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Foreword

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

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In the present document, modal verbs have the following meanings:

shall indicates a mandatory requirement to do something

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may indicates permission to do something

need not indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

can indicates that something is possible

cannot indicates that something is impossible

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will indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

will not indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

might indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

Introduction

This clause is optional. If it exists, it is always the second unnumbered clause.

1 Scope

The present document specifies the stage 3 protocol and data model for the ADRF Service Based Interface. It provides stage 3 protocol definitions and message flows, and specifies the API for each service offered by the ADRF.

The 5G System stage 2 architecture and procedures are specified in 3GPP TS 23.501 [2] and 3GPP TS 23.502 [3]. The stage 2 definition and procedures of store and retrieve the collected data and analytics are contained in 3GPP TS 23.288 [14] and 3GPP TS 23.502 [3].

The Technical Realization of the Service Based Architecture and the Principles and Guidelines for Services Definition are specified in 3GPP TS 29.500 [4] and 3GPP TS 29.501 [5].

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] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".

[4] 3GPP TS 29.500: "5G System; Technical Realization of Service Based Architecture; Stage 3".

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

[6] OpenAPI: "OpenAPI 3.0.0 Specification", https://github.com/OAI/OpenAPI-Specification/blob/master/versions/3.0.0.md.

[7] 3GPP TR 21.900: "Technical Specification Group working methods".

[8] 3GPP TS 33.501: "Security architecture and procedures for 5G system".

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

[10] 3GPP TS 29.510: "5G System; Network Function Repository Services; Stage 3".

[11] IETF RFC 9113: "HTTP/2".

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

[13] IETF RFC 9457: "Problem Details for HTTP APIs"

[14] 3GPP TS 23.288: "Architecture enhancements for 5G System (5GS) to support network data analytics services".

[15] 3GPP TS 29.520: "5G System; Network Data Analytics Services; Stage 3".

[16] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces; Stage 3".

[17] 3GPP TS 29.508: "5G System; Session Management Event Exposure Service; Stage 3".

[18] 3GPP TS 29.518: "5G System; Access and Mobility Management Services; Stage 3".

[19] 3GPP TS 29.503: "5G System; Unified Data Management Services; Stage 3".

[20] 3GPP TS 29.517: "5G System; Application Function Event Exposure Services; Stage 3".

[21] 3GPP TS 29.591: "5G System; Network Exposure Function Southbound Services; Stage 3".

[22] 3GPP TS 29.122: "T8 reference point for Northbound APIs".

[23] 3GPP TS 29.574: "5G System; Data Collection Coordination Services; Stage 3".

[24] 3GPP TS 29.576: "5G System; Messaging Framework Adaptor Services; Stage 3".

[25] 3GPP TS 29.536: "5G System; Network Slice Admission Control Services; Stage 3".

[26] 3GPP TS 29.564: "5G System; User Plane Function Services; Stage 3".

[27] 3GPP TS 29.515: "5G System; Gateway Mobile Location Services; Stage 3".

[28] 3GPP TS 29.552: "5G System; Network Data Analytics signalling flows; Stage 3".

3 Definitions, symbols 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].

None.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

None.

3.3 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].

ADRF	Analytics Data Repository Function
AF	Application Function
AMF	Access and Mobility Management Function
DCCF	Data Collection Coordination Function
GMLC	Gateway Mobile Location Centre
MFAF	Messaging Framework Adaptor Function
NEF	Network Exposure Function
NF	Network Function
NRF	Network Repository Function
NWDAF	Network Data Analytics Function
NSACF	Network Slice Admission Control Function
SMF	Session Management Function
UDM	Unified Data Management
UPF	User Plane Function

4 Services offered by the ADRF

4.1 Introduction

The Analytics Data Repository Service is used for the Analytics Data Repository Function (ADRF) to storage and retrieval of data and ML model(s) by e.g. NF service consumers (e.g. NWDAF) which access the data or ML model(s) using Nadrf service. The ADRF offers to NF service consumers the following services:

Table 4.1-1: Service provided by ADRF

Service Name	Description	Service Operations	Operation Semantics	Example Consumer(s)
Nadrf_DataManagement (NOTE 1)	This service enables the NF service consumers to store, retrieve and remove the data or analytics in an ADRF.	StorageRequest	Request / Response	DCCF, NWDAF, MFAF
		StorageSubscriptionRequest	Request / Response	DCCF, NWDAF
		StorageSubscriptionRemoval	Request / Response	DCCF, NWDAF
		RetrievalRequest	Request / Response	DCCF, NWDAF
		RetrievalSubscribe	Subscribe / Notify	DCCF, NWDAF
		RetrievalUnsubscribe	Subscribe / Notify	DCCF, NWDAF
		RetrievalNotify	Subscribe / Notify	DCCF, NWDAF
		Delete	Request / Response	DCCF, NWDAF
Nadrf_MLModelManagement (NOTE 2)	This service enables the NF service consumers to store, retrieve and delete ML model(s) in an ADRF.	StorageRequest	Request / Response	NWDAF
		RetrievalRequest	Request / Response	NWDAF
		Delete	Request / Response	NWDAF
NOTE 1: The services correspond to the Nadrf_DataManagement service as defined in 3GPP TS 23.288 [14]. NOTE 2: The services correspond to the Nadrf_MLModelManagement service as defined in 3GPP TS 23.288 [14].				

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

Table 4.1-2: API Descriptions

Service Name	Clause	Description	OpenAPI Specification File	apiName	Annex
Nadrf_DataManagement	4.2	API for Nadrf_DataManagement		nadrf_datamanagement	Annex A.2 Nadrf_DataManagement API
Nadrf_MLModelManagement	4.3	API for Nadrf_MLModelManagement		nadrf_mlmodelmanagement	Annex A.3 Nadrf_MLModelManagement API

4.2 Nadrf_DataManagement Service

4.2.1 Service Description

4.2.1.1 Overview

The Nadrf_DataManagement service as defined in 3GPP TS 23.288 [14], is provided by the Analytics Data Repository Function (ADRF).

This service:

- allows NF service consumers to store data or analytics in the ADRF, and request/receive notifications about data or analytics that are about to be deleted;
- allows NF service consumers to retrieve data or analytics from an ADRF; and
- allows NF service consumers to delete data or analytics from an ADRF.

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 [14].

The Nadrf_DataManagement service is part of the Nadrf service-based interface exhibited by the Analytics Data Repository Function (ADRF).

Known consumers of the Nadrf_DataManagement service are:

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

The Nadrf_DataManagement service is provided by the ADRF and consumed by the NF service consumers as shown in figure 4.2.1.2-1 for the SBI representation model and in figure 4.2.1.2-2 for the reference point representation model.

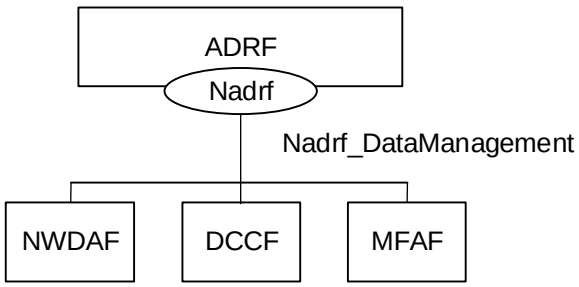

Figure 4.2.1.2-1: Reference Architecture for the Nadrf_DataManagement Service; SBI representation

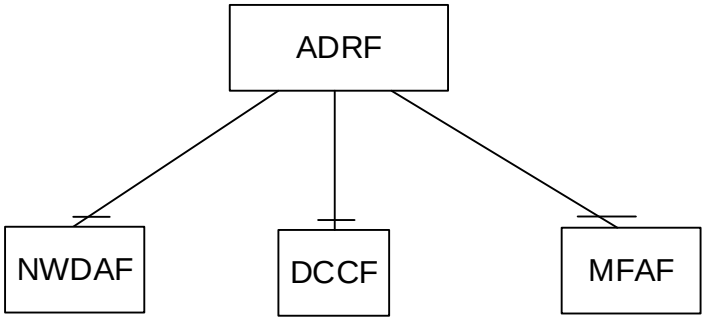

Figure 4.2.1.2-2: Nadrf_DataManagement service architecture, reference point representation

4.2.1.3 Network Functions

4.2.1.3.1 Analytics Data Repository Function (ADRF)

The Analytics Data Repository Function (ADRF) provides the functionality to allow NF service consumers to store, retrieve, and remove data or analytics from the ADRF, and request/receive notifications about data or analytics that are about to be deleted.

4.2.1.3.2 NF Service Consumers

The NWDAF and DCCF:

- supports storing data or analytics in the ADRF, and requesting/receiving notifications about data or analytics that are about to be deleted;
- supports retrieving data or analytics from an ADRF; and
- supports deletion data or analytics from an ADRF.

The MFAF:

- supports storing data or analytics in the ADRF.

4.2.2 Service Operations

4.2.2.1 Introduction

Table 4.2.2.1-1: Operations of the Nadrf_DataManagement Service

Service operation name	Description	Initiated by
Nadrf_DataManagement_StorageRequest	This service operation is used by an NF to request the ADRF to store data or analytics. Data or analytics are provided to the ADRF in the request message.	NF service consumer (DCCF, NWDAF, MFAF)
Nadrf_DataManagement_StorageSubscriptionRequest	This service operation is used by an NF to request the ADRF to initiate a subscription for data or analytics. Data or analytics provided in notifications as a result of the subsequent subscription by the ADRF are stored in the ADRF.	NF service consumer (DCCF, NWDAF)
Nadrf_DataManagement_StorageSubscriptionRemoval	This service operation is used by an NF to request that the ADRF no longer subscribes to data or analytics it is collecting and storing.	NF service consumer (DCCF, NWDAF)
Nadrf_DataManagement_RetrievalRequest	This service operation is used by an NF to retrieve stored data or analytics from the ADRF.	NF service consumer (DCCF, NWDAF)
Nadrf_DataManagement_RetrievalSubscribe	This service operation is used by an NF to retrieve stored data or analytics from the ADRF and to receive future notifications containing the corresponding data or analytics received by ADRF.	NF service consumer (DCCF, NWDAF)
Nadrf_DataManagement_RetrievalUnsubscribe	This service operation is used by an NF to request that the ADRF no longer sends data or analytics to a notification endpoint.	NF service consumer (DCCF, NWDAF)
Nadrf_DataManagement_RetrievalNotify	This service operation is used by the ADRF to notify an NF with either data or analytics, or instructions to fetch the data or analytics from the ADRF. It is also used by the ADRF to notify NF service consumers about data or analytics that are about to be deleted.	ADRF
Nadrf_DataManagement_Delete	This service operation is used by an NF to delete stored data in ADRF.	NF service consumer (DCCF, NWDAF)

4.2.2.2 Nadrf_DataManagement_StorageRequest service operation

4.2.2.2.1 General

The Nadrf_DataManagement_StorageRequest service operation is used by an NF service consumer to store data or analytics.

4.2.2.2.2 Request Storage of data or analytics

Figure 4.2.2.2.2-1 shows a scenario where the NF service consumer sends a request to the ADRF to store data or analytics.

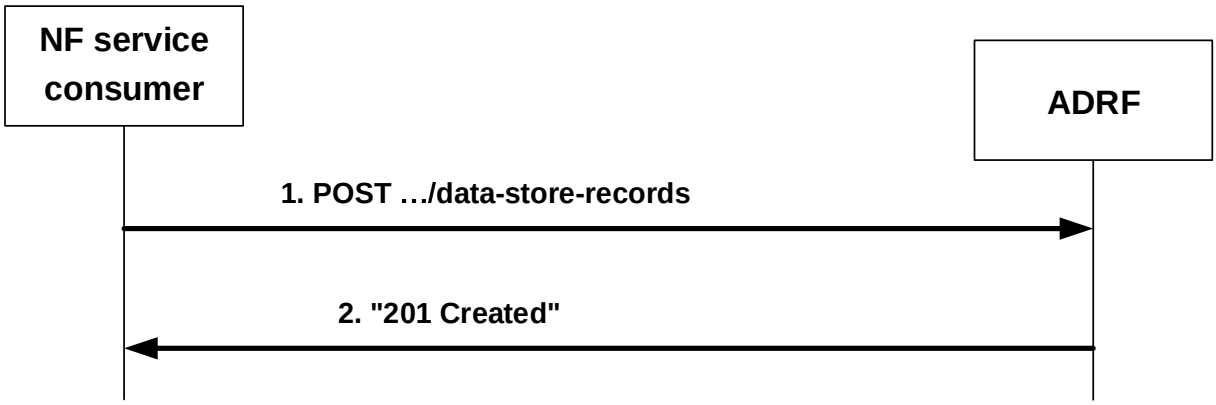

Figure 4.2.2.2.2-1: NF service consumer requesting to store data or analytics

The NF service consumer shall invoke the Nadrf_DataManagement_StorageRequest service operation to store data or analytics. The NF service consumer shall send an HTTP POST request with "{apiRoot}/nadrf-datamanagement/<apiVersion>/data-store-records" as Resource URI representing the "ADRF Data Store Records" resource, as shown in figure 4.2.2.2.2-1, step 1, to create an "Individual ADRF Data Store Record" according to the information in the message body. The NadrfDataStoreRecord data structure provided in the request body shall include:

- one of the following:
  - analytics subscription notification(s) within the "anaNotifications" attribute together with the corresponding subscription information within the "anaSub" attribute;
  - data subscription notification within the "dataNotif" attribute together with the corresponding subscription information within the " dataSub" attribute.

and may include:

- storage handling information within the "storeHandl" attribute, if the "EnhDataMgmt" feature is supported.
- a data set tag within the "dataSetTag" attribute, if the "EnhDataMgmt" feature is supported;
- data synthesis and compression information within the "dsc" attribute, if the "EnhDataMgmt" feature is supported.

NOTE: The data synthesis and compression information can include an indication that the data have been generated using a data synthesis tool, an indication that the data have been generated using a data compression tool, and information about the data synthesis and/or compression technique.

Upon the reception of an HTTP POST request with "{apiRoot}/nadrf-datamanagement/<apiVersion>/data-store-records" as Resource URI and NadrfDataStoreRecord data structure as request body, the ADRF shall:

- create a new data store record;
- assign a storeTransId;
- store the data or analytics.

NOTE 1: If the data and/or analytics is already stored or being stored in the ADRF, the ADRF will still create a new "Individual ADRF Data Store Record" resource and assign a new storeTransId if the ADRF intends to not really store the data again in the memory again based on the implementation.

If the ADRF created an "Individual ADRF Data Store Record" resource, the ADRF shall respond with "201 Created" with the message body containing a representation of the created record, as shown in figure 4.2.2.2.2-1, step 2. The ADRF shall include a Location HTTP header field. The Location header field shall contain the URI of the created record i.e. "{apiRoot}/nadrf-datamanagement/<apiVersion>/data-store-records/{storeTransId}".

If the ADRF receives storage handling information in the request but determines (e.g. based on local policy) that a different storage approach shall be followed, it indicates the determined storage approach to the consumer by setting accordingly the "storeHandl" attribute (e.g. providing a different lifetime, or omitting the deletion notification URI to indicate that no deletion alerts will be sent) in the message body of the response. When more than one consumer has requested storage lifetime for the same data or analytics, the storage approach should be based on the longest requested storage lifetime.

NOTE 2: The default operator policy for how long data or analytics are to be stored can be longer or shorter than the lifetime requested by the consumer. A default operator policy can for example accept only consumer requested lifetimes that are shorter or longer than the default policy.

If an error occurs when processing the HTTP POST request, the ADRF shall send an HTTP error response as specified in clause 5.1.7.

4.2.2.3 Nadrf_DataManagement_StorageSubscriptionRequest service operation

4.2.2.3.1 General

The Nadrf_DataManagement_StorageSubscriptionRequest service operation is used by an NF service consumer to request that the ADRF creates a subscription to data or analytics and subsequently stores notified data or analytics in the ADRF.

4.2.2.3.2 Requesting subscription and storage of data or analytics

Figure 4.2.2.3.2-1 shows a scenario where the NF service consumer sends a request to the ADRF to subscribe for data or analytics to be stored in the ADRF.

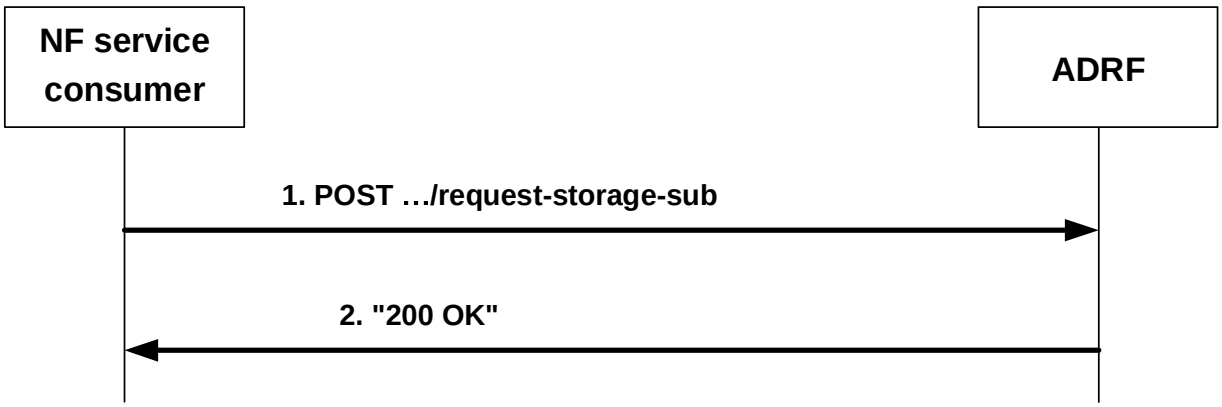

Figure 4.2.2.3.2-1: NF service consumer requesting that the ADRF subscribes to and subsequently stores data or analytics

The NF service consumer shall invoke the Nadrf_DataManagement_StorageSubscriptionRequest service operation to request the ADRF to subscribe to data or analytics. The NF service consumer shall send an HTTP POST request with "{apiRoot}/nadrf-datamanagement/<apiVersion>/request-storage-sub" as URI, as shown in figure 4.2.2.3.2-1, step 1. The NadrfDataStoreSubscription data structure provided in the request body shall include:

- one of the following subscription attributes:
  - analytics subscription information within the "anaSub" attribute;

  - data subscription information within the "dataSub" attribute;

- one of the following target identifiers:

  - DCCF or NWDAF instance identifier within the "targetNfId" attribute;

  - DCCF or NWDAF NF set identifier within the "targetNfSetId" attribute;

and may include:

- formatting instructions within the "formatInstruct" attribute;

- processing instructions within the "procInstruct" attribute or the "multiProcInstructs" attribute if the "MultiProcessingInstruction" feature is supported.

NOTE 1: The parameters provided by the NF service consumer, including Formatting and Processing Instructions (if provided) are used by the ADRF when subscribing to a DCCF or NWDAF for Data or Analytics to be stored.

- storage handling information within the "storeHandl" attribute, if the "EnhDataMgmt" feature is supported.

- a data set tag to be associated with this subscription and with the data or analytics collected based on this subscription within the "dataSetTag" attribute, if the "EnhDataMgmt" feature is supported.

Upon the reception of an HTTP POST request with "{apiRoot}/nadrf-datamanagement/<apiVersion>/request-storage-sub" as URI and NadrfDataStoreSubscription data structure as request body, the ADRF shall assign a transaction reference identifier to this request and, if the request is successfully processed and accepted, the ADRF shall respond with "200 OK" as shown in figure 4.2.2.3.2-1 step 2, with the message body containing an NadrfDataStoreSubscriptionRef data structure, which shall include the assigned transaction reference identifier as "transRefId" attribute.

NOTE 2: If the data and/or analytics is already stored or being stored in the ADRF, the ADRF will still assign a new transaction reference identifier if the ADRF intends to not really store the data again in the memory again based on the implementation.

If an error occurs when processing the HTTP POST request, the ADRF shall send an HTTP error response as specified in clause 5.1.7.

If the ADRF receives storage handling information in the request but determines (e.g. based on local policy) that a different storage approach shall be followed, it indicates the determined storage approach to the consumer by setting accordingly the "storeHandl" attribute (e.g. providing a different lifetime, or omitting the deletion notification URI to indicate that no deletion alerts will be sent) in the message body of the response. When more than one consumer has requested storage lifetime for the same data or analytics, the storage approach should be based on the longest requested storage lifetime.

NOTE 3: The default operator policy for how long data or analytics are to be stored can be longer or shorter than the lifetime requested by the consumer. A default operator policy can for example accept only consumer requested lifetimes that are shorter or longer than the default policy.

In the case of a successful response, the ADRF may subsequently create a data or analytics subscription (according to inputs that had been received in the NadrfDataStoreSubscription data structure; this is not performed if the ADRF determines that the data is already being stored based on an existing subscription) with a DCCF as described in 3GPP TS 29.574 [23] or with an NWDAF as described in 3GPP TS 29.520 [15], and create a mapping between the previously assigned and returned transaction reference identifier and the subscription that is used to serve the transaction.

