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Contents

Foreword

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

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1 Scope

The present specification provides the stage 3 definition of the Binding Support Management Service of the 5G System.

The 5G System Architecture is defined in 3GPP TS 23.501 [2]. The stage 2 definition and related procedures for Binding Support Management Service is 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 Binding Support Management Service is provided by the Binding Support Function (BSF).

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 29.513: "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] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces Stage 3".

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

[12] 3GPP TS 29.510: "5G System; Network Function Repository Services; Stage 3".

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

[14] 3GPP TS 29.213: " Policy and Charging Control signalling flows and Quality of Service (QoS) parameter mapping".

[15] 3GPP TS 33.501: "Security architecture and procedures for 5G system".

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

[17] 3GPP TS 23.527: "5G System; Restoration Procedures".

[18] 3GPP TR 21.900: "Technical Specification Group working methods".

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].

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
BSF	Binding Support Function
DNN	Data Network Name
DRA	Diameter Routing Agent
HTTP	Hypertext Transfer Protocol
FQDN	Fully Qualified Domain Name
GPSI	Generic Public Subscription Identifier
JSON	JavaScript Object Notation HTTP Hypertext Transfer Protocol
MAC	Media Access Control
NEF	Network Exposure Function
NRF	Network Repository Function
PCF	Policy Control Function
SMF	Session Management Function
S-NSSAI	Single Network Slice Selection Assistance Information
SUPI	Subscription Permanent Identifier
UDR	Unified Data Repository

4 Binding Support Management Service

4.1 Service Description

4.1.1 Overview

The Binding Support Management Service as defined in 3GPP TS 23.502 [3] and 3GPP TS 23.503 [4], is provided by the Binding Support Function (BSF).

The Nbsf_Management service is used for the BSF to provide a PDU session binding functionality, which ensures that an AF request for a certain PDU Session reaches the relevant PCF holding the PDU Session information.

This service:

- allows NF service consumers to register, update and remove the binding information; and
- allows NF service consumers to retrieve the binding information.

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] and 3GPP TS 29.513 [5].

The Binding Support Management Service (Nbsf_Management) is exhibited by the Binding Support Function (BSF).

Known consumers of the Nbsf_management service are:

- Policy Control Function (PCF)
- Network Exposure Function (NEF)
- Application Function (AF)

As described in 3GPP TS 23.503 [4], the BSF is a function that can be deployed standalone or can be the functionality provided by other network functions, such as PCF, UDR, NRF, SMF.

NOTE: The PCF accesses the Nbsf_management service at the BSF via an internal interface when it is collocated with BSF.

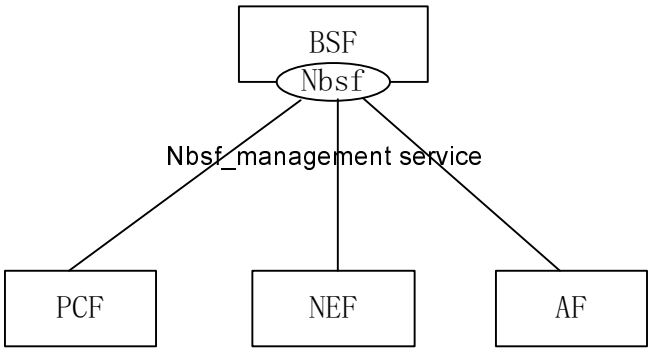

Figure 4.1.2-1: Reference Architecture for the Nbsf_management service; SBI representation

4.1.3 Network Functions

4.1.3.1 Binding Support Function (BSF)

The BSF:

- stores the binding information for a certain PDU Session; and
- discovers the binding information (e.g. the address information of the selected PCF).

The BSF allows NF service consumers (e.g.PCF) to register, update and remove the binding information, and allows NF service consumers (e.g. AF, NEF) to discover the binding information (e.g the address information of the selected PCF).

The BSF can be deployed standalone or can be collocated with other network functions, such as PCF, UDR, NRF andSMF.

4.1.3.2 NF Service Consumers

The Policy Control Function (PCF):

- registers the binding information in the BSF for a UE when an IPv4 address and/or IPv6 prefix is allocated, or a MAC address is used for the PDU session; and,
- removes the binding information in the BSF when an IPv4 address and/or IPv6 prefix is released, or a MAC address is not used for the PDU Session.

The Network Exposure Function (NEF):

- provides a means for the Application Functions to securely interact with the Policy framework for policy control to 3GPP network. During the procedure, it needs to discover the selected PCF by using the Nbsf_Management_Discovery service operation.

The Application Function (AF):

- discover the selected PCF by using the Nbsf_Management_Discovery service operation when it is allowed to interact directly with the policy framework for policy control.

