Oracle® Communications Subscriber Data Management

LTE S6a/S6d Interface Description

Release 9.3

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ORACLE®

Oracle® Communications LTE S6a/S6d Interface Description, Release 9.3

Publication History

Revision	Date	Reason
A	October 2013	Initial Release. Same as 910-6857-001_rev_a. Date updated.
B	January 2014	Added Oracle front page and copyrights. Updated release date.

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1. Introduction

1.1 General

This document aims to provide a description of the S6a/S6d Diameter-based interface as supported by the SDM. The S6a/S6d interface is part of the LTE-HSS front-end component of the SDM, alongside the 3GPP HLR, IMS HSS, AAA server, SIP Application Server and ENUM server. Like all these other front-end components, the LTE HSS leverages the centralized Subscriber Data Server (SDS 3000™) back-end database for subscriber profile information.

1.2 Document Scope

This document provides interface compliance details in order to enable interoperability testing between the Tekelec LTE-HSS and other vendor's Mobility Management Entities (MME) and Serving GPRS Support Nodes (SGSN). For both S6a (MME-HSS) and S6d (SGSN-HSS), the document will provide the supported use cases and messages, as well as supported AVPs.

1.3 References

Ref	Doc number	Version	Author	Doc name
[1]	TS 29.272	V9.0.0	3GPP	MME and SGSN related interfaces based on Diameter protocol
[2]	TS 23.401	V9.2.0	3GPP	GPRS enhancements for E-UTRAN access
[3]	TS 23.008	V9.0.0	3GPP	Organization of subscriber data
[4]	TS 23.003	V9.0.0	3GPP	Numbering, addressing and identification
[5]	TS 24.301	V9.0.0	3GPP	Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS)
[6]	TS 33.401	V9.1.0	3GPP	3GPP System Architecture Evolution: Security Architecture
[7]	TS 33.102	V9.0.0	3GPP	3G Security; Security Architecture
[8]	TS 33.210	V8.3.0	3GPP	3G Security; Network Domain Security, IP Networks Layer Security
[9]	TS 33.220	V9.1.0	3GPP	Generic Authentication Architecture (GAA); Generic bootstrapping architecture
[10]	TS 29.002	V7.4.0	3GPP	MAP
[11]	TS 29.273	V9.0.0	3GPP	3GPP EPS AAA interfaces
[12]	RFC 3588		IETF	Diameter Base Protocol
[13]	RFC 2104		IETF	HMAC: Keyed-Hashing for Message Authentication
[14]	RFC 4004		IETF	Diameter Mobile IPv4 Application
[15]	RFC 5447		IETF	Diameter Mobile IPv6
[16]	TS 29.212		3GPP	Policy and charging control over Gx reference point
[17]	TS 29.214		3GPP	Policy and charging control over Rx reference point
[18]	TS 32.299		3GPP	Telecommunication management; Charging management; Diameter charging applications
[19]	TS 32.251		3GPP	Telecommunication management; Charging management; Packet Switched (PS) domain charging
[20]	TS 32.015		3GPP	Telecommunications management; Charging management; 3G call and event data for the Packet Switched (PS) domain

Ref	Doc number	Version	Author	Doc name
[21]	TS 32.215		3GPP	Telecommunication management; Charging management; Charging data description for the Packet Switched (PS) domain
[22]	TS 23.060		3GPP	General Packet Radio Service (GPRS); Service description; Stage 2
[23]	TS 29.061		3GPP	Interworking between the Public Land Mobile Network (PLMN) supporting packet based services and Packet Data Networks (PDN)
[24]	TS 29.060		3GPP	General Packet Radio Service (GPRS); GPRS Tunneling Protocol (GTP) across the Gn and Gp interface
[25]	TS 29.229		3GPP	Cx and Dx interfaces based on the Diameter protocol; Protocol details
[26]	TS 29.329		3GPP	Sh interface based on the Diameter protocol; Protocol details

1.4 ACRONYMS

Acronym	Description
3GPP	3rd Generation Project Program
AIA	Authentication Information Answer
AIR	Authentication Information Request
AuC	Authentication Center
AVP	Attribute Value Pair
BOIC	Barring of Outgoing International Calls
CLA	Cancel Location Answer
CLR	Cancel Location Request
CSP	Concerned Signaling Point
DSA	Delete Subscriber Data Answer
DSR	Delete Subscriber Data Request
ENUM	Electronic Numbers
eSDM	Evolved Subscriber Data Management
E-UTRAN	Evolved UMTS Terrestrial Radio Access Network
GERAN	GSM/Edge Radio Access Network
GPRS	General Packet Radio Service
HLR	Home Location Register
HSS	Home Subscriber Server
IDA	Insert Subscriber Data Answer
IDR	Insert Subscriber Data Request
IMS	International Mobile Station
IMSI	International Mobile Subscriber Identity
LTE	Long Term Evolution
MAP	Mobile Application Part
MME	Mobility Management Entities
MNP	Mobile Number Portability
MSISDN	Mobile Station (international) ISDN Number
NOA	Notify Answer
NOR	Notify Request
PDN	Packet Data Network
PUA	Purge UE Answer
PUR	Purge UE Request
RSA	Reset Answer
RSR	Reset Request
SCTP	Stream Control Transmission Protocol
SDM	Subscriber Data Management
SDS	Subscriber Data Server
SGSN	Serving GPRS Support Nodes
SIM	Subscriber Identity Module
SIP	Session Initiation Protocol
SLF	Subscription Locator Function
SRF	Signaling Relay Function
TCP	Test Communications Processor
UE	User Element
UL	Update Location
ULA	Update Location Answer
ULR	Update-Location-Request
UMTS	Universal Mobile Telecommunications System
UTRAN	UMTS Terrestrial Radio Access Network

