ETSI TS 129 551 V15.3.0 (2019-04)

TECHNICAL SPECIFICATION

5G;
5G System;
Packet Flow Description Management Service;
Stage 3
(3GPP TS 29.551 version 15.3.0 Release 15)

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Sous-Préfecture de Grasse (06) N° 7803/88

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Contents

Foreword

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

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y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

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1 Scope

The present document provides the stage 3 specification of the PFD Management Service of 5G system.

The stage 2 definition and related procedures of the PFD Management Service are contained in 3GPP TS 23.502 [3] and 3GPP TS 23.503 [4]. The 5G System Architecture is defined in 3GPP TS 23.501 [2].

The Technical Realization of the Service Based Architecture and the Principles and Guidelines for Services Definition of the 5G System are specified in 3GPP TS 29.500 [5] and 3GPP TS 29.501 [6].

The Packet Flow Description Function (PFDF) provides the PFD Management Service to the NF consumers (i.e. Session Management Function). The PFDF is functionality within the NEF.

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 23.503: "Policy and Charging Control Framework for the 5G System; Stage 2".

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

[6]   3GPP TS 29.501: "5G System; Principles and Guidelines for Services Definition; Stage 3".

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

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

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

[10]   3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces Stage 3".

[11]   3GPP TS 29.122: "T8 reference point for Northbound APIs".

[12]   3GPP TS 29.251: "Gw and Gwn reference points for sponsored data connectivity".

[13]   3GPP TS 29.510: "5G System; Network Function Repository Services; Stage 3".

[14]   3GPP TS 33.501: "Security architecture and procedures for 5G system".

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

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

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].

3.2 Abbreviations

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

JSON	JavaScript Object Notation
NEF	Network Exposure Function
NRF	Network Repository Function
PFD	Packet Flow Description
PFDF	Packet Flow Description Function
SBI	Service Based Interface
SMF	Session Management Function

4 Packet Flow Description Management Service

4.1 Service Description

4.1.1 Overview

The PFD Management Service, as defined as defined in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.503 [4], is provided by the Packet Flow Description Function (PFDF).

The only known NF Service Consumer is the SMF.

This service:

- allows an SMF to subscribe to and unsubscribe from PFD changes;

- notifies an SMF about the changed PFDs; and

- allows an SMF to retrieve PFDs.

4.1.2 Service Architecture

The 5G System Architecture is defined in 3GPP TS 23.501 [2]. The Policy and Charging related 5G architecture is also described in 3GPP TS 23.503 [4].

The PFD Management Service is provided by the PFDF to the SMF and shown in the SBI representation model in Figure 4.1.2-1. PFDF is functionality within NEF.
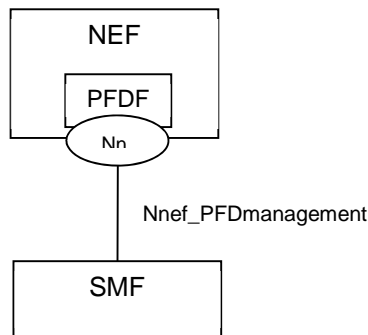
Figure 4.1.2-1: Reference Architecture for the Nnef_PFDmanagement Service; SBI representation

Figure 4.1.2-2: Reference Architecture for the Nnef_PFDmanagement Service; reference point representation

4.1.3 Network Functions

4.1.3.1 Packet Flow Description Function (PFDF)

The Packet Flow Description Function (PFDF):

- provides PFDs associated with one or more Application Identifiers; and

- allows NF consumers to subscribe to and unsubscribe from the notification of changes of PFDs for Application Identifier.

4.1.3.2 NF Service Consumers

The SMF shall support:

- requesting and receiving the PFD(s) for one or more Application Identifiers.

4.2 Service Operations

4.2.1 Introduction

Service operations defined for the Nnef_PFDmanagement Service are shown in table 4.2.1-1.

Table 4.2.1-1: Nnef_PFDmanagement Service Operations

Service Operation Name	Description	Initiated by
Nnef_PFDmanagement_Fetch	Provides the PFDs for application identifier(s) to the NF service consumer.	SMF
Nnef_PFDmanagement_Subscribe	Allows NF service consumers to subscribe the notification of events when the PFDs for application identifier change.	SMF
Nnef_PFDmanagement_Notify	Notifies NF service consumer to update and/or delete the PFDs for application identifier(s).	PFDF
Nnef_PFDmanagement_Unsubscribe	Allows NF service consumers to unsubscribe the notification of events.	SMF

4.2.2 Nnef_PFDmanagement_Fetch Service Operation

4.2.2.1 General

The Nnef_PFDmanagement_Fetch service operation provides a means for the NF service consumer to retrieve the PFDs for one or more application identifier(s).

The following procedures using the Nnef_PFDmanagement_Fetch service operation are supported:

- Retrieval of PFDs.

