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Technical Specification

**Digital cellular telecommunications system (Phase 2+);
Universal Mobile Telecommunications System (UMTS);
Generic Authentication Architecture (GAA);
Zh and Zn Interfaces based on the Diameter protocol;
Stage 3
(3GPP TS 29.109 version 6.7.0 Release 6)**



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Foreword

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1 Scope

The present stage 3 specification defines the Diameter based implementation for bootstrapping Zh interface (BSF-HSS) and Dz interface (BSF-SLF) for HSS resolution for the BSF, and GAA Application Zn interface (BSF-NAF) in Generic Authentication Architecture (GAA). The definition contains procedures, message contents and coding. The procedures for bootstrapping and usage of bootstrapped security association are defined in 3GPP TS 33.220 [5].

This specification is a part of the Generic Authentication Architecture (GAA) specification series.

The diameter based implementation is based on re-usage of Cx interface Multimedia-Auth-Request/Answer messages originally between CSCF and HSS. These messages are defined in 3GPP TS 29.229 [3]. The 3GPP IMS mobility management uses the same definitions between CSCF and HSS. The present document defines how the defined messages are used with the bootstrapping and GAA application procedures (e.g. subscriber certificates) and the application logic that is needed in GAA network elements (BSF, HSS, and NAF).

Figure 1.1 depicts the relationships of these specifications to the other specifications.

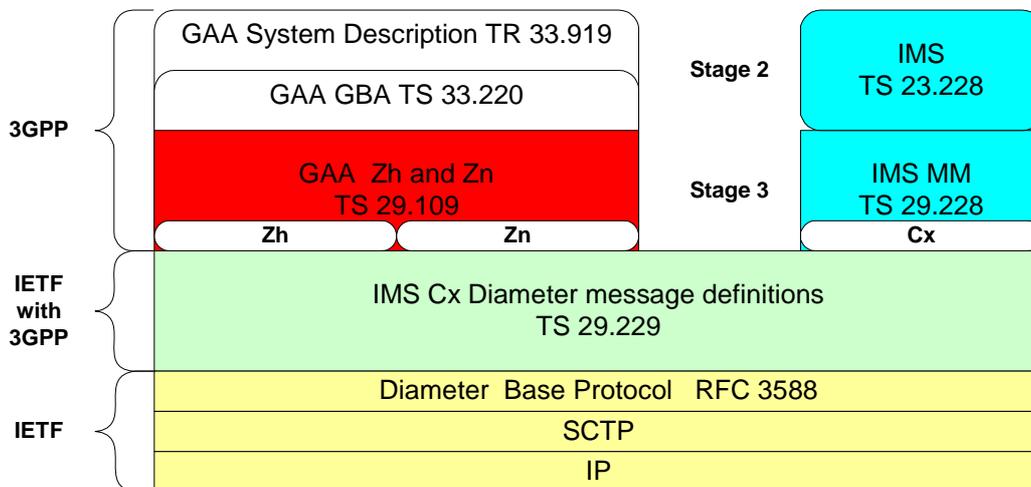
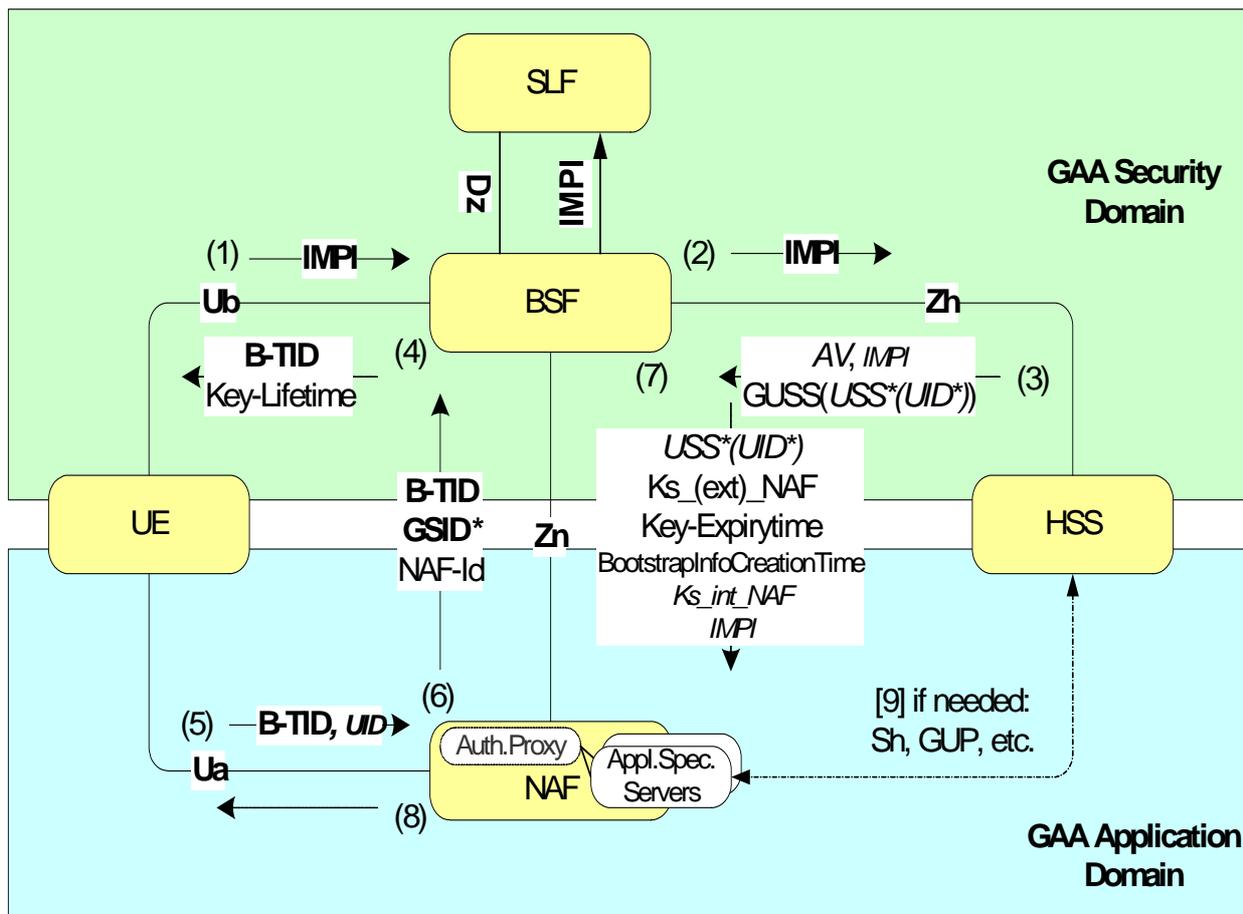


Figure 1.1: Relationships to other specifications

Figure 1.2 provides an informal overall quick introduction to the whole signalling procedures in GAA system. The important identifiers are marked bold and optional data items are italicised. The Ub and Ua interfaces, not defined in this TS , are simplified.