4.2.2.4 Nadrf_DataManagement_StorageSubscriptionRemoval service operation

4.2.2.4.1 General

The Nadrf_DataManagement_StorageSubscriptionRemoval service operation is used by an NF service consumer to request the ADRF to remove a subscription for data or analytics.

4.2.2.4.2 Requesting removal of subscription of data or analytics

Figure 4.2.2.4.2-1 shows a scenario where the NF service consumer sends a request to the ADRF to unsubscribe for storage of data or analytics.

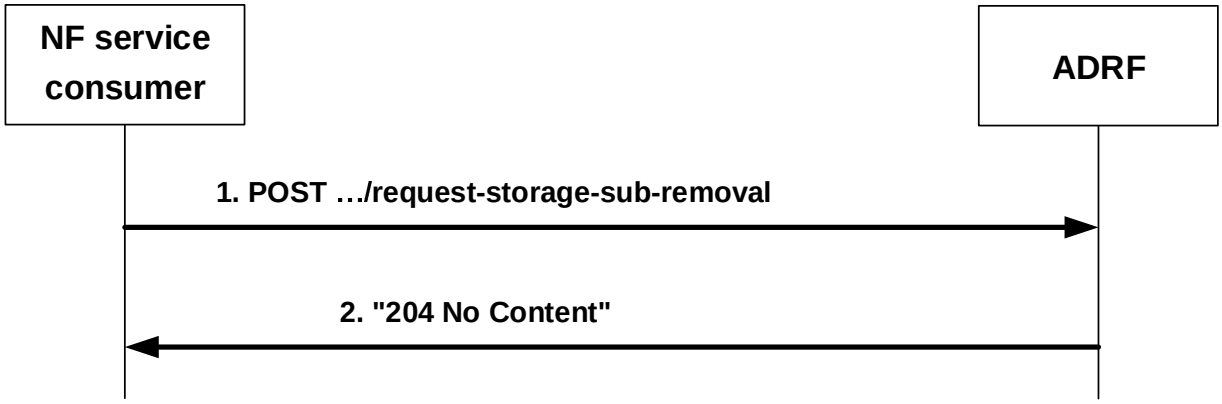

Figure 4.2.2.4.2-1: NF service consumer requesting the removal of subscription(s) to storage of data or analytics

The NF service consumer shall invoke the Nadrf_DataManagement_StorageSubscriptionRemoval service operation to request the ADRF to remove subscription(s) to data or analytics that are stored in the ADRF. The NF service consumer shall send an HTTP POST request with "{apiRoot}/nadrf-datamanagement/<apiVersion>/request-storage-sub-removal" as URI, as shown in figure 4.2.2.4.2-1, step 1. The POST request body shall contain an NadrfDataStoreSubscriptionRef data structure, which shall include a transaction reference identifier as "transRefId" attribute or, if the "EnhDataMgmt" feature is supported, a data set identifier as "dataSetId" attribute.

Upon the reception of an HTTP POST request with "{apiRoot}/nadrf-datamanagement/<apiVersion>/request-storage-sub-removal" as URI, if the ADRF successfully processed and accepted the received HTTP POST request, the ADRF shall respond with HTTP "204 No Content" status. Subsequently, the ADRF shall remove the (DCCF or NWDAF) subscription that had been created and mapped to the received transaction reference identifier or the (DCCF or NWDAF) subscription(s) associated to the received data set identifier as described in clause 4.2.2.3, unless this subscription is mapped to further transaction reference identifier(s) (of transactions that are still active) or associated with further data set identifier(s).

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

4.2.2.5 Nadrf_DataManagement_RetrievalRequest service operation

4.2.2.5.1 General

The Nadrf_DataManagement_RetrievalRequest service operation is used by an NF service consumer to retrieve stored data or analytics.

NOTE: If the data is to be collected for a user, i.e. SUPI or GPSI, the consumer needs to check the user consent by retrieving the user consent information from the UDM as described in clause 5.5 of 3GPP TS 29.552 [28] before invoking this service operation.

4.2.2.5.2 Request and get stored data or analytics from ADRF Data Store

Figure 4.2.2.5.2-1 shows a scenario where the NF service consumer sends a request to the ADRF to retrieve stored data or analytics.

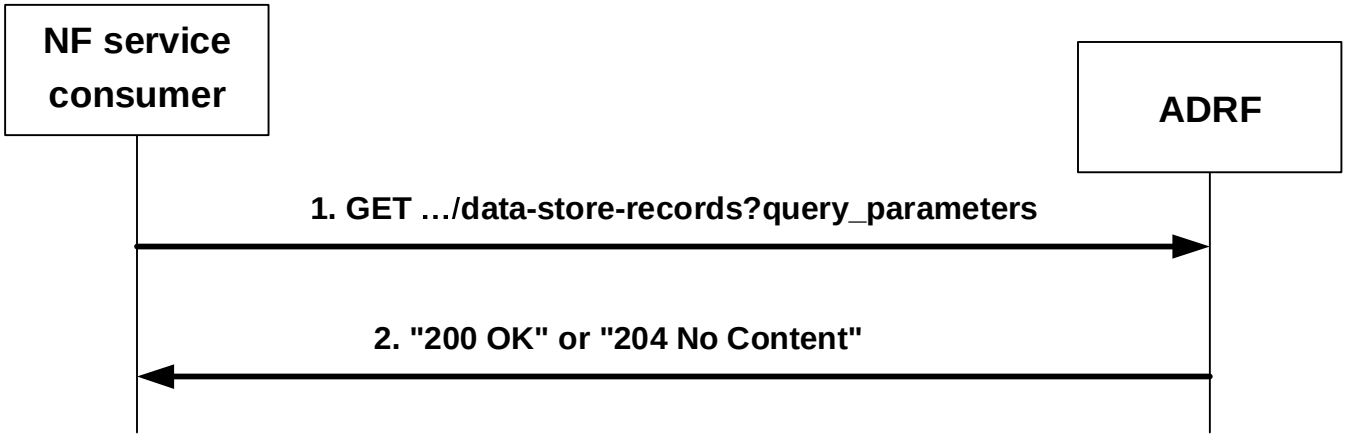

Figure 4.2.2.5.2-1: NF service consumer requesting to retrieve stored data or analytics

The NF service consumer shall invoke the Nadrf_DataManagement_RetrievalRequest service operation to retrieve stored data or analytics. The NF service consumer shall send an HTTP GET request with "{apiRoot}/nadrf-datamanagement/<apiVersion>/data-store-records" as Resource URI representing the "ADRF Data Store Records" resource, as shown in figure 4.2.2.5.2-1, step 1, to request ADRF data store records according to the query parameter value of the store transaction identifier within the "store-trans-id" attribute, the query parameter value of the fetch correlation identifier(s) within the "fetch-correlation-ids" attribute, or, if the "EnhDataMgmt" feature is supported, the query parameter value of the data set identifier within the "data-set-id" attribute.

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

- find the data or analytics according to the requested parameters.

If the requested data or analytics is found, the ADRF shall respond with "200 OK" status code with the message body containing the NadrfDataStoreRecord data structure. The NadrfDataStoreRecord data structure in the response body shall include:

- one of the following:
  - information about network analytics function events that occurred in the "anaNotifications" attribute together with the corresponding subscription information within the "anaSub" attribute;
  - information about data event within the "dataNotif" attribute together with the corresponding subscription information within the "dataSub" attribute.

and may include:

- a data set tag within the "dataSetTag" attribute, if the "EnhDataMgmt" feature is supported.
- data synthesis and compression information within the "dsc" attribute, if the "EnhDataMgmt" feature is supported.

NOTE: The data synthesis and compression information can include an indication that the data have been generated using a data synthesis tool, an indication that the data have been generated using a data compression tool, and information about the data synthesis and/or compression technique.

If the requested analytics or data does not exist, the ADRF shall respond with "204 No Content". If an error occurs when processing the HTTP GET request, the ADRF shall send an HTTP error response as specified in clause 5.1.7.

4.2.2.6 Nadrf_DataManagement_RetrievalSubscribe service operation

4.2.2.6.1 General

The Nadrf_DataManagement_RetrievalSubscribe service operation is used by an NF service consumer to subscribe to the ADRF to retrieve via notifications data or analytics that is stored in the ADRF and to receive future notifications with data or analytics when they are received by the ADRF.

NOTE: If the data is to be collected for a user, i.e. SUPI or GPSI, the consumer needs to check the user consent by retrieving the user consent information from the UDM as described in clause 5.5 of 3GPP TS 29.552 [28] before invoking this service operation.

4.2.2.6.2 Requesting retrieval and subscription of data or analytics

Figure 4.2.2.6.2-1 shows a scenario where the NF service consumer sends a request to the ADRF to retrieve and subscribe to data or analytics.

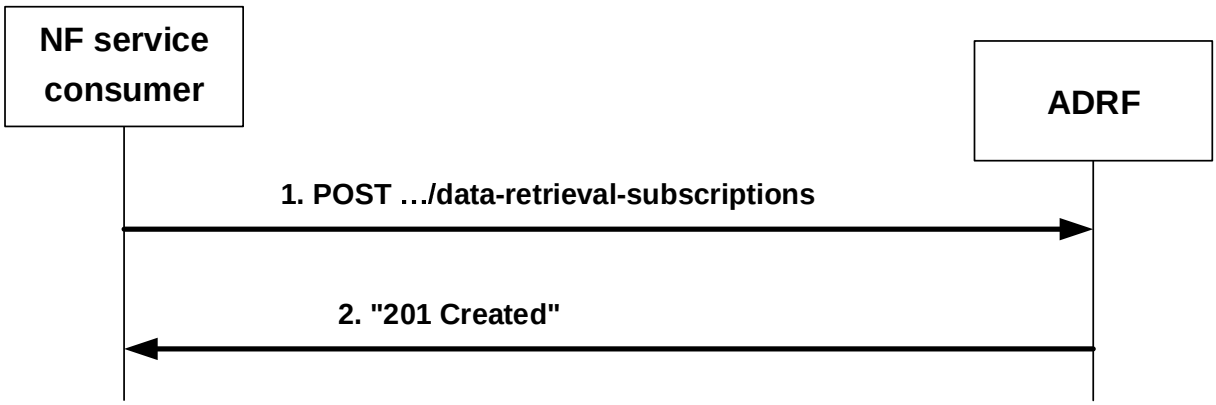

Figure 4.2.2.6.2-1: NF service consumer requesting to retrieve and subscribe to data or analytics

The NF service consumer shall invoke the Nadrf_DataManagement_RetrievalSubscribe service operation to retrieve and subscribe to data or analytics. The NF service consumer shall send an HTTP POST request with "{apiRoot}/nadrf-datamanagement/<apiVersion>/data-retrieval-subscriptions" as Resource URI representing the "ADRF Data Retrieval Subscriptions" resource, as shown in figure 4.2.2.6.2-1, step 1, to create an "Individual ADRF Data Retrieval Subscription" according to the information in the message body. The NadrfDataRetrievalSubscription data structure provided in the request body shall include:

- notification correlation identfier within the "notifCorrId" attribute;
- one of the following:
  - analytics subscription information within the "anaSub" attribute;
  - data subscription information within the "dataSub" attribute;
  - data set identifier within the "dataSetId" attribute, if the "EnhDataMgmt" feature is supported;
- a notification target address within the "notificationURI" attribute;
- a time window for the data retrieval and subscription within the "timePeriod" attribute;

and may include:

- a Consumer triggered Notification indication within the "consTrigNotif" attribute.

Upon the reception of an HTTP POST request with "{apiRoot}/nadrf-datamanagement/<apiVersion>/data-retrieval-subscriptions" as Resource URI and NadrfDataRetrievalSubscription data structure as request body, the ADRF shall:

- create a new subscription;
- assign a subscriptionId;

- store the subscription.

If the ADRF created an "Individual ADRF Data Retrieval Subscription" resource, the ADRF shall respond with "201 Created" with the message body containing a representation of the created subscription, as shown in figure 4.2.2.6.2-1, step 2. The ADRF shall include a Location HTTP header field. The Location header field shall contain the URI of the created record i.e. "{apiRoot}/nadrf-datamanagement/<apiVersion>/data-retrieval-subscriptions/{subscriptionId}".

If an error occurs when processing the HTTP POST request, the ADRF shall send an HTTP error response as specified in clause 5.1.7.

4.2.2.7 Nadrf_DataManagement_RetrievalUnsubscribe service operation

4.2.2.7.1 General

The Nadrf_DataManagement_RetrievalUnsubscribe service operation is used by an NF service consumer to remove a retrieval subscription to data or analytics.

4.2.2.7.2 Requesting removal of retrieval subscription for data or analytics

Figure 4.2.2.7.2-1 shows a scenario where the NF service consumer sends a request to the ADRF to remove a retrieval subscription for data or analytics.

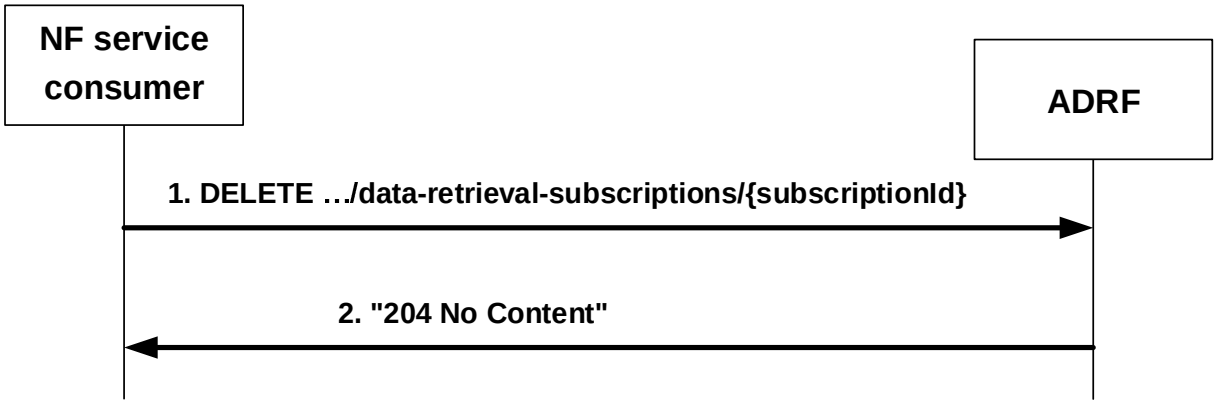

Figure 4.2.2.7.2-1: NF service consumer requesting to remove retrieval subscription for data or analytics

The NF service consumer shall invoke the Nadrf_DataManagement_RetrievalUnsubscribe service operation to remove a retrieval subscription for data or analytics. The NF service consumer shall send an HTTP DELETE request with "{apiRoot}/nadrf-datamanagement/<apiVersion>/data-retrieval-subscriptions/{subscriptionId}" as Resource URI representing an "Individual ADRF Data Retrieval Subscription" resource, as shown in figure 4.2.2.7.2-1, step 1, where "{subscriptionId}" is the identifier of the existing data retrieval subscription that is to be deleted.

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

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

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

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

4.2.2.8 Nadrf_DataManagement_RetrievalNotify service operation

4.2.2.8.1 General

The Nadrf_DataManagement_RetrievalNotify service operation is used by ADRF to notify NF service consumers about subscribed events related to data or analytics and about data or analytics that are about to be deleted.

4.2.2.8.2 Notification about subscribed data or analytics

Figure 4.2.2.8.2-1 shows a scenario where the ADRF sends a request to the NF service consumer to notify it about data or analytics events.

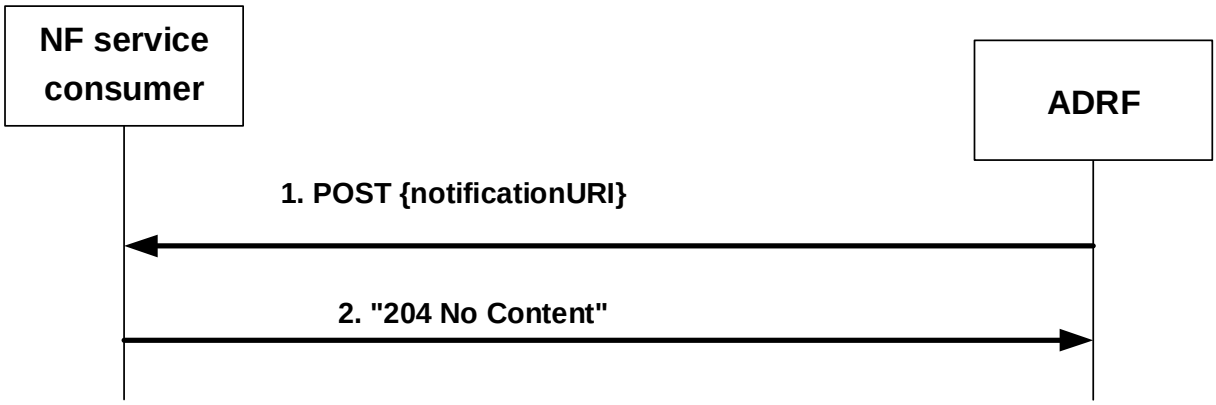

Figure 4.2.2.8.2-1: ADRF notifies the NF service consumer about subscribed data or analytics

The ADRF shall invoke the Nadrf_DataManagement_RetrievalNotify service operation to notify about subscribed data or analytics events. The ADRF shall send an HTTP POST request to the "{notificationURI}" received in the subscription (see clause 5.1.5 for the definition of this notificationURI), as shown in figure 4.2.2.8.2-1, step 1. The NadrfDataRetrievalNotification data structure provided in the request body shall include:

- notification correlation Id within the "notifCorrId" attribute;
- the time stamp which represents the time when ADRF completes preparation of the requested data or analytics within the "timeStamp" attribute;
- one of the following:
  - information about network data analytics function events that occurred in the "anaNotifications" attribute;
  - data collected from data sources (e.g. SMF, NEF) in the "dataNotif" attribute;
  - information for fetching the data or analytics in the "fetchInstruct" attribute.

NOTE: The fetch correlation identifiers included in the fetch instructions of the "fetchInstruct" attribute can be used to fetch data or analytics using the Nadrf_DataManagement_RetrievalRequest service operation as described in clause 4.2.2.5.2. The (mandatory) fetch URI included in the fetch instructions of the "fetchInstruct" attribute is expected to be in line with the standard resource URI defined for the Nadrf_DataManagement_RetrievalRequest service operation, i.e. {apiRoot}/nadrf-datamanagement/<apiVersion>/data-store-records, but it can be anything because it is actually not needed by the NF service consumer in this case.

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

- a termination request provided by the ADRF within the "terminationReq" attribute.
- data synthesis and compression information within the "dsc" attribute, if the "EnhDataMgmt" feature is supported.

NOTE: The data synthesis and compression information can include an indication that the data have been generated using a data synthesis tool, an indication that the data have been generated using a data compression tool, and information about the data synthesis and/or compression technique.

Upon the reception of an HTTP POST request with "{notificationURI}" as Resource URI and NadrfDataRetrievalNotification 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;
- 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 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].

After the successful processing of the HTTP POST request, if the ADRF requests the NF service consumer to retrieve the data or analytics with the "fetchInstruct" attribute, the NF service consumer may invoke the Nadrf_DataManagement_RetrievalRequest service operation to retrieve the notified data or analytics as defined in clause 4.2.2.5.

4.2.2.8.3 Notification about data or analytics that are about to be deleted

Figure 4.2.2.8.3-1 shows a scenario where the ADRF sends a request to the NF service consumer to notify it about data or analytics that are about to be deleted.

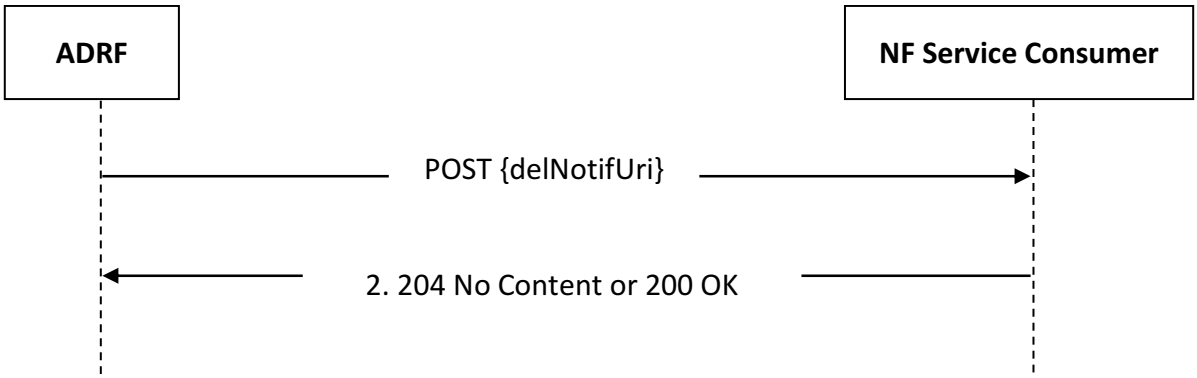

Figure 4.2.2.8.3-1: ADRF notifies the NF service consumer about data or analytics that are about to be deleted.

