

IPWorks 3GPP AAA Server-Non-3GPP Access GW STa Interface

INTERWORK DESCRIPTION

Copyright

© Ericsson AB 2016. All rights reserved. No part of this document may be reproduced in any form without the written permission of the copyright owner.

Disclaimer

The contents of this document are subject to revision without notice due to continued progress in methodology, design and manufacturing. Ericsson shall have no liability for any error or damage of any kind resulting from the use of this document.

Trademark List

All trademarks mentioned herein are the property of their respective owners. These are shown in the document IPWorks Trademark Information.



Contents

1	Introduction	1
1.1	Prerequisites	1
1.2	Related Information	1
2	Interface Overview	3
2.1	Interface Role	3
2.2	Services	3
2.3	Encapsulation and Addressing	4
3	Procedures	5
3.1	Non-3GPP IP Access Network Initiated Full Authentication and Authorization	5
3.2	Non-3GPP IP Access Network Initiated Re-Authentication and Re-Authorization	6
3.3	Non-3GPP IP Access Network Initiated Re-Authorization	6
3.4	Non-3GPP IP Access Network Initiated Session Termination	7
3.5	HSGW Initiated Fast Re-Authentication	8
3.6	AAA Server Initiated Session Termination	8
3.7	AAA Server Initiated Re-Authorization	9
4	Information Model	11
4.1	Non-3GPP IP Access Network Initiated Full Authentication and Authorization	11
4.1.1	DER Command	11
4.1.2	DEA Command	13
4.2	Non-3GPP IP Access Network Initiated Re-Authentication and Re-Authorization	14
4.3	Non-3GPP IP Access Network Initiated Re-Authorization	14
4.3.1	AAR Command	14
4.3.2	AAA Command	15
4.4	Non-3GPP IP Access Network Initiated Session Termination	15
4.4.1	STR Command	15
4.4.2	STA Command	16
4.5	HSGW Initiated Fast Re-authentication	16
4.6	AAA Initiated Session Termination	16
4.6.1	ASR Command	16



4.6.2	ASA Command	17
4.6.3	STR Command	17
4.6.4	STA Command	17
4.7	AAA Server Initiated Re-Authorization	17
4.7.1	RAR Command	17
4.7.2	RAA Command	18
5	Information Elements	19
5.1	Diameter AVPs	19
5.1.1	IETF Protocol AVPs	19
5.1.2	3GPP AVPs	24
5.2	EAP and EAP-AKA' Messages	37
5.2.1	EAP Message	37
5.2.2	EAP-AKA' Message	37
6	Error Handling	39
6.1	Diameter Error Handling	39
6.2	EAP Error Handling	40
7	Formal Syntax	43
8	Related Standards	45
	Reference List	47



1 Introduction

This document describes the STa interface between the trusted non-3GPP IP access network and the 3GPP AAA Server.

Scope

The STa interface is used to transport PMIPv6 mode related mobility parameters in the case the UE attaches to the EPC using the STa reference point.

This document covers the following topics:

- Interface Overview
- Procedure
- Information Model
- Information Elements
- Error Handling
- Formal Syntax
- Related Standards

Target Groups

This document is intended for personnel needing to understand the logical entity, including interfaces and protocols, of the IPWorks.

1.1 Prerequisites

N/A

1.2 Related Information

Trademark information, typographic conventions, definition and explanation of acronyms and terminology can be found in the following documents:

- *Trademark Information*, Reference [1]
- *Glossary of Terms and Acronyms*, Reference [2]
- *Typographic Conventions*, Reference [3]



The standard, related to the STa interface, can be found in [Section Reference](#).



2 Interface Overview

This section describes the interface between the trusted non-3GPP IP access network and the 3GPP AAA Server, as shown in Figure 1.

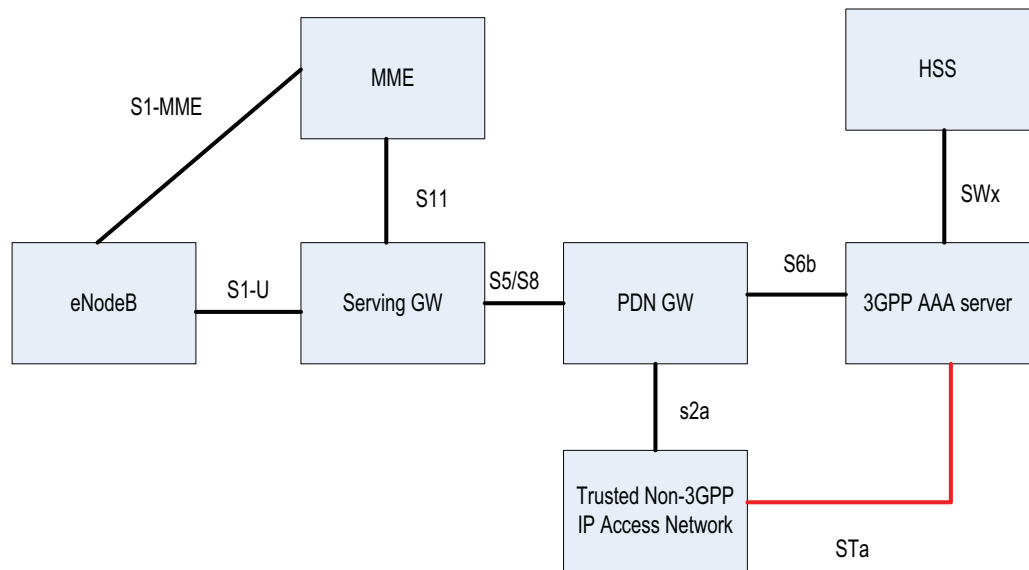


Figure 1 STa interface

2.1 Interface Role

This section describes the role of the STa interface in the EPC network.

For the STa interface, the IPWorks AAA server acts as 3GPP AAA server in the EPC network, and also takes the role of authentication and authorization for UE who attaches to the EPC through Trusted Non-3GPP IP Access Network.

2.2 Services

This section describes the services that the STa offers.

The services offered by the STa Interface are shown in Table 1.

*Table 1 Offered Services*

Offered Service	Description
Authorization , Authentication	<p>The 3GPP AAA Server is used to authenticate/authorize the UE from Non-3GPP IP Access Network:</p> <ul style="list-style-type: none">• Authenticate/Authorize the UE from Trusted/Untrusted Non-3GPP IP Access Network.• Transport PMIPv6 mode related mobility parameters in the case the UE attaches to the EPC using the STa reference point.

2.3 Encapsulation and Addressing

The following lower level protocols are used on this interface:

- TCP
- DIAMETER



3 Procedures

This section describes the processes are implemented for the STa interface.

- *Non-3GPP IP Access Network initiated full authentication and authorization*
- *Non-3GPP IP Access Network initiated Re-Authentication and Re-Authorization*
- *Non-3GPP IP Access Network initiated Re-Authorization*
- *Non-3GPP IP Access Network initiated session termination*
- *AAA initiated session termination*
- *AAA Server initiated re-authorization*

3.1 Non-3GPP IP Access Network Initiated Full Authentication and Authorization

This procedure is triggered when the UE attaches to the EPC using the STa reference point. The authentication is based on EAP-AKA'. The Diameter message is DER and DEA.

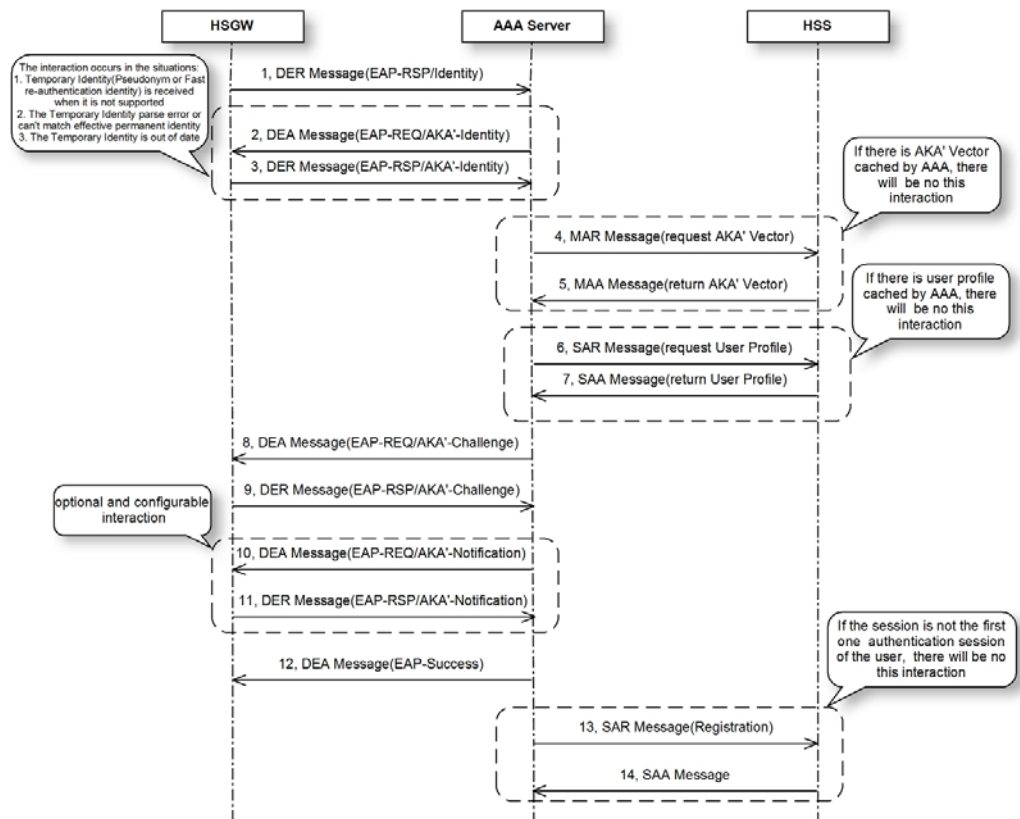


Figure 2 Non-3GPP IP Access Network Initiated Full Authentication and Authorization

3.2 Non-3GPP IP Access Network Initiated Re-Authentication and Re-Authorization

This procedure is triggered when the Trusted Non-3GPP IP Access Network performs the re-authentication and re-authorization according to local policy or triggered by HSS.