4.2.2.2 Retrieval of PFDs

This procedure as shown in Figure 4.2.2.2-1 is used to retrieve PFDs for an application identifier from the PFDF.
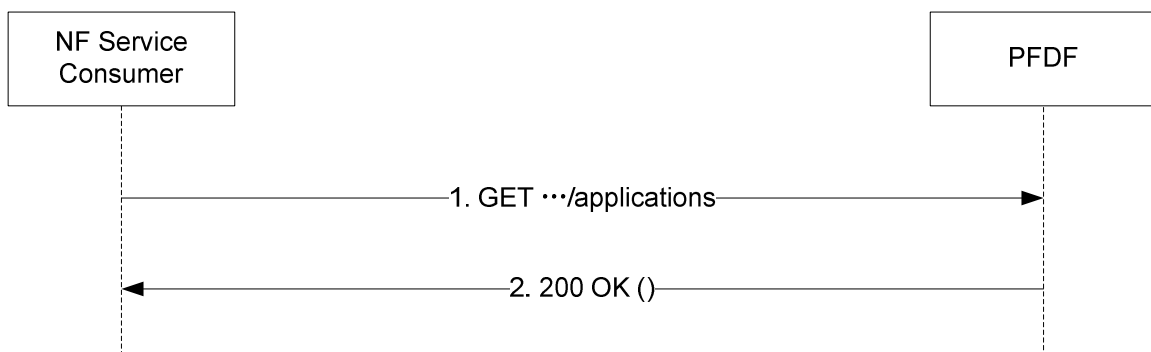
Figure 4.2.2.2-1: Retrieval of PFDs

1. The NF service consumer (i.e. SMF) shall send a GET request to the resource representing the PFD for application identifier(s) to be required:

   - for PFD of individual application identifier, the request URI shall include "{apiRoot}/nnef-pfdmanagement/v1/applications/{appId}"; and

   - for PFD of a collection of application identifiers, the request URI shall include "{apiRoot}/nnef-pfdmanagement/v1/applications/" with query parameters indicating the requested application identifier(s).

2. On success, "200 OK" shall be returned; the payload body of GET response shall contain a representation of "Individual application PFD" resource or "PFD of applications" resource for the requested application identifier(s). If the resource of one or more requested application identifier(s) is not provided in the response, the SMF shall remove the PFD(s) of the requested application identifier(s) which is not included in the response.

   On failure, one of the HTTP status code listed in table 5.3.2.3.1-3 or table 5.3.3.3.1-3 shall be returned. For "404 Not Found", the NF service consumer shall remove:

   - all the PFD(s) existing in the NF service consumer if the request is for PFD of all application identifiers;

   - the PFD(s) of the requested application identifier(s) in the NF service consumer if the request is for PFD of individual application identifier or a collection of application identifiers.

4.2.3 Nnef_PFDmanagement_Subscribe Service Operation

4.2.3.1 General

The Nnef_PFDmanagement_Subscribe service operation enables NF service consumer to subscribe the notification of events when the PFDs for application identifier change.

4.2.3.2 Subscription for event notifications on PFDs change

This procedure as shown in Figure 4.2.3.2-1 is used to subscribe the notification of events when the PFDs for application identifier change.
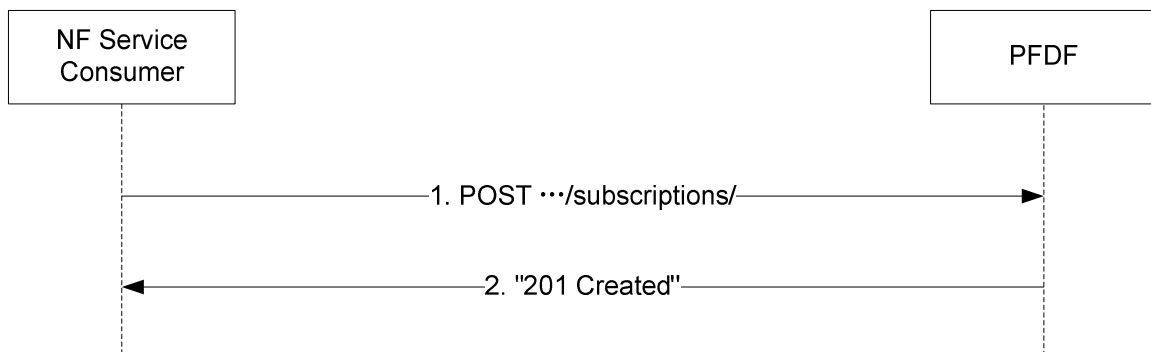
Figure 4.2.3.2-1: Creation of a subscription

1. The NF service consumer (i.e. SMF) shall send a POST request to the request URI representing the PFD subscriptions resource "{apiRoot}/nnef-pfdmanagement/v1/subscriptions". The request payload body shall include:

    - subscribed application identifier(s) optionally; and;

    - an URI where to receive the requested notifications as "notifyUri" attribute.

2. If the request is accepted, the PFDF shall:

    - create a new subscription;

    - assign an subscriptionId;

    - store the subscription; and

    - send the response with "201 Created". The payload body shall contain a representation of the created subscription, and the Location header shall contain the URI of the created subscription "{apiRoot}/nnef-pfdmanagement/v1/subscriptions/{subscriptionId}".

    Otherwise, one of the HTTP status code listed in table 5.3.4.3.1-3 shall be returned.

4.2.4 Nnef_PFDmanagement_Notify Service Operation

4.2.4.1 General

The Nnef_PFDmanagement_Notify service operation notifies the NF service consumer to update and/or delete the PFDs for application identifier(s).

The following procedures using the Nnef_PFDmanagement_Notify service operation are supported:

    - Management of PFDs.

