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Contents

Foreword

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

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where:

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2   presented to TSG for approval;

3   or greater indicates TSG approved document under change control.

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, certain modal verbs have the following meanings:

shall   indicates a mandatory requirement to do something

shall not   indicates an interdiction (prohibition) to do something

NOTE 1: The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

NOTE 2: 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

NOTE 3: 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

NOTE 4: The constructions "can" and "cannot" shall not to be used as 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

NOTE 5: 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 Nucmf Service Based Interface. It provides stage 3 protocol definitions and message flows, and specifies the API for each service offered by the UCMF.

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

[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 7540: "Hypertext Transfer Protocol Version 2 (HTTP/2)".

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

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

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

[15]   3GPP TS 29.122: "T8 reference point for northbound Application Programming Interfaces (APIs)".

[16]   IETF RFC 7396: "JSON Merge Patch".

3 Definitions, symbols 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 Symbols

No symbol is defined in the present document.

3.3 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
IMEI-TAC	Type Allocation Code part of an IMEI
NEF	Network Exposure Function
NF	Network Function
RACS	Radio Capabilities Signalling optimisation
UCMF	UE radio Capability Management Function

4 UE Radio Capability Provisioning Service

4.1 Service Description

4.1.1 Overview

The UE radio capability provisioning service, as defined in 3GPP TS 23.502 [3], is provided by the UE radio Capability Management Function (UCMF).

This service:

- allows NF service consumers to create, update and delete UCMF dictionary entries for Manufacturer-assigned UE Radio Capability IDs.

4.1.2 Service Architecture

The Service Architecture is defined in 3GPP TS 23.501 [2].

The UE radio capability provisioning service (Nucmf_Provisioning) is part of the Nucmf service-based interface exhibited by the UCMF.

The known NF service consumers of the Nucmf_Provisioning service are:

- Network Exposure Function (NEF); and

- Application Function (AF).

The Nucmf_Provisioning service is provided by the UCMF and consumed by the NEF and the AF, as shown in figure 4.1.2-1 for the SBI representation model and in figure 4.1.2-2 for reference point representation model.
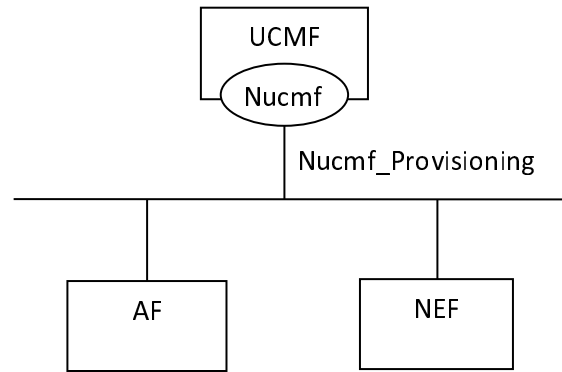
Figure 4.1.2-1: Nucmf_Provisioning service Architecture, SBI representation
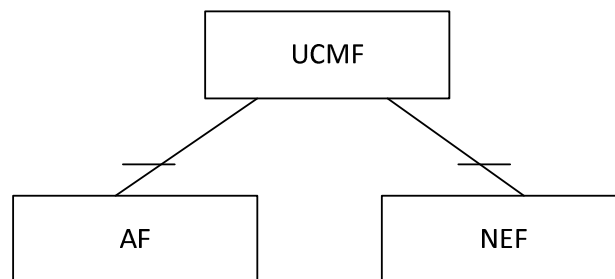
Figure 4.1.2-2: Nucmf_Provisioning service Architecture, reference point representation

4.1.3 Network Functions

4.1.3.1 UCMF

The UCMF is a functional element that provides service to the NF service consumer.

It allows NF consumers to provision (create, update and delete) UCMF dictionary entries for Manufacturer-assigned UE Radio Capability IDs.

4.1.3.2 NF Service Consumers

The Network Exposure Function (NEF):

- Provision (create, update and delete) UCMF dictionary entries for Manufacturer-assigned UE Radio Capability IDs to the UCMF, if it receives the UE Radio Capability information from the untrusted AF.

The Application Function (AF):

- As the trusted AF, provision (create, update and delete) UCMF dictionary entries for Manufacturer-assigned UE Radio Capability IDs to the UCMF.

4.2 Service Operations

4.2.1 Introduction

Service operations defined for the Nucmf_Provisioning Service are shown in table 4.2.1-1.

Table 4.2.1-1: Nucmf_Provisioning Service Operations

Service Operation Name	Description	Initiated by
Nucmf_Provisioning_Create	This service operation is used by an NF service consumer to create UE radio capability provisioning resource for Manufacturer-assigned UE Radio Capability IDs.	NF service consumer (AF, NEF)
Nucmf_Provisioning_Update	This service operation is used by an NF service consumer to modify UE radio capability provisioning resource for Manufacturer-assigned UE Radio Capability IDs.	NF service consumer (AF, NEF)
Nucmf_Provisioning_Delete	This service operation is used by an NF service consumer to remove a UE radio capability provisioning resource.	NF service consumer (AF, NEF)

4.2.2 Nucmf_Provisioning_Create service operation

4.2.2.1 General

This service operation is used by an NF service consumer to create UE radio capability provisioning resource for Manufacturer-assigned UE Radio Capability IDs.