In order to notify about data or analytics that are about to be deleted, the ADRF shall invoke the Nadrf_DataManagement_RetrievalNotify service operation. The ADRF shall send an HTTP POST request to the "{delNotifUri}" received in a storage request as defined in clause 4.2.2.2.2 or in a storage subscription request as defined in clause 4.2.2.3.2, as shown in figure 4.2.2.8.3-1, step 1. The NadrfAlertNotification data structure provided in the request body shall include:

- a notification correlation identifier within the "delNotifCorrId" attribute;
- a storage transaction identifier, which may be used by the NF service consumer to retrieve the data, within the "alertStorTransId" attribute;

NOTE: The "alertStorTransId" attribute, which is used for retrieving data prior to deletion, does not have to be the same with or related to the "storeTransId" attribute that is assigned and returned during the storage of the data.

Upon the reception of an HTTP POST request with "{delNotifUri}" as Resource URI and NadrfAlertNotification data structure as request body, if the NF service consumer successfully processed and accepted the received HTTP POST request, the NF Service Consumer shall either respond with HTTP "204 No Content" status code or with HTTP "200 OK" status code and the NadrfAlertNotificationResponse data structure in the message body.

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 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].

After the successful processing of the HTTP POST request, the NF service consumer may invoke the Nadrf_DataManagement_RetrievalRequest service operation as defined in clause 4.2.2.5, using the storage transaction identifier received within the "alertStorTransId" attribute of the NadrfAlertNotification, in order to retrieve the data or analytics that are about to be deleted.

4.2.2.9 Nadrf_DataManagement_Delete service operation

4.2.2.9.1 General

The Nadrf_DataManagement_Delete service operation is used by an NF service consumer to delete stored data or analytics.

4.2.2.9.2 Requesting removal of stored data or analytics

Figure 4.2.2.9.2-1 shows a scenario where the NF service consumer sends a request to the ADRF to delete stored data or analytics.

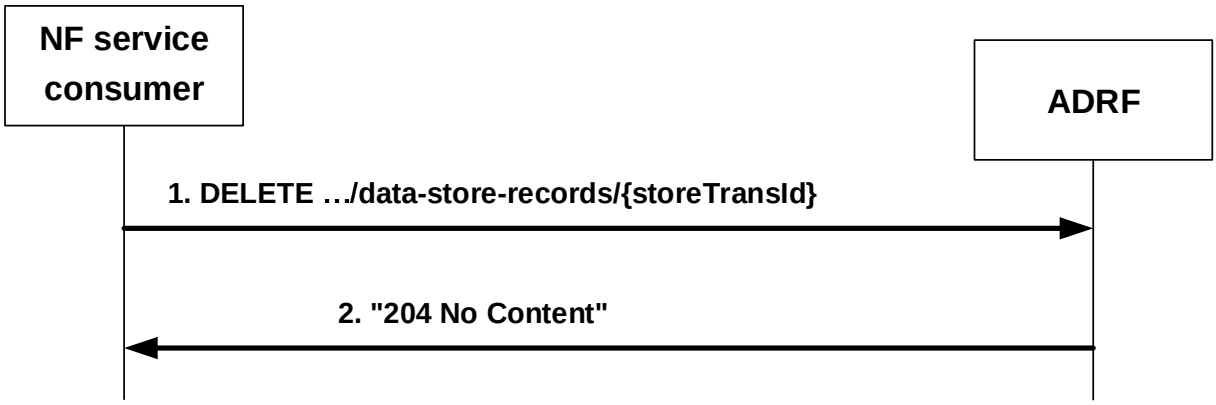

Figure 4.2.2.9.2-1: NF service consumer requesting to remove stored data or analytics

The NF service consumer shall invoke the Nadrf_DataManagement_Delete service operation to remove stored data or analytics. The NF service consumer shall send an HTTP DELETE request with "{apiRoot}/nadrf-datamanagement/<apiVersion>/data-store-records/{storeTransId}" as Resource URI representing an "Individual ADRF Data Store Record" resource, as shown in figure 4.2.2.9.2-1, step 1, where "{storeTransId}" is the transaction identifier of the stored record that is to be deleted.

Upon the reception of an HTTP DELETE request with "{apiRoot}/nadrf-datamanagement/<apiVersion>/data-store-records/{storeTransId}" as Resource URI, if the ADRF successfully processed and accepted the received HTTP DELETE request, the ADRF shall:

- remove the corresponding stored record;
- respond with HTTP "204 No Content" status code.

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

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

4.2.2.9.3 Requesting removal of stored data or analytics using data or analytics specification

Figure 4.2.2.9.3-1 shows a scenario where the NF service consumer sends a request to the ADRF to delete stored data or analytics based on a data or analytics specification.

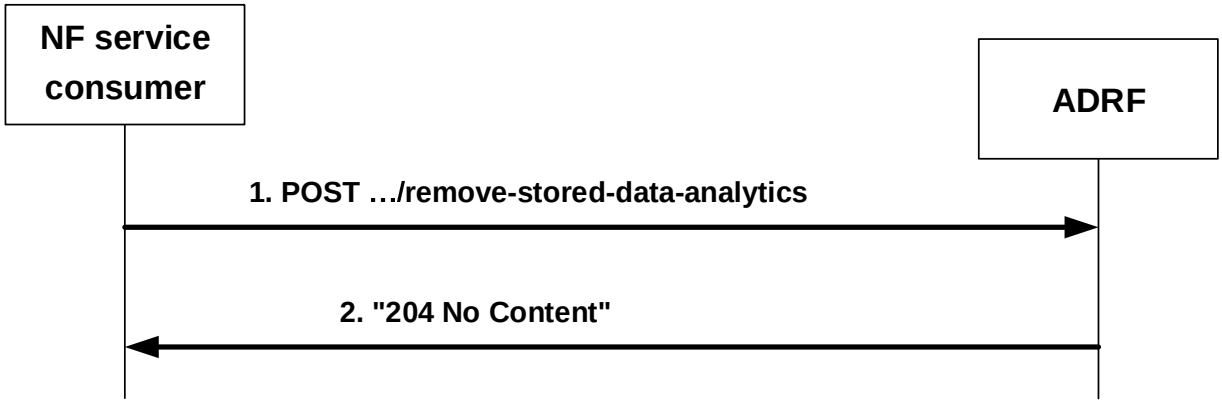

Figure 4.2.2.9.3-1: NF service consumer requesting to remove stored data or analytics

The NF service consumer shall invoke the Nadrf_DataManagement_Delete service operation to remove stored data or analytics based on a data or analytics specification. The NF service consumer shall send an HTTP POST request with "{apiRoot}/nadrf-datamanagement/<apiVersion>/remove-stored-data-analytics" as URI, as shown in figure 4.2.2.9.3-1, step 1. The POST request body shall contain an NadrfStoredDataSpec data structure. The NadrfStoredDataSpec data structure provided in the request body shall include:

- a time window in which the data to be deleted was collected in the "timePeriod" attribute; and
- one of the following:
  - a data specification in the "dataSpec" attribute;
  - an analytics specification in the "anaSpec" attribute;
  - a data set identifier within the "dataSetId" attribute, if the "EnhDataMgmt" feature is supported.

Upon the reception of an HTTP POST request with "{apiRoot}/nadrf-datamanagement/<apiVersion>/remove-stored-data-analytics" as URI, if the ADRF successfully processed and accepted the received HTTP POST request, the ADRF shall respond with HTTP "204 No Content" status. The ADRF shall remove any stored analytics or data that match the analytics specification, the data specification, or the data set identifier received in the request.

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

4.3 Nadrf_ MLModelManagement Service

4.3.1 Service Description

4.3.1.1 Overview

The Nadrf_ MLModelManagement service as defined in 3GPP TS 23.288 [14], is provided by the Analytics Data Repository Function (ADRF).

This service:

- allows NF service consumers to store ML model(s) in the ADRF;
- allows NF service consumers to retrieve ML model(s) from an ADRF; and
- allows NF service consumers to delete ML model(s) from an ADRF.

NOTE: In this specification, the storage of the ML model includes the storage of ML model and ML model address; the retrieval of the ML model includes the retrieval of the ML model address; and the removal of the ML model includes the removal of ML model and ML model address.

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 [14].

The Nadrf_MLModelManagement service is part of the Nadrf service-based interface exhibited by the Analytics Data Repository Function (ADRF).

Known consumers of the Nadrf_MLModelManagement service are:

- Network Data Analytics Function (NWDAF).

The Nadrf_MLModelManagement service is provided by the ADRF and consumed by the NF service consumers as shown in figure 4.3.1.2-1 for the SBI representation model and in figure 4.3.1.2-2 for the reference point representation model.

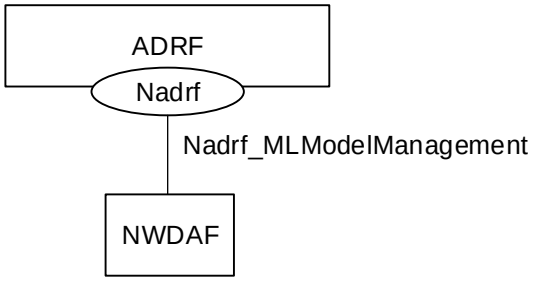

Figure 4.3.1.2-1: Reference Architecture for the Nadrf_MLModelManagement Service; SBI representation

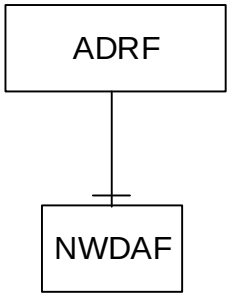

Figure 4.3.1.2-2: Nadrf_MLModelManagement service architecture, reference point representation

4.3.1.3 Network Functions

4.3.1.3.1 Analytics Data Repository Function (ADRF)

The Analytics Data Repository Function (ADRF) provides the functionality to allow NF service consumers to store, retrieve, and remove ML model(s) from the ADRF.

4.3.1.3.2 NF Service Consumers

The NWDAF:

- supports storing of ML model(s) in the ADRF;
- supports retrieving of ML model(s) from an ADRF; and
- supports deletion of ML model(s) from an ADRF.

4.3.2 Service Operations

4.3.2.1 Introduction

Table 4.3.2.1-1: Operations of the Nadrf_MLModelManagement Service

Service operation name	Description	Initiated by
Nadrf_MLModelManagement_StorageRequest	This service operation is used by an NF to request the ADRF to store or update ML model(s).	NF service consumer (NWDAF)
Nadrf_MLModelManagement_RetrievalRequest	This service operation is used by an NF to retrieve stored ML model(s) from the ADRF.	NF service consumer (NWDAF)
Nadrf_MLModelManagement_Delete	This service operation is used by an NF to delete stored ML model(s) in the ADRF.	NF service consumer (NWDAF)

4.3.2.2 Nadrf_MLModelManagement_StorageRequest service operation

4.3.2.2.1 General

The Nadrf_MLModelManagement_StorageRequest service operation is used by an NF service consumer to store ML model(s).

4.3.2.2.2 Request Storage of ML model(s)

Figure 4.3.2.2.2-1 shows a scenario where the NF service consumer sends a request to the ADRF to store ML model(s).

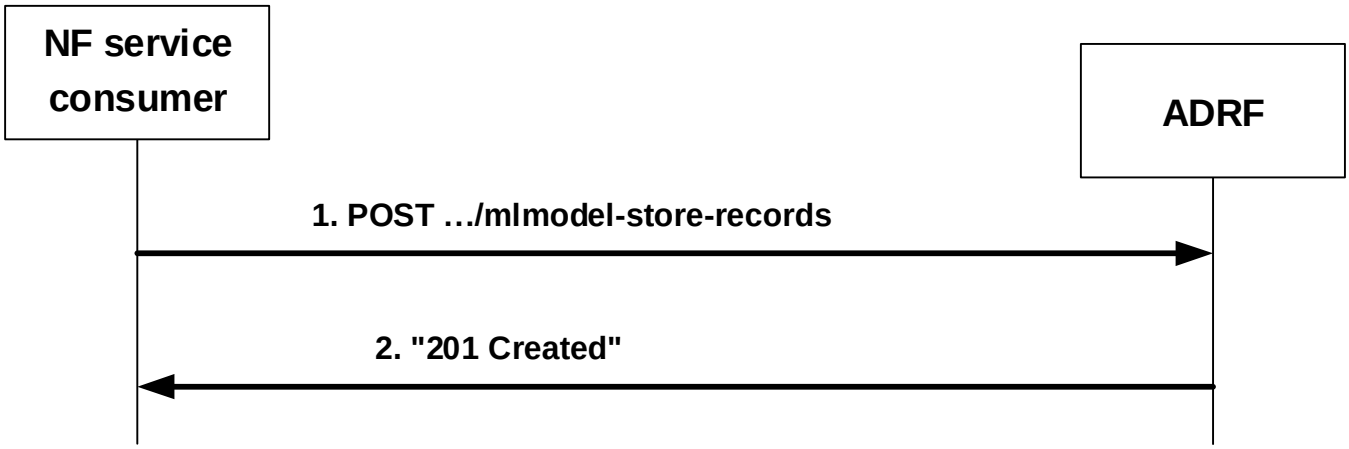

Figure 4.3.2.2.2-1: NF service consumer requesting to store ML model(s)

The NF service consumer shall invoke the Nadrf_MLModelManagement_StorageRequest service operation to store ML model(s). The NF service consumer shall send an HTTP POST request with "{apiRoot}/nadrf-mlmodelmanagement/<apiVersion>/mlmodel-store-records" as Resource URI representing the "ADRF ML Model Store Records" resource, as shown in figure 4.3.2.2.2-1, step 1, to create an "Individual ADRF ML Model Store Record" according to the information in the message body. The NadrfMLModelStoreRecord data structure provided in the request body shall include either the MLModelInfo data structure in the "mlModelInfo" attribute or the MLModel data structure in the "mlModels" attribute, while either the NF instance identifier, within the "nfInstanceId" attribute, or the NF set identifier, within the "nfSetId" attribute of the NWDAF containing MTLF shall also be provided. If the MLModelInfo data structure is provided, the unique ML model identifier within the "modelUniqueId" attribute, the address of the ML model within the "mlFileAddr" attribute, and the storage size required for each of the ML model(s) in the "mlStorageSize" attribute shall be included, while the list of allowed consumer(s) within the "allowConsumerList" may also be provided. If the MLModel data structure is provided, the unique ML model identifier within the "modelUniqueId" attribute and the ML model within the "mlModel" attribute shall be included.

Upon the reception of an HTTP POST request with "{apiRoot}/nadrf-mlmodelmanagement/<apiVersion>/mlmodel-store-records" as Resource URI and NadrfMLModelStoreRecord data structure as request body, the ADRF shall:

- create a new ML model store record;
- assign a storeTransId;
- download the ML model(s) if needed; and
- store the ML model(s).

NOTE 1: If the ML model(s) are already stored or being stored in the ADRF, the ADRF will still create a new "Individual ADRF ML Model Store Record" resource and assign a new storeTransId if the ADRF intends to not really store the ML model(s) in the memory again based on the implementation.

If the ADRF created an "Individual ADRF ML Model Store Record" resource, the ADRF shall respond with "201 Created" with the message body containing a representation of the created ML model record, as shown in figure 4.3.2.2.2-1, step 2. If the storage of the ML models provided in the "mlModelInfo" attribute or "mlModels" attribute of the request partially failed, the ADRF may include information about the models that failed to be stored within the "modelStoreResult" attribute in the response. The ADRF shall include a Location HTTP header field, which shall contain the URI of the created record i.e. "{apiRoot}/nadrf- mlmodelmanagement/<apiVersion>/mlmodel-store-records/{storeTransId}".

If the storage of all the ML models provided in the "mlModelInfo" attribute or "mlModels" attribute of the request failed for the same reason, then:

- if the ML model file address(es) was/were not found, the ADRF shall send an HTTP "404 Not Found" status code with the response body containing a ProblemDetails data structure with the "cause" attribute including the "ML_MODEL_FILE_ADDRESS_NOT_FOUND" application error response as specified in clause 5.2.7; or
- if the ML model file(s) download failed, the ADRF shall send an HTTP "500 Internal Server Error" status code with the response body containing a ProblemDetails data structure with the "cause" attribute including the "ML_MODEL_FILE_DOWNLOAD_FAILED" application error response as specified in clause 5.2.7.

If an error occurs when processing the HTTP POST request, the ADRF shall send an HTTP error response as specified in clause 5.2.7.

4.3.2.2.3 Update Storage of ML model(s)

Figure 4.3.2.2.3-1 shows a scenario where the NF service consumer sends a request to the ADRF to update ML model(s).

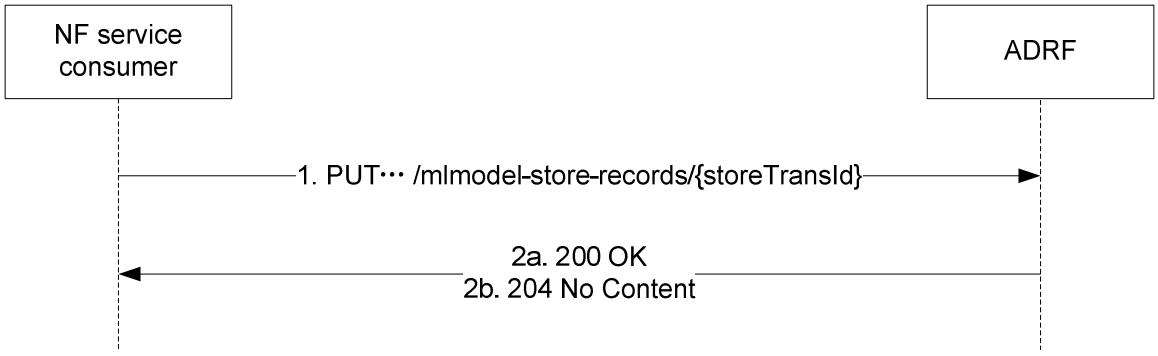

Figure 4.3.2.2.3-1: NF service consumer requesting to update ML model(s)

The NF service consumer shall invoke the Nadrf_MLModelManagement_StorageRequest service operation to update ML model(s). The NF service consumer shall send an HTTP PUT request with "{apiRoot}/nadrf-mlmodelmanagement/<apiVersion>/mlmodel-store-records/{storeTransId}" as Resource URI representing an "Individual ADRF ML Model Store Record" resource, as shown in figure 4.3.2.2.3-1, step 1, to update that resource according to the information in the message body. The NadrfMLModelStoreRecord data structure provided in the request body shall include the same contents as described in clause 4.3.2.2.2.

Upon the reception of an HTTP PUT request with "{apiRoot}/nadrf-mlmodelmanagement/<apiVersion>/mlmodel-store-records/{storeTransId}" as Resource URI and NadrfMLModelStoreRecord data structure as request body, the ADRF shall:

- download the ML model(s) if needed;
- update the ML model store record;

and shall respond with:

a) HTTP "200 OK" status code with the message body containing a representation of updated ML model record, as shown in figure 4.3.2.2.3-1, step 2a. or

b) HTTP "204 No Content" status code, as shown in figure 4.3.2.2.3-1, step 2b.

If an error occurs when processing the HTTP PUT request, the ADRF shall send an HTTP error response as specified in clause 5.2.7.

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

4.3.2.3 Nadrf_MLModelManagement_RetrievalRequest service operation

4.3.2.3.1 General

The Nadrf_MLModelManagement_RetrievalRequest service operation is used by an NF service consumer to retrieve stored ML model(s).

4.3.2.3.2 Request and get stored ML model(s) from ADRF ML Model Store

Figure 4.3.2.3.2-1 shows a scenario where the NF service consumer sends a request to the ADRF to retrieve stored ML model(s).