For detailed procedures refer to Section 3.1 on page 5.

3.3 Non-3GPP IP Access Network Initiated Re-Authorization

This procedure is triggered by the Trusted Non-3GPP IP Access network to check if the user authorization parameters previously provided by the 3GPP AAA server were modified.

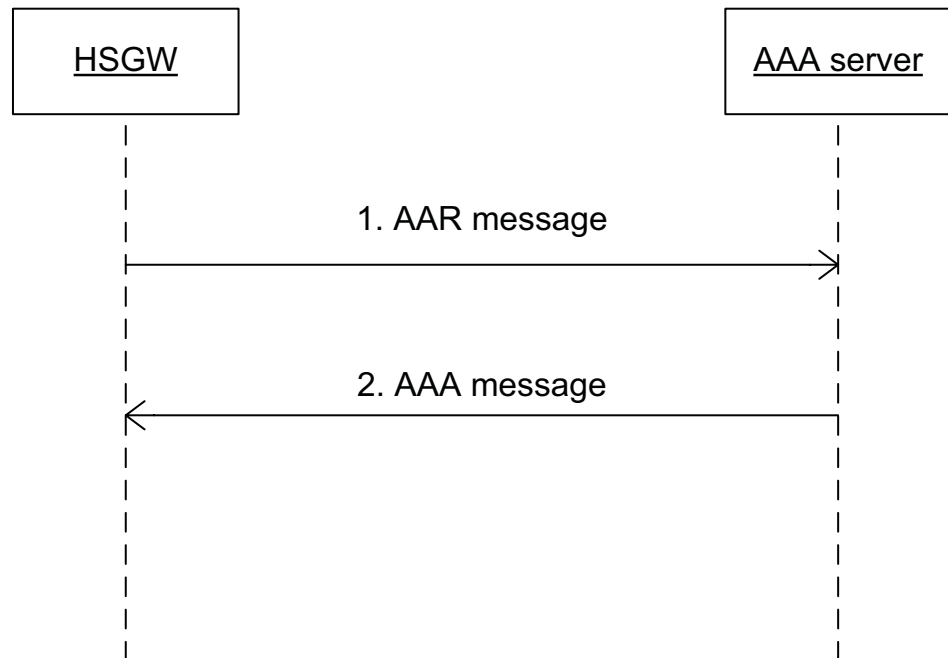


Figure 3 Non-3GPP IP Access Network Initiated Re-Authorization

3.4 Non-3GPP IP Access Network Initiated Session Termination

This procedure is triggered when the user connection is to be released. The Non-3GPP IP Access Network informs the 3GPP AAA server to remove Non-3GPP access information.

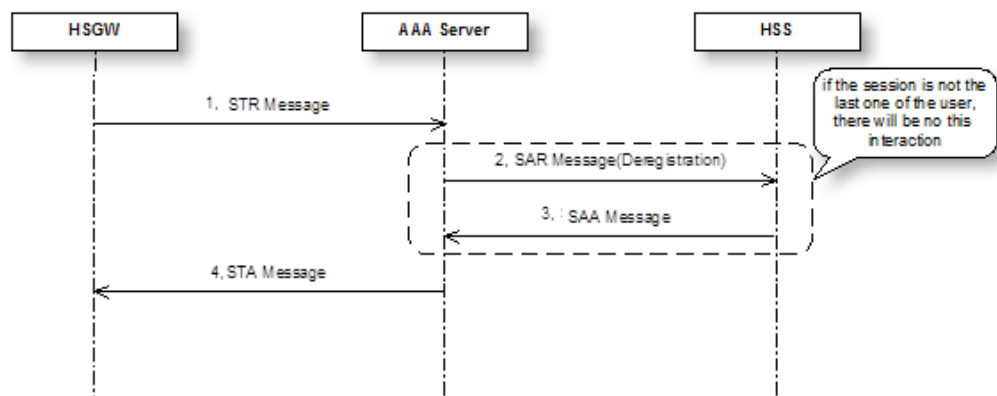


Figure 4 Non-3GPP IP Access Network Initiated Session Termination

3.5 HSGW Initiated Fast Re-Authentication

The procedure is triggered when the UE attaches to the EPC using the STa reference point with the Fast Re-authentication Identity of EAP-AKA. The Diameter message is DER and DEA.

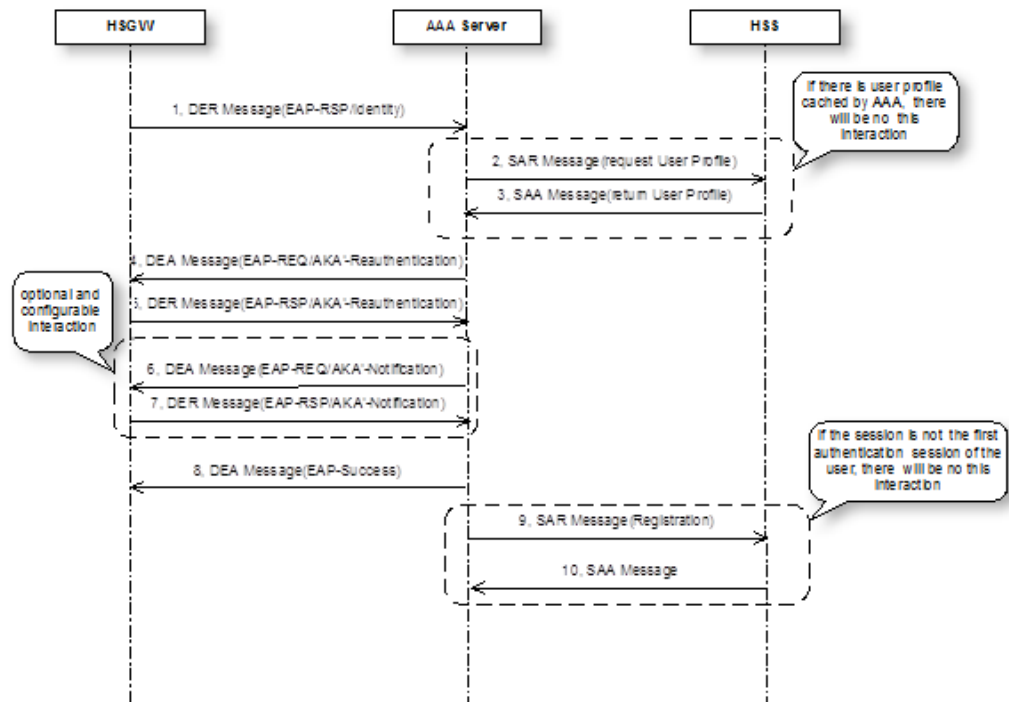


Figure 5 HSGW Initiated Fast Re-Authentication

3.6 AAA Server Initiated Session Termination

This procedure is triggered when the system administrator detaches the user from the 3GPP AAA server. The procedure is based on Diameter session abort messages.

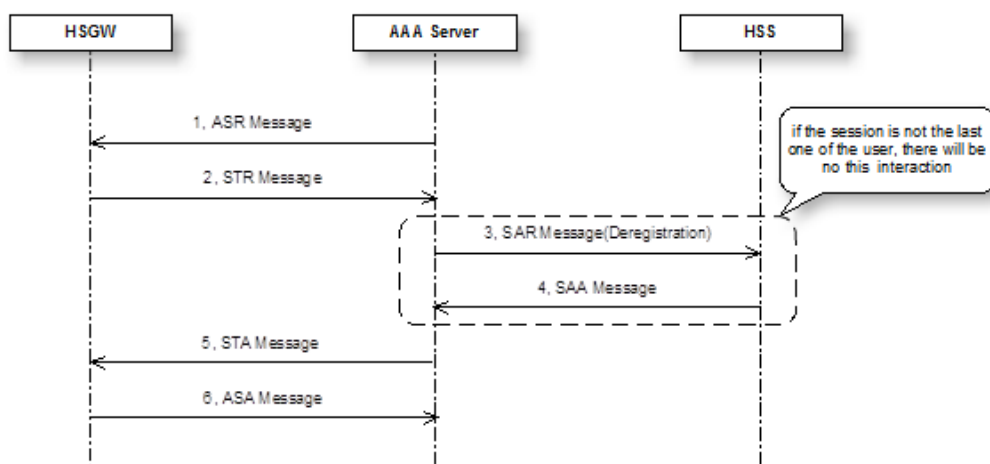


Figure 6 AAA Server Initiated Session Termination

3.7

AAA Server Initiated Re-Authorization

This procedure is triggered when the subscriber profile is modified in HSS. The procedure is based on Diameter RAR (see Section 4.7.1 on page 17) and AAR (see Section 4.3.1 on page 14) messages.

