

ETSI TS 129 542 V16.3.0 (2021-01)



**LTE;
5G;
5G System;
Session management services for Non-IP Data Delivery (NIDD);
Stage 3
(3GPP TS 29.542 version 16.3.0 Release 16)**



Reference

RTS/TSGC-0429542vg30

Keywords

5G,LTE

ETSI

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Foreword

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

- shall** indicates a mandatory requirement to do something
- shall not** indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

- should** indicates a recommendation to do something
- should not** indicates a recommendation not to do something
- may** indicates permission to do something
- need not** indicates permission not to do something

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

- can** indicates that something is possible
- cannot** indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

- 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.

1 Scope

The present document specifies the stage 3 protocol and data model for the Nsmf Service Based Interfaces for Non-IP Data Delivery (NIDD). It provides stage 3 protocol definitions and message flows, and specifies the API for the service offered by the SMF.

The 5G System stage 2 architecture and procedures are specified in 3GPP TS 23.501 [2] 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 7540: "Hypertext Transfer Protocol Version 2 (HTTP/2)".
- [12] IETF RFC 8259: "The JavaScript Object Notation (JSON) Data Interchange Format".
- [13] IETF RFC 7807: "Problem Details for HTTP APIs".
- [14] 3GPP TS 29.541: "5G System (5GS); Network Exposure (NE) function services for Non-IP Data Delivery (NIDD); Stage 3".
- [15] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces; Stage 3".

3 Definitions, symbols and abbreviations

3.1 Terms

Void.

3.2 Symbols

Void.

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].

5GC	5G Core Network
AMF	Access and Mobility Management Function
H-SMF	Home SMF
I-SMF	Intermediate SMF
NEF	Network Exposure Function
NIDD	Non-IP Data Delivery
MT	Mobile Terminated
SMF	Session Management Function
V-SMF	Visited SMF

4 Overview

4.1 Introduction

Within the 5GC, the SMF offers services to the AMF, other SMF (V-SMF, H-SMF or I-SMF), PCF and NEF via the Nsmf service based interface (see 3GPP TS 23.501 [2] and 3GPP TS 23.502 [3]).

Figure 4.1-1 provides the reference model (in service based interface representation and in reference point representation), with focus on the SMF and the scope of the present specification.

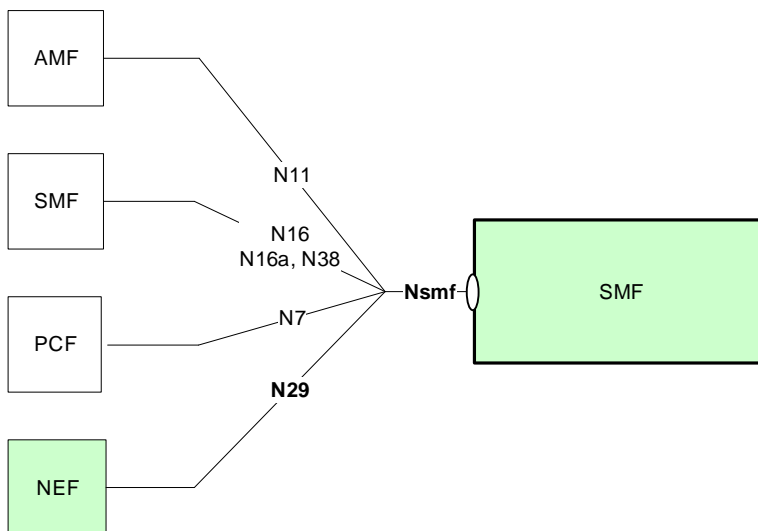


Figure 4.1-1: Reference model – SMF

N29 is the reference point between the (H-)SMF and the NEF.

The functionalities supported by the SMF are listed in clause 6.2.2 of 3GPP TS 23.501 [2].

5 Services offered by the SMF for NIDD

5.1 Introduction

The SMF supports the following service(s) for NIDD.