4.2 Service Operations

4.2.1 Introduction

Table 4.2.1-1: Operations of the Nbsf_Management Service

Service operation name	Description	Initiated by
Nbsf_Management_Register	This service operation is used to register the binding information for a UE when an IPv4 address and/or an IPv6 prefix is allocated for an IP PDU Session or a MAC address is used for an Ethernet PDU session.	NF service consumer (PCF)
Nbsf_Management_Deregister	This service operation is used to deregister the binding information for a UE when the PDU Session is released.	NF service consumer (PCF)
Nbsf_Management_Discovery	This service operation is used by an NEF or AF to discover a selected PCF .	NF service consumer (NEF, AF)

4.2.2 Nbsf_Management_Register Service Operation

4.2.2.1 General

This service operation allows the NF service consumer (e.g. PCF) to register the session binding information for a UE in the BSF by providing the user identity, the DNN, the UE address(es) and the selected PCF address for a certain PDU Session to the BSF, and BSF stores the information.

If the NF service consumer (e.g. PCF) receives a new UE address (e.g. IPv6 prefix) and already registered session binding information for this PDU session, the NF service consumer (e.g. PCF) shall register a new session binding information in the BSF.

NOTE: For a PDU session, the PCF can receive a new UE address by Npcf_SMPolicyControl_Update service operation.

4.2.2.2 Register a new PCF Session binding information

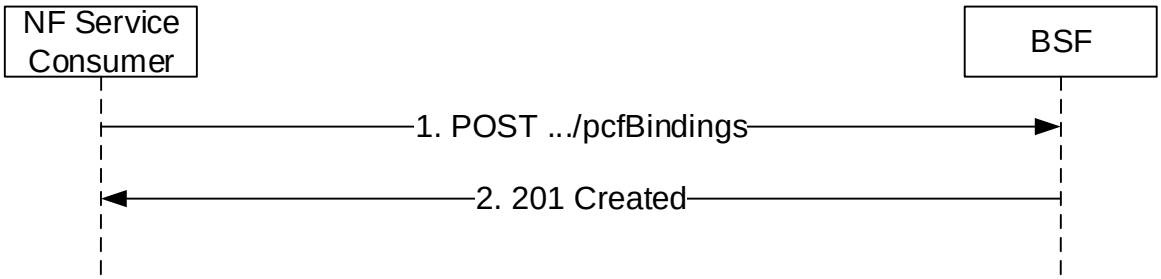

Figure 4.2.2.2-1: NF service consumer register a new PCF Session binding information

The NF service consumer shall invoke the Nbsf_Management_Register service operation to register the session binding information for a UE in the BSF. The NF service consumer shall send an HTTP POST request with "{apiRoot}/nbsf-management/v1/pcfBindings" as Resource URI representing the "PCF Session Bindings", as shown in figure 4.2.2.2-1, step 1, to create a binding information for an "Individual PCF Session Binding" according to the information (e.g. UE address(es), SUPI, GPSI, DNN, S-NSSAI) in message body. The PcfBinding data structure provided in the request body shall include:

- address information of the served UE consisting of:

(i) either IP address information consisting of:

+ the IPv4 address encoded as "ipv4Addr" attribute; and/or

+ the IPv6 address prefix encoded as "ipv6Prefix" attribute; or

(ii) the MAC address encoded as "macAddr48" attribute; and

- PCF address information consisting of:

(i) if the PCF supports the Npcf_PolicyAuthorization service:

+ the FQDN of the PCF encoded as "pcfFqdn" attribute; and/or

+ a description of IP endpoints at the PCF hosting the Npcf_PolicyAuthorization service encoded as "pcfIpEndPoints" attribute; and

(ii) if the PCF supports the Rx interface,

+ the Diameter host id of the PCF encoded as "pcfDiamHost"; and

+ the Diameter realm of the PCF and "pcfDiamRealm" attributes;

- DNN encoded as "dnn" attribute; and

- S-NSSAI encoded as "snssai" attribute;

and may include:

- SUPI encoded as "supi" attribute;

- GPSI encoded as "gpsi" attribute;

- IPv4 address domain encoded as "ipDomain" attribute.

Upon the reception of an HTTP POST request with: "{apiRoot}/nbsf-management/v1/pcfBindings" as Resource URI and PcfBinding data structure as request body, the BSF shall:

- create new binding information;

- assign a bindingId; and

- store the binding information.

The PCF as NF service consumer may provide PCF Id in "pcfId" attribute and recovery timestamp in "recoveryTime" attribute. The BSF may use the "pcfId" attribute to supervise the status of the PCF as described in subclause 5.2 of 3GPP TS 29.510 [12] and perform necessary cleanup upon status change of the PCF later, and/or both the "pcfId" attribute and the "recoveryTime" attribute in cleanup procedure as described in subclause 6.4 of 3GPP TS 23.527 [17].

