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# Contents

Intellectual Property Rights .....	2
Legal Notice .....	2
Modal verbs terminology.....	2
Foreword.....	5
1 Scope .....	6
2 References .....	6
3 Definitions and abbreviations.....	7
3.1 Definitions .....	7
3.2 Abbreviations .....	7
4 Background Data Transfer Policy Control Service .....	8
4.1 Service Description .....	8
4.1.1 Overview .....	8
4.1.2 Service Architecture .....	8
4.1.3 Network Functions.....	9
4.1.3.1 Policy Control Function (PCF) .....	9
4.1.3.2 NF Service Consumers.....	9
4.2 Service Operations .....	9
4.2.1 Introduction.....	9
4.2.2 Npcf_BDTPolicyControl_Create service operation .....	10
4.2.2.1 General .....	10
4.2.2.2 Retrieval of BDT policies .....	10
4.2.3 Npcf_BDTPolicyControl_Update service operation .....	12
4.2.3.1 General .....	12
4.2.3.2 Indication about selected transfer policy.....	12
4.2.3.3 Modification of BDT warning notification request indication .....	13
4.2.4 Npcf_BDTPolicyControl_Notify service operation .....	13
4.2.4.1 General .....	13
4.2.4.2 Sending the BDT warning notification .....	13
5 Npcf_BDTPolicyControl API.....	15
5.1 Introduction .....	15
5.2 Usage of HTTP.....	15
5.2.1 General.....	15
5.2.2 HTTP standard headers.....	15
5.2.2.1 General .....	15
5.2.2.2 Content type .....	15
5.2.3 HTTP custom headers.....	16
5.3 Resources .....	16
5.3.1 Resource Structure.....	16
5.3.2 Resource: BDT policies (Collection).....	17
5.3.2.1 Description .....	17
5.3.2.2 Resource definition .....	17
5.3.2.3 Resource Standard Methods.....	17
5.3.2.3.1 POST .....	17
5.3.2.4 Resource Custom Operations .....	18
5.3.3 Resource: Individual BDT policy (Document) .....	18
5.3.3.1 Description .....	18
5.3.3.2 Resource definition .....	18
5.3.3.3 Resource Standard Methods.....	18
5.3.3.3.1 GET .....	18
5.3.3.3.2 PATCH.....	19
5.4 Custom Operations without associated resources.....	20
5.5 Notifications .....	20
5.5.1 General.....	20

5.5.2	BDT Notification .....	21
5.5.2.1	Description .....	21
5.5.2.2	Target URI .....	21
5.5.2.3	Standard Methods .....	21
5.5.2.3.1	POST .....	21
5.6	Data Model .....	22
5.6.1	General .....	22
5.6.2	Structured data types .....	23
5.6.2.1	Introduction .....	23
5.6.2.2	Type BdtPolicy .....	23
5.6.2.3	Type BdtReqData .....	24
5.6.2.4	Type BdtPolicyData .....	25
5.6.2.5	Type TransferPolicy .....	25
5.6.2.6	Type BdtPolicyDataPatch .....	25
5.6.2.7	Void .....	26
5.6.2.8	Type NetworkAreaInfo .....	26
5.6.2.9	Void .....	26
5.6.2.10	Type Notification .....	26
5.6.2.11	Type PatchBdtPolicy .....	26
5.6.2.12	Type BdtReqDataPatch .....	27
5.6.3	Simple data types and enumerations .....	27
5.6.3.1	Introduction .....	27
5.6.3.2	Simple data types .....	27
5.7	Error handling .....	27
5.7.1	General .....	27
5.7.2	Protocol Errors .....	27
5.7.3	Application Errors .....	27
5.8	Feature negotiation .....	28
5.9	Security .....	28
<b>Annex A (normative): OpenAPI specification .....</b>		<b>29</b>
A.1	General .....	29
A.2	Npcf_BDTPolicyControl API .....	29
<b>Annex B (informative): Change history .....</b>		<b>35</b>
History .....		38

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# Foreword

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# 1 Scope

The present specification provides the stage 3 definition of the Background Data Transfer (BDT) Policy Control Service (Npcf\_BDTPolicyControl) of the 5G System.

The 5G System Architecture is defined in 3GPP TS 23.501 [2]. The stage 2 definition and related procedures for BDT Policy Control Service are specified in 3GPP TS 23.502 [3] and 3GPP TS 23.503 [4].

The 5G System stage 3 call flows are provided in 3GPP TS 29.513 [5].

The Technical Realization of the Service Based Architecture and the Principles and Guidelines for Services Definition are specified in 3GPP TS 29.500 [6] and 3GPP TS 29.501 [7].

The Policy Control Function (PCF) provides the BDT Policy Control Service. This service provides background data transfer policy negotiation function.

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# 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.
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- [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 29.513: "5G System; Policy and Charging Control signalling flows and QoS parameter mapping; Stage 3".
- [6] 3GPP TS 29.500: "5G System; Technical Realization of Service Based Architecture; Stage 3".
- [7] 3GPP TS 29.501: "5G System; Principles and Guidelines for Services Definition; Stage 3".
- [8] IETF RFC 7540: "Hypertext Transfer Protocol Version 2 (HTTP/2)".
- [9] IETF RFC 8259: "The JavaScript Object Notation (JSON) Data Interchange Format".
- [10] OpenAPI: "OpenAPI Specification Version 3.0.0", <https://spec.openapis.org/oas/v3.0.0>.
- [11] 3GPP TS 29.504: "5G System; Unified Data Repository Services; Stage 3".
- [12] 3GPP TS 29.519: "5G System; Usage of the Unified Data Repository service for Policy Data, Application Data and Structured Data for exposure; Stage 3".
- [13] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces; Stage 3".
- [14] 3GPP TS 29.122: "T8 reference point for Northbound APIs".
- [15] IETF RFC 7396: "JSON Merge Patch".
- [16] IETF RFC 3986: "Uniform Resource Identifier (URI): Generic Syntax".

- [17] IETF RFC 7807: "Problem Details for HTTP APIs".
- [18] 3GPP TS 33.501: "Security architecture and procedures for 5G system".
- [19] IETF RFC 6749: "The OAuth 2.0 Authorization Framework".
- [20] 3GPP TS 29.510: "5G System; Network Function Repository Services; Stage 3".
- [21] 3GPP TR 21.900: "Technical Specification Group working methods".
- [22] 3GPP TS 29.520: "5G System; Network Data Analytics Services; Stage 3".

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## 3 Definitions 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].

**Background data transfer:** feature that enables a 3rd party service provider to keep their costs lower by favouring time windows for data transfer to specific UEs in a geographical area during non-busy hours that are less costly and able to handle larger bitrates.

For the purposes of the present document, the following terms and definitions given in 3GPP TS 23.501 [2], clause 3.1 apply:

#### 5G System

#### Network Function

#### NF service

#### NF service operation

#### Service based interface

### 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].

AF	Application Function
ASP	Application Service Provider
BDT	Background Data Transfer
DNN	Data Network Name
JSON	JavaScript Object Notation
NEF	Network Exposure Function
NG-RAN	Next Generation - Radio Access Network
NRF	Network Repository Function
NWDAF	Network Data Analytics Function
PCF	Policy Control Function
SBI	Service Based Interface
S-NSSAI	Single Network Slice Selection Assistance Information
TAI	Tracking Area Identity
UDR	Unified Data Repository



## 4 Background Data Transfer Policy Control Service

### 4.1 Service Description

#### 4.1.1 Overview

The BDT Policy Control Service, as defined in 3GPP TS 23.502 [3] and 3GPP TS 23.503 [4], is provided by the Policy Control Function (PCF).

This service enables the NF service consumer to negotiate policy for a future background data transfer and offers the following functionalities:

- get background data transfer policies based on the request from the NF service consumer;
- update background data transfer policies based on the selection provided by the NF service consumer; and
- provide background data transfer warning notification to trigger renegotiation of background data transfer policy.

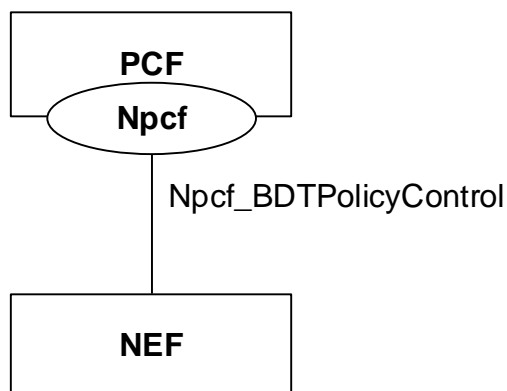
#### 4.1.2 Service Architecture

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 29.513 [5].

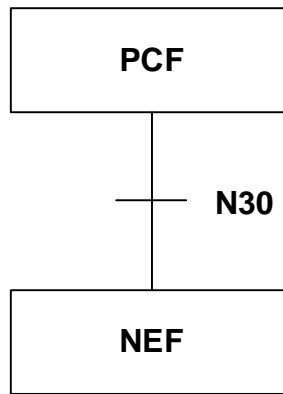
The BDT Policy Control Service (Npcf\_BDTPolicyControl) is part of the Npcf service-based interface exhibited by the Policy Control Function (PCF).

