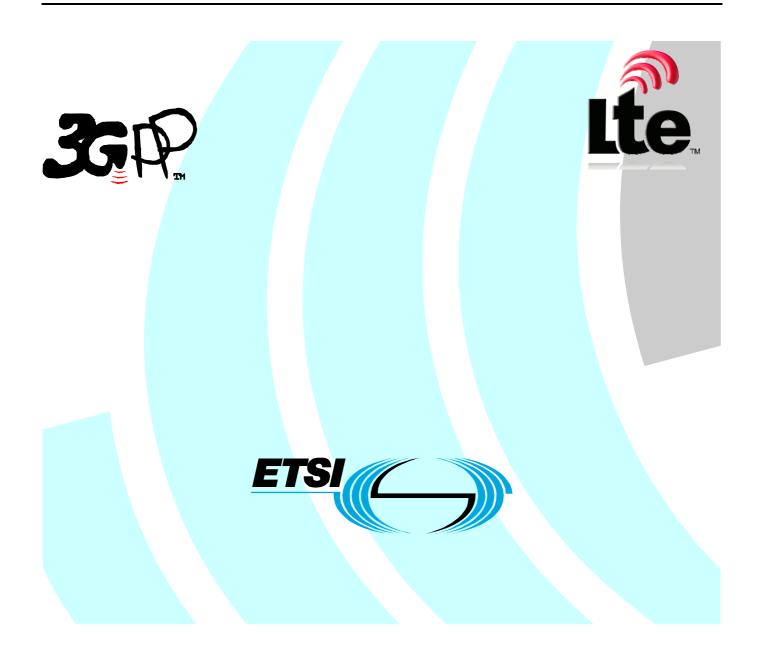# ETSI TS 129 272 V8.11.0 (2011-06)

Technical Specification

Universal Mobile Telecommunications System (UMTS); LTE; Evolved Packet System (EPS); Mobility Management Entity (MME) and Serving GPRS Support Node (SGSN) related interfaces based on Diameter protocol (3GPP TS 29.272 version 8.11.0 Release 8)

Reference

RTS/TSGC-0429272v8b0

Keywords

LTE, UMTS

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Foreword

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Contents

Foreword

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

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1   Scope

The present document describes the Mobility Management Entity (MME) and Serving GPRS Support Node (SGSN) related diameter-based interfaces towards the Home Subscriber Server (HSS), and the MME and the SGSN related diameter-based interface towards the Equipment Identity Register (EIR).

This specification defines the Diameter application for the MME-HSS, S6a reference point, and for the SGSN-HSS, S6d reference point. The interactions between the HSS and the MME/SGSN are specified, including the signalling flows.

This specification defines the Diameter application for the MME-EIR, S13 reference point, and for the SGSN-EIR, S13' reference point. The interactions between the MME/SGSN and the EIR are specified, including the signalling flows.

In this specification, if the there is no specific indication, the following principles apply:

-       "SGSN" refers to an SGSN which at least supports the S4 interface and may support Gn and Gp interfaces.

-       "S4-SGSN" refers to an SGSN which supports the S4 interface and does not support Gn and Gp interfaces.

-       Gn/Gp-SGSN refers to an SGSN which supports the Gn and Gp interfaces and does not support S4 interface.

The Evolved Packet System stage 2 description (architecture and functional solutions) is specified in 3GPP TS 23.401 [2] and in 3GPP TS 23.060 [12].

2   References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1]   3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2]   3GPP TS 23.401: "GPRS enhancements for E-UTRAN access ".

[3]   3GPP TS 23.003: "Numbering, addressing and identification".

[4]   IETF RFC 3588: "Diameter Base Protocol".

[5]   3GPP TS 33.401: "3GPP System Architecture Evolution: Security Architecture".

[6]   IETF RFC 4005: "Diameter Network Access Server Application".

[7]   IETF RFC 2234: "Augmented BNF for syntax specifications".

[8]   3GPP TS 32.299: "Charging management; Diameter charging applications".

[9]   3GPP TS 29.229: "Cx and Dx interfaces based on the Diameter protocol".

[10]   3GPP TS 29.212: "Policy and Charging Control over Gx reference point".

[11]   3GPP TS 29.214: "Policy and Charging Control over Rx reference point".

[12]   3GPP TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".

[13]   3GPP TS 22.016: "International Mobile station Equipment Identities (IMEI)".

[14] IETF RFC 4960: "Stream Control Transmission Protocol".

[15] Void

[16] 3GPP TS 33.210: "3G Security; Network Domain Security; IP Network Layer Security"..

[17] 3GPP TS 29.228: "IP multimedia (IM) Subsystem Cx and Dx Interfaces; Signalling flows and Message Elements".

[18] 3GPP TS 33.102: "3G Security; Security Architecture".

[19] 3GPP TS 36.413: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP)".

[20] IETF RFC 5778: "Diameter Mobile IPv6: Support for Home Agent to Diameter Server Interaction".

[21] 3GPP TS 29.061: "Interworking between the Public Land Mobile Network (PLMN) supporting packet based services and Packet Data Networks (PDN)".

[22] 3GPP TS 32.298: "Charging Management; CDR parameter description".

[23] 3GPP TS 32.422: "Telecommunication management; Subscriber and equipment trace; Trace control and configuration management".

[24] 3GPP TS 29.002: "Mobile Application Part (MAP) specification".

[25] 3GPP TS 29.329: "Sh Interface based on the Diameter protocol".

[26] IETF RFC 5447: "Diameter Mobile IPv6: Support for Network Access Server to Diameter Server Interaction".

[27] IETF RFC 4004: "Diameter Mobile IPv4 Application".

[28] 3GPP2 A.S0022: "Interoperability Specification (IOS) for Evolved High Rate Packet Data (eHRPD) Radio Access Network Interfaces and Interworking with Enhanced Universal Terrestrial Radio Access Network (E-UTRAN)".

[29] 3GPP TS 23.011: "Technical realization of Supplementary Services - General Aspects".

[30] 3GPP TS 23.008: "Organization of subscriber data".

[31] 3GPP TS 24.008: "Mobile radio interface Layer 3 specification; Core network protocols; Stage 3".

[32] IETF RFC 5516: "Diameter Command Code Registration for Third Generation Partnership Project (3GPP) Evolved Packet System (EPS)".

[33] 3GPP TS 32.251: "Telecommunication management; Charging management; Packet Switched (PS) domain charging".

[34] 3GPP TS 23.015:" Technical realization of Operator Determined Barring (ODB)"

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] apply.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

AVP	Attribute Value Pair
C	Conditional
EIR	Equipment Identity Register
HSS	Home Subscriber Server
IE	Information Element
M	Mandatory
MME	Mobility Management Entity
O	Optional
ODB	Operator Determined Barring
URRP-MME	User Reachability Request Parameter for MME

4 General Description

This document describes the S6a/S6d and S13/S13' interfaces related procedures, message parameters and protocol specifications.

The procedures, message parameters and protocol are similar between S6a and S6d. S6a is used for location changes of the MME, while S6d is for location changes of the SGSN. Refer to section 5 for the differences, especially section 5.2.1.

The procedures, message parameters and protocol are identical as for the S13 and S13'. See section 6 for details.

In the tables that describe the Information Elements transported by each Diameter command, each Information Element is marked as (M) Mandatory, (C) Conditional or (O) Optional in the "Cat." column. For the correct handling of the Information Element according to the category type, see the description detailed in section 6 of the 3GPP TS 29.228 [17].

5 MME – HSS (S6a) and SGSN – HSS (S6d)

5.1 Introduction

The S6a interface enables the transfer of subscriber related data between the MME and the HSS as described in the 3GPP TS 23.401 [2].

The S6d interface enables the transfer of subscriber related data between the SGSN and the HSS as described in 3GPP TS 23.060 [12].

5.2 Mobility Services

5.2.1 Location Management Procedures

5.2.1.1 Update Location

5.2.1.1.1 General

The Update Location Procedure shall be used between the MME and the HSS and between the SGSN and the HSS to update location information in the HSS. The procedure shall be invoked by the MME or SGSN and is used:

- to inform the HSS about the identity of the MME or SGSN currently serving the user, and optionally in addition;

- to update MME or SGSN with user subscription data;

- to provide the HSS with other user data, such as Terminal Information.

This procedure is mapped to the commands Update-Location-Request/Answer (ULR/ULA) in the Diameter application specified in chapter 7.

Table 5.2.1.1.1/1 specifies the involved information elements for the request.

Table 5.2.1.1.1/2 specifies the involved information elements for the answer.

Table 5.2.1.1.1/1: Update Location Request

Information element name	Mapping to Diameter AVP	Cat.	Description
IMSI	User-Name (See IETF RFC 3588 [4])	M	This information element shall contain the user IMSI, formatted according to 3GPP TS 23.003 [3], clause 2.2.
Supported Features (See 3GPP TS 29.229 [9])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.
Terminal Information (See 7.3.3)	Terminal-Information	O	This information element shall contain information about the user"s mobile equipment. Within this Information Element, only the IMEI and the Software-Version AVPs shall be used on the S6a/S6d interface.
ULR Flags (See 7.3.7)	ULR-Flags	M	This Information Element contains a bit mask. See 7.3.7 for the meaning of the bits.
Visited PLMN Id (See 7.3.9)	Visited-PLMN-Id	M	This IE shall contain the MCC and the MNC, see 3GPP TS 23.003[3]. It may be used to apply roaming based features.
RAT Type (See 7.3.13)	RAT-Type	M	This Information Element contains the radio access type the UE is using. See section 7.3.13 for details.
SGSN number (See 7.3.102)	SGSN-Number	C	This Information Element contains the ISDN number of the SGSN, see 3GPP TS 23.003 [3]. It shall be present when the message is sent on the S6d interface and the SGSN supports LCS or SMS functionalities.

Table 5.2.1.1.1/2: Update Location Answer

Information element name	Mapping to Diameter AVP	Cat.	Description
Supported Features (See 3GPP TS 29.229 [9])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.
Result (See 7.4)	Result-Code / Experimental-Result	M	This IE shall contain the result of the operation. The Result-Code AVP shall be used to indicate success / errors as defined in the Diameter Base Protocol. The Experimental-Result AVP shall be used for S6a/S6d errors. This is a grouped AVP which shall contain the 3GPP Vendor ID in the Vendor-Id AVP, and the error code in the Experimental-Result-Code AVP. The following errors are applicable: - User Unknown - Unknown EPS Subscription - RAT Not Allowed - Roaming Not Allowed
ULA-Flags (See 7.3.8)	ULA-Flags	C	This Information Element contains a bit mask. See 7.3.8 for the meaning of the bits. It shall be present only when the Result-Code AVP is DIAMETER_SUCCESS.
Subscription Data (See 7.3.2)	Subscription-Data	C	This Information Element shall contain the complete subscription profile of the user. It shall be present if success is reported, unless an explicit "skip subscriber data" indication was present in the request.

5.2.1.1.2 Detailed behaviour of the MME and the SGSN

The MME shall make use of this procedure to update the MME identity stored in the HSS (e.g. at initial attach, inter MME tracking area update or radio contact after HSS reset).

The SGSN shall make use of this procedure to update the SGSN identity stored in the HSS (e.g. at initial attach, inter SGSN routing area update or radio contact after HSS reset).

If the Update Location request is to be sent due to an inter node (SGSN to MME) update and the previous SGSN is a Gn/Gp SGSN, the MME shall set the "Single-Registration-Indication" flag in the ULR-Flags information element in the request.

If the Update Location request is to be sent due to an initial attach, the MME or SGSN shall set the "Initial-Attach-Indicator" flag in the ULR-Flags information element in the request.

A combined MME/SGSN shall set the "Skip Subscriber Data" flag in the ULR-Flags if subscriber data are already available due to a previous location update.

A standalone MME shall not indicate its support for any SGSN specific features (such as LCS/SMS related features), and it shall not request explicitly the download of GPRS data (via the GPRS-Subscription-Data-Indicator flag; see clause 7.3.7).

For a standalone MME or SGSN, if EPS or GPRS subscription data is received, the standalone MME or SGSN shall replace all of the EPS or GPRS subscription data of the user in the MME or SGSN. Any optional EPS or GPRS data not received, but stored in the standalone MME or SGSN, shall be deleted.

For a combined MME/SGSN, if EPS subscription data of the user is received, it shall replace all of the EPS subscription data of the user. Any optional EPS data not received by the combined MME/ SGSN, but stored in the MME/SGSN, shall be deleted.

For a combined MME/SGSN, if GPRS subscription data of the user is received, it shall replace all of the GPRS subscription data of the user. Any optional GPRS data not received by the combined MME/ SGSN, but stored in the MME/SGSN, shall be deleted.

When receiving an Update Location response from the HSS, the MME or SGSN shall check the result code. If it indicates success the MME or SGSN shall store the received subscription profile (if any).

When receiving GPRS-Subscription-Data AVP in the response, the SGSN or combined MME/SGSN shall delete all the stored PDP-Contexts, if there are any, and then store all the received PDP-Contexts.

When receiving the APN-Configuration-Profile AVP in a ULA, the MME or SGSN shall delete all the stored APN-Configurations, if there are any, and then store all the received APN-Configurations.

For each of the received APN-Configurations in the APN-Configuration-Profile, if both the MIP6-Agent-Info and the PDN-GW-Allocation-Type AVPs are absent in the APN-Configuration AVP, the MME or SGSN shall perform the PGW selection (static or dynamic) according to the local configuration. If MIP6-Agent-Info is present, and PDN-GW-Allocation-Type is not present, this means that the PDN GW address included in MIP6-Agent-Info has been statically allocated.

If the subscription data received for a certain APN indicates that the APN was authorized as a consequence of having the Wildcard APN in the user subscription in HSS, then the MME shall not store this APN data beyond the lifetime of the UE session and the MME shall delete them upon disconnection of the UE.

If trace data are received in the subscriber data, the MME or SGSN shall start a Trace Session. For details, see 3GPP TS 32.422 [23].

5.2.1.1.3 Detailed behaviour of the HSS

When receiving an Update Location request the HSS shall check whether subscription data exists for the IMSI.

If the HSS determines that there is not any type of subscription for that IMSI (including EPS, GPRS and CS subscription data), a Result Code of DIAMETER_ERROR_USER_UNKNOWN shall be returned.

Otherwise if there is no EPS subscription data, the HSS shall return a Result Code of DIAMETER_ERROR_UNKNOWN_EPS_SUBSCRIPTION.

If the Update Location Request is received over the S6a interface, and the subscriber has not any APN configuration, the HSS shall return a Result Code of DIAMETER_ERROR_UNKNOWN_EPS_SUBSCRIPTION.

The HSS shall check whether the RAT type the UE is using is allowed. If it is not, a Result Code of DIAMETER_ERROR_RAT_NOT_ALLOWED shall be returned.

The HSS shall check whether roaming is not allowed in the VPLMN due to ODB. If so a Result Code of DIAMETER_ERROR_ROAMING_NOT_ALLOWED shall be returned.

If the Update Location Request is received over the S6a interface, the HSS shall send a Cancel Location Request with a Cancellation-Type of MME_UPDATE_PROCEDURE (CLR; see chapter 7.2.7) to the previous MME (if any) and replace the stored MME-Identity with the received value (the MME-Identity is received within the Origin-Host AVP). The HSS shall reset the "UE purged in MME" flag. If the "Single-Registration-Indication" flag was set in the received request, the HSS shall send a Cancel Location Request with a Cancellation Type of SGSN_UPDATE_PROCEDURE to the SGSN (MAP Cancel Location), and delete the stored SGSN address and SGSN number. If the "Initial-Attach-Indicator" flag was set in the received request, regardless of whether the "Single-Registration-Indication" flag is set, the HSS shall send a Cancel Location Request with a Cancellation-Type of INITIAL_ATTACH_PROCEDURE (CLR; see chapter 7.2.7, or MAP Cancel Location) to the SGSN if there is an SGSN registration.

If the Update Location Request is received over the S6d interface, the HSS shall send a Cancel Location Request with a Cancellation-Type of SGSN_UPDATE_PROCEDURE (CLR; see chapter 7.2.7, or MAP Cancel Location) to the previous SGSN (if any) and replace the stored SGSN-Identity with the received value (the SGSN-Identity is received within the Origin-Host AVP). The HSS shall reset the "UE purged in SGSN" flag. If the "Initial-Attach-Indicator" flag was set in the received request, the HSS shall send a Cancel Location Request with a Cancellation-Type of INITIAL_ATTACH_PROCEDURE (CLR; see chapter 7.2.7) to the MME if there is an MME registration.

When the HSS receives the Update Location Request, if a 15th digit of the IMEI AVP is received, the HSS may discard it.

If the Update Location Request is received over the S6a interface for a user for which the URRP-MME parameter is set in the HSS, the HSS shall clear the URRP-MME parameter and send an indication to the corresponding Service Related Entities.

If no result code has been sent to the MME or SGSN so far, the HSS shall include the subscription data in the ULA command according to the ULR-Flags and the supported/unsupported features of the MME or SGSN, unless an explicit "skip subscriber data" indication has been received in the request, and shall return a Result Code of DIAMETER_SUCCESS.

When the APN-Configuration-Profile AVP is present in the Subscription-Data AVP sent within a ULA, the AVP shall contain at least the default APN Configuration and a Context-Identifier AVP that identifies the per subscriber"s default APN configuration. The default APN Configuration shall not contain the Wildcard APN (see 3GPP TS 23.003 [3], clause 9.2); the default APN shall always contain an explicit APN.

The GPRS Subscription data (if available in the HSS) shall only be present in the ULA command if it was indicated by the serving node in the ULR-Flags AVP (see clause 7.3.7), or when the subscription data is returned by a Pre-Rel-8 HSS (via an IWF) or when the Update Location Request is received over the S6d interface and there is no EPS subscription data stored for the subscriber.

The HSS shall use the indication received in the GPRS-Subscription-Data-Indicator for future use in the subscriber data update procedures.

LCS-Info, Teleservice-List and Call-Barring-Infor-List data shall be included according to the list of supported features indicated by the serving node (see clause 7.3.10). The check of the LCS/SMS supported features, which are only applicable to SGSN, may be skipped if the HSS determines that the serving node is a standalone MME (see clause 7.3.7).

The HSS may use the indication received in the Node-Type-Indicator for future use in the subscriber data update procedures.

Subscriber-Status AVP shall be present in the Subscription-Data AVP when sent within a ULA. If the value "OPERATOR_DETERMINED_BARRING" is sent, the Operator-Determined-Barring AVP or HPLMN-ODB AVP shall also be present in the Subscription-Data AVP, or vice versa.

Access-Restriction-Data AVP shall be present within the Subscription-Data AVP sent within a ULA if at least one of the defined restrictions applies.

APN-OI-Replacement AVP may be present in the Subscription-Data AVP sent within a ULA.

The AMBR AVP shall be present in the Subscription-Data AVP when the APN-Configuration-Profile AVP is sent within a ULA (as part of the Subscription-Data AVP).

The EPS-Subscribed-QoS-Profile AVP and the AMBR AVP shall be present in the APN-Configuration AVP when the APN-Configuration AVP is sent in the APN-Configuration-Profile AVP and when the APN-Configuration-Profile AVP is sent within a ULA (as part of the Subscription-Data AVP).

For those APNs that have been authorized as a consequence of having the Wildcard APN in the user subscription, the HSS shall include the specific APN name and associated PDN-GW identity inside the APN context of the Wildcard APN. This indicates to the MME that the particular APN shall not be cached in the MME and it shall be deleted when the UE session is terminated.

If a Result Code of DIAMETER_SUCCESS is returned, the HSS shall set the Separation Indication in the response.

5.2.1.2 Cancel Location

5.2.1.2.1 General

The Cancel Location Procedure shall be used between the HSS and the MME and between the HSS and the SGSN to delete a subscriber record from the MME or SGSN. The procedure shall be invoked by the HSS and is used:

- to inform the MME or SGSN about the subscriber"s subscription withdrawal or

- to inform the MME or SGSN about an ongoing update procedure i.e. MME or SGSN change.

- to inform the MME or SGSN about an initial attach procedure.

This procedure is mapped to the commands Cancel-Location-Request/Answer (CLR/CLA) in the Diameter application specified in chapter 7.

Table 5.2.1.2.1/1 specifies the involved information elements for the request.

Table 5.2.1.2.1/2 specifies the involved information elements for the answer.

Table 5.2.1.2.1/1: Cancel Location Request

Information element name	Mapping to Diameter AVP	Cat.	Description
IMSI	User-Name (See IETF RFC 3588 [4])	M	This information element shall contain the user IMSI, formatted according to 3GPP TS 23.003 [3], clause 2.2.
Supported Features (See 3GPP TS 29.229 [9])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.
Cancellation Type (See 7.3.24)	Cancellation-Type	M	Defined values that can be used are: - MME-Update Procedure, - SGSN-Update Procedure, - Subscription Withdrawal, - Update Procedure_IWF, - Initial Attach Procedure.

