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Contents

Foreword

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

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2 presented to TSG for approval;

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

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

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

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

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

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

should indicates a recommendation to do something

should not indicates a recommendation not to do something

may indicates permission to do something

need not indicates permission not to do something

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

can indicates that something is possible

cannot indicates that something is impossible

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

will indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

will not indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

might indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

1 Scope

The present document specifies the stage 3 protocol and data model for the Nnssf Service Based Interface. It provides stage 3 protocol definitions and message flows, and specifies the API for each service offered by the NSSF.

The 5G System stage 2 architecture and procedures are specified in 3GPP TS 23.501 [2] and 3GPP TS 23.502 [3].

The Technical Realization of the Service Based Architecture and the Principles and Guidelines for Services Definition are specified in 3GPP TS 29.500 [4] and 3GPP TS 29.501 [5].

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

[3] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".

[4] 3GPP TS 29.500: "5G System; Technical Realization of Service Based Architecture; Stage 3".

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

[6] OpenAPI: "OpenAPI Specification Version 3.0.0", https://spec.openapis.org/oas/v3.0.0.

[7] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces; Stage 3".

[8] IETF RFC 6902: "JavaScript Object Notation (JSON) Patch".

[9] 3GPP TS 23.003: "Numbering, addressing and identification".

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

[11] 3GPP TS 33.501: "Security architecture and procedures for 5G system".

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

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

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

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

[16] IETF RFC 1952: "GZIP file format specification version 4.3".

[17] 3GPP TR 21.900: "Technical Specification Group working methods".

[18] IETF RFC 7231: "Hypertext Transfer Protocol (HTTP/1.1): Semantics and Content".

[19] IETF RFC 7694: "Hypertext Transfer Protocol (HTTP) Client-Initiated Content-Encoding".

[20] 3GPP TS 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".

[21] 3GPP TS 38.413: "NG-RAN; NG Application Protocol (NGAP); Stage 3".

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].

NSAG Network Slice AS Group

4 Overview

4.1 Introduction

Within the 5GC, the NSSF offers services to the AMF and NSSF in a different PLMN via the Nnssf service based interface (see 3GPP TS 23.501 [2] and 3GPP TS 23.502 [3]).

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

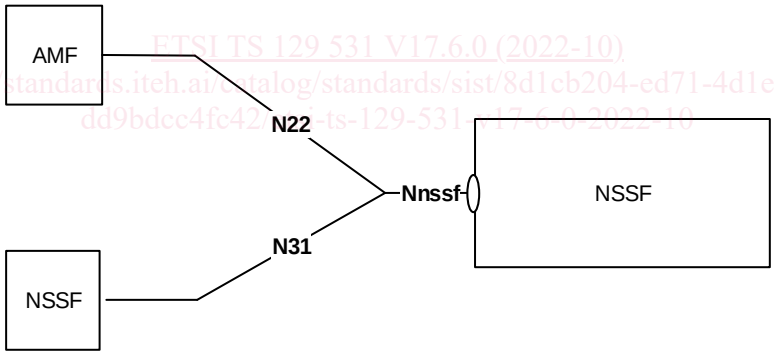

Figure 4.1-1: NSSF in 5G System architecture

The functionalities supported by the NSSF are listed in clause 6.2.14 of 3GPP TS 23.501 [2].

5 Services offered by the NSSF

5.1 Introduction

The NSSF supports the following services.

Table 5.1-1: NF Services provided by NSSF

Service Name	Description	Example Consumer
Nnssf_NSSelection	This service enables Network Slice selection in both the Serving PLMN and the HPLMN	AMF, V-NSSF
Nnssf_NSSAIAvailability	This service enables to update the S-NSSAI(s) the NF service consumer (e.g AMF) supports on a per TA basis on the NSSF and to subscribe and notify any change in status, on a per TA basis, of the SNSSAIs available per TA (unrestricted) and the restricted S-NSSAI(s) per PLMN in that TA in the serving PLMN of the UE.	AMF

Table 5.1-2 summarizes the corresponding APIs defined for this specification.

Table 5.1-2: API Descriptions

Service Name	Clause	Description	OpenAPI Specification File	apiName	Annex
Nnssf_NSSelection	6.1	NSSF Network Slice Selection Service	TS29531_Nnssf_NSSelection.yaml	nnssf-nsselection	A.2
Nnssf_NSSAIAvailability	6.2	NSSF NSSAI Availability Service	TS29531_Nnssf_NSSAIAvailability.yaml	nnssf-nssaiavailability	A.3

5.2 Nnssf_NSSelection Service

5.2.1 Service Description

The Nnssf_NSSelection service is used by an NF Service Consumer (e.g. AMF or NSSF in a different PLMN) to retrieve the information related to network slice in the non-roaming and roaming case.