The following procedure using the Nucmf_Provisioning_Create service operation is supported:

- creating a UE radio capability provisioning resource.

4.2.2.2 Creating UE radio capability provisioning resource

This procedure is used by the NF service consumer (e.g. NEF) to create a UE radio capability provisioning resource containing UCMF dictionary entries for Manufacturer-assigned UE Radio Capability IDs, as defined in 3GPP TS 23.501 [2] and 3GPP TS 23.502 [3].
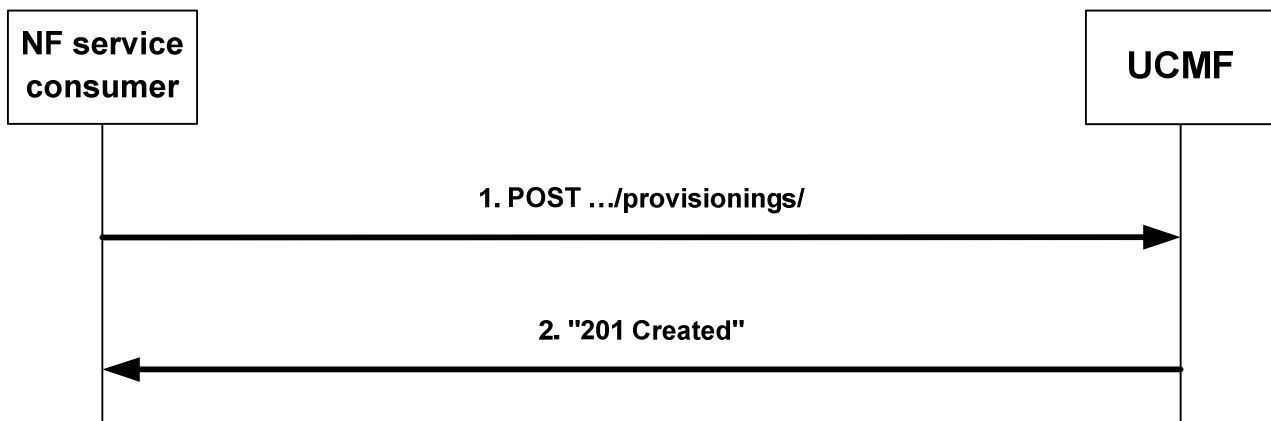
Figure 4.2.2.2-1: Creating new UE radio capability provisioning resource

To create a UE radio capability provisioning resource, the NF service consumer shall send an HTTP POST request to the UCMF with: "{apiRoot}/nucmf-provisioning/<apiVersion>/provisionings" as request URI as shown in step 1 of figure 4.2.2.2-1, and the "RacsData" data structure as request body. The "RacsData" data type shall contain one or more RACS configurations in the "racsConfigs" attribute which include:

- a RACS ID in the "racsId" attribute;

- UE radio capability information in the "racsParamEps" and/or "racsParam5Gs" attributes; and

- the related UE model(s) IMEI-TAC value(s) in the "imeiTacs" attribute.

Upon reception of the HTTP POST message from the NF service consumer requesting to create UCMF dictionary entries, the UCMF shall, for each requested RACS ID, check if there is any existing dictionary entry having the same RACS ID. If yes, the UCMF shall indicate "RACS_ID_DUPLICATED" in the "result" attribute for the requested RACS ID; otherwise if there is no other error the UCMF shall create a UCMF dictionary entry.

After processing all requested RACS IDs, if at least one UCMF dictionary entry is successfully provisioned, the UCMF shall create the resource and respond "201 Created" as shown in step 2 of figure 4.2.2.2-1 with the successfully provisioned RACS information, the UCMF may include RACS report(s) within attribute "racsReports" with a list of RACS ID(s) and the corresponding failure code for which the provisioning has failed as specified in table 5.16.2.2.3-1 of 3GPP TS 29.122 [15] in the body of the HTTP response; otherwise the UCMF shall respond "500 Internal Server Error" and may include the RACS report(s) to indicate failure details.

4.2.3 Nucmf_Provisioning_Update service operation

4.2.3.1 General

This service operation is used by an NF service consumer to modify UE radio capability provisioning resource for Manufacturer-assigned UE Radio Capability IDs.

The following procedure using the Nucmf_Provisioning_Update service operation is supported:

- modifying an existing UE radio capability provisioning resource.

