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(3GPP TS 29.575 version 19.5.0 Release 19)**



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Contents

| | |
|------------------------------------------------------------------------------------------------------|----|
| Intellectual Property Rights | 2 |
| Legal Notice | 2 |
| Modal verbs terminology..... | 2 |
| Foreword..... | 7 |
| Introduction | 8 |
| 1 Scope | 9 |
| 2 References | 9 |
| 3 Definitions, symbols and abbreviations | 10 |
| 3.1 Definitions | 10 |
| 3.2 Symbols..... | 10 |
| 3.3 Abbreviations | 10 |
| 4 Services offered by the ADRF | 11 |
| 4.1 Introduction | 11 |
| 4.2 Ndrf_DataManagement Service | 12 |
| 4.2.1 Service Description..... | 12 |
| 4.2.1.1 Overview..... | 12 |
| 4.2.1.2 Service Architecture..... | 12 |
| 4.2.1.3 Network Functions | 13 |
| 4.2.1.3.1 Analytics Data Repository Function (ADRF) | 13 |
| 4.2.1.3.2 NF Service Consumers | 13 |
| 4.2.2 Service Operations..... | 13 |
| 4.2.2.1 Introduction..... | 13 |
| 4.2.2.2 Ndrf_DataManagement_StorageRequest service operation..... | 14 |
| 4.2.2.2.1 General | 14 |
| 4.2.2.2.2 Request Storage of data or analytics..... | 14 |
| 4.2.2.3 Ndrf_DataManagement_StorageSubscriptionRequest service operation..... | 15 |
| 4.2.2.3.1 General | 15 |
| 4.2.2.3.2 Requesting subscription and storage of data or analytics | 15 |
| 4.2.2.4 Ndrf_DataManagement_StorageSubscriptionRemoval service operation | 16 |
| 4.2.2.4.1 General | 16 |
| 4.2.2.4.2 Requesting removal of subscription of data or analytics | 17 |
| 4.2.2.5 Ndrf_DataManagement_RetrievalRequest service operation | 17 |
| 4.2.2.5.1 General | 17 |
| 4.2.2.5.2 Request and get stored data or analytics from ADRF Data Store..... | 17 |
| 4.2.2.6 Ndrf_DataManagement_RetrievalSubscribe service operation..... | 19 |
| 4.2.2.6.1 General | 19 |
| 4.2.2.6.2 Requesting retrieval and subscription of data or analytics | 19 |
| 4.2.2.7 Ndrf_DataManagement_RetrievalUnsubscribe service operation | 20 |
| 4.2.2.7.1 General | 20 |
| 4.2.2.7.2 Requesting removal of retrieval subscription for data or analytics..... | 20 |
| 4.2.2.8 Ndrf_DataManagement_RetrievalNotify service operation..... | 21 |
| 4.2.2.8.1 General | 21 |
| 4.2.2.8.2 Notification about subscribed data or analytics | 21 |
| 4.2.2.8.3 Notification about data or analytics that are about to be deleted | 22 |
| 4.2.2.9 Ndrf_DataManagement_Delete service operation | 23 |
| 4.2.2.9.1 General | 23 |
| 4.2.2.9.2 Requesting removal of stored data or analytics | 23 |
| 4.2.2.9.3 Requesting removal of stored data or analytics using data or analytics specification | 23 |
| 4.3 Ndrf_MLModelManagement Service..... | 24 |
| 4.3.1 Service Description..... | 24 |
| 4.3.1.1 Overview..... | 24 |
| 4.3.1.2 Service Architecture..... | 25 |
| 4.3.1.3 Network Functions | 25 |

| | | |
|-----------|---------------------------------------------------------------------------------|----|
| 4.3.1.3.1 | Analytics Data Repository Function (ADRF) | 25 |
| 4.3.1.3.2 | NF Service Consumers | 25 |
| 4.3.2 | Service Operations | 26 |
| 4.3.2.1 | Introduction | 26 |
| 4.3.2.2 | Nadrf_MLModelManagement_StorageRequest service operation | 26 |
| 4.3.2.2.1 | General | 26 |
| 4.3.2.2.2 | Request Storage of ML model(s) | 26 |
| 4.3.2.2.3 | Update Storage of ML model(s) | 27 |
| 4.3.2.3 | Nadrf_MLModelManagement_RetrievalRequest service operation | 28 |
| 4.3.2.3.1 | General | 28 |
| 4.3.2.3.2 | Request and get stored ML model(s) from ADRF ML Model Store | 28 |
| 4.3.2.4 | Nadrf_MLModelManagement_Delete service operation | 29 |
| 4.3.2.4.1 | General | 29 |
| 4.3.2.4.2 | Requesting removal of stored ML model(s) | 29 |
| 4.3.2.4.3 | Requesting removal of stored ML model(s) using unique ML model identifier | 30 |
| 5 | API Definitions | 31 |
| 5.1 | Nadrf_DataManagement Service API | 31 |
| 5.1.1 | Introduction | 31 |
| 5.1.2 | Usage of HTTP | 31 |
| 5.1.2.1 | General | 31 |
| 5.1.2.2 | HTTP standard headers | 32 |
| 5.1.2.2.1 | General | 32 |
| 5.1.2.2.2 | Content type | 32 |
| 5.1.2.3 | HTTP custom headers | 32 |
| 5.1.3 | Resources | 32 |
| 5.1.3.1 | Overview | 32 |
| 5.1.3.2 | Resource: ADRF Data Store Records | 33 |
| 5.1.3.2.1 | Description | 33 |
| 5.1.3.2.2 | Resource Definition | 33 |
| 5.1.3.2.3 | Resource Standard Methods | 33 |
| 5.1.3.2.4 | Resource Custom Operations | 35 |
| 5.1.3.3 | Resource: Individual ADRF Data Store Record | 35 |
| 5.1.3.3.1 | Description | 35 |
| 5.1.3.3.2 | Resource Definition | 35 |
| 5.1.3.3.3 | Resource Standard Methods | 35 |
| 5.1.3.3.4 | Resource Custom Operations | 37 |
| 5.1.3.4 | Resource: ADRF Data Retrieval Subscriptions | 37 |
| 5.1.3.4.1 | Description | 37 |
| 5.1.3.4.2 | Resource Definition | 37 |
| 5.1.3.4.3 | Resource Standard Methods | 37 |
| 5.1.3.4.4 | Resource Custom Operations | 38 |
| 5.1.3.5 | Resource: Individual ADRF Data Retrieval Subscription | 38 |
| 5.1.3.5.1 | Description | 38 |
| 5.1.3.5.2 | Resource Definition | 38 |
| 5.1.3.5.3 | Resource Standard Methods | 38 |
| 5.1.3.5.4 | Resource Custom Operations | 39 |
| 5.1.4 | Custom Operations without associated resources | 39 |
| 5.1.4.1 | Overview | 39 |
| 5.1.4.2 | Operation: request-storage-sub | 40 |
| 5.1.4.2.1 | Description | 40 |
| 5.1.4.2.2 | Operation Definition | 40 |
| 5.1.4.3 | Operation: request-storage-sub-removal | 41 |
| 5.1.4.3.1 | Description | 41 |
| 5.1.4.3.2 | Operation Definition | 41 |
| 5.1.4.4 | Operation: remove-stored-data-analytics | 42 |
| 5.1.4.4.1 | Description | 42 |
| 5.1.4.4.2 | Operation Definition | 42 |
| 5.1.5 | Notifications | 43 |
| 5.1.5.1 | General | 43 |
| 5.1.5.2 | Retrieval Notification | 44 |
| 5.1.5.2.1 | Description | 44 |