IMPI Important Identity. *IMPI* optional items. *Ub* and *Ua* interfaces are simplified.

Figure 1.2: The whole signalling procedure in GAA system

2 References

The following documents contain provisions that, 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] IETF RFC 3588, "Diameter Base Protocol".
- [2] 3GPP TS 29.228: "IP Multimedia (IM) Subsystem Cx and Dx Interfaces; Signalling flows and message contents".
- [3] 3GPP TS 29.229: "Cx and Dx interfaces based on the Diameter protocol".
- [4] 3GPP TR 33.919 "Generic Authentication Architecture (GAA); System Description (rel-6) ".
- [5] 3GPP TS 33.220 "Generic Authentication Architecture (GAA); Generic Bootstrapping Architecture (rel-6) ".
- [6] 3GPP TS 33.221 "Generic Authentication Architecture (GAA); Support for Subscriber Certificates (rel-6) ".
- [7] 3GPP TS 24.109: "Bootstrapping interface (U_b) and Network application function interface (U_a);Protocol details".
- [8] 3GPP TS 29.230: "Diameter applications; 3GPP specific codes and identifiers (rel-6) "
- [9] IETF RFC 3589: "Diameter Command Codes for Third Generation Partnership Project (3GPP) Release 5".
- [10] 3GPP TS 23.008: "Organisation of subscriber data"
- [11] 3GPP TS 33.222: "Generic Authentication Architecture (GAA); Access to network application functions using secure hypertext transfer protocol (HTTPS) (rel-6) ".
- [12] 3GPP TS 23.228: "IP Multimedia Subsystem (IMS); Stage 2"

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TS 23.008 [10], 3GPP TR 33.919 [4], 3GPP TS 33.220 [5] apply with following additions.

Bootstrapping information (Bootstrapped data) in a BSF consists of a bootstrapping transaction identifier (B-TID), a key material (Ks), the key lifetime (expiry time), the bootstrapinfo creation time, the IMPI and the GUSS (if received from HSS) with BSF control information. Each bootstrapping procedure creates a bootstrapped data entity with B-TID as retrieval key..

GAA application is an application that uses the security association created by GBA Bootstrapping procedure.

GAA service is an operator specific end user service that uses the security association created by GAA Bootstrapping procedure. GAA services are identified by **GAA Service Identifiers**. A GAA service is implemented using some standardised or proprietary GAA application defined by GAA application type.

NAF specific Bootstrapping information transferred from a BSF to a NAF contains NAF and its service specific parts from bootstrapped data and needed key information derived from the bootstrapped data.

Service/Application. The term service is used here in its common meaning. A service is something that a MNO offers to subscribers. GAA Services are identified by GAA Service Identifier (GSID). In stage 2 documents ([4], [5], [6] and [11]) the term application is used in the same meaning i.e. MNOs offer applications to subscribers. There is a reason to avoid the usage of the term application here. The application is an already reserved term in Diameter. In Diameter applications are identified by Application Identifiers.

3.2 Symbols

For the purposes of the present document, the terms and definitions given in 3GPP TS 23.008 [10].

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AK	Anonymity Key
AKA	Authentication and Key Agreement
AUTN	Authentication token
AV	Authentication Vector. 3GPP AV=[RAND,AUTN,XRES,CK,IK].
AVP	Attribute-Value-Pair in Diameter messages.
BIA	BootstrappingInfo-Answer message
BIR	BootstrappingInfo-Request message
BS	BootStrapping Procedure
BSF	Bootstrapping server functionality BSF is hosted in a network element under the control of an MNO.
B-TID	Bootstrapping Transaction Identifier
CA	Certificate Authority
CK	Confidential Key
FQDN	Full Qualified Domain Name in URI (e.g. http://FQDN:80)
GAA	Generic Authentication Architecture
GBA	Generic Bootstrapping Architecture
GSID	GAA Service Identifier
GUSS	GBA User Security Settings
HSS	Home Subscriber System
IK	Integrity Key
IMPI	IP Multimedia Private Identity
IMPU	IP Multimedia Public Identity
Ks	Key Material
Ks_ext_NAF	MEbased key for a specific NAF
MNO	Mobile network operator
NAF	Operator-controlled network application function functionality. NAF is hosted in a network element under the control of an MNO.
RAND	Random challenge in authentication
REQ	In Diameter header indicates that the message is a Request.
SCTP	Stream Control Transmission Protocol
SLF	Subscription Location Function
SSC	Subscriber Certificate Procedure
Ua	UE-NAF interface for GAA applications
Ub	UE-BSF interface for bootstrapping
UE	User Equipment
Ks_int_NAF	UICC based key for a specific NAF
USS	User Security Settings (a part of GUSS)
XRES	Expected response in authentication
Zh	BSF-HSS interface for bootstrapping procedure
Zn	BSF-NAF interface for GAA applications.

4 GBA Bootstrapping Zh interface

4.1 Generic bootstrapping network architecture

The network architecture of the Bootstrapping procedure is presented in Figure 4.1. The interface Ub (bootstrapping) is defined in 3GPP TS 24.109 [7] and the interface Zh in this specification.



Figure 4.1: Network architecture of bootstrapping procedure

The protocol stack of the Zh interface in Bootstrapping procedure is presented in Figure 4.2. The Diameter Base protocol is defined in [1] and the Diameter application in 3GPP TS 29.229 [3]. The requirements for Zh interface are defined in 3GPP TS 33.220 [5].

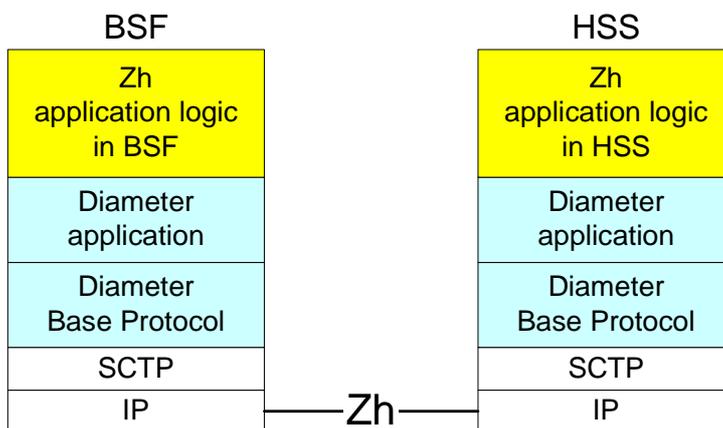


Figure 4.2: Protocol stack of Zh interface

4.2 Protocol Zh between BSF and HSS

The requirements for Zh interface are defined in 3GPP TS 33.220 [5].

