCongestion, NetworkPerformance |
| NfLoadLevelInformation | 5.1.6.2.y | Represents load level information of a given NF instance. | NfLoad |
| NfStatus | 5.1.6.2.z | Provides the percentage of time spent on various NF states | NfLoad |
| NwdafEvent | 5.1.6.3.4 | Describes the NWDAF Events. |  |
| 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. |  |
| NotificationMethod | 5.1.6.3.3 | Represents the notification methods that can be subscribed. |  |
| QosRequirement | 5.1.6.2.20 |  |  |
| QosSustainabilityInfo | 5.1.6.2.19 | Represents the QoS Sustainability information. | QoSSustainability |
| ServiceExperienceInfo | FFS | Represents the service experience information. | ServiceExperience |
| SliceLoadLevelInformation | 5.1.6.2.6 | Represents the slices and the load level information. |  |
| TargetUeInformation | 5.1.6.2.8 | Identifies the target UE information. |  |
| ThresholdLevel | 5.1.6.2.x | Describe a threshold level |  |
| TrafficCharacterization | 5.1.6.2.14 |  |  |
| UeCommunication | 5.1.6.2.12 |  |  |
| UeMobility | 5.1.6.2.9 |  |  |
| UeTrajectory | 5.1.6.2.10 |  |  |
| UserDataCongestionInfo | 5.1.6.2.17 | Represents the user data congestion information | UserDataCongestion |
| AbnormalBehaviour | 5.1.6.2.15 | Represents the abnormal behaviour information. |  |
| Exception | 5.1.6.2.16 | Describes the Exception information. |  |
| ExceptionId | 5.1.6.3.6 | Describes the Exception Id. |  |
| ExceptionTrend | 5.1.6.3.7 | Describes the Exception Trend. |  |

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 | QoSSustainablity |
| ApplicationId | 3GPP TS 29.571 [8] | Identifies the application identifier. | ServiceExperience |
| 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 |
| Dnn | 3GPP TS 29.571 [8] | Identifies the DNN. | ServiceExperience, AbnormalBehaviour |
| DurationSec | 3GPP TS 29.571 [8] |  |  |
| EthFlowDescription | 3GPP TS 29.514 [21] |  | UeCommunication |
| FlowDescription | 3GPP TS 29.514 [21] |  | UeCommunication |
| GroupId | 3GPP TS 29.571 [8] | Identifies a group of UEs. |  |
| NetworkAreaInfo | 3GPP TS 29.554 [18] | Identifies the network area. | ServiceExperienceQoSSustainability, AbnormalBehaviour |
| 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 |
| PacketDelBudget | 3GPP TS 29.571 [8] |  | QoSSustainablity |
| PacketErrRate | 3GPP TS 29.571 [8] |  | QoSSustainablity |
| ProblemDetails | 3GPP TS 29.571 [8] | Used in error responses to provide more detailed information about an error. |  |
| ReportingInformation | 3GPP TS 29.523 [20] | Represents the type of reporting the subscription requires. |  |
| ScheduledCommunicationTime | 3GPP TS 29.122 [19] |  | UeMobility UeCommunication |
| 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. |  |
| SupportedFeatures | 3GPP TS 29.571 [8] | Used to negotiate the applicability of the optional features defined in table 5.1.8-1. |  |
| TimeWindow | 3GPP TS 29.122 [19] |  |  |
| Uri | 3GPP TS 29.571 [8] |  |  |
| UserLocation | 3GPP TS 29.571 [8] |  | UeMobility |
| Volume | 3GPP TS 29.122 [19] |  | UeCommunication |

Editor's note: Whether NetworkAreaInfo defined in 3GPP TS 29.554 can cover the requirement is FFS.