| | | |
|------------|---------------------------------------------------------------------------------|----|
| 5.1.5.2.2 | Target URI..... | 44 |
| 5.1.5.2.3 | Standard Methods..... | 44 |
| 5.1.5.3 | ADRF Alert Notification..... | 45 |
| 5.1.5.3.1 | Description..... | 45 |
| 5.1.5.3.2 | Target URI..... | 45 |
| 5.1.5.3.3 | Standard Methods..... | 45 |
| 5.1.6 | Data Model..... | 46 |
| 5.1.6.1 | General..... | 46 |
| 5.1.6.2 | Structured data types..... | 50 |
| 5.1.6.2.1 | Introduction..... | 50 |
| 5.1.6.2.2 | Type: NadrfdDataStoreRecord..... | 51 |
| 5.1.6.2.3 | Type: NadrfdDataStoreSubscription..... | 52 |
| 5.1.6.2.4 | Type: NadrfdDataRetrievalSubscription..... | 53 |
| 5.1.6.2.5 | Type: NadrfdDataRetrievalNotification..... | 54 |
| 5.1.6.2.6 | Type: NadrfdDataStoreSubscriptionRef..... | 54 |
| 5.1.6.2.7 | Type: NadrfdStoredDataSpec..... | 55 |
| 5.1.6.2.8 | Type: DataSubscription..... | 55 |
| 5.1.6.2.10 | Type: StorageHandlingInfo..... | 57 |
| 5.1.6.2.11 | Type: NadrfdAlertNotification..... | 57 |
| 5.1.6.2.12 | Type: NadrfdAlertNotificationResponse..... | 57 |
| 5.1.6.2.13 | Type: DataSetTag..... | 57 |
| 5.1.6.3 | Simple data types and enumerations..... | 58 |
| 5.1.6.4 | Data types describing alternative data types or combinations of data types..... | 58 |
| 5.1.7 | Error Handling..... | 58 |
| 5.1.7.1 | General..... | 58 |
| 5.1.7.2 | Protocol Errors..... | 58 |
| 5.1.7.3 | Application Errors..... | 58 |
| 5.1.8 | Feature negotiation..... | 58 |
| 5.1.9 | Security..... | 58 |
| 5.2 | NadrfdMLModelManagement Service API..... | 59 |
| 5.2.1 | Introduction..... | 59 |
| 5.2.2 | Usage of HTTP..... | 59 |
| 5.2.2.1 | General..... | 59 |
| 5.2.2.2 | HTTP standard headers..... | 59 |
| 5.2.2.2.1 | General..... | 59 |
| 5.2.2.2.2 | Content type..... | 60 |
| 5.2.2.3 | HTTP custom headers..... | 60 |
| 5.2.3 | Resources..... | 60 |
| 5.2.3.1 | Overview..... | 60 |
| 5.2.3.2 | Resource: ADRFD ML Model Store Records..... | 61 |
| 5.2.3.2.1 | Description..... | 61 |
| 5.2.3.2.2 | Resource Definition..... | 61 |
| 5.2.3.2.3 | Resource Standard Methods..... | 61 |
| 5.2.3.2.4 | Resource Custom Operations..... | 63 |
| 5.2.3.3 | Resource: Individual ADRFD ML Model Store Record..... | 63 |
| 5.2.3.3.1 | Description..... | 63 |
| 5.2.3.3.2 | Resource Definition..... | 63 |
| 5.2.3.3.3 | Resource Standard Methods..... | 63 |
| 5.2.3.3.4 | Resource Custom Operations..... | 66 |
| 5.2.4 | Custom Operations without associated resources..... | 66 |
| 5.2.4.1 | Overview..... | 66 |
| 5.2.4.4 | Operation: remove-stored-mlmodel..... | 66 |
| 5.2.4.4.1 | Description..... | 66 |
| 5.2.4.4.2 | Operation Definition..... | 66 |
| 5.2.5 | Notifications..... | 67 |
| 5.2.6 | Data Model..... | 68 |
| 5.2.6.1 | General..... | 68 |
| 5.2.6.2 | Structured data types..... | 68 |
| 5.2.6.2.1 | Introduction..... | 68 |
| 5.2.6.2.2 | Type: NadrfdMLModelStoreRecord..... | 69 |
| 5.2.6.2.3 | Type: MLModelInfo..... | 69 |
| 5.2.6.2.4 | Type: MLModel..... | 70 |

| | | |
|---------------------------------------------------------|----------------------------------------------------------------------------------|-----------|
| 5.2.6.2.5 | Type: MLModelDelResult | 70 |
| 5.2.6.2.6 | Type: AllowedConsumer | 70 |
| 5.2.6.2.7 | Type: ModelStoreResult | 70 |
| 5.2.6.3 | Simple data types and enumerations | 70 |
| 5.2.6.3.2 | Enumeration: StoreResult | 71 |
| 5.2.6.4 | Data types describing alternative data types or combinations of data types | 71 |
| 5.2.7 | Error Handling | 71 |
| 5.2.7.1 | General | 71 |
| 5.2.7.2 | Protocol Errors | 71 |
| 5.2.7.3 | Application Errors | 71 |
| 5.2.8 | Feature negotiation | 71 |
| 5.2.9 | Security | 72 |
| Annex A (normative): OpenAPI specification | | 73 |
| A.1 | General | 73 |
| A.2 | Nadrf_DataManagement API | 73 |
| A.3 | Nadrf_MLModelManagement API | 86 |
| Annex B (informative): Change history | | 93 |
| History | | 96 |

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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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- 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".
- [29] 3GPP TS 29.572: "5G System; Location Management Services; Stage 3".
- [30] 3GPP TS 29.523: "5G System; Policy Control Event Exposure Service; 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 |
| LMF | Location Management Function |
| 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 |
| PCF | Policy 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 Nadr 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) |
|----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|----------------------------|---------------------|---------------------|
| Nadr_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 |
| Nadr_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, LMF |
| | | Delete | Request / Response | NWDAF |
| NOTE 1: The services correspond to the Nadr_DataManagement service as defined in 3GPP TS 23.288 [14]. | | | | |
| NOTE 2: The services correspond to the Nadr_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 |
|------------------------|--------|--------------------------------|-------------------------------------|------------------------|-------|
| Nadr_DataManagement | 5.1 | API for Nadr_DataManagement | TS29575_Nadr_DataManagement.yaml | nadr-datamanagement | A.2 |
| Nadr_MLModelManagement | 5.2 | API for Nadr_MLModelManagement | TS29575_Nadr_MLModelManagement.yaml | nadr-mlmodelmanagement | A.3 |

4.2 Nadrif_DataManagement Service

4.2.1 Service Description

4.2.1.1 Overview

The Nadrif_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 Nadrif_DataManagement service is part of the Nadrif service-based interface exhibited by the Analytics Data Repository Function (ADRF).

Known consumers of the Nadrif_DataManagement service are:

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

The Nadrif_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.

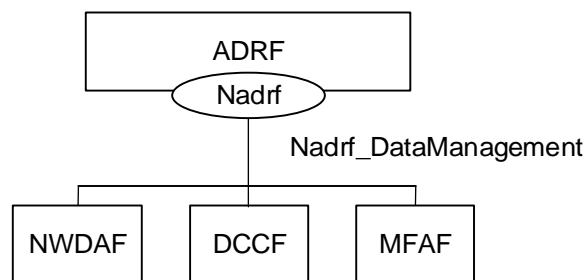


Figure 4.2.1.2-1: Reference Architecture for the Nadrif_DataManagement Service; SBI representation

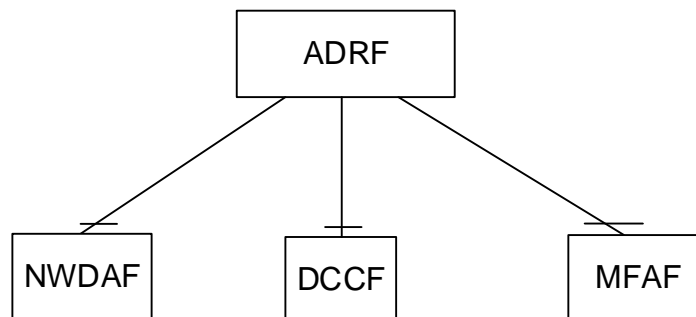


Figure 4.2.1.2-2: Nadrif_DataManagement service architecture, reference point representation

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_RetrievalSubscription | 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 or analytics in ADRF. | NF service consumer (DCCF, NWDAF) |

4.2.2.2 Ndrf_DataManagement_StorageRequest service operation

4.2.2.2.1 General

The Ndrf_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.

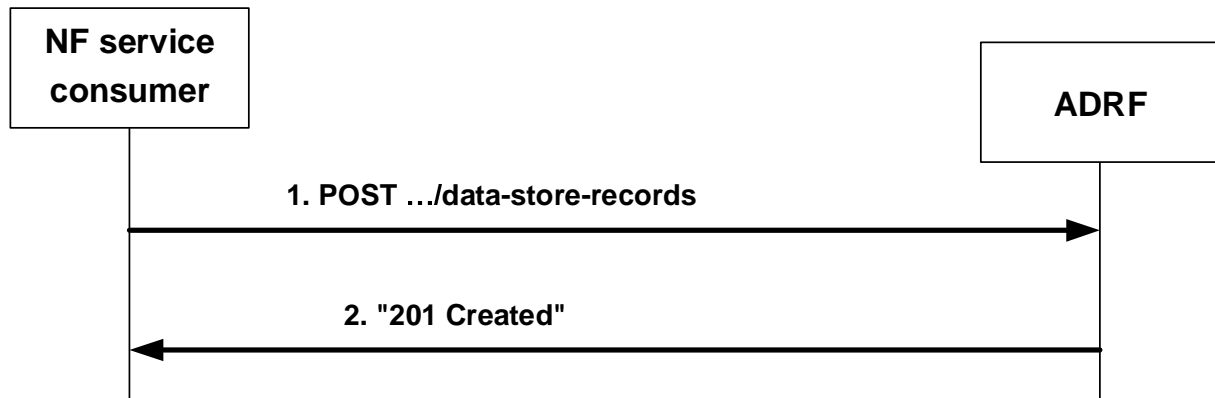


Figure 4.2.2.2.2-1: NF service consumer requesting to store data or analytics

The NF service consumer shall invoke the Ndrf_DataManagement_StorageRequest service operation to store data or analytics. The NF service consumer shall send an HTTP POST request with "{apiRoot}/ndrf-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 NdrfDataStoreRecord 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}/ndrf-datamanagement/<apiVersion>/data-store-records" as Resource URI and NdrfDataStoreRecord 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 4.2.2.2-1, 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}/nadrfdatamanagement/<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 Nadrfdatamanagement_StorageSubscriptionRequest service operation

4.2.2.3.1 General

The Nadrfdatamanagement_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.