Table 5.2.1.2.1/2: Cancel Location Answer

Information element name	Mapping to Diameter AVP	Cat.	Description
Supported Features (See 3GPP TS 29.229 [9])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.
Result (See 7.4)	Result-Code / Experimental-Result	M	The result of the operation. The Result-Code AVP shall be used to indicate success / errors as defined in the Diameter Base Protocol.

5.2.1.2.2 Detailed behaviour of the MME and the SGSN

When receiving a Cancel Location request the MME or SGSN shall check whether the IMSI is known.

If it is not known, a result code of DIAMETER_SUCCESS is returned.

If it is known, the MME or SGSN shall check the Cancellation Type and act accordingly. If a cancellation type of "Initial Attach Procedure" is received, the MME or SGSN shall not delete the subscription data. For details see 3GPP TS 23.401[2] and 3GPP TS 23.060[12]. Also in this case a result code of DIAMETER_SUCCESS is returned.

When a UE is served by a single combined MME/SGSN for both E-UTRAN and non-E-UTRAN access, the combined MME/SGSN shall check the Cancellation-Type. If it indicates Subscription Withdrawal or Update Procedure_IWF, the CLR is processed both in the MME part and in the SGSN part of the combined node. Otherwise, the CLR is processed only in the affected part of the combined node and subscription data are kept for the not affected part.

5.2.1.2.3 Detailed behaviour of the HSS

The HSS shall make use of this procedure when the subscriber"s subscription is withdrawn by the HSS operator and when the HSS detects that the UE has moved to a new MME or SGSN area.

The HSS shall include a cancellation type of "Subscription Withdrawal" if the subscriber"s subscription is withdrawn by the operator and shall include a cancellation type of "MME Update Procedure" if the UE moved to a new MME area and shall include a cancellation type of "SGSN Update Procedure" if the UE moved to a new SGSN area, and shall include a cancellation type of "Initial Attach Procedure" if the cancel location is initiated due to an Initial Attach from the UE.

5.2.1.3 Purge UE

5.2.1.3.1 General

The Purge UE Procedure shall be used between the MME and the HSS and between the SGSN and the HSS to indicate that the subscriber"s profile has been deleted from the MME or SGSN either by an MMI interaction or automatically, e.g. because the UE has been inactive for several days.

This procedure is mapped to the commands Purge-UE-Request/Answer (PUR/PUA) in the Diameter application specified in chapter 7.

Table 5.2.1.3.1/1 specifies the involved information elements for the request.

Table 5.2.1.3.1/2 specifies the involved information elements for the answer.

Table 5.2.1.3.1/1: Purge UE Request

Information element name	Mapping to Diameter AVP	Cat.	Description
IMSI	User-Name (See IETF RFC 3588 [4])	M	This information element shall contain user IMSI, formatted according to 3GPP TS 23.003 [3], clause 2.2.
Supported Features (See 3GPP TS 29.229 [9])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.

Table 5.2.1.3.1/2: Purge UE Answer

Information element name	Mapping to Diameter AVP	Cat.	Description
Supported Features (See 3GPP TS 29.229 [9])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.
Result (See 7.4)	Result-Code / Experimental-Result	M	This IE shall contain the result of the operation. The Result-Code AVP shall be used to indication success / errors as defined in the Diameter Base Protocol. The Experimental-Result AVP shall be used for S6a/S6d errors. This is a grouped AVP which shall contain the 3GPP Vendor ID in the Vendor-Id AVP, and the error code in the Experimental-Result-Code AVP. The following errors are applicable: - User Unknown
PUA-Flags (See 7.3.48)	PUA-Flags	C	This Information Element shall contain a bit mask. See section 7.3.48 for the meaning of the bits. It shall be present only when the Result-Code AVP is DIAMETER_SUCCESS.

5.2.1.3.2 Detailed behaviour of the MME and the SGSN

The MME shall make use of this procedure to set the "UE Purged in the MME" flag in the HSS when the subscription profile is deleted from the MME database due to MMI interaction or after long UE inactivity.

The SGSN shall make use of this procedure to set the "UE Purged in SGSN" flag in the HSS when the subscription profile is deleted from the SGSN database due to MMI interaction or after long UE inactivity.

The combined MME/SGSN shall make use of this procedure to set the "UE Purged in MME" and "UE Purged in SGSN" flags in the HSS when the subscription profile is deleted from the common MME/SGSN database due to MMI interaction or after long UE inactivity on all registered accesses.

When receiving a Purge UE response from the HSS the MME shall check the Result Code. If it indicates success, the MME shall check the PUA flag "freeze M-TMSI", and if set freeze the M-TMSI i.e. block it for immediate re-use.

When receiving a Purge UE response from the HSS the SGSN shall check the Result Code. If it indicates success, the SGSN shall check the PUA flag "freeze P-TMSI", and if set freeze the P-TMSI i.e. block it for immediate re-use.

When receiving a Purge UE response from the HSS the combined MME/SGSN shall check the Result Code. If it indicates success, the combined MME/SGSN shall check the PUA flag "freeze M-TMSI" and "freeze P-TMSI", and if set freeze the M-TMSI and/or the P-TMSI i.e. block it for immediate re-use.

5.2.1.3.3 Detailed behaviour of HSS

When receiving a Purge UE request the HSS shall check whether the IMSI is known.

If it is not known, a result code of DIAMETER_ERROR_USER_UNKNOWN shall be returned.

If it is known, the HSS shall set the result code to DIAMETER_SUCCESS and compare the received identity in the Origin-Host with the stored MME-Identity and/or with the stored SGSN-Identity.

If the received identity matches the stored MME-identity and the stored SGSN-Identity, the HSS shall set the PUA flags "freeze M-TMSI" and "freeze P-TMSI" in the answer message and set the flag "UE purged in MME" and set the flag "UE purged in SGSN"; If the received identity matches the stored MME-identity but not the stored SGSN-identity, the HSS shall set the PUA flag "freeze M-TMSI" and clear the PUA flag "freeze P-TMSI" in the answer message and set the flag "UE purged in MME";

If the received identity matches the stored SGSN-identity but not the stored MME-identity, the HSS shall set the PUA flag "freeze P-TMSI" and clear the PUA flag "freeze M-TMSI" in the answer message and set the flag "UE purged in SGSN";

If the received identity does not match the stored MME-identity and does not match the stored SGSN-identity, the HSS shall clear the PUA flags "freeze M-TMSI" and "freeze P-TMSI in the answer message.

5.2.2 Subscriber Data Handling Procedures

5.2.2.1 Insert Subscriber Data

5.2.2.1.1 General

The Insert Subscriber Data Procedure shall be used between the HSS and the MME and between the HSS and the SGSN for updating certain user data in the MME or SGSN in the following situations:

- due to administrative changes of the user data in the HSS and the user is now located in an MME or SGSN, i.e. if the user was given a subscription and the subscription has changed;

- the operator has applied, changed or removed Operator Determined Barring for this user;

- activate subscriber tracing in the MME or the SGSN;

- to indicate to the MME that the HSS has requested to be notified when the UE has become reachable.

If the Node-Type-Indicator information has been previously received as cleared in the ULR-Flags during update location procedure for the MME, the HSS may skip any change of the SMS/LCS-related subscription data and consequently does not have to make use of the Insert Subscriber Data procedure to update the subscription data in the MME.

This procedure is mapped to the commands Insert Subscriber Data-Request/Answer (IDR/IDA) in the Diameter application specified in chapter 7.

Table 5.2.2.1.1/1 specifies the involved information elements for the request.

Table 5.2.2.1.1/2 specifies the involved information elements for the answer.

Table 5.2.2.1.1/1: Insert Subscriber Data Request

Information element name	Mapping to Diameter AVP	Cat.	Description
IMSI	User-Name (See IETF RFC 3588 [4])	M	This information element shall contain the user IMSI, formatted according to 3GPP TS 23.003 [3], clause 2.2.
Supported Features (See 3GPP TS 29.229 [9])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.
Subscription Data (See 7.3.2)	Subscription-Data	M	This Information Element shall contain the part of the subscription profile that either is to be added to the subscription profile stored in the MME or SGSN or is replacing a part of the subscription profile stored in the MME or SGSN.
IDR Flags (See 7.3.103)	IDR-Flags	C	This Information Element shall contain a bit mask. See 7.3.103 for the meaning of the bits.

Table 5.2.2.1.1/2: Insert Subscriber Data Answer

Information element name	Mapping to Diameter AVP	Cat.	Description
Supported Features (See 3GPP TS 29.229 [9])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.
Result (See 7.4)	Result-Code / Experimental-Result	M	This IE shall contain the result of the operation. Result-Code AVP shall be used to indicate success / errors defined in the Diameter Base Protocol. The Experimental-Result AVP shall be used for S6a/S6d errors. This is a grouped AVP which shall contain the 3GPP Vendor ID in the Vendor-Id AVP, and the error code in the Experimental-Result-Code AVP. The following errors are applicable in this case: - User Unknown
IDA-Flags (See 7.3.47)	IDA-Flags	C	This Information Element shall contain a bit mask. See 7.3.47 for the meaning of the bits.

5.2.2.1.2   Detailed behaviour of the MME and the SGSN

When receiving an Insert Subscriber Data request the MME or SGSN shall check whether the IMSI is known.

If it is not known, a result code of DIAMETER_ERROR_USER_UNKNOWN shall be returned.

If it is known, the MME or SGSN shall replace the specific part of the stored subscription data with the received data, or shall add the received data to the stored data. This is accomplished by using the APN-Configuration-Profile AVP received in the IDR. The MME or SGSN shall check the ALL-APN-Configurations-Included-Indicator value. If it indicates "All_APN_CONFIGURATIONS_INCLUDED", the MME or SGSN shall delete all stored APN-Configurations and then store all received APN-Configurations. Otherwise, the MME or SGSN shall check the Context-Identifier value of each received APN-Configuration. If the Context-Identifier of a received APN-Configuration matches a Context-Identifier of a stored APN-Configuration, the MME or SGSN shall replace the stored APN-Configuration with the received APN-Configuration. If the Context-Identifier of a received APN-Configuration does not match a Context-Identifier of a stored APN-Configuration, the MME or SGSN shall add the received APN-Configuration to the stored APN-Configurations. If the addition or update of the subscription data succeeds in the MME or SGSN, the Result-Code shall be set to DIAMETER_SUCCESS. The MME or SGSN shall then acknowledge the Insert Subscriber Data message by returning an Insert Subscriber Data Answer.

For each of the received APN-Configurations in the APN-Configuration-Profile, if both the MIP6-Agent-Info and the PDN-GW-Allocation-Type AVPs are absent in the APN-Configuration AVP, the MME or SGSN shall perform the PGW selection (static or dynamic) according to the local configuration. If MIP6-Agent-Info is present, and PDN-GW-Allocation-Type is not present, this means that the PDN GW address included in MIP6-Agent-Info has been statically allocated.

If the MME is requested to notify the HSS when the UE becomes reachable, the MME shall set the URRP-MME parameter to indicate the need to inform the HSS about UE reachability, e.g. when the next NAS activity from the UE is detected.

When receiving GPRS-Subscription-Data AVP in the request, the SGSN or combined MME/SGSN shall check the Complete-Data-List-Included-Indicator value. If it indicates "All_PDP_CONTEXTS_INCLUDED", the SGSN or combined MME/SGSN shall delete all stored PDP-Contexts and then store all received PDP-Contexts. Otherwise, the SGSN or combined MME/SGSN shall check the Context-Identifier value of each received PDP-Context. If the Context-Identifier of a received PDP-Context matches a Context-Identifier of a stored PDP-Context, the SGSN or combined MME/SGSN shall replace the stored PDP-Context with the received PDP-Context. If the Context-Identifier of a received PDP-Context does not match a Context-Identifier of a stored PDP-Context, the SGSN or combined MME/SGSN shall add the received PDP-Context to the stored PDP-Contexts.

In addition, if due to regional subscription restrictions or access restrictions the entire SGSN area is restricted, SGSN shall report it to the HSS by returning the "SGSN Area Restricted" indication within the IDA flags.

When receiving HPLMN-ODB AVP, the SGSN shall replace stored HPLMN-ODB data (if any) with the received information rather than add the received information to the stored information. Unsupported Barring categories need not be stored.

When receiving Operator-Determined-Barring AVP the MME or SGSN shall replace stored ODB subscription information (if any) with the received information rather than add the received information to the stored information. Unsupported Barring categories need not be stored.

When receiving Access-Restriction-Data AVP within the Subscription-Data AVP the MME or SGSN shall replace stored information (if any) with received information rather than add received information to stored information.

When receiving APN-OI-Replacement AVP, the MME or SGSN shall replace the stored information (if any) with the received information.

When receiving Regional-Subscription-Zone-Code AVP within the Subscription-Data AVP the MME or SGSN shall replace stored Zone Codes (if any) with the received information rather than add the received information to the stored information. MMEs and SGSNs that do not support regional subscription need not store zone codes.

When receiving CSG-Subscription-Data AVP within the Subscription-Data AVP the MME or SGSN shall replace stored information (if any) with the received information rather than add the received information to the stored information.

When receiving Teleservice-List AVP, Call-Barring-Infor-List, or LCS-Info AVP, the MME or SGSN shall replace stored information (if any) with the received information rather than add the received information to the stored information.

If the MME or SGSN cannot fulfil the received request due to other reasons, e.g. due to a database error, it shall set Result-Code to DIAMETER_UNABLE_TO_COMPLY. In this case the MME or SGSN shall mark the subscription record "Subscriber to be restored in HSS".

If trace data are received in the subscriber data, the MME or SGSN shall start a Trace Session. For details, see 3GPP TS 32.422 [23].

5.2.2.1.3   Detailed behaviour of HSS

The HSS shall make use of this procedure to replace a specific part of the user data stored in the MME or SGSN with the data sent, or to add a specific part of user data to the data stored in the MME or SGSN.

Subscriber-Status AVP shall be present in the Subscription-Data AVP, sent within IDR, if the current value in the MME or SGSN needs to be changed. To remove all Operator Determined Barring Categories the Subscriber-Status shall be set to "SERVICE_GRANTED". If Subscriber-Status AVP is present and set to OPERATOR_DETERMINED_BARRING, the Operator-Determined-Barring AVP or HPLMN-ODB AVP shall also be present in the Subscription-Data AVP.

Access-Restriction-Data AVP shall be present within the Subscription-Data AVP send within an IDR if the information stored in the MME or SGSN needs to be modified.

APN-OI-Replacement AVP shall be present in the Subscription-Data AVP sent within an IDR, if the APN-OI-Replacement has been added or modified in the HSS.

The APN-Configuration-Profile AVP shall be present in the Subscription-Data AVP sent within an IDR if the Context-Identifier associated with the default APN configuration is changed or at least one APN-Configuration is added or modified by the HSS. If the default APN is changed in the HSS, the APN-Configuration-Profile AVP shall contain the Context-Identifier associated with the default APN and the APN-Configuration AVP for the default APN. The default APN Configuration shall not contain the Wildcard APN (see 3GPP TS 23.003 [3], clause 9.2); the default APN shall always contain an explicit APN.

The EPS-Subscribed-QoS-Profile AVP and the AMBR AVP shall be present in the APN-Configuration AVP when the APN-Configuration AVP is sent in the APN-Configuration-Profile AVP and when the APN-Configuration-Profile AVP is sent within a IDR (as part of the Subscription-Data AVP).

If the GPRS-Subscription-Data-Indicator information has been previously received as set in the ULR-Flags during update location procedure for the SGSN or combined MME/SGSN, the HSS shall make use of this procedure to replace the GPRS Subscription Data stored in the SGSN or combined MME/SGSN with the data sent or to add a PDP-Context to the data stored in the SGSN or combined MME/SGSN.

If the HSS receives a message from a Service Related Entity (e.g. IP-SM-GW) indicating that the UE is unreachable and if the URRP-MME parameter was not already set, the HSS shall set the URRP-MME parameter; if there is an MME registered, the HSS shall send an IDR command including the "UE Reachability Request flag" in the IDR Request Flags in order to request the MME to notify the HSS when the UE becomes reachable again, unless the HSS knows from the previous ULR command that the registered MME does not support UE reachability notifications. If the IDR is sent for the only purpose to request the MME about the UE reachability status notification, the Subscription-Data AVP shall be included empty.

All APN and PGW-ID pairs stored in the HSS not associated with an explicit APN subscription, (i.e. the access to that APN has been authorized as a consequence of having the Wildcard APN in the user subscription), shall be included by the HSS inside the APN context of the Wildcard APN, as multiple instances of the Specific-APN-Info AVP.

When receiving an Insert Subscriber Data answer with "SGSN Area Restricted" the HSS shall set the SGSN area restricted flag as "SGSN area restricted".

5.2.2.2 Delete Subscriber Data

5.2.2.2.1 General

This procedure shall be used between the MME and the HSS and between the SGSN and the HSS, to remove some or all data of the HSS user profile stored in the MME or SGSN. The procedure shall be invoked by the HSS and it corresponds to the functional level operation Delete Subscriber Data (see 3GPP TS 23.401[2]).

It shall be used to remove:

- all or a subset of the EPS subscription data (APN Configuration Profile) for the subscriber from the MME or SGSN;

- the regional subscription;

- the subscribed charging characteristics;

- Session Transfer Number for SRVCC;

- trace data.

If the Node-Type-Indicator information has been previously received as cleared in the ULR-Flags during update location procedure for the MME, the HSS may skip any removal of the SMS/LCS-related subscription data and consequently does not have to make use of the Delete Subscriber Data procedure to update the subscription data in the MME.

This procedure is mapped to the commands Delete-Subscriber-Data-Request/Answer (DSR/DSA) in the Diameter application specified in chapter 7.

Table 5.2.2.2.1/1 specifies the involved information elements for the request.

Table 5.2.2.2.1/2 specifies the involved information elements for the answer.

Table 5.2.2.2.1/1: Delete Subscriber Data Request

Information element name	Mapping to Diameter AVP	Cat.	Description
IMSI	User-Name (See IETF RFC 3588 [4])	M	This information element shall contain the user IMSI, formatted according to 3GPP TS 23.003 [3], clause 2.2.
Supported Features (See 3GPP TS 29.229 [9])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.
DSR Flags (See 7.3.25)	DSR-Flags	M	This Information Element shall contain a bit mask. See 7.3.25 for the meaning of the bits.
Trace Reference (See 7.3.64)	Trace-Reference	C	This parameter shall contain the same value as used for the activation of the Trace Session.\nThis element shall be present only if the "Trace Data Withdrawal" bit is set in the DSR-Flags.
Context Identifier (See 7.3.27)	Context-Identifier	C	This parameter shall identify the PDN subscription context or GPRS-PDP context that shall be deleted.\nThis element shall be present only if the "PDN subscription contexts Withdrawal" bit or the "PDP context withdrawal" bit is set in the DSR-Flags. In the "PDN subscription contexts Withdrawal" case, the Context-Identifier shall not be associated with the default APN configuration.\nFor the compatibility with the MAP protocol as defined in the 3GPP TS 29.002 [24], this parameter shall not have a value of zero.
TS Code List (See 7.3.100)	TS-Code	C	This parameter shall contain the teleservice codes that are to be deleted from the subscription.\nThis element shall be present only if the "SMS Withdrawal" bit is set in the DSR-Flags and the SMS related teleservice codes are to be deleted.
SS Code List (See 7.3.87)	SS-Code	C	This parameter shall contain the supplementary service codes that are to be deleted from the subscription.\nThis element shall be present only if the "SMS Withdrawal" bit is set or the "LCS Withdrawal" bit is set in the DSR-Flags.

Table 5.2.2.2.1/2: Delete Subscriber Data Answer

Information element name	Mapping to Diameter AVP	Cat.	Description
Supported Features (See 3GPP TS 29.229 [9])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.
Result (See 7.4)	Result-Code / Experimental-Result	M	This IE shall contain the result of the operation.\nThe Result-Code AVP shall be used to indicate success / errors as defined in the Diameter Base Protocol.\nThe Experimental-Result AVP shall be used for S6a/S6d errors. This is a grouped AVP which shall contain the 3GPP Vendor ID in the Vendor-Id AVP, and the error code in the Experimental-Result-Code AVP.\nThe following errors are applicable in this case:\n- User Unknown
DSA Flags (See 7.3.26)	DSA-Flags	C	This Information Element shall contain a bit mask. See 7.3.26 for the meaning of the bits.

5.2.2.2.2 Detailed behaviour of the MME and the SGSN

When receiving a Delete Subscriber Data request, the MME or SGSN shall check whether the IMSI is known.

If it is not known, a result code of DIAMETER_ERROR_USER_UNKNOWN shall be returned.

If it is known, but the Context-Identifier is associated with the default APN configuration, the MME shall not delete the PDN subscription context, and return an error with a Result-Code set to DIAMETER_UNABLE_TO_COMPLY. Otherwise, the MME or SGSN shall delete the corresponding data according to the indication as sent in the request, and acknowledge the Delete Subscriber Data message by returning a Delete Subscriber Data Answer.

If an MME receives a Delete Subscriber Data Request with the "Complete APN Configuration Profile Withdrawal" bit set in the DSR-Flags AVP, it shall return an error with a Result-Code set to DIAMETER_UNABLE_TO_COMPLY.