2. Functional Description

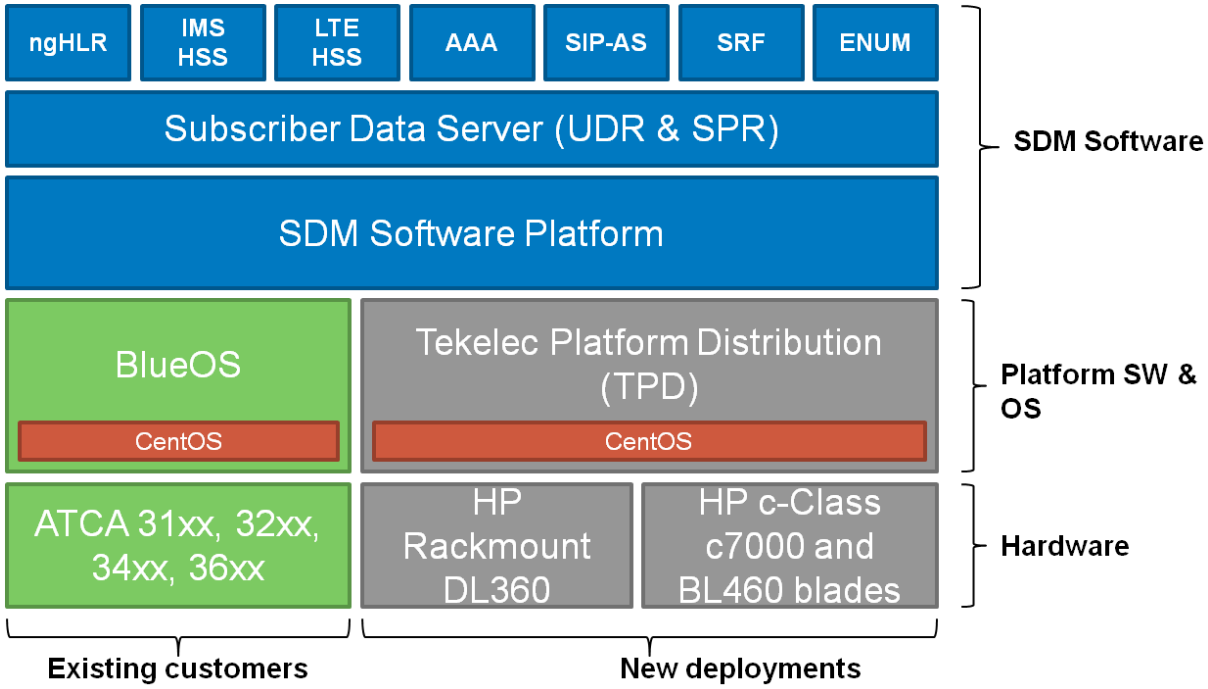
2.1 SDM Architecture Overview

The Subscriber Data Management (SDM) is an Evolved Subscriber Data Management (eSDM) platform, built with the objective to manage any number and type of profiles of a given subscriber.

The high-level architecture of the SDM is divided into 4 parts:

- The SDS, a distributed back-end subscriber database
- The Global Schema abstraction layer
- The front-end eSDM applications
- The protocol stacks (interface layer)

All the SDM front-end eSDM applications leverage the same subscriber profile database, which acts as a 3GPP User Data Repository. The front-end applications also share subscriber state and context, and therefore can trigger inter-application logic.



Alongside the LTE-HSS, the other currently supported front-end eSDM applications are;

- 3GPP HLR/AuC
- IMS HSS and SLF
- SIP Application Server (Registrar, Redirection server, User Agent Gateway)
- AAA server
- ENUM server
- Subscriber Signaling Router, including MNP-SRF

The LTE-HSS application shares the following components with the other elements of the SDM platform:

- Shared subscription profiles across GPRS/UMTS (PS) and LTE (EPS)
- Shared subscriber volatile data across GPRS/UMTS (PS) and LTE (EPS)
- Shared AuC for GERAN, UTRAN and E-UTRAN authentication
- Shared Base Diameter Stack with the IMS-HSS

2.2 LTE-HSS SUBSCRIBER PROFILES

The LTE-HSS subscriber profile leverages the existing 3GPP Release-6 compliant Packet-Switched Domain subscriber profile. Among other things, it leverages the multi-SIM / Multi-IMSI / Multi-MSISDN / Multi-Service-Profile architecture of the Tekelec SDM. New LTE-specific subscription fields have been added to the profile.

The PDN context required for LTE is supported alongside the GPRS context already existing for GPRS/UMTS. Operators therefore have the choice to provision one or the other (or both).

2.3 LTE-HSS USE CASES

Phase	Target SW vehicle	Use cases
LTE-HSS Phase 1	R5.3.0	S6a and S6d IOT with MME/SGSN vendors: - ULR/ULA - AIR/AIA - CLR/CLA - NOR/NOA - Intra-MME mobility - Inter-MME mobility - E-UTRAN authentication
LTE-HSS Phase 2	R5.3.1	S6a, S6d and Gr IOT with MME/SGSN vendors: - ISR/ISA - DSR/DSA - 3G/4G mobility with non-S6d SGSNs - GERAN/UTRAN/EUTRAN authentication - HSS-triggered provisioning - PUR/PUA - RSR/RSA
LTE-HSS Phase 3	R5.3.2	Provide Authentication toward Legacy network. - Compute a MAP-SAI message and send to legacy HLR upon AIR for IMSI defined with an Off Board SimType
LTE-HSS Phase 4	R5.3.3	Provide a seamless 3G-4G and 4G-3G roaming with legacy HLRs. - Compute a MAP-UL upon ULR if the IMSI was 3G registered in an external HLR upon 3G-4G roaming - Send CLR message to MME upon 4G-3G roaming when receiving a MAP-CL from legacy HLR
LTE-HSS Phase 5	R6.1.0	Full R9 standard compliancy CS Voice redirection to OneVoice

2.4 S6A/S6D SUPPORTED MESSAGES

Message	Abbreviation	Message direction	LTE-HSS compliance
Update-Location-Request	ULR	MME -> HSS	Supported 5.3.0
Update-Location-Answer	ULA	HSS -> MME	Supported 5.3.0
Authentication-Information-Request	AIR	MME -> HSS	Supported 5.3.0
Authentication-Information-Answer	AIA	HSS -> MME	Supported 5.3.0
Cancel-Location-Request	CLR	HSS -> MME	Supported 5.3.3
Cancel-Location-Answer	CLA	MME -> HSS	Supported 5.3.3
Insert-Subscriber-Data-Request	IDR	HSS -> MME	Supported 5.3.3
Insert-Subscriber-Data-Answer	IDA	MME -> HSS	Supported 5.3.3
Delete-Subscriber-Data-Request	DSR	HSS -> MME	Supported 5.3.3
Delete-Subscriber-Data-Answer	DSA	MME -> HSS	Supported 5.3.3
Purge-UE-Request	PUR	MME -> HSS	Supported 5.3.3
Purge-UE-Answer	PUA	HSS -> MME	Supported 5.3.3
Reset-Request	RSR	HSS -> MME	Supported 5.3.3
Reset-Answer	RSA	MME -> HSS	Supported 5.3.3
Notify-Request	NOR	MME -> HSS	Supported 5.3.3
Notify-Answer	NOA	HSS -> MME	Supported 5.3.3

2.5 PROTOCOL STACK & COMPLIANCE

The Tekelec LTE HSS supports S6a/S6d application over Diameter/TCP and Diameter/SCTP.