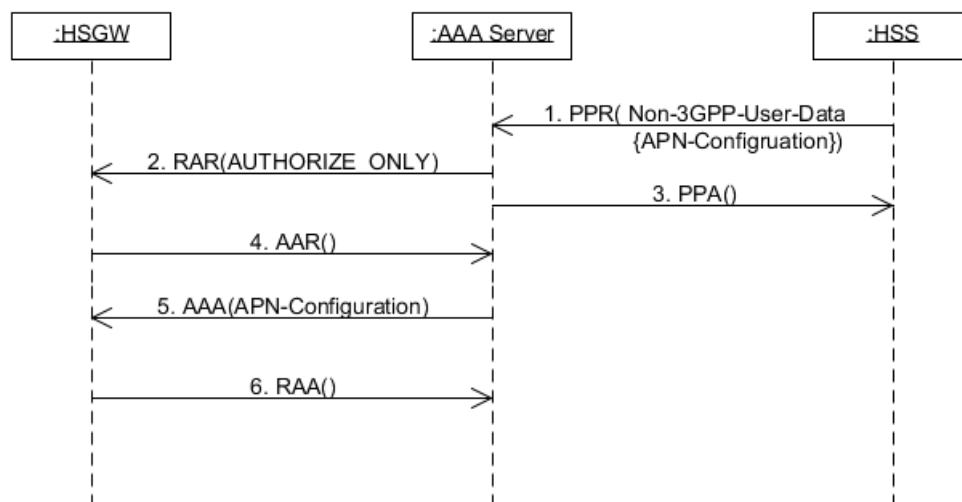


Figure 7 AAA Server Initiated Re-Authorization



4 Information Model

This section describes the information model including mandatory and optional parameters of each service operation. This document only covers the diameter messages and AVPs involved in the application.

Note: For the description and format of the Base Protocol, see Reference [4].

Table 2 shows the Augmented Backus–Naur Form (ABNF) format used in the subsections.

Table 2 Augmented Backus–Naur Form (ABNF) format

Format	Description
{ }	Mandatory
< >	Mandatory with fixed place
[]	Optional
*	Zero or more occurrences
*n	At most
n	Occurrences

4.1 Non-3GPP IP Access Network Initiated Full Authentication and Authorization

4.1.1 DER Command

The Diameter-EAP-Request (DER) command, indicated by the Command-Code field set to 268 and the “R” bit set in the Command Flags field, is sent from a non-3GPP access network NAS to a 3GPP AAA server.

The format of this command is listed as below:

```
<Diameter-EAP-Request> ::= <Diameter Header: 268, REQ, PXY, 16777250>
    <Session-Id>
    { Auth-Application-Id }
    { Origin-Host }
    { Origin-Realm }
    { Destination-Realm }
    { Auth-Request-Type }
    { EAP-Payload }
    [ User-Name ]
    [ Calling-Station-Id ]
    [ RAT-Type ]
```



```
[ ANID ]
[ QoS-Capability ]
[ MIP6-Feature-Vector ]
[ Visited-Network-Identifier ]
[ Service-Selection ]
[ Terminal-Information ]
*[ Supported-Features ]
[ Auth-Grace-Period ]
[ Authorization-Lifetime]
*[ Proxy-Info ]
*[ Route-Record ]
*[ AVP ]

<Diameter-EAP-Request>::= <Diameter Header: 268, REQ, PXY, 16777250>
<Session-Id>
{ Auth-Application-Id }
{ Origin-Host }
{ Origin-Realm }
{ Destination-Realm }
{ Auth-Request-Type }
{ EAP-Payload }
[ User-Name ]
[ Calling-Station-Id ]
[ RAT-Type ]
[ ANID ]
[ QoS-Capability ]
[ MIP6-Feature-Vector ]
[ Visited-Network-Identifier ]
[ AAA-Failure-Indication ]
[ Service-Selection ]
[ Terminal-Information ]
*[ Supported-Features ]
[ Auth-Grace-Period ]
[ Authorization-Lifetime]
*[ Proxy-Info ]
*[ AVP ]
```



Note: For the DER message that carries the EAP-Response/Identity package, the following AVPs are mandatory:

- User-Name
- Calling-Station-Id
- RAT-Type
- ANID

The AVPs used to fetch authentication vector and user profile from HSS should be carried in the first DER message that transfer the EAP-RSP/Identity message. The 3GPP AAA server will save these AVPs in the session, which will be used for later re-authentication and/or re-authorization.

The AVP `Auth-Grace-Period` and `Authorization-Lifetime` should be carried in the first DER message that transfer the EAP-RSP/Identity message if they exist.

4.1.2

DEA Command

The Diameter-EAP-Answer (DEA) command, indicated by the Command-Code field set to 268 and the “R” bit cleared in the Command Flags field, is sent from a 3GPP AAA server to a non-3GPP access network NAS.

The format of this command is listed as below:

```
<Diameter-EAP-Answer> ::= <Diameter Header: 268, PXY, 16777250>
    <Session-Id>
    { Auth-Application-Id }
    { Result-Code }
    [ Experimental-Result ]
    { Origin-Host }
    { Origin-Realm }
    { Auth-Request-Type }
    { EAP-Payload }
    [ User-Name ]
    [ Session-Timeout ]
    [ Accounting-Interim-Interval ]
    [ EAP-Master-Session-Key ]
    [ Context-Identifier ]
    [ APN-OI-Replacement ]
    *[ APN-Configuration ]
    [ MIP6-Agent-Info ]
    [ MIP6-Feature-Vector ]
    [ Mobile-Node-Identifier ]
    [Trace-Info]
    [Subscription-ID]
    [Session-Timeout]
    [ 3GPP-Charging-Characteristics ]
```

```
[ AMBR ]
*[ Redirect-Host ]
[Redirect-Host-Usage]
  [Redirect-Max-Cache-Time]
[ AN-Trusted ]
*[ Supported-Features ]
[ Auth-Grace-Period ]
[ Authorization-Lifetime]
*[ Proxy-Info ]
*[ AVP ]
```

4.2 Non-3GPP IP Access Network Initiated Re-Authentication and Re-Authorization

Refer to Section 4.1 on page 11.

4.3 Non-3GPP IP Access Network Initiated Re-Authorization

4.3.1 AAR Command

The AA-Request (AAR) command, indicated by the Command-Code field set to 265 and the "R" bit set in the Command Flags field, is sent from a Trusted Non-3GPP GW to a 3GPP AAA Server/Proxy.

The format of this command is listed as below:

```
<AA-Request> ::= <Diameter Header: 265, REQ, PXY, 16777250>
    <Session-Id>
    { Auth-Application-Id }
    { Origin-Host }
    { Origin-Realm }
    { Destination-Realm }
    { Auth-Request-Type }
    [ Destination-Host ]
    [ User-Name ]
    [ MIP6-Feature-Vector ]
    *[ Proxy-Info ]
    *[ Route-Record ]
    *[ AVP ]
```

Note: The following AVPs are mandatory for the AAR message:

- User-Name
- Destination-Host



4.3.2 AAA Command

The AA-Answer (AAA) command, indicated by the Command-Code field set to 265 and the “R” bit cleared in the Command Flags field, is sent from a 3GPP AAA Server/Proxy to a Trusted Non-3GPP GW.

The format of this command is listed as below:

```
<AA-Answer> ::= <Diameter Header: 268, PXY, 16777250>
    <Session-Id>
    { Auth-Application-Id }
    { Auth-Request-Type }
    { Result-Code }
    [ Experimental-Result ]
    { Origin-Host }
    { Origin-Realm }
    [ Session-Timeout ]
    [ Accounting-Interim-Interval ]
    [ Context-Identifier ]
    [ APN-OI-Replacement ]
    *[ APN-Configuration ]
    [ 3GPP-Charging-Characteristics ]
    [ AMBR ]
    [ MIP6-Feature-Vector ]
    *[ Proxy-Info ]
    *[ AVP ]
```

4.4 Non-3GPP IP Access Network Initiated Session Termination

4.4.1 STR Command

The Session-Termination-Request (STR) command, indicated by the Command-Code field set to 275 and the “R” bit set in the Command Flags field, is sent from a non-3GPP GW to a 3GPP AAA server. The Command Code value and ABNF are re-used from the IETF RFC 3588 Session-Termination-Request command.

The format of this command is listed as below:

```
<Session-Termination-Request> ::= <Diameter Header: 275, REQ, PXY,
    16777250>
    <Session-Id>
    { Origin-Host }
    { Origin-Realm }
    { Destination-Realm }
    { Auth-Application-Id }
    { Termination-Cause }
    [ User-Name ]
```



```
* [ Proxy-Info ]
* [ Route-Record ]
* [ AVP ]
```

Note: The following AVPs are mandatory for the STR message:

- User-Name

4.4.2 STA Command

The Session-Termination-Answer (STA) command, indicated by the Command-Code field set to 275 and the "R" bit cleared in the Command Flags field, is sent from a 3GPP AAA server to a non-3GPP GW. The Command Code value and ABNF are re-used from the IETF RFC 3588 Session-Termination-Answer command.