The only known NF service consumer of the Npcf\_BDTPolicyControl service is the Network Exposure Function (NEF).

The NEF accesses the BDT Policy Control Service at the PCF via the N30 Reference point. In the roaming scenario, the N30 reference point is located between the PCF and the NEF in the home network only.



**Figure 4.1.2-1: Reference Architecture for the Npcf\_BDTPolicyControl Service; SBI representation**



**Figure 4.1.2-2: Reference Architecture for the Npcf\_BDTPolicyControl Service; reference point representation**

## 4.1.3 Network Functions

### 4.1.3.1 Policy Control Function (PCF)

The Policy Control Function (PCF):

- Provides background data transfer policies based on the request from the NF service consumer. The PCF determines, based on information provided by the NF service consumer and other available information (e.g. network policy, load status estimation for the requested time window, network area, etc.) one or more transfer policies.
- Updates background data transfer policy based on the selection provided by the NF service consumer.
- Sends the background data transfer warning notification to the NF service consumer.

### 4.1.3.2 NF Service Consumers

The Network Exposure Function (NEF):

- requests the PCF to provide background data transfer policies;
- provides the selected background data transfer policy to the PCF; and
- indicates to the PCF whether to provide a BDT warning notification.

## 4.2 Service Operations

### 4.2.1 Introduction

**Table 4.2.1-1: Operations of the Npcf\_BDTPolicyControl Service**

Service operation name	Description	Initiated by
Npcf_BDTPolicyControl_Create	Provides the requested background data transfer policies to the NF service consumer.	NF service consumer (e.g. NEF)
Npcf_BDTPolicyControl_Update	Updates the PCF with the background data transfer policy selected by the NF service consumer.	NF service consumer (e.g. NEF)
Npcf_BDTPolicyControl_Notify	Sends the BDT notification to the NF service consumer.	PCF

## 4.2.2 Npcf\_BDTPolicyControl\_Create service operation

### 4.2.2.1 General

The Npcf\_BDTPolicyControl\_Create service operation is used by an NF service consumer to retrieve BDT policies from the PCF.

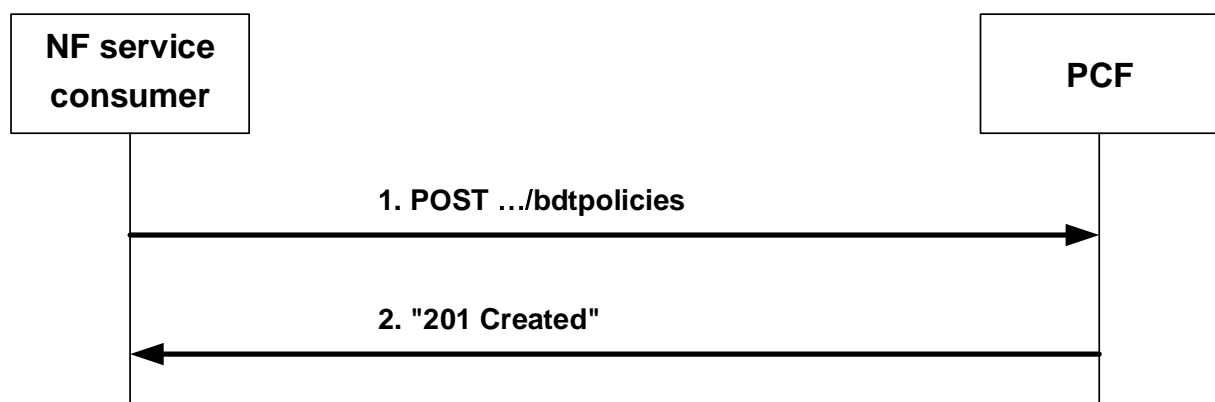
The following procedure using the Npcf\_BDTPolicyControl\_Create service operation is supported:

- retrieval of BDT policies.

### 4.2.2.2 Retrieval of BDT policies

This procedure is used by the NF service consumer to request BDT policies from the PCF, as defined in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.503 [4].

Figure 4.2.2.2-1 illustrates a retrieval of BDT policies.



**Figure 4.2.2.2-1: Retrieval of BDT policies**

Upon reception of a Background Data Transfer request from the AF indicating a transfer policy request, the NF service consumer shall invoke the Npcf\_BDTPolicyControl\_Create service operation by sending an HTTP POST request to the URI representing a "BDT policies" collection resource of the PCF (as shown in figure 4.2.2.2-1, step 1). The NF service consumer shall include a "BdtReqData" data type in a payload body of the HTTP POST request. The "BdtReqData" data type shall contain:

- an ASP identifier in the "aspId" attribute;
- a volume of data per UE in the "volPerUe" attribute;
- an expected number of UEs in the "numOfUes" attribute;
- a desired time window in the "desTimeInt" attribute; and
- if "BdtNotification\_5G" feature is supported a notification URI in the "notifUri" attribute,

and may include:

- a network area information (e.g. list of TAIs and/or NG-RAN nodes and/or cells identifiers) in the "nwAreaInfo" attribute;
- an identification of a group of UE(s) via an "interGroupId" attribute;
- a traffic descriptor of background data within the "trafficDes" attribute;
- if "BdtNotification\_5G" feature is supported an indication that BDT warning notification is requested in the "warnNotifReq" attribute; and
- a DNN and an S-NSSAI, corresponding to the ASP identifier, in the "dnn" attribute and the "snssai" attribute respectively.

If the PCF cannot successfully fulfil the received HTTP POST request due to the internal PCF error or due to the error in the HTTP POST request, the PCF shall send the HTTP error response as specified in clause 5.7.

Otherwise, upon the reception of the HTTP POST request from the NF service consumer indicating a BDT policies request, the PCF:

- may invoke the Nudr\_DataRepository\_Query service operation, as described in 3GPP TS 29.504 [11] and 3GPP TS 29.519 [12], to request from the UDR all stored transfer policies;

NOTE 1: In case only one PCF is deployed in the network, transfer policies can be locally stored in the PCF and the interaction with the UDR is not required.

- shall determine one or more acceptable transfer policies based on:
  - a) information provided by the NF service consumer; and
  - b) other available information (e.g. the existing transfer policies, network policy, load status estimation for the desired time window); and
- shall create a BDT Reference ID.

The PCF shall send to the NF service consumer a "201 Created" response to the HTTP POST request, as shown in figure 4.2.2.2-1, step 2. The PCF shall include in the "201 Created" response:

- a Location header field; and
- a "BdtPolicy" data type in the payload body containing the BDT Reference ID in the "bdtRefId" attribute and acceptable transfer policy/ies in the "transPolicies" attribute.

The Location header field shall contain the URI of the created individual BDT policy resource i.e. "{apiRoot}/npcf-bdtpolicycontrol/v1/bdtpolicies/{bdtPolicyId}".

For each included transfer policy, the PCF shall provide:

- a transfer policy ID in the "transPolicyId" attribute;
- a recommended time window in the "recTimeInt" attribute; and
- a reference to charging rate for the recommended time window in the "ratingGroup" attribute,

and may provide a maximum aggregated bitrate for the uplink direction in the "maxBitRateUl" attribute and/or a maximum aggregated bitrate for the downlink direction in the "maxBitRateDl" attribute.

If the BdtNotification\_5G feature is supported the PCF shall not assign value "0" for any transfer policy ID.

NOTE 2: As specified in clause 4.2.3.2, value "0" of transfer policy ID is reserved and indicates that no transfer policy is selected.

The PCF may map the ASP identifier into a target DNN and S-NSSAI based on local configuration if the NF service consumer did not provide the DNN and S-NSAAI to the PCF.

If the PCF included in the "BdtPolicy" data type:

- more than one transfer policy, the PCF shall wait for the transfer policy selected by the NF service consumer as described in clause 4.2.3; or
- only one transfer policy, the PCF may invoke the Nudr\_DataRepository\_Update service operation, as described in 3GPP TS 29.504 [11] and 3GPP TS 29.519 [12] clause 5.2.9.3.2, to update the UDR with the selected transfer policy, the corresponding BDT Reference ID, the volume of data per UE, the expected number of UEs and, if available, a network area information, the associated DNN and S-NSSAI for the provided ASP identifier.

NOTE 3: In case only one PCF is deployed in the network, transfer policies can be locally stored in the PCF and the interaction with the UDR is not required.

## 4.2.3 Npcf\_BDTPolicyControl\_Update service operation

### 4.2.3.1 General

The Npcf\_BDTPolicyControl\_Update service operation is used by an NF service consumer to update a BDT policy to the PCF.