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

##### 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) |  |
| applicationIds | array(ApplicationId) | C | 1..N | Identification(s) of application to which the subscription applies. The absence of applicationIds means subscription to all applications.For event "UE\_COMM”, one and only one application id shall be included. | ServiceExperienceUeCommunication |
| dnns | array(Dnn) | C | 1..N | Identification(s) of DNN to which the subscription applies. The absence of dnns means subscription to all DNNs  | ServiceExperience, AbnormalBehaviour |
| dnais | array(Dnai) | C | 1..N | Identification(s) of user plane access to DN(s) which the subscription applies. | ServiceExperience |
| event | NwdafEvent | M | 1 | Event that is subscribed. |  |
| loadLevelThreshold | integer | C | 0..1 | Shall be supplied for notification method "THRESHOLD". on event subscription level or "ON\_EVENT\_DETECTION" on all events level, if the event is "SLICE\_LOAD\_LEVEL".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 instance identified by snssai is reached. |  |
| matchingDir | MatchingDirection | 0 | 0..1 | A matching direction may be provided alongside a threshold | NfLoad, QoSSustainability, UserDataCongestion, NetworkPerformance  |
| nfLoadLvlThd | array(ThresholdLevel) | C | 1..N | Shall be supplied in order to start reporting when an average load level is reached.(NOTE X) | NfLoad |
| networkArea | NetworkAreaInfo | C | 0..1 | Identification of network area to which the subscription applies. The absence of networkAreas means subscription to all network areas. | ServiceExperience, UeMobility, QoSSustainability, AbnormalBehaviour, UserDataCongestion |
| nfInstanceIds | NfInstanceId | O | 1..N | Identification(s) of NF instances. | NfLoad |
| nfSetIds | NfSetId | O | 1..N | Identification(s) of NF instance sets. | NfLoad |
| nfTypes | NfType | O | 1..N | Identification(s) of NF types. | NfLoad |
| notificationMethod | NotificationMethod | O | 0..1 | Indicate the notification method. (NOTE 2) |  |
| qosRequ | QosRequirement | C | 0..1 | Indicates the QoS requirements. It shall be included when subscribed event is "QOS\_SUSTAINABILITY". | QoSSustainability |
| qosFlowRetainThresholds | array(ThresholdLevel) | C | 1..N | Shall be supplied for the 5QI of GBR resource type.  | QoSSustainablity |
| ranUeThroughputThresholds | array(ThresholdLevel) | C | 1..N | Shall be supplied for the 5Qi of non-GBR resource type. | QoSSustainability |
| repetitionPeriod | DurationSec | C | 0..1 | Shall be supplied for notification Method "PERIODIC". |  |
| snssais | array(Snssai) | C | 1..N | Identification(s) of network slice to which the subscription applies. (NOTE 1) |  |
| maxAnaEntry | Uinteger | O | 0..1 | Identifies the maximum number of analytics entries expected per Analytics reporting, e.g. For UE Mobility analytics, a list of UE trajectory information may be provided in the order of time, this attribute limits the maximum time slots that can be provided by the NWDAF. | UeMobilityUeCommunicationNfLoad |
| tgtUe | TargetUeInformation | O | 0..1 | Identifies target UE information | (NOTE 3) |
| congThresholds | array(ThresholdLevel) | O | 1..N | Represents the congestion threshold levels. (NOTE 4) | UserDataCongestion |
| NOTE 1: When subscribed event is "SLICE\_LOAD\_LEVEL", "NF\_LOAD" or "SERVICE\_EXPERIENCE", either information about slice(s) identified by snssais, or anySlice set to "TRUE" shall be included. When subscribed is "QOS\_SUSTAINABILITY", the identifications of network slices is optional.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: Once "congThresholds" or “nfLoadLvlThd” is supplied, the notificationMethod shall be "THRESHOLD".NOTE X: This property should be provided if the "notifMethod" in "evtReq" is set to "ON\_EVENT\_DETECTION" or "notificationMethod" in "eventSubscriptions" is set to "THRESHOLD" or omitted. |

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

##### 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. |  |
| expiry | DateTime | O | 0..1 | It defines the expiration time after which the analytics information will become invalid. |  |
| nfLoadLevelInfo | array(NfLoadLevelInformation) | C | 1..N | The NF load level information. When subscribed event is "NF\_LOAD", the nfLoadLevelInfo shall be included. | NfLoad |
| qosSustainInfos | array(QosSustainabilityInfo) | C | 1..N | The QoS sustainability information.When subscribed event is “QOS\_SUSTAINABILITY”, the qosSustainabilityInfo 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. |  |
| svcExpInfo | ServiceExperienceInfo | C | 0..1 | The service experience information.When subscribed event is "SERVICE\_EXPERIENCE", the svcExpInfo 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 congetion information. Shall be present if the subscribed event is "USER\_DATA\_CONGETSTION". | UserDataCongestion |

Editor's note: The data type ServiceExperienceInfo is FFS.