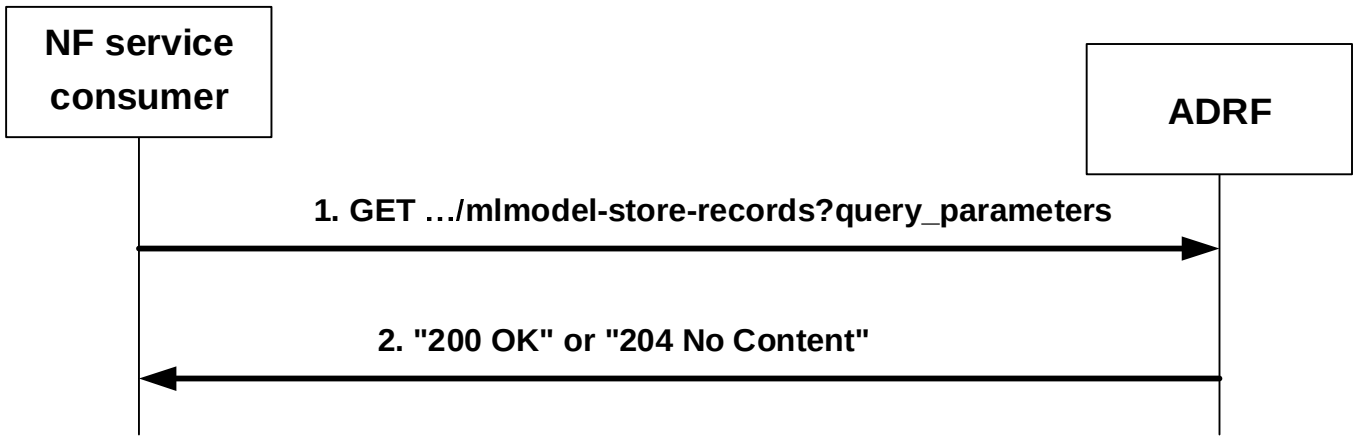

Figure 4.3.2.3.2-1: NF service consumer requesting to retrieve stored ML model(s)

The NF service consumer shall invoke the Nadrf_MLModelManagement_RetrievalRequest service operation to retrieve stored ML model(s). The NF service consumer shall send an HTTP GET request with "{apiRoot}/nadrf-mlmodelmanagement/<apiVersion>/mlmodel-store-records" as Resource URI representing the "ADRF ML Model Store Records" resource, as shown in figure 4.3.2.3.2-1, step 1, to request ADRF ML model store records according to the storage transaction identifier within the "store-trans-id" query parameter or the unique ML model identifier(s) within the "model-unique-ids" query parameter.

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

- find the ML model(s) according to the requested parameters.

If one or more of the requested ML model(s) are found, the ADRF shall respond with "200 OK" status code with the message body containing the NadrfMLModelStoreRecord data structure. The NadrfMLModelStoreRecord data structure in the response body shall include the MLModelInfo data structure in the "mlModelInfo" attribute with the

unique ML model identifier in the "modelUniqueId" attribute and the address of the ML model file stored in the ADRF in the "mlFileAddr" attribute.

If the NF Service Consumer is not included in the allowed NF consumer list for the ML model and/or is not same as the NF of the NWDAF containing MTLF that stored the model, the ADRF shall send an HTTP "403 Forbidden" error response including the "cause" attribute set to "RETRIEVAL_ML_MODEL_NOT_ALLOWED".

If none of the requested ML model(s) exist, the ADRF shall respond with "204 No Content". If an error occurs when processing the HTTP GET request, the ADRF shall send an HTTP error response as specified in clause 5.2.7.

4.3.2.4 Nadrf_MLModelManagement_Delete service operation

4.3.2.4.1 General

The Nadrf_MLModelManagement_Delete service operation is used by an NF service consumer to delete stored ML model(s).

4.3.2.4.2 Requesting removal of stored ML model(s)

Figure 4.3.2.4.2-1 shows a scenario where the NF service consumer sends a request to the ADRF to delete stored ML model(s).

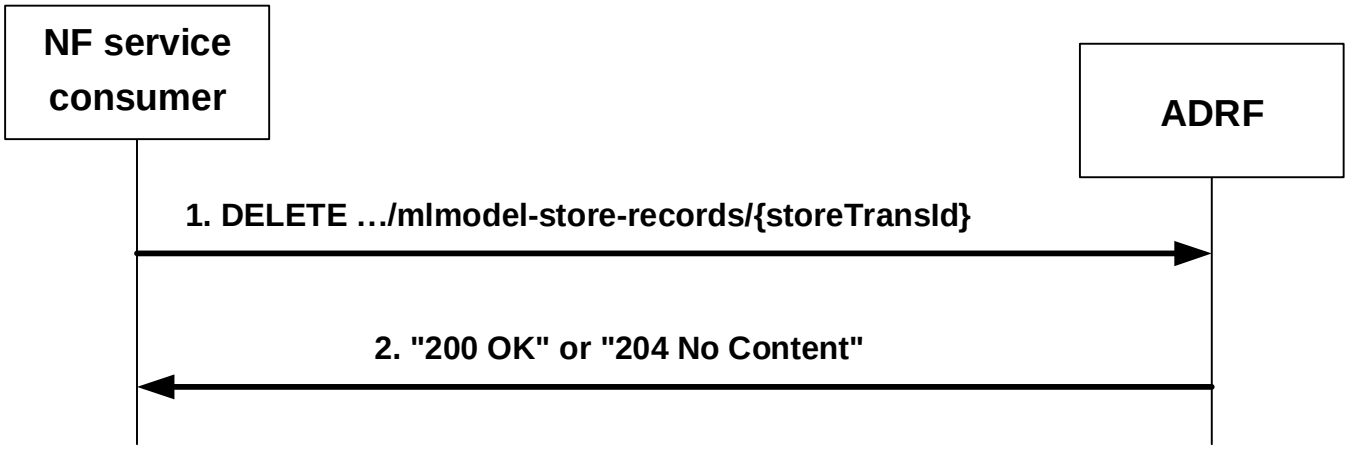

Figure 4.3.2.4.2-1: NF service consumer requesting to remove stored ML model(s)

The NF service consumer shall invoke the Nadrf_MLModelManagement_Delete service operation to remove the ML model(s) that are stored in the corresponding storage transaction. The NF service consumer shall send an HTTP DELETE request with "{apiRoot}/nadrf-mlmodelmanagement/<apiVersion>/mlmodel-store-records/{storeTransId}" as Resource URI representing an "Individual ADRF ML Model Store Record" resource, as shown in figure 4.3.2.4.2-1, step 1, where "{storeTransId}" is the transaction identifier of the stored record that is to be deleted.

Upon the reception of an HTTP DELETE request with "{apiRoot}/nadrf-mlmodelmanagement/<apiVersion>/mlmodel-store-records/{storeTransId}" as Resource URI, if the ADRF successfully processed and accepted the received HTTP DELETE request, the ADRF shall:

- remove the storage transaction corresponding stored ML model record;
- respond with HTTP "204 No Content" status code, or with HTTP "200 OK" status code with the message body containing, for each of the ML Models that had been stored under the given storage transaction identifier, the MLModelDelResult data structure with the unique ML model identifier in the "modelUniqueId" attribute and the result in the "deleteResult" attribute.

If the deletion of all the ML models that had been stored under the given storage transaction identifier failed for the same reason, then:

- if the ML model(s) was/were not found the ADRF shall send an HTTP "404 Not Found" status code with the response body containing a ProblemDetails data structure with the "cause" attribute including the "ML_MODEL_NOT_FOUND" application error response as specified in clause 5.2.7; or

- if the ML model(s) was/were found but not deleted the ADRF shall send an HTTP "500 Internal Server Error" status code with the response body containing a ProblemDetails data structure with the "cause" attribute including the "ML_MODEL_FOUND_BUT_NOT_DELETED" application error response as specified in clause 5.2.7.

If errors occur when processing the HTTP DELETE request, the ADRF shall send an HTTP error response as specified in clause 5.2.7.

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

4.3.2.4.3 Requesting removal of stored ML model(s) using unique ML model identifier

Figure 4.3.2.4.3-1 shows a scenario where the NF service consumer sends a request to the ADRF to delete stored ML model(s) based on the unique ML model identifier.

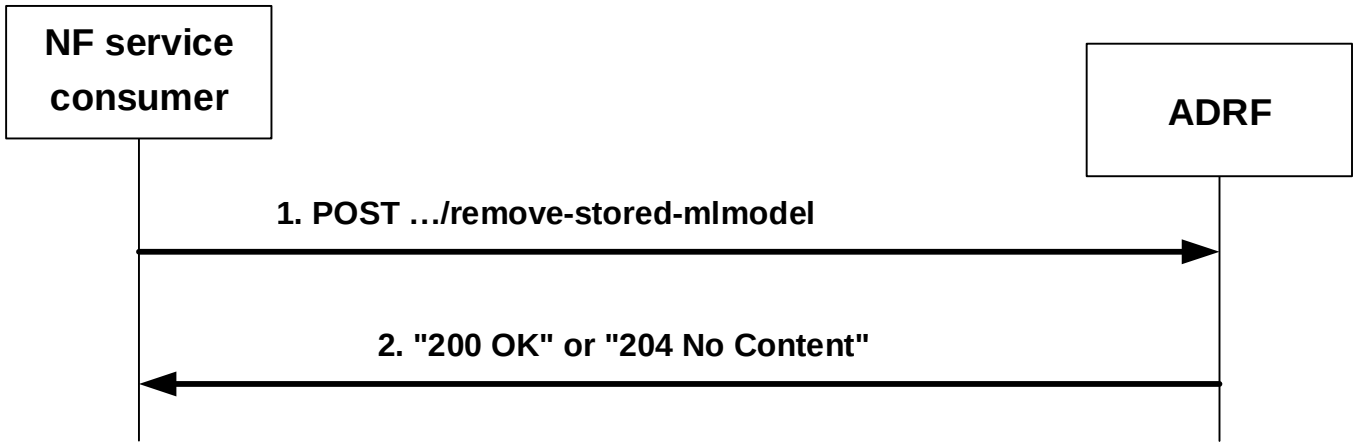

Figure 4.3.2.4.3-1: NF service consumer requesting to remove stored ML model(s)

The NF service consumer shall invoke the Nadrf_MLModelManagement_Delete service operation to remove stored ML model(s) based on the unique ML model identifier. The NF service consumer shall send an HTTP POST request with "{apiRoot}/nadrf-mlmodelmanagement/<apiVersion>/remove-stored-mlmodel" as URI, as shown in figure 4.3.2.4.3-1, step 1. The POST request body shall contain the list of ML model identifiers of the ML models that are to be deleted.

Upon the reception of an HTTP POST request with "{apiRoot}/nadrf-mlmodelmanagement/<apiVersion>/remove-stored-mlmodel" as URI, if the ADRF successfully processed and accepted the received HTTP POST request, the ADRF shall remove any stored ML model(s) that match the unique ML model identifier(s) received in the request and respond with HTTP "204 No Content" status if all deletions were successful or with HTTP "200 OK" status with the message body containing the MLModelDelResult data structure if the deletion was partially successful.

If the deletion of all the ML models identified by the unique ML model identifier in the "modelUniqueId" attribute of the request failed for the same reason, then:

- if the ML model(s) was/were not found the ADRF shall send an HTTP "404 Not Found" status code with the response body containing a ProblemDetails data structure with the "cause" attribute including the "ML_MODEL_NOT_FOUND" application error response as specified in clause 5.2.7; or

- if the ML model(s) was/were found but not deleted the ADRF shall send an HTTP "500 Internal Server Error" status code with the response body containing a ProblemDetails data structure with the "cause" attribute including the "ML_MODEL_FOUND_BUT_NOT_DELETED" application error response as specified in clause 5.2.7.

If errors occur when processing the HTTP POST request, the ADRF shall send an HTTP error response as specified in clause 5.2.7.

5 API Definitions

5.1 Nadrf_DataManagement Service API

5.1.1 Introduction

The Nadrf_DataManagement service shall use the Nadrf_DataManagement API.

The API URI of the Nadrf_DataManagement API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in HTTP requests from the NF service consumer towards the NF service producer shall have the Resource URI structure defined in clause 4.4.1 of 3GPP TS 29.501 [5], i.e.:

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

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].
- The <apiName> shall be "nadrf-datamanagement".
- 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 9113 [11], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [4].

The OpenAPI [6] specification of HTTP messages and content bodies for the Nadrf_DataManagement API 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 [4] for the usage of HTTP standard headers.

5.1.2.2.2 Content type

JSON, IETF RFC 8259 [12], 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 [4]. 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 9457 [13].

5.1.2.3 HTTP custom headers

The mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [4] shall be supported, and the optional HTTP custom header fields specified in clause 5.2.3.3 of 3GPP TS 29.500 [4] may be supported.

5.1.3 Resources

5.1.3.1 Overview

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 Nadrf_DataManagement API.

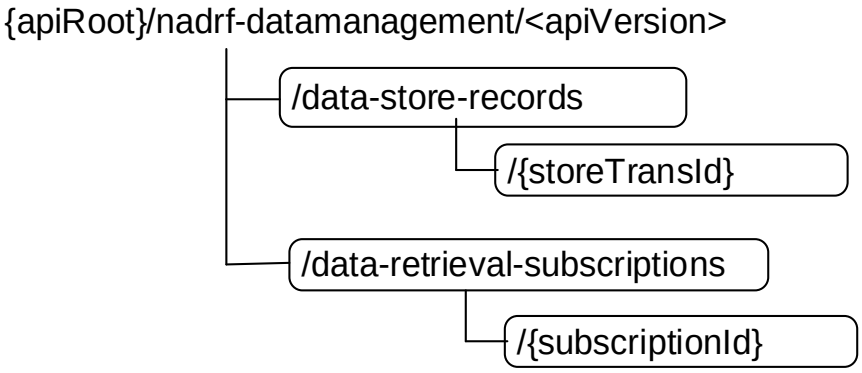

Figure 5.1.3.1-1: Resource URI structure of the Nadrf_DataManagement API

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
ADRF Data Store Records	/data-store-records	GET	Retrieve the stored data or analytics
		POST	Create a new Individual Data Store resource.
Individual ADRF Data Store Record	/data-store-records/{storeTransId}	DELETE	Delete an individual ADRF Data Store Record identified by {storeTransId}.
ADRF Data Retrieval Subscriptions	/data-retrieval-subscriptions	POST	Create a new Individual ADRF Data Retrieval Subscription resource.
Individual ADRF Data Retrieval Subscription	/data-retrieval-subscriptions/{subscriptionId}	DELETE	Delete an individual ADRF Data Retrieval Subscription identified by {subscriptionId}.

5.1.3.2 Resource: ADRF Data Store Records

5.1.3.2.1 Description

The ADRF Data Store Records resource represents all data storage records to the Nadrf_DataManagement Service at a given ADRF. The resource allows an NF service consumer to create a new Individual ADRF Data Store Record resource and to retrieve Individual ADRF Data Store Record resources that fulfil certain criteria.

5.1.3.2.2 Resource Definition

Resource URI: **{apiRoot}/nadrf-datamanagement/<apiVersion>/data-store-records**

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	Applicability
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
NadrfDataStoreRecord	M	1	New individual Data Store Record to be created

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
NadrfDataStoreRecord	M	1	201 Created	The creation of an Individual Data Store Record resource is confirmed, and a representation of that resource is returned.
NOTE: The mandatory HTTP error status code for the HTTP POST method listed in Table 5.1.7.1-1 of 3GPP TS 29.500 [4] shall also apply.				

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}/nadrf-datamanagement/<apiVersion>/data-store-records/{storeTransId}

5.1.3.2.3.2 GET

This method shall support the URI query parameters specified in table 5.1.3.2.3.2-1.

Table 5.1.3.2.3.2-1: URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description
store-trans-id	string	O	0..1	Identifies the "Storage Transaction Identifier" of data store record in ADRF. (NOTE)
fetch-correlation-ids	array(string)	O	1..N	Identifies fetch correlation identifiers received as part of fetch instruction. (NOTE)
data-set-id	string	O	0..1	Identifies a data set, i.e. the data or analytics records that contain the same value in the data set identifier of their data set tag. It may only be provided if the "EnhDataMgmt" feature is supported.
NOTE: Exactly one of "store-trans-id", "fetch-correlation-ids", and "data-set-id" shall be provided.				

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 GET Request Body on this resource

Data type	P	Cardinality	Description
n/a			

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

Data type	P	Cardinality	Response codes	Description
NadrfDataStoreRecord	M	1	200 OK	Data Store record.
n/a			204 No Content	If the request ADRF Data Store Record does not exist, the ADRF shall respond with "204 No Content ".
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the HTTP GET method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 5.1.3.2.3.1-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative ADRF (service) instance towards which the request should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Contains the identifier of the target ADRF (service) instance towards which the request should be redirected.

Table 5.1.3.2.3.1-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative ADRF (service) instance towards which the request should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Contains the identifier of the target ADRF (service) instance towards which the request should be redirected.

5.1.3.2.4 Resource Custom Operations

None.

5.1.3.3 Resource: Individual ADRF Data Store Record

5.1.3.3.1 Description

The Individual ADRF Data Store Record resource represents data or analytics stored via the Nadrf_DataManagement_StorageRequest in ADRF.

5.1.3.3.2 Resource Definition

Resource URI: **{apiRoot}/nadrf-datamanagement/<apiVersion>/data-store-records/{storeTransId}**

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.
storeTransId	string	Identifies an individual data store record.

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	Applicability
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	The Individual ADRF Data Store Record resource was deleted successfully.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during Individual ADRF Data Store Record deletion. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during Individual ADRF Data Store Record deletion. (NOTE 2)
NOTE 1: The mandatory HTTP error status code for the HTTP DELETE method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

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	Contains an alternative URI of the resource located in an alternative ADRF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target ADRF (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	Contains an alternative URI of the resource located in an alternative ADRF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target ADRF (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: ADRF Data Retrieval Subscriptions

5.1.3.4.1 Description

The ADRF Data Retrieval Subscriptions resource represents all data retrieval subscriptions to the Nadrf_DataManagement Service at a given ADRF. The resource allows an NF service consumer to create a new Individual ADRF Data Retrieval Subscription resource.

5.1.3.4.2 Resource Definition

Resource URI: **{apiRoot}/nadrf-datamanagement/<apiVersion>/data-retrieval-subscriptions**

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

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

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	Applicability
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
NadrfDataRetrievalSubscription	M	1	Individual ADRF Data Retrieval Subscription resource to be created.

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
NadrfDataRetrievalSubscription	M	1	201 Created	The creation of an Individual ADRF Data Retrieval Subscription resource is confirmed and a representation of that resource is returned.
NOTE: The mandatory HTTP error status code for the HTTP POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] shall 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}/nadrf-datamanagement/<apiVersion>/data-retrieval-subscriptions/{subscriptionId}

5.1.3.4.4 Resource Custom Operations

None in this release of the specification.

5.1.3.5 Resource: Individual ADRF Data Retrieval Subscription

5.1.3.5.1 Description

The Individual ADRF Data Retrieval Subscription resource represents single ADRF data retrieval subscription to the Nadrf_DataManagement Service at a given ADRF. The resource allows an NF service consumer to delete Individual ADRF Data Retrieval Subscription resource.

5.1.3.5.2 Resource Definition

Resource URI: **{apiRoot}/nadrf-datamanagement/<apiVersion>/data-retrieval-subscriptions/{subscriptionId}**

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
subscriptionId	string	Identifies a subscription to the Nadrf_DataManagement 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	Applicability
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	The Individual ADRF Data Retrieval Subscription resource was deleted successfully.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during Individual ADRF Data Store Record deletion. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during Individual ADRF Data Store Record deletion. (NOTE 2)
NOTE 1: The mandatory HTTP error status code for the HTTP DELETE method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

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	Contains an alternative URI of the resource located in an alternative ADRF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target ADRF (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	Contains an alternative URI of the resource located in an alternative ADRF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target ADRF (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

5.1.4.1 Overview

The structure of the custom operation URIs of the Nadrf_DataManagement service is shown in Figure 5.1.4.1-1.

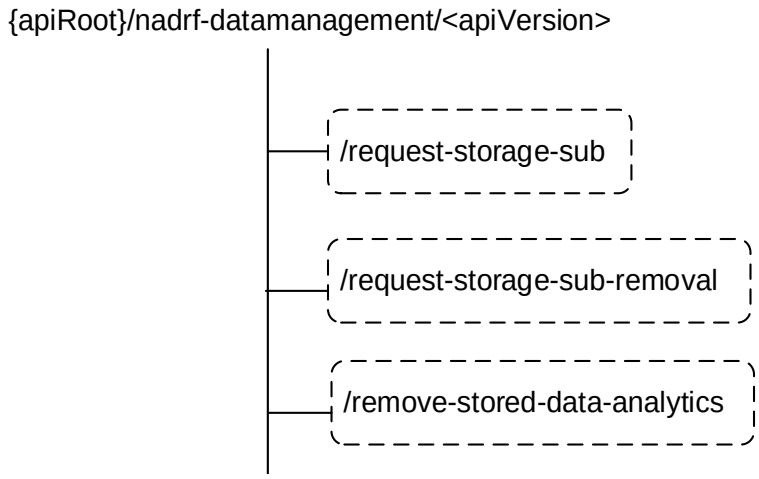

Figure 5.1.4.1-1: Custom operation URI structure of the Nadrf_DataManagement API

Table 5.1.4.1-1 provides an overview of the custom operations and applicable HTTP methods.