It also enables the NSSF to provide to the AMF the Allowed NSSAI and the Configured NSSAI for the Serving PLMN.

It also enables the NSSF to provide to the AMF the NSAG information associated with the Configured NSSAI for the Serving PLMN.

The NF service consumer discovers the NSSF based on the local configuration. The NSSF in a different PLMN is discovered based on the self-constructed FQDN as specified in 3GPP TS 23.003 [9].

5.2.2 Service Operations

5.2.2.1 Introduction

For the Nnssf_NSSelection service the following service operations are defined:

- Get.

5.2.2.2 GET

5.2.2.2.1 General

The Get operation shall be invoked by the AMF in the non-roaming or roaming scenario to retrieve:

- The slice selection information including the Allowed NSSAI, Configured NSSAI, target AMF Set or the list of candidate AMF(s), and optionally
  - The Mapping Of Allowed NSSAI;

- The Mapping Of Configured NSSAI;
- NSI ID(s) associated with the Network Slice instances of the Allowed NSSAI;
- NRF(s) to be used to select NFs/services within the selected Network Slice instance(s) and NRF to be used to determine the list of candidate AMF(s) from the AMF Set, during Registration procedure;
- Information on whether the S-NSSAI(s) not included in the Allowed NSSAI which were part of the Requested NSSAI are rejected in the serving PLMN or in the current TA;
- The Target NSSAI that includes the S-NSSAI(s) as defined in clause 5.3.4.3.3 of 3GPP TS 23.501 [2], and
- The NSAG information associated with Configured NSSAI as defined in clause 5.15.x of 3GPP TS 23.501 [2].

- The NRF to be used to select NFs/services within the selected network slice instance, and optionally the NSI ID associated with the S-NSSAI provided in the input, during the PDU Session Establishment procedure.
- The slice mapping information including the mapping of S-NSSAI(s) of the VPLMN to corresponding HPLMN S-NSSAI(s).

The Get operation shall also be invoked by the vNSSF in the roaming scenario to retrieve:

- The hNRF to be used to select NFs/services within the selected network slice instance in the HPLMN, and optionally the NSI ID associated with the S-NSSAI provided in the input, during the PDU Session Establishment procedure.

It is used in the following procedures:

- Registration procedure (see clause 4.2.2.2.2 of 3GPP TS 23.502 [3]);
- Registration with AMF re-allocation (see clause 4.2.2.2.3 of 3GPP TS 23.502 [3]);
- EPS to 5GS handover using N26 interface (see clause 4.11.1.2.2 of 3GPP TS 23.502 [3]);
- EPS to 5GS mobility registration procedure (see clauses 4.11.1.3.3, 4.11.1.3.3A, 4.11.1.3.4 and 4.23.12 of 3GPP TS 23.502 [3]);
- Xn and N2 Handover procedures with PLMN change (see clauses 4.9.1, 4.23.7 and 4.23.11 of 3GPP TS 23.502 [3]);
- UE Configuration Update procedure (see clause 4.2.4.2 of 3GPP TS 23.502 [3]);
- SMF selection for non-roaming and roaming with local breakout (see clause 4.3.2.2.3.2 of 3GPP TS 23.502 [3]) or SMF selection for home-routed roaming scenario (see clause 4.3.2.2.3.3 of 3GPP TS 23.502 [3]).

NOTE: The list of procedures above, which trigger invoking of the Nnssf_NSSelection_Get service operation, is not exhaustive.

5.2.2.2.2 Get service operation of Nnssf_NSSelection service

In this procedure, the NF Service Consumer (e.g. AMF) retrieves the slice selection information including the Allowed NSSAI, Configured NSSAI, target AMF Set or the list of candidate AMF(s) and other optional information.

This service operation shall also be used to retrieve the slice mapping information including the mapping of S-NSSAI(s) of the VPLMN to corresponding HPLMN S-NSSAI(s), e.g. during inter-PLMN mobility procedure and/or mobility procedure within VPLMN from EPS to 5GS.

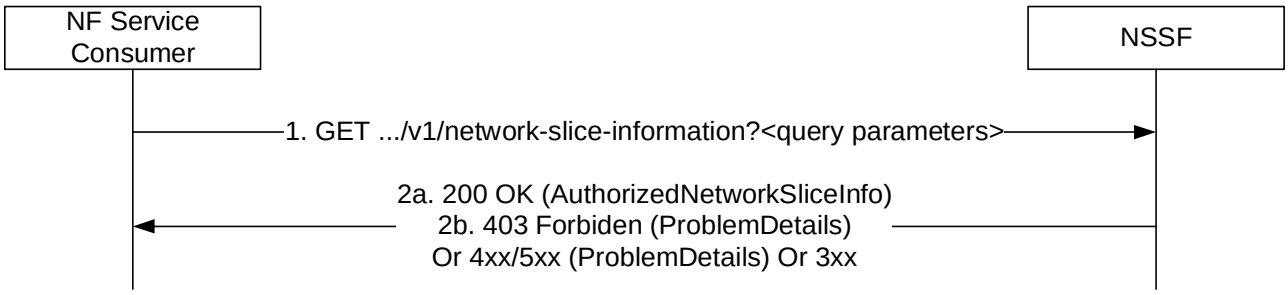

Figure 5.2.2.2.2-1: Retrieve the network slice information during the mobility procedure