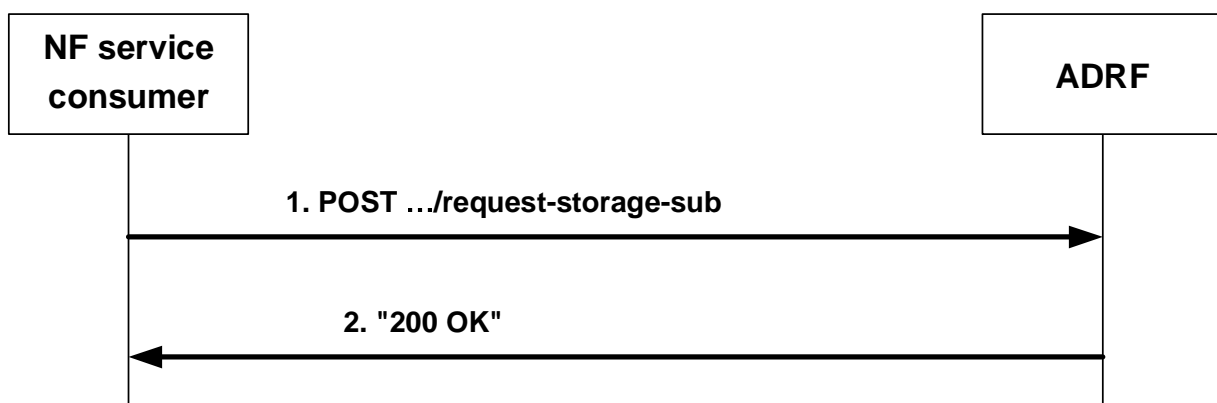


Figure 4.2.2.3.2-1: NF service consumer requesting that the ADRF subscribes to and subsequently stores data or analytics

The NF service consumer shall invoke the Nadrfdatamanagement_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}/nadrfdatamanagement/<apiVersion>/request-storage-sub" as URI, as shown in figure 4.2.2.3.2-1, step 1. The Nadrfdatamanagement_StorageSubscription 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}/nadr-datamanagement/<apiVersion>/request-storage-sub" as URI and NadrDataStoreSubscription 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 NadrDataStoreSubscriptionRef 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 NadrDataStoreSubscription 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 Nadr_DataManagement_StorageSubscriptionRemoval service operation

4.2.2.4.1 General

The Nadr_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.

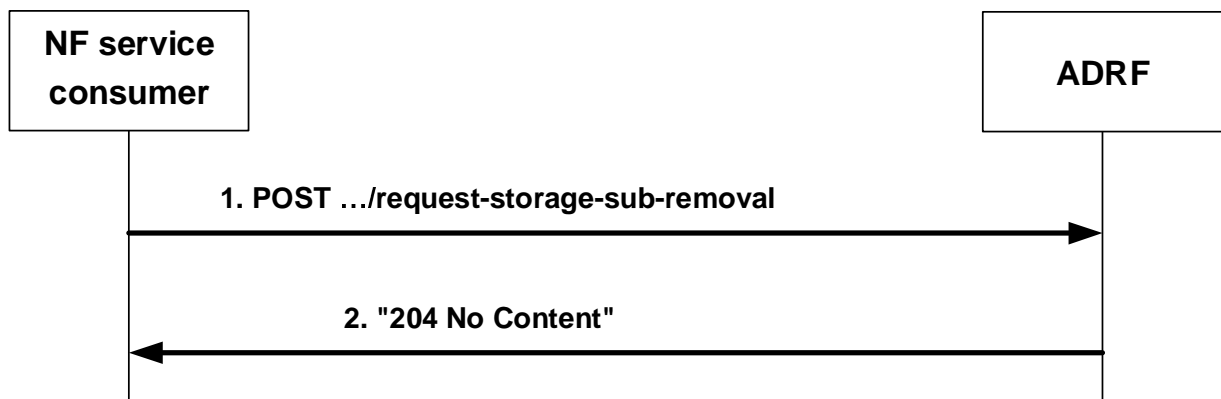


Figure 4.2.2.4.2-1: NF service consumer requesting the removal of subscription(s) to storage of data or analytics

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.

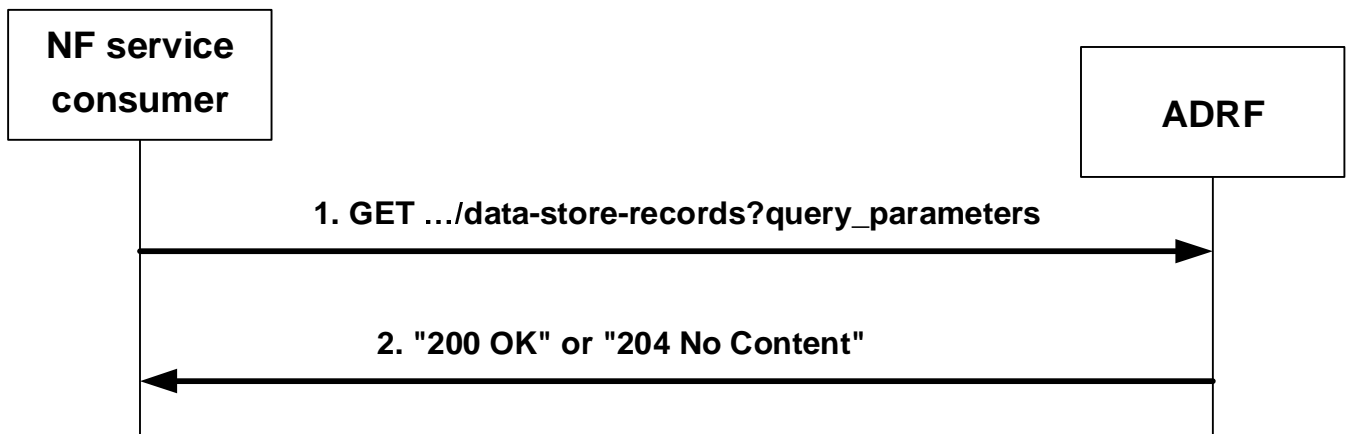


Figure 4.2.2.5.2-1: NF service consumer requesting to retrieve stored data or analytics

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 Ndrf_DataManagement_RetrievalSubscribe service operation

4.2.2.6.1 General

The Ndrf_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.

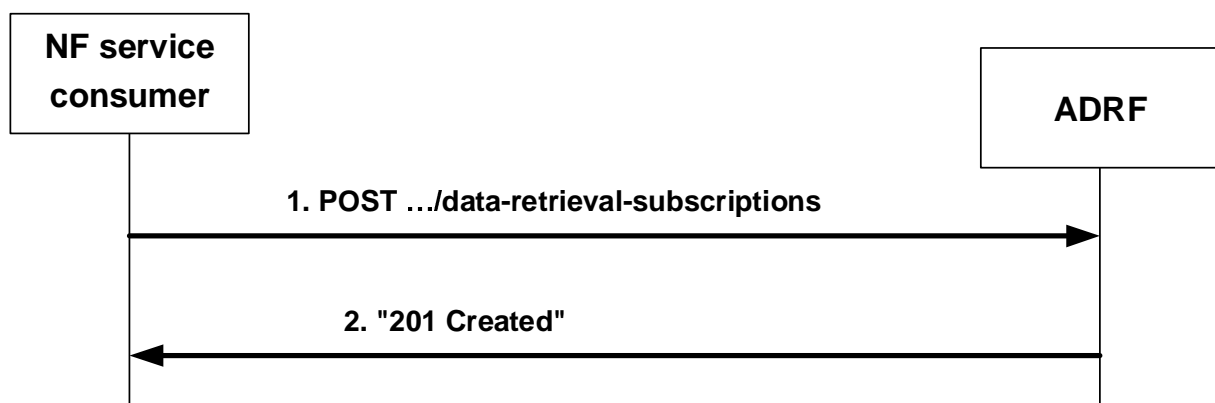


Figure 4.2.2.6.2-1: NF service consumer requesting to retrieve and subscribe to data or analytics

The NF service consumer shall invoke the Ndrf_DataManagement_RetrievalSubscribe service operation to retrieve and subscribe to data or analytics. The NF service consumer shall send an HTTP POST request with "{apiRoot}/ndrf-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 NdrfDataRetrievalSubscription data structure provided in the request body shall include:

- notification correlation identifier 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}/ndrf-datamanagement/<apiVersion>/data-retrieval-subscriptions" as Resource URI and NdrfDataRetrievalSubscription 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}/nadrfdatamanagement/<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 Nadrfdatamanagement RetrievalUnsubscribe service operation

4.2.2.7.1 General

The Nadrfdatamanagement 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.

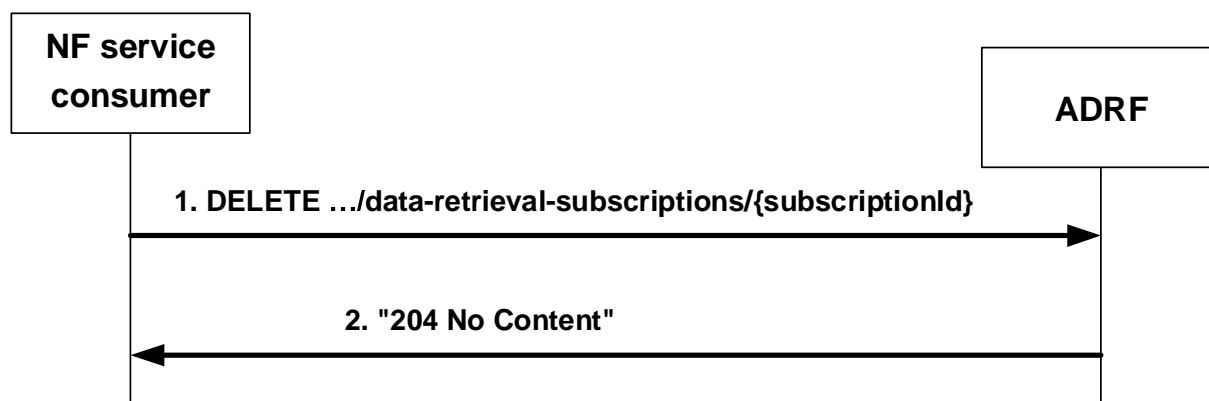


Figure 4.2.2.7.2-1: NF service consumer requesting to remove retrieval subscription for data or analytics

The NF service consumer shall invoke the Nadrfdatamanagement RetrievalUnsubscribe service operation to remove a retrieval subscription for data or analytics. The NF service consumer shall send an HTTP DELETE request with "{apiRoot}/nadrfdatamanagement/<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}/nadrfdatamanagement/<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 Nadrif_DataManagement_RetrievalNotify service operation

4.2.2.8.1 General

The Nadrif_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.