The format of this command is listed as below:

```
<Session-Termination-Answer> ::= <Diameter Header: 275, PXY, 16777250>
    <Session-Id>
    { Result-Code }
    { Origin-Host }
    { Origin-Realm }
    [Redirect-Host-Usage]
    [Redirect-Max-Cache-Time]
    * [ Proxy-Info ]
    * [ AVP ]
```

4.5 HSGW Initiated Fast Re-authentication

Refer to Section 4.1 on page 11.

4.6 AAA Initiated Session Termination

4.6.1 ASR Command

The Abort-Session-Request (ASR) command, indicated by the Command-Code field set to 274 and the "R" bit set in the Command Flags field, is sent from a 3GPP AAA Server/Proxy to a non-3GPP access network NAS. ABNF for the ASR commands is as follows:

The format of this command is listed as below:

```
<Abort-Session-Request> ::= <Diameter Header: 274, REQ, PXY, 16777250>
    <Session-Id>
    { Origin-Host }
    { Origin-Realm }
    { Destination-Realm }
```



```
{ Destination-Host }
{ Auth-Application-Id }
[ User-Name ]
[ Auth-Session-State ]
*[ AVP ]
```

4.6.2 ASA Command

The Abort-Session-Answer (ASA) command, indicated by the Command-Code field set to 274 and the "R" bit cleared in the Command Flags field, is sent from a non-3GPP access network NAS to a 3GPP AAA Server/Proxy. ABNF for the ASA commands is as follows:

The format of this command is listed as below:

```
<Abort-Session-Answer> ::= <Diameter Header: 274, PXY, 16777250>
                           <Session-Id>
                           { Result-Code }
                           { Origin-Host }
                           { Origin-Realm }
                           *[ AVP ]
```

4.6.3 STR Command

Refer to Section Section 4.4.1 on page 15.

4.6.4 STA Command

Refer to Section Section 4.4.2 on page 16.

4.7 AAA Server Initiated Re-Authorization

4.7.1 RAR Command

The Diameter Re-Auth-Request (RAR) command, indicated by the Command-Code field set to 258 and the "R" bit set in the Command Flags field, is sent from a 3GPP AAA Server to a Trusted Non-3GPP access network. ABNF for the RAR command is as follows:

```
< Re-Auth-Request > ::= < Diameter Header: 258, REQ, PXY, 16777250>
                           < Session-Id >
                           { Origin-Host }
                           { Origin-Realm }
                           { Destination-Realm }
                           { Destination-Host }
                           { Auth-Application-Id }
```

```
{ Re-Auth-Request-Type }  
[ User-Name ]  
...  
*[ AVP ]
```

4.7.2 RAA Command

The Diameter Re-Auth-Answer (ASA) command, indicated by the Command-Code field set to 258 and the "R" bit cleared in the Command Flags field, is sent from a Trusted Non-3GPP access network to a 3GPP AAA Server/Proxy. ABNF for the RAA commands is as follows:

```
< Re-Auth-Answer > ::= < Diameter Header: 258, PXY, 16777250 >  
    < Session-Id >  
    { Result-Code }  
    { Origin-Host }  
    { Origin-Realm }  
    ...  
    *[ AVP ]
```



5 Information Elements

5.1 Diameter AVPs

5.1.1 IETF Protocol AVPs

Diameter Base Protocol (RFC3588) AVPs that are included in the STa messages, are described in Reference [4].

Table 3 IETF Protocol AVPs

Attribute Name	AVP Code	Value Type	Must	May	Should not	Must not	Description
MIP6-Feature-Vector	124	Unsigned 64	M			V	See Section 5.1.1.1 on page 20
MIP6-Home-Link-Prefix	125	OctetString	M	P		V	See Section 5.1.1.2 on page 20
Re-Auth-Request-Type	285	Enumerated	M	P		V	See Section 5.1.1.3 on page 20
MIP-Home-Agent-Address	334	Address	M			V	See Section 5.1.1.4 on page 20
MIP-Home-Agent-Host	348	Grouped	M			V	See Section 5.1.1.5 on page 20
EAP-Payload	462	OctetString	M			V	See Section 5.1.1.6 on page 21
EAP-Master-Session-Key	464	OctetString	M			V	See Section 5.1.1.7 on page 21
MIP6-Agent-Info	486	Grouped	M			V	See Section 5.1.1.8 on page 21
Service-Selection	493	UTF8String	M	P		V	See Section 5.1.1.9 on page 21
Mobile-Node-Identifier	506	UTF8String	M	P		V	See Section 5.1.1.10 on page 22
QoS-Profile-Id	573	Unsigned 32	M			V	See Section 5.1.1.11 on page 22
QoS-Profile-Template	574	Grouped	M			V	See Section 5.1.1.12 on page 22
QoS-Capability	578	Grouped	M			V	See Section 5.1.1.13 on page 22
Subscription-ID	433	Grouped	M	P		V	See Section 5.1.1.14 on page 23
Subscription-Id-Type	450	Enumerated	M	P		V	See Section 5.1.1.15 on page 23
Subscription-Id-Data	444	UTF8String	M	P		V	See Section 5.1.1.16 on page 23
Proxy-Info	284	Grouped	M			V, P	See Section 5.1.1.17 on page 23
Route-Record	282	DiamIdent	M			V	See Section 5.1.1.18 on page 24



5.1.1.1 MIP6-Feature-Vector

The MIP6-Feature-Vector AVP contains a 64 bit flags field of supported mobility capabilities of the NAS. This AVP is defined in IETF RFC 5447.

The NAS may include this AVP in a request message to indicate the mobility capabilities of the NAS to the 3GPP AAA server. Similarly, the Diameter server may include this AVP in an answer message to inform the NAS about which of the NAS indicated capabilities are supported or authorized by the 3GPP AAA Server.

Following capabilities are supported on S6b reference point in PMIPv6 mode:

- PMIPv6_SUPPORTED
- IP4_HOA_SUPPORTED

5.1.1.2 MIP6-Home-Link-Prefix

The MIP6-Home-Link-Prefix AVP defined in RFC 5447 is of type `OctetString` and contains the Mobile IPv6 home network prefix information in a network byte order.

5.1.1.3 Re-Auth-Request-Type

The Re-Auth-Request-Type AVP (AVP Code 285) is of type Enumerated. And it indicates whether the user is to be authorized only or authenticated and authorized.

AUTHORIZE_ONLY	0
AUTHORIZE_AUTHENTICATE	1

5.1.1.4 MIP-Home-Agent-Address

The MIP-Home-Agent-Address AVP is of type Address defined in Reference RFC 4004. This AVP shall contain either IPv4 or IPv6 address of the PDN-GW and this IP address shall be used as the PDN-GW IP address as indicated defined in Reference 3GPP TS 29.272

5.1.1.5 MIP-Home-Agent-Host

The MIP-Home-Agent-Host AVP is of type Grouped and is defined in RFC 4004. This AVP shall contain a FQDN of the PDN-GW which shall be used to resolve the PDN-GW IP address using the Domain Name Service function as defined in Reference 3GPP TS 29.272

The Data field of this AVP has the following ABNF grammar:



```
MIP-Home-Agent-Host ::= <AVP Header: 348>
                        { Destination-Realm }
                        { Destination-Host }
                        * [ AVP ]
```

5.1.1.6 EAP-Payload

The EAP-Payload AVP is of type `OctetString` defined in RFC 4072 and is used to encapsulate the actual EAP packet that is being exchanged between the EAP client and the home Diameter server.

5.1.1.7 EAP-Master-Session-Key

The EAP-Master-Session-Key AVP is of type `OctetString` defined in RFC 4072. It contains keying material for protecting the communications between the user and the NAS.

5.1.1.8 MIP6-Agent-Info

The MIP6-Agent-Info AVP is of type `Grouped` as defined in Reference RFC 5447. It contains the identity of the PDNGW as defined in Reference 3GPP TS 29.272. The identity of PDN GW is either an IP address transported in MIP-Home-Agent-Address or an FQDN transported in MIP-Home-Agent-Host. FQDN shall be used if known.

The Data field of this AVP has the following ABNF grammar:

```
MIP6-Agent-Info ::= <AVP Header: 486>
                    *2 [ MIP-Home-Agent-Address ]
                    [ MIP-Home-Agent-Host ]
                    [ MIP6-Home-Link-Prefix ]
                    * [ AVP ]
```

Within the MIP6-Agent-Info AVP, if static address allocation is used, there may be either: an IPv4 address or an IPv6 address of the PGW contained in one MIP-Home-Agent-Address AVP; both IPv4 address and IPv6 address of the PGW contained in two MIP-Home-Agent-Address AVPs.

5.1.1.9 Service-Selection

The Service-Selection AVP is of type `UTF8String` defined in Reference RFC5778. This AVP shall contain either the APN Network Identifier (for example, an APN without the Operator Network Identifier), or the wild card value as defined in Reference 3GPP TS 29.272.