If the deletion of the subscription data succeeds in the MME or SGSN, the Result-Code shall be set to DIAMETER_SUCCESS.

If the Regional Subscription is deleted from the subscription data, the SGSN shall check for its routing areas whether they are allowed or not. If the entire SGSN area is restricted, SGSN shall report it to the HSS by returning the "SGSN Area Restricted" indication within the DSA flags.

If the EPS Subscription Data is deleted from the subscription data, the MME or SGSN shall check whether all EPS Subscription Data for the subscriber is deleted or if only a subset of the stored EPS Subscription Data for the subscriber is deleted, the MME or SGSN may then deactivate the associated affected active EPS bearers.

If the Subscribed Charging Characteristics are deleted from the subscription data, the Gn/Gp-SGSN shall maintain the existing Subscribed Charging Characteristics throughout the lifetime of the existing MM and PDP contexts, see 3GPP TS 32.251 [33].

If the Subscribed Charging Characteristics are deleted from the subscription data, the MME or S4-SGSN shall maintain the existing Subscribed Charging Characteristics throughout the lifetime of the existing IP CAN bearer, see 3GPP TS 32.251 [33].

If the MME or SGSN cannot fulfil the received request for other reasons, e.g. due to a database error, it shall set the Result-Code to DIAMETER_UNABLE_TO_COMPLY. In this case, the MME or SGSN shall mark the subscription record "Subscriber to be restored in HSS".

If trace data are deleted from the subscription data, the MME or SGSN shall deactivate the Trace Session identified by the trace reference. For details, see 3GPP TS 32.422 [23].

5.2.2.2.3 Detailed behaviour of the HSS

The HSS shall make use of this procedure to remove deleted subscription data from the MME or SGSN.

The HSS shall make use of this procedure to remove deleted GPRS Subscription Data from the SGSN or combined MME/SGSN if the GPRS-Subscription-Data-Indicator information has been previously received as set in the ULR-Flags during update location procedure for the MME.

The HSS shall not set the "Complete APN Configuration Profile Withdrawal" bit in the DSR-Flags AVP when sending a Delete Subscriber Data Request to an MME, since the default APN shall always be present in an MME.

When receiving a Delete Subscriber Data Answer with "SGSN Area Restricted" the HSS shall set the SGSN area restricted flag as "SGSN area restricted".

5.2.3 Authentication Procedures

5.2.3.1 Authentication Information Retrieval

5.2.3.1.1 General

The Authentication Information Retrieval Procedure shall be used by the MME and by the SGSN to request Authentication Information from the HSS.

This procedure is mapped to the commands Authentication-Information-Request/Answer (AIR/AIA) in the Diameter application specified in chapter 7.

Table 5.2.3.1.1/1 specifies the involved information elements for the request.

Table 5.2.3.1.1/2 specifies the involved information elements for the answer.

Table 5.2.3.1.1/1: Authentication Information Request

Information element name	Mapping to Diameter AVP	Cat.	Description
IMSI	User-Name (See IETF RFC 3588 [4])	M	This information element shall contain the user IMSI, formatted according to 3GPP TS 23.003 [3], clause 2.2.
Supported Features (See 3GPP TS 29.229 [9])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.
Requested E-UTRAN Authentication Info (See 7.3.11)	Requested-EUTRAN-Authentication-Info	C	This information element shall contain the information related to authentication requests for E-UTRAN.
Requested UTRAN/GERAN Authentication Info (See 7.3.12)	Requested-UTRAN-GERAN Authentication-Info	C	This information element shall contain the information related to authentication requests for UTRAN or GERAN.
Visited PLMN ID (See 7.3.9)	Visited-PLMN-ID	M	This IE shall contain the MCC and the MNC of the visited PLMN, see 3GPP TS 23.003 [3].

Table 5.2.3.1.1/2: Authentication Information Answer

Information element name	Mapping to Diameter AVP	Cat.	Description
Result (See 7.4)	Result-Code / Experimental-Result	M	This IE shall contain the result of the operation. This IE shall contain the Result-Code AVP shall be used to indicate success / errors as defined in the Diameter Base Protocol. The Experimental-Result AVP shall be used for S6a/S6d errors. This is a grouped AVP which shall contain the 3GPP Vendor ID in the Vendor-Id AVP, and the error code in the Experimental-Result-Code AVP. The following errors are applicable in this case: - User Unknown - Unknown EPS Subscription
Supported Features (See 3GPP TS 29.229 [9])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.
Authentication Info (See 7.3.17)	Authentication-Info	C	This IE shall contain the Authentication Vectors.

5.2.3.1.2 Detailed behaviour of the MME and the SGSN

The MME or SGSN shall make use of this procedure in order to retrieve the Authentication Vectors from the HSS.

If the request is triggered by a synchronization failure during E-UTRAN authentication, the MME or combined MME/SGSN shall include the Re-Synchronization Information in the Requested-EUTRAN-Authentication-Info AVP in the request.

If the request is triggered by a synchronization failure during UTRAN or GERAN authentication, the SGSN or combined MME/SGSN shall include the Re-Synchronization Information in the Requested-UTRAN-GERAN-Authentication-Info AVP in the request.

Re-Synchronization Information shall not be present in both the Requested-EUTRAN-Authentication-Info AVP and the Requested-UTRAN-GERAN-Authentication-Info AVP.

A stand alone MME shall include the Requested-EUTRAN-Authentication-Info AVP and shall not include the Requested-UTRAN-GERAN-Authentication-Info AVP in the request. The Immediate-Response-Preferred AVP should be present if a EUTRAN-Vector is needed for immediate use.

A stand alone SGSN shall not include the Requested-EUTRAN-Authentication-Info AVP and shall include the Requested-UTRAN-GERAN-Authentication-Info AVP in the request. The Immediate-Response-Preferred AVP should be present if a UTRAN/GERAN-Vector is needed for immediate use.

A combined MME/SGSN may include both the Requested-EUTRAN-Authentication-Info AVP and the Requested-UTRAN-GERAN-Authentication-Info AVP in the request. If both the Requested-EUTRAN-Authentication-Info AVP and the Requested-UTRAN-GERAN-Authentication-Info AVP are present in the request, the Immediate-Response-Preferred AVP shall be present if the requested authentication vectors are needed for immediate use. The content of the Immediate-Response-Preferred AVP shall correspond to the access type which the UE is currently to be authenticated. The Immediate-Response-Preferred AVP shall not be present in both the Requested-EUTRAN-Authentication-Info AVP and the Requested-UTRAN-GERAN-Authentication-Info AVP. The presence of an Immediate-Response-Preferred AVP shall indicate that a vector is needed for immediate use.

When EUTRAN-AVs and UTRAN-AVs or GERAN-AVs are requested, presence of Immediate-Response-Preferred AVP within the Requested-EUTRAN-Authentication-Info AVP shall indicate that EUTRAN-AVs are requested for immediate use in the MME/SGSN; presence of Immediate-Response-Preferred AVP within the Requested-UTRAN-GERAN-Authentication-Info AVP shall indicate that UTRAN-AVs or GERAN-AVs are requested for immediate use in the MME/SGSN. It may be used by the HSS to determine the number of vectors to be obtained from the AuC and the number of vectors downloaded to the MME or SGSN.

When receiving an Authentication Information response from the HSS, the MME or SGSN shall check the Result Code. If it indicates success and Authentication Information is present in the result, the MME or SGSN shall use the received vectors. For details see 3GPP TS 33.401 [5].

Vectors with lower Item Number should be used before Vectors with higher Item Number are used in the MME or SGSN. For Vectors received within different requests those received by the earlier request should be used before those received by the later request.

5.2.3.1.3 Detailed behaviour of the HSS

When receiving an Authentication Information request the HSS shall check whether subscription data exists for the IMSI.

If the HSS determines that there is not any type of subscription for the IMSI (including EPS, GPRS and CS subscription data), a result code of DIAMETER_ERROR_USER_UNKNOWN shall be returned.

Otherwise if there is no EPS or GPRS subscription, the HSS shall return a result code of DIAMETER_ERROR_UNKNOWN_ EPS_SUBSCRIPTION.

The HSS shall then request the AuC to generate the corresponding requested Authentication Vectors (AVs). Subject to load considerations and/or other implementation specific considerations which may be based on the presence of an Immediate-Response-Preferred AVP, less AVs than the requested number of AVs may be generated.

If EUTRAN-Authentication-Info is requested, when receiving AVs from the AuC, the HSS shall generate the KASME before sending the response to the MME or combined MME-SGSN.

If an Immediate-Response-Preferred AVP is present in the Request but the AuC is unable to calculate any corresponding AVs due to unallowed attachment for the UE, e.g. the UE is attaching via E-UTRAN with a SIM card equipped, the HSS shall return an error DIAMETER_AUTHORIZATION_REJECTED, the HSS shall not return any AV to the requesting node in the response. Otherwise, if no corresponding pre-computed AV is available, and the AuC is unable to calculate any corresponding AVs due to unknown failures, such as the internal database error, the result code shall be set to DIAMETER_AUTHENTICATION_DATA_UNAVAILABLE. The MME or the SGSN may request authentication vectors again.

For details see 3GPP TS 33.401 [5]. KASME generation is not performed before sending the response to the SGSN.

If the Requested-EUTRAN-Authentication-Info AVP is present in the request, the HSS shall download E-UTRAN authentication vectors to the MME. If the Requested-UTRAN-GERAN-Authentication-Info AVP is present in the request, the HSS shall download UTRAN or GERAN authentication vectors to the SGSN.

If the Immediate Response Preferred parameter has been received, the HSS may use it together with the number of requested vectors and the number of vectors stored in the HSS that are pre-computed to determine the number of vectors to be obtained from the AuC. The HSS may return less number of vectors than requested to the MME or SGSN. If both the Requested-EUTRAN-Authentication-Info AVP and the Requested-UTRAN-GERAN-Authentication-Info AVP are in the request, and one of them includes the Immediate Response Preferred parameter, the HSS may omit the vectors request that are not for immediate use. KASME is always computed for each E-UTRAN vector due to the PLMN-binding before sending the response to the MME independent of the presence of the Immediate Response Preferred parameter.

If the Re-Synchronization-Info AVP has been received, the HSS shall check the AUTS parameter before sending new authentication vectors to the MME or the SGSN. For details see 3GPP TS 33.102 [18]. If both the Requested-EUTRAN-Authentication-Info AVP and the Requested-UTRAN-GERAN-Authentication-Info AVP are in the request, and both of them include the Re-Synchronization-Info AVP, the HSS shall not check the AUTS parameter and return the result code of DIAMETER_UNABLE_TO_COMPLY. Any authentication vectors shall not be sent by the HSS to the requesting node in the response.

If more than one EPS or UTRAN or GERAN Vector is to be included within one Authentication-Info AVP, the Item-Number AVP shall be present within each Vector.

The HSS shall then return the result code DIAMETER_SUCCESS and the generated AVs (if any) to the MME or SGSN.

5.2.4 Fault Recovery Procedures

5.2.4.1 Reset

5.2.4.1.1 General

The Reset Procedure shall be used by the HSS, after a restart, to indicate to the MME and to the SGSN that a failure has occurred.

This procedure is mapped to the commands Reset-Request/Answer (RSR/RSA) in the Diameter application specified in chapter 7.

Table 5.2.4.1.1/1 specifies the involved information elements for the request.

Table 5.2.4.1.1/2 specifies the involved information elements for the answer.

Table 5.2.4.1.1/1: Reset Request

Information element name	Mapping to Diameter AVP	Cat.	Description
User Id List (See 7.3.50)	User-Id	O	This IE shall contain a list of User-Ids where a User-Id comprises the leading digits of an IMSI (i.e. MCC, MNC, leading digits of MSIN) and it shall identify the set of subscribers whose IMSIs begin with the User-Id. The HSS may include this information element if the occurred failure is limited to subscribers identified by one or more User-Ids.
Supported Features (See 3GPP TS 29.229 [9])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.

Table 5.2.4.1.1/2: Reset Answer

Information element name	Mapping to Diameter AVP	Cat.	Description
Supported Features (See 3GPP TS 29.229 [9])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.
Result (See 7.4)	Result-Code / Experimental-Result	M	This IE shall contain the result of the operation. The Result-Code AVP shall be used to indicate success / errors as defined in the Diameter Base Protocol. The Experimental-Result AVP shall be used for S6a/S6d errors. This is a grouped AVP which shall contain the 3GPP Vendor ID in the Vendor-Id AVP, and the error code in the Experimental-Result-Code AVP. There are no Experimental-Result codes applicable for this command.

5.2.4.1.2 Detailed behaviour of the MME and the SGSN

When receiving a Reset message the MME or SGSN shall mark all impacted subscriber records " Location Information Confirmed in HSS " as "Not Confirmed". The MME or SGSN shall make use of the HSS Identity received in the Origin-Host AVP and may make use of the received User-Id-List (if any) in order to determine which subscriber records are impacted.

At the next authenticated radio contact with the UE concerned, if the subscriber record "Location Information Confirmed in HSS" is marked as "Not Confirmed", the restoration procedure shall be triggered.

5.2.4.1.3 Detailed behaviour of the HSS

The HSS shall make use of this procedure in order to indicate to the MME and SGSN that the HSS has restarted and may have lost the current MME-Identity and SGSN-Identity of some of its subscribers who may be currently roaming in the MME area and SGSN area, and that the HSS, therefore, cannot send a Cancel Location messages or Insert Subscriber Data messages when needed.

The HSS optionally may include a list of Ids identifying a subset of subscribers served by the HSS, if the occurred failure is limited to those subscribers.

5.2.5 Notification Procedures

5.2.5.1 Notification

5.2.5.1.1 General

The Notification Procedure shall be used between the MME and the HSS and between the SGSN and the HSS when an inter MME or SGSN location update does not occur but the HSS needs to be notified about

- an update of terminal information;

The Notification Procedure shall also be used between the MME and the HSS and between the SGSN and the HSS if the HSS needs to be notified about:

- an assignment/change of a dynamically allocated PDN GW for an APN;

The Notification Procedure shall be used between the MME and the HSS when an inter MME location update does not occur but the HSS needs to be notified about

- the need to send a Cancel Location to the current SGSN.

The Notification Procedure shall be used between the SGSN and the HSS to notify the HSS about:

- the UE is present or the UE has memory capacity available to receive one or more short messages.

The Notification Procedure shall be used between the MME and the HSS to notify the HSS that:

- the UE has become reachable again.

This procedure is mapped to the commands Notify-Request/Answer (NOR/NOA) in the Diameter application specified in chapter 7.

Table 5.2.5.1.1/1 specifies the involved information elements for the request.

Table 5.2.5.1.1/2 specifies the involved information elements for the answer.

Table 5.2.5.1.1/1: Notify Request

Information element name	Mapping to Diameter AVP	Cat.	Description
IMSI	User-Name (See IETF RFC 3588 [4])	M	This information element shall contain the user IMSI, formatted according to 3GPP TS 23.003 [3], clause 2.2.
Supported Features (See 3GPP TS 29.229 [9])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.
Terminal Information (See 7.3.3)	Terminal-Information	C	This information element shall contain information about the user"s mobile equipment. When notifying the HSS about any change of Terminal Information, the MME or SGSN shall include the new Terminal Information in the request. Within this Information Element, only the IMEI and the Software-Version AVPs shall be used on the S6a/S6d interface.
PDN GW Identity (See 7.3.45)	MIP6-Agent-Info	C	This IE shall contain the identity of the selected and dynamically allocated PDN GW for an APN. It shall be present if a new PDN-GW has been selected and the subscriber is allowed handover to non 3GPP access. When notifying the HSS about a newly selected PDN GW, the MME or SGSN shall include the PDN-GW-Identity in the request.
PGW PLMN ID	Visited-Network-Identifier	C	This IE identifies the PLMN in which the PDN GW is located. It shall be present when the PDN GW Identity is present.
Context Identifier (See 7.3.27)	Context-Identifier	O	This parameter shall identify the APN for the selected PDN GW. It may be present if it is available and the selected PDN-GW is present and is particular for one specific APN and not common to all the APNs. For the compatibility with the MAP protocol as defined in the 3GPP TS 29.002 [24], this parameter shall not have a value of zero.
APN (See TS 23.008 [30])	Service-Selection (See IETF RFC 5778 [20])	C	This IE shall contain the APN for the selected and dynamically allocated PDN GW. It shall be present if the selected PDN-GW is present and is particular for one specific APN and not common to all the APNs.
Alert Reason (See 7.3.83)	Alert-Reason	C	This parameter shall indicate if the mobile subscriber is present or the MS has memory available. It shall be present when notifying the HSS about the presence of the UE or the UE has memory capacity available to receive one or more short messages.
NOR Flags (See 7.3.49)	NOR-Flags	C	This Information Element shall contain a bit mask. See 7.3.49 for the meaning of the bits. Absence of this information element shall be interpreted as all bits set to 0. When notifying the HSS about the need to send cancel location to the current SGSN, the MME shall set the "Single-Registration-Indication" flag in the NOR-Flags. When notifying the HSS about the "restricted" status of the current SGSN area, the SGSN shall set the "SGSN area restricted" flag in the NOR-Flags. When notifying the HSS about the presence of the UE or the UE has memory capacity available to receive one or more short messages, the SGSN shall set the "Ready for SM" flag in the NOR-Flags. When notifying the HSS that the UE has become reachable again, the MME shall set the "UE Reachable" flag in the NOR-Flags.

Table 5.2.5.1.1/2: Notify Answer

Information element name	Mapping to Diameter AVP	Cat.	Description
Result (See 7.4)	Result-Code / Experimental-Result	M	This IE shall contain the result of the operation. The Result-Code AVP shall be used to indicate success / errors as defined in the Diameter Base Protocol. The Experimental-Result AVP shall be used for S6a/S6d errors. This is a grouped AVP which shall contain the 3GPP Vendor ID in the Vendor-Id AVP, and the error code in the Experimental-Result-Code AVP. The following errors are applicable in this case: - User Unknown
Supported Features (See 3GPP TS 29.229 [9])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.

5.2.5.1.2 Detailed behaviour of the MME and the SGSN

The MME or SGSN shall include conditional AVPs in NOR according to the description given in table 5.2.5.1.1/1.

If the MME sends a Notify Request to inform the HSS that the UE has become reachable again, the MME shall clear the corresponding URRP-MME for the UE.

When receiving a Notify response from the HSS, no special action in the MME or SGSN is needed.

5.2.5.1.3 Detailed behaviour of the HSS

When receiving a Notify request the HSS shall check whether the IMSI is known.

If it is not known, a result code of DIAMETER_ERROR_USER_UNKNOWN is returned.

If it is known, the HSS shall set the result code to DIAMETER_SUCCESS, unless otherwise stated, and

- store the new terminal information if present in the request;

- store the new PDN GW and PLMN ID for an APN if present in the request and the APN is present in the subscription and if PDN GW is dynamically allocated; otherwise the HSS shall not store the new PDN GW data and shall set the result code to DIAMETER_ERROR_UNABLE_TO_COMPLY;

- store the new PDN GW and PLMN ID, and the APN itself, if both are present in the request, and the APN is not present in the subscription but a wild card APN is present in the subscription;

- mark the location area as "restricted" if so indicated in the request;

- send Cancel Location to the current SGSN if so indicated in the request;

- if the UE has become reachable again, and NOR is received on S6a from an MME, the HSS shall clear the URRP-MME parameter for the UE and send an indication to the Service Related Entities;

- when NOR is received on S6d from an SGSN (with the Alert Reason present), the HSS shall reset the MNRG flag and send a MAP-Alert-Service-Centre message, i.e. the behaviour in the HSS should be the same as when a MAP-Ready for SM is received from an SGSN;

and then send the response to the MME or SGSN.

6 MME – EIR (S13) and SGSN – EIR (S13')

6.1 Introduction

The S13 interface shall enable the ME Identity check procedure between the MME and the EIR as described in the 3GPP TS 23.401 [2].

The S13' interface shall enable the ME Identity check procedure between the SGSN and the EIR as described in the 3GPP TS 23.060 [12].

6.2 ME Identity Check Procedures

6.2.1 ME Identity Check

6.2.1.1 General

This Mobile Equipment Identity Check Procedure shall be used between the MME and the EIR and between the SGSN and the EIR to check the Mobile Equipment's identity status (e.g. to check that it has not been stolen, or, to verify that it does not have faults).

This procedure is mapped to the commands ME-Identity-Check-Request/Answer (ECR/ECA) in the Diameter application specified in chapter 6.

Table 6.2.1.1/1 specifies the involved information elements for the request.

Table 6.2.1.1/2 specifies the involved information elements for the answer.

Table 6.2.1.1/1: ME Identity Check Request

Information element name	Mapping to Diameter AVP	Cat.	Description
Terminal Information (See 7.3.3)	Terminal-Information	M	This information element shall contain the information about the used mobile equipment i.e. the IMEI.
IMSI	User-Name (See IETF RFC 3588 [4])	O	This information element shall contain the user IMSI, formatted according to 3GPP TS 23.003 [3], clause 2.2.