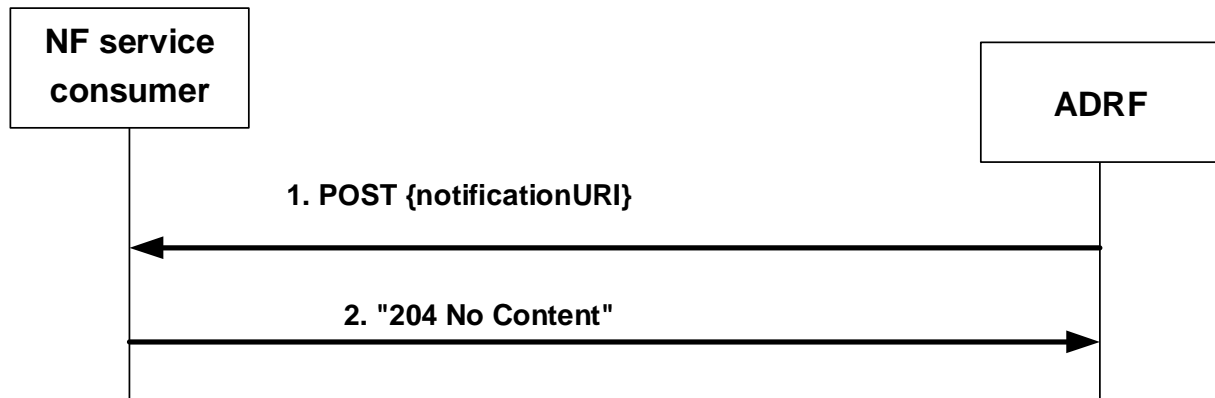


Figure 4.2.2.8.2-1: ADRF notifies the NF service consumer about subscribed data or analytics

The ADRF shall invoke the Nadrif_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 NadrifDataRetrievalNotification 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 Nadrif_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 Nadrif_DataManagement_RetrievalRequest service operation, i.e. {apiRoot}/nadrif-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 NadrifDataRetrievalNotification 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 NadrDataRetrievalNotification 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 NadrDataManagement_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.

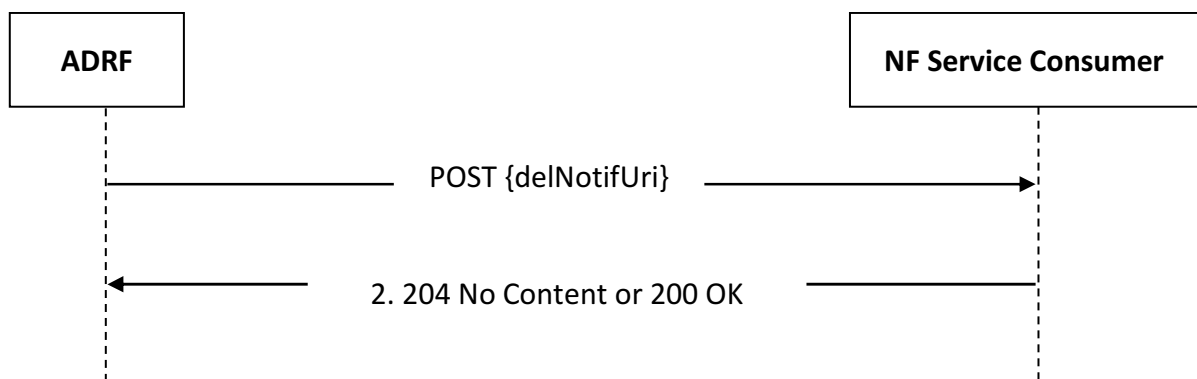


Figure 4.2.2.8.3-1: ADRF notifies the NF service consumer about data or analytics that are about to be deleted.

In order to notify about data or analytics that are about to be deleted, the ADRF shall invoke the NadrDataManagement_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 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 NadrAlertNotification 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 NadrAlertNotification 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 NadrAlertNotificationResponse 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 Nadrif_DataManagement_RetrievalRequest service operation as defined in clause 4.2.2.5, using the storage transaction identifier received within the "alertStorTransId" attribute of the NadrifAlertNotification, in order to retrieve the data or analytics that are about to be deleted.

4.2.2.9 Nadrif_DataManagement_Delete service operation

4.2.2.9.1 General

The Nadrif_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.

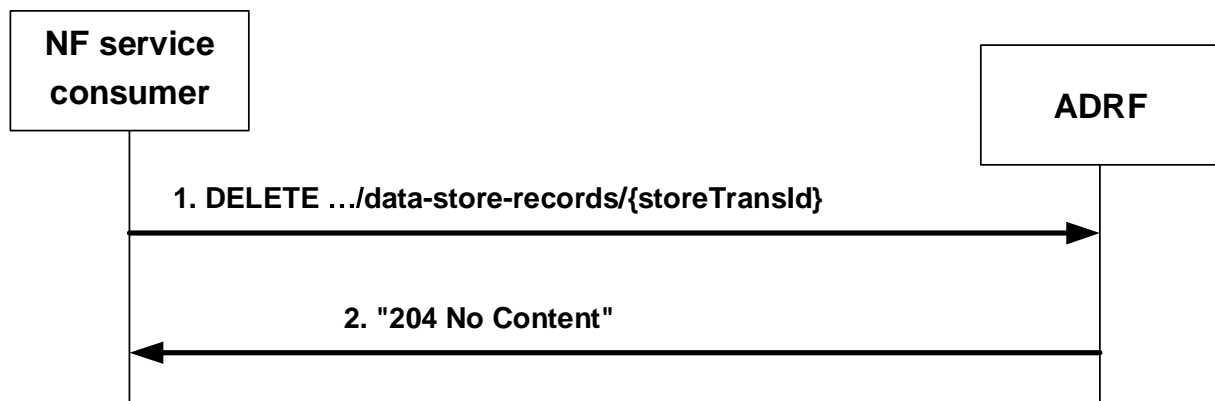


Figure 4.2.2.9.2-1: NF service consumer requesting to remove stored data or analytics

The NF service consumer shall invoke the Nadrif_DataManagement_Delete service operation to remove stored data or analytics. The NF service consumer shall send an HTTP DELETE request with "{apiRoot}/nadrif-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}/nadrif-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.

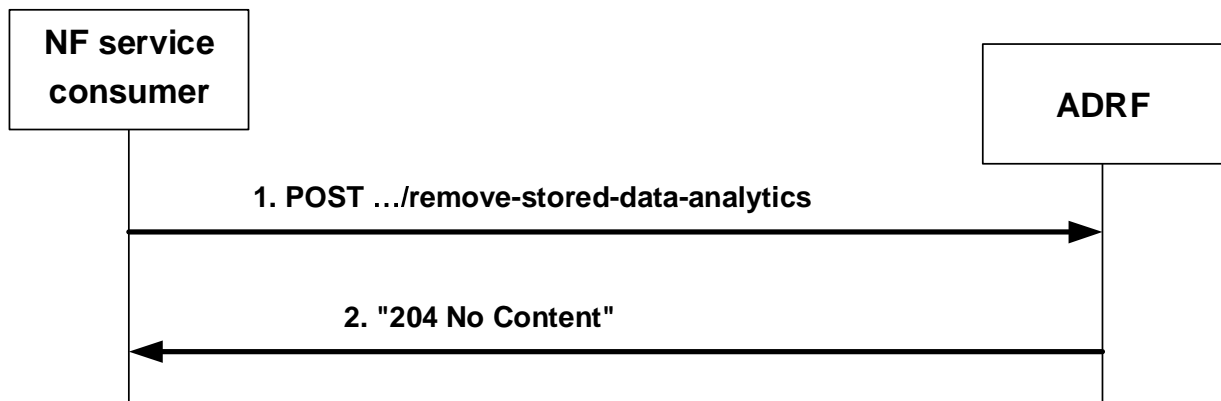


Figure 4.2.2.9.3-1: NF service consumer requesting to remove stored data or analytics

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 Ndrf_MLModelManagement service is part of the Ndrf service-based interface exhibited by the Analytics Data Repository Function (ADRF).

Known consumers of the Ndrf_MLModelManagement service are:

- Network Data Analytics Function (NWDAF)
- Location Management Function (LMF)

The Ndrf_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.