4.2.3.2 Modifying a UE radio capability provisioning resource

Figure 4.2.3.2-1: Modifying a UE radio capability provisioning resource

In order to modify a UE radio capability provisioning resource, i.e. add new UCMF dictionary entries, update and/or remove the existing UCMF dictionary entries for one or more UCMF ID(s), the NF service consumer shall send an HTTP PUT or PATCH request to the UCMF with: "{apiRoot}/nucmf-provisioning/<apiVersion>/provisionings/{provisioningId}" as request URI as shown in step 1 of figure 4.2.3.2-1, and the "RacsData" or "RacsDataPatch" data structure as request body, correspondingly. The "RacsData" or "RacsDataPatch" data type shall contain one or more RACS configurations in the "racsConfigs" attribute which include:

- a RACS ID in the "racsId" attribute;

- UE radio capability information in the "racsParamEps" and/or "racsParam5Gs" attributes; and

- the related UE model(s) IMEI-TAC value(s) in the "imeiTacs" attribute.

Upon reception of the HTTP PUT message from the NF service consumer, the UCMF shall start replacing the existing UE radio capability provisioning resource and update the corresponding UCMF dictionary entr(ies).

Upon reception of the HTTP PATCH message from the NF service consumer, the UCMF shall start modifying the existing UE radio capability provisioning resource:

- remove RACS ID and its UE radio capability information with a NULL map key value, and the corresponding UCMF dictionary entry;

- replace the UE radio capability information for any existing RACS ID in the resource, and the corresponding UCMF dictionary entry; and/or

- create a UCMF dictionary entry for any new RACS ID if there is no ID conflict with other existing resources.

After processing all requested RACS IDs, if at least one UCMF dictionary entry is successfully provisioned, the UCMF shall respond "200 OK" as shown in step 2 of figure 4.2.3.2-1 with the successfully provisioned RACS information, the UCMF may include RACS report(s) within attribute "racsReports" with a list of RACS ID(s) and the corresponding failure code for which the provisioning has failed as specified in table 5.16.2.2.3-1 of 3GPP TS 29.122 [15] in the body of the HTTP response; otherwise the UCMF shall respond "500 Internal Server Error" and may include the RACS report(s) to indicate failure details.

4.2.4 Nucmf_Provisioning_Delete service operation

4.2.4.1 General

This service operation is used by an NF service consumer to remove UE radio capability provisioning resource for Manufacturer-assigned UE Radio Capability IDs.

The following procedure using the Nucmf_Provisioning_Delete service operation is supported:

- removing an existing UE radio capability provisioning resource.

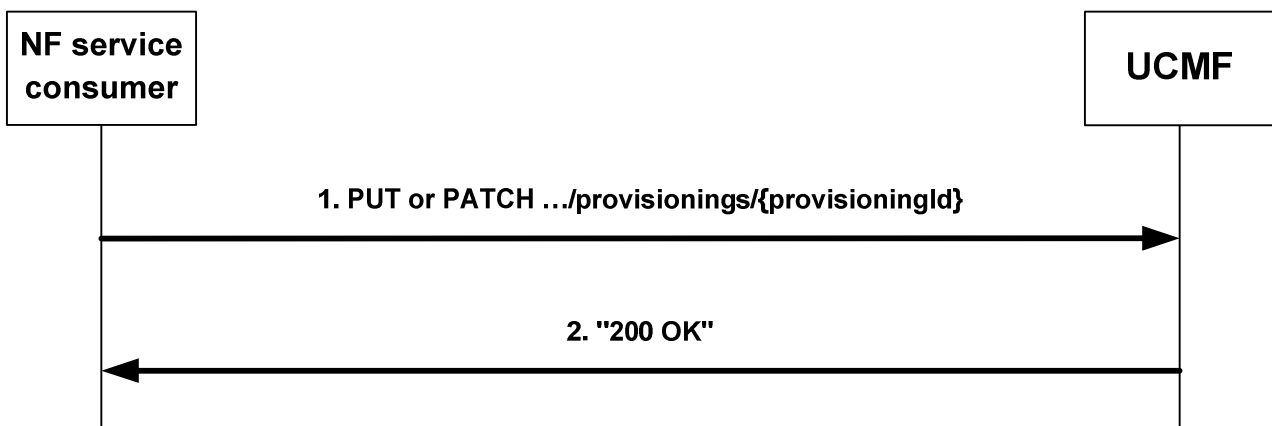### 4.2.4.2 Removing a UE radio capability provisioning resource
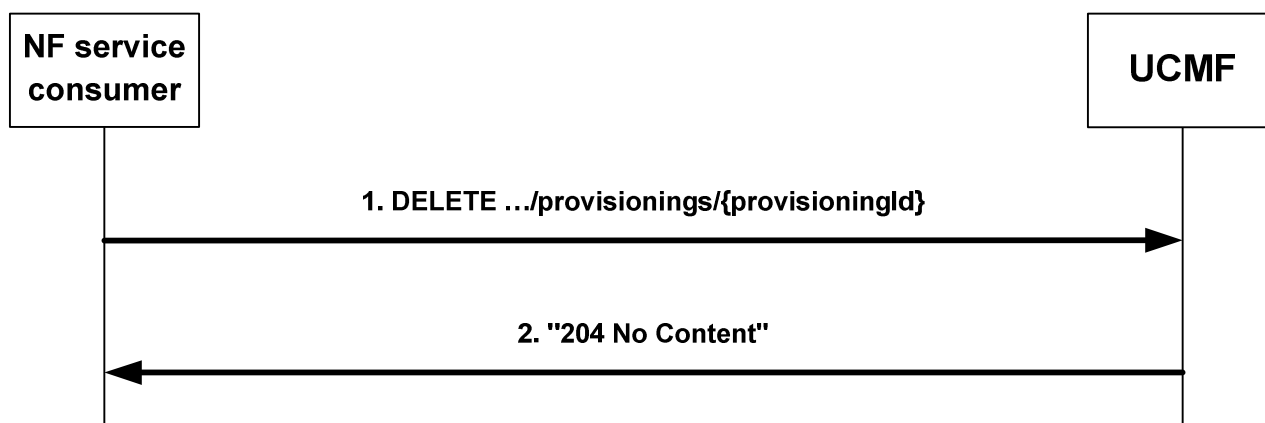
Figure 4.2.4.2-1: Removing a UE radio capability provisioning resource