If the BSF created an "Individual PCF Session Binding" resource, the BSF shall respond with "201 Created" with the message body containing a representation of the created binding information, as shown in figure 4.2.2.2.2-1, step 2. The BSF shall include a Location HTTP header field. The Location header field shall contain the URI of the created binding information i.e. "{apiRoot}/nbsf-management/v1/pcfBindings/{bindingId}".

4.2.3 Nbsf_Management_Deregister Service Operation

4.2.3.1 General

This service operation allows the service consumer to remove the session binding information for a UE in the BSF. It is executed by deleting a given resource identified by an "Individual PCF Session Binding" resource identifier. The operation is invoked by issuing an HTTP DELETE request on the URI representing the specific session binding information.

4.2.3.2 Deregister an individual PCF Session binding information

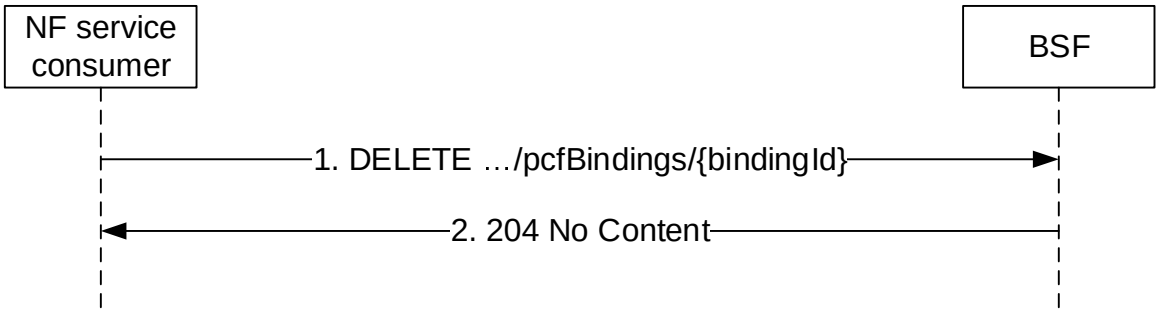

Figure 4.2.3.2-1: Session Binding Information Deregistration

The NF service consumer shall invoke the Nbsf_Management_DeRegister service operation to deregister the session binding information for a UE in the BSF. The NF service consumer shall send an HTTP DELETE request with "{apiRoot}/nbsf-management/v1/pcfBindings/{bindingId}" as Resource URI, where "{bindingId}" is the "Individual PCF Session Binding" resource identifier that is to be deleted.

Upon the the reception of an HTTP DELETE request with: "{apiRoot}/nbsf-management/v1/pcfBindings/{bindingId}" as Resource URI, the BSF shall:

- remove the corresponding binding information.

If the HTTP DELETE request message from the NF service consumer is accepted, the BSF shall respond with "204 No Content". If the Individual PCF Session Binding resource does not exist, the BSF shall respond with "404 Not Found".

4.2.4 Nbsf_Management_Discovery Service Operation

4.2.4.1 General

This service operation allows the service consumer to use the HTTP GET method to obtain the address information of the selected PCF.

4.2.4.2 Retrieve the PCF Session binding information for a given tuple

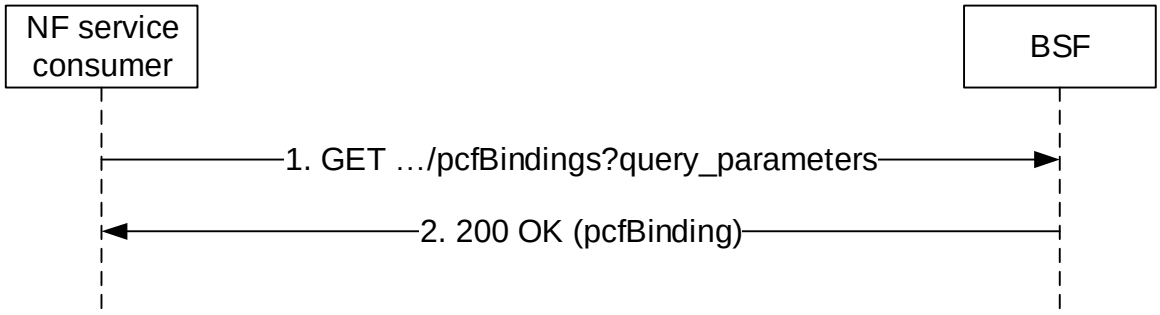

Figure 4.2.4.2-1: NF service consumer retrieve the PCF Session binding information for a given tuple

The NF service consumer shall invoke the Nbsf_Management_Discovery service operation to obtain address information of the the selected PCF for a PDU session in the BSF. The NF service consumer shall send an HTTP GET request with "{apiRoot}/nbsf-management/v1/pcfBindings" as Resource URI, where "query parameters" shall include:

- UE address;

and may include:

- SUPI or GPSI;
- DNN and optionally S-NSSAI; and

- IPv4 address domain.