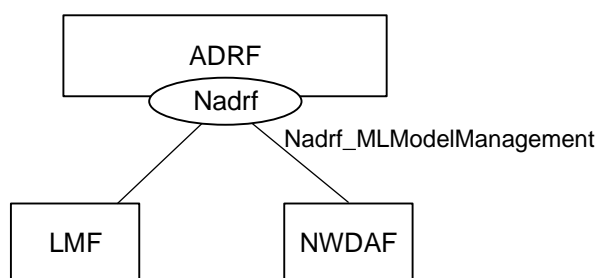


Figure 4.3.1.2-1: Reference Architecture for the Ndrf_MLModelManagement Service; SBI representation

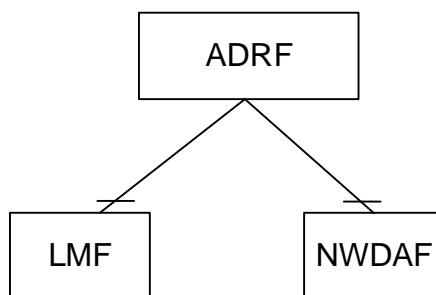


Figure 4.3.1.2-2: Ndrf_MLModelManagement service architecture, reference point representation

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.

The LMF:

- supports retrieving of ML model(s) from the 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_RetrieveRequest | This service operation is used by an NF to retrieve stored ML model(s) from the ADRF. | NF service consumer (NWDAF, LMF) |
| 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).

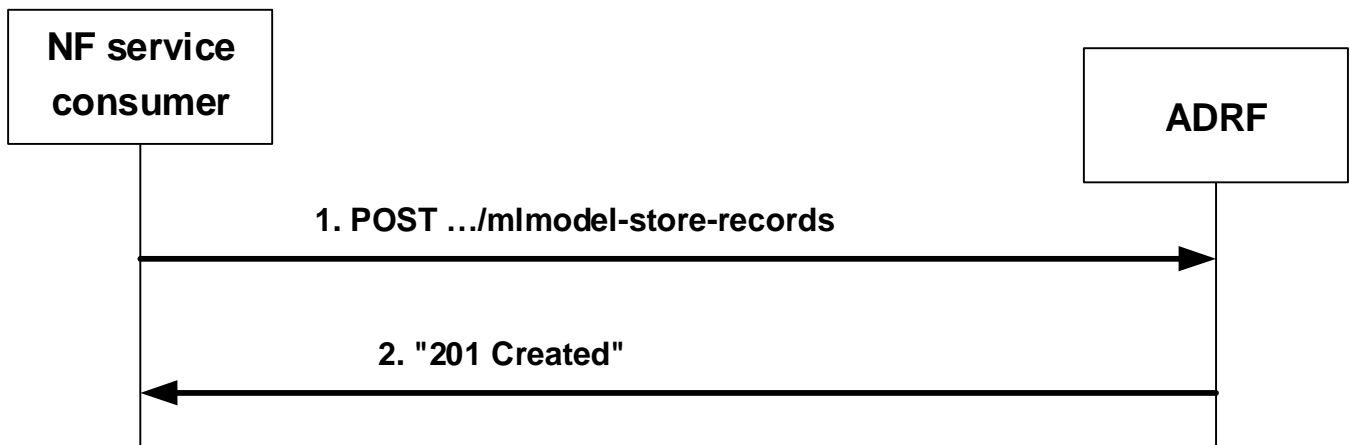


Figure 4.3.2.2.2-1: NF service consumer requesting to store ML model(s)

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 NadrfMLModelStoreRecord data structure provided in the request body as described in clause 5.2.3.2.3.1 and clause 5.2.6.2.2.

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 the ML model storage result within the "modelStoreResult" attribute or "modelStoreResults" attribute if the "EnModelMgmt" feature is supported in the response. The ADRF shall include a Location HTTP header field, which shall contain the URI of the created record i.e. "{apiRoot}/nadr- 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).

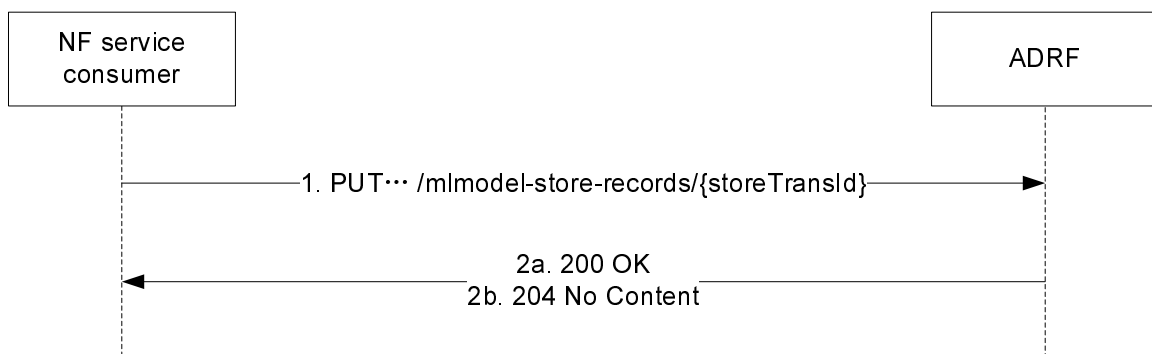


Figure 4.3.2.2.3-1: NF service consumer requesting to update ML model(s)

The NF service consumer shall invoke the Nadr-MLModelManagement_StorageRequest service operation to update ML model(s). The NF service consumer shall send an HTTP PUT request with "{apiRoot}/nadr-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 Nadr-MLModelStoreRecord data structure provided in the request body as described in clause 5.2.3.3.3.2 and clause 5.2.6.2.2.

Upon the reception of an HTTP PUT request with "{apiRoot}/nadr-mlmodelmanagement/<apiVersion>/mlmodel-store-records/{storeTransId}" as Resource URI and Nadr-MLModelStoreRecord 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 the storage of the ML models provided in the "mlModelInfo" attribute or "mlModels" attribute of the request partially failed, the ADRF may include the ML model storage result within the "modelStoreResult" attribute or "modelStoreResults" attribute if the "EnModelMgmt" feature is supported in the response.

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 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 Ndrf_MLModelManagement_RetrievalRequest service operation

4.3.2.3.1 General

The Ndrf_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).

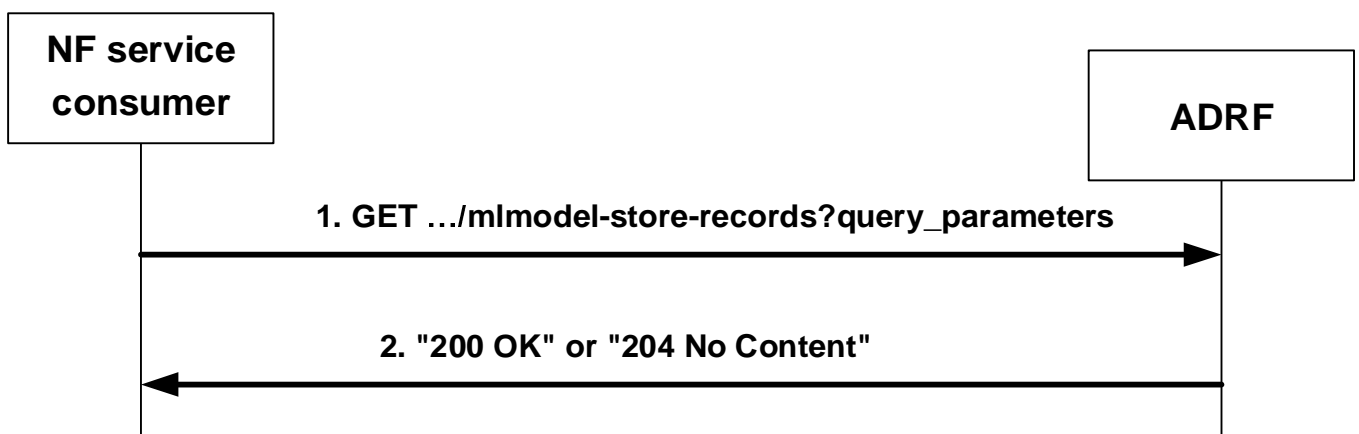


Figure 4.3.2.3.2-1: NF service consumer requesting to retrieve stored ML model(s)

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. When the "EnhModelMgmt" feature is supported, if the retrieval of the ML models provided in the "store-trans-id" or "model-unique-ids" query parameters of the request partially failed, the ADRF may include information about the models that failed to be retrieved within the "modelStoreResult" attribute in the response.

If the retrieval of all the ML models provided in the "mlModelInfo" attribute or "mlModels" attribute of the request failed:

- 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).

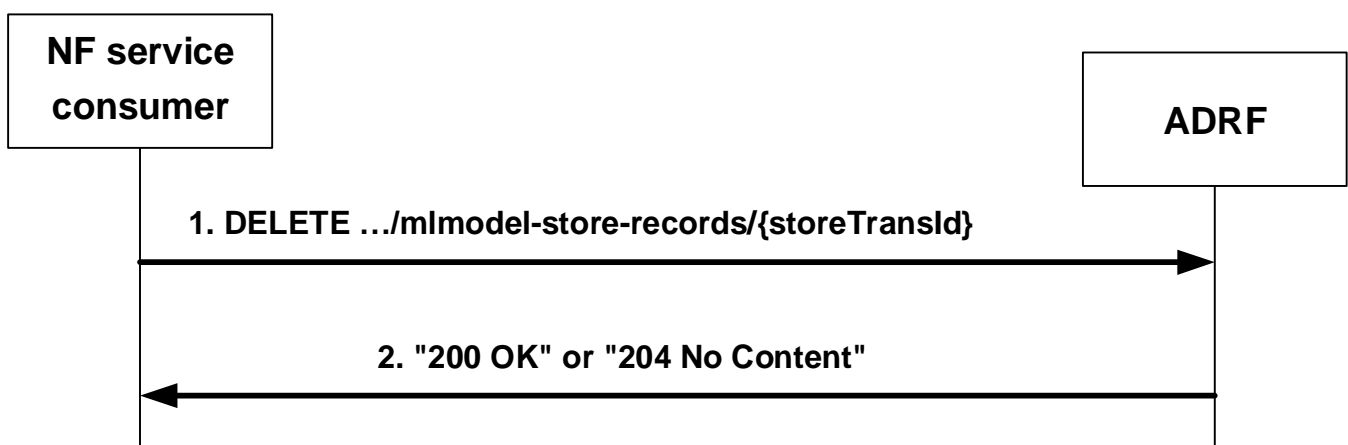


Figure 4.3.2.4.2-1: NF service consumer requesting to remove stored ML model(s)

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.