4.2.4.2　Notification of PFD change
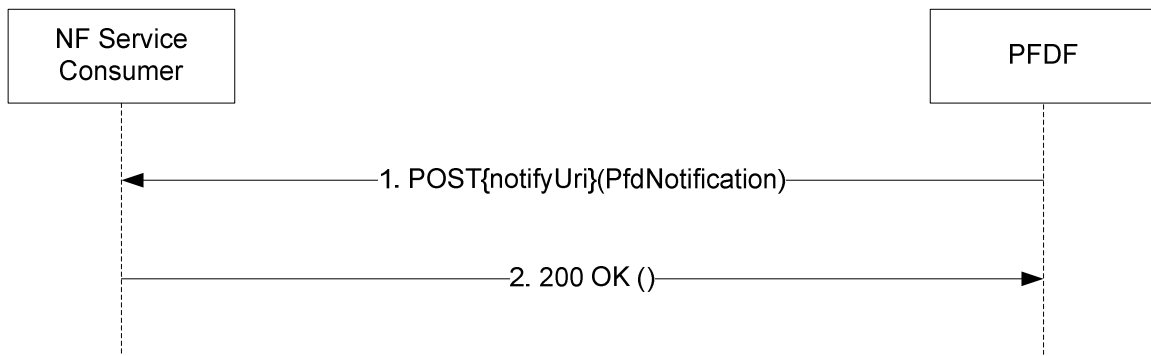
Figure 4.2.4.2-1: Notification of PFD change

1. The PFDF shall send a POST request to the NF service consumer (i.e. SMF) using the notifyUri provided during creation of the subscription resource as specified in subclause 5.6.2.3. The payload body of the POST request shall contain the PfdChangeNotification data structure.

2　If the notification is accepted, the NF service consumer shall reply with:

   - "204 No Content" indicating the successful provisioning of all PFDs; or

   - "200 OK" and the payload body of the response shall contain "PfdChangeReport" with detailed information of failed application(s)..

   Otherwise, one of the HTTP status code listed in table 5.5.2.3.1-3 shall be returned.

4.2.5　Nnef_PFDmanagement_Unsubscribe Service Operation

4.2.5.1　General

The Nnef_PFDmanagement_Unsubscribe service operation is used by the NF service consumer to unsubscribe the notification of events.

4.2.5.2　Unsubscribe from event notifications on PFDs change
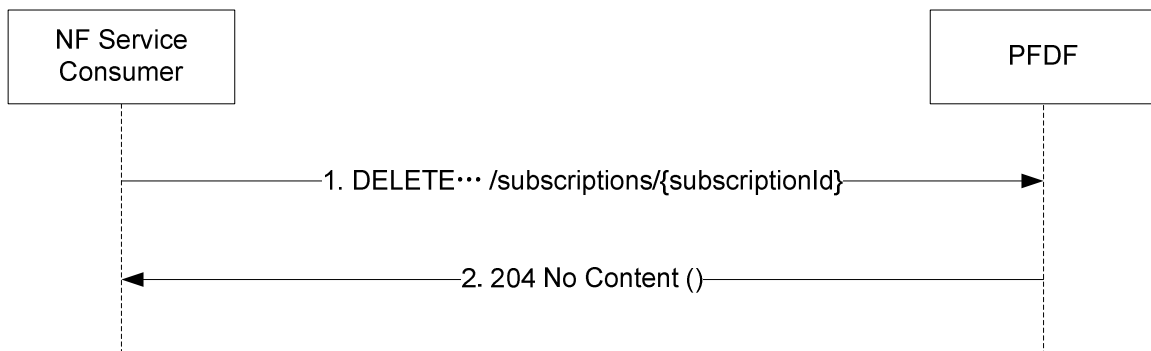
Figure 4.2.5.2-1: Unsubscribe from event notifications on PFDs change

1. The NF Service Consumer (i.e. SMF) shall send a DELETE request to the resource URI representing the individual PFD subscription. The request body shall be empty.

2. If the request is accepted, "204 No Content" shall be returned. The response body shall be empty.

   Otherwise, one of the HTTP status code listed in table 5.3.5.3.1-3 shall be returned.

5 Nnef_PFDmanagement API

5.1 Introduction

The Packet Flow Description Management Service shall use the Nnef_PFDmanagement API.

The request URI used in HTTP request from the NF service consumer towards the PFDF shall have the structure defined in subclause 4.4.1 of 3GPP TS 29.501 [6], i.e.:

{apiRoot}/{apiName}/{apiVersion}/{apiSpecificResourceUriPart}

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [6].

- The {apiName} shall be "nnef-pfdmanagement".

- The {apiVersion} shall be "v1".

- The {apiSpecificResourceUriPart} shall be set as described in subclause 5.3.

5.2 Usage of HTTP

5.2.1 General

HTTP/2, IETF RFC 7540 [7], shall be used as specified in subclause 5.2 of 3GPP TS 29.500 [5].

HTTP/2 shall be transported as specified in subclause 5.3 of 3GPP TS 29.500 [5].

The OpenAPI [9] specification of HTTP messages and content bodies for the Nnef_PFDmanagement service is contained in Annex A.

5.2.2 HTTP standard headers

5.2.2.1 General

See subclause 5.2.2 of 3GPP TS 29.500 [5] for the usage of HTTP standard headers.

