ETSI TS 129 551 V15.1.0 (2018-10)

TECHNICAL SPECIFICATION

5G;
5G System;
Packet Flow Description Management Service;
Stage 3
(3GPP TS 29.551 version 15.1.0 Release 15)

Reference
RTS/TSGC-0329551vf10

Keywords
5G

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00   Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

The present document can be downloaded from:
http://www.etsi.org/standards-search

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the only prevailing document is the print of the Portable Document Format (PDF) version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at
https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx

If you find errors in the present document, please send your comment to one of the following services:
https://portal.etsi.org/People/CommiteeSupportStaff.aspx

Copyright Notification

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (https://ipr.etsi.org/).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

Foreword

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

The present document may refer to technical specifications or reports using their 3GPP identities, UMTS identities or GSM identities. These should be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between GSM, UMTS, 3GPP and ETSI identities can be found under http://webapp.etsi.org/key/queryform.asp.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Contents

Foreword

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

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x   the first digit:

1   presented to TSG for information;

2   presented to TSG for approval;

3   or greater indicates TSG approved document under change control.

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

z   the third digit is incremented when editorial only changes have been incorporated in the document.

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".

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].

API	Application Programming Interface
HTTP	Hypertext Transfer Protocol
NF	Network Function
PFDF	Packet Flow Description 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.
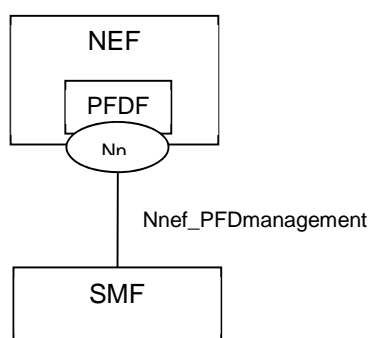
Figure 4.1.2-1: Reference Architecture for the Nnef_PFDmanagement Service; SBI representation

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.
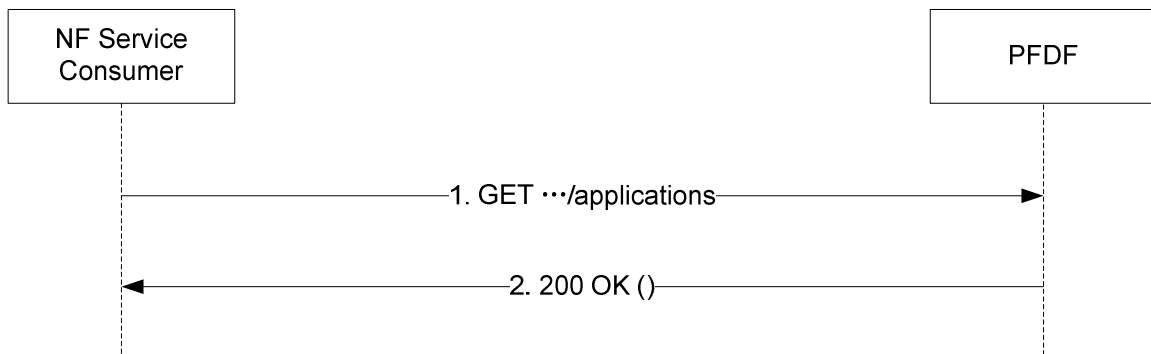
Figure 4.2.2.2-1: Retrieval of PFDs

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}";

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

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

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.
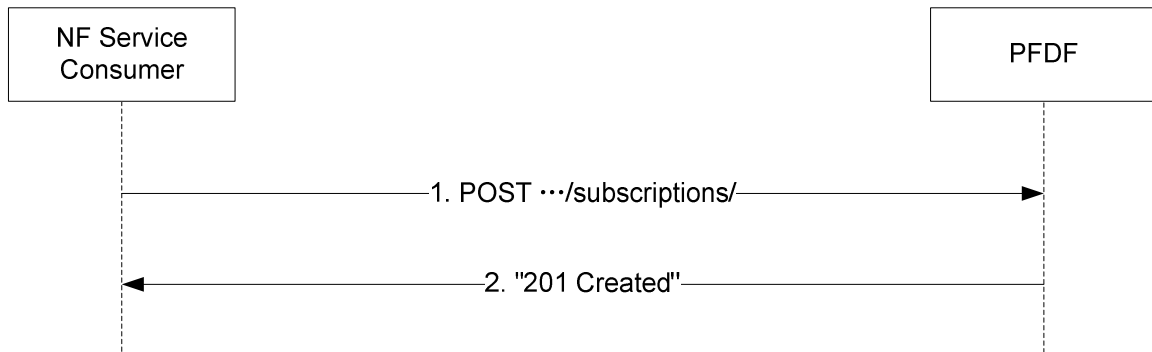
Figure 4.2.3.2-1: Creation of a subscription