Table 6.2.1.1/2: ME Identity Check Answer

Information element name	Mapping to Diameter AVP	Cat.	Description
Result (See 7.4)	Result-Code / Experimental-Result	M	This IE shall contain the result of the operation. The Result-Code AVP shall be used to indicate success / errors as defined in the Diameter Base Protocol. The Experimental-Result AVP shall be used for S13/S13' errors. This is a grouped AVP which shall contain the 3GPP Vendor ID in the Vendor-Id AVP, and the error code in the Experimental-Result-Code AVP. The following errors are applicable in this case: - Unknown equipment
Equipment Status (See 7.3.51)	Equipment-Status	C	This information element shall contain the status of the requested mobile equipment as defined in 3GPP TS 22.016 [13]. It shall be present if the result of the ME Identity Check is DIAMETER_SUCCESS.

6.2.1.2   Detailed behaviour of the MME and the SGSN

The MME or the SGSN shall make use of this procedure to check the ME identity, if the MME or the SGSN is configured to check the IMEI with the EIR.

IMSI may be sent together with Terminal Information to the EIR for operator-determined purposes.

When receiving the ME Identity Check answer from the EIR, the MME or the SGSN shall check the result code and the equipment status. Dependent upon the result, the MME or the SGSN will decide its subsequent actions (e.g. sending an Attach Reject if the EIR indicates that the Mobile Equipment is unknown or blacklisted).

6.2.1.3   Detailed behaviour of the EIR

When receiving an ME Identity Check request, the EIR shall check whether the mobile equipment is known. The EIR shall identify the mobile equipment based on the first 14 digits of the IMEI AVP.

If it is not known, a result code of DIAMETER_ERROR_ EQUIPMENT_UNKNOWN is returned.

If it is known, the EIR shall return DIAMETER_SUCCESS with the equipment status.

7 Protocol Specification and Implementation

7.1 Introduction

7.1.1 Use of Diameter base protocol

The Diameter Base Protocol as specified in IETF RFC 3588 [4] shall apply except as modified by the defined support of the methods and the defined support of the commands and AVPs, result and error codes as specified in this specification. Unless otherwise specified, the procedures (including error handling and unrecognised information handling) shall be used unmodified.

7.1.2 Securing Diameter Messages

For secure transport of Diameter messages, see 3GPP TS 33.210 [16]

7.1.3 Accounting functionality

Accounting functionality (Accounting Session State Machine, related command codes and AVPs) shall not be used on the S6a, S6d, S13 and S13' interfaces.

7.1.4 Use of sessions

Between the MME and the HSS and between the SGSN and the HSS and between the MME and the EIR, Diameter sessions shall be implicitly terminated. An implicitly terminated session is one for which the server does not maintain state information. The client shall not send any re-authorization or session termination requests to the server.

The Diameter base protocol includes the Auth-Session-State AVP as the mechanism for the implementation of implicitly terminated sessions.

The client (server) shall include in its requests (responses) the Auth-Session-State AVP set to the value NO_STATE_MAINTAINED (1), as described in IETF RFC 3588 [4]. As a consequence, the server shall not maintain any state information about this session and the client shall not send any session termination request. Neither the Authorization-Lifetime AVP nor the Session-Timeout AVP shall be present in requests or responses.

7.1.5 Transport protocol

Diameter messages over the S6a, S6d, S13 and S13' interfaces shall make use of SCTP IETF RFC 4960 [14] .

7.1.6 Routing considerations

This clause specifies the use of the Diameter routing AVPs Destination-Realm and Destination-Host.

If an MME or SGSN knows the address/name of the HSS for a certain user, and the associated home network domain name, both the Destination-Realm and Destination-Host AVPs shall be present in the request.

 If an MME or SGSN knows only the home network domain name for a certain user, the Destination-Realm AVP shall be present and the command shall be routed to the next Diameter node.

If an MME or SGSN knows only the identity of the user, the home network domain name shall be derived from the user's IMSI (MNC and MCC values) to construct the EPC Home Network Realm/Domain, as indicated in 3GPP TS 23.003 [3], clause 19.2, and use it as Destination-Realm.

Consequently, the Destination-Host AVP is declared as optional in the ABNF for all requests initiated by an MME or SGSN.

The address/name of the EIR shall be locally configured in the MME.

Requests initiated by the HSS towards an MME or SGSN shall include both Destination-Host and Destination-Realm AVPs.

The HSS obtains the Destination-Host AVP to use in requests towards an MME or SGSN, from the Origin-Host AVP received in previous requests from the MME or SGSN. Consequently, the Destination-Host AVP is declared as mandatory in the ABNF for all requests initiated by the HSS.

The HSS obtains the Destination-Realm AVP to use in requests towards an MME or SGSN, from the Origin-Realm AVP received in previous requests from the MME or SGSN.

Destination-Realm AVP is declared as mandatory in the ABNF for all requests.

If the Vendor-Specific-Application-ID AVP is received in any of the commands, it may be ignored by the receiving node, and it shall not be used for routing purposes.

7.1.7 Advertising Application Support

The HSS, MME, SGSN and EIR shall advertise support of the Diameter S6a/S6d and/or S13/S13' Application by including the value of the application identifier in the Auth-Application-Id AVP within the Vendor-Specific-Application-Id grouped AVP of the Capabilities-Exchange-Request and Capabilities-Exchange-Answer commands.

The vendor identifier value of 3GPP (10415) shall be included in the Supported-Vendor-Id AVP of the Capabilities-Exchange-Request and Capabilities-Exchange-Answer commands, and in the Vendor-Id AVP within the Vendor-Specific-Application-Id grouped AVP of the Capabilities-Exchange-Request and Capabilities-Exchange-Answer commands.

The Vendor-Id AVP included in Capabilities-Exchange-Request and Capabilities-Exchange-Answer commands that is not included in the Vendor-Specific-Application-Id AVPs as described above shall indicate the manufacturer of the Diameter node as per RFC 3588 [4].

7.1.8 Diameter Application Identifier

This clause specifies two Diameter applications: one is for the S6a/S6d interface application, and the other is for the S13/S13' interface application.

The S6a/S6d interface application allows a Diameter server and a Diameter client:

- to exchange location information;

- to authorize a user to access the EPS;

- to exchange authentication information;

- to download and handle changes in the subscriber data stored in the server.

The S6a/S6d interface protocol shall be defined as an IETF vendor specific Diameter application, where the vendor is 3GPP. The vendor identifier assigned by IANA to 3GPP (http://www.iana.org/assignments/enterprise-numbers) is 10415.

The Diameter application identifier assigned to the S6a/S6d interface application is 16777251 (allocated by IANA).

The S13/S13' interface application allows a Diameter server and a Diameter client:

- to check the validity of the ME Identity.

The S13/S13' interface protocol shall be defined as an IETF vendor specific Diameter application, where the vendor is 3GPP. The vendor identifier assigned by IANA to 3GPP (http://www.iana.org/assignments/enterprise-numbers) is 10415.

The Diameter application identifier assigned to the S13/S13' interface application is 16777252 (allocated by IANA).

7.1.9   Use of the Supported-Features AVP

When new functionality is introduced on the S6a/S6d interfaces, it should be defined as optional. If backwards incompatible changes can not be avoided, the new functionality shall be introduced as a new feature and support advertised with the Supported-Features AVP. The usage of the Supported-Features AVP on the S6a/S6d interfaces is consistent with the procedures for the dynamic discovery of supported features as defined in clause 7.2 of 3GPP TS 29.229 [9].

When extending the application by adding new AVPs for a feature, the new AVPs shall have the M bit cleared and the AVP shall not be defined mandatory in the command ABNF.

As defined in 3GPP TS 29.229 [9], the Supported-Features AVP is of type grouped and contains the Vendor-Id, Feature-List-ID and Feature-List AVPs. On the all reference points as specified in this specificaion, the Supported-Features AVP is used to identify features that have been defined by 3GPP and hence, for features defined in this document, the Vendor-Id AVP shall contain the vendor ID of 3GPP (10415). If there are multiple feature lists defined for the reference point, the Feature-List-ID AVP shall differentiate those lists from one another.

The Table 7.3.10/1 defines the features applicable to the S6a/S6d interfaces for the feature list with a Feature-List-ID of 1.

7.2 Commands

7.2.1 Introduction

This section defines the Command code values and related ABNF for each command described in this specification.

7.2.2 Command-Code values

This section defines Command-Code values for the S6a/S6d interface application and S13/S13' interface application as allocated by IANA in the IETF RFC 5516 [32].

Every command is defined by means of the ABNF syntax IETF RFC 2234 [7], according to the rules in IETF RFC 3588 [4]. In the case, the definition and use of an AVP is not specified in this document, the guidelines in IETF RFC 3588 [4] shall apply.

NOTE: For this release, the Vendor-Specific-Application-ID is included as an optional AVP in all commands in order to ensure interoperability with diameter agents following a strict implementation of IETF RFC 3588, by which messages not including this AVP will be rejected. IETF RFC 3588 indicates that the AVP shall be present in all proxiable commands, such as those specified here, dispite that the contents of this AVP are redundant since the Application ID is already present in the command header. This AVP may be removed in subsequent revisions of this specification, once the diameter base protocol is updated accordingly.

The following Command Codes are defined in this specification:

Table 7.2.2/1: Command-Code values for S6a/S6d

Command-Name	Abbreviation	Code	Section
Update-Location-Request	ULR	316	7.2.3
Update-Location-Answer	ULA	316	7.2.4
Cancel-Location-Request	CLR	317	7.2.7
Cancel-Location-Answer	CLA	317	7.2.8
Authentication-Information-Request	AIR	318	7.2.5
Authentication-Information-Answer	AIA	318	7.2.6
Insert-Subscriber-Data-Request	IDR	319	7.2.9
Insert-Subscriber-Data-Answer	IDA	319	7.2.10
Delete-Subscriber-Data-Request	DSR	320	7.2.11
Delete-Subscriber-Data-Answer	DSA	320	7.2.12
Purge-UE-Request	PUR	321	7.2.13
Purge-UE-Answer	PUA	321	7.2.14
Reset-Request	RSR	322	7.2.15
Reset-Answer	RSA	322	7.2.16
Notify-Request	NOR	323	7.2.17
Notify-Answer	NOA	323	7.2.18

For these commands, the Application-ID field shall be set to 16777251 (application identifier of the S6a/S6d interface application, allocated by IANA).

Table 7.2.2/2: Command-Code values for S13/S13'

Command-Name	Abbreviation	Code	Section
ME-Identity-Check-Request	ECR	324	7.2.19
ME-Identity-Check-Answer	ECA	324	7.2.20

For these commands, the Application-ID field shall be set to 16777252 (application identifier of the S13/S13' interface application, allocated by IANA).

7.2.3 Update-Location-Request (ULR) Command

The Update-Location-Request (ULR) command, indicated by the Command-Code field set to 316 and the "R" bit set in the Command Flags field, is sent from MME or SGSN to HSS.

Message Format

```
< Update-Location-Request> ::=   < Diameter Header: 316, REQ, PXY, 16777251 >
                          < Session-Id >
                          [ Vendor-Specific-Application-Id ]
                          { Auth-Session-State }
                          { Origin-Host }
                          { Origin-Realm }
                          [ Destination-Host ]
                          { Destination-Realm }
                          { User-Name }
                          *[ Supported-Features ]
                          [ Terminal-Information ]
                          { RAT-Type }
                          { ULR-Flags }
                          { Visited-PLMN-Id }
                          [ SGSN-Number ]
                          *[ AVP ]
                          *[ Proxy-Info ]
                          *[ Route-Record ]
```

7.2.4 Update-Location-Answer (ULA) Command

The Update-Location-Answer (ULA) command, indicated by the Command-Code field set to 316 and the 'R' bit cleared in the Command Flags field, is sent from HSS to MME or SGSN.

Message Format

```
< Update-Location-Answer> ::=   < Diameter Header: 316, PXY, 16777251 >
                          < Session-Id >
                          [ Vendor-Specific-Application-Id ]
                          [ Result-Code ]
                          [ Experimental-Result ]
                          { Auth-Session-State }
                          { Origin-Host }
                          { Origin-Realm }
                          *[ Supported-Features ]
                          [ ULA-Flags ]
                          [ Subscription-Data ]
                          *[ AVP ]
                          *[ Failed-AVP ]
                          *[ Proxy-Info ]
                          *[ Route-Record ]
```

7.2.5   Authentication-Information-Request (AIR) Command

The Authentication-Information-Request (AIR) command, indicated by the Command-Code field set to 318 and the 'R' bit set in the Command Flags field, is sent from MME or SGSN to HSS.

Message Format

```
< Authentication-Information-Request> ::=     < Diameter Header: 318, REQ, PXY, 16777251 >
                                        < Session-Id >
                                        [ Vendor-Specific-Application-Id ]
                                        { Auth-Session-State }
                                        { Origin-Host }
                                        { Origin-Realm }
                                        [ Destination-Host ]
                                        { Destination-Realm }
                                        { User-Name }
                                        *[Supported-Features]
                                        [ Requested-EUTRAN-Authentication-Info ]
                                        [ Requested-UTRAN-GERAN-Authentication-Info ]
                                        { Visited-PLMN-Id }
                                        *[ AVP ]
                                        *[ Proxy-Info ]
                                        *[ Route-Record ]
```

7.2.6   Authentication-Information-Answer (AIA) Command

The Authentication-Information-Answer (AIA) command, indicated by the Command-Code field set to318 and the 'R' bit cleared in the Command Flags field, is sent from HSS to MME or SGSN.

Message Format

```
< Authentication-Information-Answer> ::=     < Diameter Header: 318, PXY, 16777251 >
                                       < Session-Id >
                                       [ Vendor-Specific-Application-Id ]
                                       [ Result-Code ]
                                       [ Experimental-Result ]
                                       { Auth-Session-State }
                                       { Origin-Host }
                                       { Origin-Realm }
                                       * [Supported-Features]
                                       [ Authentication-Info ]
                                       *[ AVP ]
                                       *[ Failed-AVP ]
                                       *[ Proxy-Info ]
                                       *[ Route-Record ]
```

7.2.7   Cancel-Location-Request (CLR) Command

The Cancel-Location-Request (CLR) command, indicated by the Command-Code field set to 317 and the 'R' bit set in the Command Flags field, is sent from HSS to MME or SGSN.

Message Format

```
< Cancel-Location-Request> ::=     < Diameter Header: 317, REQ, PXY, 16777251 >
                              < Session-Id >
                              [ Vendor-Specific-Application-Id ]
                              { Auth-Session-State }
                              { Origin-Host }
                              { Origin-Realm }
                              { Destination-Host }
                              { Destination-Realm }
                              { User-Name }
```

                                        *[Supported-Features]
                                        { Cancellation-Type }
                                        *[AVP]
                                        *[Proxy-Info]
                                        *[Route-Record]

7.2.8   Cancel-Location-Answer (CLA) Command

The Cancel-Location-Answer (CLA) command, indicated by the Command-Code field set to 317 and the 'R' bit cleared in the Command Flags field, is sent from MME or SGSN to HSS.

Message Format

        < Cancel-Location-Answer> ::=   < Diameter Header: 317, PXY, 16777251 >
                                        < Session-Id >
                                        [Vendor-Specific-Application-Id]
                                        *[Supported-Features]
                                        [Result-Code]
                                        [Experimental-Result]
                                        { Auth-Session-State }
                                        { Origin-Host }
                                        { Origin-Realm }
                                        *[AVP]
                                        *[Failed-AVP]
                                        *[Proxy-Info]
                                        *[Route-Record]

7.2.9   Insert-Subscriber-Data-Request (IDR) Command

The Insert-Subscriber-Data-Request (IDR) command, indicated by the Command-Code field set to 319 and the 'R' bit set in the Command Flags field, is sent from HSS to MME or SGSN.

Message Format

        < Insert-Subscriber-Data-Request> ::=   < Diameter Header: 319, REQ, PXY, 16777251 >
                                        < Session-Id >
                                        [Vendor-Specific-Application-Id]
                                        { Auth-Session-State }
                                        { Origin-Host }
                                        { Origin-Realm }
                                        { Destination-Host }
                                        { Destination-Realm }
                                        { User-Name }
                                        *[Supported-Features]
                                        { Subscription-Data}
                                        [IDR- Flags]
                                        *[AVP]
                                        *[Proxy-Info]
                                        *[Route-Record]

7.2.10   Insert-Subscriber-Data-Answer (IDA) Command

The Insert-Subscriber-Data-Answer (IDA) command, indicated by the Command-Code field set to 319 and the 'R' bit cleared in the Command Flags field, is sent from MME or SGSN to HSS.

Message Format

        < Insert-Subscriber-Data-Answer> ::=   < Diameter Header: 319, PXY, 16777251 >
                                        < Session-Id >
                                        [Vendor-Specific-Application-Id]
                                        *[Supported-Features]
                                        [Result-Code]
                                        [Experimental-Result]
                                        { Auth-Session-State }

```
                                            { Origin-Host }
                                            { Origin-Realm }
                                            [ IDA-Flags ]
                                            *[ AVP ]
                                            *[ Failed-AVP ]
                                            *[ Proxy-Info ]
                                            *[ Route-Record ]
```

7.2.11   Delete-Subscriber-Data-Request (DSR) Command

The Delete-SubscriberData-Request (DSR) command, indicated by the Command-Code field set to 320 and the 'R' bit set in the Command Flags field, is sent from HSS to MME or SGSN.

Message Format

```
    < Delete-Subscriber-Data-Request > ::=    < Diameter Header: 320, REQ, PXY, 16777251 >
                                            < Session-Id >
                                            [ Vendor-Specific-Application-Id ]
                                            { Auth-Session-State }
                                            { Origin-Host }
                                            { Origin-Realm }
                                            { Destination-Host }
                                            { Destination-Realm }
                                            { User-Name }
                                            *[ Supported-Features ]
                                            { DSR-Flags }
                                            *[ Context-Identifier ]
                                            [ Trace-Reference ]
                                            *[ TS-Code ]
                                            *[ SS-Code ]
                                            *[ AVP ]
                                            *[ Proxy-Info ]
                                            *[ Route-Record ]
```

7.2.12   Delete-Subscriber-Data-Answer (DSA) Command

The Delete-SubscriberData-Answer (DSA) command, indicated by the Command-Code field set to 320 and the 'R' bit cleared in the Command Flags field, is sent from MME or SGSN to HSS.

Message Format

```
    < Delete-Subscriber-Data-Answer> ::=    < Diameter Header: 320, PXY, 16777251 >
                                            < Session-Id >
                                            [ Vendor-Specific-Application-Id ]
                                            *[ Supported-Features ]
                                            [ Result-Code ]
                                            [ Experimental-Result ]
                                            { Auth-Session-State }
                                            { Origin-Host }
                                            { Origin-Realm }
                                            [ DSA-Flags ]
                                            *[ AVP ]
                                            *[ Failed-AVP ]
                                            *[ Proxy-Info ]
                                            *[ Route-Record ]
```

7.2.13   Purge-UE-Request (PUR) Command

The Purge-UE-Request (PUR) command, indicated by the Command-Code field set to 321 and the 'R' bit set in the Command Flags field, is sent from MME or SGSN to HSS.

Message Format

```
    < Purge-UE-Request> ::=    < Diameter Header: 321, REQ, PXY, 16777251 >
```

< Session-Id >
[Vendor-Specific-Application-Id]
{ Auth-Session-State }
{ Origin-Host }
{ Origin-Realm }
[Destination-Host]
{ Destination-Realm }
{ User-Name }
*[Supported-Features]
*[AVP]
*[Proxy-Info]
*[Route-Record]

7.2.14   Purge-UE-Answer (PUA) Command

The Purge-UE-Answer (PUA) command, indicated by the Command-Code field set to 321 and the 'R' bit cleared in the Command Flags field, is sent from HSS to MME or SGSN.

Message Format

< Purge-UE-Answer> ::=   < Diameter Header: 321, PXY, 16777251 >
< Session-Id >
[Vendor-Specific-Application-Id]
*[Supported-Features]
[Result-Code]
[Experimental-Result]
{ Auth-Session-State }
{ Origin-Host }
{ Origin-Realm }
[PUA-Flags]
*[AVP]
*[Failed-AVP]
*[Proxy-Info]
*[Route-Record]

7.2.15   Reset-Request (RSR) Command

The Reset-Request (RSR) command, indicated by the Command-Code field set to 322 and the 'R' bit set in the Command Flags field, is sent from HSS to MME or SGSN.

Message Format

< Reset-Request> ::=   < Diameter Header: 322, REQ, PXY, 16777251 >
< Session-Id >
[Vendor-Specific-Application-Id]
{ Auth-Session-State }
{ Origin-Host }
{ Origin-Realm }
{ Destination-Host }
{ Destination-Realm }
*[Supported-Features]
*[User-Id]
*[AVP]
*[Proxy-Info]
*[Route-Record]

7.2.16   Reset-Answer (RSA) Command

The Authentication-Information-Answer (RSA) command, indicated by the Command-Code field set to 322 and the 'R' bit cleared in the Command Flags field, is sent from MME or SGSN to HSS.