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

##### 5.1.6.2.x Type ThresholdLevel

Table 5.1.6.2.20-1: 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) | NfLoad |
| nfCpuUsage | integer | C | 0..1 | Value of NF CPU Usage that triggers notification (NOTE 2) | NfLoad |
| nfMemoryUsage | integer | C | 0..1 | Average usage of memory (NOTE 2) | NfLoad |
| nfStorageUsage | integer | C | 0..1 | Average usage of storage (NOTE 2) | NfLoad |
| NOTE 1: This attribute should be provided when subscribed event is "USER\_DATA\_CONGESTION".NOTE 2: At least one attribute should be provided when subscribed event is "NF\_LOAD". |

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

##### 5.1.6.2.y Type NfLoadLevelInformation

Table 5.1.6.2.y-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 | O | 0..1 | Availability status of the NF |  |
| nfCpuUsage | integer | C | 0..1 | Average usage CPU (NOTE 1) (NOTE 2) |  |
| nfMemoryUsage | integer | C | 0..1 | Average usage of memory (NOTE 1) (NOTE 2) |  |
| nfStorageUsage | integer | C | 0..1 | Average usage of storage (NOTE 1) (NOTE 2) |  |
| nfLoadLevel | integer | C | 0..1 | Average load information (NOTE 1) (NOTE 2) |  |
| nfLoadLevelPeak | integer | O | 0..1 | Peak load information(NOTE 2) |  |
| NOTE 1: At least one value shall be provided.NOTE 2: The values are percentages which are provided as estimated over a given period. |

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

##### 5.1.6.2.z Type NfStatus

Table 5.1.6.2.z-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 1: 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. |

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

##### 5.1.6.3.x Enumeration: MatchingDirection

Table 5.1.6.3.x-1: Enumeration TimeUnit

|  |  |  |
| --- | --- | --- |
| 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. |  |

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

#### 5.2.6.1 General

This subclause 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 |
| AnalyticsData | 5.2.6.2.2 | Describes analytics with parameters indicated in the request |  |
| AnalyticsReportingRequirement | 5.2.6.2.4 | Describes the analytics reporting requirement information. |  |
| EventFilter | 5.2.6.2.3 | Also missing in release 15. |  |
| EventId | 5.2.6.3.3 | Describes the type of analytics. |  |

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.

Table 5.2.6.1-2: Nnwdaf\_AnalyticsInfo re-used Data Types

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Reference | Comments | Applicability |
| Accuracy | 5.1.6.3.5 | Represents the preferred level of accuracy of the analytics. |  |
| AnySlice | 5.1.6.3.2 |  |  |
| ApplicationId | 3GPP TS 29.571 [8] | Identifies the application. | ServiceExperience |
| DateTime | 3GPP TS 29.571 [8] | Identifies the time. |  |
| Dnn | 3GPP TS 29.571 [8] | Identifies the DNN. | ServiceExperience |
| Dnai | 3GPP TS 29.571 [8] | Identifies a user plane access to one or more DN(s) | ServiceExperience |
| NetworkAreaInfo | 3GPP TS 29.554 [18] | The network area information. | UeMobilityNetworkPerformanceQosSustainabilityServiceExperienceUserDataCongestion |
| NfLoadLevelInformation | 5.1.6.2.y  | 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 |
| ProblemDetails | 3GPP TS 29.571 [8] | Used in error responses to provide more detailed information about an error. |  |
| QosRequirement | 5.1.6.2.20 |  |  |
| QosSustainabilityInfo | 5.1.6.2.19 |  |  |
| Supi | 3GPP TS 29.571 [8] | Identifies the UE. |  |
| 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] |  | ServiceExperienceSliceLoadLevel |
| SliceLoadLevelInformation | 5.1.6.2.6 |  |  |
| TargetUeInformation | 5.1.6.2.8 | Identifies the target UE information. |  |
| UeCommunication | 5.1.6.2.12 |  |  |
| UeMobility | 5.1.6.2.9 |  |  |
| UserDataCongestionInfo | 5.1.6.2.17 |  |  |
| AbnormalBehaviour | 5.1.6.2.15 | Represents the abnormal behaviour information. |  |
| Exception | 5.1.6.2.16 | Describes the Exception information. |  |