The S6a/S6d implementation in R5.3.3 is compliant with TS 29.272 v9.0.0 (Sep-2009) and TS 23.401 v9.2.0 (Sep-2009).

3. Location Management Procedures

3.1 Update Location Procedure

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 uses the commands Update-Location-Request/Answer (ULR/ULA) in the Diameter application.

3.1.1 HSS Behavior

- When receiving an Update Location request the HSS will check whether the IMSI is known.
- If it is not known, a Result Code of DIAMETER_ERROR_USER_UNKNOWN will be returned.
- If it is known, but the subscriber has no Subscriber Profile Assigned, the HSS returns 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 will return a Result Code of DIAMETER_ERROR_UNKNOWN_EPS_SUBSCRIPTION.
- The HSS will check whether the RAT type the UE is using is allowed. If it is not, a Result Code of DIAMETER_ERROR_RAT_NOT_ALLOWED will be returned.
- The HSS will check whether roaming is not allowed in the VPLMN due to ODB. If so a Result Code of DIAMETER_ERROR_ROAMING_NOT_ALLOWED will be returned.
- If the Update Location Request is received over the S6a interface, the HSS will send a Cancel Location Request (CLR) 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). If the "Initial-Attach-Indicator" flag was set in the received request, the HSS will send a Cancel Location Request (CLR) to the SGSN if there is an SGSN registration.
- If the Update Location Request is received over the S6d interface, the HSS will send a Cancel Location Request (CLR) 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). If the "Initial-Attach-Indicator" flag was set in the received request, the HSS will send a Cancel Location Request (CLR) to the MME if there is an MME registration.
- If the "Single-Registration-Indication" flag was set in the received request, the HSS will send a MAP Cancel Location message to the SGSN, delete the stored SGSN address and SGSN number.
- If no result code has been sent to the MME or SGSN so far, the HSS will 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 will 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 will contain at least the default APN Configuration and a Context-Identifier AVP that identifies the per subscriber's default APN configuration.
- The GPRS Subscription data (if available in the HSS) will only be present in the ULA command if it was indicated by the serving node in the ULR-Flags AVP, or when the Update Location Request is received over the S6d interface and there is no EPS subscription data stored for the subscriber.
- Subscriber-Status AVP will 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 will also be present in the Subscription-Data AVP, or vice versa.
- If a Result Code of DIAMETER_SUCCESS is returned, the HSS will set the Separation Indication in the response.

3.1.1.1 Not supported in current release

LCS-Info, All LCS-related procedures and Trace Function

3.1.1.2 LTE-HSS Roaming Templates

This feature is optional. Contact the Tekelec Customer care Center to make it available. Once available it can be activated and deactivated.

The LTE-HSS Roaming Templates (LRT) is an extension to the behavior of the HSS when ULR (update location request) messages are received. It defines a set of criteria for controlling the roaming of UE (user equipment) to the 4G network.

When a ULR message is received the HSS checks whether or not an LRT is associated with the subscriber profile. If none is found then the HSS checks the IMSI in the request to see if it is part of an IMSI range that has been assigned to an LRT. If no LRT is found then no additional screening is performed and the request is processed using existing logic.

Three services can be configured on an LRT. These services are independent of each other. Any combination of these services can be configured on any LRT:

1. Access Restrictions
   This service allows subscribers to connect via 2G/3G but not LTE.
2. APN Filtering
   This service screens the APNs that are returned with the subscriber profile.
3. VPLMN Address Allowed blocking within an APN
   This service turns off the "VPLMN Address Allowed" setting on the APNs that are returned to a visited network.

3.1.2 ULR MESSAGE

The table below provides the supported ULR AVPs.

AVP	Supported	Cat	Notes
Session-Id	Yes	M	Specified by MME
Auth-Session-State	Yes	M	NO_STATE_MAINTAINED
Origin-Host	Yes	M	Specified by MME
Origin-Realm	Yes	M	Specified by MME
Destination-Host	Yes	M	HSS host
Destination-Realm	Yes	M	HSS realm
User-Name	Yes	M	Must contain the active IMSI of the subscriber (note: LTE-HSS supports the Multi-IMSI per SIM card, and dynamic association of IMSIs)
Supported-Features	Yes	O	Supported by the HSS in this release: 0 ODB-all-APN 1 ODB-HPLMN-APN 2 ODB-VPLMN-APN 3 ODB-all-OG 4 ODB-all-InternationalOG 5 ODB-all-InternationalOGNotToHPLMN-Country 6 ODB-all-InterzonalOG 7 ODB-all-InterzonalOGNotToHPLMN-Country 8 ODB-all-InterzonalOGAndInternationalOGNotToHPLMN-Country 9 RegSub 21 SM-MO-PP 22 Barring-OutgoingCalls 23 BAOC 24 BOIC 25 BOICExHC
Vendor-ID	Yes	O	
Feature-List-ID	Yes	O	
Feature-List	Yes	O	
Terminal-Information	Yes	O	
IMEI	Yes	O	
Software-Version	Yes	O	
ULR-Flags	Yes	M	**Bit # / Description / Expected value** 0 Single-Registration-Indication 0 1 S6a/S6d-Indicator 1 2 Skip Subscriber Data 0 or 1 3 GPRS-Subscription-Data-Indicator 0 or 1 4 Node-Type-Indicator 0 5 Initial-Attach-Indicator 0
Visited-PLMN-Id	Yes	M	MCC-MNC
RAT-Type	Yes	M	UTRAN (1000) GERAN (1001) EUTRAN (1004)
SGSN-Number	Yes	C	e.164 address

3.1.3 ULA MESSAGE

The table below provides the supported ULA AVPs.

