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Foreword

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

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

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

Introduction

This clause is optional. If it exists, it is always the second unnumbered clause.

1 Scope

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

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] 3GPP TS 29.518: "5G System; Access and Mobility Management Services; Stage 3".

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

[8] ECMA-262: "ECMAScript® Language Specification", https://www.ecma-international.org/ecma-262/5.1/.

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

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

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

[12] 3GPP TS 23.003: "Numbering, Addressing and Identification".

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

[14] IETF RFC 6901: "JavaScript Object Notation (JSON) Pointer".

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

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

[17] IETF RFC 3986: "Uniform Resource Identifier (URI): Generic Syntax".

[18] IETF RFC 4122: "A Universally Unique IDentifier (UUID) URN Namespace".

[19] IETF RFC 7232: "Hypertext Transfer Protocol (HTTP/1.1): Conditional Requests".

[20] IETF RFC 7234: "Hypertext Transfer Protocol (HTTP/1.1): Caching".

[21] 3GPP TS 29.244: "Interface between the Control Plane and the User Plane Nodes; Stage 3".

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

[23] IETF RFC 2782: "A DNS RR for specifying the location of services (DNS SRV)".

[24] IETF RFC 7515: "JSON Web Signature (JWS)".

[25] IETF RFC 7519: "JSON Web Token (JWT)".

[26] W3C HTML 4.01 Specification, https://www.w3.org/TR/2018/SPSD-html401-20180327/.

[27] 3GPP TS 23.527: "5G System; Restoration Procedures; Stage 2".

[28] 3GPP TS 29.513: "5G System; Policy and Charging Control signalling flows and QoS parameter mapping; Stage 3".

[29] 3GPP TS 38.413: "NG-RAN; NG Application Protocol (NGAP)".

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

[31] 3GPP TR 21.900: "Technical Specification Group working methods".

[32] Void.

[33] Void.

[34] Void.

[35] Void.

[36] 3GPP TS 29.503: "Unified Data Management Services".

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].

5GC	5G Core Network
CHF	Charging Function
NF	Network Function
NRF	NF Repository Function

4 Overview

The Network Function (NF) Repository Function (NRF) is the network entity in the 5G Core Network (5GC) supporting the following functionality:

- Maintains the NF profile of available NF instances and their supported services;

- Allows other NF instances to subscribe to, and get notified about, the registration in NRF of new NF instances of a given type;

- Supports service discovery function. It receives NF Discovery Requests from NF instances, and provides the information of the available NF instances fulfilling certain criteria (e.g., supporting a given service).

Figures 4-1 shows the reference architecture for the 5GC, with focus on the NRF:

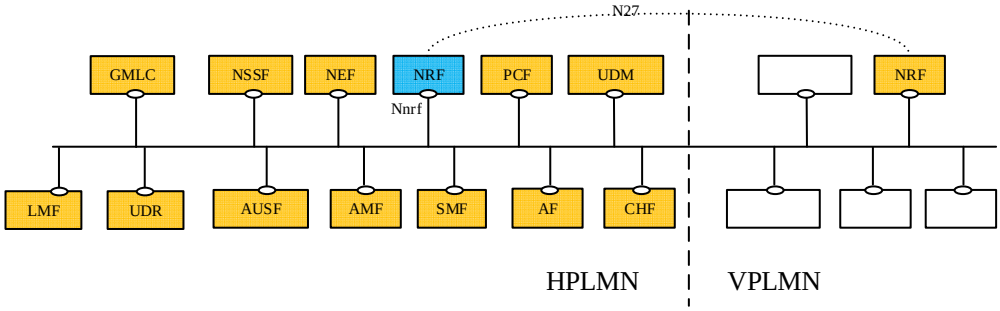

Figure 4-1: 5G System architecture

For the sake of clarity, the NRF is never depicted in reference point representation figures, given that the NRF interacts with every other NF in the 5GC. As an exception, in the roaming case, the reference point between the vNRF and the hNRF is named as N27. The reference point name of N27 is used only for representation purposes, but its functionality is included in the services offered by the Nnrf Service-Based Interface.