The following procedure using the Npcf\_BDTPolicyControl\_Update service operation are supported:

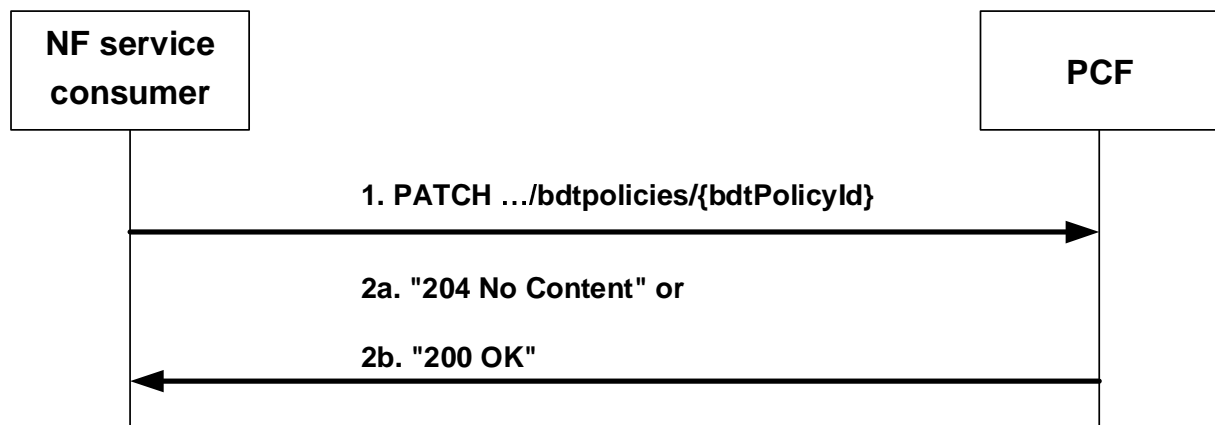
- indication about selected transfer policy; and
- modification of a BDT warning notification request indication.

### 4.2.3.2 Indication about selected transfer policy

When the feature "PatchCorrection" is supported, this procedure is used by the NF service consumer to inform the PCF about selected transfer policy, as defined in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.503 [4], if the AF selected the transfer policy from the received transfer policy list after:

- retrieval of the BDT policies as described in clause 4.2.2; or
- reception of the BDT warning notification as described in clause 4.2.4.

Figure 4.2.3.2-1 illustrates an indication about selected transfer policy.



**Figure 4.2.3.2-1: Indication about selected transfer policy**

Upon reception of a Background Data Transfer request from the AF indicating transfer policy selection, the NF service consumer shall invoke the Npcf\_BDTPolicyControl\_Update service operation by sending an HTTP PATCH request to the PCF, as shown in figure 4.2.3.2-1, step 1. The NF service consumer shall set the request URI to "{apiRoot}/npcf-bdtpolicycontrol/v1/bdtpolicies/{bdtPolicyId}".

The NF service consumer shall include a "PatchBdtPolicy" data type in a payload body of the HTTP PATCH request. When the AF selects a transfer policy, the "PatchBdtPolicy" data type shall contain a "bdtPolData" attribute which shall encode the transfer policy ID of the selected transfer policy in the "selTransPolicyId" attribute. In the case of transfer policy re-negotiation and if the BdtNotification\_5G feature is supported and the AF did not select any transfer policy, the NF service consumer shall set the "selTransPolicyId" attribute to value "0" to indicate no transfer policy is selected.

If the PCF cannot successfully fulfil the received HTTP PATCH request due to the internal PCF error or due to the error in the HTTP PATCH request, the PCF shall send the HTTP error response as specified in clause 5.7.

If the feature "ES3XX" is supported, and the PCF determines the received HTTP PATCH request needs to be redirected, the PCF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [6].

Otherwise, upon the reception of the HTTP PATCH request from the NF service consumer, the PCF:

- in case of the initial transfer policy negotiation may invoke the Nudr\_DataRepository\_Update service operation, as described in 3GPP TS 29.504 [11] and 3GPP TS 29.519 [12] clause 5.2.9.3.2, to update the UDR with the

selected transfer policy, the corresponding BDT Reference ID, the volume of data per UE, the expected number of UEs and, if available, a network area information, the associated DNN and S-NSSAI for the provided ASP identifier; or

- in case of transfer policy re-negotiation may invoke:
  - a) if a transfer policy is selected the Nudr\_DataRepository\_Update service operation, as described in 3GPP TS 29.504 [11] and 3GPP TS 29.519 [12] clause 5.2.9.3.4, to update the UDR with the selected candidate transfer policy and set the "bdtpStatus" attribute to value "VALID" within the BdtDataPatch data type; or
  - b) if no transfer policy is selected the Nudr\_DataRepository\_Delete service operation, as described in 3GPP TS 29.504 [11] and 3GPP TS 29.519 [12] clause 5.2.9.3.3, to remove the transfer policy from the UDR; and

NOTE: In case only one PCF is deployed in the network, transfer policies can be locally stored in the PCF and the interaction with the UDR is not required.

- shall send:
  - a) a "204 No Content" response (as shown in figure 4.2.3.2-1, step 2a); or
  - b) a "200 OK" response (as shown in figure 4.2.3.2-1, step 2b) with a "BdtPolicy" data type in the payload body,

to the HTTP PATCH request to the NF service consumer.

### 4.2.3.3 Modification of BDT warning notification request indication

This procedure is used by an AF to modify a BDT warning notification request indication when the feature "BdtNotification\_5G" and the feature "PatchCorrection" are supported.

Upon reception of a request from the AF to modify the BDT warning notification request indication, the NF service consumer shall invoke the Npcf\_BDTPolicyControl\_Update service operation by sending an HTTP PATCH request to the PCF, as described in clause 4.2.3.2. The NF service consumer shall indicate whether a BDT warning notification shall be enabled or disabled by including the "warnNotifReq" attribute in the "bdtReqData" attribute of the "PatchBdtPolicy" data type.

If the BDT warning notification is not required anymore the NF service consumer shall set the value of the "warnNotifReq" attribute to "false".

If the BDT warning notification is again required the NF service consumer shall set the value of the "warnNotifReq" attribute to "true".

Upon the reception of the HTTP PATCH request from the NF service consumer indicating a modification of the BDT warning notification request indication, the PCF shall acknowledge that request by sending an HTTP response message as described in clause 4.2.3.2.

## 4.2.4 Npcf\_BDTPolicyControl\_Notify service operation

### 4.2.4.1 General

The Npcf\_BDTPolicyControl\_Notify service operation is used by the PCF to send the BDT notification to the NF service consumer.

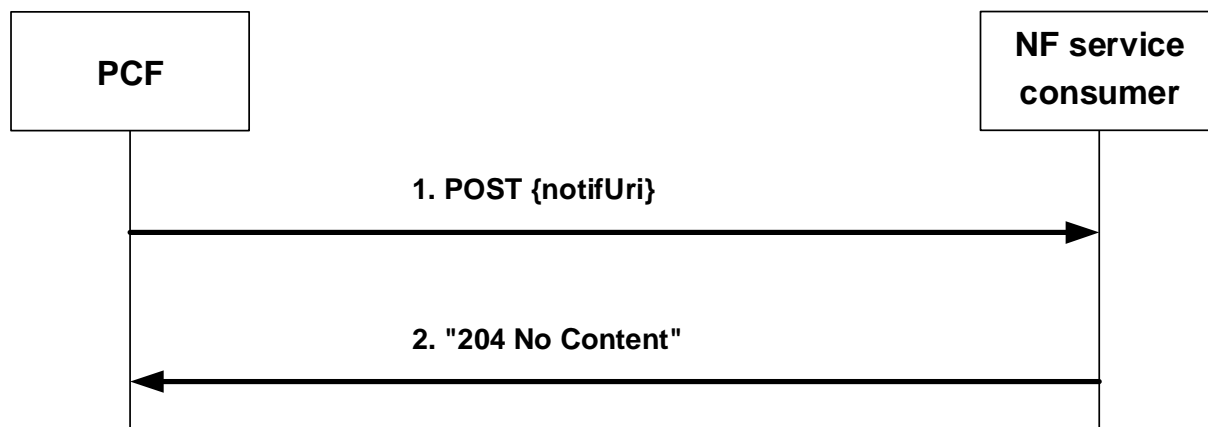
The following procedure using the Npcf\_BDTPolicyControl\_Notify service operation is supported:

- sending the BDT warning notification to the NF service consumer.

### 4.2.4.2 Sending the BDT warning notification

This procedure is used by the PCF to inform the NF service consumer that network performance in the area of interest goes below the criteria set by the operator, as defined in clause 6.1.2.4 of 3GPP TS 23.503 [4].

Figure 4.2.4.2-1 illustrates a BDT warning notification from the PCF.



**Figure 4.2.4.2-1: BDT warning notification**

When the PCF knows that the network performance in the area of interest goes below the criteria set by the operator from the NWDAF as described in 3GPP TS 29.520 [22] and if the BDT warning notification is enabled, the PCF may try to re-negotiate the affected BDT policies with the affected AFs. To do this, the PCF retrieves all the background transfer policies together with their additionally stored AF provided information for BDT policy decision (e.g. their corresponding desired time window, the number of UEs, the volume of data per UE, etc.) from the UDR, identifies the BDT policy(ies) that are not desirable anymore due to the degradation of the network performance and tries to calculate one or more new candidate BDT policies based on the AF provided information, the background transfer policies retrieved from the UDR and the current network performance as follows:

- If the BDT policies retrieved from the UDR include the "bdtpStatus" attribute indicating the BDT policy is invalid, the PCF may calculate one or more new candidate BDT policies without considering the invalid BDT policy.
- If the PCF does not find any new candidate BDT policies, the previously negotiated BDT policy shall be kept and no interaction with the AF shall occur.