AVP	Supported	Cat	Notes
Session-Id	Yes	M	Specified by MME
Auth-Session-State	Yes	M	NO_STATE_MAINTAINED
Origin-Host	Yes	M	Specified by MME
Origin-Realm	Yes	M	Specified by MME
Supported-Features	Yes	O	Supported by the HSS in this release:
Vendor-ID	Yes	O	0 ODB-all-APN 1 ODB-HPLMN-APN 2 ODB-VPLMN-APN 3 ODB-all-OG 4 ODB-all-InternationalOG 5 ODB-all-InternationalOGNotToHPLMN-Country 6 ODB-all-InterzonalOG 7 ODB-all-InterzonalOGNotToHPLMN-Country 8 ODB-all-InterzonalOGAndInternationalOGNotToHPLMN-Country 9 RegSub 21 SM-MO-PP 22 Barring-OutgoingCalls 23 BAOC 24 BOIC 25 BOICExHC The HSS will reply only with the set of features that are supported by both the MME/SGSN and HSS.
Feature-List-ID	Yes	O	
Feature-List	Yes	O	
Result-Code	Yes	M	DIAMETER_SUCCESS DIAMETER_ERROR_USER_UNKNOWN (5001) DIAMETER_ERROR_UNKNOWN_EPS_SUBSCRIPTION (5420) DIAMETER_ERROR_RAT_NOT_ALLOWED (5421) DIAMETER_ERROR_ROAMING_NOT_ALLOWED (5004)
ULA-Flags	Yes	C	Bit 0 – Separation Indication – HSS always sets this bit to 1
Subscription-Data	Yes	C	Includes the complete subscription profile of the user. Present if success is reported, unless an explicit "skip subscriber data" indication was present in the ULR.
Subscriber-Status	Yes	C	SERVICE_GRANTED (0) OPERATOR_DETERMINED_BARRING (1)
MSISDN	Yes	C	The MSISDN set as displayed for this IMSI. Note the LTE-HSS supports Multi-MSISDN per subscription.
STN-SR	*No*	*C*	*Not supported, not sent by HSS*
Network-Access-Mode	Yes	C	PACKET_AND_CIRCUIT (0) ONLY_PACKET (2)

AVP	Supported	Cat	Notes
Operator-Determined-Barring	Yes	C	**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
HPLMN-ODB	Yes	C	**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
Regional-Subscription-Zone-Code	Yes	C	Up to 10 Zone Codes, as provisioned in the subscriber profile
Access-Restriction-Data	Yes	C	**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
APN-OI-Replacement	Yes	C	As provisioned in the subscriber profile
LCS-Info	*No*	*C*	*Not supported, not sent by HSS*
Teleservice-List	Yes	C	As provisioned in the subscriber profile
TS-Code	Yes	C	As provisioned in the subscriber profile
Call-Barring-Info-List	Yes	C	As provisioned in the subscriber profile
SS-Code	Yes	C	As provisioned in the subscriber profile
3GPP-Charging-Characteristics	Yes	C	As provisioned in the subscriber profile
AMBR	Yes	C	As provisioned in the subscriber profile
Max-Requested-Bandwidth-UL	Yes	C	As provisioned in the subscriber profile
Max-Requested-Bandwidth-DL	Yes	C	As provisioned in the subscriber profile
APN-Configuration-Profile	Yes	C	As provisioned in the subscriber profile
Context-Identifier	Yes	C	As provisioned in the subscriber profile
All-APN-Configurations-Included-Indicator	Yes	C	All_APN_CONFIGURATIONS_INCLUDED (0) MODIFIED/ADDED_APN_CONFIGURATIONS_INCLUDED (1)
APN-Configuration	Yes	C	As provisioned in the subscriber profile
Context-Identifier	Yes	C	As provisioned in the subscriber profile
Served-Party-IP-Address	Yes	C	As provisioned in the subscriber profile
PDN-Type	Yes	C	IPv4 (0) IPv6 (1) IPv4v6 (2) IPv4_OR_IPv6 (3)
Service-Selection	Yes	C	Wildcard APN not supported

AVP	Supported	Cat	Notes
EPS-Subscribed-QoS-Profile	Yes	C	As provisioned in the subscriber profile
QoS-Class-Identifier	Yes	C	As provisioned in the subscriber profile
Allocation-Retention-Priority	Yes	C	As provisioned in the subscriber profile
Priority-level	Yes	C	As provisioned in the subscriber profile
Pre-emption-capability	Yes	C	As provisioned in the subscriber profile
Pre-emption-vulnerability	Yes	C	As provisioned in the subscriber profile
VPLMN-Dynamic-Address-Allowed	Yes	C	NOTALLOWED (0) ALLOWED (1)
MIP6-Agent-Info	Yes	C	As provisioned in the subscriber profile
MIP-Home-Agent-Address	Yes	C	As provisioned in the subscriber profile
MIP-Home-Agent-Host	Yes	C	As provisioned in the subscriber profile
MIP6-Home-Link-Prefix	Yes	C	As provisioned in the subscriber profile
PDN-GW-Allocation-Type	Yes	C	STATIC (0) DYNAMIC (1)
3GPP-Charging-Characteristics	Yes	C	As provisioned in the subscriber profile
AMBR	Yes	C	As provisioned in the subscriber profile
Max-Requested-Bandwidth-UL	Yes	C	As provisioned in the subscriber profile
Max-Requested-Bandwidth-DL	Yes	C	As provisioned in the subscriber profile
Specific-APN-Info	Yes	C	As provisioned in the subscriber profile
RAT-Frequency-Selection-Priority-ID	Yes	C	As provisioned in the subscriber profile
Trace-Data	*No*	*C*	*Not supported, not sent by HSS*
GPRS-Subscription-Data	Yes	C	As provisioned in the subscriber profile
Complete-Data-List-Included-Indicator	Yes	C	All_PDP_CONTEXTS_INCLUDED (0) MODIFIED/ADDED_PDP CONTEXTS_INCLUDED (1)
PDP-Context	Yes	C	As provisioned in the subscriber profile
Context-Identifier	Yes	C	As provisioned in the subscriber profile
PDP-Type	Yes	C	As per 29.002
PDP-Address	Yes	C	As provisioned in the subscriber profile
QoS-Subscribed	Yes	C	As per 29.002
VPLMN-Dynamic-Address-Allowed	Yes	C	As provisioned in the subscriber profile
Service-Selection	Yes	C	Wildcard APN not supported
3GPP-Charging-Characteristics	Yes	C	As provisioned in the subscriber profile
CSG-Subscription-Data	*Yes*	*C*	As provisioned in the subscriber profile
CSG-ID	*Yes*	*C*	As provisioned in the subscriber profile
Expiration-date	*Yes*	*C*	As provisioned in the subscriber profile
Roaming-Restricted-Due-To-Unsupported-Feature	Yes	C	Roaming-Restricted-Due-To-Unsupported-Feature (0)