The Bootstrapping Zh interface performs the retrieval of an authentication vector and possibly GBA User Security Settings from the HSS. The overall Bootstrapping procedure is depicted in Figure 4.3. The basic procedure is:

A) A UE starts the bootstrapping procedure by protocol Ub with a BSF giving the IMPI of the user (see 3GPP TS 24.109 [7]).

B) The BSF starts protocol Zh with user's HSS

- The BSF requests user's authentication vector and GBA User Security Settings(GUSS) corresponding to the IMPI.
- The HSS supplies to the BSF the requested authentication vector and GUSS (if any).

NOTE: If there is more than one HSS deployed within the network, the BSF may have to contact the SLF using the Dz interface prior to sending the request for information to the HSS (see section 6.4).

C) The BSF continues the protocol Ub with the UE (see 3GPP TS 24.109 [7]).

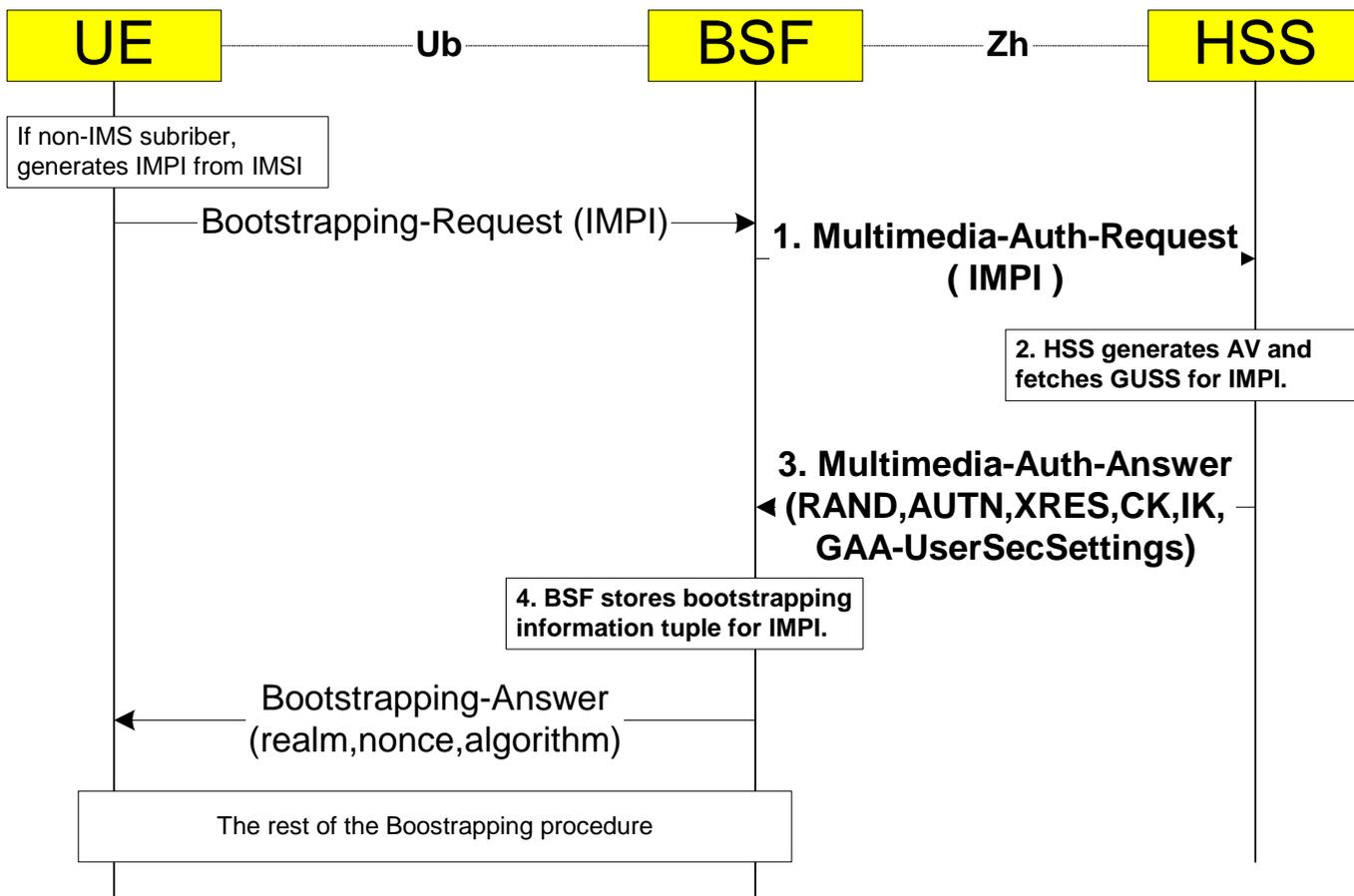


Figure 4.3: The GBA bootstrapping procedure

The steps of the bootstrapping procedure in Figure 4.3 are:

Step 1

The BSF shall send the following Bootstrapping-Request to the HSS in the format of Multimedia-Auth-Request (MAR) message. The content of the message is given below in the same format as in 3GPP TS 29.229 [3]. The curly brackets indicate mandatory AVPs. The square brackets indicate optional AVPs. The 'address of' refers to the Fully Qualified Host Name (FQDN).

```

<Multimedia-Auth-Request> ::= <Diameter Header: 303, REQ, PXY, 16777221 >
    < Session-Id >
    { Vendor-Specific-Application-Id }
    { Auth-Session-State } ; NO_STATE_MAINTAINED
    { Origin-Host } ; Address of BSF
    { Origin-Realm } ; Realm of BSF
    { Destination-Realm } ; Realm of HSS
    [ Destination-Host ] ; Address of the HSS
    { User-Name } ; IMPI from UE
    * [ AVP ]
    * [ Proxy-Info ]
    * [ Route-Record ]
    
```

The content of mandatory Vendor-Specific-Application-ID according [1] is:

```

<Vendor-Specific-Application-Id> ::= <AVP header: 260>
    1* [Vendor-Id] ; 3GPP is 10415
    0*1 {Auth-Application-Id} ; 16777221
    0*1 {Acct-Application-Id} ; Omitted
    
```

When determining the value of Destination-Host AVP the BSF can use redirector function (SLF) to resolve the address of the HSS if needed (see 3GPP TS 29.229 [3]). The BSF shall set the Auth-Session-State AVP to NO_STATE_MAINTAINED to inform that the HSS does not need to maintain any status information for this session according 3GPP TS 29.229 [3]. The User-name is the IMS Private User Identity (IMPI) as required in 3GPP TS 29.228 [2].

Step 2

When the HSS receives the MAR message, the HSS shall derive the user Authentication Vector (AV) information according the IMPI and populates it into SIP-Auth-Data AVP as defined in 3GPP TS 29.229 [3]. If GUSS exists for the IMPI, the HSS shall also fetch the GUSS into the GBA-UserSecSettings AVP.