If one or more new candidate BDT policies are calculated, the PCF shall:

- if the PCF has not locally stored the background transfer policies, invoke the Nudr\_DataRepository\_Update service operation, as described in 3GPP TS 29.504 [11] and 3GPP TS 29.519 [12] clause 5.2.9.3.4, to invalidate the affected background transfer policy stored in the UDR by including the "bdtpStatus" attribute set to value "INVALID" within the BdtDataPatch data type; and
- invoke the Npcf\_BDTPolicyControl\_Notify service operation by sending the HTTP POST request with the BDT warning notification to the NF service consumer so that the NF service consumer can notify the AF.

The PCF shall include a "Notification" data type in a payload body of the HTTP POST request.

The "Notification" data type provided in the request body:

- shall contain the BDT Reference ID of the impacted transfer policy within the "bdtRefId" attribute;
- may contain the time window when the network performance will go below the criteria set by the operator within the "timeWindow" attribute;
- may contain the network area where the network performance will go below the criteria set by the operator within the "nwAreaInfo" attribute; and
- may contain the list of candidate transfer policies in the "candPolicies" attribute.

**NOTE:** The AF might select a new background transfer policy or might not select any new background transfer policy from the offered candidate list when receives the BDT warning notification.

Upon the reception of the HTTP POST request from the PCF, the NF service consumer shall acknowledge that request by sending an HTTP response message with the corresponding status code.

If the HTTP POST request from the PCF is accepted, the NF service consumer shall acknowledge the receipt of the notification with a "204 No Content" response to HTTP POST request, as shown in figure 4.2.4.2-1, step 2.

If the HTTP POST request from the PCF is not accepted, the NF service consumer shall send an HTTP error response as specified in clause 5.7.

If the feature "ES3XX" is supported, and the NF service consumer determines the received HTTP POST request needs to be redirected, the NF service consumer shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [6].

---

## 5 Npcf\_BDTPolicyControl API

### 5.1 Introduction

The BDT Policy Control Service shall use the Npcf\_BDTPolicyControl API.

The API URI of the Npcf\_BDTPolicyControl API shall be:

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

The request URI used in each HTTP request from the NF service consumer towards the PCF shall have the structure defined in clause 4.4.1 of 3GPP TS 29.501 [7], i.e.:

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

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [7].
- The <apiName> shall be "npcf-bdtpolicycontrol".
- The <apiVersion> shall be "v1".
- The <apiSpecificResourceUriPart> shall be set as described in clause 5.3.

### 5.2 Usage of HTTP

#### 5.2.1 General

HTTP/2, IETF RFC 7540 [8], shall be used as specified in clause 5.2 of 3GPP TS 29.500 [6].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [6].

The OpenAPI [10] specification of HTTP messages and content bodies for the Npcf\_BDTPolicyControl is contained in Annex A.

#### 5.2.2 HTTP standard headers

##### 5.2.2.1 General

See clause 5.2.2 of 3GPP TS 29.500 [6] for the usage of HTTP standard headers.

##### 5.2.2.2 Content type

JSON, IETF RFC 8259 [9], shall be used as content type of the HTTP bodies specified in the present specification as specified in clause 5.4 of 3GPP TS 29.500 [6]. The use of the JSON format shall be signalled by the content type "application/json".



JSON object used in the HTTP PATCH request shall be encoded according to "JSON Merge Patch" and shall be signalled by the content type "application/merge-patch+json", as defined in IETF RFC 7396 [15].

"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 [17].

### 5.2.3 HTTP custom headers

The Npcf\_BDTPolicyControl API shall support mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [6] and may support optional HTTP custom header fields specified in clause 5.2.3.3 of 3GPP TS 29.500 [6].

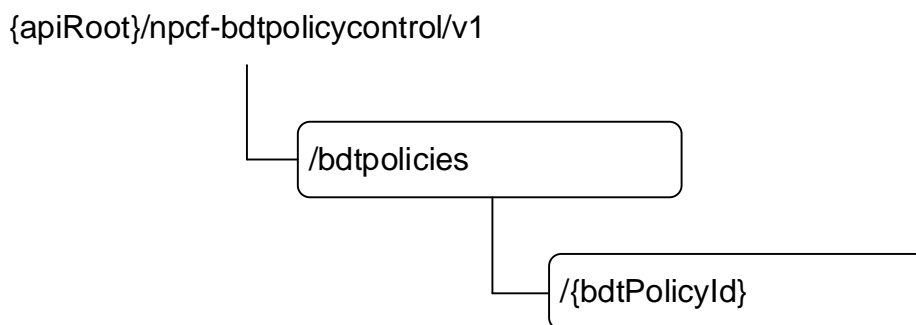
In this Release of the specification, no specific custom headers are defined for the Npcf\_BDTPolicyControl API.

## 5.3 Resources

### 5.3.1 Resource Structure

This clause describes the structure for the Resource URIs and the resources and methods used for the service.

Figure 5.3.1-1 depicts the resource URIs structure for the Npcf\_BDTPolicyControl API.



**Figure 5.3.1-1: Resource URI structure of the Npcf\_BDTPolicyControl 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
BDT policies	/bdtpolicies	POST	Npcf_BDTPolicyControl_Create. Creates a new Individual BDT policy resource.
Individual BDT policy	/bdtpolicies/{bdtPolicyId}	GET	Reads an Individual BDT policy resource.
		PATCH	Npcf_BDTPolicyControl_Update. Modifies an existing Individual BDT policy resource by selecting or reselecting a transfer policy.

## 5.3.2 Resource: BDT policies (Collection)

### 5.3.2.1 Description

The BDT policies resource represents all the transfer policies that exist in the BDT Policy Control service at a given PCF instance.

### 5.3.2.2 Resource definition

Resource URI: **{apiRoot}/npcf-bdtpolicycontrol/v1/bdtpolicies**

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	Data type	Definition
apiRoot	string	See clause 5.1.

### 5.3.2.3 Resource Standard Methods

#### 5.3.2.3.1 POST

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 POST method on this resource**

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.3.2.3.1-2 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 POST Request Body on this resource**

Data type	P	Cardinality	Description
BdtReqData	M	1	Contains information for the creation of a new Individual BDT policy resource.

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

Data type	P	Cardinality	Response Codes	Description
BdtPolicy	M	1	201 Created	Successful case. The creation of an Individual BDT policy resource is confirmed and a representation of that resource is returned.
n/a			303 See Other	The result of the HTTP POST request would be equivalent to the existing Individual BDT policy resource. The HTTP response shall contain a Location header field set to the URI of the existing individual BDT policy resource.

NOTE: In addition, the HTTP status codes which are specified as mandatory in table 5.2.7.1-1 of 3GPP TS 29.500 [6] for the POST method shall also apply.

**Table 5.3.2.3.1-4: Headers supported by the 201 Response Code on this resource**

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains the URI of the newly created resource, according to the structure: <b>{apiRoot}/npcf-bdtpolicycontrol/v1/bdtpolicies/{bdtPolicyId}</b> .

**Table 5.3.2.3.1-5: Headers supported by the 303 Response Code on this resource**

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains the URI of the existing individual BDT policy resource.

#### 5.3.2.4 Resource Custom Operations

None.

### 5.3.3 Resource: Individual BDT policy (Document)

#### 5.3.3.1 Description

The Individual BDT policy resource represents the transfer policies that exist in the BDT Policy Control service at a given PCF instance.

#### 5.3.3.2 Resource definition

Resource URI: {apiRoot}/npcf-bdtpolicycontrol/v1/bdtpolicies/{bdtPolicyId}

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	Data type	Definition
apiRoot	string	See clause 5.1.
bdtPolicyId	string	Identifies the individual BDT policy resource in the PCF. To enable the value to be used as part of a URI, the string shall only contain allowed characters according to the "lower-with-hyphen" naming convention defined in clause 5.1.3 of 3GPP TS 29.501 [7] and rules for a path segment defined in IETF RFC 3986 [16].

#### 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
BdtPolicy	M	1	200 OK	A representation of an Individual BDT policy resource is returned.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during resource retrieval. The response shall include a Location header field containing an alternative URI of the resource located in an alternative PCF (service) instance. Applicable if the feature "ES3XX" is supported.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during resource retrieval. The response shall include a Location header field containing an alternative URI of the resource located in an alternative PCF (service) instance. Applicable if the feature "ES3XX" is supported.
ProblemDetails	O	0..1	404 Not Found	(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 [6] for the GET method shall also apply.

NOTE 2: Failure cases are described in clause 5.7.