Message Format

```
< Reset-Answer> ::=      < Diameter Header: 322, PXY, 16777251 >
                         < Session-Id >
                         [ Vendor-Specific-Application-Id ]
                         *[ Supported-Features ]
                         [ Result-Code ]
                         [ Experimental-Result ]
                         { Auth-Session-State }
                         { Origin-Host }
                         { Origin-Realm }
                         *[ AVP ]
                         *[ Failed-AVP ]
                         *[ Proxy-Info ]
                         *[ Route-Record ]
```

7.2.17   Notify-Request (NOR) Command

The Notify-Request (NOR) command, indicated by the Command-Code field set to 323 and the 'R' bit set in the Command Flags field, is sent from MME or SGSN to HSS.

Message Format

```
< Notify-Request> ::=    < Diameter Header: 323, REQ, PXY, 16777251 >
                         < Session-Id >
                         [ Vendor-Specific-Application-Id ]
                         { Auth-Session-State }
                         { Origin-Host }
                         { Origin-Realm }
                         [ Destination-Host ]
                         { Destination-Realm }
                         { User-Name }
                         * [ Supported-Features ]
                         [ Terminal-Information ]
                         [ MIP6-Agent-Info ]
                         [ Visited-Network-Identifier ]
                         [ Context-Identifier ]
                         [Service-Selection]
                         [ Alert-Reason ]
                         [ NOR-Flags ]
                         *[ AVP ]
                         *[ Proxy-Info ]
                         *[ Route-Record ]
```

7.2.18   Notify-Answer (NOA) Command

The Notify-Answer (NOA) command, indicated by the Command-Code field set to 323 and the 'R' bit cleared in the Command Flags field, is sent from HSS to MME or SGSN.

Message Format

```
< Notify-Answer> ::=    < Diameter Header: 323, PXY, 16777251 >
                        < Session-Id >
                        [ Vendor-Specific-Application-Id ]
                        [ Result-Code ]
                        [ Experimental-Result ]
                        { Auth-Session-State }
                        { Origin-Host }
                        { Origin-Realm }
                        *[ Supported-Features ]
                        *[ AVP ]
                        *[ Failed-AVP ]
                        *[ Proxy-Info ]
                        *[ Route-Record ]
```

7.2.19   ME-Identity-Check-Request (ECR) Command

The ME-Identity-Check-Request (ECR) command, indicated by the Command-Code field set to 324 and the 'R' bit set in the Command Flags field, is sent from MME or SGSN to EIR.

Message Format

```
< ME-Identity-Check-Request > ::=    < Diameter Header: 324, REQ, PXY, 16777252 >
                                     < Session-Id >
                                     [ Vendor-Specific-Application-Id ]
                                     { Auth-Session-State }
                                     { Origin-Host }
                                     { Origin-Realm }
                                     [ Destination-Host ]
                                     { Destination-Realm }
                                     { Terminal-Information }
                                     [ User-Name ]
                                     *[ AVP ]
                                     *[ Proxy-Info ]
                                     *[ Route-Record ]
```

7.2.20   ME-Identity-Check-Answer (ECA) Command

The ME-Identity-Check-Answer (ECA) command, indicated by the Command-Code field set to 324 and the 'R' bit cleared in the Command Flags field, is sent from EIR to MME or SGSN.

Message Format

```
< ME-Identity-Check-Answer> ::=     < Diameter Header: 324, PXY, 16777252 >
                                     < Session-Id >
                                     [ Vendor-Specific-Application-Id ]
                                     [ Result-Code ]
                                     [ Experimental-Result ]
                                     { Auth-Session-State }
                                     { Origin-Host }
                                     { Origin-Realm }
                                     [ Equipment-Status ]
                                     *[ AVP ]
                                     *[ Failed-AVP ]
                                     *[ Proxy-Info ]
                                     *[ Route-Record ]
```

7.3 Information Elements

7.3.1 General

The following table specifies the Diameter AVPs defined for the S6a/S6d interface protocol and S13/S13' 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).

For all AVPs which contain bit masks and are of the type Unsigned32, e.g., ULR-Flags, DSR-Flags, PUA-Flags, etc., bit 0 shall be the least significant bit. For example, to get the value of bit 0, a bit mask of 0x0001 should be used.

Table 7.3.1/1: S6a/S6d and S13/S13' specific Diameter AVPs

Attribute Name	AVP Code	Section defined	Value Type	AVP Flag rules				
				Must	May	Should not	Must not	May Encr.
Subscription-Data	1400	7.3.2	Grouped	M, V				No
Terminal-Information	1401	7.3.3	Grouped	M, V				No
IMEI	1402	7.3.4	UTF8String	M, V				No
Software-Version	1403	7.3.5	UTF8String	M, V				No
QoS-Subscribed	1404	7.3.77	OctetString	M, V				No
ULR-Flags	1405	7.3.7	Unsigned32	M, V				No
ULA-Flags	1406	7.3.8	Unsigned32	M, V				No
Visited-PLMN-Id	1407	7.3.9	OctetString	M, V				No
Requested-EUTRAN-Authentication-Info	1408	7.3.11	Grouped	M, V				No
Requested-UTRAN- GERAN-Authentication-Info	1409	7.3.12	Grouped	M, V				No
Number-Of-Requested-Vectors	1410	7.3.14	Unsigned32	M, V				No
Re-Synchronization-Info	1411	7.3.15	OctetString	M, V				No
Immediate-Response-Preferred	1412	7.3.16	Unsigned32	M, V				No
Authentication-Info	1413	7.3.17	Grouped	M, V				No
E-UTRAN-Vector	1414	7.3.18	Grouped	M, V				No
UTRAN-Vector	1415	7.3.19	Grouped	M, V				No
GERAN-Vector	1416	7.3.20	Grouped	M, V				No
Network-Access-Mode	1417	7.3.21	Enumerated	M, V				No
HPLMN-ODB	1418	7.3.22	Unsigned32	M, V				No
Item-Number	1419	7.3.23	Unsigned32	M, V				No
Cancellation-Type	1420	7.3.24	Enumerated	M, V				No
DSR-Flags	1421	7.3.25	Unsigned32	M, V				No
DSA-Flags	1422	7.3.26	Unsigned32	M, V				No
Context-Identifier	1423	7.3.27	Unsigned32	M, V				No
Subscriber-Status	1424	7.3.29	Enumerated	M, V				No
Operator-Determined-Barring	1425	7.3.30	Unsigned32	M, V				No
Access-Restriction-Data	1426	7.3.31	Unsigned32	M, V				No
APN-OI-Replacement	1427	7.3.32	UTF8String	M, V				No
All-APN-Configurations-Included-Indicator	1428	7.3.33	Enumerated	M, V				No
APN-Configuration-Profile	1429	7.3.34	Grouped	M, V				No
APN-Configuration	1430	7.3.35	Grouped	M, V				No
EPS-Subscribed-QoS-Profile	1431	7.3.37	Grouped	M, V				No
VPLMN-Dynamic-Address-Allowed	1432	7.3.38	Enumerated	M, V				No
STN-SR	1433	7.3.39	OctetString	M, V				No
Alert-Reason	1434	7.3.83	Enumerate	M, V				No
AMBR	1435	7.3.41	Grouped	M, V				No
CSG-Subscription-Data	1436	7.3.78	Grouped	M. V				No
CSG-Id	1437	7.3.79	Unsigned32	M, V				No
PDN-GW-Allocation-Type	1438	7.3.44	Enumerated	M, V				No
Expiration-Date	1439	7.3.80	Time	M, V				No
RAT-Frequency-Selection-Priority-ID	1440	7.3.46	Unsigned32	M, V				No
IDA-Flags	1441	7.3.47	Unsigned32	M, V				No
PUA-Flags	1442	7.3.48	Unsigned32	M, V				No
NOR-Flags	1443	7.3.49	Unsigned32	M, V				No
User-Id	1444	7.3.50	UTF8String	V			M	No
Equipment-Status	1445	7.3.51	Enumerated	M, V				No
Regional-Subscription-Zone-Code	1446	7.3.52	OctetString	M, V				No
RAND	1447	7.3.53	OctetString	M, V				No
XRES	1448	7.3.54	OctetString	M, V				No
AUTN	1449	7.3.55	OctetString	M, V				No
KASME	1450	7.3.56	OctetString	M, V				No
Trace-Collection-Entity	1452	7.3.98	Address	M, V				No
Kc	1453	7.3.59	OctetString	M, V				No
SRES	1454	7.3.60	OctetString	M, V				No
PDN-Type	1456	7.3.62	Enumerated	M, V				No
Roaming-Restricted-Due-To-Unsupported-Feature	1457	7.3.81	Enumerated	M, V				No
Trace-Data	1458	7.3.63	Grouped	M, V				No

Trace-Reference	1459	7.3.64	OctetString	M, V				No
Trace-Depth	1462	7.3.67	Enumerated	M, V				No
Trace-NE-Type-List	1463	7.3.68	OctetString	M, V				No
Trace-Interface-List	1464	7.3.69	OctetString	M, V				No
Trace-Event-List	1465	7.3.70	OctetString	M, V				No
OMC-Id	1466	7.3.71	OctetString	M, V				No
GPRS-Subscription-Data	1467	7.3.72	Grouped	M, V				No
Complete-Data-List-Included-Indicator	1468	7.3.73	Enumerated	M, V				No
PDP-Context	1469	7.3.74	Grouped	M, V				No
PDP-Type	1470	7.3.75	OctetString	M, V				No
3GPP2-MEID	1471	7.3.6	OctetString	M, V				No
Specific-APN-Info	1472	7.3.82	Grouped	M, V				No
LCS-Info	1473	7.3.84	Grouped	M, V				No
GMLC-Number	1474	7.3.85	OctetString	M, V				No
LCS-PrivacyException	1475	7.3.86	Grouped	M, V				No
SS-Code	1476	7.3.87	OctetString	M, V				No
SS-Status	1477	7.3.88	Grouped	M, V				No
Notification-To-UE-User	1478	7.3.89	Enumerated	M, V				No
External-Client	1479	7.3.90	Grouped	M, V				No
Client-Identity	1480	7.3.91	OctetString	M, V				No
GMLC-Restriction	1481	7.3.92	Enumerated	M, V				No
PLMN-Client	1482	7.3.93	Enumerated	M, V				No
Service-Type	1483	7.3.94	Grouped	M, V				No
ServiceTypeIdentity	1484	7.3.95	Unsigned32	M, V				No
MO-LR	1485	7.3.96	Grouped	M, V				No
Teleservice-List	1486	7.3.99	Grouped	M, V				No
TS-Code	1487	7.3.100	OctetString	M, V				No
Call-Barring-Infor-List	1488	7.3.101	Grouped	M, V				No
SGSN-Number	1489	7.3.102	OctetString	M, V				No
IDR-Flags	1490	7.3.103	Unsigned32	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. For further details, see IETF RFC 3588 [4].								

The following table specifies the Diameter AVPs re-used by the S6a/S6d interface protocol from existing Diameter Applications, including a reference to their respective specifications and when needed, a short description of their use within S6a and S6d.

Any other AVPs from existing Diameter Applications, except for the AVPs from Diameter Base Protocol, do not need to be supported. The AVPs from Diameter Base Protocol are not included in table 7.3.1/2, but they may be re-used for the S6a/S6d protocol and the S13/S13' protocol.

Table 7.3.1/2: S6a/S6d and S13/S13' re-used Diameter AVPs

Attribute Name	Reference	Comments	M-bit
Service-Selection	IETF RFC 5778 [20]	See section 7.3.36	
3GPP-Charging-Characteristics	3GPP TS 29.061 [21]	See 3GPP TS 32.251 [33] Annex A and 3GPP TS 32.298 [22] section 5.1.2.2.7 This attribute holds the EPS PDN Connection Charging Characteristics data for an EPS APN Configuration, or the PDP context Charging Characteristics for GPRS PDP context, or the Subscribed Charging Characteristics data for the subscriber level 3GPP Charging Characteristics; refer to 3GPP TS 23.008 [30].	
Supported-Features	3GPP TS 29.229 [9]		
Feature-List-ID	3GPP TS 29.229 [9]		
Feature-List	3GPP TS 29.229 [9]	See section 7.3.10	
Served-Party-IP-Address	3GPP TS 32.299 [8]	holds the PDN IP Address of the user	
QoS-Class-Identifier	3GPP TS 29.212 [10]		
Allocation-Retention-Priority	3GPP TS 29.212 [10]	See section 7.3.40	
Priority-Level	3GPP TS 29.212 [10]		
Pre-emption-Capability	3GPP TS 29.212 [10]		
Pre-emption-Vulnerability	3GPP TS 29.212 [10]		
Max-Requested-Bandwidth-DL	3GPP TS 29.214 [11]		
Max-Requested-Bandwidth-UL	3GPP TS 29.214 [11]		
RAT-Type	3GPP TS 29.212 [10]	See section 7.3.13	Must set
MSISDN	3GPP TS 29.329 [25]		
MIP6-Agent-Info	IETF Draft RFC 5447 [26]		
MIP-Home-Agent-Address	IETF RFC 4004 [27]		
MIP-Home-Agent-Host	IETF RFC 4004 [27]		
PDP-Address	3GPP TS 32.299 [8]		
Confidentiality-Key	3GPP TS 29.229 [9]	See section 7.3.57	
Integrity-Key	3GPP TS 29.229 [9]	See section 7.3.58	
Visited-Network-Identifier	3GPP TS 29.229 [9]	See section 7.3.105	Must not set
NOTE 1: The M-bit settings for re-used AVPs override those of the defining specifications that are referenced. Values include: "Must set", "Must not set". If the M-bit setting is blank, then the defining specification applies.			
NOTE 2: If the M-bit is set for an AVP and the receiving server does not understand the AVP, it shall return a rejection. If the M-bit is not set for an AVP, the receiving server shall not return a rejection, whether or not it understands the AVP.			

7.3.2   Subscription-Data

The Subscription-Data AVP is of type Grouped. It shall contain the information related to the user profile relevant for EPS and GERAN/UTRAN.

AVP format:

Subscription-Data ::= <AVP header: 1400 10415>

      [Subscriber-Status]

      [MSISDN]

      [STN-SR]

      [Network-Access-Mode]

      [Operator-Determined-Barring]

      [HPLMN-ODB]

      *10[Regional-Subscription-Zone-Code]

      [Access-Restriction-Data]

      [APN-OI-Replacement]

      [LCS-Info]

      [Teleservice-List]

      [Call-Barring-Infor-List]

      [3GPP-Charging-Characteristics]

      [AMBR]

      [APN-Configuration-Profile]

      [RAT-Frequency-Selection-Priority-ID]

      [Trace-Data]

      [GPRS-Subscription-Data]

      *[CSG-Subscription-Data]

      [Roaming-Restricted-Due-To-Unsupported-Feature]

      *[AVP]

The AMBR included in this grouped AVP shall include the AMBR associated to the user"s subscription (UE-AMBR).

7.3.3   Terminal-Information

The Terminal-Information AVP is of type Grouped. This AVP shall contain the information about the user"s terminal.

AVP format

Terminal Information ::= <AVP header: 1401 10415>

      [IMEI]

      [3GPP2-MEID]

      [Software-Version]

      *[AVP]

7.3.4   IMEI

The IMEI AVP is of type UTF8String. This AVP shall contain the International Mobile Equipment Identity, as specified in 3GPP TS 23.003 [3]. It should consist of 14 digits, including the 8-digit Type Allocation Code (TAC) and the 6-digit Serial Number (SNR). It may also include a 15th digit.

7.3.5   Software-Version

The Software-Version AVP is of type UTF8String. This AVP shall contain the 2-digit Software Version Number (SVN) of the International Mobile Equipment Identity, as specified in 3GPP TS 23.003 [3].

7.3.6   3GPP2-MEID

This AVP is of type OctetString. This AVP contains the Mobile Equipment Identifier of the user's terminal. For further details on the encoding of the AVP data, refer to the encoding of the Mobile Identity (MEID) octets 3 to 10 in 3GPP2 A.S0022 [28] Annex A.

7.3.7   ULR-Flags

The ULR-Flags AVP is of type Unsigned32 and it shall contain a bit mask. The meaning of the bits shall be as defined in table 7.3.7/1:

Table 7.3.7/1: ULR-Flags

Bit	Name	Description
0	Single-Registration-Indication	This bit, when set, indicates that the HSS shall send Cancel Location to the SGSN. An SGSN shall not set this bit when sending ULR.
1	S6a/S6d-Indicator	This bit, when set, indicates that the ULR message is sent on the S6a interface, i.e. the source node is an MME (or a combined MME/SGSN to which the UE is attached via E-UTRAN). This bit, when cleared, indicates that the ULR message is sent on the S6d interface, i.e. the source node is an SGSN (or a combined MME/SGSN to which the UE is attached via UTRAN or GERAN).
2	Skip Subscriber Data	This bit, when set, indicates that the HSS may skip subscription data in ULA. If the subscription data has changed in the HSS after the last sucessfull update of the MME/SGSN, the HSS shall ignore this bit and send the updated subscription data. If the HSS effectively skips the sending of subscription data, the GPRS-Subscription-Data-Indicator flag can be ignored.
3	GPRS-Subscription-Data-Indicator	This bit, when set, indicates that the HSS shall include in the ULA command the GPRS subscription data, if available in the HSS; it shall be included in the GPRS-Subscription-Data AVP inside the Subscription-Data AVP (see 7.3.2). Otherwise, the HSS shall not include the GPRS-Subscription-Data AVP in the response, unless the Update Location Request is received over the S6d interface and there is no EPS subscription data stored for the subscriber, or when the subscription data is returned by a Pre-Rel-8 HSS (via an IWF). A standalone MME shall not set this bit when sending a ULR.
4	Node-Type-Indicator	This bit, when set, indicates that the requesting node is a combined MME/SGSN. This bit, when cleared, indicates that the requesting node is a single MME or SGSN; in this case, if the S6a/S6d-Indicator is set, the HSS may skip the check of those supported features only applicable to the SGSN, and consequently skip the download of the SMS/LCS-related subscription data to a standalone MME.
5	Initial-Attach-Indicator	This bit, when set, indicates that the HSS shall send Cancel Location to the MME or SGSN if there is the MME or SGSN registration.
6	PS-LCS-Not-Supported-By-UE	This bit, when set, indicates to the HSS that the UE does not support neither UE Based nor UE Assisted positioning methods for Packet Switched Location Services. The SGSN shall set this bit on the basis of the UE capability information and the access technology supported by the SGSN.
Bits not defined in this table shall be cleared by the sending MME or SGSN and discarded by the receiving HSS.		

7.3.8 ULA-Flags

The ULA-Flags AVP is of type Unsigned32 and it shall contain a bit mask. The meaning of the bits shall be as defined in table 7.3.8/1:

Table 7.3.8/1: ULA-Flags

Bit	Name	Description
0	Separation Indication	This bit, when set, indicates that the HSS stores SGSN number and MME number in separate memory. A Rel-8 HSS shall set the bit. An IWF interworking with a pre Rel-8 HSS/HLR shall clear the bit.
Bits not defined in this table shall be cleared by the sending HSS and discarded by the receiving MME or SGSN.		

7.3.9 Visited-PLMN-Id

The Visited-PLMN-Id AVP is of type OctetString. This AVP shall contain the concatenation of MCC and MNC. See 3GPP TS 23.003 [3]. The content of this AVP shall be encoded as an octet string according to table 7.3.9-1.

See 3GPP TS 24.008 [31], clause 10.5.1.13, PLMN list, for the coding of MCC and MNC. If MNC is 2 digits long, bits 5 to 8 of octet 2 are coded as "1111".

Table 7.3.9/1: Encoding format for Visited-PLMN-Id AVP

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

7.3.10 Feature-List AVP

The syntax of this AVP is defined in 3GPP TS 29.229 [9]. For the S6a/S6d application, the meaning of the bits shall be as defined in table 7.3.10/1.