The MAR/MAA sequence in the Zh interface must not change possible status information of the possible simultaneously ongoing IMS MM application sessions in the HSS.

If the User-Name (IMPI) from the BSF is totally unknown to the HSS, the error situation 5401 is raised.

Step 3

The HSS shall send the following Bootstrapping-Answer message in the format of Multimedia-Auth-Answer (MAA) message back to the BSF.

```
< Multimedia-Auth-Answer > ::= < Diameter Header: 303, PXY, 16777221 >
    < Session-Id >
    { Vendor-Specific-Application-Id }
    [ Result-Code ]
    [ Experimental-Result ]
    { Auth-Session-State }           ; NO_STATE_MAINTAINED
    { Origin-Host }                 ; Address of HSS
    { Origin-Realm }                ; Realm of HSS
    [ User-Name ]                   ; IMPI
    * [ SIP-Auth-Data-Item ]
    [ GBA-UserSecSettings ]         ; GUSS
    * [ AVP ]
    * [ Proxy-Info ]
    * [ Route-Record ]
```

The HSS shall set the mandatory Auth-Session-State AVP to NO_STATE_MAINTAINED because the HSS does not maintain any state information about this session and the BSF does not need to send any session termination request 3GPP TS 29.229 [3]. The User-name AVP (IMPI) may be sent back for checking. The required authentication vectors are sent in the SIP-Auth-Data-Items AVP. The security settings of user's all GAA applications are sent in GBA-UserSecSettings AVP.

Step 4.

When the BSF receives the MAA message, the BSF shall check the value of the SIP-Authentication-Scheme AVP. If the BSF does not support the authentication-scheme the BSF shall stop processing the message and should indicate an error via the O&M subsystem.

The BSF generates the needed key material (Ks) from confidential key (CK) and integrity key (IK) as described in 3GPP TS 33.220 [5] and stores temporarily the tuple <IMPI,Ks,GBA-UserSecSettings> for further use in GAA applications. The rest of the bootstrapping procedure in Ub interface will later add also the Bootstrapping Transaction Identifier (B-TID) to that tuple as key and the key lifetime (expiry time).

5 GAA Application Zn interface

5.1 Applications" network architecture

The network architecture of the GAA applications procedure is presented in Figure 5.1. The 3GPP GAA applications are listed in annex B. Different GAA applications may implement the Ua interface in different way. The Zn interface is defined in this specification.

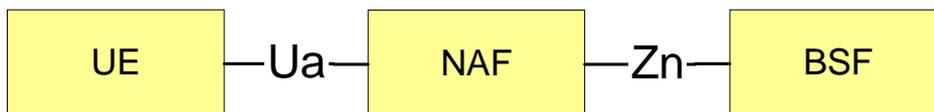


Figure 5.1: Network architecture of GAA application

The protocol stack of the Zn interface for GAA applications is presented in Figure 5.2. The diameter Base protocol is defined in [1] and the Diameter application in 3GPP TS 29.229 [3]. The requirements for Zn interface are defined in 3GPP TS 33.220 [5].

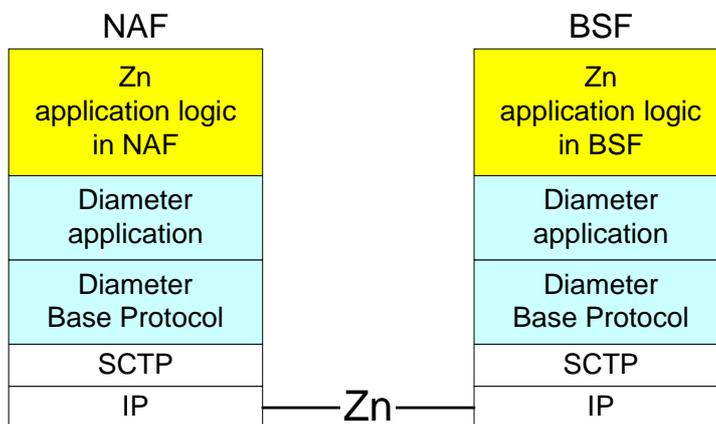


Figure 5.2: Protocol stack of Zn interface

5.2 Protocol Zn between NAF and BSF

The requirements for Zn interface are defined in 3GPP TS 33.220 [5].

The protocol Zn retrieves the key material and possibly user security settings data by NAF from BSF. After UE is authenticated with the BSF, every time the UE wants to interact with an NAF the following steps are executed as depicted in Figure 5.3. The basic procedure is:

A) The UE starts protocol Ua (see 3GPP TS 33.220 [5])

- In general, the UE and the NAF will not yet share the key(s) required to protect protocol Ua. If they already do, there is no need for the NAF to invoke protocol Zn.
- It is assumed that UE supplies sufficient information to NAF, i.e. the Bootstrapping Transaction Identifier (B-TID), to allow the NAF to retrieve specific key material (e.g. Ks_NAF in the case of GBA_ME, and Ks_ext_NAF or Ks_int_NAF or both in the case of GBA_U) from BSF.
- The UE derives the keys required to protect protocol Ua from the key material.

B) The NAF starts protocol Zn with BSF

- The NAF requests NAF specific key material corresponding to the information supplied by the UE to the NAF (i.e. the bootstrapping transaction identifier) in the start of protocol Ua.

- The BSF generates and supplies to the NAF the requested NAF specific key material, the expiry time, the bootstrapinfo creation time, and the appropriate User Security Settings defined for received application identifiers.

C) The NAF continues protocol Ua with the UE (see 3GPP TS 33.221 [6])

Once the run of protocol Ua is completed the purpose of bootstrapping is fulfilled as it enabled UE and NAF to run protocol Ua in a secure way.

The common GAA application procedure is presented in Figure 5.3.