5.2.2.2 Content type

JSON, IETF RFC 8259 [8], shall be used as content type of the HTTP bodies specified in the present specification, as specified in subclause 5.4 of 3GPP TS 29.500 [5]. The use of the JSON format shall be signalled by the content type "application/json".

"Problem Details" JSON object shall be used to indicate additional details of the error in a HTTP response body and shall be signalled by the content type "application/problem+json", as defined in IETF RFC 7807 [16].

5.2.3 HTTP custom headers

None

5.3 Resources

5.3.1 Resource Structure

{apiRoot}/nnef-pfdmanagement/v1
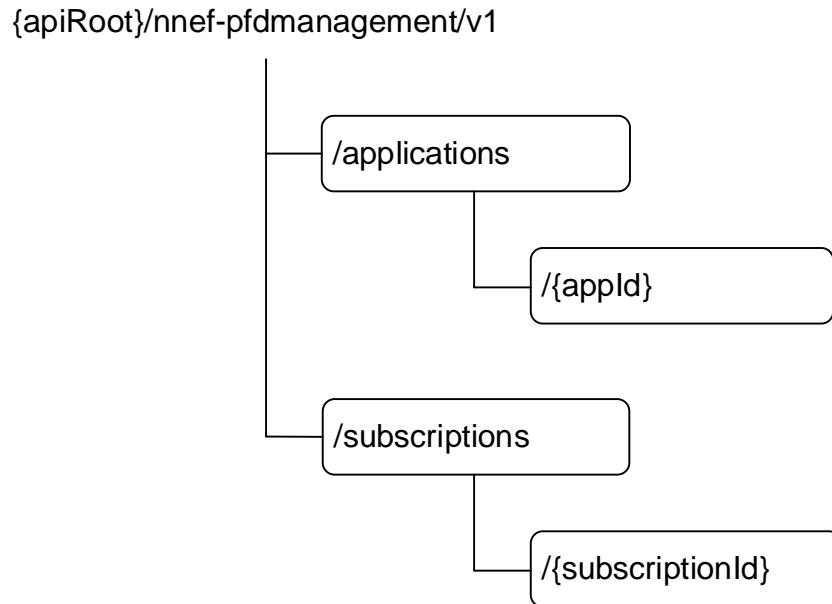
Figure 5.3.1-1: Resource URI structure of the Nnef_PFDmanagement API

Table 5.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 5.3.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method or custom operation	Description
PFD of applications	//{apiRoot}/ nnef-pfdmanagement/v1 /applications	GET	Nnef_PFDmanagement_Fetch. Retrieve PFDs for all applications or for one or multiple applications with query parameter.
Individual application PFD	//{apiRoot}/ nnef-pfdmanagement/v1 /applications/{appId}	GET	Nnef_PFDmanagement_Fetch. Retrieve the PFD for an application.
PFD subscriptions	//{apiRoot}/ nnef-pfdmanagement/v1 /subscriptions	POST	Nnef_PFDmanagement_Subscribe. Subscribe the notification of PFD changes.
Individual PFD subscription	//{apiRoot}/ nnef-pfdmanagement/v1 /subscriptions/{subscriptionId}	DELETE	Nnef_PFDmanagement_Unsubscribe. Delete a subscription of PFD change notification.

5.3.2 Resource: PFD of applications

5.3.2.1 Description

This resource represents PFDs for all applications.

5.3.2.2 Resource definition

Resource URI: **{apiRoot}/nnef-pfdmanagement/v1/applications**

This resource shall support the resource URI variables defined in table 5.3.2.2-1.

Table 5.3.2.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See subclause 5.1

5.3.2.3 Resource Standard Methods

5.3.2.3.1 GET

This method shall support the URI query parameters specified in table 5.3.2.3.1-1.

Table 5.3.2.3.1-1: URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description
application-ids	array(ApplicationId)	M	1..N	The required application identifier(s) for the returned PFDs
supported-features	SupportedFeatures	O	0..1	To filter irrelevant responses related to unsupported features.

This method shall support the request data structures specified in table 5.3.2.3.1-2 and the response data structures and response codes specified in table 5.3.2.3.1-3.

Table 5.3.2.3.1-2: Data structures supported by the GET Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 5.3.2.3.1-3: Data structures supported by the GET Response Body on this resource

Data type	P	Cardinality	Response codes	Description
array(PfdDataforApp)	M	0..N	200 OK	The PFDs for one or more application identifier(s) in the request URI are returned.
NOTE: In addition, the HTTP status codes which are specified as mandatory in table 5.2.7.1-1 of 3GPP TS 29.500 [5] for the GET method shall also apply.				

5.3.2.4 Resource Custom Operations

None.

5.3.3 Resource: Individual application PFD

5.3.3.1 Description

This resource represents the PFD identified by an application identifier.

5.3.3.2 Resource definition

Resource URI: **{apiRoot}/nnef-pfdmanagement/v1/applications/{appId}**

This resource shall support the resource URI variables defined in table 5.3.3.2-1.

Table 5.3.3.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See subclause 5.1.
appId	String identifying a set of PFD for an application identifier.

5.3.3.3 Resource Standard Methods

5.3.3.3.1 GET

This method shall support the URI query parameters specified in table 5.3.3.3.1-1.

Table 5.3.3.3.1-1: URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description
supported-features	SupportedFeatures	O	0..1	To filter irrelevant responses related to unsupported features.