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

##### 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 |
| sliceLoadLevelInfos | array(SliceLoadLevelInformation) | C | 1..N | The slices and the load level information. Shall be present when the requested event is "LOAD\_LEVEL\_INFORMATION". |  |
| networkPerfs | array(NetworkPerformanceInfo) | C | 1..N | The network performance information.Shall be present when the requested event is "NETWORK\_PERFORMANCE". | NetworkPerformance |
| nfLoadLevelInfo | array(NfLoadLevelInformation) | C | 1..N | The NF load information.When subscribed event is "NF\_LOAD", the nfLoadLevelInfo shall be included. | NfLoad |
| qosSustainInfos | array(QosSustainabilityInfo) | C | 1..N | The QoS sustainability informations in the certain geographic areas. It shall present if eventId is "QOS\_SUSTAINABILITY" | QoSSustainability |
| ueMobs | array(UeMobility) | C | 1..N | The UE mobility information.When subscribed event is "UE\_MOBILITY", the "ueMobs" attribute shall be included. | UeMobility |
| ueComms | array(UeCommunication) | C | 1..N | The UE communication information.When subscribed 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 |
| supportedFeatures | SupportedFeatures | M | 1 | List of Supported features used as described in subclause 5.1.8.This parameter shall be supplied by NWDAF in the reply of GET request that request the analytics resource. |  |
| svcExpInfo | ServiceExperienceInfo(FFS) | C | 1..N | The service experience information.  | ServiceExperience |
| abnorBehavrs | array(AbnormalBehaviour) | C | 1..N | The abnormal behaviour information.  | abnorBehavrs |

Editor's note: The data type definition for NetworkPerformanceInfo is FFS.

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

##### 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 | Identification(s) of application. It shall be included when eventId is "SERVICE\_EXPERIENCE".  | ServiceExperience |
| dnns | array(Dnn) | C | 1..N | Identification(s) of DNN. It may be included when eventId is "SERVICE\_EXPERIENCE". | ServiceExperience |
| dnais | array(Dnai) | C | 1..N | Identification(s) of user plane accesses to DN(s) which the subscription applies. It may be included when eventId is "SERVICE\_EXPERIENCE". | ServiceExperience |
| snssais | array(Snssai) | C | 1..N | Identification(s) of network slice to which the subscription belongs. (NOTE 1) |  |
| nfInstanceIds | NfInstanceId | O | 1..N | Identification(s) of NF instances. | NfLoad |
| nfSetIds | NfSetIdf | O | 1..N | Identification(s) of NF instance sets. | NfLoad |
| nfTypes | NfType | O | 1..N | Identification(s) of NF types. | NfLoad |
| networkArea | NetworkAreaInfo | C | 0..1 | This IE represents the network area where the NF service consumer wants to know the analytics result. (NOTE 2) | UeMobilityNetworkPerformanceQosSustainabilityServiceExperienceUserDataCongestion |
| maxAnaEntry | Uinteger | O | 0..1 | Maximum number of analytics entries expected for an analytics report. | UeMobilityUeCommunicationNetworkPerformance |
| qosRequ | QoSRequirement | C | 0..1 | Represents the QoS requirements. This attribute shall be included when eventId is "QOS\_SUSTAINABILITY". | QoSSustainability |
| qosFlowRetainThresholds | array(ThresholdLevel) | C | 1..N | Shall be supplied for the 5QI of GBR resource type.  | QoSSustainablity |
| ranUeThroughputThresholds | array(Threshold) | C | 1..N | Shall be supplied for the 5Qi of non-GBR resource type. | QoSSustainability |
| NOTE 1: When event-id in the request is "LOAD\_LEVEL\_INFORMATION" or "NF\_LOAD", either information about slice(s) identified by snssais, or anySlice set to "TRUE" shall be included.NOTE 2: For "NETWORK\_PERFORMANCE", this attribute shall be provided if the event applied for all UEs (i.e. "anyUe" attribute set to true). |

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

# A.2 Nnwdaf\_EventsSubscription API

openapi: 3.0.0

info:

 version: 1.1.0.alpha-3

 title: Nnwdaf\_EventsSubscription

 description: |

 Nnwdaf\_EventsSubscription Service API.