3.2 CANCEL LOCATION PROCEDURE

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:

1. the subscriber's subscription withdrawal
2. an ongoing update procedure i.e. MME or SGSN change
3. an initial attach procedure

This procedure uses the commands Cancel-Location-Request/Answer (CLR/CLA) in the Diameter application.

3.2.1 HSS BEHAVIOR

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

3.2.1.1 Not supported in current release

- Operator-triggered Cancel Location is not supported (only Mobility-related Cancel Location Requests). CLR is triggered upon Subscription deletion.

3.2.2 CLR MESSAGE

The table below provides the supported CLR AVPs.

AVP	Supported	Cat	Notes
Session-Id	Yes	M	Specified by HSS
Auth-Session-State	Yes	M	NO_STATE_MAINTAINED
Origin-Host	Yes	M	Specified by HSS
Origin-Realm	Yes	M	Specified by HSS
Destination-Host	Yes	M	MME host
Destination-Realm	Yes	M	MME realm
User-Name	Yes	M	The active IMSI registered with this MME/SGSN is used
Supported-Features	Yes	O	Supported by the HSS in this release: 0 ODB-all-APN 1 ODB-HPLMN-APN 2 ODB-VPLMN-APN 3 ODB-all-OG 4 ODB-all-InternationalOG 5 ODB-all-InternationalOGNotToHPLMN-Country 6 ODB-all-InterzonalOG 7 ODB-all-InterzonalOGNotToHPLMN-Country 8 ODB-all-InterzonalOGAndInternationalOGNotToHPLMN-Country 9 RegSub 21 SM-MO-PP 22 Barring-OutgoingCalls 23 BAOC 24 BOIC 25 BOICExHC The HSS will not send any Supported Features in a CLR.
Vendor-ID	Yes	O	
Feature-List-ID	Yes	O	
Feature-List	Yes	O	
Cancellation-Type	Yes	M	**Currently supported:** MME_UPDATE_PROCEDURE (0) SGSN_UPDATE_PROCEDURE (1) INITIAL_ATTACH_PROCEDURE (4) **Future:** SUBSCRIPTION_WITHDRAWAL (2) **Not supported:** UPDATE_PROCEDURE_IWF (3)

3.2.3 CLA MESSAGE

The table below provides the supported CLA AVPs.

AVP	Supported	Cat	Notes
Session-Id	Yes	M	Specified by HSS
Auth-Session-State	Yes	M	NO_STATE_MAINTAINED
Origin-Host	Yes	M	Specified by HSS
Origin-Realm	Yes	M	Specified by HSS
Supported-Features	Yes	O	Supported by the HSS in this release:
Vendor-ID	Yes	O	0 ODB-all-APN
Feature-List-ID	Yes	O	1 ODB-HPLMN-APN
Feature-List	Yes	O	2 ODB-VPLMN-APN 3 ODB-all-OG 4 ODB-all-InternationalOG 5 ODB-all-InternationalOGNotToHPLMN-Country 6 ODB-all-InterzonalOG 7 ODB-all-InterzonalOGNotToHPLMN-Country 8 ODB-all-InterzonalOGAndInternationalOGNotToHPLMN-Country 9 RegSub 21 SM-MO-PP 22 Barring-OutgoingCalls 23 BAOC 24 BOIC 25 BOICExHC The HSS understands the above features but does not expect to get any Supported Feature back from the MME in a CLA.
Result-Code	Yes	M	DIAMETER_SUCCESS DIAMETER_ERROR_USER_UNKNOWN (5001)

3.3 PURGE UE PROCEDURE

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.

3.3.1 HSS BEHAVIOR

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 they are identical the HSS shall set the PUA flags "freeze M-TMSI" and/or "freeze P-TMSI" in the answer message and set the flag "UE purged in MME" and/or set the flag "UE purged in SGSN"; otherwise it shall clear the PUA flags "freeze M-TMSI" and "freeze P-TMSI.

3.3.2 PUR MESSAGE

The table below provides the supported PUR AVPs.

AVP	Supported	Cat	Notes
Session-Id	Yes	M	Specified by MME
Auth-Session-State	Yes	M	NO_STATE_MAINTAINED
Origin-Host	Yes	M	Specified by MME
Origin-Realm	Yes	M	Specified by MME
Destination-Host	Yes	M	HSS host
Destination-Realm	Yes	M	HSS realm
User-Name	Yes	M	Must contain the active IMSI of the subscriber (note: LTE-HSS supports the Multi-IMSI per SIM card, and dynamic association of Isis)
Supported-Features	Yes	O	Supported by the HSS in this release: 0 ODB-all-APN 1 ODB-HPLMN-APN 2 ODB-VPLMN-APN 3 ODB-all-OG 4 ODB-all-InternationalOG 5 ODB-all-InternationalOGNotToHPLMN-Country 6 ODB-all-InterzonalOG 7 ODB-all-InterzonalOGNotToHPLMN-Country 8 ODB-all-InterzonalOGAndInternationalOGNotToHPLMN-Country 9 RegSub 21 SM-MO-PP 22 Barring-OutgoingCalls 23 BAOC 24 BOIC 25 BOICExHC The HSS understands the above features but does not expect to get any Supported Feature from the MME in a PUR.
Vendor-ID	Yes	O	
Feature-List-ID	Yes	O	
Feature-List	Yes	O	

3.3.3 PUA MESSAGE

The table below provides the supported PUA AVPs.