5 Services Offered by the NRF

5.1 Introduction

The NRF offers to other NFs the following services:

- Nnrf_NFManagement
- Nnrf_NFDiscovery
- Nnrf_AccessToken (OAuth2 Authorization)

5.2 Nnrf_NFManagement Service

5.2.1 Service Description

The Nnrf_NFManagement service allows a Network Function Instance in the serving PLMN to register, update or deregister its profile in the NRF.

The Nnrf_NFManagement service also allows an NRF Instance to register, update or deregister its profile in another NRF in the same PLMN.

NOTE: Alternatively, other means such as OA&M can also be used to register, update or deregister NRF profile in another NRF.

It also allows an NF to subscribe to be notified of registration, deregistration and profile changes of NF Instances along with their NF services.

The NF profile consists of general parameters of the NF Instance, and also the parameters of the different NF Service Instances exposed by the NF Instance.

The PLMN of the NRF may comprise one or multiple PLMN IDs (i.e. MCC and MNC). An NRF configured with multiple PLMN IDs shall support registering, updating and deregistering the profile of Network Function Instances from any of these PLMN IDs.

The Nnrf_NFManagement service also allows retrieving a list of NF Instances currently registered in the NRF or the NF Profile of a given NF Instance.

5.2.2 Service Operations

5.2.2.1 Introduction

The services operations defined for the Nnrf_NFManagement service are as follows:

- NFRegister: It allows an NF Instance to register its NF profile in the NRF; it includes the registration of the general parameters of the NF Instance, together with the list of services exposed by the NF Instance. This service operation is not allowed to be invoked from an NRF in a different PLMN.
- NFUpdate: It allows an NF Instance to replace, or update partially, the parameters of its NF profile (including the parameters of the associated services) in the NRF; it also allows to add or delete individual services offered by the NF Instance. This service operation is not allowed to be invoked from an NRF in a different PLMN.
- NFDeregister: It allows an NF Instance to deregister its NF profile in the NRF, including the services offered by the NF Instance. This service operation is not allowed to be invoked from an NRF in a different PLMN.
- NFStatusSubscribe: It allows an NF Instance to subscribe to changes on the status of NF Instances registered in NRF. This service operation can be invoked by an NF Instance in a different PLMN (via the local NRF in that PLMN).
- NFStatusNotify: It allows the NRF to notify subscribed NF Instances of changes on the status of NF Instances. This service operation can be invoked directly between the NRF and an NF Instance in a different PLMN (without involvement of the local NRF in that PLMN).
- NFStatusUnsubscribe: It allows an NF Instance to unsubscribe to changes on the status of NF Instances registered in NRF. This service operation can be invoked by an NF Instance in a different PLMN (via the local NRF in that PLMN).

NOTE 1: The "change of status" of the NFStatus service operations can imply a request to be notified of newly registered NF Instances in NRF, or to be notified of profile changes of a specific NF Instance, or to be notified of the deregistration of an NF Instance.

NOTE 2: An NRF instance can also use the NFRegister, NFUpdate or NFDeregister service operations or OA&M system to register, update or deregister its profile in another NRF in the same PLMN.

- NFListRetrieval: It allows retrieving a list of NFs currently registered in the NRF. This service operation is not allowed to be invoked from an NRF in a different PLMN.
- NFProfileRetrieval: It allows retrieving the NF Profile of a given NF instance. This service operation is not allowed to be invoked from an NRF in a different PLMN.

The NFStatusSubscribe / NFstatusNotify / NFStatusUnsubscribe operations can be invoked by an NF Service Consumer (i.e., "source NF") requesting to be notified about events (registration, deregistration, profile change) related to an NF instance (i.e., "target NF") located in the same PLMN, or in a different PLMN.

In the description of these operations in clauses 5.2.2.5, 5.2.2.6 and 5.2.2.7, when the NF instances are located in the same PLMN, both source NF and target NF are said to be located in the "Serving PLMN" but, in the general case, the functionality is not restricted to the PLMN that is serving a given UE, and it shall be applicable as well to any scenario in which source NF and target NFs belong to the same PLMN.