NOTE: The query parameters S-NSSAI and/or IPv4 addres domain is helpful in the scenario of IPv4 address overlapping where the same IPv4 address may be allocated to UE PDU sessions.

Upon the reception of an HTTP GET request with: "{apiRoot}/nbsf-management/v1/pcfBindings" as Resource URI, the BSF shallsearch the corresponding binding information. If "ipv6Prefix" is used as an UE IPv6 address in the query parameter, the BSF shall use the longest prefix match to find a matching IPv6 prefix so that the IPv6 address in the query parameter is within the address range covered by that matching IPv6 prefix. The IPv6 address in the query parameter shall be formatted as an IPv6 prefix value including the trailing prefix length "/128".

If the HTTP request message from the NF service consumer is accepted and a session binding resource matching the query parameters exists, the BSF shall reply with a "200 OK" HTTP response containing the corresponding PcfBinding data structure, as provided by the PCF during the Nbsf_Management_Register Service Operation in the response body. If the PCF Session Binding resource does not exist, the BSF shall respond with "404 Not Found". If an invalid combination of query parameters (i.e. a combination without UE address(es)) is contained in the request URI, the BSF shall respond with an "400 Bad Request" HTTP error code containing "INVALID_QUERY_PARAM" as application error within the ProblemDetails IE. If more then one PCF Session Binding resources are found, the BSF shall respond with "400 Bad Request" HTTP error code containing "MULTIPLE_BINDING_INFO_FOUND" as application error within the ProblemDetails IE.

5 Nbsf_Management Service API

5.1 Introduction

The Nbsf_management Service shall use the Nbsf_management API.

The request URI used in each HTTP request from the NF service consumer towards the BSF shall have the structure defined in subclause 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 "nbsf-management".
- 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 [8], shall be used as specified in clause 5 of 3GPP TS 29.500 [6].

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

The OpenAPI [11] specification of HTTP messages and content bodies for the Nbsf_management 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 [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 subclause 5.4 of 3GPP TS 29.500 [6]. The use of the JSON format shall be signalled by the content type "application/json".

"Problem Details" JSON object shall be used to indicate additional details of the error in a HTTP response body and shall be signalled by the content type "application/problem+json", as defined in IETF RFC 7807 [13].

5.2.3 HTTP custom headers

5.2.3.1 General

The Nbsf_Management Service API shall support HTTP custom header fields specified in subclause 5.2.3.2 of 3GPP TS 29.500 [6].

In this release of the specification, no specific custom headers are defined for the Nbsf_Management Service API.

5.3 Resources

5.3.1 Resource Structure

The structure of the Resource URI of the Nbsf_Management service is shown in figure 5.3.1-1.

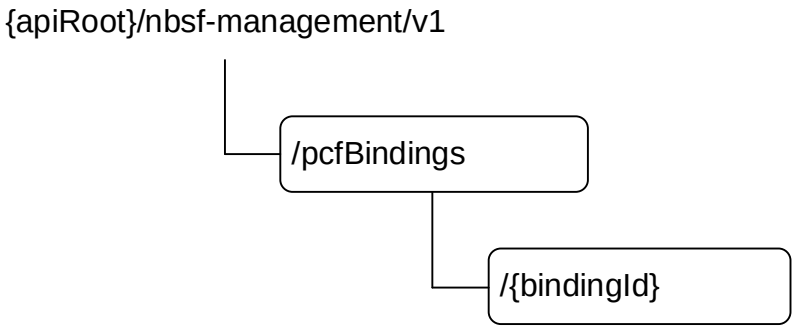

Figure 5.3.1-1: Resource URI structure of the Nbsf_Management API

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
PCF Session Bindings	{apiRoot}/ nbsf-management/v1 /pcfBindings	POST	Register new PCF Session binding information of a given UE address in BSF.
		GET	Retrieve the Session binding information i.e. PCF address information of a given tuple (UE address(es), SUPI; GPSI, DNN, snssai).
Individual PCF Session Binding	{apiRoot}/ nbsf-management/v1 /pcfBindings /{bindingId}	DELETE	Deregister existing PCF Session binding information from BSF.

5.3.2 Resource: PCF Session Bindings

5.3.2.1 Description

This resource represents a collection of the different PCF Session binding information of given UE address(es) registered in the BSF.

5.3.2.2 Resource definition

Resource URI: {apiRoot}/nbsf-management/v1/pcfBindings

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 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
PcfBinding	M	1	Register a new Individual PCF binding information.