This method shall support the request data structures specified in table 5.3.3.3.1-2 and the response data structures and response codes specified in table 5.3.3.3.1-3.

Table 5.3.3.3.1-2: Data structures supported by the GET Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 5.3.3.3.1-3: Data structures supported by the GET Response Body on this resource

Data type	P	Cardinality	Response codes	Description
PfdDataForApp	M	1	200 OK	A representation of PFDs for an application in the request URI is returned.
NOTE: In addition, the HTTP status codes which are specified as mandatory in table 5.2.7.1-1 of 3GPP TS 29.500 [5] for the GET method shall also apply.				

5.3.3.4 Resource Custom Operations

None.

5.3.4 Resource: PFD subscriptions

5.3.4.1 Description

This resource represents a collection of subscriptions created by NF service consumers of Nnef_PFDmanagement service.

5.3.4.2 Resource definition

Resource URI: **{apiRoot}/nnef-pfdmanagement/v1/subscriptions**

This resource shall support the resource URI variables defined in table 5.3.4.2-1.

Table 5.3.4.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See subclause 5.1

5.3.4.3 Resource Standard Methods

5.3.4.3.1 POST

This method shall support the URI query parameters specified in table 5.3.4.3.1-1.

Table 5.3.4.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.3.4.3.1-2 and the response data structures and response codes specified in table 5.3.4.3.1-3.

Table 5.3.4.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
PfdSubscription	M	1	Create a PfdSubscription resource.

Table 5.3.4.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
PfdSubscription	M	1	201 Created	The creation of a PfdSubscription resource is confirmed and a representation of that resource is returned.
NOTE: In addition, the HTTP status codes which are specified as mandatory in table 5.2.7.1-1 of 3GPP TS 29.500 [5] for the POST method shall also apply.				

5.3.4.4 Resource Custom Operations

None.

5.3.5 Resource: Individual PFD subscription

5.3.5.1 Description

This resource represents an individual PFD subscription created by NF service consumers of Nnef_PFDmanagement service.

5.3.5.2 Resource definition

Resource URI: **{apiRoot}/nnef-pfdmanagement/v1/subscriptions/{subscriptionId}**

This resource shall support the resource URI variables defined in table 5.3.5.2-1.

Table 5.3.5.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See subclause 5.1
subscriptionId	String identifies an individual subscription to the PFD management service

5.3.5.3 Resource Standard Methods

5.3.5.3.1 DELETE

This method shall support the URI query parameters specified in table 5.3.5.3.1-1.

Table 5.3.5.3.1-1: URI query parameters supported by the DELETE method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.3.5.3.1-2 and the response data structures and response codes specified in table 5.3.5.3.1-3.

Table 5.3.5.3.1-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 5.3.5.3.1-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The PfdSubscription resource matching the subscriptionId was deleted successfully.
NOTE: In addition, the HTTP status codes which are specified as mandatory in table 5.2.7.1-1 of 3GPP TS 29.500 [5] for the DELETE method shall also apply.				

5.3.5.4 Resource Custom Operations

None.

5.4 Custom Operations without associated resources

None

5.5 Notifications

5.5.1 General

Notifications shall comply to subclause 6.2 of 3GPP TS 29.500 [5] and subclause 4.6.2.3 of 3GPP TS 29.501 [6].

Table 5.5.1-1: Notifications

Custom operation URI	Mapped HTTP method	Description
{notifyUri}/notify	POST	Notification of PFD change.

5.5.2 PFD Change Notification

5.5.2.1 Description

The PFD Change Notification is used by the PFDF to inform the NF service consumer, which has subscribed to this Notification via the PFD subscriptions resource.

5.5.2.2 Target URI

The Notification URI **"{notifyUri}/notify"** shall be used with the URI variables defined in table 5.5.2.2-1.

Table 5.5.2.2-1: URI variables

Name	Definition
notifyUri	String formatted as URI with the Notification Uri as assigned within the PFD subscriptions resource and described within the PfdSubscription data type (see table 5.6.2.3-1).

5.5.2.3 Standard Methods

5.5.2.3.1 POST

This method shall support the URI query parameters specified in table 5.5.2.3.1-1.

Table 5.5.2.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.5.2.3.1-2 and the response data structures and response codes specified in table 5.5.2.3.1-3.

Table 5.5.2.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
array(PfdChangeNotification)	M	1..N	Provides PFD change information.

Table 5.5.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The PFD operation in the notification is performed successfully, i.e. all PFD changes are accepted by the SMF.
array(PfdChangeReport)	M	1..N	200 OK	The PFD operation in the notification is performed and the PfdChangeReport indicates failure reason for each failed application in the partial success.
ProblemDetails	M	1	500 Internal Server Error	The server encountered an unexpected condition that prevented it from fulfilling the request. PFDs for all applications are not accepted by the SMF. (NOTE 2)
NOTE 1: In addition, the HTTP status codes which are specified as mandatory in table 5.2.7.1-1 of 3GPP TS 29.500 [5] for the POST method shall also apply.				
NOTE 2: Failure cases are described in subclause 5.7.				

5.6 Data Model

5.6.1 General

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

Table 5.6.1-1 specifies the data types defined for the Nnef_PFDmanagement service based interface protocol.