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externalDocs:

 description: 3GPP TS 29.520 V16.2.0; 5G System; Network Data Analytics Services.

 url: 'http://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 subclause 4.4 of 3GPP TS 29.501.

paths:

 /subscriptions:

 post:

 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/v1/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.

 '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:

 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.

 '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: The Individual NWDAF Event Subscription resource does not exist.

 content:

 application/problem+json:

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/ProblemDetails'

 '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:

 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.

 '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: The Individual NWDAF Event Subscription resource does not exist.

 content:

 application/problem+json:

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/ProblemDetails'

 '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:

 type: object

 properties:

 eventSubscriptions:

 type: array

 items:

 $ref: '#/components/schemas/EventSubscription'

 minItems: 1

 description: Subscribed events

 evtReq:

 $ref: '#/components/schemas/EventReportingRequirement'

 notificationURI:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri'

 supportedFeatures:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/SupportedFeatures'

 required:

 - eventSubscriptions

 EventSubscription:

 type: object

 properties:

 anySlice:

 $ref: '#/components/schemas/AnySlice'

 applicationIds:

 type: array

 items:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/ApplicationId'

 minItems: 1

 description: Identification(s) of application to which the subscription applies. When subscribed event is "SERVICE\_EXPERIENCE", the absence of applicationIds means subscription to all applications.

 dnns:

 type: array

 items:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Dnn'

 minItems: 1

 description: Identification(s) of DNN to which the subscription applies. When subscribed event is "SERVICE\_EXPERIENCE", the absence of dnns means subscription to all DNNs.

 dnais:

 type: array

 items:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Dnai'

 minItems: 1

 event:

 $ref: '#/components/schemas/NwdafEvent'

 loadLevelThreshold:

 type: integer

 description: Shall be supplied for notification method "THRESHOLD". 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 instance identified by snssai is reached.

 notificationMethod:

 $ref: '#/components/schemas/NotificationMethod'

 matchingDir:

 $ref: '#/components/schemas/MatchingDirection

 nfLoadLvlThd:

 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:

 items:

 type: array

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/NfSetId'

 minItems: 1

 nfTypes:

 type: array

 items:

 $ref: 'TS29510\_Nnrf\_NFManagement#/components/schemas/NfType'

 minItems: 1

 networkArea:

 $ref: 'TS29554\_Npcf\_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'

 qosRequ:

 $ref: '#/components/schemas/QosRequirement'

 qosFlowRetainThresholds:

 type: array

 items:

 $ref: '#/components/schemas/ThresholdLevel'

 minItems: 1

 ranUeThroughputThresholds:

 type: array

 items:

 $ref: '#/components/schemas/ThresholdLevel'

 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. When subscribed event is "SLICE\_LOAD\_LEVEL", either information about slice(s) identified by snssai, or anySlice set to "TRUE" shall be included. It corresponds to snssais in the data model definition of 3GPP TS 29.520. When subscribed is “QOS\_SUSTAINABILITY”, the identifications of network slices is optional.

 maxAnaEntry:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uinteger'

 tgtUe:

 $ref: '#/components/schemas/TargetUeInformation'

 congThresholds:

 type: array

 items:

 $ref: '#/components/schemas/ThresholdLevel'

 minItems: 1

 required:

 - event

 NnwdafEventsSubscriptionNotification:

 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

 required:

 - eventNotifications

 - subscriptionId

 EventNotification:

 type: object

 properties:

 event:

 $ref: '#/components/schemas/NwdafEvent'

 expiry:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/DateTime'

 nfLoadLevelInfo:

 type: array

 items:

 $ref: '#/components/schemas/NfLoadLevelInfo'

 minItems: 1

 sliceLoadLevelInfo:

 $ref: '#/components/schemas/SliceLoadLevelInformation'

 svcExpInfo:

 $ref: '#/components/schemas/ServiceExperienceInfo'

 qosSustainInfo:

 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

 required:

 - event

#

# Editor's note: The data type ServiceExperienceInformation is FFS.

#

 ServiceExperienceInfo:

 type: string

 SliceLoadLevelInformation:

 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.

 required:

 - loadLevelInformation

 - snssais

 EventReportingRequirement:

 type: object

 properties:

 accuracy:

 $ref: '#/components/schemas/Accuracy'

 startTs:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/DateTime'

 endTs:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/DateTime'