Table 5.1.4.1-1: Custom operations without associated resources

Custom operation URI	Mapped HTTP method	Description
{apiRoot}/nadrf-datamanagement/<apiVersion>/request-storage-sub	POST	Request the ADRF to create a subscription for data or analytics and then store the received data or analytics in the ADRF.
{apiRoot}/nadrf-datamanagement/<apiVersion>/request-storage-sub-removal	POST	Request the ADRF to remove a subscription for data or analytics.
{apiRoot}/nadrf-datamanagement/<apiVersion>/remove-stored-data-analytics	POST	Request the ADRF to remove already stored data or analytics.

5.1.4.2 Operation: request-storage-sub

5.1.4.2.1 Description

The operation is used by the NF service consumer to request the ADRF to create a subscription for data or analytics and then store the received data or analytics in the ADRF.

5.1.4.2.2 Operation Definition

This operation shall support the request data structures shown in Table 5.1.4.2.2-1 and the response data structures and error codes specified in Tables 5.1.4.2.2-2.

Table 5.1.4.2.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
NadrfDataStoreSubscription	M	1	Information about the storage subscription that the ADRF shall create.

Table 5.1.4.2.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
NadrfDataStoreSubscriptionRef	M	1	200 OK	Successful request to trigger the creation of a subscription for data or analytics at the ADRF. A reference is provided.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
NOTE 1: The mandatory HTTP error status code for the HTTP POST method listed in Table 5.1.7.1-1 of 3GPP TS 29.500 [4] shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 5.1.4.2.2-3: Headers supported by the 307 Response Code on this custom operation

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative ADRF (service) instance towards which the request should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Contains the identifier of the target ADRF (service) instance towards which the request should be redirected.

Table 5.1.4.2.2-4: Headers supported by the 308 Response Code on this custom operation

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative ADRF (service) instance towards which the request should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Contains the identifier of the target ADRF (service) instance towards which the request should be redirected.

5.1.4.3 Operation: request-storage-sub-removal

5.1.4.3.1 Description

The operation is used by the NF service consumer to request the ADRF to remove a subscription for data or analytics which was used to store the received data or analytics in the ADRF.

5.1.4.3.2 Operation Definition

This operation shall support the request data structures shown in Table 5.1.4.3.2-1 and the response data structures and error codes specified in Tables 5.1.4.3.2-2.

Table 5.1.4.3.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
NadrfDataStoreSubscriptionRef	M	1	Reference used to identify the subscription that the ADRF shall remove.

Table 5.1.4.3.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful request to trigger the removal of a subscription for data or analytics at the ADRF.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
NOTE 1: The mandatory HTTP error status code for the HTTP POST method listed in Table 5.1.7.1-1 of 3GPP TS 29.500 [4] shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 5.1.4.3.2-3: Headers supported by the 307 Response Code on this custom operation

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative ADRF (service) instance towards which the request should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Contains the identifier of the target ADRF (service) instance towards which the request should be redirected.

Table 5.1.4.3.2-4: Headers supported by the 308 Response Code on this custom operation

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative ADRF (service) instance towards which the request should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Contains the identifier of the target ADRF (service) instance towards which the request should be redirected.

5.1.4.4 Operation: remove-stored-data-analytics

5.1.4.4.1 Description

The operation is used by the NF service consumer to request the ADRF to remove stored data or analytics based on a data or analytics specification.

5.1.4.4.2 Operation Definition

This operation shall support the request data structures shown in Table 5.1.4.4.2-1 and the response data structures and error codes specified in Tables 5.1.4.4.2-2.

Table 5.1.4.4.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
NadrfStoredDataSpec	M	1	Information about the specification of data or analytics stored in ADRF.

Table 5.1.4.4.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful request to remove data or analytics at the ADRF based on a data or analytics specification.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
NOTE 1: The mandatory HTTP error status code for the HTTP POST method listed in Table 5.1.7.1-1 of 3GPP TS 29.500 [4] shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 5.1.4.4.2-3: Headers supported by the 307 Response Code on this custom operation

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative ADRF (service) instance towards which the request should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Contains the identifier of the target ADRF (service) instance towards which the request should be redirected.

Table 5.1.4.4.2-4: Headers supported by the 308 Response Code on this custom operation

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative ADRF (service) instance towards which the request should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Contains the identifier of the target ADRF (service) instance towards which the request should be redirected.

5.1.5 Notifications

5.1.5.1 General

Notifications shall comply to clause 6.2 of 3GPP TS 29.500 [4] and clause 4.6.2.3 of 3GPP TS 29.501 [5].

Table 5.1.5.1-1: Notifications overview

Notification	Callback URI	HTTP method or custom operation	Description (service operation)
Retrieval Notification	{notificationURI}	POST	Report data or analytics from ADRF.
ADRF Alert Notification	{delNotifUri}	POST	Notify about data or analytics that are about to be deleted.

5.1.5.2 Retrieval Notification

5.1.5.2.1 Description

The Retrieval Notification is used by the NF service producer to report one or several data retrieval events to an NF service consumer that has subscribed to such notifications.

5.1.5.2.2 Target URI

The Callback URI **"{notificationURI}"** shall be used with the callback URI variables defined in table 5.1.5.2.2-1.

Table 5.1.5.2.2-1: Callback URI variables

Name	Definition
notificationURI	String formatted as URI with the Callback Uri

5.1.5.2.3 Standard Methods

5.1.5.2.3.1 POST

This method shall support the request data structures specified in table 5.1.5.2.3.1-1 and the response data structures and response codes specified in table 5.1.5.2.3.1-2.

Table 5.1.5.2.3.1-1: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
NadrfDataRetrievalNotification	M	1	Provides information about observed data or analytics.

Table 5.1.5.2.3.1-2: Data structures supported by the POST Response Body

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 retrieval notification. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during the retrieval notification. (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 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 5.1.5.2.3.1-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF service consumer (service) instance towards which the notification request is redirected.

Table 5.1.5.2.3.1-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF service consumer (service) instance towards which the notification request is redirected.

5.1.5.3 ADRF Alert Notification

5.1.5.3.1 Description

The ADRF Alert Notification is used by the NF service producer to notify an NF service consumer about data or analytics that are about to be deleted.

5.1.5.3.2 Target URI

The Callback URI **"{delNotifUri}"** shall be used with the callback URI variables defined in table 5.1.5.3.2-1.

Table 5.1.5.3.2-1: Callback URI variables

Name	Definition
delNotifUri	String formatted as URI with the Callback Uri

5.1.5.3.3 Standard Methods

5.1.5.3.3.1 POST

This method shall support the request data structures specified in table 5.1.5.3.3.1-1 and the response data structures and response codes specified in table 5.1.5.3.3.1-2.

Table 5.1.5.3.3.1-1: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
NadrfAlertNotification	M	1	Contains information about data or analytics that are about to be deleted.

Table 5.1.5.3.3.1-2: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
NadrfAlertNotificationResponse	M	1	200 OK	The receipt of the Notification is acknowledged and a response with information about the planned action is provided.
n/a			204 No Content	The receipt of the Notification is acknowledged.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (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 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 5.1.5.3.3.1-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative NF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected.

Table 5.1.5.3.3.1-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative NF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
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 Nadrf_DataManagement API.

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

Table 5.1.6.1-1: Nadrf_DataManagement specific Data Types

Data type	Clause defined	Description	Applicability
DataNotification	5.1.6.2.9	Represents a data subscription notification of one of various possible data sources.	
DataSetTag	5.1.6.2.13	Contains an identifier and a description of associated data or analytics records.	EnhDataMgmt
DataSubscription	5.1.6.2.8	Contains information about Data specification.	
NadrfAlertNotification	5.1.6.2.11	Contains information about data or analytics that are about to be deleted.	EnhDataMgmt
NadrfAlertNotificationResponse	5.1.6.2.12	Contains information about the planned action upon receiving an alert.	EnhDataMgmt
NadrfDataRetrievalNotification	5.1.6.2.5	Represents a notification that corresponds with an Individual ADRF Data Retrieval Subscription resource.	
NadrfDataRetrievalSubscription	5.1.6.2.4	Represents an Individual ADRF Data Retrieval Subscription resource.	
NadrfDataStoreRecord	5.1.6.2.2	Represents an Individual ADRF Data Store Record resource.	
NadrfDataStoreSubscription	5.1.6.2.3	Contains information to be used by the ADRF to create a Data or Analytics subscription.	
NadrfDataStoreSubscriptionRef	5.1.6.2.6	Contains a reference to a request for a Data or Analytics subscription.	
NadrfStoredDataSpec	5.1.6.2.7	Contains information about Data or Analytics specification.	
StorageHandlingInfo	5.1.6.2.10	Contains storage handling information for data or analytics.	EnhDataMgmt

Table 5.1.6.1-2 specifies data types re-used by the Nadrf_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 Nadrf_DataManagement service based interface.

Table 5.1.6.1-2: Nadrf_DataManagement re-used Data Types

Data type	Reference	Comments	Applicability
AfEventExposureNotif	3GPP TS 29.517 [20]	Represents notifications on AF event(s) that occurred for an Individual AF Event Subscription resource.	
AfEventExposureSubsc	3GPP TS 29.517 [20]	Represents AF event subscription.	
AmfEventNotification	3GPP TS 29.518 [18]	Represents notifications on AMF event(s) that occurred for an Individual AMF Event Subscription resource.	
AmfEventSubscription	3GPP TS 29.518 [18]	Represents AMF event subscription.	
DurationSec	3GPP TS 29.571 [16]	Unsigned integer identifying a period of time in units of seconds.	EnhDataMgmt
DateTime	3GPP TS 29.571 [16]	Identifies the time.	
EeSubscription	3GPP TS 29.503 [19]	Represents UDM event subscription.	
EventNotifyData	3GPP TS 29.515 [27]	Represents GMLC event notification.	LocEvents
FetchInstruction	3GPP TS 29.576 [24]	The fetch instruction indicates that the data or analytics can be fetched by the consumer.	
FormattingInstruction	3GPP TS 29.574 [23]	DCCF formatting Instructions.	
InputData	3GPP TS 29.515 [27]	Represents GMLC event subscription.	LocEvents
MonitoringReport	3GPP TS 29.503 [19]	UDM Monitoring Report.	
NefEventExposureNotif	3GPP TS 29.591 [21]	Represents notifications on network exposure event(s) that occurred for an Individual Network Exposure Event Subscription resource.	
NefEventExposureSubsc	3GPP TS 29.591 [21]	Represents NEF event subscription.	
NfInstanceId	3GPP TS 29.571 [16]	NF instance identifier.	
NfSetId	3GPP TS 29.571 [16]	NF set identifier.	
NnwdafEventsSubscription	3GPP TS 29.520 [15]	Represents an NWDAF analytics subscription.	
NnwdafEventsSubscriptionNotification	3GPP TS 29.520 [15]	Represents an NWDAF analytics subscription notification.	
NotificationData	3GPP TS 29.510 [10]	Represents an NRF event notification.	
NotificationData	3GPP TS 29.564 [26]	Represents a UPF event notification.	UpEvents
NsmfEventExposure	3GPP TS 29.508 [17]	Represents SMF event subscription.	
NsmfEventExposureNotification	3GPP TS 29.508 [17]	Represents SMF event notification.	
ProcessingInstruction	3GPP TS 29.574 [23]	DCCF processing Instructions.	
SACEventReport	3GPP TS 29.536 [25]	Represents an NSACF event notification.	
SACEventSubscription	3GPP TS 29.536 [25]	Represents and NSACF event subscription.	
SubscriptionData	3GPP TS 29.510 [10]	Represents an NRF event subscription.	
SupportedFeatures	3GPP TS 29.571 [6]	Used to negotiate the applicability of the optional features defined in table 5.1.8-1.	
TimeWindow	3GPP TS 29.122 [22]	Represents a time window.	

UpfEventSubscription	3GPP TS 29.564 [26]	Represents a UPF event subscription.	UpEvents
Uri	3GPP TS 29.571 [16]	URI.	

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: NadrfDataStoreRecord

Table 5.1.6.2.2-1: Definition of type NadrfDataStoreRecord

Attribute name	Data type	P	Cardinality	Description	Applicability
dataNotif	DataNotification	C	0..1	Data subscription notification. (NOTE 1)	
anaNotifications	array(NnwdafEventsSubscriptionNotification)	C	1..N	List of analytics subscription notifications. (NOTE 1)	
anaSub	NnwdafEventsSubscription	C	0..1	Represents the subscription information of the corresponding analytics notification. Shall be present if the "anaNotifications" attribute is provided. (NOTE 2)	
dataSetTag	DataSetTag	O	0..1	Data set tag of the stored data or analytics.	EnhDataMgmt
dsc	string	O	0..1	Data synthesis and compression information. (NOTE 3)	EnhDataMgmt
dataSub	DataSubscription	C	0..1	Represents the subscription information of the corresponding data notification. Shall be present if the "dataNotif" attribute is provided. (NOTE 2)	
storeHandl	StorageHandlingInfo	O	0..1	Contains storage handling information for the data or analytics that are being stored.	EnhDataMgmt
suppFeat	SupportedFeatures	C	0..1	This IE represents a list of Supported features as described in clause 5.1.8. It shall be present if at least one feature defined in clause 5.1.8 is supported.	
NOTE 1: Exactly one of the attributes "anaNotifications" and "dataNotif" shall be provided. NOTE 2: Exactly one of the attributes "anaSub" and "dataSub" shall be provided. NOTE 3: The format and the contents of this attribute are up to the implementation.					

5.1.6.2.3 Type: NadrfDataStoreSubscription

Table 5.1.6.2.3-1: Definition of type NadrfDataStoreSubscription

Attribute name	Data type	P	Cardinality	Description	Applicability
anaSub	NnwdafEventsSubscription	C	0..1	Subscribed analytics events. (NOTE 1)	
dataSetTag	DataSetTag	O	0..1	Data set tag of the stored data or analytics.	EnhDataMgmt
dataSub	DataSubscription	C	0..1	Represents requested Events subscription. (NOTE 1)	
targetNfId	NfInstanceId	C	0..1	DCCF or NWDAF NF instance identifier to which the ADRF shall create the requested subscription. (NOTE 2)	
targetNfSetId	NfSetId	C	0..1	DCCF or NWDAF NF set identifier to which the ADRF shall create the requested subscription. (NOTE 2)	
formatInstruct	FormattingInstruction	O	0..1	Formatting instructions to be used for sending event notifications.	
procInstruct	ProcessingInstruction	O	0..1	Processing instructions to be used for sending event notifications. (NOTE 3)	
multiProcInstructs	array(ProcessingInstruction)	O	1..N	Processing instructions to be used for sending event notifications. (NOTE 3)	MultiProcessingInstruction
storeHandl	StorageHandlingInfo	O	0..1	Contains storage handling information for the data or analytics that will be collected and stored based on the requested subscription.	EnhDataMgmt
suppFeat	SupportedFeatures	C	0..1	This IE represents a list of Supported features as described in clause 5.1.8. It shall be present if at least one feature defined in clause 5.1.8 is supported.	

NOTE 1: Exactly one of these attributes shall be provided.
NOTE 2: One of "targetNfId" and "targetNfSetId" shall be provided.
NOTE 3: The "multiProcInstructs" attribute shall be used instead of the "procInstruct" attribute when the "MultiProcessingInstruction" feature is supported.

5.1.6.2.4 Type: NadrfDataRetrievalSubscription

Table 5.1.6.2.4-1: Definition of type NadrfDataRetrievalSubscription

Attribute name	Data type	P	Cardinality	Description	Applicability
anaSub	NnwdafEventsSubscription	C	0..1	Subscribed analytics events. (NOTE 1)	
dataSetId	string	C	0..1	Data set identifier of stored data or analytics records. (NOTE 1)	EnhDataMgmt
dataSub	DataSubscription	C	0..1	Represents requested Events subscription. (NOTE 1)	
notificationURI	Uri	M	1	Notification target address.	
timePeriod	TimeWindow	M	1	Represents a start time and a stop time during which the requested data is collected and/or will be collected at the data source.	
notifCorrId	string	M	1	Notification correlation identifier provided by the NF service consumer to be used later by the ADRF in the notifications that correspond with this subscription. The value of this attribute shall be unique per subscription for a given NF service consumer.	
consTrigNotif	boolean	O	0..1	If provided and set to "true", it indicates that notifications shall be buffered (sending only fetch instructions to the NF service consumer) until the NF service consumer requests their delivery using Nadrf_DataManagement Service. The default value is "false".	
suppFeat	SupportedFeatures	C	0..1	This IE represents a list of Supported features as described in clause 5.1.8. It shall be present if at least one feature defined in clause 5.1.8 is supported.	
NOTE 1: Exactly one of these attributes shall be provided.					

5.1.6.2.5 Type: NadrfDataRetrievalNotification

Table 5.1.6.2.5-1: Definition of type NadrfDataRetrievalNotification

Attribute name	Data type	P	Cardinality	Description	Applicability
notifCorrId	string	M	1	This attribute indicates the notification correlation identifier provided by the NF service consumer during the data retrieval subscription. This parameter can be useful if the NF service consumer uses a common callback URI for multiple subscriptions.	
anaNotifications	array(NnwdafEventsSubscriptionNotification)	C	1..N	List of analytics subscription notifications. (NOTE 1)	
dataNotif	DataNotification	C	0..1	Data subscription notification. (NOTE 1)	
fetchInstruct	FetchInstruction	C	0..1	The fetch instruction indicates that the data or analytics can be fetched by the consumer. (NOTE 1)	
terminationReq	boolean	O	0..1	If provided and set to "true", it indicates that the subscription is requested to be terminated, i.e. no further notifications related to this subscription will be provided. The default value is "false".	
dsc	string	O	0..1	Data synthesis and compression information. (NOTE 2)	EnhDataMgmt
timeStamp	DateTime	M	1	It represents the time when ADRF completed preparation of the requested data or analytics.	
NOTE 1: Exactly one of these attributes shall be provided. NOTE 2: The format and the contents of this attribute are up to the implementation.					

5.1.6.2.6 Type: NadrfDataStoreSubscriptionRef

Table 5.1.6.2.6-1: Definition of type NadrfDataStoreSubscriptionRef

Attribute name	Data type	P	Cardinality	Description	Applicability
transRefId	string	C	0..1	Transaction reference identifier. (NOTE)	
dataSetId	string	C	0..1	Data set identifier associated with a storage subscription. (NOTE)	EnhDataMgmt
suppFeat	SupportedFeatures	C	0..1	This IE represents a list of Supported features as described in clause 5.1.8. It shall be present in the POST response if the NF service consumer includes the "suppFeat" attribute in the POST request.	
NOTE: One of the "transRefId" and "dataSetId" attributes shall be provided.					

5.1.6.2.7 Type: NadrfStoredDataSpec

Table 5.1.6.2.7-1: Definition of type NadrfStoredDataSpec

Attribute name	Data type	P	Cardinality	Description	Applicability
dataSpec	DataSubscription	C	0..1	Represents data specification. (NOTE)	
anaSpec	NnwdafEventsSubscription	C	0..1	Represents analytics specification. (NOTE)	
timePeriod	TimeWindow	M	1	Represents a start time and a stop time during which the requested data to be removed was collected at the data source.	
dataSetId	string	C	0..1	Data set identifier of stored data or analytics records. (NOTE)	EnhDataMgmt
NOTE: Exactly one of these attributes shall be provided.					

5.1.6.2.8 Type: DataSubscription

Table 5.1.6.2.8-1: Definition of type DataSubscription

Attribute name	Data type	P	Cardinality	Description	Applicability
amfDataSub	AmfEventSubscription	C	0..1	Represents requested AMF Events subscription. (NOTE)	
smfDataSub	NsmfEventExposure	C	0..1	Represents requested SMF Events subscription. (NOTE)	
udmDataSub	EeSubscription	C	0..1	Represents requested UDM Events subscription. (NOTE)	
nefDataSub	NefEventExposureSubsc	C	0..1	Represents requested NEF Events subscription. (NOTE)	
afDataSub	AfEventExposureSubsc	C	0..1	Represents requested AF Events subscription. (NOTE)	
nrfDataSub	SubscriptionData	C	0..1	Represents requested NRF Events subscription. (NOTE)	
nsacfDataSub	SACEventSubscription	C	0..1	Represents requested NSACF Events subscription. (NOTE)	
upfDataSub	UpfEventSubscription	C	0..1	Represents requested UPF Events subscription. (NOTE)	UpEvents
gmlcDataSub	InputData	C	0..1	Represents requested GMLC Events subscription. (NOTE)	LocEvents
NOTE: Exactly one of these attributes shall be provided.					