Table 5.6.1-1: Nnef_PFDmanagement specific Data Types

Data type	Section defined	Description	Applicability
PfdDataForApp	5.6.2.2	Represents the PFDs for an application identifier.	
PfdSubscription	5.6.2.3	Represents a PFD subscription.	
PfdChangeNotification	5.6.2.4	Represents PFD change information.	
PfdContent	5.6.2.5	Represents the content of a PFD for an application identifier.	
PfdChangeReport	5.6.2.6	Represents error of PFD change.	

Table 5.6.1-2 specifies data types re-used by the Nnef_PFDmanagement 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 Nnef_PFDmanagement service based interface.

Table 5.6.1-2: Nnef_PFDmanagement re-used Data Types

Data type	Reference	Comments	Applicability
ApplicationId	3GPP TS 29.571 [10]		
DateTime	3GPP TS 29.571 [10]		
SupportedFeatures	3GPP TS 29.571 [10]		
Uri	3GPP TS 29.571 [10]		

5.6.2 Structured data types

5.6.2.1 Introduction

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

Allowed structures are: array, object.

5.6.2.2 Type: PfdDataForApp

Table 5.6.2.2-1: Definition of type PfdDataForApp

Attribute name	Data type	P	Cardinality	Description	Applicability
applicationId	ApplicationId	M	1	Identifier of an application.	
pfds	array(PfdContent)	M	1..N	PFDs for the application identifier.	
cachingTime	dDateTime	O	0..1	Caching time for an application identifier.	

5.6.2.3 Type: PfdSubscription

Table 5.6.2.3-1: Definition of type PfdSubscription

Attribute name	Data type	P	Cardinality	Description	Applicability
applicationIds	array(ApplicationId)	O	1..N	Identifiers of applications with PFDs change.	
notifyUri	Uri	M	1	Identifies the recipient of notifications sent by PFDF for this subscription.	
supportedFeatures	SupportedFeatures	M	1	List of supported features used as described in subclause 5.8. This parameter shall be provided by the NF service consumer in the POST request that request the creation of a subscription, and shall be provided by the PFDF in the response of corresponding request.	

5.6.2.4 Type: PfdChangeNotification

Table 5.6.2.4-1: Definition of type PfdChangeNotification

Attribute name	Data type	P	Cardinality	Description	Applicability
applicationId	ApplicationId	M	1	Identifier of an application.	
removalFlag	boolean	C	0..1	Indication of removal of PFDs for an existing application identifier.	
partialFlag	boolean	C	0..1	Indication of partial update of PFDs for an existing application identifier if this operation is supported according to feature negotiation.	PartialUpdate
pfds	array(PfdContent)	C	1..N	PFD creation/update for the application identifier as specified in subclause 6.3.3.5 of 3GPP TS 29.251 [12].	

5.6.2.5 Type: PfdContent

Table 5.6.2.5-1: Definition of type PfdContent

Attribute name	Data type	P	Cardinality	Description	Applicability
pfdId	string	C	0..1	Identifies a PDF of an application identifier. If PartialUpdate feature is supported during PFD change event subscription, this attribute shall be provided by the PFDF.	
flowDescriptions	array(string)	O	1..N	Represents a 3-tuple with protocol, server ip and server port for UL/DL application traffic.	
urls	array(string)	O	1..N	Indicates a URL or a regular expression which is used to match the significant parts of the URL.	
domainNames	array(string)	O	1..N	Indicates an FQDN or a regular expression as a domain name matching criteria.	

5.6.2.6 Type: PfdChangeReport

Table 5.6.2.6-1: PfdChangeReport

Attribute name	Data type	P	Cardinality	Description	Applicability
pfdError	ProblemDetails	M	1	More information on the error shall be provided in the "cause" attribute of the "ProblemDetails" structure. The "cause" attribute in the ProblemDetails shall be set to one of following application errors (see table 5.2.7.1-1 of 3GPP TS 29.500 [5]): - SYSTEM_FAILURE - INSUFFICIENT_RESOURCES - UNSPECIFIED_NF_FAILURE	
applicationId	array(ApplicationId)	M	1..N	Indicates the application identifier(s) which PFD(s) are failed to be added or modified.	

5.6.3 Simple data types and enumerations

5.6.3.1 Introduction

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

5.6.3.2 Simple data types

The simple data types defined in table 5.6.3.2-1 shall be supported.

Table 5.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

5.7 Error handling

5.7.1 General

HTTP error handling shall be supported as specified in subclause 5.2.4 of 3GPP TS 29.500 [5].

For the Nnef_PFDmanagement API, HTTP error responses shall be supported as specified in subclause 4.8 of 3GPP TS 29.501 [6]. Protocol errors and application errors specified in table 5.2.7.2-1 of 3GPP TS 29.500 [5] 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 [5].

In addition, the requirements in the following subclauses shall apply.

5.7.2 Protocol Errors

In this Release of the specification, there are no additional protocol errors applicable for the Nnef_PFDmanagement API.

5.7.3 Application Errors

The application errors defined for the Nnef_PFDmanagement service are listed in table 5.7.3-1.