Table 5.1-1: NF Service(s) provided by SMF for NIDD

Service Name	Description	Example Consumer
Nsmf_NIDD	This service allows the NF consumer NF to deliver NIDD MT data to PDU sessions.	NEF

5.2 Nsmf_NIDD Service

5.2.1 Service Description

The Nsmf_NIDD service operates on the PDU Sessions. The service operations exposed by this service allow an NF consumer (i.e. NEF) to deliver NEF anchored Mobile Terminated (MT) data for a given PDU session of a UE towards the SMF.

The Nsmf_NIDD service supports the following service operations:

Table 5.2.1-1: Service operations supported by the Nsmf_NIDD service

Service Operations	Description	Operation Semantics	Example Consumer(s)
Delivery	Deliver MT NIDD user data to the PDU session of the UE.	Request/Response	NEF

5.2.2 Service Operations

5.2.2.1 Introduction

See Table 5.2.1-1 for an overview of the service operations supported by the Nsmf_NIDD service.

5.2.2.2 Delivery

5.2.2.2.1 General

The Delivery service operation shall be used to transfer NEF anchored MT data for a given PDU session.

It is used in the following procedures:

- NEF anchored Mobile Terminated Data Transport (see clause 4.25.5 of 3GPP TS 23.502 [3]).

The NF Service Consumer (i.e. NEF) shall deliver MT data to the SMF by using the HTTP POST method ("deliver" custom operation) as shown in Figure 5.2.2.2.1-1.

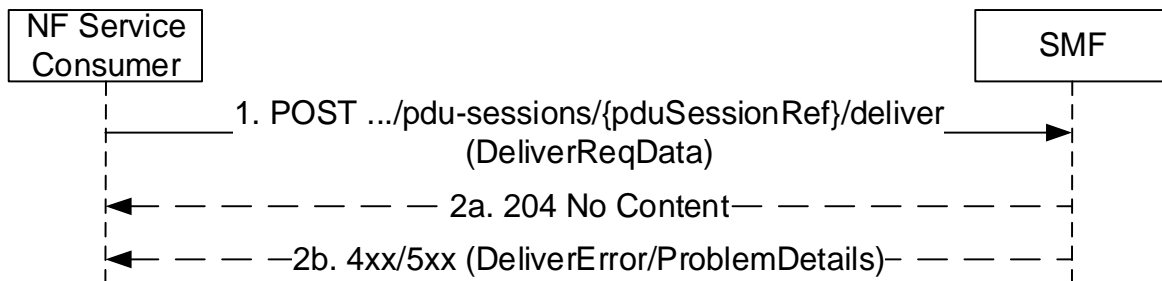


Figure 5.2.2.2.1-1: Transfer MT Data

1. The NF Service Consumer shall send a POST request to the URI of "deliver" custom operation on an Individual PDU session resource in the SMF. The payload body of the POST request shall contain the MT data to be delivered.

NOTE: The URI of the individual PDU session resource is provided by SMF to the NEF during SMF-NEF connection creation (see clause 5.2.2.2.1 of 3GPP TS 29.541 [14]).

2a. On success, "204 No Content" shall be returned.

2b. On failure, one of the HTTP status code listed in Table 6.1.3.2.4.2.2-2 shall be returned. For a 4xx/5xx response, the message body may contain a DeliverError or ProblemDetails object, with the "cause" attribute indicating the cause of the failure. If Estimated Maximum Waiting Time is received from AMF, the SMF shall include it in the message body.

6 API Definitions

6.1 Nsmf_NIDD Service API

6.1.1 Introduction

The Nsmf_NIDD service shall use the Nsmf_NIDD API.

The API URI of the Nsmf_NIDD API shall be:

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

The request URI used in HTTP request 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 "nsmf-nidd".
- The <apiVersion> shall be "v1".
- The <apiSpecificResourceUriPart> shall be set as described in clause 6.1.3.

6.1.2 Usage of HTTP

6.1.2.1 General

HTTP/2, IETF RFC 7540 [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 Nsmf_NIDD API is contained in Annex A.

6.1.2.2 HTTP standard headers

6.1.2.2.1 General

The usage of HTTP standard headers shall be supported as specified in clause 5.2.2 of 3GPP TS 29.500 [4].

