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Contents

Foreword

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

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

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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

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may indicates permission to do something

need not indicates permission not to do something

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can indicates that something is possible

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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 Nnsacf Service Based Interface. It provides stage 3 protocol definitions and message flows, and specifies the API for each service offered by the NSACF.

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 TR 21.900: "Technical Specification Group working methods".

[8] 3GPP TS 33.501: "Security architecture and procedures for 5G system".

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

[10] 3GPP TS 29.510: "5G System; Network Function Repository Services; Stage 3".

[11] IETF RFC 9113: "HTTP/2".

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

[13] IETF RFC 9457: "Problem Details for HTTP APIs".

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

[15] Void

[16] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces Stage 3".

[17] Void

[18] 3GPP TS 23.288: "Architecture enhancements for 5G System (5GS) to support network data analytics services".

3 Definitions, 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
5GC	5G Core Network
AMF	Access Management Function
DCCF	Data Collection Coordination Function
EAC	Early Admission Control
MCX	Mission Critical Service
MPS	Multimedia Priority Service
NEF	Network Exposure Function
NID	Network identifier
NSAC	Network Slice Admission Control
NSACF	Network Slice Admission Control Function
NSCE	Network Slice Capability Enablement
NWDAF	Network Data Analytics Function
SMF	Session Management Function
SNPN	Standalone Non-Public Network

4 Overview

4.1 General

Within the 5GC of a PLMN or a SNPN, the NSACF offers services to the AMF, SMF (or combined SMF+PGW-C), NWDAF, NEF, DCCF, NSCE and NSACF via the Nnsacf service based interface (see 3GPP TS 23.501 [2] and 3GPP TS 23.502 [3]).

Figures 4.1 provides the reference model (in service based interface representation and in reference point representation), with focus on the NSACF and the scope of the present specification.

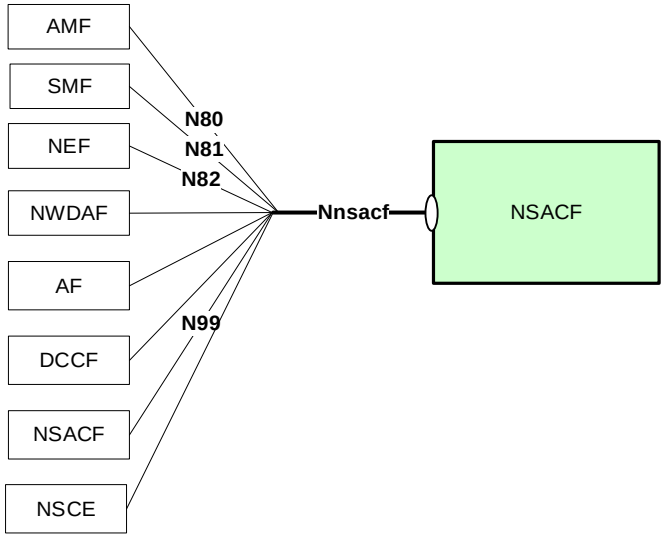

Figure 4-1: Reference model – NSACF

The functionalities supported by the NSACF are listed in clause 6.2.28 of 3GPP TS 23.501 [2].

The services and service operations provided by the Nnsacf interface are listed in clause 5.2.21 of 3GPP TS 23.502 [3].

When the UE connects to EPS and EPS counting is required, it is the combined SMF+PGW-C invokes NSACF services to perform network slice admission control, during PDN connection establishment procedure and PDN connection release procedure, as specified in clause 5.15.11.5 of 3GPP TS 23.501 [2].

NOTE: A trusted AF can access NSACF services either via NEF to NSACF or directly to NSACF. An untrusted AF shall only be allowed to access NSACF services via NEF. If multiple NSACFs are deployed in the network and the trusted AF is interested in the aggregated report, then the trusted AF collects the report from NEF, instead of contacting multiple NSACFs directly.

4.1A NSAC Architecture Options

If the network is configured with a single NSAC service area, there is a single NSACF deployed to handle the admissions for an S-NSSAI.

If the network is configured with multiple NSAC service areas, one of the three NSAC architecture options, i.e. non-hierarchical NSAC architecture, centralized NSAC architecture and hierarchical NSAC architecture (as specified in clause 5.15.11.0 of 3GPP TS 23.501 [2]), may be selected to handle the admissions for an S-NSSAI based on operator's policy.