Table 5.7.3-1: Application errors

Application Error	HTTP status code	Description
SYSTEM_FAILURE	500 Internal Server Error	Something functions wrongly in PFD provisioning or the PFD provisioning does not function at all. (NOTE)
INSUFFICIENT_RESOURCE	500 Internal Server Error	There is limitation for resource storage. (NOTE)
UNSPECIFIED_NF_FAILURE	500 Internal Server Error	Unspecified reason. (NOTE)
NOTE: This application error is included in the responses to the POST request of PFD change notification.		

5.8 Feature negotiation

The optional features in table 5.8-1 are defined for the Nnef_PFDmanagement API. They shall be negotiated using the extensibility mechanism defined in subclause 6.6 of 3GPP TS 29.500 [5].

Table 5.8-1: Supported Features

Feature number	Feature Name	Description
1	PartialUpdate	The PFDF can use this feature for partial update of PFDs.

5.9 Security

As indicated in 3GPP TS 33.501 [14] and 3GPP TS 29.500 [5], the access to the Nnef_PFDmanagement API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [15]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [13]) plays the role of the authorization server.

If OAuth2 is used, an NF Service Consumer, prior to consuming services offered by the Nnef_PFDmanagement API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [13], subclause 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 Nnef_PFDmanagement service.

The Nnef_PFDmanagement API defines a single scope "nnef-pfdmanagement" for OAuth2 authorization (as specified in 3GPP TS 33.501 [14]) for the entire service, and it does not define any additional scopes at resource or operation level.

Annex A (normative):
OpenAPI specification

A.1 General

The present Annex contains an OpenAPI [9] specification of HTTP messages and content bodies used by the Nnef_PFDmanagement API.

In case of conflicts between the main body of the present document and the present Annex, the information in the main body shall be applicable.

A.2 Nnef_PFDmanagement API

```
openapi: 3.0.0
info:
  title: Nnef_PFDmanagement Sevice API
  version: "1.0.0"
  description: Packet Flow Description Management Service
#
externalDocs:
  description: 3GPP TS 29.551 v15.3.0, 5G System; Packet Flow Description Management Service
  url: 'http://www.3gpp.org/ftp/Specs/archive/29_series/29.551/'
#
servers:
  - url: '{apiRoot}/nnef-pfdmanagement/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in subclause 4.4 of 3GPP TS 29.501
security:
  - {}
  - oAuth2ClientCredentials:
    - nnef-pfdmanagement
paths:
  /applications:
    get:
      summary: Retrieve PFDs for all applications or for one or multiple applications with query
parameter.
      tags:
        - PFD of applications
      operationId: Nnef_PFDmanagement_Fetch
      parameters:
        - name: application-ids
          description: The required application identifier(s) for the returned PFDs.
          in: query
          required: true
          schema:
            type: array
            items:
              $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
            minItems: 1
        - name: supported-features
          in: query
          description: To filter irrelevant responses related to unsupported features
          schema:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
      responses:
        '200':
          description: The PFDs for one or more application identifier(s) in the request URI are
returned.
          content:
            application/json:
              schema:
                type: array
                items:
                  $ref: '#/components/schemas/PfdDataForApp'
                minItems: 0
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
```

```
          '403':
            $ref: 'TS29571_CommonData.yaml#/components/responses/403'
          '404':
            $ref: 'TS29571_CommonData.yaml#/components/responses/404'
          '406':
            $ref: 'TS29571_CommonData.yaml#/components/responses/406'
          '414':
            $ref: 'TS29571_CommonData.yaml#/components/responses/414'
          '429':
            $ref: 'TS29571_CommonData.yaml#/components/responses/429'
          '500':
            $ref: 'TS29571_CommonData.yaml#/components/responses/500'
          '503':
            $ref: 'TS29571_CommonData.yaml#/components/responses/503'

  /applications/{appId}:
    get:
      summary: Retrieve the PFD for an application.
      tags:
        - Individual application PFD
      operationId: Nnef_PFDmanagement_Fetch
      parameters:
        - name: appId
          description: The required application identifier(s) for the returned PFDs.
          in: path
          required: true
          schema:
            type: string
        - name: supported-features
          in: query
          description: To filter irrelevant responses related to unsupported features
          schema:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
      responses:
        '200':
          description: A representation of PFDs for an application in the request URI is returned.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/PfdDataForApp'
        '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'
        '414':
          $ref: 'TS29571_CommonData.yaml#/components/responses/414'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'

  /subscriptions:
    post:
      summary: Subscribe the notification of PFD changes.
      tags:
        - PFD subscriptions
      operationId: Nnef_PFDmanagement_Subscribe
      requestBody:
        description: a PfdSubscription resource to be created.
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/PfdSubscription'
      callbacks:
        PfdChangeNotification:
          '{request.body#/notifyUri}':
            post:
              summary: Notification of PFD change.
              tags:
```

```
                           - PfdChangeNotification data
                      operationId: Nnef_PFDmanagement_Notify
                      requestBody:
                        required: true
                        content:
                          application/json:
                            schema:
                              type: array
                              items:
                                $ref: '#/components/schemas/PfdChangeNotification'
                              minItems: 1
                      responses:
                        '200':
                         description: The PFD operation in the notification is performed and the
PfdChangeReport indicates failure reason.
                          content:
                            application/json:
                              schema:
                                type: array
                                items:
                                  $ref: '#/components/schemas/PfdChangeReport'
                                minItems: 1
                        '204':
                         description: The PFD operation in the notification is performed successfully.
                        '400':
                         $ref: 'TS29571_CommonData.yaml#/components/responses/400'
                        '401':
                         $ref: 'TS29571_CommonData.yaml#/components/responses/401'
                        '403':
                         $ref: 'TS29571_CommonData.yaml#/components/responses/403'
                        '404':
                         $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'


      responses:
        '201':
          description: The creation of a PfdSubscription resource is confirmed and a representation
of that resource is returned.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/PfdSubscription'
          headers:
            Location:
              description: 'Contains the URI of the newly created resource, according to the
structure: {apiRoot}/nnef-pfdmanagement/v1/subscriptions/{subscriptionId}'
              required: true
              schema:
                type: string
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
```

```
            $ref: 'TS29571_CommonData.yaml#/components/responses/500'
          '503':
            $ref: 'TS29571_CommonData.yaml#/components/responses/503'

  /subscriptions/{subscriptionId}:
    delete:
      summary: Delete a subscription of PFD change notification.
      tags:
        - Individual PFD subscription
      operationId: Nnef_PFDmanagement_Unsubscribe
      parameters:
        - name: subscriptionId
          description: Identify the subscription.
          in: path
          required: true
          schema:
            type: string
      responses:
        '204':
          description: The PfdSubscription resource matching the subscriptionId was deleted
successfully.
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'

components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            nnef-pfdmanagement: Access to the Nnef_PFDmanagement API
  schemas:
#
# STRUCTURED DATA TYPES
#
    PfdContent:
      type: object
      properties:
        pfdId:
          type: string
          description: Identifies a PDF of an application identifier.
        flowDescriptions:
          type: array
          items:
            type: string
          minItems: 1
          description: Represents a 3-tuple with protocol, server ip and server port for UL/DL
application traffic.
        urls:
          type: array
          items:
            type: string
          minItems: 1
          description: Indicates a URL or a regular expression which is used to match the
significant parts of the URL.
        domainNames:
          type: array
          items:
            type: string
          minItems: 1
          description: Indicates an FQDN or a regular expression as a domain name matching criteria.

    PfdDataForApp:
      type: object
```

```
      properties:
        applicationId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
        pfds:
          type: array
          items:
            $ref: '#/components/schemas/PfdContent'
          minItems: 1
        cachingTime:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      required:
        - applicationId
        - pfds

  PfdSubscription:
    type: object
    properties:
      applicationIds:
        type: array
        items:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
        minItems: 1
      notifyUri:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
      supportedFeatures:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
    required:
      - notifyUri
      - supportedFeatures

  PfdChangeNotification:
    type: object
    properties:
      applicationId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
      removalFlag:
        type: boolean
        default: false
      partialFlag:
        type: boolean
        default: false
      pfds:
        type: array
        items:
          $ref: '#/components/schemas/PfdContent'
        minItems: 1
    required:
      - applicationId

  PfdChangeReport:
    type: object
    properties:
      pfdError:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
      applicationId:
        type: array
        items:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
        minItems: 1
    required:
      - pfdError
      - applicationId
```