The contents of the Service-Selection AVP shall be formatted as a character string composed of one or more labels separated by dots “.” or as the wild card APN, such as AVP consisting of only one ASCII label.

5.1.1.10 Mobile-Node-Identifier

The Mobile-Node-Identifier AVP is of type UTF8String defined in RFC 5779 and contains the mobile node identifier (MN-Identifier; see RFC5213) in the NAI RFC4282 format. This AVP is used on the MAG-to-HAAA interface.

The Mobile-Node-Identifier AVP is designed for deployments where the MAG does not have a way to find out such MN identity that could be used in subsequent PBU/PBA exchanges (for example, due to identity hiding during the network access authentication) or the HAAA needs to assign periodically changing identities to the MN.

The Mobile-Node-Identifier AVP is returned in the answer message that ends a successful authentication (and possibly an authorization) exchange between the MAG and the HAAA, assuming the HAAA is also able to provide the MAG with the MN-Identifier in the first place.

The MAG MUST use the received MN-Identifier, if it has not been able to get the mobile node identifier through other means. If the MAG already has a valid mobile node identifier, then the MAG MUST discard the received MN-Identifier.

5.1.1.11 QoS-Profile-Id

The QoS-Profile-Id AVP (AVP Code 573) is of type Unsigned32 defined in RFC 5777 and contains a QoS profile template identifier. An initial QoS profile template is defined with value of 0 and can be found in RFC5624. The registry for the QoS profile templates is created with the same document.

5.1.1.12 QoS-Profile-Template

The QoS-Profile-Template AVP (AVP Code 574) is of type Grouped defined in RFC 5777 and defines the namespace of the QoS profile (indicated in the Vendor-ID AVP) followed by the specific value for the profile.

The Vendor-Id AVP contains a 32-bit IANA Private Enterprise Number(PEN), and the QoS-Profile-Id AVP contains the template identifier assigned by the vendor. The vendor identifier of zero (0) is used for the IETF.

```
QoS-Profile-Template ::= <AVP Header: 574>
                        { Vendor-Id }
                        { QoS-Profile-Id }
                        *[ AVP ]
```



5.1.1.13 QoS-Capability

The QoS-Capability AVP contains a list of supported Quality of Service profile templates (and therefore the support of the respective parameter AVPs). This AVP is defined in IETF RFC 5777.

```
QoS-Capability ::= <AVP Header: 578>
                  1*{ QoS-Profile-Template }
                  *[ AVP ]
```

5.1.1.14 Subscription-ID

The Subscription-ID AVP is of type Grouped and indicates the user identity to be used for charging purposes. It is defined in the IETF RFC 4006 [20]. EPC shall make use only of the IMSI and MSISDN values. This grouped AVP shall set the sub-AVP Subscription-Id-Type to value "END_USER_E164" and shall set the sub-AVP Subscription-IdData to the MSISDN value.

The AVP Data field has the following ABNF grammar:

```
Subscription-Id ::= < AVP Header: 443 >
                  { Subscription-Id-Type }
                  { Subscription-Id-Data }
```

5.1.1.15 Subscription-Id-Type

The Subscription-Id-Type AVP (AVP Code 450) is of type Enumerated as shown in Table 4.

This AVP determines which type of identifier is carried by the Subscription-Id AVP.

Table 4 Subscription-Id-Type

END_USE R_E164	0	The identifier is in international E.164 format (e.g., MSISDN), according to the ITU-T E.164 numbering plan defined in [E164] and [CE164].
END_USE R_IMSI	1	The identifier is in international IMSI format, according to the ITU-T E.212 numbering plan as defined in [E212] and [CE212].
END_USE R_SIP_URI	2	The identifier is in the form of a SIP URI, as defined in [SIP].
END_USE R_NAI	3	The identifier is in the form of a Network Access Identifier as defined in [NAI].
END_USE R_PRIVAT E	4	The Identifier is a credit-control server private identifier.

5.1.1.16 Subscription-Id-Data

The Subscription-Id-Data AVP (AVP Code 444) is used to identify the end user and is of type UTF8String.

The Subscription-Id-Type AVP defines which type of identifier is used.

5.1.1.17 Proxy-Info

The Proxy-Info AVP is of type Grouped defined in RFC 6733. This AVP shall contain the identity and local state information of the Diameter node that creates and adds it to a message.

5.1.1.18 Route-Record

The Route-Record AVP is of type DiameterIdentity defined in RFC 6733. The identity added in this AVP must be the same as the one received in the Origin-Host of the Capabilities Exchange message.

5.1.2 3GPP AVPs

The following table describes the 3GPP AVPs defined in the STa application, AVP Code values, types and possible AVP flag values. The 3GPP AVPs have Vendor-ID= 10415.

Table 5 3GPP AVPs

Attribute Name	AVP Code	Value Type	Must	May	Should not	Must not	Description
3GPP-Charging-Characteristics	13	UTF8String	V			M	See Section 5.1.2.1 on page 26
Max-Requested-Bandwidth-DL	515	Unsigned32	M,V				See Section 5.1.2.2 on page 26
Max-Requested-Bandwidth-UL	516	Unsigned32	M,V				See Section 5.1.2.3 on page 26
Visited-Network-Identifier	600	OctetString	M,V				See Section 5.1.2.4 on page 27
AAA-Failure-Indication	1518	Unsigned32	V			M,P	See Section 5.1.2.5 on page 27
Supported-Features	628	Grouped	V			M	See Section 5.1.2.6 on page 27
Feature-List-ID	629	Unsigned32	V			M	See Section 5.1.2.29 on page 33
Feature-List	630	Unsigned32	V			M	See Section 5.1.2.30 on page 33
Served-Party-IP-Address	848	Addresses	M,V				See Section 5.1.2.7 on page 28
QoS-Class-Identifier	1028	Enumerated	M,V				See Section 5.1.2.8 on page 28
RAT-Type	1032	Enumerated	M,V	P		M	See Section 5.1.2.9 on page 28
Allocation-Retention-Priority	1034	Grouped	V			M	See Section 5.1.2.10 on page 28
Priority-Level	1046	Unsigned32	V			M	See Section 5.1.2.11 on page 28
Pre-emption-Capability	1047	Enumerated	V			M	See Section 5.1.2.12 on page 29



Table 5 3GPP AVPs

Attribute Name	AVP Code	Value Type	Must	May	Should not	Must not	Description
Pre-emption-Vulnerability	1048	Enumerated	V				See Section 5.1.2.13 on page 29
Terminal-Information	1401	Grouped	M,V				See Section 5.1.2.14 on page 29
IMEI	1402	UTF8String	M,V				See Section 5.1.2.16 on page 30
Software-Version	1403	UTFString	M,V				See Section 5.1.2.17 on page 30
Context-Identifier	1423	Unsigned32	M,V				See Section 5.1.2.18 on page 30
APN-OI-Replacement	1427	UTF8String	M,V				See Section 5.1.2.19 on page 31
APN-Configuration	1430	Grouped	M,V				See Section 5.1.2.15 on page 30
EPS-Subscribed-QoS-Profile	1431	Grouped	M,V				See Section 5.1.2.20 on page 31
VPLMN-Dynamic-Address-Allowed	1432	Enumerated	M,V				See Section 5.1.2.21 on page 31
AMBR	1435	Grouped	M,V				See Section 5.1.2.22 on page 31
PDN-GW-Allocation-Type	1438	Enumerated	M,V				See Section 5.1.2.23 on page 32
PDN-Type	1456	Enumerated	M,V				See Section 5.1.2.24 on page 32
3GPP2-MEID	1471	OctetString	M,V				See Section 5.1.2.25 on page 33
Specific-APN-Info	1472	Grouped	M,V				See Section 5.1.2.26 on page 33
AN-Trusted	1503	Enumerated	M,V				See Section 5.1.2.27 on page 33
ANID	1504	UTF8String	M,V				See Section 5.1.2.28 on page 33
AAA-Failure-Indication	1518	Unsigned32	V			M,P	See Section 5.1.2.31 on page 34
Trace-Info	1505	Grouped	V			M,P	See Section 5.1.2.32 on page 34
Trace-Data	1458	Grouped	M,V				See Section 5.1.2.33 on page 34
Trace-Reference	1459	OctetString	M,V				See Section 5.1.2.34 on page 35
Trace-Depth	1462	Enumerated	M,V				See Section 5.1.2.35 on page 35
Trace-NE-Type-List	1463	OctetString	M,V				See Section 5.1.2.36 on page 36
Trace-Interface-List	1464	OctetString	M,V				See Section 5.1.2.37 on page 36

Table 5 3GPP AVPs

Attribute Name	AVP Code	Value Type	Must	May	Should not	Must not	Description
Trace-Event-List	1465	OctetString	M,V				See Section 5.1.2.38 on page 36
OMC-Id	1466	OctetString	M,V				See Section 5.1.2.39 on page 36
Trace-Collection-Entity	1452	Addresses	M,V				See Section 5.1.2.40 on page 36

5.1.2.1 3GPP-Charging-Characteristics

The 3GPP-Charging-Characteristics AVP is of type UTF8String. It contains the Charging Characteristics defined in Reference 3GPP TS 29.061.