 TargetUeInformation:

 type: object

 properties:

 anyUe:

 type: boolean

 supi:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Supi'

 intGroupId:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/GroupId'

 UeMobility:

 type: object

 properties:

 supi:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Supi'

 ueTraj:

 type: array

 items:

 $ref: '#/components/schemas/UeTrajectory'

 minItems: 1

 required:

 - ueTraj

 UeTrajectory:

 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'

 locInfo:

 type: array

 items:

 $ref: '#/components/schemas/LocationInfo'

 minItems: 1

 required:

 - duration

 - locInfo

 LocationInfo:

 type: object

 properties:

 loc:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/UserLocation'

 ratio:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uinteger'

 confidence:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uinteger'

 required:

 - loc

 UeCommunication:

 type: object

 properties:

 supi:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Supi'

 comm:

 type: array

 items:

 $ref: '#/components/schemas/Communication'

 minItems: 1

 Communication:

 type: object

 properties:

 commDur:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/DurationSec'

 perioTime:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/DurationSec'

 ts:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/DateTime'

 recurringTime:

 $ref: 'TS29122\_CpProvisioning.yaml#/components/schemas/ScheduledCommunicationTime'

 trafChar:

 $ref: '#/components/schemas/TrafficCharacterization'

 ratio:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uinteger'

 confidence:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uinteger'

 required:

 - commDur

 TrafficCharacterization:

 type: object

 properties:

 dnn:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Dnn'

 snssai:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Snssai'

 ethfDescs:

 type: array

 items:

 $ref: 'TS29514\_Npcf\_PolicyAuthorization.yaml#/components/schemas/EthFlowDescription'

 minItems: 1

 fDescs:

 type: array

 items:

 $ref: 'TS29514\_Npcf\_PolicyAuthorization.yaml#/components/schemas/FlowDescription'

 minItems: 1

 ulVol:

 $ref: 'TS29122\_CommonData.yaml#/components/schemas/Volume'

 dlVol:

 $ref: 'TS29122\_CommonData.yaml#/components/schemas/Volume'

 UserDataCongestionInfo:

 type: object

 properties:

 networkArea:

 $ref: 'TS29554\_Npcf\_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'

 congestionInfo:

 $ref: '#/components/schemas/CongestionInfo'

 CongestionInfo:

 type: object

 properties:

 congType:

 $ref: '#/components/schemas/CongestionType'

 timeIntev:

 $ref: 'TS29122\_CommonData.yaml#/components/schemas/TimeWindow'

 nsi:

 $ref: '#/components/schemas/ThresholdLevel'

 required:

 - congType

 - timeIntev

 - nsi

 QosSustainabilityInfo:

 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'

 crossedQosFlowRetainThresholds:

 type: array

 items:

 $ref: '#/components/schemas/ThresholdLevel'

 minItems: 1

 crossedRanUeThroughputThresholds:

 type: array

 items:

 $ref: '#/components/schemas/ThresholdLevel'

 minItems: 1

 confidence:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uinteger'

 QosRequirement:

 type: object

 properties:

 5qi:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/5Qi'

 pdb:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/PacketDelBudget'

 per:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/PacketErrRate'

 required:

 - 5qi

 ThresholdLevel:

 type: object

 properties:

 congLevel:

 type: integer

 nfLoadLevel:

 type: integer

 nfCpuUsage:

 type: integer

 nfMemoryUsage:

 type: integer

 nfStorageUsage:

 type: integer

 NfLoadLevelInformation:

 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

 required:

 - nfType

 - nfInstanceId

 NfStatus:

 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'

 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 instance.

 AbnormalBehaviour:

 type: object

 properties:

 supi:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Supi'

 exceps:

 type: array

 items:

 $ref: '#/components/schemas/Exception'

 minItems: 1

 required:

 - exceps

 Exception:

 type: object

 properties:

 excepId:

 $ref: '#/components/schemas/ExceptionId'

 excepLevel:

 type: integer

 excepTrend:

 $ref: '#/components/schemas/ExceptionTrend'

 addtMeasInfo:

 type: string

 required:

 - excepId

 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 peridodicly. The periodic of the notification is identified by repetitionPeriod defined in subclause 5.1.6.2.3.

 - THRESHOLD: The subscribe of NWDAF Event is upon threshold exceeded. The threshold of the notification is identified by loadLevelThreshold defined in subclause 5.1.6.2.3.