In order to remove a UE radio capability provisioning resource, the NF service consumer shall send an HTTP DELETE request to the UCMF with: "{apiRoot}/nucmf-provisioning/<apiVersion>/provisionings/{provisioningId}" as request URI as shown in step 1 of figure 4.2.4.2-1.

Upon successful reception of the HTTP DELETE, the AF shall remove the corresponding resource and the corresponding UCMF dictionary entries, and send an HTTP "204 No Content" response as shown in step 2 of figure 4.2.4.2-1.

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

5 Nucmf_Provisioning Service API

5.1 Introduction

The UE radio capability provisioning service shall use the Nucmf_Provisioning API.

The API URI of the Nucmf_Provisioning API shall be:

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

The request URIs used in HTTP requests from the NF service consumer towards the NF service producer shall have the Resource URI structure defined in clause 4.4.1 of 3GPP TS 29.501 [5], i.e.:

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

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].

- The <apiName> shall be "nucmf-provisioning".

- The <apiVersion> shall be "v1".

- The <apiSpecificResourceUriPart> shall be set as described in clause 5.3.

5.2 Usage of HTTP

5.2.1 General

HTTP/2, IETF RFC 7540 [11], shall be used as specified in clause 5.2 of 3GPP TS 29.500 [4].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [4].

The OpenAPI [6] specification of HTTP messages and content bodies for the Nucmf_Provisioning API is contained in Annex A.

5.2.2 HTTP standard headers

5.2.2.1 General

See clause 5.2.2 of 3GPP TS 29.500 [4] for the usage of HTTP standard headers.

5.2.2.2 Content type

JSON, IETF RFC 8259 [12], shall be used as content type of the HTTP bodies specified in the present specification as specified in clause 5.4 of 3GPP TS 29.500 [4]. The use of the JSON format shall be signalled by the content type "application/json".

JSON object used in the HTTP PATCH request shall be encoded according to "JSON Merge Patch" and shall be signalled by the content type "application/merge-patch+json", as defined in IETF RFC 7396 [16].

"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

The mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [4] shall be applicable.

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

5.3 Resources

5.3.1 Overview

{apiRoot}/nucmf-provisioning/<apiVersion>

/provisionings
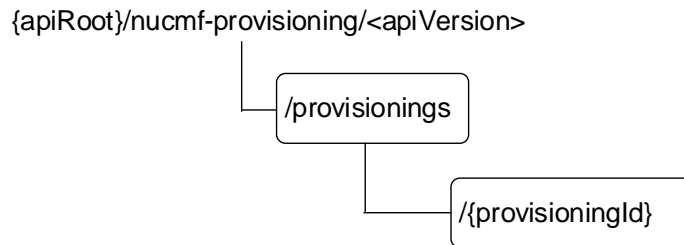
/{provisioningId}

Figure 5.3.1-1: Resource URI structure of the Nucmf_Provisioning 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
UE radio capability provisionings	{apiRoot}/nucmf-provisioning/<apiVersion>/ provisionings	POST	Create a UE radio capability provisioning resource.
Individual UE radio capability provisioning	{apiRoot}/nucmf-provisioning/<apiVersion>/ provisionings/{provisioningId}	GET	Read an existing UE radio capability provisioning resource.
		PUT	Modify an existing UE radio capability provisioning resource.
		PATCH	Modify an existing UE radio capability provisioning resource.
		DELETE	Remove an existing UE radio capability provisioning resource.

5.3.2 Resource: UE radio capability provisionings (Collection)

5.3.2.1 Description

The UE radio capability provisionings resource represents all the provisionings that exist in the UE radio capability provisioning service at a given UCMF instance.