**Table 5.3.3.3.1-4: Headers supported by the 307 Response Code on this resource**

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative PCF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

**Table 5.3.3.3.1-5: Headers supported by the 308 Response Code on this resource**

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative PCF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

### 5.3.3.3.2 PATCH

This method shall support the URI query parameters specified in table 5.3.3.3.2-1.

**Table 5.3.3.3.2-1: URI query parameters supported by the PATCH method on this resource**

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.3.3.3.2-2 and the response data structures and response codes specified in table 5.3.3.3.2-3.

**Table 5.3.3.3.2-2: Data structures supported by the PATCH Request Body on this resource**

Data type	P	Cardinality	Description
PatchBdtPolicy	M	1	Contains modification instructions to be performed on the BdtPolicy data structure to select a transfer policy and in addition, may indicate whether the BDT warning notification is enabled or disabled.

**Table 5.3.3.3.2-3: Data structures supported by the PATCH Response Body on this resource**

Data type	P	Cardinality	Response Codes	Description
BdtPolicy	M	1	200 OK	Successful case. The Individual BDT Policy resource is modified and a representation of that resource is returned.
n/a			204 No Content	Successful case. The Individual BDT Policy resource is modified.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during resource modification. The response shall include a Location header field containing an alternative URI of the resource located in an alternative PCF (service) instance. Applicable if the feature "ES3XX" is supported.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during resource modification. The response shall include a Location header field containing an alternative URI of the resource located in an alternative PCF (service) instance. Applicable if the feature "ES3XX" is supported.
ProblemDetails	O	0..1	404 Not Found	(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 [6] for the PATCH method shall also apply.

NOTE 2: Failure cases are described in clause 5.7.

**Table 5.3.3.3.2-4: Headers supported by the 307 Response Code on this resource**

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative PCF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

**Table 5.3.3.3.2-5: Headers supported by the 308 Response Code on this resource**

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative PCF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

## 5.4 Custom Operations without associated resources

No custom operation is defined in this Release of the specification.

## 5.5 Notifications

### 5.5.1 General

Notifications shall comply to clause 6.2 of 3GPP TS 29.500 [6] and clause 4.6.2.3 of 3GPP TS 29.501 [7].

**Table 5.5.1-1: Notifications overview**

Notification	Callback URI	HTTP method or custom operation	Description (service operation)
BDT Notification	{notifUri}	POST	Provides BDT notification.

## 5.5.2 BDT Notification

### 5.5.2.1 Description

The BDT Notification is used by the PCF to notify the NF service consumer about changed conditions for background data transfer e.g. that a network performance in the area of interest goes below the criteria set by the operator.

### 5.5.2.2 Target URI

The Callback URI "{**notifUri**}" shall be used with the callback URI variables defined in table 5.5.2.2-1.

**Table 5.5.2.2-1: Callback URI variables**

Name	Data type	Definition
notifUri	Uri	It contains the URI of the recipient of BDT notification as assigned by the NF service consumer during the Create service operation and described within the BdtReqData (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
Notification	M	1	Provides BDT notification.

**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	Successful case. The reception of the BDT notification is acknowledged.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during notification. The response shall include a Location header field containing an alternative URI representing the end point of an alternative NF consumer (service) instance where the notification should be sent. Applicable if the feature "ES3XX" is supported.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during notification. The response shall include a Location header field containing an alternative URI representing the end point of an alternative NF consumer (service) instance where the notification should be sent. Applicable if the feature "ES3XX" is supported.

NOTE: In addition, the HTTP status codes which are specified as mandatory in table 5.2.7.1-1 of 3GPP TS 29.500 [6] for the POST method shall also apply.

**Table 5.5.2.3.1-4: Headers supported by the 307 Response Code on this resource**

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected.

**Table 5.5.2.3.1-5: Headers supported by the 308 Response Code on this resource**

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected.

## 5.6 Data Model

### 5.6.1 General

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

Table 5.6.1-1 specifies the data types defined for the Npcf\_BDTPolicyControl service based interface protocol.

**Table 5.6.1-1: Npcf\_BDTPolicyControl specific Data Types**

Data type	Section defined	Description	Applicability
BdtPolicy	5.6.2.2	Represents an Individual BDT policy resource.	
BdtPolicyData	5.6.2.4	Describes an Individual BDT policy resource.	
BdtPolicyDataPatch	5.6.2.6	Contains modification instructions to be performed on the "bdtPolData" property of the BdtPolicy data structure to select a transfer policy.	
BdtReqData	5.6.2.3	Contains information for creation a new Individual BDT policy resource.	
BdtReqDataPatch	5.6.2.12	Describes the modifications to the BDT request data of an Individual BDT policy resource.	PatchCorrection
NetworkAreaInfo	5.6.2.8	Describes a network area information in which the NF service consumer requests the number of UEs.	
Notification	5.6.2.10	Contains the BDT notification information.	BdtNotification_5G
PatchBdtPolicy	5.6.2.11	Describes the modifications to the BDT Policy Data and BDT Policy Request data of an Individual BDT policy resource.	PatchCorrection
TransferPolicy	5.6.2.5	Describes a transfer policy.	

Table 5.6.1-2 specifies data types re-used by the Npcf\_BDTPolicyControl 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 Npcf\_BDTPolicyControl service based interface.

Table 5.6.1-2: Npcf\_BDTPolicyControl re-used Data Types

Data type	Reference	Comments	Applicability
BdtReferenceld	3GPP TS 29.122 [14]	Identifies transfer policy of background data transfer for provided ASP.	
BitRate	3GPP TS 29.571 [13]	Specifies bitrate in kbits per second.	
Dnn	3GPP TS 29.571 [13]	Identifies a Data Network Name.	
Ecgi	3GPP TS 29.571 [13]	Represents an EUTRA cell identifier.	
GlobalRanNodeId	3GPP TS 29.571 [13]	Represents an identity of the NG-RAN node.	
GroupId	3GPP TS 29.571 [13]	Identifies a group of UEs.	
Ncgi	3GPP TS 29.571 [13]	Represents an NR cell identifier.	
ProblemDetails	3GPP TS 29.571 [13]	Used in error responses to provide more detailed information about an error.	
RedirectResponse	3GPP TS 29.571 [13]	Contains redirection related information.	ES3XX
Snsai	3GPP TS 29.571 [13]	Identifies a Single Network Slice Selection Assistance Information.	
SupportedFeatures	3GPP TS 29.571 [13]	Used to negotiate the applicability of the optional features defined in table 5.8-1.	
Tai	3GPP TS 29.571 [13]	Represents a tracking area identity.	
TimeWindow	3GPP TS 29.122 [14]	Specifies a time interval.	
TrafficDescriptor	3GPP TS 29.122 [14]	Represents a traffic descriptor.	
Uri	3GPP TS 29.571 [13]	String providing an URI.	BdtNotification_5G
UsageThreshold	3GPP TS 29.122 [14]	Represents a data volume expected to be transferred per UE.	

## 5.6.2 Structured data types

### 5.6.2.1 Introduction

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

### 5.6.2.2 Type BdtPolicy

Table 5.6.2.2-1: Definition of type BdtPolicy

Attribute name	Data type	P	Cardinality	Description	Applicability
bdtPolData	BdtPolicyData	C	0..1	Describes the authorization data of an Individual BDT Policy created by the PCF. It shall be present in the response to the POST request that requests a creation of an Individual BDT Policy resource and in the response to GET request.	
bdtReqData	BdtReqData	C	0..1	Identifies the service requirements of an Individual BDT Policy. It shall be present in the POST request that requests a creation of an Individual BDT Policy resource and in the response to GET request.	



## 5.6.2.3 Type BdtReqData

Table 5.6.2.3-1: Definition of type BdtReqData

Attribute name	Data type	P	Cardinality	Description	Applicability
aspId	AspId	M	1	This IE contains an identity of an application service provider.	
desTimeInt	TimeWindow	M	1	This IE indicates a desired time window for BDT.	
dnn	Dnn	O	0..1	This IE identifies a DNN.	
interGroupId	GroupId	O	0..1	Represents an internal group identifier and identifies a group of UEs.	
notifUri	Uri	O	0..1	This IE indicates that the NF service consumer requests a BDT notification from the PCF. It contains an URI of the recipient of BDT notification.	BdtNotification_5G
nwAreaInfo	NetworkAreaInfo	O	0..1	This IE represents a network area information in which the NF service consumer requests a number of UEs. It may be present in the POST request that requests a creation of an Individual BDT Policy and in the response to GET request.	
numOfUes	integer	M	1	This IE indicates a number of UEs.	
snssai	Snssai	O	0..1	This IE identifies a slice.	
suppFeat	SupportedFeatures	C	0..1	This IE represents a list of Supported features used as described in clause 5.8. It shall be supplied by the NF service consumer in the POST request that request a creation of an Individual BDT Policy resource.	
trafficDes	TrafficDescriptor	O	0..1	Contains the traffic descriptor of the background data.	
volPerUe	UsageThreshold	M	1	This IE indicates a data volume expected to be transferred per UE.	
warnNotifReq	boolean	O	0..1	This IE indicates whether the BDT warning notification is enabled or disabled. It may be present: - in the POST request that requests a creation of an Individual BDT Policy and in the corresponding response; and - in responses to GET and PATCH requests.  true: enabled; false: disabled (default).	BdtNotification_5G

## 5.6.2.4 Type BdtPolicyData

Table 5.6.2.4-1: Definition of type BdtPolicyData

Attribute name	Data type	P	Cardinality	Description	Applicability
bdtRefId	BdtReferenceld	M	1	This IE indicates transfer policies of background data transfer for provided ASP.	
selTransPolicyId	integer	C	0..1	This IE contains the identity of the selected transfer policy. It shall be present in the response to the PATCH request that modifies an Individual BDT Policy resource to indicate a selected transfer policy.	
suppFeat	SupportedFeatures	C	0..1	This IE represents a list of Supported features used as described in clause 5.8. It shall be supplied by the PCF in the response to the POST request that requests a creation of an Individual BDT Policy resource.	
transPolicies	array(TransferPolicy)	M	1..N	This IE contains transfer policies. It shall be supplied by the PCF in the response to the POST request that requests a creation of an Individual BDT Policy resource.	