1 The AMF shall send a GET request to the NSSF.

If the AMF wants to retrieve the slice selection information, one or more of the following parameters shall be included in the slice-info-request-for-registration query parameter:

- Requested NSSAI and Subscribed S-NSSAI(s) with the indication if marked as default S-NSSAI and the associated subscribed NSSRG information;
- optionally UE support of subscription-based restrictions to simultaneous registration of network slice feature Indication;
- UDM indication to provide all subscribed S-NSSAIs for UEs not indicating support of subscription-based restrictions to simultaneous registration of network slices feature;
- Indication of the support of NSAG by the UE.

If the AMF wants to retrieve the slice mapping information, the following parameters shall be included in the slice-info-request-for-registration query parameter:

- sNssaiForMapping IE and;
- requestMapping IE.

In both scenarios, the AMF shall also include the following parameters in the message:

- PLMN ID of the SUPI in roaming scenarios;
- TAI;
- NF type of the NF service consumer and;
- Requester ID.

2a On success, "200 OK" shall be returned when the NSSF is able to find authorized network slice information for the requested network slice selection information, the response body shall include a payload body containing at least the following parameters:

- Allowed NSSAI and;
- target AMF Set or the list of candidate AMF(s).

The payload body may additionally contain the following parameters:

- a target AMF Service Set;
- Target NSSAI.

"200 OK" shall also be returned when the NSSF is able to find the requested slicing mapping information, the response body shall include a payload body containing the mapping of S-NSSAI(s) of the VPLMN to corresponding HPLMN S-NSSAI(s) included in the allowedNssaiList IE.

NSSFs of a PLMN that implement AMF reallocation via RAN by supporting the NGAP REROUTE NAS REQUEST procedure (see clause 8.6.5 of 3GPP TS 38.413 [21]) should return the target AMF set ID in its response. The NSSF may query the NRF to discover target AMF Set if this information is not known by other means (e.g. if not provided by AMF during Nnssf_NSSAIAvailability_Update service operation).

If subscribed NSSRG list is provided, the NSSF shall provide the compatible S-NSSAIs in the Allowed NSSAI as defined in clause 5.15.12 of 3GPP TS 23.501 [2] and compatible S-NSSAIs in the Target NSSAI (if provided).

If the request indicated that UE does not support subscription-based restrictions to simultaneous registration of network slice feature, and UDM has requested to provide all subscribed S-NSSAIs for such UEs, Configured NSSAI, if included, shall be provided ignoring the NSSRG restrictions.

If the AMF has indicated the support of NSAG by the UE, the NSSF shall include the "nsagInfoList" attribute with NSAG information if available.

2b If no slice instances can be found for the requested slice selection information or the requested slice mapping information, then the NSSF shall return a 403 Forbidden response with the "ProblemDetails" IE containing the Application Error "SNSSAI_NOT_SUPPORTED" (cf. Table 6.1.7.3-1).

On failure or redirection, the NSSF shall return one of the HTTP status codes together with the response body listed in Table 6.1.3.2.3.1-3.

5.2.2.2.3 Get service operation of Nnssf_NSSelection service during the PDU session establishment

In this procedure, the NF Service Consumer (e.g. AMF) retrieves the NRF and the optionally the NSI ID of the network slice instance:

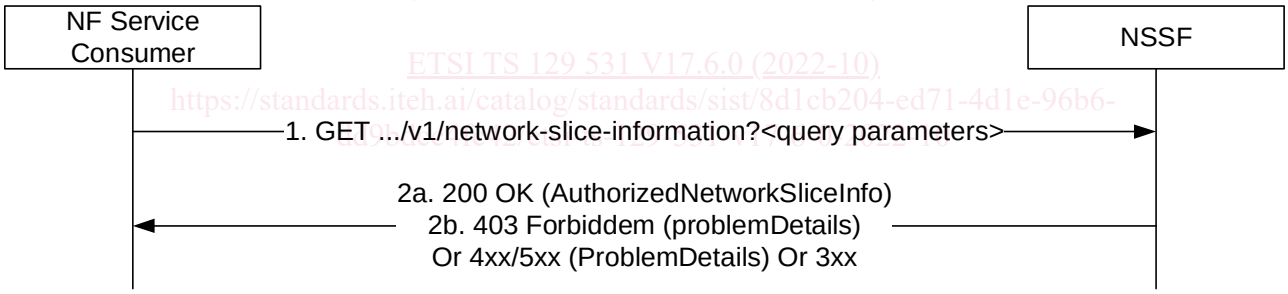

Figure 5.2.2.2.3-1: Retrieve the network slice information during the PDU session establishment procedure