6.1.2.2.2 Content type

The following content types shall be supported:

- the JSON format (IETF RFC 8259 [12]). The use of the JSON format shall be signalled by the content type "application/json". See also clause 5.4 of 3GPP TS 29.500 [4].
- the Problem Details JSON Object (IETF RFC 7807 [13]). The use of the Problem Details JSON object in a HTTP response body shall be signalled by the content type "application/problem+json".

NOTE: "application/json" is used in a response that includes a payload body containing an application-specific data structure, see clause 4.8 of 3GPP TS 29.501 [5].

Multipart messages shall also be supported (see clause 6.1.2.4) using the content type "multipart/related", comprising:

- one JSON body part with the "application/json" content type; and
- one or two binary body parts with 3gpp vendor specific content subtypes.

The 3gpp vendor specific content subtypes defined in Table 6.1.2.2.2-1 shall be supported.

Table 6.1.2.2.2-1: 3GPP vendor specific content subtypes

content subtype	Description
vnd.3gpp.5gnas	Binary encoded payload, encoding a 5GS NAS message or 5G NAS IEs, as specified in 3GPP TS 24.501 [7].

See clause 6.1.6.5 for the binary payloads supported in the binary body part of multipart messages.

6.1.2.3 HTTP custom headers

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

For 3GPP specific HTTP custom headers used across all service based interfaces, see clause 5.2.3 of 3GPP TS 29.500 [4].

6.1.3 Resources

6.1.3.1 Overview

Figure 6.1.3.1-1 describes the resource URI structure of the Nsmf_NIDD API.

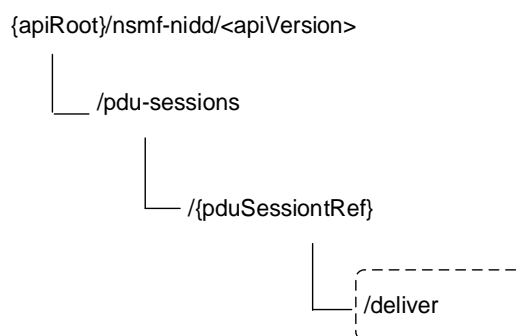


Figure 6.1.3.1-1: Resource URI structure of the Nsmf_NIDD API

Table 6.1.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 6.1.3.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method or custom operation	Description
Individual PDU session	/pdu-sessions/{pduSessionRef}/deliver	deliver (POST)	Delivery Service Operation

6.1.3.2 Resource: Individual PDU session

6.1.3.2.1 Description

This resource represents an individual PDU session created in SMF for NIDD.

This resource is modelled with the Document resource archetype (see clause C.1 of 3GPP TS 29.501 [5]).

6.1.3.2.2 Resource Definition

Resource URI: **{apiRoot}/nsmf-nidd/<apiVersion>/pdu-sessions/{pduSessionRef}**

This resource shall support the resource URI variables defined in table 6.1.3.2.2-1.

Table 6.1.3.2.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 6.1.1
apiVersion	See clause 6.1.1
pduSessionRef	PDU session reference assigned by the SMF during SMF-NEF Connection creation.

6.1.3.2.3 Resource Standard Methods

None.

6.1.3.2.4 Resource Custom Operations

6.1.3.2.4.1 Overview

Table 6.1.3.2.4.1-1: Custom operations

Custom operation URI	Mapped HTTP method	Description
{resourceUri}/deliver	POST	Delivery service operation.

6.1.3.2.4.2 Operation: deliver

6.1.3.2.4.2.1 Description

This custom operation enables to deliver NEF anchored MT data for a given PDU session towards the SMF.

6.1.3.2.4.2.2 Operation Definition

This operation shall support the request data structures specified in table 6.1.3.2.4.2.2-1 and the response data structure and response codes specified in table 6.1.3.2.4.2.2-2.

Table 6.1.3.2.4.2.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
DeliverReqData	M	1	Representation of the payload of a Deliver Request

Table 6.1.3.2.4.2.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful delivery of MT data.
DeliverError	O	0..1	504 Gateway Timeout	The "cause" attribute may be used to indicate the following application errors: - UE_NOT_REACHABLE, if the UE is not reachable to deliver the mobile terminated data; if Estimated Maximum Waiting Time shall be included if available; See table 6.1.7.3-1 for the description of these errors.
NOTE: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] other than those specified in the table above also apply, with a ProblemDetails data type when needed (see clause 5.2.7 of 3GPP TS 29.500 [4]).				