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
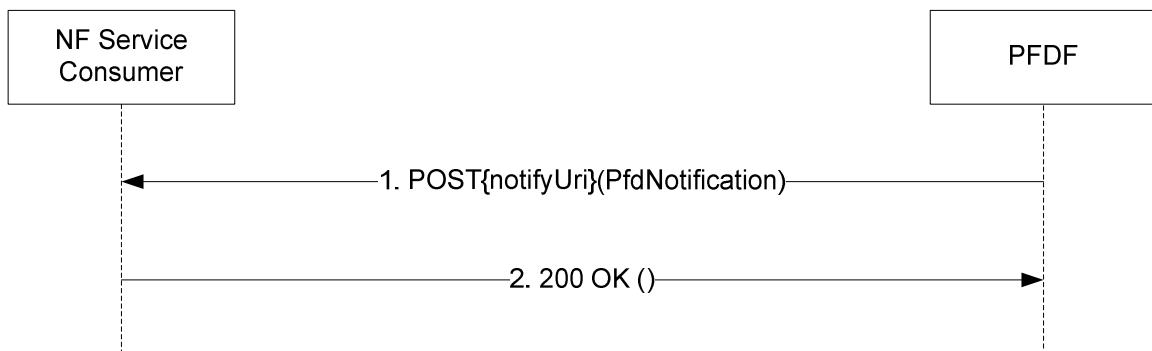
Figure 4.2.4.2-1: Notification of PFD change

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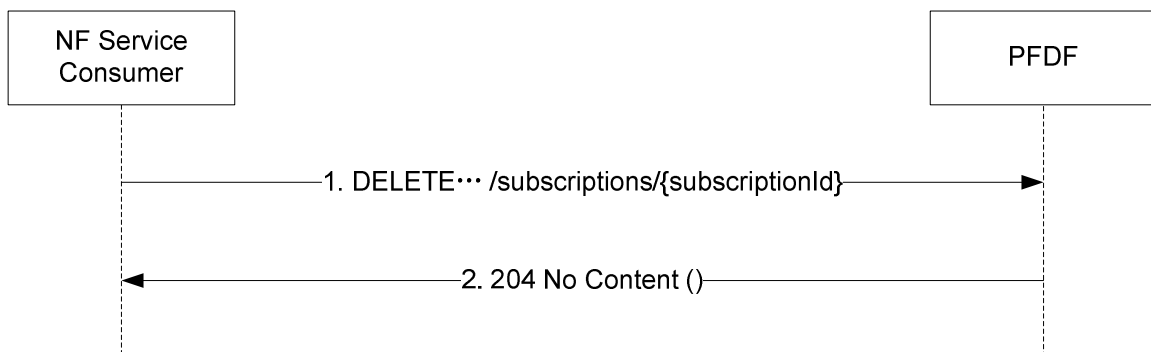
Figure 4.2.5.2-1: Unsubscribe from event notifications on PFDs change

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 [2], i.e.:

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

with the following components:

-   The {apiRoot} shall be set as described in 3GPP TS 29.501 [2].

-   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].

5.2.3 HTTP custom headers

None

5.3 Resources

5.3.1 Resource Structure
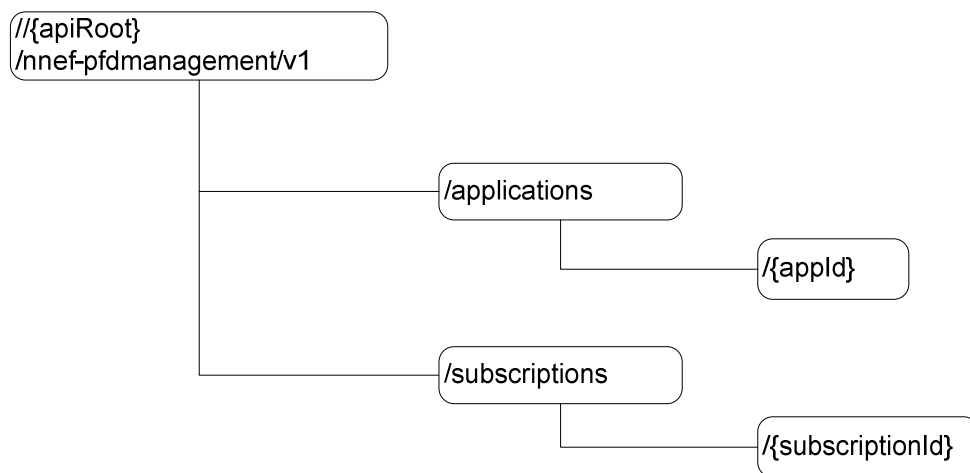
Figure 5.3.1-1: Resource URI structure of the Nnef_PFDmanagement API

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
applicationId	ApplicationId	O	0..N	The required application identifier(s) for the returned PFDs

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
PfdDataforApp	M	1..N	200 OK	The PFDs for one or more application identifier(s) in the request URI are returned.
n/a			404 Not Found	No resource exists.
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
n/a				