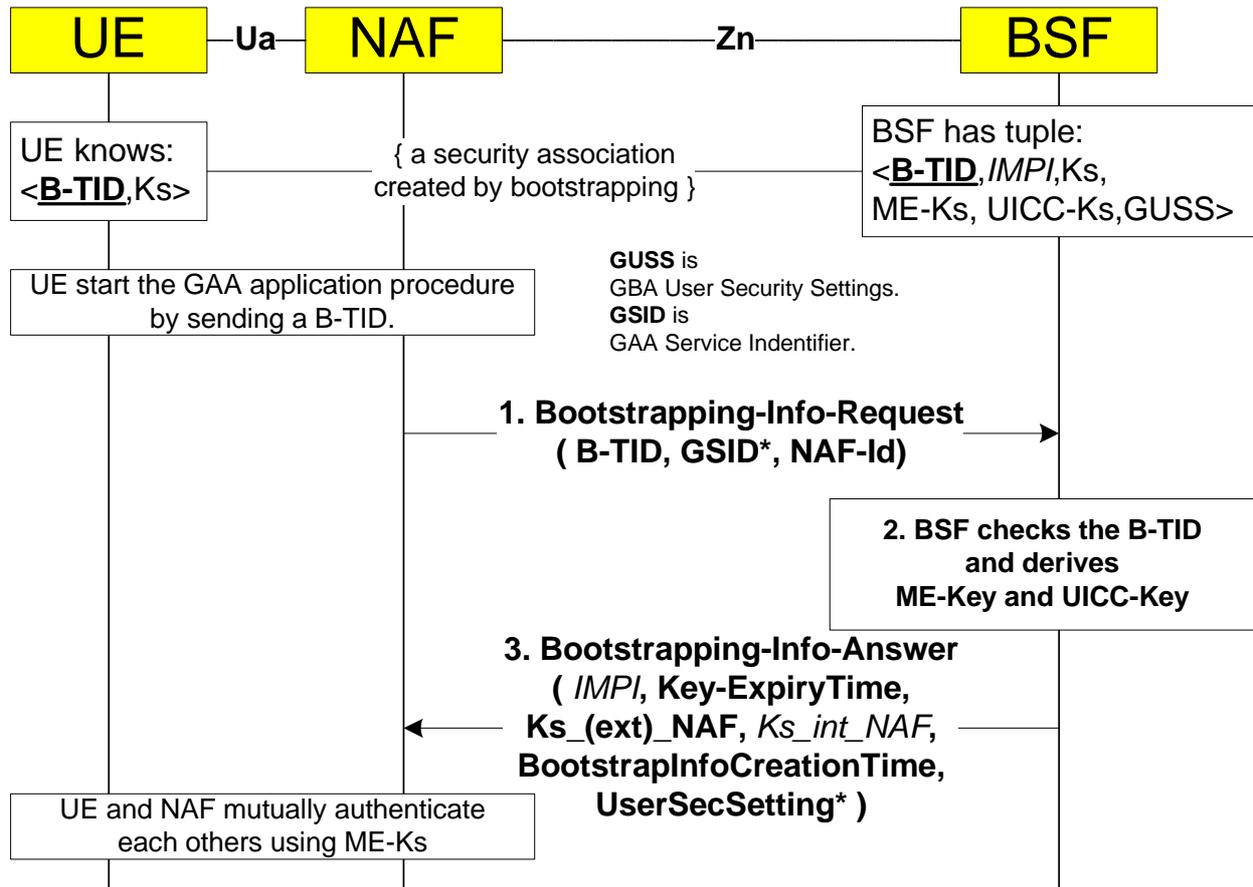


Figure 5.3: The GAA application procedure

The steps of the GAA application procedure in Figure 5.3 are:

Step 1

The NAF shall send a Bootstrapping-Info-Request message (BIR) to the BSF. The content of the message is given here in the same format as in 3GPP TS 29.229 [3]. The curly brackets indicate mandatory AVPs. The square brackets indicate optional AVP. The address refers to the Fully Qualified Host Name (FQDN).

```

< Bootstrapping-Info-Request > ::= < Diameter Header: 310, REQ, PXY, 16777220 >
  < Session-Id >
  { Vendor-Specific-Application-Id }
  { Origin-Host } ; Address of NAF
  { Origin-Realm } ; Realm of NAF
  { Destination-Realm } ; Realm of BSF
  [ Destination-Host ] ; Address of the BSF
  * [ GAA-Service-Identifier ] ; Service identifiers
  { Transaction-Identifier } ; B-TID
  { NAF-Id } ; NAF_ID
  [ GBA_U-Awareness-Indicator ] ; GBA_U awareness of the NAF
  * [ AVP ]
  * [ Proxy-Info ]
  * [ Route-Record ]

```

The content of Vendor-Specific-Application-ID according [1] is:

```

< Vendor-Specific-Application-Id > ::= < AVP header: 260 >
  1* [ Vendor-Id ] ; 3GPP is 10415
  0*1 { Auth-Application-Id } ; 16777220
  0*1 { Acct-Application-Id } ; Omitted

```

The Destination-Realm AVP is set to subscriber's BSF. The address of the BSF is extracted from the B-TID.

NOTE: In the case where the subscriber has contacted a NAF that is in a visited network, the NAF contacts the subscriber's home BSF through a Diameter-Proxy (D-Proxy) that is located in the same network as the NAF. The local BSF and the D-Proxy may be co-located. See 3GPP TS 33.220 [6].

The NAF indicates the GAA services for which the information is retrieved by GAA-Service-Identifier AVPs. The Bootstrapping Transaction Identifier defines the earlier bootstrapping procedure execution.

Step 2

In the successful case the BSF has a tuple <B-TID, IMPI, Ks, Key lifetime, Bootstrapinfo creation time, GBA-UserSecSettings> identified by Bootstrapping Transaction Identifier (B-TID). When the BSF receives the request it checks the existence and validity of the tuple for given B-TID. If checking fails the BSF sends an Answer message with Experimental-Result set to indicate the error type 5403. If the tuple for B-TID exists, but is expired, error type 5403 is also send to indicate needs for renewal of the bootstrapping procedure. In successful case the Result-Code is set to 2xxx as defined in [1].

The BSF derives the key material for the ME (i.e., Ks_NAF in the case of GBA_ME, and Ks_ext_NAF in the case of GBA_U) and possibly the key material for the UICC (i.e., Ks_int_NAF in the case of GBA_U) according to the B-TID and packs them into ME-Key-Material AVP and possible UICC-Key-Material AVP. The ME-Key-Material contains Ks_(ext)_NAF and the UICC-key-Material contains the Ks_int_NAF key. The BSF select correct user's Security Settings according the request's GAA-Service-Identifier AVP to GBA-UserSecSettings AVP. If NAF grouping is used by the operator and there are one or more USSs corresponding to the requested GSID, then also the nafGroup attribute of USS is checked. If the NAF has sent a GAA-Service-Identifier that does not have corresponding user's security settings, and the BSF is locally configured to reject those requests from the NAF, then the error 5402 is raised. If the NAF has sent a GAA-Service-Identifier that have corresponding user's security settings, but the BSF is locally configured to reject those from that NAF, then the error 5402 is raised too.

The NAF may be addressed from the UE with different FQDNs. The BSF shall check if this NAF-Id is allowed to be used for the NAF. If the NAF identified by its Origin-Host AVP is configured in the BSF not to be authorized to use the given NAF-Id, the BSF may raise the error situation 5402. The BSF may also be configured so that a certain NAF is not authorized to use a certain GAA-Service-Identifier. This situation may be also indicated by error code 5402.