5.3.2.2 Resource Definition

Resource URI: **{apiRoot}/nucmf-provisionings/<apiVersion>/provisionings**

This resource shall support the resource URI variables defined in table 5.3.2.2-1.

Table 5.3.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 5.1.
apiVersion	string	See clause 5.1.

5.3.2.3 Resource Standard Methods

5.3.2.3.1 POST

This method shall support the URI query parameters specified in table 5.3.2.3.1-1.

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

Name	Data type	P	Cardinality	Description	Applicability
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
RacsData	M	1	Contains information for the creation of an Individual UE radio capability provisioning resource.

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

Data type	P	Cardinality	Response codes	Description
RacsData	M	1	201 Created	The creation of an Individual UE radio capability provisioning resource is confirmed and a representation of that resource is returned.
array(RacsFailureReport)	M	1..N	500 Internal Server Error	The RACS data for all RACS IDs were not provisioned successfully.
NOTE: The mandatory HTTP error status codes for the POST method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				

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

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains the URI of the newly created resource, according to the structure: {apiRoot}/nucmf-provisioning/<apiVersion>/provisionings/{provisioningId}

5.3.2.4 Resource Custom Operations

None.

5.3.3 Resource: Individual UE radio capability provisioning (Document)

5.3.3.1 Description

The Individual UE radio capability provisioning resource represents a single provisioning that exist in the UE radio capability provisioning service at a given UCMF instance.

5.3.3.2 Resource Definition

Resource URI: **{apiRoot}/nucmf-provisionings/<apiVersion>/provisionings/{provisioningId}**

This resource shall support the resource URI variables defined in table 5.3.3.2-1.

Table 5.3.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 5.1.
apiVersion	string	See clause 5.1.
provisioningId	string	Identifies the individual UE radio capability resource in the UCMF. To enable the value to be used as part of a URI, the string shall only contain allowed characters according to the "lower-with-hyphen" naming convention defined in clause 5.1.3 of 3GPP TS 29.501 [5] and rules for a path segment defined in IETF RFC 3986 [14].

5.3.3.3 Resource Standard Methods

5.3.3.3.1 GET

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

Table 5.3.3.3.1-1: URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 5.3.3.3.1-2 and the response data structures and response codes specified in table 5.3.3.3.1-3.

Table 5.3.3.3.1-2: Data structures supported by the GET Request Body on this resource

Data type	P	Cardinality	Description
n/a			

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

Data type	P	Cardinality	Response codes	Description
RacsData	M	1	200 OK	A representation of an Individual UE radio capability provisioning resource is returned.
NOTE: The mandatory HTTP error status codes for the GET method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				

5.3.3.3.2 PUT

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

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

Name	Data type	P	Cardinality	Description	Applicability
n/a					

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

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

Data type	P	Cardinality	Description
RacsData	M	1	Contains the modification of an Individual UE radio capability provisioning data.

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

Data type	P	Cardinality	Response codes	Description
RacsData	M	1	200 OK	The Individual UE radio capability provisioning resource is modified and a representation of that resource is returned.
array(RacsFailureReport)	M	1..N	500 Internal Server Error	The RACS data for all RACS IDs were not provisioned successfully.
NOTE: The mandatory HTTP error status codes for the PUT method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				

5.3.3.3.3 PATCH

This method shall support the URI query parameters specified in table 5.3.3.3.3-1.

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

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 5.3.3.3.3-2 and the response data structures and response codes specified in table 5.3.3.3.3-3.

Table 5.3.3.3.3-2: Data structures supported by the PATCH Request Body on this resource

Data type	P	Cardinality	Description
RacsDataPatch	M	1	Contains the modification of an Individual UE radio capability provisioning data.

Table 5.3.3.3.3-3: Data structures supported by the PATCH Response Body on this resource

Data type	P	Cardinality	Response codes	Description
RacsData	M	1	200 OK	The Individual UE radio capability provisioning resource is modified and a representation of that resource is returned.
array(RacsFailureReport)	M	1..N	500 Internal Server Error	The RACS data for all RACS IDs were not provisioned successfully.
NOTE: The mandatory HTTP error status codes for the PATCH method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				

5.3.3.3.4 DELETE

This method shall support the URI query parameters specified in table 5.3.3.3.4-1.

Table 5.3.3.3.4-1: URI query parameters supported by the DELETE method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 5.3.3.3.4-2 and the response data structures and response codes specified in table 5.3.3.3.4-3.

Table 5.3.3.3.4-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 5.3.3.3.4-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The Individual UE radio capability resource was successfully removed.
NOTE: The mandatory HTTP error status codes for the DELETE method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				

5.4 Custom Operations without associated resources

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

5.5 Notifications

Notifications are not applicable for the current Release.

5.6 Data Model

5.6.1 General

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

Table 5.6-1 specifies the data types defined for the Nucmf_Provisioning service based interface protocol.