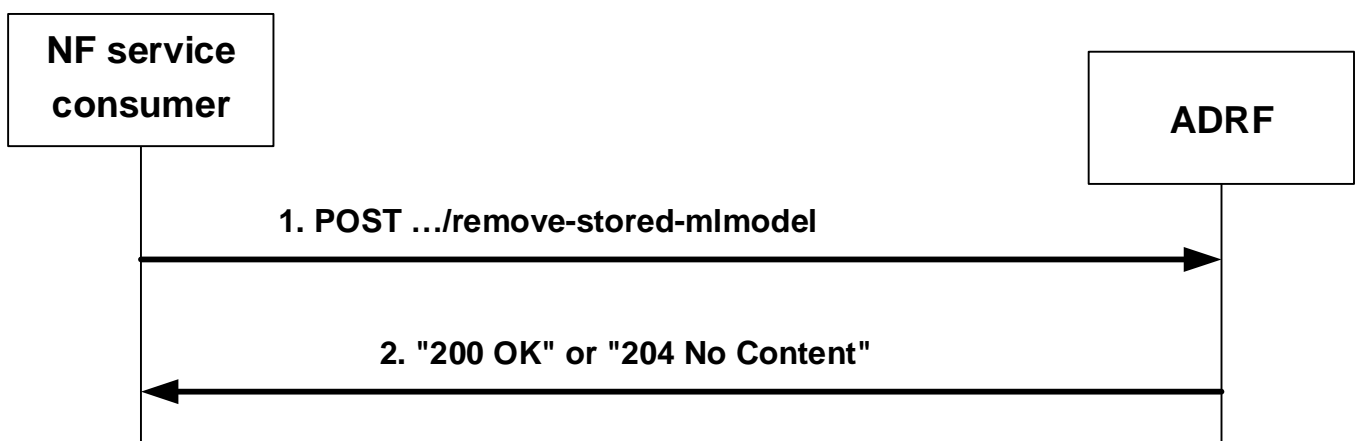


Figure 4.3.2.4.3-1: NF service consumer requesting to remove stored ML model(s)

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 as described in clause 5.2.4.4.

Upon the reception of an HTTP POST request with "{apiRoot}/nadrflmlmodelmanagement/<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 NadrflDataManagement Service API

5.1.1 Introduction

The NadrflDataManagement service shall use the NadrflDataManagement API.

The API URI of the NadrflDataManagement 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 "nadrfl-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 NadrflDataManagement 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 Ndrf_DataManagement API.

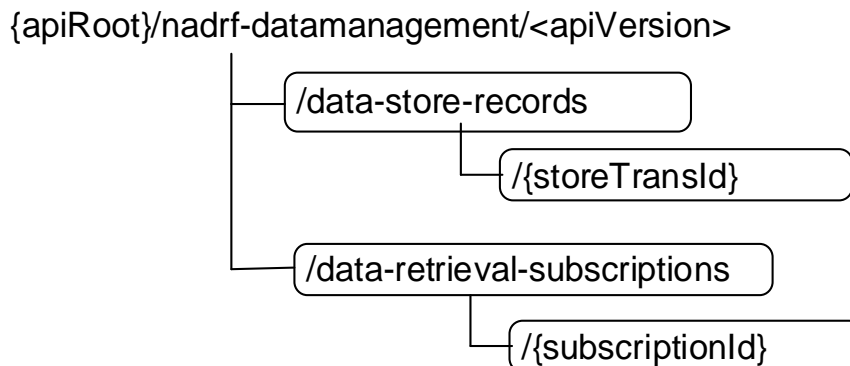


Figure 5.1.3.1-1: Resource URI structure of the Ndrf_DataManagement API

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 Record 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 Ndrf_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}/ndrf-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 |
|---------------------|---|-------------|------------------------------------------------|
| NdrfDataStoreRecord | 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 5.2.7.1-1 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 Ndrf_DataManagement_StorageRequest in ADRF.

5.1.3.3.2 Resource Definition

Resource URI: {apiRoot}/ndrf-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 Nadrif_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}/nadrif-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 |
|---------------------------------|---|-------------|---------------------------------------------------------------------|
| NadrifDataRetrievalSubscription | 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 |
|---------------------------------|---|-------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| NadrifDataRetrievalSubscription | 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}/nadr-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 Nadr_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}/nadr-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 Nadr_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 Retrieval Subscription deletion. (NOTE 2) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection, during Individual ADRF Data Retrieval Subscription 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 Nadrif_DataManagement service is shown in Figure 5.1.4.1-1.

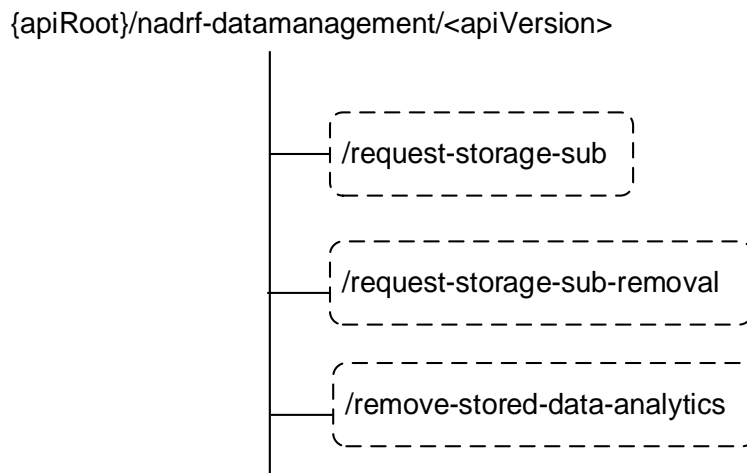


Figure 5.1.4.1-1: Custom operation URI structure of the Nadrf_DataManagement API

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 5.2.7.1-1 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 5.1.4.2.2-3: 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 5.2.7.1-1 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 5.1.4.3.2-3: 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 |
|----------------------|---|-------------|--------------------------------------------------------------------------|
| NadrfStoredData Spec | 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 5.2.7.1-1 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 5.1.4.4.2-3: 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 Ndrf_DataManagement API.

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

Table 5.1.6.1-1: Nadrif_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. | |
| NadrifAlertNotification | 5.1.6.2.11 | Contains information about data or analytics that are about to be deleted. | EnhDataMgmt |
| NadrifAlertNotificationResponse | 5.1.6.2.12 | Contains information about the planned action upon receiving an alert. | EnhDataMgmt |
| NadrifDataRetrievalNotification | 5.1.6.2.5 | Represents a notification that corresponds with an Individual ADRF Data Retrieval Subscription resource. | |
| NadrifDataRetrievalSubscription | 5.1.6.2.4 | Represents an Individual ADRF Data Retrieval Subscription resource. | |
| NadrifDataStoreRecord | 5.1.6.2.2 | Represents an Individual ADRF Data Store Record resource. | |
| NadrifDataStoreSubscription | 5.1.6.2.3 | Contains information to be used by the ADRF to create a Data or Analytics subscription. | |
| NadrifDataStoreSubscriptionRef | 5.1.6.2.6 | Contains a reference to a request for a Data or Analytics subscription. | |
| NadrifStoredDataSpec | 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 Nadrif_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 Nadrif_DataManagement service based interface.

Table 5.1.6.1-2: Ndrf_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 |
| LmfDataExposureNotification | 3GPP TS 29.572 [29] | Represents an LMF data exposure event notification. | LmfEvents |
| LmfDataExposureSubscription | 3GPP TS 29.572 [29] | Represents an LMF data exposure subscription. | LmfEvents |
| 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. | |
| NfInstancelid | 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 an SMF event subscription. | |
| NsmfEventExposureNotification | 3GPP TS 29.508 [17] | Represents an SMF event notification. | |
| PcEventExposureNotif | 3GPP TS 29.523 [30] | Represents a PCF event notification. | PcfEvents |
| PcEventExposureSubsc | 3GPP TS 29.523 [30] | Represents a PCF event subscription. | PcfEvents |
| 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 an NSACF event subscription. | |
| SubscriptionData | 3GPP TS 29.510 [10] | Represents an NRF event subscription. | |
| SupportedFeatures | 3GPP TS 29.571 [16] | 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: NdrfDataStoreRecord

Table 5.1.6.2.2-1: Definition of type NdrfDataStoreRecord

| 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 | Contains the list of supported features among the ones defined in clause 5.1.8. This attribute shall be provided only when feature negotiation needs to take place. | |
| 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: NdrfDataStoreSubscription

Table 5.1.6.2.3-1: Definition of type NdrfDataStoreSubscription

| 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. | |
| proclInstruct | ProcessingInstruction | O | 0..1 | Processing instructions to be used for sending event notifications. (NOTE 3) | |
| multiProclInstructs | 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 |
| supFeat | SupportedFeatures | C | 0..1 | Contains the list of supported features among the ones defined in clause 5.1.8. This attribute shall be provided only when feature negotiation needs to take place. | |

NOTE 1: Exactly one of these attributes shall be provided.