## 5.6.2.5 Type TransferPolicy

Table 5.6.2.5-1: Definition of type TransferPolicy

Attribute name	Data type	P	Cardinality	Description	Applicability
maxBitRateDl	BitRate	O	0..1	This IE indicates a maximum aggregated bitrate in the downlink direction authorized by the PCF.	
maxBitRateUl	BitRate	O	0..1	This IE indicates a maximum aggregated bitrate in the uplink direction authorized by the PCF.	
ratingGroup	integer	M	1	This IE indicates a rating group for the recommended time window.	
recTimeInt	TimeWindow	M	1	This IE indicates a recommended time window of a transfer policy.	
transPolicyId	integer	M	1	This IE contains an identity of a transfer policy.	

## 5.6.2.6 Type BdtPolicyDataPatch

Table 5.6.2.6-1: Definition of type BdtPolicyDataPatch

Attribute name	Data type	P	Cardinality	Description	Applicability
selTransPolicyId	integer	M	1	This IE contains an identity (i.e. the transPolicyId value) of a selected transfer policy. If the BdtNotification_5G feature is supported value "0" indicates that no transfer policy is selected.	

## 5.6.2.7 Void

## 5.6.2.8 Type NetworkAreaInfo

Table 5.6.2.8-1: Definition of type NetworkAreaInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
ecgis	array(Ecgi)	O	1..N	This IE contains a list of E-UTRA cell identities.	
ncgis	array(Ncgi)	O	1..N	This IE contains a list of NR cell identities.	
gRanNodeIds	array(GlobalRanNodeId)	O	1..N	This IE contains a list of the NG-RAN nodes. The "n3IwId" attribute within the "GlobalRanNodeId" data type shall not be supplied.	
tais	array(Tai)	O	1..N	This IE contains a list of tracking area identities.	
NOTE: The NetworkAreaInfo data type allows any combination of defined properties.					

## 5.6.2.9 Void

## 5.6.2.10 Type Notification

Table 5.6.2.10-1: Definition of type Notification

Attribute name	Data type	P	Cardinality	Description	Applicability
bdtRefId	BdtReferenceId	M	1	This IE indicates transfer policies of background data transfer which the notification corresponds to.	
candPolicies	array(TransferPolicy)	O	1..N	This IE contains a list of the candidate transfer policies from which the AF may select a new transfer policy due to a network performance is below the criteria set by the operator.	
nwAreaInfo	NetworkAreaInfo	O	0..1	This IE represents a network area where a network performance will go below the criteria set by the operator.	
timeWindow	TimeWindow	O	0..1	This IE indicates a time window when a network performance will go below the criteria set by the operator.	

## 5.6.2.11 Type PatchBdtPolicy

Table 5.6.2.11-1: Definition of type PatchBdtPolicy

Attribute name	Data type	P	Cardinality	Description	Applicability
bdtPolData	BdtPolicyDataPatch	O	0..1	Describes the updates in BDT policy data of an Individual BDT Policy resource, e.g., describes the selected BDT policy.	
bdtReqData	BdtReqDataPatch	O	0..1	Describes the updates in BDT policy request data of an Individual BDT Policy resource, e.g., describes the updates in warning notification requirements.	

## 5.6.2.12 Type BdtReqDataPatch

**Table 5.6.2.12-1: Definition of type BdtReqDataPatch**

Attribute name	Data type	P	Cardinality	Description	Applicability
warnNotifReq	boolean	O	0..1	This IE indicates whether the BDT warning notification is enabled or disabled.	BdtNotification_5G

## 5.6.3 Simple data types and enumerations

### 5.6.3.1 Introduction

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

### 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
Aspld	string	This IE contains an identity of an application service provider.	

## 5.7 Error handling

### 5.7.1 General

HTTP error handling shall be supported as specified in clause 5.2.4 of 3GPP TS 29.500 [6].

For the Npcf\_BDTPolicyControl API, HTTP error responses shall be supported as specified in clause 4.8 of 3GPP TS 29.501 [7].

Protocol errors and application errors specified in table 5.2.7.2-1 of 3GPP TS 29.500 [6] 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 [6].

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

### 5.7.2 Protocol Errors

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

### 5.7.3 Application Errors

The application errors defined for the Npcf\_BDTPolicyControl API are listed in table 5.7.3-1.

**Table 5.7.3-1: Application errors**

Application Error	HTTP status code	Description
BDT_POLICY_NOT_FOUND	404 Not Found	The HTTP request is rejected because the specified Individual BDT policy resource does not exist. (NOTE 1)
NOTE 1: This application error is included in the responses to the GET and PATCH requests.		
NOTE 2: Including a "ProblemDetails" data structure with the "cause" attribute in the HTTP response is optional unless explicitly mandated in the service operation clauses.		

## 5.8 Feature negotiation

The optional features in table 5.8-1 are defined for the Npcf\_BDTPolicyControl API. They shall be negotiated using the extensibility mechanism defined in clause 6.6.2 of 3GPP TS 29.500 [6].

When requesting the PCF to create an Individual BDT policy resource the NF service consumer shall indicate the optional features the NF service consumer supports for the Npcf\_BDTPolicyControl service by including the "suppFeat" attribute in the "BdtReqData" data type of the HTTP POST request.

The PCF shall determine the supported features for the created Individual BDT policy resource as specified in clause 6.6.2 of 3GPP TS 29.500 [6]. The PCF shall indicate the supported features in the HTTP response confirming the creation of the Individual BDT policy resource by including the "suppFeat" attribute in the "BdtPolicyData" data type.

**Table 5.8-1: Supported Features**

Feature number	Feature Name	Description
1	BdtNotification_5G	This feature indicates the support of sending the BDT notification to the NF service consumer. This feature includes sending of the BDT warning notification to the NF service consumer.
2	ES3XX	Extended Support for 3xx redirections. This feature indicates the support of redirection for any service operation, according to Stateless NF procedures as specified in clauses 6.5.3.2 and 6.5.3.3 of 3GPP TS 29.500 [6] and according to HTTP redirection principles for indirect communication, as specified in clause 6.10.9 of 3GPP TS 29.500 [6].
3	PatchCorrection	Indicates support of the correction to the PATCH method. When this feature is not supported, the interoperability between a NF service consumer and the PCF can only be ensured when it is not required the update of the Individual BDT policy resource.

## 5.9 Security

As indicated in 3GPP TS 33.501 [18] and 3GPP TS 29.500 [6], the access to the Npcf\_BDTPolicyControl API, based on local configuration, may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [19]), using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [20]) plays the role of the authorization server.

If OAuth2 authorization is used, an NF service consumer, prior to consuming services offered by the Npcf\_BDTPolicyControl API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [20], 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 Npcf\_BDTPolicyControl service.

The Npcf\_BDTPolicyControl API defines a single scope "npcf-bdtpolicycontrol" for OAuth2 authorization (as specified in 3GPP TS 33.501 [18]) for the entire API, 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 [10] specification of HTTP messages and content bodies used by the Npcf\_BDTPolicyControl API.

This Annex shall take precedence when being discrepant to other parts of the specification with respect to the encoding of information elements and methods within the API.

**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 file contained in this 3GPP Technical Specification are available on a Git-based repository that uses the GitLab software version control system (see clause 5B of the 3GPP TR 21.900 [21] and clause 5.3.1 of the 3GPP TS 29.501 [7] for further information).