The structure of the Charging Characteristics value according to Reference 3GPP TS 32.299 is as follows:

Table 6 3GPP-Charging-Characteristics

8	7	6	5	4	3	2	1	
B4	B3	B2	B1	P3	P2	P1	P0	octet 1
B12	B11	B10	B9	B8	B7	B6	B5	octet 2

Bits P0-P3 refer to the Charging Characteristics Profile Index and B1-B12 may be used by the operator for non-standardised behavior.

Each octet of the Charging Characteristics value is represented via 2 UTF-8 encoded characters in the 3GPP-Charging-Characteristics AVP, defining its hexadecimal representation. For example, if P3 and P1 are set to 1, and all the B bits are set to 0, the value of octet 1 is 10, which hexadecimal representation is 0x0A, and in text form is "0A". Octet 2 is set to 0, represented as 0x00 in hexadecimal and "00" in text, so the 3GPP-Charging-Characteristics value in UTF-8 would be "0A00".

5.1.2.2 Max-Requested-Bandwidth-DL

The Max-Requested-Bandwidth-DL AVP is of type Unsigned32 defined in 3GPP TS 29.124, and it indicates the maximum requested bandwidth in bits per second for a downlink IP flow. The bandwidth contains all the overhead coming from the IP-layer and the layers above, for instance: IP, UDP, RTP and RTP payload.



5.1.2.3 Max-Requested-Bandwidth-UL

The Max-Requested-Bandwidth-UL AVP is of type Unsigned32 defined in 3GPP TS 29.124, and it indicates the maximum requested bandwidth in bits per second for an uplink IP flow. The bandwidth contains all the overhead coming from the IP-layer and the layers above, for instance: IP, UDP, RTP and RTP payload.

5.1.2.4 Visited-Network-Identifier

The Visited-Network-Identifier AVP defined in Reference 3GPP TS 29.229 is of type OctetString. It contains an identifier of the visited network when it is received in MAR message. Otherwise it contains the identity of the network where the PDN-GW was allocated, in the case of dynamic PDN-GW assignment.

The AVP shall be encoded as defined in Reference 3GPP TS 29.272:
`mnc<MNC>.mcc<MCC>.3gppnetwork.org.`

5.1.2.5 AAA-Failure-Indication

The AAA-Failure-Indication AVP is of type Unsigned32 and it contains a bitmask.

Table 7 shows the meaning of the bits:

Table 7 AAA-Failure-Indication

Bit	Name	Description
0	AAA Failure	This bit, when set, indicates that a previously assigned 3GPP AAA Server is unavailable.

For bits not defined in Table 7, they must be cleared by the sender and discarded by the receiver.

5.1.2.6 Supported-Features

The Supported-Features AVP is of type Grouped, and it is defined in Reference 3GPP TS 29.229. If this AVP is present, it may inform the destination host about the features that the origin host supports.

The Feature-List AVP contains a list of supported features of the origin host. The Vendor-Id AVP and the Feature-List AVP together identify which feature list is carried in the Supported-Features AVP. Where a Supported-Features AVP is used to identify features that have been defined by 3GPP, the Vendor-Id AVP contains the vendor ID of 3GPP.

Vendors may define proprietary features, but it is strongly recommended that the possibility is used only as the last resort. Where the Supported-Features AVP is used to identify features that have been defined by a vendor other than

3GPP, it contains the vendor ID of the specific vendor in question. If there are multiple feature lists defined by the same vendor, the Feature-List-ID AVP differentiates those lists from one another.

The destination host uses the value of the Feature-List-ID AVP to identify the feature list. Its Data field has the following ABNF grammar:

```
Supported-Features ::= <AVP Header: 628, Vendor-Id: 10415>
                        { Vendor-Id }
                        { Feature-List-ID }
                        { Feature-List }
                        * [ AVP ]
```

5.1.2.7 Served-Party-IP-Address

The Served-Party-IP-Address AVP defined in Reference 3GPP TS 32.299 is of type Address. It contains the IPv4 address, the IPv6 address or the IPv6 prefix of the user, if static IP address allocation is used. For the IPv6 prefix, the lower 64 bits of the address shall be set to zero.

5.1.2.8 QoS-Class-Identifier

The QoS-Class-Identifier AVP is of type Enumerated defined in 3GPP TS 29.212, and it identifies a set of IP-CAN specific QoS parameters that define the authorized QoS, excluding the applicable bitrates for the IP-CAN bearer or service flow.

5.1.2.9 RAT-Type

The RAT-Type AVP is of type Enumerated defined in 3GPP TS 29.212 and is used to identify the radio access technology that is serving the UE.

5.1.2.10 Allocation-Retention-Priority

The Allocation-Retention-Priority AVP is of type Grouped defined in 3GPP TS 29.212. It indicates Priority of Allocation and Retention for the corresponding Access Point Name (APN) configuration within the Priority-Level AVP. The Data field of this AVP has the following ABNF grammar:

```
Allocation-Retention-Priority ::= <AVP Header: 1034 ,
                                   Vendor-Id: 10415>
                                   { Priority-Level }
                                   * [ AVP ]
```



5.1.2.11 **Priority-Level**

The Priority-Level AVP is of type Unsigned 32 defined in 3GPP TS 29.212. The priority level defines the relative importance of a resource request.

The AVP is used for deciding whether a bearer establishment or modification request can be accepted or needs to be rejected in case of resource limitations. The AVP can also be used to decide which existing bearers to pre-empt during resource limitations. The priority level defines the relative importance of a resource request. Values 1 to 15 are defined, with value 1 as the highest level of priority.

5.1.2.12 **Pre-emption-Capability**

The Pre-emption-Capability AVP is of type Enumerated defined in 3GPP TS 29.212. The AVP defines whether a service data flow can get resources that were already assigned to another service data flow with a lower priority level. The following values are defined:

PRE-EMPTION_CAPABILITY_ENABLED (0)

This value indicates that the service data flow is allowed to get resources that were already assigned to another service data flow with a lower priority level.

PRE-EMPTION_CAPABILITY_DISABLED (1)

This value indicates that the service data flow is not allowed to get resources that were already assigned to another service data flow with a lower priority level. This is the default value applicable if this AVP is not provided.

5.1.2.13 **Pre-emption-Vulnerability**

The Pre-emption Vulnerability AVP is of type Enumerated defined in 3GPP TS 29.212. The AVP defines whether a service data flow can lose the resources assigned to it in order to admit a service data flow with higher priority level. The following values are defined:

PRE-EMPTION_VULNERABILITY_ENABLED (0)

This value indicates that the resources assigned to the service data flow can be pre-empted and allocated to a service data flow with a higher priority level. This is the default value applicable if this AVP is not provided.

PRE-EMPTION_VULNERABILITY_DISABLED (1)

This value indicates that the resources assigned to the service data flow shall not be pre-empted and allocated to a service data flow with a higher priority level.

5.1.2.14 Terminal-Information

The Terminal-Information AVP is of type Grouped defined in 3GPP TS 29.272. This AVP contains the information about the user's terminal.

The Data field of this AVP has the following ABNF grammar:

```
Terminal-Information ::= <AVP Header: 1401 , Vendor-Id: 10415>
                        [ IMEI ]
                        [3GPP2-MEID]
                        [Software-Version ]
                        *[ AVP ]
```

5.1.2.15 APN-Configuration

The APN-Configuration AVP is of type Grouped defined in 3GPP TS 29.272. It contains the information related to APN configuration for a single APN.

The Data field of this AVP has the following ABNF grammar:

```
APN-Configuration ::= <AVP Header: 1430 , Vendor-Id: 10415>
                      { Context-Identifier }
                      { Service-Selection }
                      { PDN-Type }
                      *2 [ Served-Party-IP-Address ]
                      [MIP6-Agent-Info]
                      [Visited-Network-Identifier]
                      [PDN-GW-Allocation-Type]
                      [ EPS-Subscribed-QoS-Profile ]
                      [ VPLMN-Dynamic-Address-Allowed ]
                      [ 3GPP-Charging-Characteristics ]
                      [ AMBR ]
                      * [Specific-APN-Info]
                      * [ AVP ]
```

5.1.2.16 IMEI

The IMEI AVP is of type UTF8String defined in 3GPP TS 29.272. This AVP contains the International Mobile Equipment Identity.

5.1.2.17 Software-Version

The Software-Version AVP is of type UTF8String. This AVP defined in 3GPP TS 29.272, contains the Software Version of the International Mobile Equipment Identity.



5.1.2.18 Context-Identifier

The Context-Identifier AVP is of type Unsigned32 defined in 3GPP TS 29.272 and uniquely identifies an EPS APN configuration within a user subscription.

5.1.2.19 APN-OI-Replacement

The APN-OI-Replacement AVP is of type UTF8String defined in 3GPP TS 29.272. This AVP Indicates the domain name to replace the APN Operator Identifier (OI) when constructing the Packet Data Network (PDN) Gateway (GW) Fully Qualified Domain Name (FQDN) upon which to perform a Domain Name System (DNS) resolution. The contents of the APN-OI-Replacement AVP are formatted as a character string composed of one or more labels separated by dots (“.”).

5.1.2.20 EPS-Subscribed-QoS-Profile

The EPS-Subscribed-QoS-Profile AVP is of type Grouped defined in 3GPP TS 29.272 and contains the bearer-level QoS parameters (QoS Class Identifier and Allocation Retention Priority) associated to the default bearer for an APN. See Reference 3GPP TS 29.272.