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
PcfBinding	M	1	201 Created	The creation of an individual PCF session biding.
NOTE: The mandatory HTTP error status codes for the POST method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] shall also apply.				

5.3.2.3.2 GET

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

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

Name	Data type	P	Cardinality	Description
ipv4Addr	Ipv4Addr	C	0..1	The IPv4 Address of the served UE. (NOTE 1)
ipv6Prefix	Ipv6Prefix	C	0..1	The IPv6 Address of the served UE. (NOTE 1) The NF service consumer shall append '/128' to the IPv6 address in the attribute value. E.g. '2001:db8:85a3::8a2e:370:7334/128'.
macAddr48	MacAddr48	C	0..1	The MAC Address of the served UE. (NOTE 1)
dnn	Dnn	O	0..1	DNN
supi	Supi	O	0..1	Subscription Permanent Identifier
gpsi	Gpsi	O	0..1	Generic Public Subscription Identifier
snssai	Snssai	O	0..1	The identification of slice. (NOTE 2)
ipDomain	string	O	0..1	The IPv4 address domain identifier. (NOTE 2)
supp-feat	SupportedFeatures	O	0..1	To filter irrelevant responses related to unsupported features.
NOTE 1: One and only one of query parameter ipv4-addr, ipv6-prefix or mac-addr48 shall be present. NOTE 2: The query parameters snssai and/or ipDomain, if applicable (IPv4 address overlapping), shall be present with query parameter ipv4Addr.				

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 5.3.2.3.1-2: 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
PcfBinding	M	1	200 OK	The individual PCF session binding information resource matching the query parameter(s) is returned.
n/a			204 No Content	There is no PCF session binding information matching the query parameter(s).
ProblemDetails	M	1	400 Bad Request	More than one binding information is found. (NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the GET method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] shall also apply. NOTE 2: Failure cases are described in subclause 5.7.				

5.3.3 Resource: Individual PCF Session Binding

5.3.3.1 Description

This resource represents a collection of the different PCF Session binding information of given UE address(es) registered in the BSF.

5.3.3.2 Resource definition

Resource URI: **{apiRoot}/nbsf-management/v1/pcfBindings/{bindingId}**

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
bindingId	Represents the individual PCF Session Binding. To enable that the value is used as part of a URI, the string shall only contain characters allowed according to the "lower-with-hyphen" naming convention defined in 3GPP TS 29.501 [7].

5.3.3.3 Resource Standard Methods

5.3.3.3.1 DELETE

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

Table 5.3.3.3.1-1: 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 5.3.3.3.1-2 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 DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

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

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful case: The Individual PCF session binding information resource is deleted.
NOTE: The mandatory HTTP error status codes for the POST method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [6] shall also apply.				

5.4 Custom Operations without associated resources

None in this release of this specification.

5.5 Notifications

None in this release of this specification.

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 N_{bsf} service based interface protocol.

Table 5.6.1-1: N_{bsf} specific Data Types

Data type	Section defined	Description	Applicability
PcfBinding	5.6.2.2	Identifies an Individual PCF binding.	

Table 5.6.1-2 specifies data types re-used by the N_{bsf} service based interface protocol from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the N_{bsf} service based interface.

Table 5.6.1-2: N_{bsf} re-used Data Types

Data type	Reference	Comments	Applicability
DateTime	3GPP TS 29.571 [10]		
DiameterIdentity	3GPP TS 29.571 [10]		
Dnn	3GPP TS 29.571 [10]		
Fqdn	3GPP TS 29.510 [12]		
Gpsi	3GPP TS 29.571 [10]		
IpEndPoint	3GPP TS 29.510 [12]		
Ipv4Addr,	3GPP TS 29.571 [10]		
Ipv6Prefix	3GPP TS 29.571 [10]		
MacAddr48	3GPP TS 29.571 [10]		
NfInstanceId	3GPP TS 29.571 [10]		
ProblemDetails	3GPP TS 29.571 [10]	Used in error responses to provide more detailed information about an error.	
Snssai	3GPP TS 29.571 [10]		
Supi	3GPP TS 29.571 [10]		
SupportedFeatures	3GPP TS 29.571 [10]	Used to negotiate the applicability of the optional features defined in table 5.8-1.	