## A.2 Npcf\_BDTPolicyControl API

openapi: 3.0.0

info:

```
title: Npcf_BDTPolicyControl Service API
version: 1.2.0
description: |
  PCF BDT Policy Control Service.
  © 2022, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
  All rights reserved.
```

externalDocs:

```
description: >
  3GPP TS 29.554 V17.4.0; 5G System; Background Data Transfer Policy Control Service.
url: 'https://www.3gpp.org/ftp/Specs/archive/29_series/29.554/'
```

servers:

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

security:

```
- {}
- oAuth2ClientCredentials:
  - npcf-bdtpolicycontrol
```

paths:

```
/bdtpolicies:
  post:
    summary: Create a new Individual BDT policy
    operationId: CreateBDTPolicy
    tags:
      - BDT policies (Collection)
    requestBody:
      description: >
        Contains information for the creation of a new Individual BDT policy resource.
      required: true
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/BdtReqData'
    responses:
      '201':
        description: Background data transfer policies offered to an ASP.
        content:
```

```

    application/json:
      schema:
        $ref: '#/components/schemas/BdtPolicy'
  headers:
    Location:
      description: >
        Contains the URI of the created individual BDT policy resource,
        according to the structure
        {apiRoot}/npcf-bdtpolicycontrol/v1/bdtpolicies/{bdtPolicyId}
      required: true
      schema:
        type: string
  '303':
    description: >
      See Other. The result of the POST request would be equivalent to the
      existing Individual BDT policy resource.
    headers:
      Location:
        description: Contains the URI of the existing individual BDT policy resource.
        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'
  default:
    $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  callbacks:
    BdtNotification:
      '{$request.body#/notifUri}':
        post:
          requestBody:
            required: true
            content:
              application/json:
                schema:
                  $ref: '#/components/schemas/Notification'
  responses:
    '204':
      description: No Content, a reception of the BDT notification was successful.
    '307':
      $ref: 'TS29571_CommonData.yaml#/components/responses/307'
    '308':
      $ref: 'TS29571_CommonData.yaml#/components/responses/308'
    '400':
      $ref: 'TS29571_CommonData.yaml#/components/responses/400'
    '401':
      $ref: 'TS29571_CommonData.yaml#/components/responses/401'
    '403':
      $ref: 'TS29571_CommonData.yaml#/components/responses/403'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '411':
      $ref: 'TS29571_CommonData.yaml#/components/responses/411'
    '413':
      $ref: 'TS29571_CommonData.yaml#/components/responses/413'
    '415':
      $ref: 'TS29571_CommonData.yaml#/components/responses/415'
    '429':
      $ref: 'TS29571_CommonData.yaml#/components/responses/429'
    '500':

```

```

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

/bdtpolicies/{bdtPolicyId}:
  get:
    summary: Read an Individual BDT policy
    operationId: GetBDTPolicy
    tags:
      - Individual BDT policy (Document)
    parameters:
      - name: bdtPolicyId
        description: String identifying the individual BDT policy resource in the PCF.
        in: path
        required: true
        schema:
          type: string
    responses:
      '200':
        description: Background data transfer policies offered to and selected by an ASP.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/BdtPolicy'
      '307':
        $ref: 'TS29571_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29571_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '406':
        $ref: 'TS29571_CommonData.yaml#/components/responses/406'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  patch:
    summary: Update an Individual BDT policy
    operationId: UpdateBDTPolicy
    tags:
      - Individual BDT policy (Document)
    parameters:
      - name: bdtPolicyId
        description: String identifying the individual BDT policy resource in the PCF.
        in: path
        required: true
        schema:
          type: string
    requestBody:
      description: >
        Contains modification instruction to be performed on the BdtPolicy data
        structure to select a transfer policy and in addition, may indicate whether
        the BDT warning notification is enabled or disabled.
      required: true
      content:
        application/merge-patch+json:
          schema:
            $ref: '#/components/schemas/PatchBdtPolicy'
    responses:
      '200':
        description: >
          The Individual BDT Policy resource is modified and a representation of that
          resource is returned.
        content:
          application/json:
            schema:

```



```

    $ref: '#/components/schemas/BdtPolicy'
  '204':
    description: The Individual BDT Policy resource is modified.
  '307':
    $ref: 'TS29571_CommonData.yaml#/components/responses/307'
  '308':
    $ref: 'TS29571_CommonData.yaml#/components/responses/308'
  '400':
    $ref: 'TS29571_CommonData.yaml#/components/responses/400'
  '401':
    $ref: 'TS29571_CommonData.yaml#/components/responses/401'
  '403':
    $ref: 'TS29571_CommonData.yaml#/components/responses/403'
  '404':
    $ref: 'TS29571_CommonData.yaml#/components/responses/404'
  '411':
    $ref: 'TS29571_CommonData.yaml#/components/responses/411'
  '413':
    $ref: 'TS29571_CommonData.yaml#/components/responses/413'
  '415':
    $ref: 'TS29571_CommonData.yaml#/components/responses/415'
  '429':
    $ref: 'TS29571_CommonData.yaml#/components/responses/429'
  '500':
    $ref: 'TS29571_CommonData.yaml#/components/responses/500'
  '503':
    $ref: 'TS29571_CommonData.yaml#/components/responses/503'
  default:
    $ref: 'TS29571_CommonData.yaml#/components/responses/default'

```

components:

```

securitySchemes:
  oAuth2ClientCredentials:
    type: oauth2
    flows:
      clientCredentials:
        tokenUrl: '{nrfApiRoot}/oauth2/token'
        scopes:
          npcf-bdtpolicycontrol: Access to the Npcf_BDTPolicyControl API

```

schemas:

# Structured data types

```

BdtPolicy:
  description: Represents an Individual BDT policy resource.
  type: object
  properties:
    bdtPolData:
      $ref: '#/components/schemas/BdtPolicyData'
    bdtReqData:
      $ref: '#/components/schemas/BdtReqData'

BdtReqData:
  description: >
    Contains service requirements for creation a new Individual BDT policy resource.
  type: object
  required:
  - aspId
  - desTimeInt
  - numOfUes
  - volPerUe
  properties:
    aspId:
      $ref: '#/components/schemas/AspId'
    desTimeInt:
      $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
    dnn:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
    interGroupId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/GroupId'
    notifUri:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
    nwAreaInfo:
      $ref: '#/components/schemas/NetworkAreaInfo'
    numOfUes:
      description: Indicates a number of UEs.

```

```

    type: integer
  volPerUe:
    $ref: 'TS29122_CommonData.yaml#/components/schemas/UsageThreshold'
  snssai:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
  suppFeat:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
  trafficDes:
    $ref: 'TS29122_ResourceManagementOfBdt.yaml#/components/schemas/TrafficDescriptor'
  warnNotifReq:
    description: Indicates whether the BDT warning notification is enabled or disabled.
    type: boolean
    default: false

BdtPolicyData:
  description: Describes the authorization data of an Individual BDT policy resource.
  type: object
  required:
  - bdtRefId
  - transfPolicies
  properties:
    bdtRefId:
      $ref: 'TS29122_CommonData.yaml#/components/schemas/BdtReferenceId'
    transfPolicies:
      description: Contains transfer policies.
      type: array
      items:
        $ref: '#/components/schemas/TransferPolicy'
      minItems: 1
    selTransPolicyId:
      description: Contains an identity of the selected transfer policy.
      type: integer
    suppFeat:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'

PatchBdtPolicy:
  description: >
    Describes the updates in authorization data of an Individual BDT Policy created
    by the PCF.
  type: object
  properties:
    bdtPolData:
      $ref: '#/components/schemas/BdtPolicyDataPatch'
    bdtReqData:
      $ref: '#/components/schemas/BdtReqDataPatch'

BdtPolicyDataPatch:
  description: >
    A JSON Merge Patch body schema containing modification instruction to be performed
    on the bdtPolData attribute of the BdtPolicy data structure to select a transfer
    policy. Adds selTransPolicyId to BdtPolicyData data structure.
  type: object
  required:
  - selTransPolicyId
  properties:
    selTransPolicyId:
      description: >
        Contains an identity (i.e. transPolicyId value) of the selected transfer
        policy. If the BdtNotification_5G feature is supported value 0 indicates that
        no transfer policy is selected.
      type: integer

BdtReqDataPatch:
  description: >
    A JSON Merge Patch body schema containing modification instruction to be performed
    on the bdtReqData attribute of the BdtPolicy data structure to indicate whether
    the BDT warning notification is enabled or disabled. Modifies warnNotifReq from
    BdtReqData data structure.
  type: object
  properties:
    warnNotifReq:
      description: Indicates whether the BDT warning notification is enabled or disabled.
      type: boolean

TransferPolicy:
  description: Describes a transfer policy.
  type: object
  required:

```

```

- ratingGroup
- recTimeInt
- transPolicyId
properties:
  maxBitRateDl:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
  maxBitRateUl:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
  ratingGroup:
    description: Indicates a rating group for the recommended time window.
    type: integer
  recTimeInt:
    $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
  transPolicyId:
    description: Contains an identity of a transfer policy.
    type: integer

```

```

NetworkAreaInfo:
  description: >
    Describes a network area information in which the NF service consumer requests
    the number of UEs.
  type: object
  properties:
    ecgis:
      description: Contains a list of E-UTRA cell identities.
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Ecgi'
      minItems: 1
    ncgis:
      description: Contains a list of NR cell identities.
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Ncgi'
      minItems: 1
    gRanNodeIds:
      description: Contains a list of NG RAN nodes.
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/GlobalRanNodeId'
      minItems: 1
    tais:
      description: Contains a list of tracking area identities.
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Tai'
      minItems: 1