NOTE 2: One of "targetNfId" and "targetNfSetId" shall be provided.

NOTE 3: The "multiProclInstructs" attribute shall be used instead of the "proclInstruct" attribute when the "MultiProcessingInstruction" feature is supported.

5.1.6.2.4 Type: NadrDataRetrievalSubscription

Table 5.1.6.2.4-1: Definition of type NadrDataRetrievalSubscription

| 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 Nadr_DataManagement Service. The default value is "false". | |
| suppFeat | SupportedFeatures | C | 0..1 | Contains the list of supported features among the ones defined in clause 5.1.8. This attribute shall be provided only when feature negotiation needs to take place. | |

NOTE 1: Exactly one of these attributes shall be provided.

5.1.6.2.5 Type: NadrDataRetrievalNotification

Table 5.1.6.2.5-1: Definition of type NadrDataRetrievalNotification

| 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(NnwdaEventsSubscriptionNotification) | 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: NadrDataStoreSubscriptionRef

Table 5.1.6.2.6-1: Definition of type NadrDataStoreSubscriptionRef

| 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 |
| supFeat | SupportedFeatures | C | 0..1 | Contains the list of supported features among the ones defined in clause 5.1.8. This attribute shall be provided only when feature negotiation needs to take place. | |

NOTE: One of the "transRefId" and "dataSetId" attributes shall be provided.

5.1.6.2.7 Type: NdrfStoredDataSpec

Table 5.1.6.2.7-1: Definition of type NdrfStoredDataSpec

| 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 |
| lmfDataSub | LmfDataExposureSubscription | C | 0..1 | Represents requested LMF Events subscription. (NOTE) | LmfEvents |
| pcfDataSub | PcEventExposureSubsc | C | 0..1 | Represents requested PCF Events subscription. (NOTE) | PcfEvents |

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 |
| lmfEventNotifs | array(LmfDataExposureNotification) | C | 1..N | List of notifications on LMF event(s). (NOTE 1) | LmfEvents |
| pcfEventNotifs | array(PcEventExposureNotif) | C | 1..N | List of notifications on PCF event(s). (NOTE 1) | PcfEvents |
| 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 in the case of NRF events or 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 PcfEvents feature is supported, within the PcEventNotification contained in the PcEventExposureNotif data type, or, if the LocEvents feature is supported, the "timestampOfLocationEstimate" attribute within EventNotifyData, or, if the LmfEvents feature is supported, the "timeStamp" attribute within the LmfDataExposureNotification, 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. | |
| delNotifCorrld | 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: NadrAlertNotification

Table 5.1.6.2.11-1: Definition of type NadrAlertNotification

| 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. | |
| delNotifCorrld | string | M | 1 | Notification correlation identifier for the alert. | |

5.1.6.2.12 Type: NadrAlertNotificationResponse

Table 5.1.6.2.12-1: Definition of type NadrAlertNotificationResponse

| 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 Ndrf_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 Ndrf_DataManagement API.

5.1.7.2 Protocol Errors

No specific procedures for the Ndrf_DataManagement service are specified.

5.1.7.3 Application Errors

The application errors defined for the Ndrf_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 Ndrf_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 | LmfEvents | This feature indicates the support of LMF data exposure events. |
| 6 | PcfEvents | This feature indicates the support of PCF event exposure events. |

5.1.9 Security

As indicated in 3GPP TS 33.501 [8] and 3GPP TS 29.500 [4], the access to the Ndrf_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 Ndrf_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 Ndrf_DataManagement service.

The Ndrf_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 Ndrf_DataManagement API

| Scope | Description |
|------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| "ndrf-datamanagement" | Access to the Ndrf_DataManagement API |
| "ndrf-datamanagement:storage-read-delete-subs" | Access to service operations applying to Ndrf_DataManagement_StorageSubscriptionRequest, Ndrf_DataManagement_StorageSubscriptionRemoval, Ndrf_DataManagement_RetrievalRequest, Ndrf_DataManagement_RetrievalSubscribe, Ndrf_DataManagement_RetrievalUnsubscribe, Ndrf_DataManagement_RetrievalNotify, Ndrf_DataManagement_Delete service operations. |

5.2 Ndrf_MLModelManagement Service API

5.2.1 Introduction

The Ndrf_MLModelManagement service shall use the Ndrf_MLModelManagement API.

The API URI of the Ndrf_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 "ndrf-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 Ndrf_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 Ndrf_MLModelManagement API.

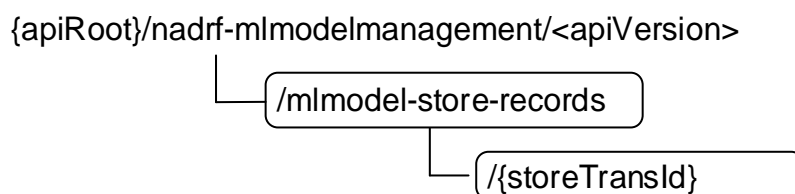


Figure 5.2.3.1-1: Resource URI structure of the Ndrf_MLModelManagement API

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 NadrMLModelManagement 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}/nadrmlmodelmanagement/<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 |
|------------------------|---|-------------|----------------------------------------------------|
| NadrMLModelStoreRecord | 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 |
|------------------------------------------------------------------------------------------------------------------------------|---|-------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| NadrMLModelStoreRecord | 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 5.2.7.1-1 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) |
| supported-features | SupportedFeatures | O | 0..1 | The features supported by the NF service consumer. |

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 Nadrif_MLModelManagement_StorageRequest in ADRF.

5.2.3.3.2 Resource Definition

Resource URI: {apiRoot}/nadrif-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 Nadrif_MLModelManagement service is shown in Figure 5.2.4.1-1.

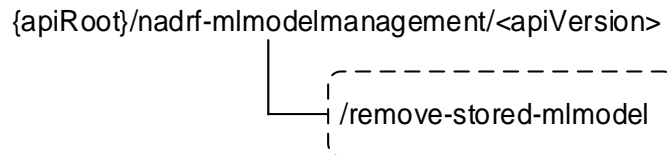


Figure 5.2.4.1-1: Custom operation URI structure of the Nadrif_MLModelManagement API

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}/nadrif-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 5.2.7.1-1 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]). | | | | |

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 Ndrf_MLModelManagement API.

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

Table 5.2.6.1-1: Ndrf_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. | |
| NdrfMLModelStoreRecord | 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 Ndrf_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/retrieval result. | |
| StoreResult | 5.2.6.3.2 | Indicates the result of the store/retrieval operation. | |

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

Table 5.2.6.1-2: Ndrf_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: NdrfMLModelStoreRecord

Table 5.2.6.2.2-1: Definition of type NdrfMLModelStoreRecord

| Attribute name | Data type | P | Cardinality | Description | Applicability |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| nfInstanceld | NfInstanceld | 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 | ModelStoreResult | O | 0..1 | Indicates the result of the store operation. If the "EnModelMgmt" feature is supported, the attribute also indicates the failure cause of the retrieval operation. (NOTE 3) | |
| modelStoreResults | array(ModelStoreResult) | O | 1..N | Indicates the result of the store operation. (NOTE 3) | EnModelMgmt |
| suppFeat | SupportedFeatures | C | 0..1 | Contains the list of supported features among the ones defined in clause 5.2.8. This attribute shall be provided only when feature negotiation needs to take place. | |
| <p>NOTE 1: One of "nfInstanceld" and "nfSetId" attributes shall be provided.</p> <p>NOTE 2: Any of the "mlModelInfo" and "mlModels" attributes shall be provided.</p> <p>NOTE 3: The "modelStoreResult" and "modelStoreResults" attributes are only applicable to the response to an Ndrf_MLModelManagement_StorageRequest service operation. The "modelStoreResults" attribute shall be used instead of the "modelStoreResult" attribute when the "EnModelMgmt" feature is supported. If the "EnModelMgmt" feature is supported, this attribute is also applicable to the response to an Ndrf_MLModelManagement_RetrievalRequest service operation.</p> | | | | | |

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 |
|-------------------|------------------------|---|-------------|---------------------------------------------------|---------------|
| modelUniqueld | UInteger | M | 1 | Unique ML Model identifier | |
| mlModel | Binary | M | 1 | Represents an ML model. The value is out of 3GPP. | |
| allowConsumerList | array(AllowedConsumer) | O | 1..N | The allowed NF consumer list for the ML model. | EnModelMgmt |

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 |
|----------------|--------------|---|-------------|----------------------------------------------|---------------|
| modelUniqueld | 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 |
|-------------------------------------------------------------------------|--------------|---|-------------|------------------------------------|---------------|
| nfInstanceld | NfInstanceld | C | 0..1 | Identification of NF instance. | |
| nfSetId | NfSetId | C | 0..1 | Identification of NF instance set. | |
| NOTE: One of "nfInstanceld" 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 |
|----------------|-------------|---|-------------|---------------------------------------------|---------------|
| modelUniqueld | 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 the failure cause of ML model storage is because the ML model file address was not found. | |
| ML_MODEL_FILE_DOWNLOAD_FAILED | Indicates the failure cause of ML model storage is because the download of the ML model file failed. | |
| RETRIEVAL_ML_MODEL_NOT_ALLOWED | Indicates the failure cause of ML model retrieval is because the retrieval of the ML model is not allowed. | EnModelMgmt |

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 Nadr_f_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 Nadr_f_MLModelManagement API.