5.1.6.2.9 Type: DataNotification

Table 5.1.6.2.9-1: Definition of type DataNotification

Attribute name	Data type	P	Cardinality	Description	Applicability
afEventNotifs	array(AfEventExposureNotif)	C	1..N	List of notifications on AF event(s). (NOTE 1)	
amfEventNotifs	array(AmfEventNotification)	C	1..N	List of notifications on AMF event(s). (NOTE 1)	
gmlcEventNotifs	array(EventNotifyData)	C	1..N	List of notifications on GMLC event(s). (NOTE 1)	LocEvents
smfEventNotifs	array(NsmfEventExposureNotification)	C	1..N	List of notifications on SMF event(s). (NOTE 1)	
udmEventNotifs	array(MonitoringReport)	C	1..N	List of monitoring reports containing information about UDM event(s). (NOTE 1)	
nefEventNotifs	array(NefEventExposureNotif)	C	1..N	List of notifications on network exposure event(s). (NOTE 1)	
nrfEventNotifs	array(NotificationData)	C	1..N	List of notifications on NRF event(s) as defined in 3GPP TS 29.510 [10]. (NOTE 1)	
nsacfEventNotifs	array(SACEventReport)	C	1..N	List of notifications on NSACF event(s). (NOTE 1)	
upfEventNotifs	array(NotificationData)	C	1..N	List of notifications on UPF event(s) as defined in 3GPP TS 29.564 [26]. (NOTE 1)	UpEvents
timeStamp	DateTime	O	0..1	Indicates the timestamp for the event(s). (NOTE 2)	

NOTE 1: Exactly one of these attributes shall be provided.
NOTE 2: The "timeStamp" attribute within the DataNotification data type may be provided if any of the "timeStamp" attribute within AfEventNotification contained in the AfEventExposureNotif, or within AmfEventReport contained in the AmfEventNotification, or within EventNotification contained in the NsmfEventExposureNotification, or within MonitoringReport, or within NefEventNotification contained in the NefEventExposureNotif, or within SACEventReportItem contained in the SACEventReport, or, if the UpEvents feature is supported, within the NotificationItem contained in the NotificationData data type, or, if the LocEvents feature is supported, the "timestampOfLocationEstimate" attribute within EventNotifyData, is not provided.

5.1.6.2.10 Type: StorageHandlingInfo

Table 5.1.6.2.10-1: Definition of type StorageHandlingInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
lifetime	DurationSec	O	0..1	Indicates the lifetime of the provided data or analytics as a duration in seconds.	
delNotifUri	Uri	O	0..1	Notification Uri for receiving deletion alerts. Its presence indicates that the NF service consumer wants to receive such notifications.	
delNotifCorrId	string	C	0..1	Notification correlation identifier for the deletion alerts. It shall be provided if the "delNotifUri" attribute is provided.	

5.1.6.2.11 Type: NadrfAlertNotification

Table 5.1.6.2.11-1: Definition of type NadrfAlertNotification

Attribute name	Data type	P	Cardinality	Description	Applicability
alertStorTransId	string	M	1	Storage transaction identifier that can be used to retrieve the data or analytics that are about to be deleted.	
delNotifCorrId	string	M	1	Notification correlation identifier for the alert.	

5.1.6.2.12 Type: NadrfAlertNotificationResponse

Table 5.1.6.2.12-1: Definition of type NadrfAlertNotificationResponse

Attribute name	Data type	P	Cardinality	Description	Applicability
retrievalInd	boolean	M	1	If the NF service consumer had received a Data or Analytics Deletion Alert in the notification and determined to retrieve stored data or analytics prior to deletion, it shall be set to "true". Otherwise, it shall be set to "false".	

5.1.6.2.13 Type: DataSetTag

Table 5.1.6.2.13-1: Definition of type DataSetTag

Attribute name	Data type	P	Cardinality	Description	Applicability
dataSetId	string	M	1	Data set identifier of data or analytics records.	
dataSetDesc	string	O	0..1	Human-readable data set description of data or analytics records.	

5.1.6.3 Simple data types and enumerations

None.

5.1.6.4 Data types describing alternative data types or combinations of data types

None.

5.1.7 Error Handling

5.1.7.1 General

For the Nadrf_DataManagement API, HTTP error responses shall be supported as specified in clause 4.8 of 3GPP TS 29.501 [5]. Protocol errors and application errors specified in table 5.2.7.2-1 of 3GPP TS 29.500 [4] 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 [4].

In addition, the requirements in the following clauses are applicable for the Nadrf_DataManagement API.

5.1.7.2 Protocol Errors

No specific procedures for the Nadrf_DataManagement service are specified.

5.1.7.3 Application Errors

The application errors defined for the Nadrf_DataManagement service are listed in Table 5.1.7.3-1.

Table 5.1.7.3-1: Application errors

Application Error	HTTP status code	Description

5.1.8 Feature negotiation

The optional features in table 5.1.8-1 are defined for the Nadrf_DataManagement API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 5.1.8-1: Supported Features

Feature number	Feature Name	Description
1	MultiProcessingInstruction	Indicates the support of multiple processing instructions.
2	UpEvents	Indicates the support of UPF events.
3	EnhDataMgmt	Indicates the support of enhanced data management mechanisms.
4	LocEvents	This feature indicates the support of location events.

5.1.9 Security

As indicated in 3GPP TS 33.501 [8] and 3GPP TS 29.500 [4], the access to the Nadrf_DataManagement API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [9]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [10]) plays the role of the authorization server.

As indicated in 3GPP TS 33.501 [8] and 3GPP TS 29.500 [4], the access to the Nadrf_DataManagement API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [9]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [10]) plays the role of the authorization server.

If OAuth2 is used, an NF Service Consumer, prior to consuming services offered by the Nadrf_DataManagement API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [10], 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 Nadrf_DataManagement service.

The Nadrf_DataManagement API defines the following scopes for OAuth2 authorization as described in 3GPP TS 29.501 [5], clause 4.10.

Table 5.1.9-1: OAuth2 scopes defined in Nadrf_DataManagement API

Scope	Description
"nadrf-datamanagement"	Access to the Nadrf_DataManagement API
"nadrf-datamanagement:storage-read-delete-subs"	Access to service operations applying to Nadrf_DataManagement_StorageSubscriptionRequest, Nadrf_DataManagement_StorageSubscriptionRemoval, Nadrf_DataManagement_RetrievalRequest, Nadrf_DataManagement_RetrievalSubscribe, Nadrf_DataManagement_RetrievalUnsubscribe, Nadrf_DataManagement_RetrievalNotify, Nadrf_DataManagement_Delete service operations.

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5.2 Nadrf_MLModelManagement Service API

5.2.1 Introduction

The Nadrf_MLModelManagement service shall use the Nadrf_MLModelManagement API.

The API URI of the Nadrf_MLModelManagement API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in HTTP requests from the NF service consumer towards the NF service producer shall have the Resource URI structure defined in clause 4.4.1 of 3GPP TS 29.501 [5], i.e.:

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

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].
- The <apiName> shall be "nadrf-mlmodelmanagement".
- 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 9113 [11], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [4].

The OpenAPI [6] specification of HTTP messages and content bodies for the Nadrf_MLModelManagement API 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 [4] for the usage of HTTP standard headers.

5.2.2.2.2 Content type

JSON, IETF RFC 8259 [12], 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 [4]. 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 9457 [13].

5.2.2.3 HTTP custom headers

The mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [4] shall be supported, and the optional HTTP custom header fields specified in clause 5.2.3.3 of 3GPP TS 29.500 [4] may be supported.

5.2.3 Resources

5.2.3.1 Overview

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 Nadrf_MLModelManagement API.

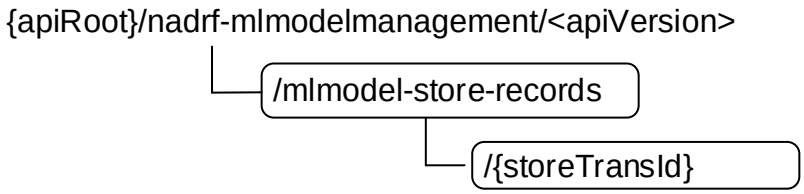

Figure 5.2.3.1-1: Resource URI structure of the Nadrf_MLModelManagement API

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
ADRF ML Model Store Records	/mlmodel-store-records	GET	Retrieve the stored ML model(s).
		POST	Create a new Individual ADRF ML Model Store Record resource.
Individual ADRF ML Model Store Record	/mlmodel-store-records/{storeTransId}	DELETE	Delete an Individual ADRF ML Model Store Record identified by {storeTransId}.
		PUT	Modify an Individual ADRF ML Model Store Record identified by {storeTransId}.

5.2.3.2 Resource: ADRF ML Model Store Records

5.2.3.2.1 Description

The ADRF ML Model Store Records resource represents all ML model storage records to the Nadrf_MLModelManagement Service at a given ADRF. The resource allows an NF service consumer to create a new Individual ADRF ML Model Store Record resource and to retrieve Individual ADRF ML Model Store Record resources that fulfil certain criteria.

5.2.3.2.2 Resource Definition

Resource URI: **{apiRoot}/nadrf-mlmodelmanagement/<apiVersion>/mlmodel-store-records**

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 POST

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 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 5.2.3.2.3.1-2 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 POST Request Body on this resource

Data type	P	Cardinality	Description
NadrfMLModelStoreRecord	M	1	New individual ML Model Store Record to be created

Table 5.2.3.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
NadrfMLModelStoreRecord	M	1	201 Created	The creation of an Individual ADRF ML Model Store Record resource is confirmed, and a representation of that resource is returned.
ProblemDetails	O	0..1	404 Not Found	NOTE 2
ProblemDetails	O	0..1	500 Internal Server Error	NOTE 2
NOTE 1: The mandatory HTTP error status code for the POST method listed in Table 5.1.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: Failure cases are described in clause 5.2.7.3.				

Table 5.2.3.2.3.1-4: 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}/nadrf-mlmodelmanagement/<apiVersion>/mlmodel-store-records/{storeTransId}

5.2.3.2.3.2 GET

This method shall support the URI query parameters specified in table 5.2.3.2.3.2-1.

Table 5.2.3.2.3.2-1: URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description
store-trans-id	string	C	0..1	Identifies the "Storage Transaction Identifier" of ML model store record in ADRF. (NOTE)
model-unique-ids	array(Uinteger)	C	0..N	Identifies the unique ML model identifiers of the ML models stored in ADRF. (NOTE)
NOTE: Exactly one of the "store-trans-id" and "model-unique-ids" query parameters shall be provided.				

This method shall support the request data structures specified in table 5.2.3.2.3.2-2 and the response data structures and response codes specified in table 5.2.3.2.3.2-3.

Table 5.2.3.2.3.2-2: Data structures supported by the GET Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 5.2.3.2.3.2-3: Data structures supported by the GET Response Body on this resource

Data type	P	Cardinality	Response codes	Description
NadrfMLModelStoreRecord	M	1	200 OK	ML Model Store record.
n/a			204 No Content	If the request ADRF ML Model Store Record does not exist, the ADRF shall respond with "204 No Content".
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 3)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 3)
ProblemDetails	O	0..1	403 Forbidden	(NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the HTTP GET method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] shall also apply. NOTE 2: Failure cases are described in clause 5.2.7. NOTE 3: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 5.2.3.2.3.2-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative ADRF (service) instance towards which the request should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Contains the identifier of the target ADRF (service) instance towards which the request should be redirected.

Table 5.2.3.2.3.2-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative ADRF (service) instance towards which the request should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Contains the identifier of the target ADRF (service) instance towards which the request should be redirected.

5.2.3.2.4 Resource Custom Operations

None.

5.2.3.3 Resource: Individual ADRF ML Model Store Record

5.2.3.3.1 Description

The Individual ADRF ML Model Store Record resource represents ML model(s) stored via the Nadrf_MLModelManagement_StorageRequest in ADRF.

5.2.3.3.2 Resource Definition

Resource URI: **{apiRoot}/nadrf-mlmodelmanagement/<apiVersion>/mlmodel-store-records/{storeTransId}**

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.
storeTransId	string	Identifies an individual data store record.

5.2.3.3.3 Resource Standard Methods

5.2.3.3.3.1 DELETE

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 DELETE method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 5.2.3.3.3.1-2 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 DELETE 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 DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The Individual ADRF ML Model Store Record resource was deleted successfully.
array(MLModelDelResult)	M	1..N	200 OK	Attempted to remove ML model(s) in the Individual ADRF ML Model Store Record resource. A representation of ML Model delete result information is returned.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during Individual ADRF ML Model Store Record deletion. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during Individual ADRF ML Model Store Record deletion. (NOTE 2)
ProblemDetails	O	0..1	404 Not Found	NOTE 3
ProblemDetails	O	0..1	500 Internal Server Error	NOTE 3
NOTE 1: The mandatory HTTP error status code for the DELETE method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). NOTE 3: Failure cases are described in clause 5.2.7.3.				

Table 5.2.3.3.3.1-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative ADRF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target ADRF (service) instance towards which the request is redirected.

Table 5.2.3.3.3.1-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative ADRF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target ADRF (service) instance towards which the request is redirected.

5.2.3.3.3.2 PUT

This method shall support the URI query parameters specified in table 5.2.3.3.3.2-1.

Table 5.2.3.3.3.2-1: URI query parameters supported by the PUT method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 5.2.3.3.3.2-2 and the response data structures and response codes specified in table 5.2.3.3.3.2-3.

Table 5.2.3.3.3.2-2: Data structures supported by the PUT Request Body on this resource

Data type	P	Cardinality	Description
NadrfMLModelStoreRecord	M	1	Parameters to replace an individual ML Model Store Record.

Table 5.2.3.3.3.2-3: Data structures supported by the PUT Response Body on this resource

Data type	P	Cardinality	Response codes	Description
NadrfMLModelStoreRecord	M	1	200 OK	The Individual ADRF ML Model Store Record resource was modified successfully and a representation of that resource is returned.
n/a			204 No Content	The Individual ADRF ML Model Store Record resource was modified successfully.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during Individual ADRF ML Model Store Record modification. (NOTE 3)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during Individual ADRF ML Model Store Record modification. (NOTE 3)
ProblemDetails	O	0..1	404 Not Found	(NOTE 2)
ProblemDetails	O	0..1	500 Internal Server Error	(NOTE 2)

NOTE 1: The mandatory HTTP error status code for the PUT method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.
NOTE 2: Failure cases are described in clause 5.2.7.3.
NOTE 3: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).

5.2.3.3.4 Resource Custom Operations

None in this release of the specification.

5.2.4 Custom Operations without associated resources

5.2.4.1 Overview

The structure of the custom operation URIs of the Nadrf_MLModelManagement service is shown in Figure 5.2.4.1-1.

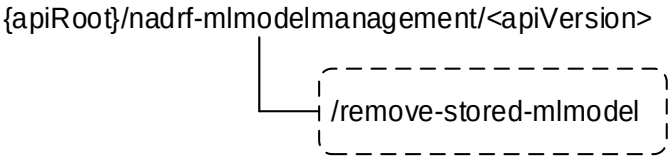

Figure 5.2.4.1-1: Custom operation URI structure of the Nadrf_MLModelManagement API

Table 5.2.4.1-1 provides an overview of the custom operations and applicable HTTP methods.

Table 5.2.4.1-1: Custom operations without associated resources

Custom operation URI	Mapped HTTP method	Description
{apiRoot}/nadrf-mlmodelmanagement/<apiVersion>/remove-stored-mlmodel	POST	Request the ADRF to remove already stored ML model.

5.2.4.4 Operation: remove-stored-mlmodel

5.2.4.4.1 Description

The operation is used by the NF service consumer to request the ADRF to remove stored ML model(s) based on a unique ML model identifier.

5.2.4.4.2 Operation Definition

This operation shall support the request data structures shown in Table 5.2.4.4.2-1 and the response data structures and error codes specified in Tables 5.2.4.4.2-2.

Table 5.2.4.4.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
array(Uinteger)	M	1..N	Unique ML model identifier(s) of the ML model(s) stored in ADRF.

Table 5.2.4.4.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The ML model(s) of all provided ML model identifiers have been successfully deleted.
array(MLModelDelResult)	M	1..N	200 OK	Attempted to remove ML model(s) in the ADRF based on the unique ML model identifier. A representation of ML Model delete result information is returned.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 3)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 3)
ProblemDetails	O	0..1	404 Not Found	NOTE 2
ProblemDetails	O	0..1	500 Internal Server Error	NOTE 2
NOTE 1: The mandatory HTTP error status code for the POST method listed in Table 5.1.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: Failure cases are described in clause 5.2.7.3. NOTE 3: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 5.2.4.4.2-3: Headers supported by the 307 Response Code on this custom operation

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative ADRF (service) instance towards which the request should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Contains the identifier of the target ADRF (service) instance towards which the request should be redirected.

Table 5.2.4.4.2-4: Headers supported by the 308 Response Code on this custom operation

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative ADRF (service) instance towards which the request should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Contains the identifier of the target ADRF (service) instance towards which the request should be redirected.

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 Nadrf_MLModelManagement API.

Table 5.2.6.1-1 specifies the data types defined for the Nadrf_MLModelManagement service based interface protocol.

Table 5.2.6.1-1: Nadrf_MLModelManagement specific Data Types

Data type	Clause defined	Description	Applicability
AllowedConsumer	5.2.6.2.6	Contains the identifier of NF instance and NF set.	
DeleteResult	5.2.6.3.1	Indicates the result of the delete operation.	
NadrfMLModelStoreRecord	5.2.6.2.2	Represents an Individual ADRF ML Model Store Record resource.	
MLModel	5.2.6.2.4	Represents an ML model.	
MLModelDelResult	5.2.6.2.5	Represents information provided in the response to the Nadrf_MLModelManagement Delete service operation.	
MLModelInfo	5.2.6.2.3	Represents information of the ML Model.	
ModelStoreResult	5.2.6.2.7	Contains information about ML model storage result.	
StoreResult	5.2.6.3.2	Indicates the result of the store operation.	

Table 5.2.6.1-2 specifies data types re-used by the Nadrf_MLModelManagement 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 Nadrf_MLModelManagement service based interface.

Table 5.2.6.1-2: Nadrf_MLModelManagement re-used Data Types

Data type	Reference	Comments	Applicability
Binary	3GPP TS 29.571 [16]	String with format "binary".	
MLModelAddr	3GPP TS 29.520 [15]	Address of ML model file	
NfInstanceId	3GPP TS 29.571 [16]	NF instance identifier.	
NfSetId	3GPP TS 29.571 [16]	NF set identifier.	
SupportedFeatures	3GPP TS 29.571 [16]	Used to negotiate the applicability of the optional features defined in table 5.2.8-1.	
Uinteger	3GPP TS 29.571 [16]	Unsigned Integer, i.e. only value 0 and integers above 0 are permissible.	

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: NadrfMLModelStoreRecord

Table 5.2.6.2.2-1: Definition of type NadrfMLModelStoreRecord

Attribute name	Data type	P	Cardinality	Description	Applicability
nfInstanceId	NfInstanceId	C	0..1	NF instance Identifier of the NWDAF containing MTLF. (NOTE 1)	
nfSetId	NfSetId	C	0..1	NF set identifier of the NWDAF containing MTLF. (NOTE 1)	
mlModelInfo	array(MLModelInfo)	C	1..N	ML Model information. (NOTE 2)	
mlModels	array(MLModel)	C	1..N	Each element represents an ML model. (NOTE 2)	
modelStoreResult	array(ModelStoreResult)	O	1..N	Indicates the result of the store operation. (NOTE 3)	
suppFeat	SupportedFeatures	C	0..1	This IE represents a list of Supported features as described in clause 5.2.7. It shall be present if at least one feature defined in clause 5.2.7 is supported.	
NOTE 1: One of "nfInstanceId" and "nfSetId" attributes shall be provided. NOTE 2: Any of the "mlModelInfo" and "mlModels" attributes shall be provided. NOTE 3: The "modelStoreResult" attribute is only applicable to the response to an Nadrf_MLModelManagement_StorageRequest service operation.					

5.2.6.2.3 Type: MLModelInfo

Table 5.2.6.2.3-1: Definition of type MLModelInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
modelUniqueId	Uinteger	M	1	Unique ML Model identifier	
mlFileAddr	MLModelAddr	M	1	Address (e.g. a URL or an FQDN) of the ML model file.	
mlStorageSize	Uinteger	M	1	Storage size in octets required for each of the ML model.	
allowConsumerList	array(AllowedConsumer)	O	1..N	The allowed NF consumer list for the ML model.	

5.2.6.2.4 Type: MLModel

Table 5.2.6.2.4-1: Definition of type MLModel

Attribute name	Data type	P	Cardinality	Description	Applicability
modelUniqueId	Uinteger	M	1	Unique ML Model identifier	
mlModel	Binary	M	1	Represents an ML model. The value is out of 3GPP.	

5.2.6.2.5 Type: MLModelDelResult

Table 5.2.6.2.5-1: Definition of type MLModelDelResult

Attribute name	Data type	P	Cardinality	Description	Applicability
modelUniqueId	Uinteger	M	1	Unique ML Model identifier	
deleteResult	DeleteResult	M	1	Indicates the result of the delete operation	

5.2.6.2.6 Type: AllowedConsumer

Table 5.2.6.2.6-1: Definition of type AllowedConsumer

Attribute name	Data type	P	Cardinality	Description	Applicability
nfInstanceId	NfInstanceId	C	0..1	Identification of NF instance.	
nfSetId	NfSetId	C	0..1	Identification of NF instance set.	
NOTE: One of "nfInstanceId" and "nfSetId" attributes shall be provided.					