```

```

Notification:
  description: Describes a BDT notification.
  type: object
  required:
  - bdtRefId
  properties:
    bdtRefId:
      $ref: 'TS29122_CommonData.yaml#/components/schemas/BdtReferenceId'
    candPolicies:
      description: >
        Contains a list of the candidate transfer policies from which the AF may
        select a new transfer policy due to a network performance is below the criteria
        set by the operator.
      type: array
      items:
        $ref: '#/components/schemas/TransferPolicy'
      minItems: 1
    nwAreaInfo:
      $ref: '#/components/schemas/NetworkAreaInfo'
    timeWindow:
      $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'

```

# Simple data types

```

AspId:
  description: Contains an identity of an application service provider.
  type: string

```

## Annex B (informative): Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Cat	Subject/Comment	New version
2018-01						TS skeleton	0.0.0
2018-01	CT3#94	C3-180369				Inclusion of C3-180188 agreed in CT3#94.	0.1.0
2018-03	CT3#95	C3-181376				Inclusion of documents agreed in CT3#95: C3-181055, C3-181091, C3-181268, C3-181269, C3-181270.	0.2.0
2018-04	CT3#96	C3-182524				Inclusion of documents agreed in CT3#96: C3-182048, C3-182428, C3-182427, C3-182051, C3-182052, C3-182053, C3-182429, C3-182454, C3-182430, C3-182232.	0.3.0
2018-06	CT3#97	C3-183915				Inclusion of documents agreed in CT3#97: C3-183241, C3-183280, C3-183289, C3-183291, C3-183292, C3-183297, C3-183298, C3-183562, C3-183563, C3-183564, C3-183565, C3-183714, C3-183869.	0.4.0
2018-06	CT#80	CP-181028				TS sent to plenary for approval	1.0.0
2018-06	CT#80	CP-181028				TS approved by plenary	15.0.0
2018-09	CT#81	CP-182015	0001	1	B	Format of bdtPolicyId	15.1.0
2018-09	CT#81	CP-182015	0002	4	B	Network area information	15.1.0
2018-09	CT#81	CP-182015	0003	1	F	Description of Structured data types	15.1.0
2018-09	CT#81	CP-182015	0004	1	F	Resource structure presentation	15.1.0
2018-09	CT#81	CP-182015	0005	1	F	Removal of externalDoc field	15.1.0
2018-09	CT#81	CP-182015	0006		F	Corrections related to Feature negotiation	15.1.0
2018-09	CT#81	CP-182015	0007		F	"404 Not found" response in OpenAPI	15.1.0
2018-12	CT#82	CP-183205	0008	1	F	Correction of apiName	15.2.0
2018-12	CT#82	CP-183205	0010		F	Supported content types	15.2.0
2018-12	CT#82	CP-183205	0011		F	Definition of BdtPolicyData structure	15.2.0
2018-12	CT#82	CP-183205	0012		F	Non-empty arrays in OpenAPI file	15.2.0
2018-12	CT#82	CP-183205	0013	1	F	Adding the externalDocs field in the OpenAPI	15.2.0
2018-12	CT#82	CP-183205	0014		F	Adding HTTP status code "200 OK"	15.2.0
2018-12	CT#82	CP-183205	0015	1	F	Error indicating "Unspecified resource URI structure"	15.2.0
2018-12	CT#82	CP-183205	0016	3	F	Npcf_BDTPolicyControl API Authorization based on OAuth2	15.2.0
2018-12	CT#82	CP-183205	0017	1	F	API version update	15.2.0
2018-12	CT#82	CP-183205	0018		F	Default value for apiRoot	15.2.0
2018-12	CT#82	CP-183205	0019	1	F	OpenAPI: HTTP status codes alignment	15.2.0
2018-12	CT#82	CP-183205	0020	1	F	NgRanNodeId definition in OpenAPI	15.2.0
2018-12	CT#82	CP-183205	0021		F	OpenAPI: usage of the "tags" keyword	15.2.0
2018-12	CT#82	CP-183205	0022		F	Location header field in OpenAPI	15.2.0
2018-12	CT#82	CP-183205	0023	1	F	Data structure used in PATCH request	15.2.0
2019-03	CT#83	CP-190112	0024		F	Alignment of the BDT procedures	15.3.0
2019-05	CT#84	CP-191084	0025	1	F	Storage and precedence of OpenAPI specification file	15.4.0
2019-06	CT#84	CP-191084	0028	1	F	Copyright Note in YAML file	15.4.0
2019-06	CT#84	CP-191084	0030		F	OpenAPI version number update	15.4.0
2019-06	CT#84	CP-191105	0026	2	B	Support of Npcf_BDTPolicyControl_Notify service operation	16.0.0
2019-06	CT#84	CP-191090	0027	1	B	Add External group Id	16.0.0
2019-06	CT#84	CP-191101	0031	2	F	OpenAPI version number update	16.0.0
2019-09	CT#85	CP-192157	0032	1	B	Modification of BDT warning notification request indication	16.1.0
2019-09	CT#85	CP-192173	0034		F	OpenAPI version update for TS 29.554 Rel-16	16.1.0
2019-12	CT#86	CP-193198	0035	1	F	Indication of "BdtNotification_5G" feature	16.2.0
2019-12	CT#86	CP-193212	0037		F	Update of API version and TS version in OpenAPI file	16.2.0
2020-03	CT#87e	CP-200208	0036	2	B	BDT renegotiation upon the network conditions change	16.3.0
2020-03	CT#87e	CP-200219	0038	2	B	map ASPid to DNN and SNSSAI for xBDT	16.3.0
2020-03	CT#87e	CP-200216	0039		F	Update of OpenAPI version and TS version in externalDocs field	16.3.0
2020-06	CT#88e	CP-201234	0040	1	F	Removal of not valid BDT policy from UDR	16.4.0
2020-06	CT#88e	CP-201244	0041	1	F	Storage of YAML files in ETSI Forge	16.4.0
2020-06	CT#88e	CP-201256	0043	1	F	URI of the Npcf_BDTPolicyControl service	16.4.0
2020-06	CT#88e	CP-201276	0045	1	F	Traffic descriptor for xBDT	16.4.0
2020-06	CT#88e	CP-201225	0047		A	OpenAPI: adding Location header field in 303 response	16.4.0
2020-06	CT#88e	CP-201244	0048	1	F	Optionality of ProblemDetails	16.4.0
2020-06	CT#88e	CP-201244	0049	1	F	Supported headers, Resource Data type and yaml mapping	16.4.0
2020-06	CT#88e	CP-201255	0051		F	Update of OpenAPI version and TS version in externalDocs field	16.4.0
2020-12	CT#90e	CP-203139	0053	1	F	TS 29.554 Essential Corrections and alignments	16.5.0
2020-12	CT#90e	CP-203129	0054	1	F	Correction to the BDT policy re-negotiation	16.5.0
2020-12	CT#90e	CP-203139	0055	1	F	Storage of YAML files in ETSI Forge	16.5.0
2020-12	CT#90e	CP-203110	0056	1	F	Correction to support redirection codes and the update of the Callback URI	16.5.0
2020-12	CT#90e	CP-203152	0057		F	Update of OpenAPI version and TS version in externalDocs field	16.5.0
2021-03	CT#91e	CP-210191	0058		F	Supported feature number of ES3XX	16.6.0
2021-03	CT#91e	CP-210206	0062	1	F	set bdtStatus to VALID	16.6.0
2021-03	CT#91e	CP-210201	0064	1	A	Correction to PATCH method	16.6.0

2021-03	CT#91e	CP-210239	0066		F	Update of OpenAPI version and TS version in externalDocs field	16.6.0
2021-03	CT#91e	CP-210219	0059		F	Support of optional HTTP custom header fields	17.0.0
2021-03	CT#91e	CP-210220	0060		F	Terminology alignment: usage of "NF service consumer"	17.0.0
2021-03	CT#91e	CP-210220	0061		F	OpenAPI reference	17.0.0
2021-06	CT#92e	CP-211200	0068	1	A	Redirect responses with "application/json" media type	17.1.0
2021-06	CT#92e	CP-211265	0070		F	Update of OpenAPI version and TS version in externalDocs field	17.1.0
2021-12	CT#94e	CP-213239	0071		F	API URI of the Npcf_BDTPolicyControl API	17.2.0
2022-03	CT#95e	CP-220176	0072	2	A	Alignment of "Application Errors" clause with SBI TS template	17.3.0
2022-03	CT#95e	CP-220201	0073	1	F	Formatting of description fields	17.3.0
2022-03	CT#95e	CP-220194	0075		F	Update of info and externalDocs fields	17.3.0
2022-06	CT#96	CP-221154	0076		F	Readability of the OpenAPI file and alignment with the SBI template	17.4.0
2022-06	CT#96	CP-221152	0077		F	Update of info and externalDocs fields	17.4.0

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# History

<b>Document history</b>		
V17.3.0	May 2022	Publication
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