AVP	Supported	Cat	Notes
Session-Id	Yes	M	Specified by HSS
Auth-Session-State	Yes	M	NO_STATE_MAINTAINED
Origin-Host	Yes	M	Specified by HSS
Origin-Realm	Yes	M	Specified by HSS
Destination-Host	Yes	M	MME host
Destination-Realm	Yes	M	MME realm
	Yes	M	The active IMSI registered with this MME/SGSN is used
Supported-Features	Yes	O	Supported by the HSS in this release:
Vendor-ID	Yes	O	0 ODB-all-APN 1 ODB-HPLMN-APN 2 ODB-VPLMN-APN 3 ODB-all-OG 4 ODB-all-InternationalOG 5 ODB-all-InternationalOGNotToHPLMN-Country 6 ODB-all-InterzonalOG 7 ODB-all-InterzonalOGNotToHPLMN-Country 8 ODB-all-InterzonalOGAndInternationalOGNotToHPLMN-Country 9 RegSub 21 SM-MO-PP 22 Barring-OutgoingCalls 23 BAOC 24 BOIC 25 BOICExHC The HSS will not send any Supported Features in a PUA.
Feature-List-ID	Yes	O	
Feature-List	Yes	O	
Result-Code	Yes	M	DIAMETER_SUCCESS DIAMETER_ERROR_USER_UNKNOWN (5001)
PUA-Flags	Yes	C	Currently supported and send, depending on the registration type: Freeze M-IMSI (bit 0) Freeze T-IMSI (bit 1)

4. Subscriber Data Handling Procedures

4.1 Insert Data Handling Procedures

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 HSS knows that the UE has attached to the same combined MME/SGSN via both the E-UTRAN and UTRAN/GERAN, i.e. the HSS has received the Update Location Request over both the S6a interface and S6d interface respectively with the same SGSN number, the HSS should invoke this procedure for a single time to update certain user data in the combined MME/SGSN, i.e. not invoke this procedure for each of the MME and the SGSN registered respectively.

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.

4.1.1 HSS Behavior

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 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 has received a message from the Service Related Entity indicating that the UE is unreachable, in order to request the MME to notify the HSS when the UE becomes reachable again, the HSS shall set the "UE Reachability Request flag" in the IDR Request Flags.
- For those APNs that has 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.
- When receiving an Insert Subscriber Data answer with "SGSN Area Restricted" the HSS shall set the SGSN area restricted flag as "SGSN area restricted".

4.1.2 IDR MESSAGE

The table below provides the supported IDR AVPs.

AVP	Supported	Cat	Notes
Session-Id	Yes	M	Specified by HSS
Auth-Session-State	Yes	M	NO_STATE_MAINTAINED
Origin-Host	Yes	M	HSS host
Origin-Realm	Yes	M	HSS realm
Destination-Host	Yes	M	Specified by HSS
Destination-Realm	Yes	M	Specified by HSS
User-Name	Yes	M	IMSI
Supported-Features	Yes	O	Supported by the HSS in this release: 0 ODB-all-APN 1 ODB-HPLMN-APN 2 ODB-VPLMN-APN 3 ODB-all-OG 4 ODB-all-InternationalOG 5 ODB-all-InternationalOGNotToHPLMN-Country 6 ODB-all-InterzonalOG 7 ODB-all-InterzonalOGNotToHPLMN-Country 8 ODB-all-InterzonalOGAndInternationalOGNotToHPLMN-Country 9 RegSub 21 SM-MO-PP 22 Barring-OutgoingCalls 23 BAOC 24 BOIC 25 BOICExHC The HSS will not send any supported features in an IDR.
Vendor-ID	Yes	O	
Feature-List-ID	Yes	O	
Feature-List	Yes	O	
IDR-Flags	Yes	C	The value 0 (UE-Reachability-request) is always set by HSS.
Subscription-Data	Yes	C	Includes the complete subscription profile of the user. Present if success is reported, unless an explicit "skip subscriber data" indication was present in the ULR.

AVP	Supported	Cat	Notes
Subscriber-Status	Yes	C	SERVICE_GRANTED (0) OPERATOR_DETERMINED_BARRING (1)
MSISDN	Yes	C	The MSISDN set as displayed for this IMSI. Note the LTE-HSS supports Multi-MSISDN per subscription.
STN-SR	*No*	*C*	*Not supported, not sent by HSS*
Network-Access-Mode	Yes	C	PACKET_AND_CIRCUIT (0) ONLY_PACKET (2)
Operator-Determined-Barring	Yes	C	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
HPLMN-ODB	Yes	C	**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
Regional-Subscription-Zone-Code	Yes	C	Up to 10 Zone Codes, as provisioned in the subscriber profile
Access-Restriction-Data	Yes	C	**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
APN-OI-Replacement	Yes	C	As provisioned in the subscriber profile
LCS-Info	*No*	*C*	*Not supported, not sent by HSS*
Teleservice-List	Yes	C	As provisioned in the subscriber profile
TS-Code	Yes	C	As provisioned in the subscriber profile
Call-Barring-Infor-List	Yes	C	As provisioned in the subscriber profile
SS-Code	Yes	C	As provisioned in the subscriber profile
3GPP-Charging-Characteristics	Yes	C	As provisioned in the subscriber profile
AMBR	Yes	C	As provisioned in the subscriber profile
Max-Requested-Bandwidth-UL	Yes	C	As provisioned in the subscriber profile
Max-Requested-Bandwidth-DL	Yes	C	As provisioned in the subscriber profile
APN-Configuration-Profile	Yes	C	As provisioned in the subscriber profile
Context-Identifier	Yes	C	As provisioned in the subscriber profile
All-APN-Configurations-Included-Indicator	Yes	C	All_APN_CONFIGURATIONS_INCLUDED (0) MODIFIED/ADDED_APN_CONFIGURATIONS_INCLUDED (1)
APN-Configuration	Yes	C	As provisioned in the subscriber profile
Context-Identifier	Yes	C	As provisioned in the subscriber profile