Table 7.3.10/1: Features of Feature-List-ID 1 used in S6a/S6d

Feature bit	Feature	M/O	Description
0	ODB-all-APN	O	Operator Determined Barring of all Packet Oriented Services This feature is applicable for the ULR/ULA and IDR/IDA command pairs. If the MME or SGSN does not support this feature, the HSS shall not send this ODB barring category to the MME or SGSN within ULA. Instead the HSS may reject location update. If the MME or SGSN does not indicate support of this feature in IDA and the HSS has sent this ODB category within IDR, the HSS may apply barring of roaming and send CLR.
1	ODB-HPLMN-APN	O	Operator Determined Barring of Packet Oriented Services from access points that are within the HPLMN whilst the subscriber is roaming in a VPLMN This feature is applicable for the ULR/ULA and IDR/IDA command pairs. If the MME or SGSN does not support this feature, the HSS shall not send this ODB barring category to the MME or SGSN within ULA. Instead the HSS may reject location update. If the MME or SGSN does not indicate support of this feature in IDA and the HSS has sent this ODB category within IDR, the HSS may apply barring of roaming and send CLR.
2	ODB-VPLMN-APN	O	Operator Determined Barring of Packet Oriented Services from access points that are within the roamed to VPLMN This feature is applicable for the ULR/ULA and IDR/IDA command pairs. If the MME or SGSN does not support this feature, the HSS shall not send this ODB barring category to the MME or SGSN within ULA. Instead the HSS may reject location update. If the MME or SGSN does not indicate support of this feature in IDA and the HSS has sent this ODB category within IDR, the HSS may apply barring of roaming and send CLR.
3	ODB-all-OG		Operator Determined Barring of all outgoing calls This feature is applicable for the ULR/ULA and IDR/IDA command pairs to the SGSN. The HSS shall not send this ODB barring category to the MME. If the SGSN does not support this feature, the HSS shall not send this ODB barring category to the SGSN within ULA. Instead the HSS may reject location update. If the SGSN does not indicate support of this feature in IDA and the HSS has sent this ODB category within IDR, the HSS may apply barring of roaming and send CLR.
4	ODB-all-InternationalOG	O	Operator Determined Barring of all outgoing international calls This feature is applicable for the ULR/ULA and IDR/IDA command pairs to the SGSN. The HSS shall not send this ODB barring category to the MME. If the SGSN does not support this feature, the HSS shall not send this ODB barring category to the SGSN within ULA. Instead the HSS may reject location update. If the SGSN does not indicate support of this feature in IDA and the HSS has sent this ODB category within IDR, the HSS may apply barring of roaming and send CLR.
5	ODB-all-InternationalOGNotToHPLMN-Country	O	Operator Determined Barring of all outgoing international calls except those directed to the home PLMN country This feature is applicable for the ULR/ULA and IDR/IDA command pairs to the SGSN. The HSS shall not send this ODB barring category to the MME. If the SGSN does not support this feature, the HSS shall not send this ODB barring category to the SGSN within ULA. Instead the HSS may reject location update. If the SGSN does not indicate support of this feature in IDA and the HSS has sent this ODB category within IDR, the HSS may apply barring of roaming and send CLR.

6	ODB-all-Interzonal OG	O	Operator Determined Barring of all outgoing inter-zonal calls This feature is applicable for the ULR/ULA and IDR/IDA command pairs to the SGSN. The HSS shall not send this ODB barring category to the MME. If the SGSN does not support this feature, the HSS shall not send this ODB barring category to the SGSN within ULA. Instead the HSS may reject location update. If the SGSN does not indicate support of this feature in IDA and the HSS has sent this ODB category within IDR, the HSS may apply barring of roaming and send CLR.
7	ODB-all-Interzonal OGNotToHPLMN-Country	O	Operator Determined Barring of all outgoing inter-zonal calls except those directed to the home PLMN country This feature is applicable for the ULR/ULA and IDR/IDA command pairs to the SGSN. The HSS shall not send this ODB barring category to the MME. If the SGSN does not support this feature, the HSS shall not send this ODB barring category to the SGSN within ULA. Instead the HSS may reject location update. If the SGSN does not indicate support of this feature in IDA and the HSS has sent this ODB category within IDR, the HSS may apply barring of roaming and send CLR.
8	ODB-all-Interzonal OGAndInternationalOGNotToHPLMN-Country	O	Operator Determined Barring of all outgoing international calls except those directed to the home PLMN country and Barring of all outgoing inter-zonal calls This feature is applicable for the ULR/ULA and IDR/IDA command pairs to the SGSN. The HSS shall not send this ODB barring category to the MME. If the SGSN does not support this feature, the HSS shall not send this ODB barring category to the SGSN within ULA. Instead the HSS may reject location update. If the SGSN does not indicate support of this feature in IDA and the HSS has sent this ODB category within IDR, the HSS may apply barring of roaming and send CLR.
9	RegSub	O	Regional Subscription This feature is applicable for the ULR/ULA, IDR/IDA and DSR/DSA command pairs. If the MME or SGSN does not support this feature, the HSS shall not send Regional Subscription Zone Codes to the MME or SGSN within ULA. Instead the HSS may reject location update. If the MME or SGSN does not indicate support of this feature in IDA and the HSS has sent Regional Subscription Zone Codes within IDR, the HSS may apply barring of roaming and send CLR.
10	Trace	O	Trace Function This feature is applicable for the ULR/ULA, IDR/IDA and DSR/DSA command pairs. If the MME or SGSN does not indicate support of this feature in ULR, the HSS shall not send Trace Data to the MME or SGSN within ULA. If the MME or SGSN does not indicate support of this feature in IDA, and the HSS has sent Trace Data within IDR, the HSS may store this indication, and not send any further Trace Data to that MME or SGSN. If the MME or SGSN does not indicate support of this feature in DSA, and the HSS has sent Trace Data within DSR, the HSS may store this indication, and not send any further Trace Data to that MME or SGSN
11	LCS-all-PrivExcep	O	All LCS Privacy Exception Classes This feature is applicable for the ULR/ULA and IDR/IDA command pairs. If the SGSN does not support this feature, the HSS shall not send the related LCS information to the SGSN within ULA. If the SGSN does not indicate support of this feature in IDA, and the HSS has sent the related LCS information within IDR, the HSS may store this indication, and not send any further LCS information to that SGSN.

12	LCS-Universal	O	Allow location by any LCS client This feature is applicable for the ULR/ULA and IDR/IDA command pairs. If the SGSN does not support this feature, the HSS shall not send the related LCS information to the SGSN within ULA. If the SGSN does not indicate support of this feature in IDA, and the HSS has sent the related LCS information within IDR, the HSS may store this indication, and not send any further LCS information to that SGSN.
13	LCS-CallSessionRelated	O	Allow location by any value added LCS client to which a call/session is established from the target UE This feature is applicable for the ULR/ULA and IDR/IDA command pairs. If the SGSN does not support this feature, the HSS shall not send the related LCS information to the SGSN within ULA. If the SGSN does not indicate support of this feature in IDA, and the HSS has sent the related LCS information within IDR, the HSS may store this indication, and not send any further LCS information to that SGSN.
14	LCS-CallSessionUnrelated	O	Allow location by designated external value added LCS clients This feature is applicable for the ULR/ULA and IDR/IDA command pairs. If the SGSN does not support this feature, the HSS shall not send the related LCS information to the SGSN within ULA. If the SGSN does not indicate support of this feature in IDA, and the HSS has sent the related LCS information within IDR, the HSS may store this indication, and not send any further LCS information to that SGSN.
15	LCS-PLMNOperator	O	Allow location by designated PLMN operator LCS clients This feature is applicable for the ULR/ULA and IDR/IDA command pairs. If the SGSN does not support this feature, the HSS shall not send the related LCS information to the SGSN within ULA. If the SGSN does not indicate support of this feature in IDA, and the HSS has sent the related LCS information within IDR, the HSS may store this indication, and not send any further LCS information to that SGSN.
16	LCS-ServiceType	O	Allow location by LCS clients of a designated LCS service type This feature is applicable for the ULR/ULA and IDR/IDA command pairs. If the SGSN does not support this feature, the HSS shall not send the related LCS information to the SGSN within ULA. If the SGSN does not indicate support of this feature in IDA, and the HSS has sent the related LCS information within IDR, the HSS may store this indication, and not send any further LCS information to that SGSN.
17	LCS-all-MOLR-SS	O	All Mobile Originating Location Request Classes This feature is applicable for the ULR/ULA and IDR/IDA command pairs. If the SGSN does not support this feature, the HSS shall not send the related LCS information to the SGSN within ULA. If the SGSN does not indicate support of this feature in IDA, and the HSS has sent the related LCS information within IDR, the HSS may store this indication, and not send any further LCS information to that SGSN.
18	LCS-BasicSelfLocation	O	Allow an MS to request its own location This feature is applicable for the ULR/ULA and IDR/IDA command pairs. If the SGSN does not support this feature, the HSS shall not send the related LCS information to the SGSN within ULA. If the SGSN does not indicate support of this feature in IDA, and the HSS has sent the related LCS information within IDR, the HSS may store this indication, and not send any further LCS information to that SGSN.

19	LCS-AutonomousSelfLocation	O	Allow an MS to perform self location without interaction with the PLMN Th/ULA is feature is applicable for the ULR/ULA and IDR/IDA command pairs. If the SGSN does not support this feature, the HSS shall not send the related LCS information to the SGSN within ULA. If the SGSN does not indicate support of this feature in IDA, and the HSS has sent the related LCS information within IDR, the HSS may store this indication, and not send any further LCS information to that SGSN.
20	LCS-TransferToThirdParty	O	Allow an MS to request transfer of its location to another LCS client This feature is applicable for the ULR/ULA and IDR/IDA command pairs. If the SGSN does not support this feature, the HSS shall not send the related LCS information to the SGSN within ULA. If the SGSN does not indicate support of this feature in IDA, and the HSS has sent the related LCS information within IDR, the HSS may store this indication, and not send any further LCS information to that SGSN.
21	SM-MO-PP	O	ShortMessage MO-PP This feature is applicable for the ULR/ULA and IDR/IDA command pairs over S6d. If the SGSN does not support this feature, the HSS shall not send the related SMS information to the SGSN within ULA. If the SGSN does not indicate support of this feature in IDA, and the HSS has sent the related SMS information within IDR, the HSS may store this indication, and not send any further SMS information to that SGSN.
22	Barring-OutgoingCalls	O	Barring of Outgoing Calls This feature is applicable for the ULR/ULA and IDR/IDA command pairs over S6d. If the SGSN does not support this feature, the HSS shall not send the related SMS information to the SGSN within ULA. If the SGSN does not indicate support of this feature in IDA, and the HSS has sent the related SMS information within IDR, the HSS may store this indication, and not send any further SMS information to that SGSN.
23	BAOC	O	Barring of all outgoing calls This feature is applicable for the ULR/ULA and IDR/IDA command pairs over S6d. If the SGSN does not support this feature, the HSS shall not send the related SMS information to the SGSN within ULA. If the SGSN does not indicate support of this feature in IDA, and the HSS has sent the related SMS information within IDR, the HSS may store this indication, and not send any further SMS information to that SGSN.
24	BOIC	O	Barring of outgoing international calls This feature is applicable for the ULR/ULA and IDR/IDA command pairs over S6d. If the SGSN does not support this feature, the HSS shall not send the related SMS information to the SGSN within ULA. If the SGSN does not indicate support of this feature in IDA, and the HSS has sent the related SMS information within IDR, the HSS may store this indication, and not send any further SMS information to that SGSN.

25	BOICEx HC	O	Barring of outgoing international calls except those directed to the home PLMN Country This feature is applicable for the ULR/ULA and IDR/IDA command pairs over S6d. If the SGSN does not support this feature, the HSS shall not send the related SMS information to the SGSN within ULA. If the SGSN does not indicate support of this feature in IDA, and the HSS has sent the related SMS information within IDR, the HSS may store this indication, and not send any further SMS information to that SGSN.
26	UE-Reachability-Notificati on	O	UE Reachability Notifcation This feature is applicable for the ULR/ULA and IDR/IDA command pairs, over S6a. If the MME indicates in the ULR command that it does not support the UE-Reachability-Notifications, the HSS shall not set the "UE-Reachability-Request" bit in IDR-Flags in subsequent IDR commands towards that MME.
Feature bit: The order number of the bit within the Supported-Features AVP, e.g. "1". Feature: A short name that can be used to refer to the bit and to the feature, e.g. "ODB-HPLMN-APN". M/O: Defines if the implementation of the feature is mandatory ("M") or optional ("O"). Description: A clear textual description of the feature.			

Features that are not indicated in the Supported-Features AVPs within a given application message shall not be used to construct that message.

7.3.11   Requested-EUTRAN-Authentication-Info

The Requested-EUTRAN-Authentication-Info is of type Grouped. It shall contain the information related to the authentication requests for E-UTRAN.

AVP format

Requested- EUTRAN-Authentication-Info ::= <AVP header: 1408 10415>

[Number-Of-Requested-Vectors]

[Immediate-Response-Preferred]

[Re-synchronization-Info]

*[AVP]

7.3.12   Requested-UTRAN- GERAN-Authentication-Info

The Requested-UTRAN-GERAN-Authentication-Info is of type Grouped. It shall contain the information related to the to authentication requests for UTRAN or GERAN.

AVP format

Requested-UTRAN-GERAN-Authentication-Info ::= <AVP header: 1409 10415>

[Number-Of-Requested-Vectors]

[Immediate-Response-Preferred]

[Re-synchronization-Info]

*[AVP]

7.3.13 RAT-Type

The RAT-Type AVP is of type Enumerated and is used to identify the radio access technology that is serving the UE. See 3GPP TS 29.212 [10] for the defined values.

7.3.14 Number-Of-Requested-Vectors

The Number-Of-Requested-Vectors AVP is of type Unsigned32. This AVP shall contain the number of AVs the MME or SGSN is prepared to receive.

7.3.15 Re-Synchronization-Info

The Re-Synchronization-Info AVP is of type OctetString. It shall contain the concatenation of RAND and AUTS.

7.3.16 Immediate-Response-Preferred

The Immediate-Response-Preferred AVP is of type Unsigned32. This optional AVP indicates by its presence that immediate response is preferred, and by its absence that immediate response is not preferred. If present, the value of this AVP is not significant.

When EUTRAN-AVs and UTRAN-AVs or GERAN-AVs are requested, presence of this AVP within the Requested-EUTRAN-Authentication-Info AVP shall indicate that EUTRAN-AVs are requested for immediate use in the MME/SGSN; presence of this AVP within the Requested-UTRAN-GERAN-Authentication-Info AVP shall indicate that UTRAN-AVs or GERAN-AVs are requested for immediate use in the MME/SGSN. It may be used by the HSS to determine the number of vectors to be obtained from the AuC and the number of vectors downloaded to the MME or SGSN.

7.3.17 Authentication-Info

The Authentication-Info AVP is of type Grouped. This AVP contains Authentication Vectors.

AVP format:

Authentication-Info ::= <AVP header: 1413 10415>

*[E-UTRAN-Vector]

*[UTRAN-Vector]

*[GERAN-Vector]

*[AVP]

7.3.18 E-UTRAN-Vector

The E-UTRAN-Vector AVP is of type Grouped. This AVP shall contain an E-UTRAN Vector.

AVP format:

E-UTRAN-Vector ::= <AVP header: 1414 10415>

[Item-Number]

{ RAND }

{ XRES }

{ AUTN }

{ KASME }

*[AVP]

7.3.19   UTRAN-Vector

The UTRAN-Vector AVP is of type Grouped. This AVP shall contain an UTRAN Vector.

AVP format:

> UTRAN-Vector ::= <AVP header: 1415 10415>
>
> > [Item-Number]
> >
> > { RAND }
> >
> > { XRES }
> >
> > { AUTN }
> >
> > { Confidentiality-Key }
> >
> > { Integrity-Key }
> >
> > *[AVP]

7.3.20   GERAN-Vector

The GERAN-Vector AVP is of type Grouped. This AVP shall contain a GERAN Vector.

AVP format:

> GERAN-Vector ::= <AVP header: 1416 10415>
>
> > [Item-Number]
> >
> > { RAND }
> >
> > { SRES }
> >
> > { Kc }
> >
> > *[AVP]

7.3.21   Network-Access-Mode

The Network-Access-Mode AVP is of type Enumerated. The following values are defined:

> PACKET_AND_CIRCUIT (0)
>
> Reserved (1)
>
> ONLY_PACKET (2)

7.3.22   HPLMN-ODB

The HPLMN-ODB AVP is of type Unsigned32 and it shall contain a bit mask indicating the HPLMN specific services of a subscriber that are barred by the operator. The meaning of the bits is HPLMN specific:

Table 7.3.22/1: HPLMN-ODB

Bit	Description
0	HPLMN specific barring type 1
1	HPLMN specific barring type 2
2	HPLMN specific barring type 3
3	HPLMN specific barring type 4

HPLMN-ODB may apply to mobile originated short messages and is therefore not applicable to the MME; See 3GPP TS 23.015 [34].

7.3.23   Item-Number

The Item-Number AVP is of type Unsigned32. The Item Number is used to order Vectors received within one request.

7.3.24   Cancellation-Type

The Cancellation-Type AVP is of type Enumerated and indicates the type of cancellation. The following values are defined:

   MME_UPDATE_PROCEDURE (0)

This value is used when the Cancel Location is sent to the previous MME due to a received Update Location message from a new MME.

   SGSN_UPDATE_PROCEDURE (1)

This value is used when the Cancel Location is sent to the previous SGSN due to a received Update Location message from a new SGSN.

   SUBSCRIPTION_WITHDRAWAL (2)

This value is used when the Cancel Location is sent to the current MME or SGSN due to withdrawal of the user"s subscription by the HSS operator.

   UPDATE_PROCEDURE_IWF (3)

This value is used by an IWF when interworking with a pre-Rel-8 HSS.

   INITIAL_ATTACH_PROCEDURE (4)

This value is used when the Cancel Location is sent to the MME or SGSN due to a received Update Location message during initial attach procedure from an SGSN or MME respectively.

7.3.25   DSR-Flags

The DSR-Flags AVP is of type Unsigned32 and it shall contain a bit mask. The meaning of the bits is defined in table 7.3.25/1:

Table 7.3.25/1: DSR-Flags

Bit	Name	Description
0	Regional Subscription Withdrawal	This bit, when set, indicates that Regional Subscription shall be deleted from the subscriber data.
1	Complete APN Configuration Profile Withdrawal	This bit, when set, indicates that all EPS APN configuration data for the subscriber shall be deleted from the subscriber data. This flag only applies to the S6d interface.
2	Subscribed Charging Characteristics Withdrawal	This bit, when set, indicates that the Subscribed Charging Characteristics have been deleted from the subscription data.
3	PDN subscription contexts Withdrawal	This bit, when set, indicates that the PDN subscription contexts whose identifier is included in the Context-Identifier AVP shall be deleted. (Note 1)
4	STN-SR	This bit, when set, indicates that the Session Transfer Number for SRVCC shall be deleted from the subscriber data.
5	Complete PDP context list Withdrawal	This bit, when set, indicates that all PDP contexts for the subscriber shall be deleted from the subscriber data.
6	PDP contexts Withdrawal	This bit, when set, indicates that the PDP contexts whose identifier is included in the Context-Identifier AVP shall be deleted. (Note 2)
7	Roaming Restricted due to unsupported feature	This bit, when set, indicates that the roaming restriction shall be deleted from the subscriber data in the MME or SGSN.
8	Trace Data Withdrawal	This bit, when set, indicates that the Trace Data shall be deleted from the subscriber data.
9	CSG Deleted	This bit, when set, indicates that the CSG-Subscription-Data shall be deleted from the MME or SGSN.
10	APN-OI-Replacement	This bit, when set, indicates that the APN-OI-Replacement shall be deleted from the subscriber data.
11	GMLC List Withdrawal	This bit, when set, indicates that the subscriber's LCS GMLC List shall be deleted from the SGSN.
12	LCS Withdrawal	This bit, when set, indicates that the LCS service whose code is included in the SS-Code AVP shall be deleted from the SGSN.
13	SMS Withdrawal	This bit, when set, indicates that the SMS service whose code is included in the SS-Code AVP or TS-Code AVP shall be deleted from the SGSN.
Note 1: If the Complete APN Configuration Profile Withdrawal bit is set, this bit should not be set. Note 2: If the Complete PDP context list Withdrawal bit is set, this bit should not be set. Note 3: Bits not defined in this table shall be cleared by the sending HSS and discarded by the receiving MME or SGSN. Note 4: Bits 3 and 6 are excluding alternatives and shall not both be set.		

7.3.26 DSA-Flags

The DSA-Flags AVP is of type Unsigned32 and it shall contain a bit mask. The meaning of the bits is defined in table 7.3.26/1:

Table 7.3.26/1: DSA-Flags

Bit	Name	Description
0	Network Node area restricted	This bit, when set, shall indicate that the complete Network Node area (SGSN area) is restricted due to regional subscription.
Note: Bits not defined in this table shall be cleared by the sending SGSN and discarded by the receiving HSS.		

7.3.27 Context-Identifier

The Context-Identifier AVP is of type Unsigned32.

7.3.28 Void

7.3.29 Subscriber-Status

The 3GPP Subscriber Status AVP is of type Enumerated. It shall indicate if the service is barred or granted. The following values are defined:

SERVICE_GRANTED (0)

OPERATOR_DETERMINED_BARRING (1)

7.3.30 Operator-Determined-Barring

The Operator-Determined-Barring AVP is of type Unsigned32 and it shall contain a bit mask indicating the services of a subscriber that are barred by the operator. The meaning of the bits is the following:

Table 7.3.30/1: Operator-Determined-Barring

Bit	Description
0	All Packet Oriented Services Barred
1	Roamer Access HPLMN-AP Barred
2	Roamer Access to VPLMN-AP Barred
3	Barring of all outgoing calls
4	Barring of all outgoing international calls
5	Barring of all outgoing international calls except those directed to the home PLMN country
6	Barring of all outgoing inter-zonal calls
7	Barring of all outgoing inter-zonal calls except those directed to the home PLMN country
8	Barring of all outgoing international calls except those directed to the home PLMN country and Barring of all outgoing inter-zonal calls

7.3.31 Access-Restriction-Data

The Access-Restriction-Data AVP is of type Unsigned32 and it shall contain a bit mask where each bit when set to 1 indicates a restriction.. The meaning of the bits is the following:

Table 7.3.31/1: Access-Restriction-Data

Bit	Description
0	UTRAN Not Allowed
1	GERAN Not Allowed
2	GAN Not Allowed
3	I-HSPA-Evolution Not Allowed
4	E-UTRAN Not Allowed
5	HO-To-Non-3GPP-Access Not Allowed

7.3.32   APN-OI-Replacement

The APN-OI-Replacement AVP is of type UTF8String. This AVP shall indicate the domain name to replace the APN OI for the non-roaming case and the home routed roaming case when constructing the PDN GW FQDN upon which to perform a DNS resolution. See 3GPP TS 23.003 [3].