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.
n/a			404 Not Found	The requested individual application PFD does not exist.
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.
n/a	C	1	404 Not Found.	The requested resource is not found.
ProblemDetails	C	1	400 Bad Request	Incorrect input parameter(s). The "cause" attribute in the ProblemDetails shall be set to MANDAT_ATTRI_MISSING (see table 5.7.3-1) if attribute notifyUri or supportedFeatures is not included in the payload.
ProblemDetails	C	1	500 Internal Server Error	The server encountered an unexpected condition that prevented it from fulfilling the request. The "cause" attribute in the ProblemDetails shall be set to RESOURCE_LIMITATION (see table 5.7.3-1) if there is resource limitation.
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.
n/a			404 Not Found	The requested individual PFD subscription to be deleted does not exist.
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
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.
array(PfdChangeReport)	M	1..N	200 OK	The PFD operation in the notification is performed and the PfdChangeReport indicates failure reason.
ProblemDetails	C	1	400 Bad Request	Incorrect input parameter(s). The "cause" attribute in the ProblemDetails shall be set to MANDAT_ATTRI_MISSING (see table 5.7.3-1) if the payload is empty.
ProblemDetails	M	1	500 Internal Server Error	The server encountered an unexpected condition that prevented it from fulfilling the request.
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.				

5.6 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.x	Represents the content of a PFD for an application identifier.	
PfdChangeReport	5.6.2.y	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]		
SupportedFeatures	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)	O	0..N	PFDs for the application identifier.	
cachingTime	dateTime	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
applicationId	array(ApplicationId)	O	0..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	0..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	0..N	Represents a 3-tuple with protocol, server ip and server port for UL/DL application traffic.	
urls	array(string)	O	0..N	Indicates a URL or a regular expression which is used to match the significant parts of the URL.	
domainNames	array(string)	O	0..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 5.7.3-1): - MALFUNCTION - RESOURCE_LIMITATION - OTHER_REASON	
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
MALFUNCTION	500 Internal Server Error	Something functions wrongly in PFD provisioning or the PFD provisioning does not function at all.
RESOURCE_LIMITATION	500 Internal Server Error	There is limitation for resource storage.
MANDAT_ATTRI_MISSING	400 Bad Request	A mandatory attribute is missing in the request.
OTHER_REASON	500 Internal Server Error	Unspecified reason.

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.

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.R15.0.0"
  description: Packet Flow Description Management Service
#
externalDocs:
  description: 3GPP TS 29.551 v0.4.0, 5G system; Packet Flow Description Management Service
  url: 'http://ftp.3gpp.org//Specs/archive/29_series/29.551/'
#
servers:
  - url: '{apiRoot}/nnef-pfdmanagement/v1'
    variables:
      apiRoot:
      default: https://demohost.com
      description: apiRoot as defined in subclause 4.4 of 3GPP TS 29.501

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: applicationId
            description: The required application identifier(s) for the returned PFDs.
            in: path
            required: true
            schema:
              type: string
      responses:
        '200':
          description: The PFDs for one or more application identifier(s) in the request URI are
returned.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/PfdDataforApp'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '414':
          $ref: 'TS29571_CommonData.yaml#/components/responses/414'
        '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
      responses:
```

```
      '200':
        description: A representation of PFDs for an application in the request URI is returned.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/PfdDataforApp'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '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:
              description:
              required: true
              content:
                application/json:
                  schema:
                    $ref: '#/components/schemas/PfdChangeNotification'
            responses:
              '204':
                description: The PFD operation in the notification is performed successfully.
              '200':
                description: The PFD operation in the notification is performed and the
PfdChangeReport indicates failure reason.
                content:
                  application/json:
                    schema:
                      $ref: '#/components/schemas/PfdChangeReport'
              '400':
                description: Incorrect input parameter(s).
                content:
                  application/problem+json:
                    schema:
                      $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
              '500'
                description:
                content:
                  application/problem+json:
                    schema:
                      $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
              '503'
                $ref: 'TS29571_CommonData.yaml#/components/responses/503'
              '411':
                $ref: 'TS29571_CommonData.yaml#/components/responses/411'
              '413':
                $ref: 'TS29571_CommonData.yaml#/components/responses/413'
              '415':
                $ref: 'TS29571_CommonData.yaml#/components/responses/415'


    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'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '400':
          description: Incorrect input parameter(s).
          content:
            application/problem+json:
              schema:
                $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
        '500':
          description: The server encountered an unexpected condition that prevented it from
fulfilling the request.
          content:
            application/problem+json:
              schema:
                $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'

  /subscriptions/{subscriptionId}:
    delete:
      summary: Delete a subscription of PFD change notification.
      tags:
      - Individual PFD subscription
      operationId: Nnef_PFDmanagement_Unsubscribe
      responses:
        '204':
          description: The PfdSubscription resource matching the subscriptionId was deleted
successfully.
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'

components:
  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: 0
          description: Represents a 3-tuple with protocol, server ip and server port for UL/DL
application traffic.
        urls:
          type: array
          items:
            type: string
          minItems: 0
          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: 0
      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
        itmes:
          $ref: 'TS29551_CommonData.yaml#/components/schemas/PfdContent'
        minItems: 0
      cachingTime:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
    requried:
      - applicationId

  PfdSubscription:
    type: object
    properties:
      applicationId:
        type: array
        itmes:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
      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
        itmes:
          $ref: 'TS29551_CommonData.yaml#/components/schemas/PfdContent'
        minItems: 0
    required:
      - applicationId

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

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

History

Document history		
V15.0.0	July 2018	Publication
V15.1.0	October 2018	Publication