Table 5.6-1: Nucmf_Provisioning specific Data Types

Data type	Section defined	Description	Applicability
RacsData	5.6.2.2	UE radio capability data	
RacsDataPatch	5.6.2.3	UE radio capability data for PATCH request	

Table 5.6-2 specifies data types re-used by the Nucmf_Provisioning 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 Nucmf_Provisioning service based interface.

Table 5.6-2: Nucmf_Provisioning re-used Data Types

Data type	Reference	Comments	Applicability
RacsConfiguration	3GPP TS 29.122 [15]	Represents the UE radio capability data configuration.	
RacsConfigurationRm	3GPP TS 29.122 [15]	Represents the UE radio capability data configuration with "nullable: true" property.	
RacsFailureReport	3GPP TS 29.122 [15]	Represents the report for UE radio capability data provisioning.	
SupportedFeatures	3GPP TS 29.122 [15]	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 clause defines the structures to be used in resource representations.

5.6.2.2 Type: RacsData

This type represents a UE radio capability data provided by the NF service consumer to the UCMF.

Table 5.6.2.2-1: Definition of type RacsData

Attribute name	Data type	P	Cardinality	Description	Applicability
suppFeat	SupportedFeatures	C	0..1	Used to negotiate the supported optional features of the API as described in clause 5.2.7. This attribute shall be provided in the POST request and in the response of successful resource creation.	
racsConfigs	map(RacsConfiguration)	M	1..N	Identifies the configuration related to manufacturer specific UE radio capability. Each element uniquely identifies an RACS configuration for an RACS ID and is identified in the map via the RACS ID as key. The response shall include successfully provisioned RACS data.	
racsReports	map(RacsFailureReport)	O	1..N	Supplied by the UCMF. Contains the RACS IDs for which the RACS data are not provisioned successfully.	

5.6.2.3 Type: RacsDataPatch

This type represents a UE radio capability data provided by the NF service consumer to the UCMF.

Table 5.6.2.3-1: Definition of type RacsDataPatch

Attribute name	Data type	P	Cardinality	Description	Applicability
racsConfigs	map(RacsConfigurationRm)	O	1..N	Identifies the configuration related to manufacturer specific UE radio capability. Each element uniquely identifies an RACS configuration for an RACS ID and is identified in the map via the RACS ID as key.	

5.6.3 Simple data types and enumerations

5.6.3.1 Introduction

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

5.6.3.2 Simple data types

The simple data types defined in table 5.6.3.2-1 shall be supported.

Table 5.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

5.7 Error Handling

5.7.1 General

For the Nucmf_Provisioning API, HTTP error responses shall be supported as specified in clause 4.8 of 3GPP TS 29.501 [5]. Protocol errors and application errors specified in table 5.2.7.2-1 of 3GPP TS 29.500 [4] 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 [4].

In addition, the requirements in the following clauses are applicable for the Nucmf_Provisioning API.

5.7.2 Protocol Errors

No specific procedures for the Nucmf_Provisioning service are specified.

5.7.3 Application Errors

The application errors defined for the Nucmf_Provisioning service are listed in table 5.7.3-1.

Table 5.7.3-1: Application errors

Application Error	HTTP status code	Description

5.8 Feature negotiation

The optional features in table 5.8-1 are defined for the Nucmf_Provisioning API. They shall be negotiated using the extensibility mechanism defined in clause 6.6.2 of 3GPP TS 29.500 [4].

Table 5.8-1: Supported Features

Feature number	Feature Name	Description

5.9 Security

As indicated in 3GPP TS 33.501 [8] and 3GPP TS 29.500 [4], the access to the Nucmf_Provisioning API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [9]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [10]) plays the role of the authorization server.

If OAuth2 is used, an NF Service Consumer, prior to consuming services offered by the Nucmf_Provisioning API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [10], clause 5.4.2.2.

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

The Nucmf_Provisioning API defines a single scope "nucmf-provisioning" 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

This Annex specifies the formal definition of the API(s) defined in the present specification. It consists of OpenAPI 3.0.0 specifications in YAML format.

This Annex takes precedence when being discrepant to other parts of the specification with respect to the encoding of information elements and methods within the API(s).