5.6.2 Structured data types

5.6.2.1 Introduction

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

5.6.2.2 Type PcfBinding

Table 5.6.2.2-1: Definition of type PcfBinding

Attribute name	Data type	P	Cardinality	Description	Applicability
supi	Supi	O	0..1	Subscription Permanent Identifier	
gpsi	Gpsi	O	0..1	Generic Public Subscription Identifier	
ipv4Addr	Ipv4Addr	C	0..1	The IPv4 Address of the served UE. (NOTE 1)	
ipv6Prefix	Ipv6Prefix	C	0..1	The IPv6 Address Prefix of the served UE. (NOTE 1)	
ipDomain	string	O	0..1	IPv4 address domain identifier.	
macAddr48	MacAddr48	C	0..1	The MAC Address of the served UE. (NOTE 1)	
dnn	Dnn	M	1	DNN	
pcfFqdn	Fqdn	C	0..1	FQDN of the PCF hosting the Npcf_PolicyAuthorization service. (NOTE 2)	
pcfIpEndPoints	array(IpEndPoint)	C	1..N	IP end points of the PCF hosting the Npcf_PolicyAuthorization service. (NOTE 2)	
pcfDiamHost	DiameterIdentity	C	0..1	The diameter host for an individual PCF. (NOTE 3)	
pcfDiamRealm	DiameterIdentity	C	0..1	The diameter realm for an individual PCF. (NOTE 3)	
snssai	Snssai	M	1	The identification of slice.	
suppFeat	SupportedFeatures	O	1	Used to negotiate the supported optional features as described in subclause 5.8.	
pcfId	NfInstanceId	O	0..1	PCF instance identifier	
recoveryTime	DateTime	O	0..1	Recovery time of the PCF	
NOTE 1: Either IP address(es) (ipv4Addr and/or ipv6Prefix) or macAddr48 shall be included. NOTE 2: At least one of pcfFqdn or pcfIpEndPoints shall be included if the PCF supports the Npcf_PolicyAuthorization service. NOTE 3: Both pcfDiamHost and pcfDiamRealm are provided if the PCF supports Rx interface.					

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
n/a			

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 [6].

For the Nbsf_Management Service API, HTTP error responses shall be supported as specified in subclause 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 subclauses shall apply.

5.7.2 Protocol Errors

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

5.7.3 Application Errors

The application errors defined for the Nbsf_Management Service API are listed in table 5.7.3-1. The PCF shall include in the HTTP status code a "ProblemDetails" data structure with the "cause" attribute indicating the application error as listed in table 5.7.3-1.

Table 5.7.3-1: Application errors

Application Error	HTTP status code	Description
MULTIPLE_BINDING_INFO_FOUND	400 Bad Request	Indicates that the BSF found more than one binding resource so it cannot provide the selected PCF to the consumer. (NOTE)
NOTE: This application error is included in the responses to the GET request.		

5.8 Feature negotiation

The optional features in table 5.8-1 are defined for the Nbsf_Management Service API. They shall be negotiated using the extensibility mechanism defined in subclause 6.6 of 3GPP TS 29.500 [6].

Table 5.8-1: Supported Features

Feature number	Feature Name	Description

5.9 Security

As indicated in 3GPP TS 33.501 [15] and 3GPP TS 29.500 [6], the access to the Nbsf_Management API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [16]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [12]) plays the role of the authorization server.

If OAuth2 is used, a n NF Service Consumer, prior to consuming services offered by the Nbsf_Management API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [12], subclause 5.4.2.2.

NOTE: When multiple NRFs are deployed in a network, the NRF used as authorization server is the same NRF that the NF Service Consumer used for discovering the Nbsf_Management service.

The Nbsf_Management API defines a single scope "nbsf-management" for the entire service, and it does not define any additional scopes at resource or operation level.

Annex A (normative): OpenAPI specification

A.1 General

The present Annex contains an OpenAPI [11] specification of HTTP messages and content bodies used by the Nbsf_Management 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 1: The semantics and procedures, as well as conditions, e.g. for the applicability and allowed combinations of attributes or values, not expressed in the OpenAPI definitions but defined in other parts of the specification also apply.

Informative copies of the OpenAPI specification file contained in this 3GPP Technical Specification are available on the public 3GPP file server in the following locations (see clause 5B of the 3GPP TR 21.900 [18] for further information):

- https://www.3gpp.org/ftp/Specs/archive/OpenAPI/<Release>/, and
- https://www.3gpp.org/ftp/Specs/<Plenary>/<Release>/OpenAPI/.

NOTE 2: To fetch the OpenAPI specification file after CT#83 plenary meeting for Release 15 in the above links <Plenary> must be replaced with the date the CT Plenary occurs, in the form of year-month (yyyy-mm), e.g. for CT#83 meeting <Plenary> must be replaced with value "2019-03" and <Release> must be replaced with value "Rel-15".