In different NSAC architectures, there are different roles of NSACFs as:

- independent NSACFs are deployed in each NSAC service area in non-hierarchical NSAC architecture;
- a single centralized NSACF is deployed in the whole network in centralized NSAC architecture; and
- a primary NSACF and several distributed NSACFs are deployed in hierarchical NSAC architecture.

For the hierarchical NSAC architecture, the NSACF role (i.e. primary NSACF or distributed NSACF) is configured in the NSACF per S-NSSAI (e.g. a NSACF may act as primary NSACF for a first S-NSSAI and as a distributed NSACF for a second S-NSSAI). For the same S-NSSAI, the role of primary and distributed NSACFs can be co-located at the same NSACF instance. A NSACF acting as a Primary NSACF for a given S-NSSAI handles overall NSAC for the S-NSSAI at the global level (i.e. it is ultimately responsible for the NSAC for an S-NSSAI). See clause 5.15.11 of 3GPP TS 23.501 [2].

4.2 NSAC support in roaming

In the roaming scenario, depending on operator's policy and roaming agreement, a specific NSAC admission mode (i.e. VPLMN NSAC admission, VPLMN with HPLMN assistance admission or HPLMN NSAC admission) is determined for the NSAC procedure for roaming UEs (see clause 5.15.11.3 of 3GPP TS 23.501 [2]).

For roaming UEs with LBO PDU session:

- if VPLMN NSAC admission (with or without HPLMN assistance) is determined, the vNSACF offers service to the NF in the VPLMN (e.g. AMF and SMF in VPLMN);
- if HPLMN NSAC admission is determined, the hNSACF offers service to the NF in the VPLMN (e.g. AMF and SMF in VPLMN). The AMF and SMF in VPLMN interact with hNSACF to perform NSAC procedure.

For roaming UEs with HR PDU session:

- the hNSACF offers service to the SMF in the HPLMN;
- if HPLMN NSAC admission is determined, the hNSACF offers service to the AMF in the VPLMN. Otherwise, the vNSACF offers services to the AMF in the VPLMN.

4.3 Interaction between NSACFs

NSACF interactions may exist in the following cases:

- for roaming case, if VPLMN with HPLMN assistance NSAC admission mode is determined, the NSACF in VPLMN may interact with the NSACF in HPLMN to fetch the quota for number of UEs or number of PDU sessions, and the NSACF in HPLMN may interact with the NSACF in VPLMN to provide the updated number of UEs or number of PDU sessions;
- for roaming case, if VPLMN NSAC admission mode is determined, the NSACF in VPLMN may interact with the NSACF in HPLMN to fetch the maximum number of registered UEs to be enforced and the maximum number of LBO PDU sessions to be enforced;
- in hierarchical NSAC architecture, a distributed NSACF may interact with the primary NSACF to fetch the quota for number of UEs or number of PDU sessions, and the primary NSACF may interact with the distributed NSACF to provide the updated number of UEs or number of PDU sessions, as specified in clause 5.15.11 of 3GPP TS 23.501 [2].

4.4 NSAC support in Indirect Network Sharing

In the case of Indirect Network Sharing, the NSAC of the number of UEs for roaming UEs as specified in clause 4.2 also applies. The V-NSACF and H-NSACF refer to the V-NSACF of the hosting operator network and the H-NSACF of the participating operator network in Indirect Network Sharing deployments. The serving PLMN ID provided by the AMF is set to the PLMN ID of the hosting operator and the corresponding S-NSSAI(s) belong to the hosting operator.

5 Services offered by the NSACF

5.1 Introduction

The NSACF supports the following services.

Table 5.1-1: NF Services provided by NSACF

Service Name	Description	Example Consumer
Nnsacf_NSAC	This service allows the NF service consumer to: - request the NSACF to perform per slice admission control for the number of UEs / PDU sessions, or the number of UEs with at least one PDU session/PDN connection in case EPS counting is required; - request the NSACF to send or update the local maximum number of UEs / PDU sessions, in hierarchical NSAC architecture scenario; - retrieve slice roaming quotas (i.e. the maximum number of UEs and/or PDU sessions) from the NSACF in HPLMN, in roaming scenario.	AMF, SMF, NSACF
Nnsacf_SliceEventExposure	This service provides event based notifications to the NF service consumer related to the number of UEs registered to a network slice or the number of PDU sessions established to a network slice.	NEF, AF, NWDAF, DCCF, NSACF, NSCE