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

A.2 Nucmf_Provisioning API

```
openapi: 3.0.0
info:
  title: Nucmf_Provisioning
  version: 1.0.0
  description: |
    UCMF_Provisioning Service.
    © 2020, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.
externalDocs:
  description: 3GPP TS 29.675 V16.1.0; User Equipment (UE) radio capability provisioning service;
Stage 3.
  url: http://www.3gpp.org/ftp/Specs/archive/29_series/29.675/
servers:
  - url: '{apiRoot}/nucmf-provisioning/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501
security:
  - {}
  - oAuth2ClientCredentials:
    - nucmf-provisioning
paths:
  /provisionings:
    post:
      summary: Create an Individual UE radio capability provisioning
      operationId: CreateProvisioning
      tags:
        - UE radio capability provisionings (Collection)
      requestBody:
        description: create new provisionings for a given SCS/AS.
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/RacsData'
      responses:
        '201':
          description: Created. The creation of an Individual UE radio capability provisioning
resource is confirmed and a representation of that resource is returned.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/RacsData'
          headers:
            Location:
```

```
                description: 'Contains the URI of the newly created resource'
                required: true
                schema:
                  type: string
          '400':
            $ref: 'TS29122_CommonData.yaml#/components/responses/400'
          '401':
            $ref: 'TS29122_CommonData.yaml#/components/responses/401'
          '403':
            $ref: 'TS29122_CommonData.yaml#/components/responses/403'
          '404':
            $ref: 'TS29122_CommonData.yaml#/components/responses/404'
          '411':
            $ref: 'TS29122_CommonData.yaml#/components/responses/411'
          '413':
            $ref: 'TS29122_CommonData.yaml#/components/responses/413'
          '415':
            $ref: 'TS29122_CommonData.yaml#/components/responses/415'
          '429':
            $ref: 'TS29122_CommonData.yaml#/components/responses/429'
          '500':
            description: The RACS data for all RACS IDs were not provisioned successfully.
            content:
              application/json:
                schema:
                  type: array
                  items:
                    $ref:
'TS29122_RacsParameterProvisioning.yaml#/components/schemas/RacsFailureReport'
                  minItems: 1
              application/problem+json:
                schema:
                  $ref: 'TS29122_CommonData.yaml#/components/schemas/ProblemDetails'
          '503':
            $ref: 'TS29122_CommonData.yaml#/components/responses/503'
          default:
            $ref: 'TS29122_CommonData.yaml#/components/responses/default'
  /provisionings/{provisioningId}:
    parameters:
      - name: provisioningId
        in: path
        description: Provisioning ID
        required: true
        schema:
          type: string
    get:
      summary: Get an Individual UE radio capability provisioning
      operationId: GetProvisioning
      tags:
        - Individual UE radio capability provisioning (Document)
      responses:
        '200':
          description: OK. The provisioning information related to the request URI is returned.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/RacsData'
        '400':
          $ref: 'TS29122_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29122_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29122_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29122_CommonData.yaml#/components/responses/404'
        '406':
          $ref: 'TS29122_CommonData.yaml#/components/responses/406'
        '429':
          $ref: 'TS29122_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29122_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29122_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29122_CommonData.yaml#/components/responses/default'
    patch:
      summary: Update (PATCH) an Individual UE radio capability provisioning
      operationId: UpdateProvisioning
```

```
          tags:
            - Individual UE radio capability provisioning (Document)
          requestBody:
            description: update an existing parameter provisioning.
            required: true
            content:
              application/merge-patch+json:
                schema:
                  $ref: '#/components/schemas/RacsDataPatch'
          responses:
            '200':
              description: OK. The Individual UE radio capability provisioning resource is modified and
a representation of that resource is returned.
              content:
                application/json:
                  schema:
                    $ref: '#/components/schemas/RacsData'
            '400':
              $ref: 'TS29122_CommonData.yaml#/components/responses/400'
            '401':
              $ref: 'TS29122_CommonData.yaml#/components/responses/401'
            '403':
              $ref: 'TS29122_CommonData.yaml#/components/responses/403'
            '404':
              $ref: 'TS29122_CommonData.yaml#/components/responses/404'
            '411':
              $ref: 'TS29122_CommonData.yaml#/components/responses/411'
            '413':
              $ref: 'TS29122_CommonData.yaml#/components/responses/413'
            '415':
              $ref: 'TS29122_CommonData.yaml#/components/responses/415'
            '429':
              $ref: 'TS29122_CommonData.yaml#/components/responses/429'
            '500':
              description: The RACS data for all RACS IDs were not provisioned successfully.
              content:
                application/json:
                  schema:
                    type: array
                    items:
                      $ref:
'TS29122_RacsParameterProvisioning.yaml#/components/schemas/RacsFailureReport'
                    minItems: 1
                application/problem+json:
                  schema:
                    $ref: 'TS29122_CommonData.yaml#/components/schemas/ProblemDetails'
            '503':
              $ref: 'TS29122_CommonData.yaml#/components/responses/503'
            default:
              $ref: 'TS29122_CommonData.yaml#/components/responses/default'
      put:
        summary: Replace (PUT) an Individual UE radio capability provisioning
        operationId: ReplaceProvisioning
        tags:
          - Individual UE radio capability provisioning (Document)
        requestBody:
          description: update an existing parameter provisioning.
          required: true
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/RacsData'
        responses:
          '200':
            description: OK. The Individual UE radio capability provisioning resource is modified and
a representation of that resource is returned.
            content:
              application/json:
                schema:
                  $ref: '#/components/schemas/RacsData'
          '400':
            $ref: 'TS29122_CommonData.yaml#/components/responses/400'
          '401':
            $ref: 'TS29122_CommonData.yaml#/components/responses/401'
          '403':
            $ref: 'TS29122_CommonData.yaml#/components/responses/403'
          '404':
            $ref: 'TS29122_CommonData.yaml#/components/responses/404'
```

```
            '411':
              $ref: 'TS29122_CommonData.yaml#/components/responses/411'
            '413':
              $ref: 'TS29122_CommonData.yaml#/components/responses/413'
            '415':
              $ref: 'TS29122_CommonData.yaml#/components/responses/415'
            '429':
              $ref: 'TS29122_CommonData.yaml#/components/responses/429'
            '500':
              description: The RACS data for all RACS IDs were not provisioned successfully.
              content:
                application/json:
                  schema:
                    type: array
                    items:
                        $ref:
'TS29122_RacsParameterProvisioning.yaml#/components/schemas/RacsFailureReport'
                    minItems: 1
                application/problem+json:
                  schema:
                      $ref: 'TS29122_CommonData.yaml#/components/schemas/ProblemDetails'
            '503':
              $ref: 'TS29122_CommonData.yaml#/components/responses/503'
            default:
              $ref: 'TS29122_CommonData.yaml#/components/responses/default'
    delete:
      summary: Remove an Individual UE radio capability provisioning
      operationId: RemoveProvisioning
      tags:
        - Individual UE radio capability provisioning (Document)
      responses:
        '204':
          description: No Content. The Individual UE radio capability resource was successfully
removed. The payload body shall be empty.
        '400':
          $ref: 'TS29122_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29122_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29122_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29122_CommonData.yaml#/components/responses/404'
        '429':
          $ref: 'TS29122_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29122_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29122_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29122_CommonData.yaml#/components/responses/default'
components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{tokenUrl}'
          scopes:
            nucmf-provisioning: Access to the Nucmf_Provisioning API
  schemas:
    RacsData:
      type: object
      properties:
        suppFeat:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
        racsConfigs:
          type: object
          additionalProperties:
            $ref: 'TS29122_RacsParameterProvisioning.yaml#/components/schemas/RacsConfiguration'
          minProperties: 1
          description: Identifies the configuration related to manufacturer specific UE radio
capability. Each element uniquely identifies an RACS configuration for an RACS ID and is identified
in the map via the RACS ID as key. The response shall include successfully provisioned RACS data.
        racsReports:
          type: object
          additionalProperties:
            $ref: 'TS29122_RacsParameterProvisioning.yaml#/components/schemas/RacsFailureReport'
          minProperties: 1
```

```
            description: Contains the RACS IDs for which the RACS data are not provisioned
successfully. The failure reason is also included.
            readOnly: true
      required:
        - racsConfigs
    RacsDataPatch:
      type: object
      properties:
        racsConfigs:
          type: object
          additionalProperties:
            $ref: 'TS29122_RacsParameterProvisioning.yaml#/components/schemas/RacsConfigurationRm'
          minProperties: 1
          description: Identifies the configuration related to manufacturer specific UE radio
capability. Each element uniquely identifies an RACS configuration for an RACS ID and is identified
in the map via the RACS ID as key.
```