When source NF and target NF are located in different PLMNs, the source NF is said to be in the "Serving PLMN", and the target NF (and the NRF where such NF is registered) is said to be in the "Home PLMN", similarly to the scenarios described in 3GPP TS 23.502 [3], but the functionality shall be equally applicable to any scenario between any pair of PLMNs (e.g. with the source NF in the Home PLMN and the target NF in the Serving PLMN).

5.2.2.2 NFRegister

5.2.2.2.1 General

This service operation is used:

- to register an NF in the NRF by providing the NF profile of the requesting NF to the NRF, and the NRF marks the requesting NF as available to be discovered by other NFs;
- to register services associated to an existing NF Instance;
- to register NRF information in another NRF, and this information is used for forwarding or redirecting service discovery request.

5.2.2.2.2 NF (other than NRF) registration to NRF

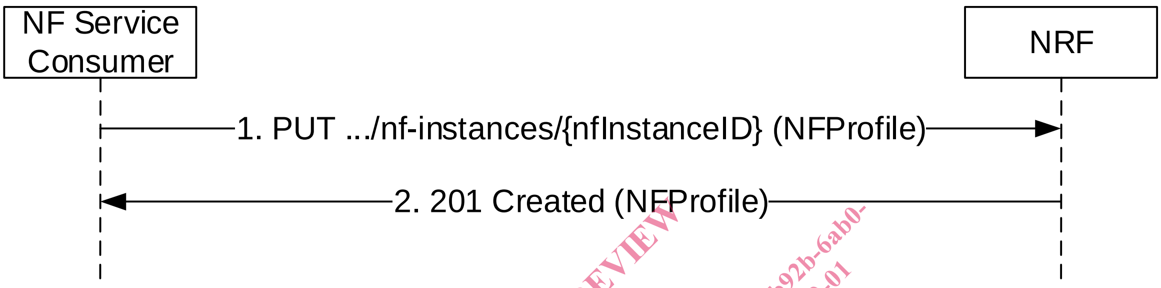

Figure 5.2.2.2.2-1: NF Instance Registration

1. The NF Service Consumer shall send a PUT request to the resource URI representing the NF Instance. The URI is determined by the NF Instance. The variable {nfInstanceID} represents an identifier, provided by the NF Service Consumer, that shall be globally unique inside the PLMN of the NRF where the NF is being registered. The format of the NF Instance ID shall be a Universally Unique Identifier (UUID) version 4, as described in IETF RFC 4122 [18].

   EXAMPLE: UUID version 4: "4947a69a-f61b-4bc1-b9da-47c9c5d14b64"

   The payload body of the PUT request shall contain a representation of the NF Instance to be created.

2. On success, "201 Created" shall be returned, the payload body of the PUT response shall contain the representation of the created resource and the "Location" header shall contain the URI of the created resource. Additionally, the NRF returns a "heart-beat timer" containing the number of seconds expected between two consecutive heart-beat messages from an NF Instance to the NRF (see clause 5.2.2.3.2). The representation of the created resource may be a complete NF Profile or a NF Profile just including the mandatory attributes of the NF Profile and the attributes which the NRF added or changed (see Annex B).

   If the registration of the NF instance fails at the NRF due to errors in the encoding of the NFProfile JSON object, the NRF shall return "400 Bad Request" status code with the ProblemDetails IE providing details of the error.

   If the registration of the NF instance fails at the NRF due to NRF internal errors, the NRF shall return "500 Internal Server Error" status code with the ProblemDetails IE providing details of the error.

The NRF shall allow the registration of a Network Function instance with any of the NF types described in clause 6.1.6.3.3, and it shall also allow registration of Network Function instances with custom NF types (e.g., NF type values not defined by 3GPP, or NF type values not defined by this API version).

NOTE: When registering a custom NF in NRF, it is recommended to use a NF type name that prevents collisions with other custom NF type names, or with NF types defined in the future by 3GPP. E.g., prefixing the custom NF type name with the string "CUSTOM_".

During the registration of a Network Function instance with a custom NF type, the NF instance may provide NF-specific data (in the "customInfo" attribute), that shall be stored by the NRF as part of the NF profile of the NF instance.