The contents of the APN-OI-Replacement AVP shall be formatted as a character string composed of one or more labels separated by dots (".").

7.3.33   All-APN-Configurations-Included-Indicator

The All-APN-Configurations-Included-Indicator AVP is of type Enumerated. The following values are defined:

All_APN_CONFIGURATIONS_INCLUDED (0)

MODIFIED/ADDED_APN_CONFIGURATIONS_INCLUDED (1)

7.3.34   APN-Configuration-Profile

The APN-Configuration-Profile AVP is of type Grouped. It shall contain the information related to the user's subscribed APN configurations for EPS. The Context-Identifier AVP within it shall that identify the per subscriber"s default APN configuration.

The AVP format shall conform to:

APN-Configuration-Profile ::= <AVP header: 1429 10415>

{ Context-Identifier }

{ All-APN-Configurations-Included-Indicator }

1*{APN-Configuration}

*[AVP]

The Subscription-Data AVP associated with an IMSI contains one APN-Configuration-Profile AVP.

Each APN-Configuration-Profile AVP contains one or more APN-Configuration AVPs.

Each APN-Configuration AVP describes the configuration for a single APN.

Therefore, the cardinality of the relationship between IMSI and APN is one-to-many.

7.3.35   APN-Configuration

The APN-Configuration AVP is of type Grouped. It shall contain the information related to the user"s subscribed APN configurations. The Context-Identifier in the APN-Configuration AVP shall identify that APN configuration, and it shall not have a value of zero. Furthermore, the Context-Identifier in the APN-Configuration AVP shall uniquely identify the EPS APN configuration per subscription. For a particular EPS user having multiple APN configurations, the Service-Selection AVP values shall be unique across APN-Configuration AVPs.

The AVP format shall conform to:

APN-Configuration ::= <AVP header: 1430 10415>

{ Context-Identifier }

* 2 [Served-Party-IP-Address]

{ PDN-Type }

{ Service-Selection}

[EPS-Subscribed-QoS Profile]

[VPLMN-Dynamic-Address-Allowed]

[MIP6-Agent-Info]

[Visited-Network-Identifier]

[PDN-GW-Allocation-Type]

[3GPP-Charging-Characteristics]

[AMBR]

*[Specific-APN-Info]

*[AVP]

The AMBR included in this grouped AVP shall include the AMBR associated to this specific APN configuration (APN-AMBR).

The Served-Party-IP-Address AVP may be present 0, 1 or 2 times. The AVP shall contain the IPv4 address, IPv6 address and/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.

The PDN-GW-Allocation-Type AVP applies to the MIP6-Agent-Info AVP. Therefore, it shall not be present if MIP6-Agent-Info is not present.

The Visited-Network-Identifier AVP indicates the PLMN where the PGW was allocated, in case of dynamic PGW assignment.

NOTE: If interworking with MAP is needed, the Context-Identifier will be in the range of 1 and 50.

7.3.36   Service-Selection

The Service-Selection AVP is of type of UTF8String. This AVP shall contain either the APN Network Identifier (i.e. an APN without the Operator Identifier) per 3GPP TS 23.003 [3], clauses 9.1 & 9.1.1, or this AVP shall contain the wild card value per 3GPP TS 23.003 [3], clause 9.1.2, and 3GPP TS 23.008 [30], clause 2.13.6).

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, i.e., consisting of only one ASCII label, "*".

This AVP is defined in IETF RFC 5778[20].

7.3.37   EPS-Subscribed-QoS-Profile

The EPS-Subscribed-QoS-Profile AVP is of type Grouped. It shall contain the bearer-level QoS parameters (QoS Class Identifier and Allocation Retention Priority) associated to the default bearer for an APN (see 3GPP TS 23.401 [2], clause 4.7.3).

AVP format

EPS-Subscribed-QoS-Profile ::= <AVP header: 1431 10415>

{ QoS-Class-Identifier }

{ Allocation-Retention-Priority }

*[AVP]

7.3.38   VPLMN-Dynamic-Address-Allowed

The VPLMN Dynamic Address Allowed AVP is of type Enumerated. It shall indicate whether for this APN, the UE is allowed to use the PDN GW in the domain of the HPLMN only, or additionally, the PDN GW in the domain of the VPLMN.. If this AVP is not present, this means that the UE is not allowed to use PDN GWs in the domain of the VPLMN. The following values are defined:

NOTALLOWED (0)

ALLOWED (1)

7.3.39   STN-SR

The STN-SR AVP is of type OctetString and shall contain the Session Transfer Number for SRVCC. See 3GPP TS 23.003 [3] for the definition of STN-SR. This AVP contains an STN-SR, in international number format as described in ITU-T Rec E.164 [8], encoded as a TBCD-string. See 3GPP TS 29.002 [24] for encoding of TBCD-strings.

7.3.40   Allocation-Retention-Priority

The Allocation-Retention-Priorit AVP is of typeGrouped and is defined in 3GPP TS 29.212 [10]. It shall indicate the Priority of Allocation and Retention for the corresponding APN configuration.

AVP format

    Allocation-Retention-Priority ::= <AVP header: 1034 10415>

            { Priority-Level }

            [Pre-emption-Capability]

            [Pre-emption-Vulnerability]

If the Pre-emption-Capability AVP is not present in the Allocation-Retention-Priority AVP, the default value shall be PRE-EMPTION_CAPABILITY_DISABLED (1).

If the Pre-emption-Vulnerability AVP is not present in the Allocation-Retention-Priority AVP, the default value shall be PRE-EMPTION_VULNERABILITY_ENABLED (0).

7.3.41   AMBR

The AMBR AVP is of type Grouped.

AVP format

    AMBR ::= <AVP header: 1435 10415>

            { Max-Requested-Bandwidth-UL }

            { Max-Requested-Bandwidth-DL }

            *[AVP]

7.3.42   MIP-Home-Agent-Address

The MIP-Home-Agent-Address AVP is of type Address and is defined in IETF RFC 4004 [27]. 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.

7.3.43   MIP-Home-Agent-Host

The MIP-Home-Agent-Host is of type Grouped and is defined in IETF RFC 4004 [27]. 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.

7.3.44 PDN-GW-Allocation-Type

The PDN-GW-Allocation-Type AVP is of type Enumerated. It shall indicate whether the PDN GW address included in MIP6-Agent-Info has been statically allocated (i.e. provisioned in the HSS by the operator), or dynamically selected by other nodes. The following values are defined:

STATIC (0)

DYNAMIC (1)

7.3.45 MIP6-Agent-Info

The MIP6-Agent-InfoAVP is of type Grouped and is defined in IETF RFC 5447 [26]. This AVP shall contain the identity of the PDN-GW. This AVP is used to convey the identity of the PDN-GW between the MME/SGSN and the HSS regardless of the specific mobility protocol used (GTP or PMIPv6). 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 to the MME/SGSN/HSS.