Annex B (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New**
2019-06						TS skeleton of UE Radio Capability Provisioning Service	0.0.0
2019-09						Includes pCRs agreed in CT3#105: C3-193417, C3-193594, C3-193648.	0.1.0
2019-10						Includes pCRs agreed in CT3#106: C3-194435.	0.2.0
2019-11						Rapporteur changes: - fill in the referred clause number of TS 29.122 in clauses 4.2.2.2 and 4.2.3.2. - correct the TS version in externalDocs and step the openAPI file version.	0.3.0
2019-12						Sent to plenary for information.	1.0.0
2020-03						Includes pCRs agreed in CT3#108-e: C3-201197.	1.1.0
2020-03	CT#87e	CP-200189				TS sent to plenary for approval	2.0.0
2020-03	CT#87e	CP-200189				TS approved by plenary	16.0.0
2020-06	CT#88e	CP-201243	0003	-	F	Correcting errors in clause 5.6	16.1.0
2020-06	CT#88e	CP-201244	0004	1	F	Storage of YAML files in ETSI Forge	16.1.0
2020-06	CT#88e	CP-201243	0002	1	F	Update to UE radio capability information data type	16.1.0
2020-06	CT#88e	CP-201189	0001	3	F	Addition of IMEI-TAC values for RACS operations	16.1.0
2020-06	CT#88e	CP-201190	0006	1	F	Avoid using the same data type for PUT and PATCH	16.1.0
2020-06	CT#88e	CP-201256	0005	1	F	URI of the Nucmf_Provisioning service	16.1.0
2020-06	CT#88e	CP-201243	0007	1	F	Correct OpenAPI scope	16.1.0
2020-06	CT#88e	CP-201243	0008	1	F	Supported headers, Resource Data type and yaml mapping	16.1.0
2020-06	CT#88e	CP-201255	0009		F	Update of OpenAPI version and TS version in externalDocs field	16.1.0

History

Document history		
V16.1.0	August 2020	Publication