6.1.4 Custom Operations without associated resources

None

6.1.5 Notifications

None.

6.1.6 Data Model

6.1.6.1 General

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

Table 6.1.6.1-1 specifies the data types defined for the Nsmf_NIDD service based interface protocol.

Table 6.1.6.1-1: Nsmf_NIDD specific Data Types

Data type	Clause defined	Description	Applicability
DeliverReqData	6.1.6.2.2	Information within Deliver Request	
DeliverAddInfo	6.1.6.2.3	Deliver Error Response Additional Information	
DeliverError	6.1.6.4.1	Deliver Error Response	

Table 6.1.6.1-2 specifies data types re-used by the N_{<NF>} 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 N_{<NF>} service based interface.

Table 6.1.6.1-2: Nsmf_NIDD re-used Data Types

Data type	Reference	Comments	Applicability
RefToBinaryData	3GPP TS 29.571 [15]	Cross-Reference to binary data encoded within a binary body part in an HTTP multipart message.	
ProblemDetails	3GPP TS 29.571 [15]	Error description	
DurationSec	3GPP TS 29.571 [15]	Duration in units of seconds	

6.1.6.2 Structured data types

6.1.6.2.1 Introduction

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

6.1.6.2.2 Type: DeliverReqData

Table 6.1.6.2.2-1: Definition of type DeliverReqData

Attribute name	Data type	P	Cardinality	Description	Applicability
mtData	RefToBinaryData	M	1	This IE shall reference the Mobile Terminated Data (see clause 6.1.6.5.1).	

6.1.6.2.3 Type: DeliverAddInfo

Table 6.1.6.2.3-1: Definition of type DeliverAddInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
maxWaitingTime	DurationSec	C	0..1	This IE shall contain the estimated maximum wait time (see clause 4.25.5 of 3GPP 23.502 [3]).	

6.1.6.3 Simple data types and enumerations

6.1.6.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

6.1.6.3.2 Simple data types

The simple data types defined in table 6.1.6.3.2-1 shall be supported.

Table 6.1.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

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

6.1.6.4.1 Type: DeliverError

Table 6.1.6.4.1-1: Definition of type DeliverError as a list of "to be combined data types"

Data type	Cardinality	Description	Applicability
ProblemDetails	1	Detail information of the problem	
DeliverAddInfo	1	Additional information to be returned in error response.	

6.1.6.5 Binary data

6.1.6.5.1 Mobile Terminated Data

Mobile Terminated Data shall encode the Data Contents of the Payload Container specified in 3GPP TS 24.501 [7], using the vnd.3gpp.5gnas content-type, as summarized in Table 6.1.6.5.1-1.

Table 6.1.6.5.1-1: Mobile Terminated Data

Mobile Terminated Data	Reference (3GPP TS 24.501 [7])	Related NAS SM message
Payload container contents in octets 4 to n	9.11.3.39	DL NAS Transport

6.1.7 Error Handling

6.1.7.1 General

For the Nsmf_NIDD 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 Nsmf_NIDD API.

6.1.7.2 Protocol Errors

No specific procedures for the Nsmf_NIDD service are specified.

6.1.7.3 Application Errors

The common application errors defined in Table 5.2.7.2-1 of 3GPP TS 29.500 [4] may be used for the Nsmf_NIDD service.

The application errors defined for the Nsmf_NIDD service are listed in Table 6.1.7.3-1.

Table 6.1.7.3-1: Application errors

Application Error	HTTP status code	Description
UE_NOT_REACHABLE	504 Gateway Timeout	The UE is not reachable for the service.