A.2 Nbsf_Management API

```
openapi: 3.0.0
info:
  version: 1.0.3
  title: Nbsf_Management
  description: |
    Binding Support Management Service API.
    © 2019, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.
externalDocs:
  description: 3GPP TS 29.521 V15.5.0; 5G System; Binding Support Management Service.
  url: 'http://www.3gpp.org/ftp/Specs/archive/29_series/29.521/'
servers:
  - url: '{apiRoot}/nbsf-management/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in subclause 4.4 of 3GPP TS 29.501.
security:
  - {}
  - oAuth2ClientCredentials:
    - nbsf-management
paths:
  /pcfBindings:
    post:
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/PcfBinding'
      responses:
        '201':
          description: The creation of an individual PCF session binding.
          content:
            application/json:
```

```
              schema:
                $ref: '#/components/schemas/PcfBinding'
          headers:
            Location:
              description: 'Contains the URI of the newly created resource, according to the
structure: {apiRoot}/nbsf-management/v1/pcfBindings/{bindingId}'
              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'
    get:
      parameters:
        - name: ipv4Addr
          in: query
          description: The IPv4 Address of the served UE.
          required: false
          schema:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv4Addr'
        - name: ipv6Prefix
          in: query
          description: The IPv6 Address of the served UE. The NF service consumer shall append
'/128' to the IPv6 address in the attribute value. E.g. '2001:db8:85a3::8a2e:370:7334/128'.
          required: false
          schema:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv6Prefix'
        - name: macAddr48
          in: query
          description: The MAC Address of the served UE.
          required: false
          schema:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/MacAddr48'
        - name: dnn
          in: query
          description: DNN.
          required: false
          schema:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
        - name: supi
          in: query
          description: Subscription Permanent Identifier.
          required: false
          schema:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        - name: gpsi
          in: query
          description: Generic Public Subscription Identifier
          required: false
          schema:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
        - name: snssai
          in: query
          description: The identification of slice.
          required: false
          content:
            application/json:
              schema:
                $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
```

```
        - name: ipDomain
          in: query
          description: The IPv4 address domain identifier.
          required: false
          schema:
            type: string
        - name: supp-feat
          in: query
          description: To filter irrelevant responses related to unsupported features
          schema:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
      responses:
        '200':
          description: The individual PCF session binding session binding information resource
matching the query parameter(s) is returned.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/PcfBinding'
        '204':
          description: There is no PCF session binding information matching the query parameter(s).
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '406':
          $ref: 'TS29571_CommonData.yaml#/components/responses/406'
        '414':
          $ref: 'TS29571_CommonData.yaml#/components/responses/414'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  /pcfBindings/{bindingId}:
    delete:
      parameters:
        - name: bindingId
          in: path
          description: Represents the individual PCF Session Binding.
          required: true
          schema:
            type: string
      responses:
        '204':
          description: No Content. The Individual PCF session binding information resource is
deleted.
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'
components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
```

```
            nbsf-management: Access to the Nbsf_Management API
  schemas:
    PcfBinding:
      type: object
      properties:
        supi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        gpsi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
        ipv4Addr:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv4Addr'
        ipv6Prefix:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv6Prefix'
        ipDomain:
          type: string
        macAddr48:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/MacAddr48'
        dnn:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
        pcfFqdn:
          $ref: 'TS29510_Nnrf_NFManagement.yaml#/components/schemas/Fqdn'
        pcfIpEndPoints:
          type: array
          items:
            $ref: 'TS29510_Nnrf_NFManagement.yaml#/components/schemas/IpEndPoint'
          minItems: 1
          description: IP end points of the PCF hosting the Npcf_PolicyAuthorization service. At
least one of pcfFqdn or pcfIpEndPoints shall be included if the PCF supports the
Npcf_PolicyAuthorization service.
        pcfDiamHost:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DiameterIdentity'
        pcfDiamRealm:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DiameterIdentity'
        snssai:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
        suppFeat:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
        pcfId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
        recoveryTime:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      required:
        - dnn
        - snssai
      oneOf:
        - anyOf:
          - required: [ipv4Addr]
          - required: [ipv6Prefix]
        - required: [macAddr48]
      anyOf:
        - anyOf:
          - required: [pcfFqdn]
          - required: [pcfIpEndPoints]
        - required: [pcfDiamHost, pcfDiamRealm]
```

Annex B (informative): Deployment option to support BSF and DRA coexistence due to network migration

As described in Annex B of 3GPP TS 23.503 [4], the Diameter Routing Agent (DRA) and the BSF can coexist in an operator's network during the network migration to 5GC. The DRA is described in 3GPP TS 29.213 [14] and can be a service consumer of the Nbsf_Management_Discovery service.

During the Rx session establishment, the DRA can discover the selected PCF for the related subscriber by using the Nbsf_Management_Discovery service operation to obtain the related PCF address if it has no stored binding information derived from an ongoing Gx session for that subscriber.

NOTE 1: For a UE in the EPC there is a Gx session and the DRA stores the binding information. For a UE in the 5GC the Npcf_SmPolicyControl service is used and the BSF stores the binding information.