5.2.6.2.7 Type: ModelStoreResult

Table 5.2.6.2.7-1: Definition of type ModelStoreResult

Attribute name	Data type	P	Cardinality	Description	Applicability
modelUniqueId	Uinteger	M	1	Unique ML Model identifier of the ML Model.	
storeResult	StoreResult	M	1	Storage result information.	

5.2.6.3 Simple data types and enumerations

5.2.6.3.1 Enumeration: DeleteResult

Table 5.2.6.3.1-1: Enumeration DeleteResult

Attribute name	Description	Applicability
ML_MODEL_DELETED	Indicates that the ML model was deleted in ADRF.	
ML_MODEL_NOT_FOUND	Indicates that the ML model was not found in ADRF.	
ML_MODEL_FOUND_BUT_NOT_DELETED	Indicates that the ML model was found in ADRF but not deleted.	

5.2.6.3.2 Enumeration: StoreResult

Table 5.2.6.3.2-1: Enumeration StoreResult

Attribute name	Description	Applicability
ML_MODEL_FILE_STORED_IN_ADRF	Indicates that the ML model was successfully stored in ADRF.	
ML_MODEL_FILE_ADDRESS_NOT_FOUND	Indicates that the ML model file address was not found.	
ML_MODEL_FILE_DOWNLOAD_FAILED	Indicates that the download of the ML model file failed.	

5.2.6.4 Data types describing alternative data types or combinations of data types

None.

5.2.7 Error Handling

5.2.7.1 General

For the Nadrf_MLModelManagement API, HTTP error responses shall be supported as specified in clause 4.8 of 3GPP TS 29.501 [5]. Protocol errors and application errors specified in table 5.2.7.2-1 of 3GPP TS 29.500 [4] 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 [4].

In addition, the requirements in the following clauses are applicable for the Nadrf_MLModelManagement API.

5.2.7.2 Protocol Errors

No specific procedures for the Nadrf_MLModelManagement service are specified.

5.2.7.3 Application Errors

The application errors defined for the Nadrf_MLModelManagement service are listed in Table 5.2.7.3-1.

Table 5.2.7.3-1: Application errors

Application Error	HTTP status code	Description
RETRIEVAL_ML_MODEL_NOT_ALLOWED	403 Forbidden	Indicates that the retrieval of the ML model is not allowed.
ML_MODEL_FILE_ADDRESS_NOT_FOUND	404 Not Found	Indicates in the response to a storage reques that the ML model file address was not found.
ML_MODEL_FILE_DOWNLOAD_FAILED	500 Internal Server Error	Indicates in the response to a storage request that the download of the ML model file failed.
ML_MODEL_NOT_FOUND	404 Not Found	Indicates in the response to a delete request that the ML model was not found in ADRF.
ML_MODEL_FOUND_BUT_NOT_DELETED	500 Internal Server Error	Indicates in the response to a delete request that the ML model was found in ADRF but not deleted.

5.2.8 Feature negotiation

The optional features in table 5.2.8-1 are defined for the Nadrf_MLModelManagement API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 5.2.8-1: Supported Features

Feature number	Feature Name	Description

5.2.9 Security

As indicated in 3GPP TS 33.501 [8] and 3GPP TS 29.500 [4], the access to the Nadrf_MLModelManagement API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [9]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [10]) plays the role of the authorization server.

If OAuth2 is used, an NF Service Consumer, prior to consuming services offered by the Nadrf_MLModelManagement API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [10], 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 Nadrf_MLModelManagement service.

The Nadrf_MLModelManagement API defines a single scope "nadrf-mlmodelmanagement" 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

This Annex specifies the formal definition of the API(s) defined in the present specification. It consists of OpenAPI 3.0.0 specifications in YAML format.

This Annex takes 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 1: 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 3GPP TS 29.501 [5] clause 5.3.1 and 3GPP TR 21.900 [7] clause 5B).

A.2 Nadrf_DataManagement API

```
openapi: 3.0.0
info:
  version: 1.1.0
  title: Nadrf_DataManagement
  description: |
    ADRF Data Management Service.
    © 2023, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.
externalDocs:
  description: 3GPP TS 29.575 V18.6.0; 5G System; Analytics Data Repository Services; Stage 3.
  url: 'https://www.3gpp.org/ftp/Specs/archive/29_series/29.575/'
#
servers:
  - url: '{apiRoot}/nadrf-datamanagement/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501.
#
security:
  - oAuth2ClientCredentials:
    - nadrf-datamanagement
  - {}
#
paths:
  /data-store-records:
    post:
      summary: Creates a new Individual Data Store Record resource.
      operationId: CreateADRFDataStoreRecord
      tags:
        - ADRF Data Store Records (Collection)
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NadrfDataStoreRecord'
        required: true
        description: ADRF data store record to be stored.
      responses:
        '201':
          description: Successful creation of new Individual ADRF Data Store Record resource.
          headers:
            Location:
              description: >
                Contains the URI of the newly created resource, according to the structure
                {apiRoot}/nadrf-datamanagement/<apiVersion>/data-store-records/{storeTransId}
```

```
          required: true
          schema:
            type: string
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/NadrfDataStoreRecord'
    '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'
    '502':
      $ref: 'TS29571_CommonData.yaml#/components/responses/502'
    '503':
      $ref: 'TS29571_CommonData.yaml#/components/responses/503'
    default:
      $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  callbacks:
    storageAlertNotification:
      '{$request.body#/delNotifUri}':
        post:
          requestBody:
            required: true
            content:
              application/json:
                schema:
                  $ref: '#/components/schemas/NadrfAlertNotification'
          responses:
            '200':
              description: The alert receipt is acknowledged and a planned action is provided.
              content:
                application/json:
                  schema:
                    $ref: '#/components/schemas/NadrfAlertNotificationResponse'
            '204':
              description: The alert receipt 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'
            '502':
              $ref: 'TS29571_CommonData.yaml#/components/responses/502'
            '503':
              $ref: 'TS29571_CommonData.yaml#/components/responses/503'
            default:
              $ref: 'TS29571_CommonData.yaml#/components/responses/default'
```

```
    get:
      summary: Retrieves existing Individual ADRF Data Store Records.
      operationId: GetAdrfDataStoreRecords
      tags:
        - ADRF Data Store Records (Collection)
      security:
        - {}
        - oAuth2ClientCredentials:
          - nadrf-datamanagement
        - oAuth2ClientCredentials:
          - nadrf-datamanagement
          - nadrf-datamanagement:storage-read-delete-subs
      parameters:
        - name: store-trans-id
          description: A storage transaction identifier of a data store record in ADRF.
          in: query
          required: false
          schema:
            type: string
        - name: fetch-correlation-ids
          description: Fetch correlation identifiers received as part of fetch instruction.
          in: query
          required: false
          style: form
          explode: false
          schema:
            type: array
            items:
              type: string
            minItems: 1
        - name: data-set-id
          description: The data set identifier.
          in: query
          required: false
          schema:
            type: string
      responses:
        '200':
          description: Data store records are returned.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/NadrfDataStoreRecord'
        '204':
          description: No matching ADRF data were found.
        '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'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  /data-store-records/{storeTransId}:
    delete:
      summary: Delete an existing Individual ADRF Data Store Record.
      operationId: DeleteADRFDataStoreRecord
      tags:
        - Individual ADRF Data Store Record (Document)
      security:
        - {}
        - oAuth2ClientCredentials:
```

```
        - nadrf-datamanagement
      - oAuth2ClientCredentials:
        - nadrf-datamanagement
        - nadrf-datamanagement:storage-read-delete-subs
    parameters:
      - name: storeTransId
        in: path
        description: String identifying a Data Store Record in ADRF.
        required: true
        schema:
          type: string
    responses:
      '204':
        description: >
          No Content. The Individual ADRF Data Store Record resource matching the
          storeTransId 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'
      '502':
        $ref: 'TS29571_CommonData.yaml#/components/responses/502'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  /data-retrieval-subscriptions:
    post:
      summary: Creates a new Individual ADRF Data Retrieval Subscription resource.
      operationId: CreateADRFDataRetrievalSubscription
      tags:
        - ADRF Data Retrieval Subscriptions (Collection)
      security:
        - {}
        - oAuth2ClientCredentials:
          - nadrf-datamanagement
        - oAuth2ClientCredentials:
          - nadrf-datamanagement
          - nadrf-datamanagement:storage-read-delete-subs
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NadrfDataRetrievalSubscription'
        required: true
        description: Individual ADRF Data Retrieval Subscription resource to be created.
      responses:
        '201':
          description: Created a new Individual ADRF Data Retrieval Subscription resource.
          headers:
            Location:
              description: >
                Contains the URI of the newly created resource, according to the structure
                {apiRoot}/nadrf-datamanagement/<apiVersion>/data-retrieval-
subscriptions/{subscriptionId}
              required: true
              schema:
                type: string
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/NadrfDataRetrievalSubscription'
        '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'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'
      callbacks:
        adrfDataRetrievalNotification:
          '{$request.body#/notificationURI}':
            post:
              requestBody:
                required: true
                content:
                  application/json:
                    schema:
                      $ref: '#/components/schemas/NadrfDataRetrievalNotification'
              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'
                '502':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/502'
                '503':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/503'
                default:
                  $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  /data-retrieval-subscriptions/{subscriptionId}:
    delete:
      summary: Delete an existing Individual ADRF Data Retrieval Subscription resource.
      operationId: DeleteADRFDataRetrievalSubscription
      tags:
        - Individual ADRF Data Retrieval Subscription (Document)
      security:
        - {}
        - oAuth2ClientCredentials:
          - nadrf-datamanagement
        - oAuth2ClientCredentials:
          - nadrf-datamanagement
          - nadrf-datamanagement:storage-read-delete-subs
      parameters:
        - name: subscriptionId
          in: path
          description: >
```

```
          String identifying a data retrieval subscription to the Nadrf_DataManagement
          Service.
        required: true
        schema:
          type: string
    responses:
      '204':
        description: >
          No Content. The Individual ADRF Data Retrieval 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'
      '502':
        $ref: 'TS29571_CommonData.yaml#/components/responses/502'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'
/request-storage-sub:
  post:
    summary: Triggers the creation of a new ADRF Storage Subscription.
    operationId: CreateADRFStorageSubscription
    tags:
      - ADRF Storage Subscriptions
    security:
      - {}
      - oAuth2ClientCredentials:
        - nadrf-datamanagement
      - oAuth2ClientCredentials:
        - nadrf-datamanagement
        - nadrf-datamanagement:storage-read-delete-subs
    requestBody:
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/NadrfDataStoreSubscription'
      required: true
    responses:
      '200':
        description: >
          Successful response with reference used to identify the subscription at the ADRF.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NadrfDataStoreSubscriptionRef'
      '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'
      '502':
        $ref: 'TS29571_CommonData.yaml#/components/responses/502'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'
    callbacks:
      storageSubAlertNotification:
        '{$request.body#/delNotifUri}':
          post:
            requestBody:
              required: true
              content:
                application/json:
                  schema:
                    $ref: '#/components/schemas/NadrfAlertNotification'
            responses:
              '200':
                description: The alert receipt is acknowledged and a planned action is provided.
                content:
                  application/json:
                    schema:
                      $ref: '#/components/schemas/NadrfAlertNotificationResponse'
              '204':
                description: The alert receipt 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'
              '502':
                $ref: 'TS29571_CommonData.yaml#/components/responses/502'
              '503':
                $ref: 'TS29571_CommonData.yaml#/components/responses/503'
              default:
                $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  /request-storage-sub-removal:
    post:
      summary: Triggers the removal of ADRF storage subscription.
      operationId: DeleteADRFStorageSubscription
      tags:
        - ADRF Storage Subscriptions
      security:
        - {}
        - oAuth2ClientCredentials:
          - nadrf-datamanagement
        - oAuth2ClientCredentials:
          - nadrf-datamanagement
          - nadrf-datamanagement:storage-read-delete-subs
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NadrfDataStoreSubscriptionRef'
        required: true
      responses:
        '204':
          description: >
```

```
          No Content. The ADRF Storage Subscription matching the provided reference 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'
        '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'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  /remove-stored-data-analytics:
    post:
      summary: Remove ADRF data based on data or analytics specification.
      operationId: DeleteADRFData
      tags:
        - ADRF Stored Data
      security:
        - {}
        - oAuth2ClientCredentials:
          - nadrf-datamanagement
        - oAuth2ClientCredentials:
          - nadrf-datamanagement
          - nadrf-datamanagement:storage-read-delete-subs
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NadrfStoredDataSpec'
        required: true
      responses:
        '204':
          description: No Content. The ADRF data matching the provided specification is 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'
        '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'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '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:
            nadrf-datamanagement: Access to the nadrf-datamanagement API
            nadrf-datamanagement:storage-read-delete-subs: >
              Access to service operations applying to
              Nadrf_DataManagement_StorageRequest Nadrf_DataManagement_StorageSubscriptionRequest,
              Nadrf_DataManagement_StorageSubscriptionRemoval,
              Nadrf_DataManagement_RetrievalRequest,
              Nadrf_DataManagement_RetrievalSubscribe, Nadrf_DataManagement_RetrievalUnsubscribe,
              Nadrf_DataManagement_RetrievalNotify, Nadrf_DataManagement_Delete service operations
#
  schemas:
#
    NadrfDataStoreRecord:
      description: Represents an Individual ADRF Data Store Record.
      type: object
      oneOf:
        - allOf:
          - required: [anaSub]
          - required: [anaNotifications]
        - allOf:
          - required: [dataSub]
          - required: [dataNotif]
      properties:
        dataNotif:
          $ref: '#/components/schemas/DataNotification'
        anaNotifications:
          type: array
          items:
            $ref:
'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/NnwdafEventsSubscriptionNotification'
          minItems: 1
          description: List of analytics subscription notifications.
        anaSub:
          type: array
          items:
            $ref:
'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/NnwdafEventsSubscription'
          minItems: 1
          description: >
            Represents the subscription information of the corresponding analytics notification.
        dataSub:
          type: array
          items:
            $ref: '#/components/schemas/DataSubscription'
          minItems: 1
          description: >
            Represents the subscription information of the corresponding data notification.
        storeHandl:
          $ref: '#/components/schemas/StorageHandlingInfo'
        dataSetTag:
          $ref: '#/components/schemas/DataSetTag'
        dsc:
          type: string
          description: Data synthesis and compression information.
        suppFeat:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
#
    NadrfDataStoreSubscription:
      description: >
        Contains information to be used by the ADRF to create a Data or Analytics subscription.
      type: object
      allOf:
        - oneOf:
          - required: [anaSub]
          - required: [dataSub]
        - oneOf:
          - required: [targetNfId]
          - required: [targetNfSetId]
      properties:
```

```
        anaSub:
          $ref:
'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/NnwdafEventsSubscription'
        dataSetTag:
          $ref: '#/components/schemas/DataSetTag'
        dataSub:
          $ref: '#/components/schemas/DataSubscription'
        targetNfId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
        targetNfSetId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/NfSetId'
        formatInstruct:
          $ref: 'TS29574_Ndccf_DataManagement.yaml#/components/schemas/FormattingInstruction'
        procInstruct:
          $ref: 'TS29574_Ndccf_DataManagement.yaml#/components/schemas/ProcessingInstruction'
        multiProcInstructs:
          type: array
          items:
            $ref: 'TS29574_Ndccf_DataManagement.yaml#/components/schemas/ProcessingInstruction'
          minItems: 1
          description: Processing instructions to be used for sending event notifications.
        storeHandl:
          $ref: '#/components/schemas/StorageHandlingInfo'
        suppFeat:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
#
    NadrfDataRetrievalSubscription:
      description: Represents an Individual ADRF Data Retrieval Subscription.
      type: object
      required:
        - notifCorrId
        - notificationURI
        - timePeriod
      oneOf:
        - required: [anaSub]
        - required: [dataSub]
        - required: [dataSetId]
      properties:
        anaSub:
          $ref:
'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/NnwdafEventsSubscription'
        dataSetId:
          type: string
          description: data set identifier of the data or analytics that are subscribed.
        dataSub:
          $ref: '#/components/schemas/DataSubscription'
        notificationURI:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        timePeriod:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
        notifCorrId:
          type: string
          description: Notification correlation identifier.
        consTrigNotif:
          type: boolean
          description: >
            It indicates that notifications shall be buffered (sending only fetch instructions
            to the NF service consumer) until the NF service consumer requests their delivery
            using Nadrf_DataManagement Service.
        suppFeat:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
#
    NadrfDataRetrievalNotification:
      description: >
        Represents a notification that corresponds with an Individual ADRF Data
        Retrieval Subscription.
      type: object
      required:
        - notifCorrId
        - timeStamp
      oneOf:
        - required: [anaNotifications]
        - required: [dataNotif]
        - required: [fetchInstruct]
      properties:
        notifCorrId:
          type: string
          description: Notification correlation identifier.
```

```
        anaNotifications:
          type: array
          items:
            $ref:
'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/NnwdafEventsSubscriptionNotification'
          minItems: 1
          description: List of analytics subscription notifications.
        dataNotif:
          $ref: '#/components/schemas/DataNotification'
        fetchInstruct:
          $ref: 'TS29576_Nmfaf_3caDataManagement.yaml#/components/schemas/FetchInstruction'#
        terminationReq:
          type: boolean
          description: >
            It indicates the termination of the data management subscription that requested by the
            ADRF.
        dsc:
          type: string
          description: Data synthesis and compression information.
        timeStamp:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
#
    NadrfDataStoreSubscriptionRef:
      description: Contains a reference to a request for a Data or Analytics subscription.
      type: object
      oneOf:
        - required: [transRefId]
        - required: [dataSetId]
      properties:
        transRefId:
          type: string
          description: Transaction reference identifier.
        dataSetId:
          type: string
          description: data set identifier of data or analytics.
#
    NadrfStoredDataSpec:
      description: Contains information about Data or Analytics specification.
      type: object
      required:
       - timePeriod
      oneOf:
        - required: [dataSpec]
        - required: [anaSpec]
        - required: [dataSetId]
      properties:
        dataSpec:
          $ref: '#/components/schemas/DataSubscription'
        anaSpec:
          $ref:
'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/NnwdafEventsSubscription'
        timePeriod:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
        dataSetId:
          type: string
          description: Data set identifier of stored data or analytics records.
#
    DataSubscription:
      description: Contains a data specification.
      type: object
      oneOf:
        - required: [amfDataSub]
        - required: [smfDataSub]
        - required: [udmDataSub]
        - required: [nefDataSub]
        - required: [afDataSub]
        - required: [nrfDataSub]
        - required: [nsacfDataSub]
        - required: [upfDataSub]
        - required: [gmlcDataSub]
      properties:
        amfDataSub:
          $ref: 'TS29518_Namf_EventExposure.yaml#/components/schemas/AmfEventSubscription'
        smfDataSub:
          $ref: 'TS29508_Nsmf_EventExposure.yaml#/components/schemas/NsmfEventExposure'
        udmDataSub:
          $ref: 'TS29503_Nudm_EE.yaml#/components/schemas/EeSubscription'
        afDataSub:
```

```
          $ref: 'TS29517_Naf_EventExposure.yaml#/components/schemas/AfEventExposureSubsc'
        nefDataSub:
          $ref: 'TS29591_Nnef_EventExposure.yaml#/components/schemas/NefEventExposureSubsc'
        nrfDataSub:
          $ref: 'TS29510_Nnrf_NFManagement.yaml#/components/schemas/SubscriptionData'
        nsacfDataSub:
          $ref: 'TS29536_Nnsacf_SliceEventExposure.yaml#/components/schemas/SACEventSubscription'
        upfDataSub:
          $ref: 'TS29564_Nupf_EventExposure.yaml#/components/schemas/UpfEventSubscription'
        gmlcDataSub:
          $ref: 'TS29515_Ngmlc_Location.yaml#/components/schemas/InputData'
#
    DataNotification:
      description: Represents a Data Subscription Notification.
      type: object
      oneOf:
        - required: [amfEventNotifs]
        - required: [smfEventNotifs]
        - required: [udmEventNotifs]
        - required: [nefEventNotifs]
        - required: [afEventNotifs]
        - required: [nrfEventNotifs]
        - required: [nsacfEventNotifs]
        - required: [upfEventNotifs]
        - required: [gmlcEventNotifs]
      properties:
        amfEventNotifs:
          type: array
          items:
            $ref: 'TS29518_Namf_EventExposure.yaml#/components/schemas/AmfEventNotification'
          minItems: 1
          description: List of notifications of AMF events.
        smfEventNotifs:
          type: array
          items:
            $ref:
'TS29508_Nsmf_EventExposure.yaml#/components/schemas/NsmfEventExposureNotification'
          minItems: 1
          description: List of notifications of SMF events.
        udmEventNotifs:
          type: array
          items:
            $ref: 'TS29503_Nudm_EE.yaml#/components/schemas/MonitoringReport'
          minItems: 1
          description: List of notifications of UDM events.
        nefEventNotifs:
          type: array
          items:
            $ref: 'TS29591_Nnef_EventExposure.yaml#/components/schemas/NefEventExposureNotif'
          minItems: 1
          description: List of notifications of NEF events.
        afEventNotifs:
          type: array
          items:
            $ref: 'TS29517_Naf_EventExposure.yaml#/components/schemas/AfEventExposureNotif'
          minItems: 1
          description: List of notifications of AF events.
        nrfEventNotifs:
          type: array
          items:
            $ref: 'TS29510_Nnrf_NFManagement.yaml#/components/schemas/NotificationData'
          minItems: 1
          description: List of notifications of NRF events.
        nsacfEventNotifs:
          type: array
          items:
            $ref: 'TS29536_Nnsacf_SliceEventExposure.yaml#/components/schemas/SACEventReport'
          minItems: 1
          description: List of notifications of NSACF events.
        upfEventNotifs:
          type: array
          items:
            $ref: 'TS29564_Nupf_EventExposure.yaml#/components/schemas/NotificationData'
          minItems: 1
          description: List of notifications of UPF events.
        gmlcEventNotifs:
          type: array
          items:
```

```
            $ref: 'TS29515_Ngmlc_Location.yaml#/components/schemas/EventNotifyData'
          minItems: 1
          description: List of notifications of GMLC events.
        timeStamp:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'

#
    StorageHandlingInfo:
      description: Contains storage handling information about data or analytics.
      type: object
      properties:
        lifetime:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
        delNotifUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        delNotifCorrId:
          type: string
          description: Notification correlation identifier for deletion alerts.
#
    NadrfAlertNotification:
      description: Contains information about data or analytics that are about to be deleted.
      type: object
      properties:
        alertStorTransId:
          type: string
          description: >
            Storage transaction identifier that can be used to retrieve data or analytics.
        delNotifCorrId:
          type: string
          description: Notification correlation identifier.
      required:
       - alertStorTransId
       - delNotifCorrId
#
    NadrfAlertNotificationResponse:
      description: >
        Contains information about planned actions related to data or analytics
        that are about to be deleted.
      type: object
      properties:
        retrievalInd:
          type: boolean
          description: >
            Indicates if the NF service consumer has determined to retrieve the data
            or analytics that are about to be deleted.
      required:
       - retrievalInd
#
    DataSetTag:
      description: Contains an identifier and a description of associated records.
      type: object
      required:
       - dataSetId
      properties:
        dataSetId:
          type: string
          description: Data set identifier of data or analytics records.
        dataSetDesc:
          type: string
          description: Data set description of data or analytics records.
#
```