5.2.7.2 Protocol Errors

No specific procedures for the Nadr_f_MLModelManagement service are specified.

5.2.7.3 Application Errors

The application errors defined for the Nadr_f_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 request 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 Nadr_f_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 |
|----------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | EnModelMgmt | This feature indicates the enhancement of ML model management, including: <ul style="list-style-type: none">- supporting allowed NF consumer list for the ML model (not downloaded by the ADRF).- supporting multiple model storage results.- supporting partial failure for ML models retrieval. |

5.2.9 Security

As indicated in 3GPP TS 33.501 [8] and 3GPP TS 29.500 [4], the access to the Nadrif_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 Nadrif_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 Nadrif_MLModelManagement service.

The Nadrif_MLModelManagement API defines a single scope "nadrif-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 Ndrf_DataManagement API

```

openapi: 3.0.0
info:
  version: 1.2.0
  title: Ndrf_DataManagement
  description: |
    ADRF Data Management Service.
    © 2025, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.
externalDocs:
  description: 3GPP TS 29.575 V19.5.0; 5G System; Analytics Data Repository Services; Stage 3.
  url: 'https://www.3gpp.org/ftp/Specs/archive/29_series/29.575/'
#
servers:
- url: '{apiRoot}/ndrf-datamanagement/v1'
  variables:
    apiRoot:
      default: https://example.com
      description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501.
#
security:
- oAuth2ClientCredentials:
  - ndrf-datamanagement
- {}
#
paths:
  /data-store-records:
    post:
      summary: Creates a new Individual Data Store Record resource.
      operationId: CreateADRFDDataStoreRecord
      tags:
        - ADRF Data Store Records (Collection)
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NdrfDataStoreRecord'
            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}/ndrf-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:

```

```

- nadrž-datamanagement
- oAuth2ClientCredentials:
- nadrž-datamanagement
- nadrž-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: CreateADRFDDataRetrievalSubscription
    tags:
      - ADRF Data Retrieval Subscriptions (Collection)
    security:
      - {}
      - oAuth2ClientCredentials:
          - nadrž-datamanagement
      - oAuth2ClientCredentials:
          - nadrž-datamanagement
          - nadrž-datamanagement:storage-read-delete-subs
    requestBody:
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/NadržDataRetrievalSubscription'
          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}/nadrž-datamanagement/<apiVersion>/data-retrieval-
subscriptions/{subscriptionId}
            required: true
            schema:
              type: string
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NadržDataRetrievalSubscription'
      '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 Ndrf_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:
          - ndrfdatamanagement
      - oAuth2ClientCredentials:
          - ndrfdatamanagement
          - ndrfdatamanagement:storage-read-delete-subs
    requestBody:
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/NdrfDataStoreSubscription'
      required: true
    responses:
      '200':
        description: >
          Successful response with reference used to identify the subscription at the ADRF.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NdrfDataStoreSubscriptionRef'
      '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'
#
NdrfDataRetrievalSubscription:
  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 Ndrf_DataManagement Service.
    suppFeat:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
#
NdrfDataRetrievalNotification:
  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]
    - required: [lmfDataSub]
    - required: [pcfDataSub]
  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'
  lmfDataSub:
    $ref: 'TS29572_Nlmf_DataExposure.yaml#/components/schemas/LmfDataExposureSubscription'
  pcfDataSub:
    $ref: 'TS29523_Npcf_EventExposure.yaml#/components/schemas/PcEventExposureSubsc'
#
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]
    - required: [lmfEventNotifs]
    - required: [pcfEventNotifs]
  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.
  lmfEventNotifs:
    type: array
    items:
      $ref: 'TS29572_Nlmf_DataExposure.yaml#/components/schemas/LmfDataExposureNotification'
    minItems: 1
    description: List of notifications of LMF events.
  pcfEventNotifs:
    type: array
    items:
      $ref: 'TS29523_Npcf_EventExposure.yaml#/components/schemas/PcEventExposureNotif'
    minItems: 1
    description: List of notifications of PCF 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: 1.1.0
  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 V19.5.0; 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: CreateADRFFMLModelStoreRecord
      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'
    - name: supported-features
      description: The features supported by the NF service consumer.
      in: query
      required: false
      schema:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
  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'
      modelStoreResults:
        type: array
        items:
          $ref: '#/components/schemas/ModelStoreResult'
        minItems: 1
        description: Indicates the multiple model storage results.
#
  MLModelInfo:
    description: Represents information 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 information 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 information 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'
    allowConsumerList:
      type: array
      items:
        $ref: '#/components/schemas/AllowedConsumer'
      minItems: 1
      description: The allowed consumer list of the ML Model.
#
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

```

```
- RETRIEVAL_ML_MODEL_NOT_ALLOWED
- 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 the failure cause of ML model storage is
      because the ML model file address was not found.
    - ML_MODEL_FILE_DOWNLOAD_FAILED: Indicates the failure cause of ML model storage is
      because the download of the ML model file failed.
    - RETRIEVAL_ML_MODEL_NOT_ALLOWED: Indicates the failure cause of ML model retrieval is
      because the retrieval of the ML model is not allowed.
```

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 Nadr_ DataManagement data model | 17.1.0 |
| 2022-06 | CT#96 | CP-221132 | 0003 | 1 | F | Corrections in the Nadr_ 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 Nadr_ 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 Nadr_ 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 Nadr_ 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 Nadr_ DataManagement_RetrievalNotify service | 17.2.0 |
| 2022-09 | CT#97e | CP-222103 | 0022 | 1 | F | Corrections in descriptions of the Nadr_ 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 Nadr_ DataManagement_RetrievalSubscribe | 18.0.0 |
| 2022-12 | CT#98e | CP-223176 | 0034 | 1 | F | Correction of data type of proclnstruct | 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 Nadr_ 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 Application 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 |
| 2024-09 | CT#105 | CP-242118 | 0089 | 1 | F | Completion of Introduction tables | 19.0.0 |
| 2024-09 | CT#105 | CP-242124 | 0090 | | F | Correction to security of NadrF_DataManagement API | 19.0.0 |
| 2024-09 | CT#105 | CP-242124 | 0091 | | F | Support of feature negotiation at ML Model retrieval from ADRF | 19.0.0 |
| 2024-09 | CT#105 | CP-242124 | 0092 | | F | ADRF API corrections | 19.0.0 |
| 2024-09 | CT#105 | CP-242113 | 0096 | | F | Update of info and externalDocs fields | 19.0.0 |
| 2024-12 | CT#106 | CP-243088 | 0097 | 1 | B | Adding allowConsumerList for ML model | 19.1.0 |
| 2024-12 | CT#106 | CP-243088 | 0098 | | F | Correction of resource name | 19.1.0 |
| 2024-12 | CT#106 | CP-243090 | 0099 | | F | Naming misspelling for ADRF Data Management | 19.1.0 |
| 2024-12 | CT#106 | CP-243090 | 0100 | | F | Naming misspelling for ADRF ML Model Management | 19.1.0 |
| 2024-12 | CT#106 | CP-243095 | 0101 | 1 | B | Adding LMF as LM model training and performance monitoring data source | 19.1.0 |
| 2024-12 | CT#106 | CP-243147 | 0102 | | F | Update of info and externalDocs fields | 19.1.0 |
| 2025-03 | CT#107 | CP-250083 | 0103 | 1 | B | Adding PCF as data source | 19.2.0 |
| 2025-03 | CT#107 | CP-250083 | 0104 | 1 | B | Adding LMF as consumer of NadrF_MLModelManagement_RetrievalRequest service operation | 19.2.0 |
| 2025-03 | CT#107 | CP-250130 | 0107 | | F | Update of info and externalDocs fields | 19.2.0 |
| 2025-06 | CT#108 | CP-251088 | 0108 | 1 | B | Support of multiple model storage results | 19.3.0 |
| 2025-06 | CT#108 | CP-251088 | 0109 | 1 | B | failure case for ML model update | 19.3.0 |
| 2025-06 | CT#108 | CP-251088 | 0110 | 1 | B | partial failure for ML model retrieval | 19.3.0 |
| 2025-06 | CT#108 | CP-251086 | 0111 | | B | Enhancements on the consumers of NadrF_MLModelManagement Service | 19.3.0 |
| 2025-06 | CT#108 | CP-251089 | 0112 | 2 | F | Enhancement on the ML model Storage service description | 19.3.0 |
| 2025-06 | CT#108 | CP-251232 | 0115 | | F | Update of info and externalDocs fields | 19.3.0 |
| 2025-09 | CT#109 | CP-252114 | 0117 | | F | Update of info and externalDocs fields | 19.4.0 |
| 2025-12 | CT#110 | CP-253029 | 0118 | 1 | F | TS reference correction | 19.5.0 |
| 2025-12 | CT#110 | CP-253029 | 0119 | | F | Corrections to Supported Features | 19.5.0 |
| 2025-12 | CT#110 | CP-253065 | 0122 | | F | Update of info and externalDocs fields | 19.5.0 |

History

| Version | Date | Status |
|----------------|---------------|---------------|
| V19.4.0 | January 2026 | Publication |
| V19.5.0 | February 2026 | Publication |
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