NOTE 2: If the DRA has no stored binding information derived from an ongoing Gx session for a subscriber, the DRA needs to request new binding information for each Rx session establishment because the information in the BSF could have changed compared to any previous binding information the DRA requested.

Annex C (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New**
2018-01						TS skeleton of Binding Support Management Service specification	0.0.0
2018-01						Inclusion of documents agreed in CT3#94 C3-180301, C3-180191, C3-180192 and C3-180193.	0.1.0
2018-03						Inclusion of documents agreed in CT3#95 C3-181350 and C3-181352.	0.2.0
2018-04						Inclusion of documents agreed in CT3#96 C3-182424 and C3-182510.	0.3.0
2018-05						Inclusion of documents agreed in CT3#97 C3-183287, C3-183500, C3-183881, C3-183502 and C3-183733.	0.4.0
2018-06	CT#80	CP-181031				TS sent to plenary for approval.	1.0.0
2018-06	CT#80	CP-181031				TS approved by plenary	15.0.0
2018-09	CT#81	CP-182015	0001	2	F	PCF id correction for BSF	15.1.0
2018-09	CT#81	CP-182015	0002		F	Reference update: OpenAPI specification	15.1.0
2018-09	CT#81	CP-182015	0004	2	F	Clarification on mandatory HTTP error status codes	15.1.0
2018-09	CT#81	CP-182015	0005	6	B	OpenAPI for TS 29.521	15.1.0
2018-09	CT#81	CP-182015	0006	1	F	Description of Structured data types	15.1.0
2018-09	CT#81	CP-182015	0007	1	B	Support of IPv4 overlapping	15.1.0
2018-09	CT#81	CP-182015	0008		F	Correction of the service name	15.1.0
2018-09	CT#81	CP-182015	0009	1	F	Resource structure presentation	15.1.0
2018-12	CT#82	CP-183205	0011		F	Default value for apiRoot Default value for apiRoot	15.2.0
2018-12	CT#82	CP-183205	0012		F	Correction to DELETE Method for Nbsf_Management Service API	15.2.0
2018-12	CT#82	CP-183205	0013		F	Correction to Typos in URI Paths	15.2.0
2018-12	CT#82	CP-183205	0015		F	API version	15.2.0
2018-12	CT#82	CP-183205	0016		F	ExternalDocs OpenAPI field	15.2.0
2018-12	CT#82	CP-183205	0017		F	Location header field in OpenAPI	15.2.0
2018-12	CT#82	CP-183205	0018	1	F	Security	15.2.0
2018-12	CT#82	CP-183205	0019	1	F	supported content types	15.2.0
2018-12	CT#82	CP-183205	0020	2	F	HTTP Error responses	15.2.0
2018-12	CT#82	CP-183205	0021	2	F	DRA as service consumer	15.2.0
2018-12	CT#82	CP-183205	0023		F	Change presence in BSF binding	15.2.0
2018-12	CT#82	CP-183205	0024	1	F	Presence conditions in yaml file	15.2.0
2018-12	CT#82	CP-183205	0025	1	F	Missing 201 response body for POST to /pcfBindings	15.2.0
2019-03	CT#83	CP-190113	0028	2	F	Handling of unsupported query parameter combinations	15.3.0
2019-03	CT#83	CP-190113	0029	1	F	Correction of description of the Nbsf_Management_Register Service and Nbsf_Management_Discovery service operations	15.3.0
2019-03	CT#83	CP-190113	0030		F	BSF resource cleanup	15.3.0
2019-03	CT#83	CP-190113	0031	1	F	Formatting of structured data types in query parameters	15.3.0
2019-03	CT#83	CP-190113	0032	1	F	Correction on the handling of UE addresses	15.3.0
2019-03	CT#83	CP-190110	0033	2	F	Miscellaneous BSF correction	15.3.0
2019-03	CT#83	CP-190140	0034	1	F	OpenAPI Version number update	15.3.0
2019-06	CT#84	CP-191079	0035		F	Multiple bindings for multi-homing	15.4.0
2019-06	CT#84	CP-191079	0036		F	Remove NSI ID	15.4.0
2019-06	CT#84	CP-191079	0039	1	F	Precedence of OpenAPI file	15.4.0
2019-06	CT#84	CP-191079	0040	1	F	Copyright Note in YAML files	15.4.0
2019-06	CT#84	CP-191079	0042		F	OpenAPI version number update	15.4.0
2019-09	CT#84	CP-192198	0044	2	F	Session binding for IPv6 addresses	15.5.0
2019-09	CT#84	CP-192233	0052		F	OpenAPI version update TS 29.521 Rel-15	15.5.0

History

Document history		
V15.0.0	July 2018	Publication
V15.1.0	October 2018	Publication
V15.2.0	April 2019	Publication
V15.3.0	April 2019	Publication
V15.5.0	October 2019	Publication