A.3 Nadrf_MLModelManagement API

```
openapi: 3.0.0
info:
  version: 1.0.1
  title: Nadrf_MLModelManagement
  description: |
    ADRF ML Model Management Service.
    © 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.
externalDocs:
  description: 3GPP TS 29.575 V18.7.0; 5G System; Analytics Data Repository Services; Stage 3.
  url: 'https://www.3gpp.org/ftp/Specs/archive/29_series/29.575/'
#
```

```
servers:
  - url: '{apiRoot}/nadrf-mlmodelmanagement/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501.
#
security:
  - {}
  - oAuth2ClientCredentials:
    - nadrf-mlmodelmanagement
#
paths:
  /mlmodel-store-records:
    post:
      summary: Creates a new Individual ADRF ML Model Store Record resource.
      operationId: CreateADRFMLModelStoreRecord
      tags:
        - ADRF ML Model Store Records (Collection)
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NadrfMLModelStoreRecord'
        required: true
        description: ADRF ML model store record to be stored.
      responses:
        '201':
          description: Successful creation of new Individual ADRF ML Model Store Record resource.
          headers:
            Location:
              description: >
                Contains the URI of the newly created resource, according to the structure
                {apiRoot}/nadrf-mlmodelmanagement/<apiVersion>/mlmodel-store-records/{storeTransId}
              required: true
              schema:
                type: string
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/NadrfMLModelStoreRecord'
        '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'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'
    get:
      summary: Retrieves existing Individual ADRF ML Model Store Record.
      operationId: GetAdrfMLModelStoreRecord
      tags:
        - ADRF ML Model Store Records (Collection)
      parameters:
        - name: store-trans-id
          description: A storage transaction identifier of a ML model store record in ADRF.
          in: query
          required: false
          schema:
            type: string
        - name: model-unique-ids
```

```
        description: Unique Model identifier of a ML model.
        in: query
        required: false
        schema:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
    responses:
      '200':
        description: ML model store records are returned.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NadrfMLModelStoreRecord'
      '204':
        description: No matching ADRF ML Model were found.
      '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'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '502':
        $ref: 'TS29571_CommonData.yaml#/components/responses/502'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  /mlmodel-store-records/{storeTransId}:
    delete:
      summary: Delete an existing Individual ADRF ML Model Store Record.
      operationId: DeleteADRFMLModelStoreRecord
      tags:
        - Individual ADRF ML Model Store Record (Document)
      parameters:
        - name: storeTransId
          in: path
          description: String identifying a ML Model Store Record in ADRF.
          required: true
          schema:
            type: string
      responses:
        '200':
          description: >
            Attempted to remove ML model(s) in the Individual ADRF ML Model Store Record resource.
            The result is returned.
          content:
            application/json:
              schema:
                type: array
                items:
                  $ref: '#/components/schemas/MLModelDelResult'
                minItems: 1
        '204':
          description: >
            No Content. The Individual ADRF ML Model Store Record resource matching the
            storeTransId 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'
      '502':
        $ref: 'TS29571_CommonData.yaml#/components/responses/502'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  put:
    summary: Update an existing Individual ADRF ML Model Store Record
    operationId: UpdateADRFMLModelStoreRecord
    tags:
      - Individual ADRF ML Model Store Record (Document)
    parameters:
      - name: storeTransId
        in: path
        description: String identifying a ML Model Store Record in ADRF.
        required: true
        schema:
          type: string
    requestBody:
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/NadrfMLModelStoreRecord'
      required: true
    responses:
      '200':
        description: >
          The Individual ADRF ML Model Store Record resource was modified successfully
          and a representation of that resource is returned.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NadrfMLModelStoreRecord'
      '204':
        description: The Individual ADRF ML Model Store Record 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'
      '502':
        $ref: 'TS29571_CommonData.yaml#/components/responses/502'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'
/remove-stored-mlmodel:
  post:
    summary: Remove stored ML model based on unique ML model identifier.
    operationId: DeleteADRFMLModel
    tags:
      - ADRF Stored ML Model
    requestBody:
      content:
```

```
          application/json:
            schema:
              type: array
              items:
                $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
              minItems: 1
        required: true
      responses:
        '200':
          description: >
            The ADRF ML model matching the provided unique ML model identifier
            was attempted to be deleted. The result is returned.
          content:
            application/json:
              schema:
                type: array
                items:
                  $ref: '#/components/schemas/MLModelDelResult'
                minItems: 1
        '204':
          description: >
            No Content. The ML models matching all identifiers provided in the request body
            were 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'
        '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'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '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:
            nadrf-mlmodelmanagement: Access to the nadrf-mlmodelmanagement API
#
  schemas:
#
    NadrfMLModelStoreRecord:
      description: Represents an Individual ADRF ML Model Store Record.
      type: object
      allOf:
        - oneOf:
          - required: [nfInstanceId]
          - required: [nfSetId]
        - anyOf:
          - required: [mlModelInfo]
          - required: [mlModels]
      properties:
        nfInstanceId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
        nfSetId:
```

```
          $ref: 'TS29571_CommonData.yaml#/components/schemas/NfSetId'
        mlModelInfo:
          type: array
          items:
            $ref: '#/components/schemas/MLModelInfo'
          minItems: 1
          description: List of ML Model Information.
        mlModels:
          type: array
          items:
            $ref: '#/components/schemas/MLModel'
          minItems: 1
          description: Represents ML Model(s).
        modelStoreResult:
          $ref: '#/components/schemas/ModelStoreResult'
        suppFeat:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
#
    MLModelInfo:
      description: Represents informatiom of the ML Model.
      type: object
      allOf:
        - required: [modelUniqueId]
        - required: [mlFileAddr]
        - required: [mlStorageSize]
      properties:
        modelUniqueId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
        mlFileAddr:
          $ref: 'TS29520_Nnwdaf_MLModelProvision.yaml#/components/schemas/MLModelAddr'
        mlStorageSize:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
        allowConsumerList:
          type: array
          items:
            $ref: '#/components/schemas/AllowedConsumer'
          minItems: 1
          description: The allowed consumer list of the ML Model.
#
    AllowedConsumer:
      description: Represents informatiom of the allowed consumer list of the ML Model.
      type: object
      properties:
        nfInstanceId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
        nfSetId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/NfSetId'
      oneOf:
        - required: [nfInstanceId]
        - required: [nfSetId]
#
    MLModelDelResult:
      description: Represents informatiom of the ML Model.
      type: object
      allOf:
        - required: [modelUniqueId]
        - required: [deleteResult]
      properties:
        modelUniqueId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
        deleteResult:
          $ref: '#/components/schemas/DeleteResult'
#
    MLModel:
      description: Represents an ML Model.
      type: object
      allOf:
        - required: [modelUniqueId]
        - required: [mlModel]
      properties:
        modelUniqueId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
        mlModel:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Binary'
#
    ModelStoreResult:
      description: Contains information about ML Model storage result.
      type: object
```

```
      allOf:
        - required: [modelUniqueId]
        - required: [storeResult]
      properties:
        modelUniqueId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
        storeResult:
          $ref: '#/components/schemas/StoreResult'
#
# ENUMERATIONS DATA TYPES
#
    DeleteResult:
      anyOf:
      - type: string
        enum:
          - ML_MODEL_DELETED
          - ML_MODEL_NOT_FOUND
          - ML_MODEL_FOUND_BUT_NOT_DELETED
      - 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: |
        Represents the store result type.
        Possible values are:
        - ML_MODEL_DELETED: Indicates that the ML model was deleted in ADRF.
        - ML_MODEL_NOT_FOUND: Indicates that the ML model was not found in ADRF.
        - ML_MODEL_FOUND_BUT_NOT_DELETED: Indicates that the ML model was found in ADRF but not
deleted.

#
    StoreResult:
      anyOf:
      - type: string
        enum:
          - ML_MODEL_FILE_STORED_IN_ADRF
          - ML_MODEL_FILE_ADDRESS_NOT_FOUND
          - ML_MODEL_FILE_DOWNLOAD_FAILED
      - 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: |
        Represents the store result type.
        Possible values are:
        - ML_MODEL_FILE_STORED_IN_ADRF: Indicates that the ML model was successfully stored in ADRF.
        - ML_MODEL_FILE_ADDRESS_NOT_FOUND: Indicates that the ML model file address was not found.
        - ML_MODEL_FILE_DOWNLOAD_FAILED: Indicates that the download of the ML model file failed.
```

Annex B (informative): Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2021-06	CT3#116e					TS skeleton of Analytics Data Repository Services specification	0.0.0
2021-06	CT3#116e	C3-213501				Inclusion of documents agreed in CT3#116e C3-213537.	0.1.0
2021-08	CT3#117e	C3-214579				Inclusion of documents agreed in CT3#117e C3-214478.	0.2.0
2021-11	CT3#119e	C3-216521				Inclusion of documents agreed in CT3#119e C3-216443, C3-216455, C3-216456, C3-216457, C3-216458, C3-216459, C3-216460, C3-216462, C3-216469, C3-216591, C3-216592, C3-216593.	0.3.0
2022-01	CT3#119bis-e	C3-220454				Inclusion of documents agreed in CT3#119bis-e C3-220500, C3-220512, C3-220513, C3-220440, C3-220441, C3-220369.	0.4.0
2022-02	CT3#120	C3-221516				Inclusion of documents agreed in CT3#120-e C3-221091, C3-221288, C3-221620, C3-221621.	0.5.0
2022-03	CT#95e	CP-220160				Presentation to TSG CT for approval	1.0.0
2022-03	CT#95e	CP-220160				Approved by TSG CT	17.0.0
2022-06	CT#96	CP-221132	0001	1	F	Adding 3XX response handling support for ADRF services	17.1.0
2022-06	CT#96	CP-221136	0002	3	B	Cleanup of Nadrf_DataManagement data model	17.1.0
2022-06	CT#96	CP-221132	0003	1	F	Corrections in the Nadrf_DataManagement data model	17.1.0
2022-06	CT#96	CP-221129	0004		F	Correct the Cardinality of some attributes	17.1.0
2022-06	CT#96	CP-221134	0005	3	B	Support removal of stored analytics and data from ADRF according to Analytics and Data Specification	17.1.0
2022-06	CT#96	CP-221132	0006	1	B	Support carrying Fetch Instructions in Nadrf_DataManagement_RetrievalNotify service operation	17.1.0
2022-06	CT#96	CP-221133	0008	2	F	Formatting of description fields	17.1.0
2022-06	CT#96	CP-221130	0009		F	Responses on DELETE method	17.1.0
2022-06	CT#96	CP-221133	0011	2	F	Clarification on duplicated data or analytics storage	17.1.0
2022-06	CT#96	CP-221131	0012	1	F	Correction on Nadrf_DataManagement_StorageRequest service operation	17.1.0
2022-06	CT#96	CP-221133	0014		F	Removal of repetitive description in HTTP error response	17.1.0
2022-06	CT#96	CP-221135	0016	1	F	Update inputs of Nadrf_DataManagement_RetrievalNotify service	17.1.0
2022-06	CT#96	CP-221134	0017		F	corrections to Abbreviations and Introduction	17.1.0
2022-06	CT#96	CP-221134	0018		F	correction to time period	17.1.0
2022-06	CT#96	CP-221155	0019	1	F	Update the apiVersion placeholder	17.1.0
2022-06	CT#96	CP-221152	0020		F	Update of info and externalDocs fields	17.1.0
2022-09	CT#97e	CP-222104	0021	1	F	Update inputs of Nadrf_DataManagement_RetrievalNotify service	17.2.0
2022-09	CT#97e	CP-222103	0022	1	F	Corrections in descriptions of the Nadrf_DataManagement_RetrievalRequest operation	17.2.0
2022-09	CT#97e	CP-222103	0023	1	F	ADRF data retrieval notification data model updates	17.2.0
2022-09	CT#97e	CP-222103	0024	1	F	Adding NRF and NSACF as data sources	17.2.0
2022-09	CT#97e	CP-222121	0027		F	Update of info and externalDocs fields	17.2.0
2022-12	CT#98e	CP-223173	0028	1	F	ADRF Retrieval Request inputs	17.3.0
2022-12	CT#98e	CP-223172	0029		F	ADRF Storage Subscription Request handling inconsistencies	17.3.0
2022-12	CT#98e	CP-223173	0035	1	F	The time stamp of data notification	17.3.0
2022-12	CT#98e	CP-223173	0036	1	F	Miscellaneous corrections	17.3.0
2022-12	CT#98e	CP-223192	0038	1	F	Update the apiVersion in the specification	17.3.0
2022-12	CT#98e	CP-223188	0043		F	Update of info and externalDocs fields	17.3.0
2022-12	CT#98e	CP-223191	0031		F	Adding the mandatory error code 502 Bad Gateway	18.0.0
2022-12	CT#98e	CP-223176	0032	1	F	Removal of non-sense statement for notificationURI	18.0.0
2022-12	CT#98e	CP-223176	0033	1	F	adding Consumer triggered Notification indication for Nadrf_DataManagement_RetrievalSubscribe	18.0.0
2022-12	CT#98e	CP-223176	0034	1	F	Correction of data type of procInstruct	18.0.0
2022-12	CT#98e	CP-223190	0044		F	Update of info and externalDocs fields	18.0.0
2023-03	CT#99	CP-230149	0045	1	B	Adding Supported Features for data storage and retrieval subscriptions	18.1.0
2023-03	CT#99	CP-230149	0046	1	F	Handling of fetch Instruction	18.1.0
2023-03	CT#99	CP-230162	0048		F	Update of info and externalDocs fields	18.1.0
2023-06	CT#100	CP-231157	0049	1	B	Adding UPF to the possible data sources for analytics	18.2.0
2023-06	CT#100	CP-231132	0050	3	B	OAuth2 scopes in Nadrf_DataManagement API	18.2.0
2023-06	CT#100	CP-231126	0051	1	B	Adding Storage Handling Information in ARDF Data Management requests	18.2.0
2023-06	CT#100	CP-231126	0052	1	B	Sending ADRF Deletion Alerts	18.2.0
2023-06	CT#100	CP-231125	0053		B	Using DataSetTag in ADRF requests	18.2.0
2023-06	CT#100	CP-231126	0054	1	B	Using DataSetTag in ADRF subscriptions	18.2.0
2023-06	CT#100	CP-231132	0055	1	F	Corrections to the redirection mechanism description	18.2.0
2023-06	CT#100	CP-231141	0056		F	Update of info and externalDocs fields	18.2.0

2023-09	CT#101	CP-232081	0057		B	Location Accuracy data sources	18.3.0
2023-09	CT#101	CP-232081	0058		B	Data Synthesis and Compression	18.3.0
2023-09	CT#101	CP-232098	0059	1	F	Editor Note removal for Nadrf_DataManagement API OAuth2 scope.	18.3.0
2023-09	CT#101	CP-232081	0060	1	B	Storage of ML models in ADRF	18.3.0
2023-09	CT#101	CP-232085	0061		F	Update of info and externalDocs fields	18.3.0
2023-12	CT#102	CP-233225	0062	2	B	Update the Nadrf_MLModelManagement_RetrievalRequest service	18.4.0
2023-12	CT#102	CP-233246	0063	1	B	Support of the storage of user consent	18.4.0
2023-12	CT#102	CP-233224	0064	1	F	Correction to MLModelManagement_Delete service operation	18.4.0
2023-12	CT#102	CP-233224	0065		F	Fixing wrong reference to 29.500	18.4.0
2023-12	CT#102	CP-233225	0067	1	B	Updates to Nadrf_MLModelManagement_Delete Service Operation	18.4.0
2023-12	CT#102	CP-233225	0068	1	B	Updates to Nadrf_MLModelManagement API for StorageRequest	18.4.0
2023-12	CT#102	CP-233225	0069	1	F	Updates to Nadrf_MLModelManagement_RetrievalRequest Service Operation	18.4.0
2023-12	CT#102	CP-233227	0071	1	F	Correction to MLModelManagement_StorageRequest service operation	18.4.0
2023-12	CT#102	CP-233229	0072	1	F	IETF RFC 7540, RFC 7807 obsoleted by RFC 9113 and RFC 9457 respectively	18.4.0
2023-12	CT#102	CP-233237	0073		F	Update of info and externalDocs fields	18.4.0
2024-03	CT#103	CP-240177	0074		B	Clarification for user consent for retrieving data stored in the ADRF	18.5.0
2024-03	CT#103	CP-240161	0075		F	Several corrections in Nadrf_MLModelManagement API	18.5.0
2024-03	CT#103	CP-240162	0076	1	B	Support for Apllication errors in Delete and Storage operation	18.5.0
2024-03	CT#103	CP-240161	0077	1	F	Corrections to ADRF APIs	18.5.0
2024-03	CT#103	CP-240167	0078		F	Update of info and externalDocs fields	18.5.0
2024-06	CT#104	CP-241093	0079	2	F	Correction to the OAuth2 scope in Nadrf_DataManagement API	18.6.0
2024-06	CT#104	CP-241079	0082	1	F	Nadrf_MLModelManagement service operation description correction	18.6.0
2024-06	CT#104	CP-241079	0083	1	B	Support of ML Models update	18.6.0
2024-06	CT#104	CP-241093	0084		F	Corrections to the 3xx based 3GPP SBI redirection mechanism	18.6.0
2024-06	CT#104	CP-241093	0085		F	Corrections to the support of the HTTP custom headers	18.6.0
2024-06	CT#104	CP-241078	0086		F	Corrections on Nadrf_ MLModelManagement API	18.6.0
2024-06	CT#104	CP-241086	0087		F	Update of info and externalDocs fields	18.6.0
2024-09	CT#105	CP-242119	0088	1	F	Correction to security of Nadrf_MLModelManagement API	18.7.0
2024-09	CT#105	CP-242119	0093	1	F	Corrections on 204 No Content status code of GET and resource name	18.7.0
2024-09	CT#105	CP-242119	0094		F	Corrections on the attribute name and enumeration in the Nadrf_MLModelManagement OpenAPI	18.7.0
2024-09	CT#105	CP-242120	0095		F	Update of info and externalDocs fields	18.7.0

History

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