Step 3

After that the BSF shall send a Bootstrapping-Info-Answer message (BIA) back to the NAF.

```

< Bootstrapping-Info-Answer> ::= < Diameter Header: 310, PXY, 16777220 >
  < Session-Id >
  { Vendor-Specific-Application-Id }
  [ Result-Code ]
  [ Experimental-Result]
  { Origin-Host } ; Address of BSF
  { Origin-Realm } ; Realm of BSF
  [ User-Name ] ; IMPI
  [ ME-Key-Material ] ; Required
  [ UICC-Key-Material ] ; Conditional
  [ Key-ExpiryTime ] ; Time of expiry
  [ BootstrapInfoCreationTime ] ; Bootstrapinfo creation time
  [ GBA-UserSecSettings ] ; Selected USSs
  [ GBA-Type ] ; GBA type used in bootstrapping
  * [ AVP ]
  * [ Proxy-Info ]
  * [ Route-Record ]

```

The BSF may or may not send the User-name AVP (IMPI) according its configuration.

The mandatory common key material with the ME (Ks_NAF or Ks_ext_NAF) is sent in the ME-Key-Material AVP. The common key material with the UICC (Ks_int_NAF) is optionally sent in the UICC-Key-Material AVP only if the 'uiccType' tag in bsfInfo from the HSS is set to "GBA_U".

The Key-ExpiryTime AVP contains the expiry time of the Bootstrapping information in the BSF according its configuration. The expiry time is represented according the Diameter Time data format in seconds that have passed since 0h on January 1, 1900 UTC . If a special key lifetime value is given in the 'lifeTime' tag inside the bsfInfo from the HSS in bootstrapping procedure, it is used instead of the BSF default configuration value when the expiry time is calculated.

The BootstrapInfoCreationTime AVP contains the bootstrapinfo creation time, i.e., creation time of the Bootstrapping information in the BSF. The bootstrapinfo creation time is represented in seconds that have passed since January 1, 1900 00:00:00.000 UTC.

The BSF selects the appropriate User Security Settings (if any) to the GBA-UserSecSettings AVP from stored GAA-UserSecSettings in Bootstrapping information according the GBA-Service-Identifier AVPs in the request message.

The BSF shall indicate the type of used authentication in the bootstrapping procedure to the NAF in GBA-Type, if other than 3G GBA type has been performed.

When the NAF receives the BIA message, the NAF shall check the value of the GBA-Type AVP if it is included in the message. If the NAF does not support the GBA-Type the NAF shall stop processing the message and should indicate an error via the O&M subsystem. The further procedure in the NAF when the BIA is received is described in 3GPP TS 33.220 [5], 3GPP TS 33.222 [11] and optionally in GAA service type specific TSs.

6 Diameter application for Zh and Zn interfaces

6.1 Command-Code values

The Zn interface assigns new Command-Code 310.

The messages in Zh interface use the same Command-Code value 303 as Multimedia-Auth-Request/Answer messages defined in 3GPP TS 29.229 [3] for Cx interface.

6.2 Result-Code AVP values

This section defines new result code values that must be supported by all Diameter implementations that conform to this specification. When one of the result codes defined here is included in a response, it shall be inside an Experimental-Result AVP and Result-Code AVP shall be absent.

6.2.1 Success

Errors that fall within the Success category are used to inform a peer that a request has been successfully completed.

The success category result codes defined in 3GPP TS 29.229 [3] for Cx interface are useless and therefore not required in Zh and Zn interfaces.

6.2.2 Permanent failures

Errors that fall within the Permanent Failures category are used to inform the peer that the request failed, and should not be attempted again.

The Permanent failure category result codes defined in 3GPP TS 29.229 [3] for Cx interface are useless and therefore not required in Zh and Zn interfaces.

6.2.2.1 DIAMETER_ERROR_IMPI_UNKNOWN (5401)

A message was received by the HSS for an IMPI that is unknown.

6.2.2.2 DIAMETER_ERROR_NOT_AUTHORIZED (5402)

A message was received by the BSF which the BSF can not authorize. In this case the NAF should indicate to the UE that the service is not allowed.

6.2.2.3 DIAMETER_ERROR_TRANSACTION_IDENTIFIER_INVALID (5403)

A message was received by the BSF for an invalid (e.g. unknown or expired) Bootstrapping Transaction Identifier (B-TID). In this case the NAF should request the UE to bootstrap again.

6.2.2.4 Void

6.2.2.5 Void

6.2.2.6 Void

6.2.2.7 Void

6.3 AVPs

The AVPs defined in 3GPP TS 29.229 [3] for 3GPP IMS Cx interface Multimedia-Auth-Request/Answer messages are used as they are.

The following table describes the additional new Diameter AVPs defined for the Zh and Zn interface protocol, their AVP Code values, types, possible flag values and whether or not the AVP may be encrypted. The Vendor-Id header of all AVPs defined in this specification shall be set to 3GPP (10415).

Table 6.1: New Diameter Multimedia Application AVPs

Attribute Name	AVP Code	Section defined	Value Type	AVP Flag rules				May Encr.
				Must	May	Should not	Must not	
GBA-UserSecSettings	400	6.3.1.1	OctetString	M, V				No
Transaction-Identifier	401	6.3.1.2	OctetString	M, V				No
NAF-Id	402	6.3.1.3	OctetString	M, V				No

GAA-Service-Identifier	403	6.3.1.4	OctetString	M, V				No
Key-ExpiryTime	404	6.3.1.5	Time	M, V				No
ME-Key-Material	405	6.3.1.6	OctetString	M, V				No
UICC-Key-Material	406	6.3.1.7	OctetString	M, V				No
GBA_U-Awareness-Indicator	407	6.3.1.8	Enumerated	M, V				No
BootstrapInfoCreationTime	408	6.3.1.9	Time	M, V				No
GBA-Type	410	6.3.1.10	Enumerated	M, V				No
NOTE 1: The AVP header bit denoted as "M", indicates whether support of the AVP is required. The AVP header bit denoted as "V", indicates whether the optional Vendor-ID field is present in the AVP header.								

6.3.1 Common AVPs

6.3.1.1 GBA-UserSecSettings AVP

The GAA-UserSecSettings AVP (AVP code 400) is of type OctetString. If transmitted on the Zh interface it contains GBA user security settings (GUSS). If transmitted on the the Zh interface it contains the relevant USSs only. The content of GBA-UserSecSettings AVP is a XML document which is defined in annex A.

6.3.1.2 Transaction-Identifier AVP

The Transaction-Identifier AVP (AVP code 401) is of type OctetString. This AVP contains the Bootstrapping Transaction Identifier (B-TID).

6.3.1.3 NAF-Id

The NAF-Id AVP (AVP code 402) is of type OctetString. This AVP contains the full qualified domain name (FQDN) of the NAF that the UE uses concatenated with the Ua security protocol identifier as specified in TS33.220 [5]. The FQDN of the NAF that is part of the NAF_Id may be a different domain name that with which the BSF knows the NAF.