AVP	Supported	Cat	Notes
Served-Party-IP-Address	Yes	C	As provisioned in the subscriber profile
PDN-Type	Yes	C	IPv4 (0) IPv6 (1) IPv4v6 (2) IPv4_OR_IPv6 (3)
Service-Selection	Yes	C	Wildcard APN not supported
EPS-Subscribed-QoS-Profile	Yes	C	As provisioned in the subscriber profile
QoS-Class-Identifier	Yes	C	As provisioned in the subscriber profile
Allocation-Retention-Priority	Yes	C	As provisioned in the subscriber profile
Priority-level	Yes	C	As provisioned in the subscriber profile
Pre-emption-capability	Yes	C	As provisioned in the subscriber profile
Pre-emption-vulnerability	Yes	C	As provisioned in the subscriber profile
VPLMN-Dynamic-Address-Allowed	Yes	C	NOTALLOWED (0) ALLOWED (1)
MIP6-Agent-Info	Yes	C	As provisioned in the subscriber profile
MIP-Home-Agent-Address	Yes	C	As provisioned in the subscriber profile
MIP-Home-Agent-Host	Yes	C	As provisioned in the subscriber profile
MIP6-Home-Link-Prefix	Yes	C	As provisioned in the subscriber profile
PDN-GW-Allocation-Type	Yes	C	STATIC (0) DYNAMIC (1)
3GPP-Charging-Characteristics	Yes	C	As provisioned in the subscriber profile
AMBR	Yes	C	As provisioned in the subscriber profile
Max-Requested-Bandwidth-UL	Yes	C	As provisioned in the subscriber profile
Max-Requested-Bandwidth-DL	Yes	C	As provisioned in the subscriber profile
Specific-APN-Info	Yes	C	As provisioned in the subscriber profile
RAT-Frequency-Selection-Priority-ID	Yes	C	As provisioned in the subscriber profile
Trace-Data	*No*	*C*	*Not supported, not sent by HSS*
GPRS-Subscription-Data	Yes	C	As provisioned in the subscriber profile
Complete-Data-List-Included-Indicator	Yes	C	All_PDP_CONTEXTS_INCLUDED (0) MODIFIED/ADDED_PDP CONTEXTS_INCLUDED (1)
PDP-Context	Yes	C	As provisioned in the subscriber profile
Context-Identifier	Yes	C	As provisioned in the subscriber profile
PDP-Type	Yes	C	As per 29.002
PDP-Address	Yes	C	As provisioned in the subscriber profile
QoS-Subscribed	Yes	C	As per 29.002
VPLMN-Dynamic-Address-Allowed	Yes	C	As provisioned in the subscriber profile
Service-Selection	Yes	C	Wildcard APN not supported

AVP	Supported	Cat	Notes
3GPP-Charging-Characteristics	Yes	C	As provisioned in the subscriber profile
CSG-Subscription-Data	*Yes*	*C*	As provisioned in the subscriber profile
CSG-ID	*Yes*	*C*	As provisioned in the subscriber profile
Expiration-date	*Yes*	*C*	As provisioned in the subscriber profile
Roaming-Restricted-Due-To-Unsupported-Feature	Yes	C	Roaming-Restricted-Due-To-Unsupported-Feature (0)

4.1.3 IDA MESSAGE

AVP	Supported	Cat	Notes
Session-Id	Yes	M	Specified by HSS
Auth-Session-State	Yes	M	NO_STATE_MAINTAINED
Origin-Host	Yes	M	Specified by MME
Origin-Realm	Yes	M	Specified by MME
Destination-Host	Yes	M	HSS host
Destination-Realm	Yes	M	HSS realm
Supported-Features	Yes	O	Supported by the HSS in this release: 0 ODB-all-APN 1 ODB-HPLMN-APN 2 ODB-VPLMN-APN 3 ODB-all-OG 4 ODB-all-InternationalOG 5 ODB-all-InternationalOGNotToHPLMN-Country 6 ODB-all-InterzonalOG 7 ODB-all-InterzonalOGNotToHPLMN-Country 8 ODB-all-InterzonalOGAndInternationalOGNotToHPLMN-Country 9 RegSub 21 SM-MO-PP 22 Barring-OutgoingCalls 23 BAOC 24 BOIC 25 BOICExHC HSS will not send any Supported Features in a PUA.
Vendor-ID	Yes	O	
Feature-List-ID	Yes	O	
Feature-List	Yes	O	
Result-Code	Yes	M	DIAMETER_SUCCESS DIAMETER_ERROR_USER_UNKNOWN (5001)
IDA-Flags	Yes	C	Currently supported and interpreted by HSS: Network Node Area Restricted (bit 0)

4.2 DELETE SUBSCRIBER DATA PROCEDURE

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:

1. all or a subset of the EPS subscription data (APN Configuration Profile) for the subscriber from the MME or SGSN
2. the regional subscription
3. the subscribed charging characteristics
4. Session Transfer Number for SRVCC; 3GPP 3GPP TS 29.272 V9.0.0 (2009-09) 19 Release 9
5. trace data

If the HSS knows that the UE has attached to the same combined MME/SGSN via both E-UTRAN and UTRAN/GERAN, i.e. the HSS has received the Update Location Request over both the S6a interface and S6d interface respectively with the same SGSN number, the HSS should invoke this procedure for a single time to remove some or all data of the HSS user profile stored in the combined MME/SGSN, i.e. not invoke this procedure for each of the MME and the SGSN registered respectively.

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.

4.2.1 HSS BEHAVIOR

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

4.2.1.1 Not supported in current release

Request for removal of trace data will not be send by the HSS.

4.2.2 DSR MESSAGE

The table below provides the supported DSR AVPs.