The Data field of this AVP has the following ABNF grammar:

```
EPS-Subscribed-QoS-Profile ::= <AVP Header: 1431, Vendor-Id: 10415>
                               { QoS-Class-Identifier }
                               { Allocation-Retention-Priority }
                               * [ AVP ]
```

5.1.2.21 VPLMN-Dynamic-Address-Allowed

The VPLMN-Dynamic-Address-Allowed AVP is of type Enumerated defined in 3GPP TS 29.272. It indicates whether the UE is allowed to use a dynamic address allocated in the Visited PLMN (VPLMN). The following values are defined:

Table 8 VPLMN-Dynamic-Address-Allowed AVP

AVP Value	Description
0	NOT ALLOWED
1	ALLOWED

5.1.2.22 AMBR

The AMBR AVP is of type Grouped defined in 3GPP TS 29.212 and contains AVPs that indicate the aggregate maximum bitrates requested for the uplink and downlink bandwidth.

The Data field of this AVP has the following ABNF grammar:

```
AMBR ::= <AVP Header: 1435 , Vendor-Id:10415>
        { Max-Requested-Bandwidth-UL }
        { Max-Requested-Bandwidth-DL }
        * [ AVP ]
```

5.1.2.23 PDN-GW-Allocation-Type

The PDN-GW-Allocation-Type AVP is of type Enumerated defined in 3GPP TS 29.212 and indicates whether the PDN GW address is statically allocated or dynamically selected by other nodes.

The following values are defined:

Table 9 PDN-GW-Allocation-Type AVP

AVP Value	Description
0	STATIC
1	DYNAMIC

5.1.2.24 PDN-Type

The PDN-Type AVP is of type Enumerated defined in 3GPP TS 29.272 and indicates the address type of PDN. The following values are defined:

Table 10 PDN-Type AVP

AVP value	Description
0	IPv4: This value shall be used to indicate that the PDN can be accessed only in IPv4 mode.
1	IPv6: This value shall be used to indicate that the PDN can be accessed only in IPv6 mode.
2	IPv4v6: This value shall be used to indicate that the PDN can be accessed both in IPv4 mode, in IPv6 mode, and also from UEs supporting dualstack IPv4v6.
3	IPv4_OR_IPv6: This value shall be used to indicate that the PDN can be accessed either in IPv4 mode, or in IPv6 mode, but not from UEs supporting dualstack IPv4v6.



5.1.2.25 **3GPP2-MEID**

The 3GPP2-MEID AVP is of type OctetString defined in 3GPP TS 29.272. This AVP contains the Mobile Equipment Identifier of the user's terminal.

5.1.2.26 **Specific-APN-Info**

The Specific-APN-Info AVP is of type Grouped defined in 3GPP TS 29.272. It shall only be present in the APN configuration when the APN is a wild card APN. It shall contain the APN which is not present in the subscription context but the UE is authorized to connect to and the identity of the registered PDN-GW and optionally the PLMN Id of the PDN GW.

```
Specific-APN-Info ::= <AVP Header : 1472, Vendor Id: 10415>
                        {Service-Selection}
                        [MIP6-Agent-Info]
                        [Visited-Network-Identifier]
                        * [AVP]
```

5.1.2.27 **AN-Trusted**

The AN-Trusted AVP is of type Enumerated defined in 3GPP TS 29.273. The AN-Trusted AVP sent from the 3GPP AAA Server to the Non-3GPP access network conveys the decision about the access network being trusted or untrusted by the HPLMN.

The following values are defined:

TRUSTED (0)

This value is used when the non-3GPP IP access network is to be handled as trusted.

UNTRUSTED (1)

This value is used when the non-3GPP IP access network is to be handled as untrusted.

5.1.2.28 **ANID**

The ANID AVP is of type UTF8String defined in 3GPP TS 29.212 and contains the Access Network Identity. It is used for key derivation function when the authentication method is EAP-AKA'. See Reference 3GPP TS 24.302 for possible values.

5.1.2.29 **Feature-List-ID**

The Feature-List-ID AVP is of type Unsigned32 defined in 3GPP TS 29.229, and it contains the identity of a feature list.

5.1.2.30 Feature-List

The Feature-List AVP is of type Unsigned32 defined in 3GPP TS 29.229, and it contains a bit mask indicating the supported features of an application. When the bit set, indicates the corresponding feature is supported by the application.

5.1.2.31 AAA-Failure-Indication

The AAA-Failure-Indication AVP is of type Unsigned32 and it shall contain a bitmask.

Table 11 shows the meaning of the bits:

Note: Bits not defined in this table must be cleared by the sender and discarded by the receiver.

Table 11 AAA-Failure-Indication

Bit	Name	Description
0	AAA Failure	This bit, when set, indicates that a previously assigned 3GPP AAA Server is unavailable.

5.1.2.32 Trace-Info

The Trace-Info AVP is of type Grouped. This AVP shall contain the information related to subscriber and equipment trace function and the required action, i.e. activation of deactivation.

The AVP Data field has the following ABNF grammar:

```
Trace-Info ::= <AVP header: 1505 10415>
               [Trace-Data]
               [Trace-Reference]
               * [AVP]
```

Either the Trace-Data or the Trace-Reference AVP shall be included. When trace activation is needed, Trace-Data AVP shall be included, while the trace deactivation request shall be signalled by including the Trace-Reference directly under the Trace-Info. The Trace-Reference AVP is of type OctetString. The Diameter AVP is defined in 3GPP TS 29.272.

5.1.2.33 Trace-Data

The Trace-Data AVP is of type Grouped. The Diameter AVP is defined in 3GPP TS 29.272. This AVP shall contain the information related to trace function.

The AVP Data field has the following ABNF grammar:

```
Trace-Data ::= <AVP header: 1458 10415>
               {Trace-Reference}
               {Trace-Depth}
               {Trace-NE-Type-List}
```

[Trace-Interface-List]
{Trace-Event-List}
[OMC-Id]
{Trace-Collection-Entity}
* [AVP]

5.1.2.34

Trace-Reference

The Trace-Reference AVP is of type OctetString.

This AVP shall contain the concatenation of MCC, MNC and Trace ID, where the Trace ID is a 3 byte Octet String.

Table 12 shows the content of this AVP shall be encoded as octet strings:

Table 12 Trace-Reference

8	7	6	5	4	3	2	1	
MCC digit 2				MCC digit 1				octet 1
MNC digit 3				MCC digit 3				octet 2
MNC digit 2				MNC digit 1				octet 3
Trace ID								octet 4
								octet 5
								octet 6

5.1.2.35

Trace-Depth

The Trace-Depth AVP is of type Enumerated. The possible values are those defined in 3GPP TS 32.422 for Trace Depth.

Trace depth shall be an enumerated parameter with the following possible values:

0	Minimum
1	Medium
2	Maximum
3	MinimumWithoutVendorSpecificExtension
4	MediumWithoutVendorSpecificExtension
5	MaximumWithoutVendorSpecificExtension

5.1.2.36 Trace-NE-Type-List

The Trace-NE-Type-List AVP is of type OctetString. Octets are coded according to 3GPP TS 32.422.

The Network Element types are listed as follows:

- MSC Server
- MGW
- RNC
- SGSN
- GGSN
- BM-SC
- MME
- SGW
- PDN GW
- eNB

5.1.2.37 Trace-Interface-List

The Trace-Interface-List AVP is of type OctetString. Octets are coded according to 3GPP TS 32.422.

5.1.2.38 Trace-Event-List

The Trace-Event-List AVP is of type OctetString. Octets are coded according to 3GPP TS 32.422.

5.1.2.39 OMC-Id

The OMC-Id AVP is of type OctetString. Octets are coded according to 3GPP TS 29.002

5.1.2.40 Trace-Collection-Entity

The Trace-collection-Entity AVP is of type Address and contains the IPv4 or IPv6 address of the Trace Collection Entity, as defined in 3GPP TS 32.422.



5.2 EAP and EAP-AKA' Messages

5.2.1 EAP Message

5.2.1.1 EAP-Response/Identity Message

EAP Response message's data type is `Identity`, and the user identity is carried in the data value.

5.2.1.2 EAP-Success

EAP Success message does not have any EAP data carried.

5.2.1.3 EAP-Failure

EAP Failure message does not have any EAP data carried.

5.2.2 EAP-AKA' Message

The following table provides a guide to which attributes may be found in which kinds of messages, and in what quantity. Messages are denoted with numbers in parentheses as follows:

- 1 EAP-Request/AKA-Identity
- 2 EAP-Response/AKA-Identity
- 3 EAP-Request/AKA-Challenge
- 4 EAP-Response/AKA-Challenge
- 5 EAP-Request/AKA-Notification
- 6 EAP-Response/AKA-Notification
- 7 EAP-Response/AKA-Client-Error
- 8 EAP-Request/AKA-Reauthentication
- 9 EAP-Response/AKA-Reauthentication
- 10 EAP-Response/AKA-Authentication-Reject
- 11 EAP-Response/AKA-Synchronization-Failure

The column denoted with "E" indicates whether the attribute is a nested attribute that **MUST** be included within `AT_ENCR_DATA`:

- "0" indicates that the attribute **MUST NOT** be included in the message;

- "1" indicates that the attribute MUST be included in the message;
- "0-1" indicates that the attribute is sometimes included in the message
- "0*" indicates that the attribute is not included in the message in cases specified in this document, but MAY be included in the future versions of the protocol.