6.3.1.4 GAA-Service-Identifier AVP

The GAA-Service-identifier AVP (AVP code 403) is of type OctetString. This AVP informs a BSF about the support of a GAA-service by the NAF. According this AVP the BSF can select the right service's user security settings.

For 3GPP standardized services (e.g., PKI portal), the GAA-Service-Identifier (GSID) shall be in the range 0 to 999999, and the currently standardized values for GSID shall be the GAA-Application-Type-Code of the particular service. The GAA Service Type Codes for 3GPP standardized services are defined in Annex B.

NOTE: In the future, standardized GSID values that are different than the GAA Service Type Code may be standardised (e.g. to differentiate between the services "MBMS streaming" and "MBMS download").

Examples: The GSID is "1" for all PKI-portals, and "4" for all MBMS services.

6.3.1.5 Key-ExpiryTime AVP

The Key-ExpiryTime AVP (AVP code 404) is of type Time. This AVP informs the NAF about the expiry time of the key.

6.3.1.6 ME-Key-Material AVP

The required ME-Key-Material AVP (AVP code 405) is of type OctetString. The NAF is sharing this key material (Ks_NAF in the case of GBA_ME or Ks_ext_NAF in the case of GBA_U) with the Mobile Equipment (ME).

6.3.1.7 UICC-Key-Material AVP

The condition UICC-Key-Material AVP (AVP code 406) is of type OctetString. The NAF may share this key material (Ks_int_NAF in the case of GBA_U) with a security element (e.g. USIM, ISIM, etc..) in the UICC. Only some GAA applications use this conditional AVP.

6.3.1.8 GBA_U-Awareness-Indicator

The conditional GBA_U-Awareness-Indicator AVP (AVP code 407) is of type Enumerated. The following values are defined.

NO (0) The sending node is not GBA_U aware

YES(1) The sending node is GBA_U aware

The default value is 0 i.e. absence of this AVP indicates that the sending node is not GBA_U aware.

6.3.1.9 BootstrapInfoCreationTime AVP

The BootstrapInfoCreationTime AVP (AVP code 408) is of type Time. This AVP informs the NAF about the bootstrapinfo cration time of the key.

6.3.1.10 GBA-Type

The GBA-Type AVP (AVP code 410) is of type Enumerated. The AVP informs the NAF about the authentication type that was used during bootstrapping procedure.

The following value is defined:

- 3G GBA (0) The 3G GBA has been performed as defined in TS 33.220 [5].

The default value is 0 i.e. the absence of this AVP indicates 3G GBA

6.4 User identity to HSS resolution

The User identity to HSS resolution mechanism enables the BSF to find the address of the HSS that holds the subscriber data for a given subscriber when multiple and separately addressable HSSs have been deployed by the network operator. The resolution mechanism is not required in networks that utilise a single HSS or when an BSF is configured to use pre-defined HSS.

The resolution mechanism is based on the Subscription Locator Function (SLF) and is equivalent to that described for the Cx/Dx interface described in 3GPP TS 23.228 [12]. The BSF accesses the subscription locator via the Dz interface. The Dz interface is always used in conjunction with the Zh interface. The Dz interface is based on Diameter. Its functionality is implemented by means of the routing mechanism provided by an enhanced Diameter redirect agent, which is able to extract the Subscriber identity from the received requests.

To get the HSS address the BSF sends to the SLF the Zh requests aimed for the HSS. On receipt of the HSS address from the SLF, the BSF shall send the Zh requests to the HSS. The BSF may store the HSS address and use it in further requests associated to the same Subscriber.

In networks where the use of the user identity to HSS resolution mechanism is required and the BSF is not configured to use predefined HSS, each BSF shall be configured with the address/name of the SLF implementing this resolution mechanism.

7 Use of namespaces

This clause contains the namespaces that have either been created in this 3GPP specification, or in 3GPP specification 3GPP TS 29.229 [3] or the values assigned to existing namespaces managed by IANA.

7.1 AVP codes

This specification reserves the 3GPP vendor specific values 10415:400-499 and assigns values 10415:400-408, and 410 for the GAA from the 3GPP AVP Code namespace for 3GPP Diameter applications ([8]). The 3GPP vendor specific AVP code space is managed by 3GPP CT4. See section 6 for the assignment of the namespace in this specification.

Besides the Diameter Base Protocol AVPs [1] this specification reuses the following AVPs from 3GPP TS 29.229 [3]: *Authentication-Session-State*, *User-Name*, *SIP-Auth-Data-Item* and *SIP-Number-Auth-Items*.

7.2 Experimental-Result-Code AVP values

This specification reserves Experimental-Result-Code AVP values 10415:2401-2409 and 10415:5401-5409. See section 6.2.

7.3 Command Code values

Only Command-Codes 310 and 303 from 3GPP TS 29.229 [3] is used in this specification.

This specification reuses only the Command-Code value, not the content of the original specification. The AVPs, that are defined required in TS 29.229 [3], but are not needed in Zh or Zn interfaces, are removed and are therefore not required in Zh or Zn interface messages. All new AVPs for GAA are defined optional although they may be mandatory in GAA viewpoint.

This specification does not assign new command codes to the 3GPP TS 29.229 [3].

Annex A (normative): GBA-UserSecSettings XML definition

This annex contains the XML schema definition for an XML document carrying the GBA User Security Settings inside GBA-UserSecSettings AVP in Zh and Zn interface.

```

<?xml version="1.0" encoding="UTF-8"?>

<xs:schema targetNamespace="urn:3gpp:gba:GBAGUSSSchema-R6:2007-05"
  xmlns:tns="urn:3gpp:gba:GBAGUSSSchema-R6:2007-05"
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  elementFormDefault="qualified"
  attributeFormDefault="unqualified">

  <!-- This import brings in the XML language attribute xml:lang-->
  <xs:import namespace="http://www.w3.org/XML/1998/namespace"
    schemaLocation="http://www.w3.org/2001/xml.xsd"/>

  <xs:complexType name="ExtensionType">
    <xs:sequence>
      <xs:any processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>

  <!-- The whole user's GBA specific data set -->
  <xs:complexType name="guss">
    <xs:sequence>
      <xs:element name="bsfInfo" type="tns:bsfInfoType" minOccurs="0"/>
      <xs:element name="ussList" type="tns:ussListType"/>
      <xs:element name="Extension" type="tns:ExtensionType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:attribute name="id" type="xs:string"/>
  </xs:complexType>

  <!-- BSF specific information element -->
  <xs:complexType name="bsfInfoType">
    <xs:sequence>
      <xs:element name="uiccType" type="xs:string" minOccurs="0" />
      <xs:element name="lifeTime" type="xs:integer" minOccurs="0" />
      <xs:element name="Extension" type="tns:ExtensionType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>

  <!--List of all users individual User Security Settings -->
  <xs:complexType name="ussListType">
    <xs:sequence minOccurs="0" maxOccurs="unbounded">
      <xs:element name="uss" type="tns:ussType"/>
      <xs:element name="Extension" type="tns:ExtensionType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>

  <!-- User Security Setting data -->
  <xs:complexType name="ussType">