Annex B (informative):
Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2018-01						TS skeleton of PFD Management Service specification	0.0.0
2018-01	CT3#94					Includes the following contribution agreed by CT3 at CT3#94: C3-180045, C3-180270, C3-180271.	0.1.0
2018-03	CT3#95					Includes the following contribution agreed by CT3 at CT3#95: C3-181100, C3-181262, C3-181102, C3-181103, C3-181314.	0.2.0
2018-04	CT3#96					Includes the following contribution agreed by CT3 at CT3#96: C3-182153, C3-182411, C3-182412, C3-182413, C3-182414, C3-182477, C3-182478.	0.3.0
2018-05	CT3#97					Includes the following contribution agreed by CT3 at CT3#97: C3-183115, C3-183557, C3-183558, C3-183560.	0.4.0
2018-06	CT#80	CP-181029				TS sent to plenary for approval	1.0.0
2018-06	CT#80	CP-181029				TS approved by plenary	15.0.0
2018-09	CT#81	CP-182015	0001	2	F	Protocol error statement	15.1.0
2018-09	CT#81	CP-182015	0002	1	F	Description of Structured data types	15.1.0
2018-12	CT#82	CP-183205	0003		F	Default value for apiRoot	15.2.0
2018-12	CT#82	CP-183205	0004	3	F	Cardinality	15.2.0
2018-12	CT#82	CP-183205	0005	1	F	Correct Nnef_PFDmanagement API	15.2.0
2018-12	CT#82	CP-183205	0006		F	Location Header	15.2.0
2018-12	CT#82	CP-183205	0007	1	F	Alignment of openAPI	15.2.0
2018-12	CT#82	CP-183205	0008		F	API version update	15.2.0
2018-12	CT#82	CP-183205	0009		F	Security	15.2.0
2018-12	CT#82	CP-183205	0010		F	Content type	15.2.0
2019-03	CT#83	CP-190116	0011	1	F	Fetch PFD for all applications	15.3.0
2019-03	CT#83	CP-190116	0014	1	F	Correction of resource URIs	15.3.0
2019-03	CT#83					TS version correction in Open API by MCC	15.3.0

History

Document history		
V15.0.0	July 2018	Publication
V15.1.0	October 2018	Publication
V15.2.0	April 2019	Publication
V15.3.0	April 2019	Publication