6.1.8 Feature negotiation

The optional features in table 6.1.8-1 are defined for the Nsmf_NIDD API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 6.1.8-1: Supported Features

Feature number	Feature Name	Description

6.1.9 Security

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

The Nsmf_NIDD API defines scopes for OAuth2 authorization as specified in 3GPP TS 33.501 [15]; it defines a single scope consisting on the name of the service (i.e., "nsmf-nidd"), 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 Nsmf_NIDD Service API. 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: 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 Nsmf_NIDD API

```

openapi: 3.0.0

info:
  version: '1.0.0'
  title: 'Nsmf_NIDD'
  description: |
    SMF NIDD Service.
    © 2020, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: 3GPP TS 29.542 V16.1.0; 5G System; Session Management Services for Non-IP Data
  Delivery (NIDD); Stage 3
  url: http://www.3gpp.org/ftp/Specs/archive/29_series/29.542/

servers:
  - url: '{apiRoot}/nsmf-nidd/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501.

security:
  - {}
  - oAuth2ClientCredentials:
    - nsmf-nidd

paths:
  '/pdu-sessions/{pduSessionRef}/deliver':
    post:
      summary: Delivery Service Operation
      tags:
        - Individual PDU session
      operationId: Deliver
      parameters:
        - name: pduSessionRef
          in: path
          description: PDU session reference
          required: true
          schema:
            type: string
      requestBody:
        description: representation of the payload of Deliver Request
        required: true
        content:
          multipart/related: # message with a binary body part
            schema:
              type: object
  
```

```

    properties:
      jsonData:
        $ref: '#/components/schemas/DeliverReqData'
      binaryMtData:
        type: string
        format: binary
    encoding:
      jsonData:
        contentType: application/json
      binaryMtData:
        contentType: application/vnd.3gpp.5gnas
      headers:
        Content-Id:
          schema:
            type: string
responses:
  '204':
    description: successful transferring of Delivery
  '400':
    $ref: 'TS29571_CommonData.yaml#/components/responses/400'
  '401':
    $ref: 'TS29571_CommonData.yaml#/components/responses/401'
  '403':
    $ref: 'TS29571_CommonData.yaml#/components/responses/403'
  '404':
    $ref: 'TS29571_CommonData.yaml#/components/responses/404'
  '411':
    $ref: 'TS29571_CommonData.yaml#/components/responses/411'
  '413':
    $ref: 'TS29571_CommonData.yaml#/components/responses/413'
  '415':
    $ref: 'TS29571_CommonData.yaml#/components/responses/415'
  '429':
    $ref: 'TS29571_CommonData.yaml#/components/responses/429'
  '500':
    $ref: 'TS29571_CommonData.yaml#/components/responses/500'
  '503':
    $ref: 'TS29571_CommonData.yaml#/components/responses/503'
  '504':
    description: unsuccessful delivery of mobile terminated data - gateway timeout
    content:
      application/json:
        schema:
          $ref: '#/components/schemas/DeliverError'
default:
  $ref: 'TS29571_CommonData.yaml#/components/responses/default'

components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            nsmf-nidd: Access to the nsmf-nidd API

  schemas:
    #
    # STRUCTURED DATA TYPES
    #
    DeliverReqData:
      type: object
      properties:
        mtData:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/RefToBinaryData'
      required:
        - mtData

    DeliverAddInfo:
      type: object
      properties:
        maxWaitingTime:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'

    #
    # DATA TYPES DESCRIBING ALTERNATIVE OR COMBINATION OF DATA TYPES

```

#

```
DeliverError:  
  allOf:  
    - $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'  
    - $ref: '#/components/schemas/DeliverAddInfo'
```

Annex B (informative): Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2020-03	CT4#96-e	C4-201267				Initial Draft.	0.1.0
2020-03	CT#87e	CP-200093				Presented for information and approval	1.0.0
2020-03	CT#87e					Approved at CT#87e	16.0.0
2020-06	CT#88e	CP-201071	0001	2	F	Storage of YAML files in ETSI Forge	16.1.0
2020-06	CT#88e	CP-201046	0003		F	Miscellaneous Corrections	16.1.0
2020-06	CT#88e	CP-201073	0004		F	29.542 Rel-16 API version and External doc update	16.1.0
2020-09	CT#89e	CP-202105	0005		F	Optionality of DeliverError	16.2.0
2020-12	CT#90e	CP-203032	0007		F	YAML files in 3GPP Forge	16.3.0

History

Document history		
V16.1.0	July 2020	Publication
V16.2.0	November 2020	Publication
V16.3.0	January 2021	Publication