AVP format

```
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.

The AVP MIP6-Home-Link-Prefix is not used in S6a/S6d, but it is included here to reflect the complete IETF definition of the grouped AVP.

7.3.46 RAT-Frequency-Selection-Priority-ID

The RAT-Frequency-Selection-Priority-ID AVP is of type Unsigned32 and shall contain the subscribed value of Subscriber Profile ID for RAT/Frequency Priority. For details, see 3GPP TS 23.401 [2] and 3GPP TS 23.060 [12] . The coding is defined in 3GPP TS 36.413 [19]. Values shall be in the range of 1 to 256.

7.3.47 IDA-Flags

The IDA-Flags AVP is of type Unsigned32 and it shall contain a bit mask. The meanings of the bits are defined in table 7.3.47/1:

Table 7.3.47/1: IDA-Flags

Bit	Name	Description
0	Network Node area restricted	This bit, when set, shall indicate that the complete Network Node area (SGSN area) is restricted due to regional subscription.
Note: Bits not defined in this table shall be cleared by the sending SGSN and discarded by the receiving HSS.		

7.3.48 PUA-Flags

The PUA-Flags AVP is of type Unsigned32 and it shall contain a bit mask. The meanings of the bits are defined in table 7.3.48/1:

Table 7.3.48/1: PUA-Flags

bit	name	Description
0	Freeze M-TMSI	This bit, when set, shall indicate to the MME that the M-TMSI needs to be frozen, i.e. shall not be immediately re-used.
1	Freeze P-TMSI	This bit, when set, shall indicate to the SGSN that the P-TMSI needs to be frozen, i.e. shall not be immediately re-used.
Note: Bits not defined in this table shall be cleared by the sending HSS and discarded by the receiving MME or SGSN.		

7.3.49 NOR-Flags

The NOR-Flags AVP is of type Unsigned32 and it contains a bit mask. The meaning of the bits is defined in table 7.3.49/1:

Table 7.3.49/1: NOR-Flags

bit	name	Description
0	Single-Registration-Indication	This bit, when set, shall indicate that the HSS shall send a Cancel Location message to the current SGSN due to ISR. An SGSN shall not set this bit when sending NOR.
1	SGSN area restricted	This bit, when set, shall indicate that the complete SGSN area is restricted due to regional subscription.
2	Ready for SM	This bit, when set, shall indicate that the UE is present or the UE has memory capacity available to receive one or more short messages.
3	UE Reachable	This bit, when set, shall indicate that the UE has become reachable again.
4	Reserved	The use of this bit is deprecated. This bit shall be discarded by the receiving HSS.
Note: Bits not defined in this table shall be cleared by the sending MME or SGSN and discarded by the receiving HSS.		

7.3.50 User-Id

The User-Id AVP shall be of type UTF8String. It shall contain the leading digits of an IMSI (i.e. MCC, MNC, leading digits of MSIN, see 3GPP TS 23.003 [3], clause 2.2) formatted as a character string. Within a HSS, a User-Id identifies a set of subscribers, each with identical leading IMSI digits.

7.3.51 Equipment-Status

The Equipment-Status AVP is of type Enumerated, and shall contain the status of the mobile equipment. The following values are defined:

WHITELISTED (0)

BLACKLISTED (1)

GREYLISTED (2)

7.3.52 Regional-Subscription-Zone-Code

The Regional-Subscription-Zone-Code AVP is of type OctetString. Up to 10 zone codes shall all be defined as the tracking or routing areas into which the subscriber is allowed to roam. See 3GPP TS 23.003 [3].

NOTE: Any internal list of zone code roaming restrictions that may be generated by the MME/SGSN from the information in this AVP is an implementation issue only.

7.3.53 RAND

The RAND AVP is of type OctetString. This AVP shall contain the RAND. See 3GPP TS 33.401 [5].

7.3.54 XRES

The XRES AVP is of type OctetString. This AVP shall contain the XRES. See 3GPP TS 33.401 [5].

7.3.55 AUTN

The AUTN AVP is of type OctetString. This AVP shall contain the AUTN. See 3GPP TS 33.401 [5].

7.3.56 KASME

The KASME AVP is of type OctetString. This AVP shall contain the K_ASME. See 3GPP TS 33.401 [5].

7.3.57 Confidentiality-Key AVP

The Confidentiality-Key is of type OctetString, and shall contain the Confidentiality Key (CK).

7.3.58 Integrity-Key AVP

The Integrity-Key is of type OctetString, and shall contain the Integrity Key (IK).

7.3.59 Kc AVP

The Kc-Key is of type OctetString, and shall contain the Ciphering Key (Kc).

7.3.60 SRES

The SRES AVP is of type OctetString. This AVP shall contain the SRES. See 3GPP TS 33.102 [18].

7.3.61 Void

7.3.62 PDN-Type

The PDN-Type AVP is of type Enumerated and indicates the address type of PDN. The following values are defined:

IPv4 (0)

This value shall be used to indicate that the PDN can be accessed only in IPv4 mode.

IPv6 (1)

This value shall be used to indicate that the PDN can be accessed only in IPv6 mode.

IPv4v6 (2)

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.

IPv4_OR_IPv6 (3)

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. It should be noted that this value will never be used as a requested PDN Type from the UE, since UEs will only use one of their supported PDN Types, i.e., IPv4 only, IPv6 only or IPv4v6 (dualstack). This value is only used as part of the APN subscription context, as an authorization mechanism between HSS and MME.

7.3.63   Trace-Data AVP

The Trace-Data AVP is of type Grouped. This AVP shall contain the information related to trace function.

AVP format

> 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]

7.3.64   Trace-Reference AVP

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. See 3GPP TS 32.422 [23]. The content of this AVP shall be encoded as octet strings according to table 7.3.64-1. Bits 1111 shall be used as filler when MCC or MNC have less than 3 digits.

Table 7.3.64/1: Encoding format for Trace-Reference AVP

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

7.3.65   Void

7.3.66   Void

7.3.67   Trace-Depth AVP

The Trace-Depth AVP is of type Enumerated. The possible values are those defined in 3GPP TS 32.422 [23] for Trace Depth.

7.3.68   Trace-NE-Type-List AVP

The Trace-NE-Type-List AVP is of type OctetString. Octets are coded according to 3GPP TS 32.422 [23].

7.3.69   Trace-Interface-List AVP

The Trace-Interface-List AVP is of type OctetString. Octets are coded according to 3GPP TS 32.422 [23].

7.3.70   Trace-Event-List AVP

The Trace-Event-List AVP is of type OctetString. Octets are coded according to 3GPP TS 32.422 [23].

7.3.71   OMC-Id AVP

The OMC-Id AVP is of type OctetString. Octets are coded according to 3GPP TS 29.002 [24].

7.3.72   GPRS-Subscription-Data

The GPRS-Subscription-Data AVP is of type Grouped. It shall contain the information related to the user profile relevant for GPRS.

AVP format:

    GPRS-Subscription-Data ::= <AVP header: 1467 10415>

            { Complete-Data-List-Included-Indicator }

            1*50{PDP-Context}

            *[AVP]

 NOTE: The max number of PDP-Context AVP aligns with the value of maxNumOfPDP-Contexts as defined in
         3GPP TS 29.002[24].

7.3.73   Complete-Data-List-Included-Indicator

The Complete-Data-List-Included-Indicator AVP is of type Enumerated. The following values are defined:

   All_PDP_CONTEXTS_INCLUDED (0)

   MODIFIED/ADDED_PDP CONTEXTS_INCLUDED (1)

7.3.74   PDP-Context

The PDP-Context AVP is of type Grouped. For a particular GPRS user having multiple PDP Context configurations, the Service-Selection AVP values may be the same for different PDP-Context AVPs.

AVP format

    PDP-Context ::= <AVP header: 1469 10415>

            { Context-Identifier }

            { PDP-Type }

            [PDP-Address]

            { QoS-Subscribed }

            [VPLMN-Dynamic-Address-Allowed]

            { Service-Selection }

            [3GPP-Charging-Characteristics]

            *[AVP]

7.3.75   PDP-Type

The PDP-Type AVP is of type OctetString. Octets are coded according to 3GPP TS 29.002 [24].

7.3.76   Void

7.3.77   QoS-Subscribed

The QoS-Subscribed AVP is of type OctetString. Octets are coded according to 3GPP TS 29.002 [24] (octets of QoS-Subscribed, Ext-QoS-Subscribed, Ext2-QoS-Subscribed and Ext3-QoS-Subscribed values are concatenated).

7.3.78   CSG-Subscription-Data

The CSG-Subscription-Data AVP is of type Grouped. This AVP shall contain the CSG-Id and optionally an associated expiration date.

AVP format

        CSG-Subscription-Data ::= <AVP header: 1436 10415>

                { CSG-Id }

                [Expiration-Date]

                *[AVP]

7.3.79   CSG-Id

The CSG-Id-Data AVP is of type Unsigned32. Values are coded according to 3GPP TS 23.003 [3]. Unused bits (least significant) shall be padded with zeros.

7.3.80   Expiration-Date

The Expiration-Date AVP is of type Time (see IETF RFC 3588 [4]) and contains the point in time when subscription to the CSG-Id expires.

7.3.81   Roaming-Restricted-Due-To-Unsupported-Feature

The Roaming-Restricted-Due-To-Unsupported-Feature AVP is of type Enumerated and indicates that roaming is restricted due to unsupported feature. The following value is defined:

    Roaming-Restricted-Due-To-Unsupported-Feature (0)

7.3.82   Specific-APN-Info AVP

The Specific-APN-Info AVP is of type Grouped. 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.

The AVP format shall conform to:

        Specific-APN-Info ::= <AVP header: 1472 10415>

                { Service-Selection }

                { MIP6-Agent-Info }

                [Visited-Network-Identifier]

                *[AVP]

7.3.83   Alert-Reason AVP

The Alert-Reason AVP is of type Enumerated. The following values are defined:

UE_PRESENT (0)

UE_MEMORY_AVAILABLE (1)

7.3.84   LCS-Info

The LCS-Info AVP is of type Grouped. This AVP shall contain the following LCS related information for a subscriber:

- list of GMLCs in the HPLMN that are permitted to issue a call/session unrelated or call/session related MT-LR location request for this UE;

- privacy exception list;

- MO-LR list.

AVP format

LCS-Info ::= <AVP header: 1473 10415>

*[GMLC-Number]

*[LCS-PrivacyException]

*[MO-LR]

*[AVP]

7.3.85   GMLC-Number

The GMLC-Number AVP is of type OctetString. This AVP shall contain the ISDN number of the GMLC. For further details on the encoding of this AVP, see 3GPP TS 23.003[3].

7.3.86   LCS-PrivacyException

The LCS-PrivacyException AVP is of type Grouped. This AVP shall contain the classes of LCS Client that are allowed to locate any target UE.

AVP format

LCS-PrivacyException ::= <AVP header: 1475 10415>

{ SS-Code }

{ SS-Status }

[Notification-To-UE-User]

*[External-Client]

*[PLMN-Client]

*[Service-Type]

*[AVP]

7.3.87   SS-Code

The SS-Code AVP is of type OctetString. Octets are coded according to 3GPP TS 29.002 [24].

7.3.88 SS-Status

The SS-Status AVP is of type OctetString. Octets are coded according to 3GPP TS 29.002 [24]. For details, see 3GPP TS 23.011 [29].

7.3.89 Notification-To-UE-User

The Privacy-Notification-UE-User AVP is of type Enumerated. The following values are defined:

NOTIFY_LOCATION_ALLOWED (0)

NOTIFYANDVERIFY_LOCATION_ALLOWED_IF_NO_RESPONSE (1)

NOTIFYANDVERIFY_LOCATION_NOT_ALLOWED_IF_NO_RESPONSE (2)

LOCATION_NOT_ALLOWED (3)

7.3.90 External-Client

The External-Client AVP is of type Grouped. This AVP shall contain the identities of the external clients that are allowed to locate a target UE for a MT-LR.

AVP format

> External-Client ::= <AVP header: 1479 10415>
>
> { Client-Identity }
>
> [GMLC-Restriction]
>
> [Notification-To-UE-User]
>
> *[AVP]

7.3.91 Client-Identity

The Client-Identity AVP is of type OctetString and it shall contain the ISDN number of the external client. For further details on the encoding of this AVP, see 3GPP TS 23.003 [3].

7.3.92 GMLC-Restriction

The GMLC-Restriction AVP is of type Enumerated. The following values are defined:

GMLC_LIST (0)

HOME_COUNTRY (1)

7.3.93 PLMN-Client

The PLMN-Client AVP is of type Enumerated. The following values are defined:

BROADCAST_SERVICE (0)

O_AND_M_HPLMN (1)

O_AND_M_VPLMN (2)

ANONYMOUS_LOCATION (3)

TARGET_UE_SUBSCRIBED_SERVICE (4)

7.3.94 Service-Type

The Service-Type AVP is of type Grouped. This AVP shall contain the identities of the service type of the clients that are allowed to locate a target UE for an MT-LR.

AVP format

> Service-Type ::= <AVP header: 1483 10415>
>
>> { ServiceTypeIdentity }
>>
>> [GMLC-Restriction]
>>
>> [Notification-To-UE-User]
>>
>> *[AVP]

7.3.95 ServiceTypeIdentity

The ServiceTypeIdentity AVP is of type Unsigned32. For details on the values of this AVP, see 3GPP TS 29.002 [24].

7.3.96 MO-LR

The MO-LR AVP is of type Grouped. This AVP shall contain the classes of MO-LR for which a subscription exists for a particular UE.

AVP format

> MO-LR ::= <AVP header: 1485 10415>
>
>> { SS-Code }
>>
>> { SS-Status }
>>
>> *[AVP]

7.3.97 Void

7.3.98 Trace-Collection-Entity AVP

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 [23], clause 5.9.

7.3.99 Teleservice-List

The Teleservice-List AVP is of type Grouped. This AVP shall contain the service codes for the short message related teleservice for a subscriber:

AVP format

> Teleservice-List ::= <AVP header: 1486 10415>
>
>> 1 * { TS-Code }* [AVP]

7.3.100 TS-Code

The TS-Code AVP is of type OctetString. Octets are coded according to 3GPP TS 29.002 [24].

7.3.101 Call-Barring-Infor-List

The Call-Barring-Infor-List AVP is of type Grouped. This AVP shall contain the service codes for the short message related call barring services for a subscriber:

AVP format

    Call-Barring-Infor-List ::= <AVP header: 1488 10415>

        1 * { SS-Code }

        * [AVP]

7.3.102 SGSN-Number AVP

The SGSN-Number AVP is of type OctetString and it shall contain the ISDN number of the SGSN. For further details on the definition of this AVP, see 3GPP TS 23.003[3]. This AVP contains an SGSN-Number in international number format as described in ITU-T Rec E.164 [8] and shall be encoded as a TBCD-string. See 3GPP TS 29.002 [24] for encoding of TBCD-strings.

7.3.103 IDR-Flags

The IDR-Flags AVP is of type Unsigned32 and it shall contain a bit mask. The meaning of the bits shall be as defined in table 7.3.103/1:

Table 7.3.103/1: IDR-Flags

bit	name	Description
0	UE Reachability Request	This bit when set shall indicate to the MME that the HSS is awaiting a Notification of UE Reachability.
Note:	Bits not defined in this table shall be cleared by the sending HSS and discarded by the receiving MME.	

7.3.104 Void

7.3.105 Visited-Network-Identifier

The Visited-Network-Identifier AVP 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:

    mnc<MNC>.mcc<MCC>.3gppnetwork.org

7.4 Result-Code and Experimental-Result Values

7.4.1 General

This section defines result code values that shall be supported by all Diameter implementations that conform to this specification.

7.4.2 Success

Result codes that fall within the Success category shall be used to inform a peer that a request has been successfully completed. The Result-Code AVP values defined in Diameter Base Protocol RFC 3588 [4] shall be applied.

7.4.3 Permanent Failures

Errors that fall within the Permanent Failures category shall be used to inform the peer that the request has failed, and should not be attempted again. The Result-Code AVP values defined in Diameter Base Protocol RFC 3588 [4] shall be

applied. When one of the result codes defined here is included in a response, it shall be inside an Experimental-Result AVP and the Result-Code AVP shall be absent.

7.4.3.1 DIAMETER_ERROR_USER_UNKNOWN (5001)

This result code shall be sent by the HSS to indicate that the user identified by the IMSI is unknown

7.4.3.2 DIAMETER_ERROR_UNKNOWN_EPS_SUBSCRIPTION (5420)

This result code shall be sent by the HSS to indicate that no EPS subscription is associated with the IMSI.

7.4.3.3 DIAMETER_ERROR_RAT_NOT_ALLOWED (5421)

This result code shall be sent by the HSS to indicate the RAT type the UE is using is not allowed for the IMSI.

7.4.3.4 DIAMETER_ERROR_ROAMING_NOT_ALLOWED (5004)

This result code shall be sent by the HSS to indicate that the subscriber is not allowed to roam within the MME or SGSN area.

7.4.3.5 DIAMETER_ERROR_EQUIPMENT_UNKNOWN (5422)

This result code shall be sent by the EIR to indicate that the mobile equipment is not known in the EIR.

7.4.4 Transient Failures

Result codes that fall within the transient failures category shall be used to inform a peer that the request could not be satisfied at the time it was received, but may be able to satisfy the request in the future. The Result-Code AVP values defined in Diameter Base Protocol RFC 3588 [4] shall be applied. When one of the result codes defined here is included in a response, it shall be inside an Experimental-Result AVP and the Result-Code AVP shall be absent.

7.4.41 DIAMETER_AUTHENTICATION_DATA_UNAVAILABLE (4181)

This result code shall be sent by the HSS to indicate that an unexpectedly transient failure occurs. The requesting node can try the request again in the future.

8 User identity to HSS resolution

The User identity to HSS resolution mechanism enables the MME, SGSN (for non-roaming case) or Diameter Relay/proxy agents in the home network (for roaming case) to find the identity of the HSS that holds the subscriber data for a given user identity when multiple and separately addressable HSSs have been deployed in the home network. The resolution mechanism is not required in networks that utilise a single HSS.

This User identity to HSS resolution mechanism may rely on routing capabilitites provided by Diameter and be implemented in the home operator network within dedicated Diameter Agents (Redirect Agents or Proxy Agents) responsible for determining the HSS identity based on the provided user identity. If this Diameter based implementation is selected by the Home network operator, the principles described below shall apply.

In non-roaming case, in networks where more than one independently addressable HSS are deployed in the home network, each MME and SGSN shall be configured with the address/identity of a Diameter Agent (Redirect Agent or Proxy Agent) implementing this resolution mechanism.

For support of roaming case, Diameter Relay agents and/or Diameter Proxy agents in the home network receiving the Diameter signalling from visited networks shall be configured with the address/identity of a Diameter Agent (Redirect Agent or Proxy Agent) implementing this resolution mechanism.

To get the HSS identity that holds the subscriber data for a given user identity in the home network, the Diameter request normally destined to the HSS shall be sent to a pre-configured address/identity of a Diameter agent supporting the User identity to HSS resolution mechanism.

- If this Diameter request is received by a Diameter Redirect Agent, the Diameter Redirect Agent shall determine the HSS identity based on the provided user identity and shall return a notification of redirection towards the HSS identity, in response to the Diameter request. Multiple HSS identities may be included in the response, as specified in IETF RFC 3588 [4]. In such a case, the requesting Diameter entity shall send the Diameter request to the first HSS identity in the ordered list received in the Diameter response from the Diameter Redirect Agent. If no successful response to the Diameter request is received, the requesting Diameter entity shall send a Diameter request to the next HSS identity in the ordered list. This procedure shall be repeated until a successful response from an HSS is received. After the user identity to HSS resolution, the MME or the SGSN shall store the determined HSS identity/name/Realm and shall use it in further Diameter requests to the same user identity.

- If this Diameter request is received by a Diameter Proxy Agent, the Diameter Proxy Agent shall determine the HSS identity based on the provided user identity and shall forward the Diameter request directly to the HSS. In this case, the user identity to HSS resolution decision is communicated to the MME/SGSN in the Origin-Host/Origin-Realm AVPs of the response. The MME or the SGSN may store the determined HSS identity/name/Realm and may use it in further Diameter requests to the same user identity.

In roaming case, whereas a Diameter Relay Agent is stateless, a stateful Diameter Proxy Agent in the home network may store the determined HSS identity/name/Realm and use it in further Diameter requests associated to the same user identity.

NOTE: Alternatives to the user identity to HSS resolution Diameter based implementation are outside the scope of this specification.

Annex A (normative):
MME mapping table for S6a and NAS Cause Code values

The MME will at Attach communicate with HSS to retrieve subscription data. If this operation is not successful, there are several possible cause codes, which need to be mapped to appropriate cause codes over NAS to the UE.

This mapping shall be as shown in Tables A.1 and A.2.

Table A.1: Mapping between S6a error codes and NAS Cause Code values

Reject indication from HSS to MME over S6a/S6d	NAS Cause Code to UE
DIAMETER_ERROR_USER_UNKNOWN (5001)	#8 "EPS services and non-EPS services not allowed"
DIAMETER_ERROR_UNKNOWN_EPS_SUBSCRIPTION (5420)	#15 "No suitable cells in tracking area"
DIAMETER_ERROR_RAT_NOT_ALLOWED (5421)	#15 "No suitable cells in tracking area", or #13 "Roaming not allowed in this tracking area", or #12 "Tracking area not allowed" (NOTE 1)
DIAMETER_ERROR_ROAMING_NOT_ALLOWED (5004) (NOTE3)	#11 "PLMN not allowed"
DIAMETER_AUTHORIZATION_REJECTED (5003)	#15 "No suitable cells in tracking area"
DIAMETER_UNABLE_TO_COMPLY (5012), DIAMETER_INVALID_AVP_VALUE (5004) (NOTE 2)	#17 "Network failure"
NOTE 1: Any of those NAS Cause Code values may be sent to the UE, depending on operator's choice. NOTE 2: Any other permanent errors from the diameter base protocol, not listed here, should be also mapped to NAS Cause Code #17 "Network failure". NOTE 3: The MME might detect that roaming is not allowed by internal configuration.	

Table A.2: Mapping between NAS Cause Code values and network conditions

NAS cause code to UE	Condition
#2 "IMSI Unknown in HSS"	The MME receives a SGsAP-LOCATION-UPDATE-REJECT message from the VLR indicating in the reject cause "IMSI unknown in HSS". Only used in the Combined Tracking and Location Area Update procedure.
#14 "EPS services not allowed in this PLMN"	The MME receives in Update-Location-Answer message an indication of Roaming restricted in MME due to unsupported feature
#19 "ESM failure"	The value OPERATOR_DETERMINED_BARRING is received in the Subscriber-Status AVP

#12 "Tracking area not allowed"	The HSS indicates that due to subscription to a "regionally restricted service" the UE is not allowed to operate in the tracking area.
#25 "Not authorized for this CSG"	The CSG ID of the cell from where the UE has sent the TRACKING AREA UPDATE REQUEST message is not contained in the Allowed CSG list.
#15 "No suitable cells in tracking area"	The MME receives the Diameter error DIAMETER_UNABLE_TO_DELIVER (3002) and no re-routing takes place or DIAMETER_REALM_NOT_SERVED (3003) from another Diameter Agent (e.g. from a Diameter EDGE Relay Agent or from the GRX/IPX)
#15 "No suitable cells in tracking area" #14 "EPS services not allowed in this PLMN" NOTE: Any of those NAS Cause Code values may be sent to the UE, depending on operator's choice / configuration, e.g. NAS Cause Code #14 is to be sent to the UE if the network is an LTE only network.	The MME detects that it cannot communicate with the HSS in the HPLMN of the subscriber. How the MME detect this is implementation specific.

Annex B (informative): Change history

Change history								
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**		**Old**	**New**
2008-09	CT#41	CP-080475			V2.0.0 approved in CT#41		2.0.0	8.0.0
2008-12	CT#42	CP-080691	0001	1	S6a Vendor-Specific-Application-Id AVP		8.0.0	8.1.0
		CP-080691	0002	1	RegSub feature			
		CP-080691	0005		Clarification on Immediate-Response-Preferred			
		CP-080691	0006	1	Correction of the Reference of Supported Features			
		CP-080691	0007		Definition of RAT-Frequency-Selection-Priority			
		CP-080691	0008	2	ME Identity Check			
		CP-080703	0009	2	Gr alignment			
		CP-080971	0010	3	Closed Subscriber Group			
		CP-080691	0011		AVP codes			
		CP-080691	0012	1	MSISDN AVP			
		CP-080691	0013		Result codes			
		CP-080691	0014		Removal of Editor's note in ULA Flag			
		CP-080691	0015	2	Duplicated AMBR AVP and Use of Called-Station-Id			
		CP-080691	0017		Change of AVP to carry the APN information			
		CP-080691	0018	1	Reference to 3GPP-Charging-Characteristics			
		CP-080691	0019		Access Restriction Data Definition			
		CP-080691	0020		AMBR Definition			
		CP-080691	0021	1	AVPs Encoding			
		CP-080691	0022	1	PDN-GW Delete			
		CP-080691	0023	1	Requesting Node Type Clarification			
		CP-080691	0024		Authn Session State AVP			
		CP-080691	0026	2	Trace Session Activation and Deactivation			
		CP-080691	0027	1	Context-Identifier in APN-Configuration-Profile			
		CP-080691	0029		APN-OIReplacement			
		CP-080703	0032		Access Restriction			
		CP-080691	0033	1	Context Identifier clarification			
		CP-080691	0034	1	APN-Configuration correction			
		CP-080691	0037		Removal of Supported RAT Types			
		CP-080691	0039	1	Extension of the Terminal-Information AVP for non-3GPP accesses			
		CP-080691	0040		Conditionality of ULA-Flags and PUA-Flags AVPs			
		CP-080691	0042		Wrong Description for Complete APN Configuration Profile Withdrawal			
		CP-080691	0043		Purge UE Detailed Behaviour			
		CP-080691	0044	1	MME/SGSN area restricted flag cleanup			
					TS number in cover page corrected		8.1.0	8.1.1
2009-03	CT#43	CP-090056	0048	2	Context Identifier for Update or Removal of PDN GW		8.1.1	8.2.0
		CP-090046	0049		Clarification of the relationship between Subscriber-Status and ODB			
		CP-090046	0051	2	Context-Identifier in APN-Configuration-Profile			
		CP-090024	0052		Update of the AVP Codes			
		CP-090236	0053	2	PDN GW update for Wildcard APN			
		CP-090044	0054	1	Ready for SM			
		CP-090046	0055		ODB for SM			
		CP-090044	0056	2	Handling LCS Subscription Data			
		CP-090046	0057	2	Charging Characteristics			
		CP-090046	0058	2	Regional-Subscription-Zone-Code AVP Correction			
		CP-090046	0059	2	Trace Depth corrections			
		CP-090046	0060	2	Delete Subscriber Data Request procedure			
		CP-090046	0063	1	Coding definition for STN-SR			
		CP-090046	0064		Trace Reference in DSR			
		CP-090046	0065	1	DSR-Flags			
		CP-090046	0066	2	Clarification on All-APN-Configurations-Included-Indicator			
		CP-090046	0069		User-Name AVP contains only the IMSI			
		CP-090046	0070	1	MIP6-Agent-Info Definition and Usage			
		CP-090046	0075	1	Allocation Retention Priority			
		CP-090046	0076	1	APN includes only the Network Identifier			
		CP-090046	0077		Error Codes and ABNF Corrections			
		CP-090039	0078	4	User to HSS resolution			
		CP-090046	0079	1	Introducing the Trace-Collection-Entity AVP			
		CP-090046	0081	4	Usage of Immediate-Response-Preferred AVP			
		CP-090044	0082	3	Handling SMS Subscription Data			
		CP-090046	0083		SCTP version			
		CP-090046	0084		RFC 5447 References			
2009-06	CT#44	CP-090287	0086	1	Notification of SMS over IP Non-Delivery for E-UTRAN and UE		8.2.0	8.3.0

				Reachability			
	CP-090287	0087	1	Coding of Immediate Response Preferred AVP			
	CP-090287	0088		Trace Event List			
	CP-090287	0089		Removal of Requesting Node Type from AIR			
	CP-090287	0091		Regional-Subscription-Zone-Code clarification			
	CP-090287	0092		Clarification of PLMN encoding			
	CP-090287	0093		Diameter Command Codes for S6a/S6d/S13/S13"			
	CP-090287	0094		Update of Diameter Codes			
	CP-090287	0095	1	Formatting of APN in Service-Selection AVP			
	CP-090378	0096	3	User Data Download Indication			
	CP-090315	0097		Usage of Single-Registration-Indication			
	CP-090495	0098	3	ULR processing enhancement			
2009-09 CT#45	CP-090531	0100	2	Correction on APN-OI-Replacement		8.3.0	8.4.0
	CP-090726	0101	3	GPRS subscription data over S6d			
	CP-090531	0102	1	Usage of DIAMETER_ERROR_UNKNOWN_EPS_SUBSCRIPTION			
	CP-090531	0103	6	Cancel Location for Initial Attach			
	CP-090531	0104	4	Subscriber Data Update			
	CP-090531	0105	1	Usage of Single Registration Indication			
	CP-090531	0106	2	Charging Characteristics Reference			
	CP-090531	0107	1	Alerting Reason Behaviour			
	CP-090531	0108	1	Wildcard APN			
	CP-090531	0109		Subscriber's NAM			
	CP-090531	0111		Trace ID length correction			
	CP-090531	0112	1	Subscription-Data AVP in Update Location Answer			
	CP-090531	0113	1	Default values for Allocation Retention Priority AVP			
	CP-090531	0114		Default APN and Wildcard APN			
	CP-090531	0115	2	Correction in behavior of DSR-Flags			
	CP-090531	0116	1	PDN Type			
	CP-090531	0118	1	Clarification on the process of skip subscriber data flag in the HSS			
	CP-090532	0119	1	Corrections on IDR ABNF and Service Type AVP			
	CP-090532	0120	1	TS-Code AVP is missing in DSR command			
	CP-090532	0123	1	Cleanup of the TS			
	CP-090532	0124	1	Format of User-Id			
	CP-090532	0125	1	GPRS Subscription Data Update			
	CP-090532	0126	2	APN-Configuration-Profile			
	CP-090532	0128	1	3GPP2-MEID AVP			
	CP-090532	0129	1	MIP6-Agent-Info AVP			
	CP-090532	0130		Alignment of Supported Feature concept with 29.229			
	CP-090532	0133	1	EPS Subscribed QoS			
	CP-090532	0137	1	Restruction of the TS 29.272			
	CP-090532	0138	1	Trace Depth per session			
	CP-090532	0140		Clarification of Unsigned32 bit flag AVPs			
	CP-090532	0141	1	Extra Regional-Subscription-Zone-Codes			
	CP-090532	0142	1	Clarification of Service-Selection AVP encoding			
	CP-090532	0143	1	User to HSS identity resolution for Diameter Proxy Agents			
	CP-090532	0144		RFSP coding			
2009-12 CT#46	CP-091030	0147	4	Clarification on Some Subscription Data List Handling in MME/SGSN		8.4.0	8.5.0
	CP-090767	0151	2	RFSP alignment in 29.272			
	CP-090767	0154	2	Wildcard APN			
	CP-090767	0156	1	Lifetime of Charging Characteristics after Change			
	CP-091030	0158	2	Correction on the UE initiated detach procedure			
	CP-090767	0162	2	FQDN for S6a NOR			
	CP-090767	0164		HPLMN-ODB AVP correction			
	CP-091032	0166		From GMLC-Address to GMLC-Number			
	CP-091030	0170	1	Static PDN GW			
	CP-091030	0176	1	Clarification on Usage of Re-Synchronization-Info AVP			
	CP-091030	0178	1	Clarification on the Number of PDP-Contexts in the GPRS-Subscription-Data AVP			
	CP-090767	0184		APN-Configuration-Profile usage in IDR			
	CP-091030	0186	2	IMEI encoding			
	CP-091030	0188	1	APN-Configuration Service-Selection values			
	CP-091030	0190	1	QoS attributes			
	CP-091030	0197	2	Vendor Specific Application ID			
	CP-090776	0199	1	Destination Realm			
	CP-090767	0201		Correction to ME identity check procedure			
	CP-090767	0203		Reference of 3GPP-Charging-Characteristics			
	CP-090767	0205		Reset procedure MME/SGSN behavior			
2010-03 CT#47	CP-100020	0180	2	Correction to Purge UE Detailed Behaviour		8.5.0	8.6.0
		0209		HPLMN ODB			
		0216		Cancellation-Type clarifications			
		0218	1	IETF References update			
		0220		Static PDN GW			

			0226	1	Indication of PLMN ID of the selected PGW		
			0235	2	Indication of LCS Capabilities support over S6a/S6d		
			0237	1	Fix ambiguity on context id AVP		
			0239		Handling of UE Reachability MME Parameter		
2010-06	CT#48	CP-100264	0240	1	Service-Selection values	8.6.0	8.7.0
			0242	1	MIP6-Agent-Info		
			0256	1	Correction of an integration error for CR0239		
			0259	1	Correction of Context-Identifier		
			0244	2	Fix ambiguity on usage of the Supported-Features AVP		
		CP-100265	0263	2	MME mapping between Diameter error codes and NAS Cause Code values		
		CP-100415	0264		S6a Diameter Error Codes		
2010-09	CT#49	CP-100576	0274	2	NAS Cause Code values	8.7.0	8.8.0
		CP-100444	0280	2	Correction to Delete Subscriber Data for SGSN		
			0282	1	Unclear Cancel-Type Setting for Single Registration and Initial Attach		
2010-12	CT#50	CP-100689	0295	1	Removal of Notify Messages during detach or last PDN connection deactivation via 3GPP access	8.8.0	8.9.0
			0311	1	Correction of Restoration flag		
			0317		Default APN and Wildcard APN		
			0320	1	Usage of PGW Allocation Type AVP		
2011-03	CT#51	CP-110042	0335	3	Correction of error cause handling	8.9.0	8.10.0
			0341		AMBR Correction		
			0354	1	Feature Flag for UE Reachability Notification		
			0356	1	Setting of M bit AVP flag		
2011-06	CT#52	CP-110351	0360		SGSN-Number AVP correction	8.10.0	8.11.0

History

Document history		
V8.1.1	January 2009	Publication
V8.2.0	April 2009	Publication
V8.3.0	June 2009	Publication
V8.4.0	October 2009	Publication
V8.5.0	January 2010	Publication
V8.6.0	April 2010	Publication
V8.7.0	June 2010	Publication
V8.8.0	October 2010	Publication
V8.9.0	January 2011	Publication
V8.10.0	May 2011	Publication
V8.11.0	June 2011	Publication