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
Nnsacf_NSAC	6.1	Per slice admission control service to control the number of UEs / PDU sessions or the combination, or configure the local maximum number of UEs / PDU sessions in a distributed NSACF in hierarchical NSAC architecture, or retrieve slice roaming quotas from HPLMN NSACF in roaming scenario.	TS29536_Nnsacf_NSAC.yaml	nnsacf-nsac	A.2
Nnsacf_SliceEventExposure	6.2	Slice related event subscription and notification	TS29536_Nnsacf_SliceEventExposure.yaml	nnsacf-slice-ee	A.3

5.2 Nnsacf_NSAC Service

5.2.1 Service Description

The Nnsacf_NSAC service provides the service capability for the NF Service Consumer (e.g. AMF, SMF or primary NSACF) to request admission control for UEs accessing a specific network slice, or for PDU sessions to be established to a specific network slice. The following are the key functionalities of this NF service:

- Request the NSACF to control the number of UEs registered to a specific network slice, e.g. perform availability check and update the number of UEs registered to a specific network slice;
- Request the NSACF to control the number of PDU sessions established to a specific network slice, e.g. perform availability check and update the number of PDU sessions established to a specific network slice;
- Request the NSACF to control the number of UEs with at least one PDU session/PDN connection established on a network slice if EPS counting is required;
- Notify the NF Service Consumer (e.g. AMF) of the activation/deactivation of EAC (Early Admission Control) mode for NSAC procedure;
- Request the NSACF to configure or update the local maximum number of registered UEs and/or number of PDU sessions of the network slice at a distributed NSACF, in hierarchical NSAC architecture.

- Request the NSACF in HPLMN to provide slice roaming quotas (i.e. the maximum number of UEs / PDU session in NSACF in VPLMN), in roaming scenario.

The Nnsacf_NSAC service supports the following service operations.

Table 5.2.1-1: Service operations supported by the Nnsacf_NSAC service

Service Operations	Description	Operation Semantics	Example Consumer(s)
NumOfUEsUpdate	Request the NSACF to perform admission control for the number of registered UEs, or the number of UEs with at least one PDU session/PDN connection in case EPS counting is required.	Request/Response	AMF, combined SMF+PGW-C, NSACF
NumOfPDUsUpdate	Request the NSACF to perform admission control for the number of PDU sessions, or the number of UEs with at least one PDU session/PDN connection in case EPS counting is required.	Request/Response	SMF, combined SMF+PGW-C, NSACF
EACNotify	Notify the NF Service Consumer of the activation/deactivation of EAC mode.	Subscribe/Notify	AMF
LocalNumberUpdate	Request the distributed NSACF to update its local maximum number of registered UEs and/or PDU sessions of the network slice, in hierarchical NSAC architecture.	Request/Response	primary NSACF
QuotaUpdate	Request the primary or central NSACF at HPLMN to update the slice roaming quotas (i.e. the maximum number of registered UEs and/or the maximum number of PDU sessions of a network slice) at the primary or central NSACF of VPLMN.	Request/Response	V-NSACF

When the UE connects to EPS and EPS counting is required for the S-NSSAI subjected to NSAC, only one of the configurations shall be applied as specified in clause 5.15.11.5 of 3GPP TS 23.501 [2]:

- Maximum number of registered UEs and/or maximum number of PDU session. In that case the combined SMF+PGW-C shall invoke the NumOfUEsUpdate and NumOfPDUsUpdate service operations in sequence. If the NumOfUEsUpdate returns failure, the combined SMF+PGW-C shall not continue invoking the NumOfPDUsUpdate. If the NumOfPDUsUpate returns failure then the combined SMF+PGW-C shall invoke the NumOfUEUpdate to decrease the UE count. Or,

- Maximum number of UEs with at least one PDU session/PDN Connection and/or maximum number of PDU session. In that case the combined SMF+PGW-C shall be configured with option 1 and shall invoke the NumOfUEsUpdate service operation or with option 2 and shall invoke NumOfPDUsUpdate service operation to NSACF to perform admission control for the number of UEs with at least one PDU session/PDN connection and/or maximum number of PDU session as specified in clause 5.15.11.5a of 3GPP TS 23.501 [2].

5.2.2 Service Operations

5.2.2.1 Introduction

This clause introduces the related procedures using Nnsacf_NSAC service operations to request the NSACF to control the number of UEs registered to a specific network slice.

5.2.2.2 NumOfUEsUpdate

5.2.2.2.1 General

The NumOfUEsUpdate service operation shall be used by the NF Service Consumer (e.g. AMF, combined SMF+PGW-C, or NSACF) to request the NSACF to control the number of UEs registered to a specific network slice, e.g. perform availability check and update the number of UEs registered to a network slice. It is used in the following procedures: