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

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shall not indicates an interdiction (prohibition) to do something

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should indicates a recommendation to do something

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need not indicates permission not to do something

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

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

The stage 2 architecture and procedures of SBA-enabled GBA is specified in 3GPP TS 33.220 [14] and 3GPP TS 33.223 [15].

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 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] 3GPP TS 33.220: "Generic Authentication Architecture (GAA); Generic Bootstrapping Architecture (GBA)".

[15] 3GPP TS 33.223: "Generic Authentication Architecture (GAA); Generic Bootstrapping Architecture (GBA) Push function".

[16] 3GPP TS 33.224: "Generic Authentication Architecture (GAA); Generic Bootstrapping Architecture (GBA) Push Layer".

[17] 3GPP TS 29.109: "Generic Authentication Architecture (GAA); Zh and Zn Interfaces based on the Diameter protocol; Stage 3".

[18] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces; 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].

Bootstrapping Server Function: BSF is hosted in a network element under the control of an MNO. BSF, HSS, and UEs participate in GBA in which a shared secret is established between the network and a UE by running the bootstrapping procedure. The shared secret can be used between NAFs and UEs, for example, for authentication purposes. In the context of the present specification, the BSF is an SBA-capable BSF.

GBA Function: A function on the ME executing the bootstrapping procedure with BSF (i.e. supporting the Ub reference point) and providing Ua applications with security association to run bootstrapping usage procedure. GBA function is called by a Ua application when a Ua application wants to use bootstrapped security association.

Network Application Function: NAF is hosted in a network element. GBA may be used between NAFs and UEs for authentication purposes, and for securing the communication path between the UE and the NAF. In the context of the present specification, the NAF is an SBA-capable NAF.

GBA User Security Settings: GUSS contains the BSF specific information element and the set of all application-specific USSs.

Ua Application: An application on the ME intended to run bootstrapping usage procedure with a NAF.

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].

BSF	Bootstrapping Server Function
GBA	Generic Bootstrapping Architecture
GUSS	GBA User Security Settings
HSS	Home Subscriber System
NAF	Network Application Function
SBA	Service-Based Architecture
USS	User Security Setting

4 Overview

Nbsp is a Service-based interface exhibited by GBA BSF (Generic Bootstrapping Architecture; Bootstrapping Server Function) which is a Network Function that supports the following functionality:

- Allows the NAF and the Push-NAF to fetch the key material agreed during a previous protocol run between the UE and the GBA BSF. It is also used to fetch application-specific user security settings from the GBA BSF, if requested by the NAF.

The reference points N66 and N67 (see Fig 4-1 below) show the interaction between the GBA BSF and the NAF and Push-NAF Network Functions.

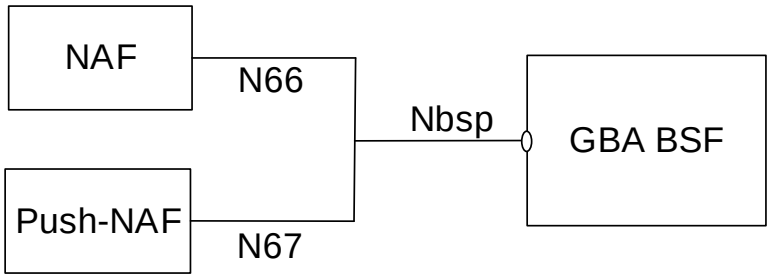

Figure 4-1: Reference Model – Nbsp

In the context of the present specification, the GBA BSF is an SBA-capable BSF, and the NAF and Push-NAF are also SBA-capable Network Functions (see 3GPP TS 33.220 [14] and 3GPP TS 33.223 [15]).

5 Services offered by the GBA BSF

5.1 Introduction

The GBA BSF offers the following services via the Nbsp interface:

- Nbsp_GBA Service

Table 5.1-1 summarizes the corresponding APIs defined for this specification.

Table 5.1-1: API Descriptions

Service Name	Clause	Description	OpenAPI Specification File	apiName	Annex
Nbsp_GBA	5.2	Nbsp GBA Service	TS29309_Nbsp_GBA.yaml	nbsp-gba	A.2

5.2 Nbsp_GBA Service

5.2.1 Service Description

This service is exposed by the GBA BSF for the purpose of providing GBA bootstrap information to an SBI-capable NAF, and GBA push information (GPI) to an SBI-capable Push-NAF, for the derivation of the application key material (e.g. Ks_(ext/int)_NAF). It also supports to fetch application-specific user security settings (USS) from the GBA BSF.

5.2.2 Service Operations

5.2.2.1 Introduction

For the Nbsp_GBA service the following service operations are defined:

- BootstrapInfo
- PushInfo

5.2.2.2 BootstrapInfo

5.2.2.2.1 General

This service operation is used between the SBI-capable NAF and the GBA BSF to request the key material agreed during bootstrapping from the UE to the GBA BSF. It is also used to fetch application-specific user security settings from the BSF, if requested by the NAF.

5.2.2.2.2 Boostrapping Info Retrieval

Figure 5.2.2.2.2-1 shows a scenario where the NF Service Consumer (e.g. the SBI-capable NAF) sends a request to the GBA BSF to receive the bootstrapping info and optionally the user security settings.

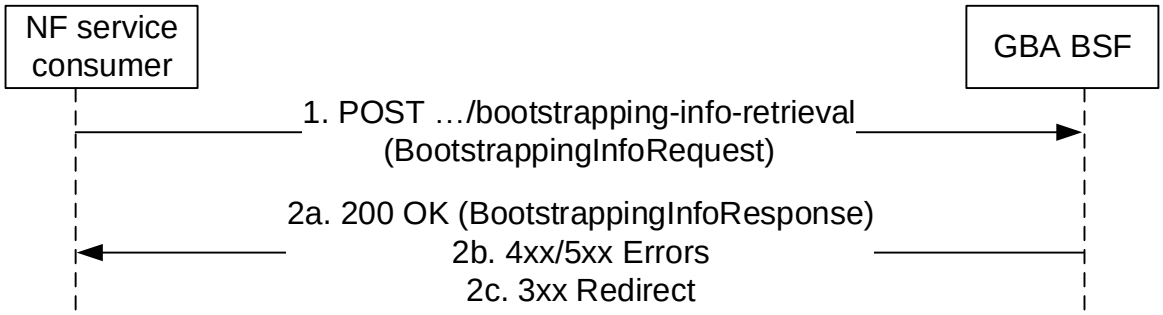

Figure 5.2.2.2.2-1: Requesting Bootstrapping Info

1. The NF Service Consumer sends a POST request (custom method "bootstrapping-info-retrieval") to the GBA BSF. The request includes the B-TID, the NAF-Id and optionally a flag to indicate that the NAF is GBA_U aware, and a list of GAA Service Identifiers (GSID).

2a. On success the GBA BSF responds with "200 OK" and including in the message body the key material (Ks_NAF in case of GBA_ME and Ks_ext_NAF in case of GBA_U), the key material lifetime and the bootstrapping creation time. Optionally, it may include additional key material (i.e. Ks_int_NAF), application-specific user security settings and the UE private identity.

On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the POST response body.

In the case of redirection, the GBA BSF shall return 3xx status code, which shall contain a Location header with an URI pointing to the endpoint of another GBA BSF (service) instance.

5.2.2.3 PushInfo

5.2.2.3.1 General

This service operation is used between the SBI-capable Push-NAF and the GBA BSF to request the GBA Push Information (GPI) in order to bootstrap the UE with GBA key material. It is also used to fetch application-specific user security settings from the BSF, if requested by the Push-NAF.

5.2.2.3.2 Push Info Retrieval

Figure 5.2.2.3.2-1 shows a scenario where the NF Service Consumer (e.g. the SBI-capable Push-NAF) sends a request to the GBA BSF to receive the bootstrapping info and optionally the user security settings.

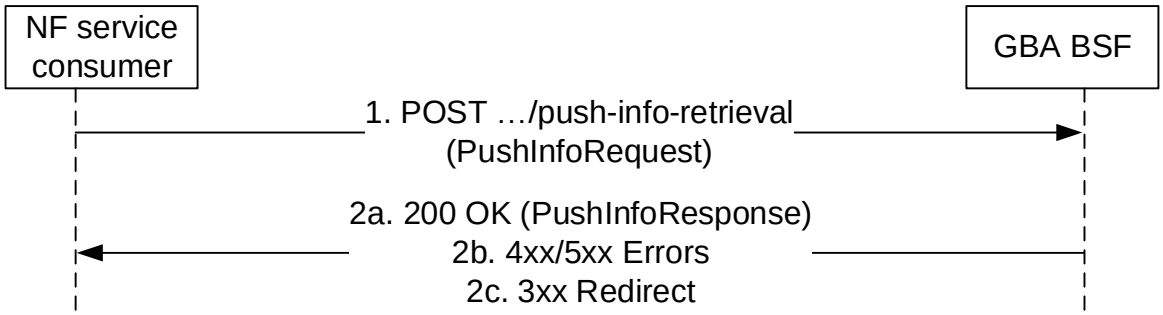

Figure 5.2.2.3.2-1: Requesting Push Info

1. The NF Service Consumer sends a POST request (custom method "push-info-retrieval") to the GBA BSF. The request includes the User Identity (Private or Public Identity), User Identity type, UICC application identifier, Push-NAF-Id, Push-NAF SA identifier, Indicator for use of GBA_ME or GBA_U, Requested Push-NAF key lifetime, Private User Identity indicator, list of GAA Service Identifiers (GSID), AUTS and RAND.

2a. On success the GBA BSF responds with "200 OK" and including in the message body the GPI data, key material (Ks_NAF in case of GBA_ME and Ks_ext_NAF in case of GBA_U), key material lifetime, application-specific user security settings. Optionally, it may include additional key material (i.e. Ks_int_NAF), application-specific user security settings and the UE private identity.

On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the POST response body.

In the case of redirection, the GBA BSF shall return 3xx status code, which shall contain a Location header with an URI pointing to the endpoint of another GBA BSF (service) instance.

6 API Definitions

6.1 Nbsp_GBA Service API

6.1.1 Introduction

The Nbsp_GBA service shall use the Nbsp_GBA API.

The API URI of the Nbsp_GBA 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 "nbsp-gba".
- The <apiVersion> shall be "v1".
- The <apiSpecificResourceUriPart> shall be set as described in clause 6.1.3.

6.1.2 Usage of HTTP

6.1.2.1 General

HTTP/2, IETF RFC 7540 [11], shall be used as specified in clause 5 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 Nbsp_GBA API is contained in Annex A.

6.1.2.2 HTTP standard headers

6.1.2.2.1 General

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

6.1.2.2.2 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".

"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].

6.1.2.3 HTTP custom headers

The mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [4] shall be supported, and the optional HTTP custom header fields specified in clause 5.2.3.3 of 3GPP TS 29.500 [4] may be supported.

6.1.3 Resources

In this release of this specification, no resources are defined for the Nbsp_GBA service.

6.1.3.1 Overview

The structure of the Resource URIs of the Nbsp_GBA service is shown in figure 6.1.3.1-1.

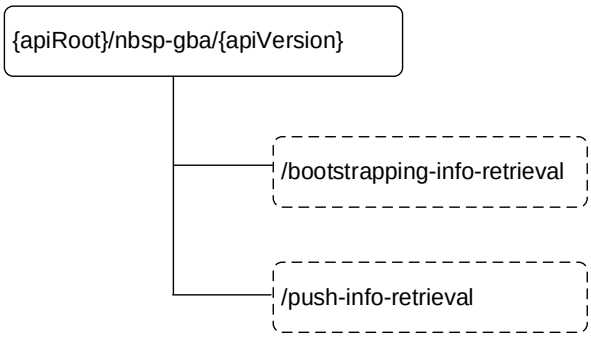

Figure 6.1.3.1-1: Resource URI structure of the Nbsp_GBA API

6.1.4 Custom Operations without associated resources

6.1.4.1 Overview

Table 6.1.4.1-1: Custom operations without associated resources

Operation Name	Custom operation URI	Mapped HTTP method	Description
Bootstrapping Info Retrieval	/bootstrapping-info-retrieval	POST	
Push Info Retrieval	/push-info-retrieval	POST	

6.1.4.2 Operation: Bootstrapping Info Retrieval

6.1.4.2.1 Description

6.1.4.2.2 Operation Definition

This operation shall support the response data structures and response codes specified in tables 6.1.4.2.2-1 and 6.1.4.2.2-2.

Table 6.1.4.2.2-1: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
BootstrappingInfo Request	M	1	Request body of the Bootstrapping Info Request

Table 6.1.4.2.2-2: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
BootstrappingInfo Response	M	1	200 OK	A response body containing the BootstrappingInfoResponse shall be returned.
RedirectRespons e	O	0..1	307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing a different URI. The URI shall be an alternative URI of the resource located on an alternative service instance within the same GBA BSF (service) set.
RedirectRespons e	O	0..1	308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing a different URI. The URI shall be an alternative URI of the resource located on an alternative service instance within the same GBA BSF (service) set.
ProblemDetails	O	0..1	403 Forbidden	The NAF is not authorized to request Bootstrapping Information from the GBA BSF.
NOTE: The mandatory HTTP error status code for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				

Table 6.1.4.2.2-3: Headers supported by the 307 Response Code

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance within the same GBA BSF (service) set.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected.

Table 6.1.4.2.2-4: Headers supported by the 308 Response Code

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance within the same GBA BSF (service) set.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected.

6.1.4.3 Operation: Push Info Retrieval

6.1.4.3.1 Description

6.1.4.3.2 Operation Definition

This operation shall support the response data structures and response codes specified in tables 6.1.4.3.2-1 and 6.1.4.3.2-2.

Table 6.1.4.3.2-1: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
PushInfoRequest	M	1	Request body of the Push Info Request

Table 6.1.4.3.2-2: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
PushInfoResponse	M	1	200 OK	A response body containing the PushInfoResponse shall be returned.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing a different URI. The URI shall be an alternative URI of the resource located on an alternative service instance within the same GBA BSF (service) set.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing a different URI. The URI shall be an alternative URI of the resource located on an alternative service instance within the same GBA BSF (service) set.
ProblemDetails	O	0..1	403 Forbidden	The Push-NAF is not authorized to request GBA Push Information (GPI) from the GBA BSF.
NOTE: The mandatory HTTP error status code for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				

Table 6.1.4.3.2-3: Headers supported by the 307 Response Code

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance within the same GBA BSF (service) set.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected.

Table 6.1.4.3.2-4: Headers supported by the 308 Response Code

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance within the same GBA BSF (service) set.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected.

6.1.5 Notifications

In this release of this specification, no notifications are defined for the Nbsp_GBA service.

6.1.6 Data Model

6.1.6.1 General

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

Table 6.1.6.1-1 specifies the data types defined for the Nbsp_GBA service-based interface protocol.

Table 6.1.6.1-1: Nbsp_GBA specific Data Types

Data type	Clause defined	Description
BootstrappingInfoRequest	6.1.6.2.2	Request body of the HTTP POST operation for resource "/bootstrapping-info-request".
BootstrappingInfoResponse	6.1.6.2.3	Response body of the HTTP POST operation for resource "/bootstrapping-info-request".
PushInfoRequest	6.1.6.2.4	Request body of the HTTP POST operation for resource "/push-info-request".
PushInfoResponse	6.1.6.2.5	Response body of the HTTP POST operation for resource "/push-info-request".
NafId	6.1.6.2.6	NAF ID, containing the NAF FQDN and the Ua Security Protocol Identifier.
UssListItem	6.1.6.2.7	Data item in a User Security Settings array list.
Uss	6.1.6.2.8	User Security Settings for a given GAA Service.
UeIdsItem	6.1.6.2.9	Data item in a UE ID array list.
FlagsItem	6.1.6.2.10	Data item in a Flags array list.
GsId	6.1.6.3.2	GAA Service Identifier.
GsType	6.1.6.3.2	GAA Service Type.
BtId	6.1.6.3.2	Bootstrapping Transaction Identifier.
MeKeyMaterial	6.1.6.3.2	ME Key Material (hex-encoded string).
UiccKeyMaterial	6.1.6.3.2	UICC key material (hex-encoded string).
UeId	6.1.6.3.2	Public Identity of the UE.
Impi	6.1.6.3.2	IMS Private Identity of the UE
Flag	6.1.6.3.2	GAA authorization flags, as defined in 3GPP TS 29.109 [17], Annex C.
GbaPushInfo	6.1.6.3.2	GBA Push Info (hex-encoded string).
NafGroup	6.1.6.3.2	NAF Group (string).
PtId	6.1.6.3.2	P-TID.
UiccAppLabel	6.1.6.3.2	UICC Application Label (string).
Auts	6.1.6.3.2	AUTS in UMTS AKA.
Rand	6.1.6.3.2	RAND in UMTS AKA.
KeyChoice	6.1.6.3.3	Type of key (ME-based or UICC-based) that the NAF shall use.
UiccOrMe	6.1.6.3.4	Indicates whether GBA_ME or GBA_U is to be used for GBA push.
SecFeature	6.1.6.3.5	Security features supported by the BSF or the NAF.
GbaType	6.1.6.3.6	Authentication type used by the UE for GBA.
UeIdType	6.1.6.3.7	Type of UE Identity (public or private).

Table 6.1.6.1-2 specifies data types re-used by the Nbsp_GBA 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 Nbsp_GBA service-based interface.

Table 6.1.6.1-2: Nbsp_GBA re-used Data Types

Data type	Reference	Comments
Uint32	3GPP TS 29.571 [18]	Unsigned 32-bit integer.
DateTime	3GPP TS 29.571 [18]	String with a "date-time" format, as defined by OpenAPI [6].
ProblemDetails	3GPP TS 29.571 [18]	Response body of error response messages.
RedirectResponse	3GPP TS 29.571 [18]	Response body of a redirect response message.
Fqdn	3GPP TS 29.510 [10]	Fully Qualified Domain Name

6.1.6.2 Structured data types

6.1.6.2.1 Introduction

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

6.1.6.2.2 Type: BootstrappingInfoRequest

Table 6.1.6.2.2-1: Definition of type BootstrappingInfoRequest

Attribute name	Data type	P	Cardinality	Description
btId	BtId	M	1	Bootstrapping Transaction Identifier
nafId	NafId	M	1	NAF Identifier
gbaUAware	boolean	O	0..1	GBA-U Awareness Indicator. true: The sending node is GBA_U aware false (default) or absent: The sending node is not GBA_U aware.
gsIds	array(GsId)	O	1..N	GBA Service Identifiers

6.1.6.2.3 Type: BootstrappingInfoResponse

Table 6.1.6.2.3-1: Definition of type BootstrappingInfoResponse

Attribute name	Data type	P	Cardinality	Description
meKeyMaterial	MeKeyMaterial	M	1	ME key material (Ks_NAF or Ks_Ext_NAF)
uiccKeyMaterial	UiccKeyMaterial	O	0..1	UICC key material (Ks_Int_NAF)
keyExpiryTime	DateTime	O	0..1	Key expiry time
bootstrappingInfoCreationTime	DateTime	O	0..1	Bootstrapping Info Creation Time
ussList	array(UssListItem)	O	1..N	GBA User Security Settings per GBA Service Identifier
gbaType	GbaType	O	0..1	Authentication type that was used by the UE during the bootstrapping procedure.
impi	Impi	O	0..1	UE Private Identity

6.1.6.2.4 Type: PushInfoRequest

Table 6.1.6.2.4-1: Definition of type PushInfoRequest

Attribute name	Data type	P	Cardinality	Description
ueId	UeId	M	1	User Identity.
ueIdType	UeIdType	M	1	Type of UE identity (public or private).
uiccAppLabel	UiccAppLabel	M	1	UICC Application Label.
nafId	NafId	M	1	NAF Identifier.
ptId	PtId	M	1	P-TID (NAF SA Identifier).
uiccOrMe	UiccOrMe	M	1	Indicates whether GBA_ME or GBA_U is to be used for GBA push.
requestedLifeTime	DateTime	M	1	Requested key lifetime for the NAF keys.
privateIdRequest	boolean	O	0..1	Indicates to the BSF whether the UE private identity shall be returned to the NAF in the response message. true: the private identity is requested by the NAF, and it shall be returned by the BSF. false (default) or absent: the private identity is not requested by the NAF.
gbaUAware	boolean	O	0..1	GBA-U Awareness Indicator.
gsIds	array(GsId)	O	1..N	GBA Service Identifiers.
auts	Auts	O	0..1	AUTS in UMTS AKA.
rand	Rand	O	0..1	RAND in UMTS AKA.
securityFeaturesRequest	array(SecFeature)	O	1..N	Security Features supported by the NAF.

6.1.6.2.5 Type: PushInfoResponse

Table 6.1.6.2.5-1: Definition of type PushInfoResponse

Attribute name	Data type	P	Cardinality	Description
meKeyMaterial	MeKeyMaterial	M	1	ME key material (Ks_NAF or Ks_Ext_NAF).
gbaPushInfo	GbaPushInfo	M	1	GBA Push Info
uiccKeyMaterial	UiccKeyMaterial	O	0..1	UICC key material (Ks_Int_NAF).
keyExpiryTime	DateTime	O	0..1	Key expiry time.
bootstrappingInfoCreationTime	DateTime	O	0..1	Bootstrapping Info Creation Time.
ussList	array(UssListItem)	O	1..N	GBA User Security Settings per GBA Service Identifier
gbaType	GbaType	O	0..1	GBA Type.
impi	Impi	O	0..1	UE Private Identity.
securityFeaturesResponse	array(SecFeature)	O	0..N	If the BSF does not support the usage of securityFeatures or the NAF did not include any securityFeaturesRequest attribute in the PushInfoRequest message, this IE shall be absent. If securityFeatures element is not defined in the GUSS of the UE, or there is no common securityFeature between NAF and BSF, the BSF shall include an empty array in the securityFeaturesResponse attribute.

6.1.6.2.6 Type: NafId

Table 6.1.6.2.6-1: Definition of type NafId

Attribute name	Data type	P	Cardinality	Description
nafFqdn	Fqdn	M	1	FQDN of the NAF.
uaSecProtId	string	M	1	Ua Security Protocol Identifier. It shall contain 5 octets, as described in 3GPP TS 33.220 [14], encoded as a sequence of 10 hexadecimal characters. pattern: "^[A-Fa-f0-9]{10}$"

6.1.6.2.7 Type: UssListItem

Table 6.1.6.2.7-1: Definition of type UssListItem

Attribute name	Data type	P	Cardinality	Description
uss	Uss	M	1	User Security Settings.

6.1.6.2.8 Type: Uss

Table 6.1.6.2.8-1: Definition of type Uss

Attribute name	Data type	P	Cardinality	Description
gsId	GsId	M	1	GAA Service ID.
gsType	GsType	M	1	GAA Service Type.
ueIds	array(UeIdsItem)	M	1..N	List of UE Identities
nafGroup	NafGroup	O	0..1	NAF Group.
flags	array(FlagsItem)	O	1..N	List of security flags supported for the current GAA service.
keyChoice	KeyChoice	O	0..1	Type of key that the NAF shall use.

6.1.6.2.9 Type: UeIdsItem

Table 6.1.6.2.9-1: Definition of type UeIdsItem

Attribute name	Data type	P	Cardinality	Description
ueId	UeId	M	1	Identity of the UE

6.1.6.2.10 Type: FlagsItem

Table 6.1.6.2.10-1: Definition of type FlagsItem

Attribute name	Data type	P	Cardinality	Description
flag	Flag	M	1	Security flag supported for the corresponding GAA Service.

6.1.6.3 Simple data types and enumerations

6.1.6.3.1 Introduction

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

6.1.6.3.2 Simple data types

The simple data types defined in table 6.1.6.3.2-1 shall be supported.

Table 6.1.6.3.2-1: Simple data types

Type Name	Type Definition	Description
GsId	Uint32	GAA Service Identifier. For 3GPP standardized values, see 3GPP TS 29.109 [17], Annex B.
GsType	Uint32	GAA Service Type. For 3GPP standardized values, see 3GPP TS 29.109 [17], Annex B.
BtId	string	Bootstrapping Transaction Identifier. It shall take the form of a NAI, where the realm part identifies the FQDN of the BSF. See 3GPP TS 33.220 [14].
MeKeyMaterial	string	ME key material, containing a 256-bit key, encoded as a sequence of 64 hexadecimal characters. pattern: "^[A-Fa-f0-9]{64}$"
UiccKeyMaterial	string	UICC key material, containing a 256-bit key, encoded as a sequence of 64 hexadecimal characters. pattern: "^[A-Fa-f0-9]{64}$"
UeId	string	Identity of the UE.
Impi	string	IMS Private Identity of the UE.
Flag	Uint32	GAA authorization flags, associated to the specific GAA Service Type, as defined in 3GPP TS 29.109 [17], Annex C.
GbaPushInfo	string	GBA Push Info binary data, as defined in 3GPP TS 33.223 [15], clause 5.3.5, encoded as a sequence of hexadecimal characters. pattern: "^([A-Fa-f0-9]{2})+$"
NafGroup	string	NAF Group.
PtId	string	P-TID.
UiccAppLabel	string	UICC Application Label.
Auts	string	AUTS in UMTS AKA, containing a 112-bit value, encoded as a sequence of 28 hexadecimal characters. pattern: "^[A-Fa-f0-9]{28}$"
Rand	string	RAND in UMTS AKA, containing a 128-bit value, encoded as a sequence of 32 hexadecimal characters. pattern: "^[A-Fa-f0-9]{32}$"

6.1.6.3.3 Enumeration: KeyChoice

The enumeration KeyChoice represents the type of key that the NAF shall use. It shall comply with the provisions defined in table 6.1.6.3.3-1.

Table 6.1.6.3.3-1: Enumeration KeyChoice

Enumeration value	Description
"ME_BASED_KEY"	Ks_ NAF or Ks_ext_NAF shall be used by the NAF.
"UICC_BASED_KEY"	Ks_int_NAF shall be used by the NAF.
"ME_UICC_BASED_KEYS"	Ks_ext_NAF or Ks_int_NAF can be used by the NAF.

6.1.6.3.4 Enumeration: UiccOrMe

The enumeration UiccOrMe represents whether GBA_ME or GBA_U is to be used for GBA push. It shall comply with the provisions defined in table 6.1.6.3.4-1.

Table 6.1.6.3.4-1: Enumeration UiccOrMe

Enumeration value	Description
"GBA_ME"	GBA_ME shall be used.
"GBA_U"	GBA_U shall be used.

6.1.6.3.5 Enumeration: SecFeature

The enumeration SecFeature represents security features supported by the BSF or the NAF. It shall comply with the provisions defined in table 6.1.6.3.5-1.

Table 6.1.6.3.5-1: Enumeration SecFeature

Enumeration value	Description
"GPL_U"	The UICC supports Generic Push Layer, as specified in 3GPP TS 33.224 [16].

6.1.6.3.6 Enumeration: GbaType

The enumeration GbaType represents the authentication type that was used during bootstrapping procedure. It shall comply with the provisions defined in table 6.1.6.3.6-1.

Table 6.1.6.3.6-1: Enumeration GbaType

Enumeration value	Description
"3G_GBA"	The 3G GBA has been performed as defined in 3GPP TS 33.220 [14].
"2G_GBA"	The 2G GBA has been performed as defined in 3GPP TS 33.220 [14], Annex I.
"GBA_DIGEST"	The GBA Digest has been performed as defined in 3GPP TS 33.220 [14], Annex M.

6.1.6.3.7 Enumeration: UeIdType

The enumeration UeIdType represents the type of the identity of the user. It shall comply with the provisions defined in table 6.1.6.3.7-1.

Table 6.1.6.3.7-1: Enumeration UeIdType

Enumeration value	Description
"PUBLIC"	Public user identity.
"PRIVATE"	Private user identity.

6.1.7 Error Handling

6.1.7.1 General

For the Nbsp_GBA 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 Nbsp_GBA API.

6.1.7.2 Protocol Errors

No specific procedures for the Nbsp_GBA service are specified.

6.1.7.3 Application Errors

The application errors defined for the Nbsp_GBA service are listed in Table 6.1.7.3-1.

Table 6.1.7.3-1: Application errors

Application Error	HTTP status code	Description

6.1.8 Feature negotiation

The optional features in table 6.1.8-1 are defined for the Nbsp_GBA API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 6.1.8-1: Supported Features

Feature number	Feature Name	Description

6.1.9 Security

As indicated in 3GPP TS 33.501 [8] and 3GPP TS 29.500 [4], the access to the Nbsp_GBA 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 Nbsp_GBA 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 Nbsp_GBA service.

The Nbsp_GBA API defines a single scope "nbsp-gba" 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 that uses the GitLab software version control system (see 3GPP TS 29.501 [5] clause 5.3.1 and 3GPP TR 21.900 [7] clause 5B).

A.2 Nbsp_GBA API

```
openapi: 3.0.0

info:
  version: '1.0.0-alpha.3'
  title: 'GBA BSF Nbsp_GBA Service'
  description: |
    GBA BSF Nbsp_GBA Service.
    © 2022, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: 3GPP TS 29.309 V17.0.0; 5G System; Bootstrapping Server Function (GBA BSF) Services;
Stage 3
  url: 'https://www.3gpp.org/ftp/Specs/archive/29_series/29.309/'

servers:
  - url: '{apiRoot}/nbsp-gba/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501

security:
  - {}
  - oAuth2ClientCredentials:
      - nbsp-gba

paths:
  /bootstrapping-info-retrieval:
    post:
      summary: Retrieve Bootstrapping Info from GBA BSF from NAF
      operationId: BootstrappingInfoRetrieval
      tags:
        - Bootstrapping Info Retrieval (Custom Operation)
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/BootstrappingInfoRequest'
        required: true
      responses:
        '200':
          description: Expected response to a valid request
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/BootstrappingInfoResponse'
        '307':
```

```
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '501':
          $ref: 'TS29571_CommonData.yaml#/components/responses/501'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'

  /push-info-retrieval:
    post:
      summary: Retrieve Push Info from GBA BSF from Push-NAF
      operationId: PushInfoRetrieval
      tags:
        - Push Info Retrieval (Custom Operation)
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/PushInfoRequest'
        required: true
      responses:
        '200':
          description: Expected response to a valid request
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/PushInfoResponse'
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '501':
          $ref: 'TS29571_CommonData.yaml#/components/responses/501'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'

components:
```

```
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            nbsp-gba: Access to the Nbsp_GBA API

  schemas:

#
# COMPLEX TYPES
#

    BootstrappingInfoRequest:
      description: Request body of the HTTP POST operation for resource /bootstrapping-info-request
      type: object
      required:
        - btId
        - nafId
      properties:
        btId:
          $ref: '#/components/schemas/BtId'
        nafId:
          $ref: '#/components/schemas/NafId'
        gbaUAware:
          type: boolean
          default: false
        gsIds:
          type: array
          items:
            $ref: '#/components/schemas/GsId'
          minItems: 1

    BootstrappingInfoResponse:
      description: Response body of the HTTP POST operation for resource /bootstrapping-info-request
      type: object
      required:
        - meKeyMaterial
      properties:
        meKeyMaterial:
          $ref: '#/components/schemas/MeKeyMaterial'
        uiccKeyMaterial:
          $ref: '#/components/schemas/UiccKeyMaterial'
        keyExpiryTime:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        bootstrappingInfoCreationTime:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        ussList:
          type: array
          items:
            $ref: '#/components/schemas/UssListItem'
          minItems: 1
        gbaType:
          $ref: '#/components/schemas/GbaType'
        impi:
          $ref: '#/components/schemas/Impi'

    PushInfoRequest:
      description: Request body of the HTTP POST operation for resource /push-info-request
      type: object
      required:
        - ueId
        - ueIdType
        - uiccAppLabel
        - nafId
        - ptId
        - uiccOrMe
        - requestedLifeTime
      properties:
        ueId:
          $ref: '#/components/schemas/UeId'
        ueIdType:
          $ref: '#/components/schemas/UeIdType'
        uiccAppLabel:
          $ref: '#/components/schemas/UiccAppLabel'
        nafId:
```

```
        $ref: '#/components/schemas/NafId'
      ptId:
        $ref: '#/components/schemas/PtId'
      uiccOrMe:
        $ref: '#/components/schemas/UiccOrMe'
      requestedLifeTime:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      privateIdRequest:
        type: boolean
      gbaUAware:
        type: boolean
      gsIds:
        type: array
        items:
          $ref: '#/components/schemas/GsId'
        minItems: 1
      auts:
        $ref: '#/components/schemas/Auts'
      rand:
        $ref: '#/components/schemas/Rand'
      securityFeaturesRequest:
        type: array
        items:
          $ref: '#/components/schemas/SecFeature'
        minItems: 1

  PushInfoResponse:
    description: Response body of the HTTP POST operation for resource /push-info-request
    type: object
    required:
      - meKeyMaterial
      - gbaPushInfo
    properties:
      meKeyMaterial:
        $ref: '#/components/schemas/MeKeyMaterial'
      gbaPushInfo:
        $ref: '#/components/schemas/GbaPushInfo'
      uiccKeyMaterial:
        $ref: '#/components/schemas/UiccKeyMaterial'
      keyExpiryTime:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      bootstrappingInfoCreationTime:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      ussList:
        type: array
        items:
          $ref: '#/components/schemas/UssListItem'
        minItems: 1
      gbaType:
        $ref: '#/components/schemas/GbaType'
      impi:
        $ref: '#/components/schemas/Impi'
      securityFeaturesResponse:
        type: array
        items:
          $ref: '#/components/schemas/SecFeature'

  NafId:
    description: NAF ID, containing the NAF FQDN and the Ua Security Protocol Identifier
    type: object
    required:
      - nafFqdn
      - uaSecProtId
    properties:
      nafFqdn:
        $ref: 'TS29510_Nnrf_NFManagement.yaml#/components/schemas/Fqdn'
      uaSecProtId:
        type: string
        pattern: '^[A-Fa-f0-9]{10}$'

  UssListItem:
    description: Data item in a User Security Settings array list
    type: object
    required:
      - uss
    properties:
      uss:
        $ref: '#/components/schemas/Uss'
```

```
    Uss:
      description: User Security Settings for a given GAA Service
      type: object
      required:
        - gsId
        - gsType
        - ueIds
      properties:
        gsId:
          $ref: '#/components/schemas/GsId'
        gsType:
          $ref: '#/components/schemas/GsType'
        ueIds:
          type: array
          items:
            $ref: '#/components/schemas/UeIdsItem'
          minItems: 1
        nafGroup:
          $ref: '#/components/schemas/NafGroup'
        flags:
          type: array
          items:
            $ref: '#/components/schemas/FlagsItem'
          minItems: 1
        keyChoice:
          $ref: '#/components/schemas/KeyChoice'

    UeIdsItem:
      description: Data item in a UE ID array list
      type: object
      required:
        - ueId
      properties:
        ueId:
          $ref: '#/components/schemas/UeId'

    FlagsItem:
      description: Data item in a Flags array list
      type: object
      required:
        - flag
      properties:
        flag:
          $ref: '#/components/schemas/Flag'

#
# SIMPLE TYPES
#

    GsId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uint32'

    GsType:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uint32'

    BtId:
      description: Bootstrapping Transaction Identifier
      type: string

    MeKeyMaterial:
      description: ME Key Material (hex-encoded string)
      type: string
      pattern: '^[A-Fa-f0-9]{64}$'

    UiccKeyMaterial:
      description: UICC key material (hex-encoded string)
      type: string
      pattern: '^[A-Fa-f0-9]{64}$'

    UeId:
      description: Public Identity of the UE
      type: string

    Impi:
      description: IMS Private Identity of the UE
      type: string
```

```
    Flag:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uint32'

    GbaPushInfo:
      description: GBA Push Info (hex-encoded string)
      type: string
      pattern: '^([A-Fa-f0-9]{2})+$'

    NafGroup:
      description: Character string representing a NAF Group
      type: string

    PtId:
      description: Character string representing a P-TID
      type: string

    UiccAppLabel:
      description: Character string representing an UICC Application Label
      type: string

    Auts:
      description: AUTS value in UMTS AKA
      type: string
      pattern: '^[A-Fa-f0-9]{28}$'

    Rand:
      description: RAND in UMTS AKA
      type: string
      pattern: '^[A-Fa-f0-9]{32}$'

#
# ENUMS
#

    KeyChoice:
      description: Type of key (ME-based or UICC-based) that the NAF shall use
      anyOf:
        - type: string
          enum:
            - ME_BASED_KEY
            - UICC_BASED_KEY
            - ME_UICC_BASED_KEYS
        - type: string

    UiccOrMe:
      description: Indicates whether GBA_ME or GBA_U is to be used for GBA push
      anyOf:
        - type: string
          enum:
            - GBA_ME
            - GBA_U
        - type: string

    SecFeature:
      description: Security features supported by the BSF or the NAF
      anyOf:
        - type: string
          enum:
            - GPL_U
        - type: string

    GbaType:
      description: Authentication type used by the UE for GBA
      anyOf:
        - type: string
          enum:
            - 3G_GBA
            - 2G_GBA
            - GBA_DIGEST
        - type: string

    UeIdType:
      description: Type of UE Identity (public or private)
      anyOf:
        - type: string
          enum:
            - PUBLIC
            - PRIVATE
```

```
        - type: string
```

Annex B (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2021-02	CT4#102	C4-211396				TS template agreed	0.0.0
2021-04	CT4#103	C4-212594				Incorporation of agreed pCRs from CT4#103: C4-212527, C4-212528, C4-212529	0.1.0
2021-05	CT4#104	C4-213524				Incorporation of agreed pCRs from CT4#104: C4-213293, C4-213316	0.2.0
2021-09	CT4#105	C4-214751				Incorporation of agreed pCRs from CT4#105: C4-214340, C4-214341	0.3.0
2021-10	CT4#106	C4-215515				Incorporation of agreed pCRs from CT4#106: C4-215330	0.4.0
2021-12	CT#94	CP-213154				V1.0.0. presented for information	1.0.0
2022-03	CT4#108	C4-221637				Incorporation of agreed pCRs from CT4#108: C4-221174, C4-221355	1.1.0
2022-03	CT#95e	CP-220101				TS presented for information	2.0.0
2022-03	CT#95e					TS approved	17.0.0

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