 NwdafEvent:

 anyOf:

 - type: string

 enum:

 - SLICE\_LOAD\_LEVEL

 - NF\_LOAD

 - SERVICE\_EXPERIENCE

 - QOS\_SUSTAINABILITY

 - ABNORMAL\_BEHAVIOUR

 - USER\_DATA\_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 instance

 - 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.

 - 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.

 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

 - PING\_PONG\_STATIONARY\_UE

 - TOO\_FREQUENT\_SERVICE\_ACCESS

 - ABNORMAL\_TRAFFIC\_VOLUME

 - 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

 - PING\_PONG\_STATIONARY\_UE: Ping-pong stationary UE

 - TOO\_FREQUENT\_SERVICE\_ACCESS: Too frequent Service Access

 - ABNORMAL\_TRAFFIC\_VOLUME: Abnormal traffic volume

 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.

 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.

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

# A.3 Nnwdaf\_AnalyticsInfo API

openapi: 3.0.0

info:

 version: 1.1.0.alpha-2

 title: Nnwdaf\_AnalyticsInfo

 description: |

 Nnwdaf\_AnalyticsInfo Service API.

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externalDocs:

 description: 3GPP TS 29.520 V16.2.0; 5G System; Network Data Analytics Services.

 url: 'http://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 subclause 4.4 of 3GPP TS 29.501.

paths:

 /analytics:

 get:

 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: '#/components/schemas/AnalyticsReportingRequirement'

 - 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 request 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':

 $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:

 type: object

 properties:

 sliceLoadLevelInfos:

 type: array

 items:

 $ref: 'TS29520\_Nnwdaf\_EventsSubscription.yaml#/components/schemas/SliceLoadLevelInformation'

 minItems: 1

 description: The slices and their load level information.

 nfLoadLevelInfo:

 type: array

 items:

 $ref: 'TS29520\_Nnwdaf\_EventsSubscription.yaml#/components/schemas/NfLoadLevelInformation'

 minItems: 1

 networkPerfs:

 type: array

 items:

 $ref: '#/components/schemas/NetworkPerformanceInfo'

 minItems: 1

 svcExpInfo:

 type: string

 qosSustainInfo:

 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

 EventFilter:

 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 to which the subscription belongs.

 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

 networkArea:

 $ref: 'TS29554\_Npcf\_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'

 nfInstanceIds:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/NfInstanceId

 nfSetIds:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/NfSetIdf

 nfTypes:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/NfType

 maxAnaEntry:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uinteger'

 qosRequ:

 $ref: 'TS29520\_Nnwdaf\_EventsSubscription.yaml#/components/schemas/QosRequirement'

 qosFlowRetainThresholds:

 type: array

 items:

 $ref: 'TS29520\_Nnwdaf\_EventsSubscription.yaml#/components/schemas/ThresholdLevel'

 minItems: 1

 ranUeThroughputThresholds:

 type: array

 items:

 $ref: 'TS29520\_Nnwdaf\_EventsSubscription.yaml#/components/schemas/ThresholdLevel'

 minItems: 1

 not:

 required: [anySlice, snssais]

 AnalyticsReportingRequirement:

 type: object

 properties:

 accuracy:

 $ref: 'TS29520\_Nnwdaf\_EventsSubscription.yaml#/components/schemas/Accuracy'

 startTs:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/DateTime'

 endTs:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/DateTime'

 sampRatio:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uinteger'

 NetworkPerformanceInfo:

 type: string

# Editor's note: The data type NetworkPerformanceInfo is FFS.

 EventId:

 anyOf:

 - type: string

 enum:

 - LOAD\_LEVEL\_INFORMATION

 - NF\_LOAD

 - SERVICE\_EXPERIENCE

 - QOS\_SUSTAINABILITY

 - ABNORMAL\_BEHAVIOUR

 - USER\_DATA\_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

 - LOAD\_LEVEL\_INFORMATION: Represent the analytics of load level information of corresponding network slice instance.

 - NF\_LOAD: Indicates that the event subscribed is NF Load.

 - SERVICE\_EXPERIENCE: Represent the analytics of service experience information of the specific applications.

 - QOS\_SUSTAINABILITY: Represent the analytics of QoS sustainability information in the certian 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.

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