1 The NF Service consumer (e.g. AMF or NSSF in the different PLMN) shall send a GET request to the NSSF.

The request shall include query parameters, contain at least the following parameters:

- S-NSSAI;
- S-NSSAI from the HPLMN that maps to the S-NSSAI from the Allowed NSSAI of the Serving PLMN;
- the NF type of the NF service consumer;
- Requester ID and;
- non-roaming/LBO roaming/HR roaming indication.

For the request towards an NSSF in the Serving PLMN, the query parameters shall also contain the PLMN ID of the SUPI and TAI.

2a On success, "200 OK" shall be returned when the NSSF is able to find network slice instance information for the requested network slice selection information, the response body shall include a payload body containing at least the NRF to be used to select NFs/services within the selected Network Slice instance;

2b If no slice instances can be found for the requested slice selection information, then the NSSF shall return a 403 Forbidden response with the "ProblemDetails" IE containing the Application Error "SNSSAI_NOT_SUPPORTED" (cf. Table 6.1.7.3-1).

On failure or redirection, the NSSF shall return one of the HTTP status codes together with the response body listed in Table 6.1.3.2.3.1-3.

5.2.2.2.4 Get service operation of Nnssf_NSSelection service during UE configuration update procedure

In this procedure, the NF Service Consumer (e.g. AMF) retrieves network slice configuration information (e.g. the Allowed NSSAI and the Configured NSSAI) during the UE configuration update procedure.

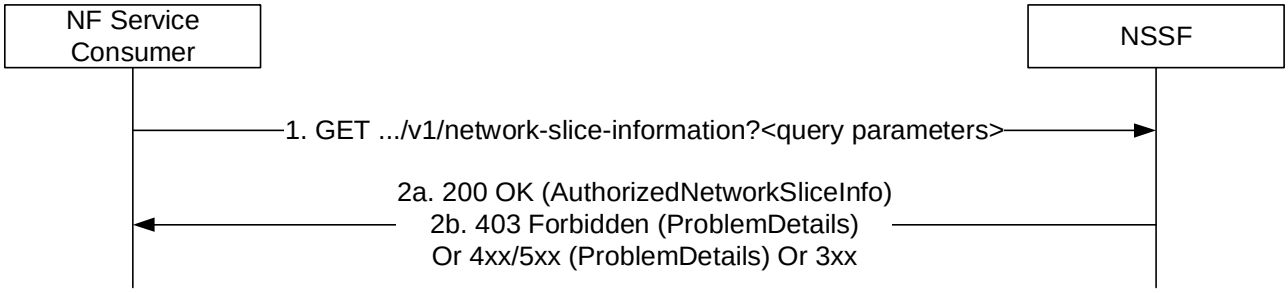

Figure 5.2.2.2.4-1: Retrieve the network slice information during UE configuration update procedure

1 The NF Service consumer (e.g. AMF) shall send a GET request to the NSSF. The request shall include query parameters:

- Subscribed S-NSSAI(s) with the indication if the S-NSSAI is marked as default S-NSSAI and the associated subscribed NSSRG information;
- optionally UE support of subscription-based restrictions to simultaneous registration of network slice feature Indication;

- UDM indication to provide all subscribed S-NSSAIs for UEs not indicating support of subscription-based restrictions to simultaneous registration of network slices feature;
- Rejected S-NSSAI(s) for the Registration Area;
- PLMN ID of the SUPI;
- TAI;
- Indication of the support of NSAG by the UE;
- NF type of the NF service consumer and;
- the NF instance ID of the requester NF.

NOTE: When the AMF invokes UE Configuration Update procedure to determine the Target NSSAI to redirect the UE to the dedicated frequency band(s) for an S-NSSAI (as specified in clause 5.3.4.3.3 of 3GPP TS 23.501 [2]), the AMF provides the Allowed NSSAI and the rejected S-NSSAI(s) for the current Registration Area to the NSSF; the Allowed NSSAI and Rejected S-NSSAI(s) for the RA does not include any S-NSSAI that failed for Network Slice-Specific Authentication and Authorization. The AMF does not include the Requested NSSAI to the NSSF in this procedure, thus the NSSF will not provide Allowed NSSAI again to the AMF in the response.

2a On success, "200 OK" shall be returned when the NSSF is able to find authorized network slice information for the requested network slice selection information, the response body shall include a payload body containing at least the following parameters:

- Allowed NSSAI;