```

```

<xs:sequence>
  <xs:element name="uids" type="tns:uidsType"/>
  <xs:element name="flags" type="tns:flagsType"/>
  <xs:element name="Extension" type="tns:ExtensionType" minOccurs="0"/>
  <xs:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded"/>
</xs:sequence>
<xs:attribute name="id" use="required" type="xs:string"/>
<xs:attribute name="type" use="required" type="xs:int"/>
<xs:attribute name="nafGroup" use="optional" type="xs:string"/>
</xs:complexType>

<!-- User Public Identities for authentication -->
<xs:complexType name="uidsType">
  <xs:sequence minOccurs="1" maxOccurs="unbounded">
    <xs:element name="uid" type="xs:string"/>
    <xs:element name="Extension" type="tns:ExtensionType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded"/>
  </xs:sequence>
</xs:complexType>

<!-- GAA Application type specific Authorization flag codes -->
<xs:complexType name="flagsType">
  <xs:sequence minOccurs="0" maxOccurs="unbounded">
    <xs:element name="flag" type="xs:int"/>
    <xs:element name="Extension" type="tns:ExtensionType" minOccurs="0"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded"/>
  </xs:sequence>
</xs:complexType>
</xs:schema>

```

Note: The <xs:any> element within the complex type ExtensionType allows for compatible standard extensions in future releases. The <xs:any> elements within the other complex types allow for compatible private extensions.

The values are:

- The value of the attribute 'id' in the element 'guss' is the the same as user's IM Private Identity (IMPI) used in User-Name AVP.
- The value of the attribute 'id' in the element 'uss' is the same as service identifier (GSID) used in GAA-Service-Identifier AVP.
- The value of the element "uiccType" in the element "bsfInfo" is:
GBA to indicate the basic case, or
GBA_U to indicate that generation of Ks_int_NAF is also required in the BSF.
The default value is GBA.
- The value of the element "lifeTime" in the element "bsfInfo" indicates a user specific key lifetime (duration in seconds). If the lifeTime element is missing the default value in the BSF is used.
- The value of attribute "type" in the element "uss" is GAA service type code defined in annex B.
- The value of attribute 'nafGroup' in the element 'uss' is an operator internal group designator for a NAF group the USS is valid for. If this attribute is missing then only the attribute 'id' is used for selection of this element.
- Values of the element "uid" are user's public authentication identities from the HSS.

- Values of element 'flag' are user's authorization flag codes from the HSS for GAA service type indicated in the type attribute in the parent uss element. If an authorization flag exist the NAF have permission to give the corresponding service, otherwise not

In the following illustrative example the values are italicised and underlined. The content of one User Security Setting tag is boxed.

```
<guss id="358500004836551@ims.mnc050.mcc358.3gppnetwork.org">
  <bsfInfo>
    <lifeTime>86400</lifeTime>
  </bsfInfo>
  <ussList>
    <uss id="1" type="1">
      <uids>
        <uid>tel:358504836551</uid>
        <uid>lauri.laitinen@nokia.com</uid>
        ...
      </uids>
      <flags>
        <flag>1</flag>
        ...
      </flags>
    </uss>
    ...
  </ussList>
</guss>
```

The above GAA User Security Settings example for user '358500004836551@ims.mnc050.mcc358.3gppnetwork.org' defines that for PKI-Portal (GAA service type code is 1) services are allowed for user identities 'tel:358504836551' and 'lauri.laitinen@nokia.com' and authentication is allowed (flag 1 exists) but non-repudiation is not allowed (flag 2 is missing) to NAFs that provide the GAA service identified by "1" GAA Service Identifier. The BSF shall not generate UICC-Ks, because uiccType is missing. A special key lifetime defines that the duration after which the key expires is 86400 seconds.

Annex B (normative): GAA Service Type Codes

The GAA Service Type Code values are used in GAA to indicate interpretation, coding and usage of GAA service type specific data.

For examples each GAA service type may have their own set of authorization flags. Meaning and coding of these flags are defined in Annex C. There may also be proprietary GAA service types with their own definitions in the future.

Code values 0 – 999999 are reserved for standardized GAA service types.

The following values are defined for standardized GAA service types with 3GPP specification:

- 0 Unspecific service
- 1 PKI-Portal
- 2 Authentication Proxy
- 3 Presence
- 4 MBMS

Default value is 0. An unspecific service may or may not have user security settings containing or not a list of public identities. An unspecific service cannot have specified authorization flags or other service type specific data.

Annex C (normative): GAA Authorization flag codes

For GAA services which have a defined set of special authorization flag codes the following rule holds: The service specified by the GAA authorization flag codes is allowed for a user only if user's user security setting contains that flag.

The following standardised GAA service types that are listed in previous annex B have the following special authorization flag codes:

PKI-Portal (1)

- 1 Authentication allowed
- 2 Non-repudiation allowed

Annex D (informative): Change history

Change history											
Date	TSG #	TSG Doc.	CR	R e v	Subject/Comment	Old	New				
2004-09	CN#25	NP-040410			Version 2.0.0 approved in CN#25	2.0.0	6.0.0				
2004-12	CN#26	NP-040580	001		Authorization Flag Code Annex	6.0.0	6.1.0				
2004-12			002		Finalization of GAA Service Identifier						
2004-12			003	1	BSF control information (bsfInfo) tag to GUSS						
2004-12			005		Structure to GAA Service Identifier						
2004-12			006	1	Finalisation of terminology						
2004-12			008	1	Command code 310 Zn messages						
2004-12			009		Introduction of NAF groups						
2005-01									Fix Word problem	6.1.0	6.1.1
2005-03			CN#27	NP-050041	010				GAA Error Codes	6.1.1	6.2.0
	011				Only one AV from HSS to BSF						
	012				Clarification of LifeTime/ExpiryTime terminology						
	013	1			Application identifiers to Z-interfaces						
	014	1			Modification of key lifetime material						
2005-06	CT#28	CP-050090	0015		XML extensibility	6.2.0	6.3.0				
			0016	1	Remove BSF from visited network						
2005-09	CT#29	CP-050300	0017	1	Correction for GBA with multiple HSS's	6.3.0	6.4.0				
			0021		Key naming alignment with TS 33.220						
2005-12	CT#30	CP-050613	0018	3	XML syntax correction	6.4.0	6.5.0				
		CP-050609	0023		Authentication error handling in Zh and Zn						
2006-03	CT#31	CP-060071	0024	1	Correction of NAF_ID	6.5.0	6.6.0				
2007-06	CT#36	CP-070317	0039	1	GUSS schema fix	6.6.0	6.7.0				

History

Document history		
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