Table 13 EAP Attributes

Attribute	1	2	3	4	5	6	7	8	9	10	11	E
AT_PERM ANENT_ID _REQ	0-1											N
AT_IDENTI TY		0-1										N
AT_RAND			1									N
AT_AUTN			1									N
AT_RES				1								N
AT_AUTS									1			N
AT_NEXT PSEUDON YM			0-1									Y
AT_IV			0-1	0*	0-1	0-1						N
AT_ENCR_ DATA			0-1	0*	0-1	0-1						N
AT_PADDI NG			0-1	0*	0-1	0-1						Y
AT_CHEC KCODE			0-1	0-1								N
AT_RESUL T_IND			0-1	0-1								N
AT_MAC			1	1	0-1	0-1						N
AT_COUN TER					0-1	0-1		1	1			Y
AT_COUN TER_TOO_ SMALL									0-1			Y
AT_NONC E_S								1				Y
AT_NOTIFI CATION					1							N
AT_CLIEN T_ERROR _CODE							1					N
AT_KDF_I NPUT			1	0-1								N
AT_KDF			1	0-1								N



6 Error Handling

6.1 Diameter Error Handling

Table 14 Diameter Error Handling

Error Scenario	Return Code
Diameter message check according to dictionary	DIAMETER_AVP_UNSUPPORTED(5001) + Failed-AVP DIAMETER_INVALID_AVP_VALUE(5004) + Failed-AVP DIAMETER_MISSING_AVP(5005) + Failed-AVP DIAMETER_AVP_NOT_ALLOWED(5008) DIAMETER_AVP_OCCURS_TOO_MANY_TIMES(5009) DIAMETER_UNSUPPORTED_VERSION(5011)
Missing mandatory AVP required by the 3GPP TS, for example, the User-Name AVP in the DER message	Result-Code = "DIAMETER_MISSING_AVP", Failed-AVP should be set with missing AVP.
In the initial authentication DER message, the check of RAT-Type and ANID is wrong	Result-Code = "DIAMETER_UNABLE_TO_COMPLY"
HSS return DIAMETER_ERROR_USER_UNKNOWN	Experimental-Result-Code = "DIAMETER_ERROR_USER_UNKNOWN"
HSS return DIAMETER_ERROR_USER_NO_NON_3GPP_SUBSCRIPTION	Experimental-Result-Code = "DIAMETER_ERROR_USER_NO_NON_3GPP_SUBSCRIPTION"
HSS return DIAMETER_ERROR_ROAMING_NOT_ALLOWED	Experimental-Result-Code = "DIAMETER_ERROR_ROAMING_NOT_ALLOWED"
HSS return DIAMETER_ERROR_IDENTITY_ALREADY_REGISTERED	Result-Code = "DIAMETER_REDIRECT_INDICATION"
HSS return other errors	Result-Code = "DIAMETER_UNABLE_TO_COMPLY"
For re-authentication & re-authorization, User-Name or Identity is not belonged to the same session	Experimental-Result-Code = "DIAMETER_ERROR_USER_UNKNOWN"
For re-authentication & re-authorization, RAT-Type and ANID is not belonged to the same session	Result-Code = "DIAMETER_UNABLE_TO_COMPLY"
For re-authorization, session is not found in AAA server	Result-Code = "DIAMETER_UNKNOWN_SESSION_ID"
For re-authorization, user is not belong to the same session	Experimental-Result-Code = "DIAMETER_ERROR_USER_UNKNOWN"
For re-authorization, user profile is not found in AAA server	Result-Code = "DIAMETER_AUTHORIZATION_REJECTED"
For session termination, session is not found in AAA server	Result-Code = "DIAMETER_UNKNOWN_SESSION_ID"
For session termination, user is not belonged to the same session	Experimental-Result-Code = "DIAMETER_ERROR_USER_UNKNOWN"
Deregistration from the HSS failed	Result-Code = "DIAMETER_UNABLE_TO_COMPLY"

6.2 EAP Error Handling

Table 15 EAP Error Handling

EAP message length, code and type error	Result-Code = "DIAMETER_AUTHENTICATI ON_REJECTED", EAP-Payload should be set with the value from the request DER
Unknown subtype of EAP AKA' message	Discard the message
EAP AKA' message attribute error	AAA server MUST issue the EAP-Request/AKA'-Notification packet with an AT_NOTIFICATION code that implies failure (16384 or 0). The Result-Code should be set to DIAMETER_MULTI_ROUND_AUTH. If the EAP-Response/AKA'-Notification is received from the Trusted Non-3GPP Access Network, AAA server should send EAP-Failure message with code equals 4, the Result-Code of DEA message should be set to DIAMETER _AUTHENTICATION_REJECTED.
EAP-Response/Identity started with unknown digit(not '0', '2', '4', '6', '7', '8')	Result-Code = "DIAMETER_AUTHENTICATI ON_REJECTED", EAP-Payload should be set with the value from the request DER
Validating AT_MAC or AT_RES in EAP-Response/AKA'-Challenge message	Validating AT_MAC or AT_RES in EAP-Response/AKA'-Challenge message
AT_CHECKCODE error	AAA server MUST issue the EAP-Request/AKA'-Notification packet with an AT_NOTIFICATION code that implies failure (16384 or 0). The Result-Code should be set to DIAMETER_MULTI_ROUND_AUTH. If the EAP-Response/AKA'-Notification is received from the Trusted Non-3GPP Access Network, AAA server should send EAP-Failure message with code equals 4, the Result-Code of DEA message should be set to DIAMETER _AUTHENTICATION_REJECTED.
Receive EAP-Response/AKA'-Client-Error and EAP-Response/AKA'-Authentication-Reje ct from Access Network	AAA server sends EAP-Failure to the peer and the DEA Result-Code is DIAMETER_AU THENTICATION_REJECTED.
	For re-authentication, AAA server should send SAR message to HSS with the Server-Assignment-Type set to AUTHENTICATION_FAILURE
Receive EAP-Response/AKA'-Synchronizatio n-Failure from Access Network	The 3GPP AAA server should delete the old authentication vector and send MAR message to fetch new authentication vectors from HSS



Table 15 EAP Error Handling

The re-authentication failed (with the EAP-Failure returned to Non-3GPP Access Network)	AAA server should send SAR message to HSS with the Server-Assignment-Type set to AUTHENTICATION_FAILURE
The authentication using pseudonym identity is not supported and AAA server receives the pseudonym identity.	The AAA server should send EAP-Request/AKA'-Identity to request permanent identity.
The pseudonym identity is supported and AAA server can't parse or recognize it.	
The pseudonym identity is supported and the received pseudonym identity is out of date	
The authentication using fast re-authentication identity is not supported and AAA server receives the fast re-authentication identity.	The AAA server should send EAP-Request/AKA'-Identity to request permanent identity.
The fast re-authentication identity is supported and AAA server can't parse or recognize it.	
The fast re-authentication identity is supported and the received fast re-authentication identity is out of date	





7 Formal Syntax

Diameter Base Protocol RFC 3588 Reference [4] is used to describe messages and AVPs.





8 Related Standards

This section states the related standards and explains any deviations from them.

- 3GPP EPS AAA interfaces 3GPP TS 29.273 version 11.5.012.5.0
- Diameter Base Protocol RFC 3588
- Extensible Authentication Protocol Method for 3rd Generation Authentication and Key Agreement (EAP-AKA) RFC 4187
- Improved Extensible Authentication Protocol Method for 3rd Generation Authentication and Key Agreement (EAP-AKA') RFC 5448
- Extensible Authentication Protocol (EAP) RFC 3748
- Diameter Extensible Authentication Protocol (EAP) Application RFC 4072
- Universal Mobile Telecommunications System (UMTS); LTE; Architecture enhancements for non-3GPP accesses (3GPP TS 23.402 version 9.6.0 Release 9)





Reference List

IPWorks Library Documents

- [1] *Trademark Information*
- [2] *Glossary of Terms and Acronyms*
- [3] *Typographic Conventions*

Standards

- [4] [*Diameter Base Protocol RFC 3588*](#)
- [5] [*Extensible Authentication Protocol Method for 3rd Generation Authentication and Key Agreement \(EAP-AKA\) RFC 4187*](#)
- [6] [*Improved Extensible Authentication Protocol Method for 3rd Generation Authentication and Key Agreement \(EAP-AKA'\) RFC 5448*](#)
- [7] [*Extensible Authentication Protocol \(EAP\) RFC 3748*](#)
- [8] [*Diameter Extensible Authentication Protocol \(EAP\) Application RFC 4072*](#)
- [9] [*Universal Mobile Telecommunications System \(UMTS\); LTE3GPP EPS AAA interfaces; Evolved Packet System \(EPS\); \(3GPP TS 29.273 version 11.5.0 version 12.5.0\)*](#)
- [10] [*Universal Mobile Telecommunications System \(UMTS\); LTE; Architecture enhancements for non-3GPP accesses \(3GPP TS 23.402 version 9.6.0 Release 9\)*](#)