AVP	Supported	Cat	Notes
Session-Id	Yes	M	Specified by HSS
Auth-Session-State	Yes	M	NO_STATE_MAINTAINED
Origin-Host	Yes	M	Specified by HSS
Origin-Realm	Yes	M	Specified by HSS
Destination-Host	Yes	M	MME host
Destination-Realm	Yes	M	MME realm
User-Name	Yes	M	The active IMSI registered with this MME/SGSN is used
Supported-Features	Yes	O	Supported by the HSS in this release: 0 ODB-all-APN 1 ODB-HPLMN-APN 2 ODB-VPLMN-APN 3 ODB-all-OG 4 ODB-all-InternationalOG 5 ODB-all-InternationalOGNotToHPLMN-Country 6 ODB-all-InterzonalOG 7 ODB-all-InterzonalOGNotToHPLMN-Country 8 ODB-all-InterzonalOGAndInternationalOGNotToHPLMN-Country 9 RegSub 21 SM-MO-PP 22 Barring-OutgoingCalls 23 BAOC 24 BOIC 25 BOICExHC The HSS will not send any Supported Features in a DSR.
Vendor-ID	Yes	O	
Feature-List-ID	Yes	O	
Feature-List	Yes	O	
DSR-Flags	Yes	M	HSS supports and sets those bits according to the relevant provisioning or traffic operation: **Bit Description** 0 Regional Subscription Withdrawal 1 Complete APN Configuration Profile Withdrawal 2 Subscribed Charging Characteristics Withdrawal 3 PDN subscription contexts Withdrawal 5 Complete PDP context list Withdrawal 6 PDP contexts Withdrawal 9 CSG Deleted 10 APN-OI-Replacement 13 Barring of all outgoing international calls except those directed to the home PLMN country and Barring of all outgoing inter-zonal callsBit The following bits are not supported and will not be sent: **Bit Description** 4 STN-SR 7 Roaming Restricted due to unsupported feature 8 Trace Data Withdrawal 11 GMLC List Withdrawal 12 LCS Withdrawal

AVP	Supported	Cat	Notes
Trace-Reference	Yes	C	Trace Reference is not supported
Context-Identifier	Yes	C	This parameter shall identify the PDN subscription context or GPRS-PDP context that shall be deleted. This 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.
TS-Code-List	Yes	C	This parameter shall contain the teleservice codes that are to be deleted from the subscription. This 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	Yes	c	SS-Code-List is not supported.

4.2.3 DSA MESSAGE

(Message Supported: Document not complete)

5. Authentication Procedures

5.1 Authentication Information Retrieval Procedure

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

This procedure uses the commands Authentication-Information-Request/Answer (AIR/AIA) in the Diameter application.

5.1.1 HSS Behavior

- When receiving an Authentication Information request the HSS will 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, but the subscriber has no EPS or GPRS subscription, the HSS may (as a configuration option) return a result code of DIAMETER_ERROR_UNKNOWN_ EPS_SUBSCRIPTION
- The HSS will then request the AuC to generate the corresponding requested Authentication Vectors (AVs).
- If EUTRAN-Authentication-Info is requested, when receiving AVs from the AuC, the HSS will generate the KASME before sending the response to the MME or combined MME-SGSN.
- The HSS will always calculate and return the requested number of authentication vectors up to 32 for each category (E-UTRAN/UTRAN/GERAN). In other words, the HSS will always answer as if the Immediate-Response-Preferred attribute was present. If more than 32 vectors of each category are requested, then only 32 of them will be returned. If the AuC is unable to calculate any corresponding AVs due to unknown failures, such as the internal database error, the result code will be set to DIAMETER_AUTHENTICATION_DATA_UNAVAILABLE. The MME or the SGSN may request authentication vectors again.
- If the Requested-EUTRAN-Authentication-Info AVP is present in the request, the HSS will download E-UTRAN authentication vectors to the MME. If the Requested-UTRAN-GERAN-Authentication-Info AVP is present in the request, the HSS will download UTRAN or GERAN authentication vectors to the SGSN.
- If more than one EPS or UTRAN or GERAN Vector is to be included within one Authentication-Info AVP, the Item-Number AVP will be present within each Vector.
- The HSS will then return the result code DIAMETER_SUCCESS and the generated AVs (if any) to the MME or SGSN.

5.1.2 AIR MESSAGE

The following table provides the supported AIR AVPs.

AVP	Supported	Cat	Notes
Session-Id	Yes	M	Specified by MME
Auth-Session-State	Yes	M	NO_STATE_MAINTAINED
Origin-Host	Yes	M	Specified by MME
Origin-Realm	Yes	M	Specified by MME
Destination-Host	Yes	M	HSS host
Destination-Realm	Yes	M	HSS realm
User-Name	Yes	M	Must contain the active IMSI of the subscriber (note: LTE-HSS supports the Multi-IMSI per SIM card, and dynamic association of IMSIs)
Supported-Features	Yes	O	Supported by the HSS in this release: 0 ODB-all-APN 1 ODB-HPLMN-APN 2 ODB-VPLMN-APN 3 ODB-all-OG 4 ODB-all-InternationalOG 5 ODB-all-InternationalOGNotToHPLMN-Country 6 ODB-all-InterzonalOG 7 ODB-all-InterzonalOGNotToHPLMN-Country 8 ODB-all-InterzonalOGAndInternationalOGNotToHPLMN-Country 9 RegSub 21 SM-MO-PP 22 Barring-OutgoingCalls 23 BAOC 24 BOIC 25 BOICExHC The HSS understands the above features but does not expect to get any Supported Feature from the MME in an AIR.
Vendor-ID	Yes	O	
Feature-List-ID	Yes	O	
Feature-List	Yes	O	
Requested-EUTRAN-Authentication-Info	Yes	C	Authentication info requested from the MME for a device in a E-UTRAN security context
Number-Of-Requested-Vectors	Yes	C	
Immediate-Response-Preferred	Yes	C	
Re-synchronization-Info	Yes	C	
Requested-UTRAN-GERAN Authentication-Info	Yes	C	Authentication info requested from the MME for a device in a UTRAN or GERAN security context
Number-Of-Requested-Vectors	Yes	C	
Immediate-Response-Preferred	Yes	C	
Re-synchronization-Info	Yes	C	
Visited-PLMN-ID	Yes	M	MCC-MNC

5.1.3 AIA MESSAGE

The following table provides the supported AIA AVPs.

AVP	Supported	Cat	Notes
Session-Id	Yes	M	Specified by HSS
Auth-Session-State	Yes	M	NO_STATE_MAINTAINED
Origin-Host	Yes	M	Specified by HSS
Origin-Realm	Yes	M	Specified by HSS
Result-Code	Yes	M	DIAMETER_SUCCESS DIAMETER_ERROR_USER_UNKNOWN (5001) DIAMETER_ERROR_UNKNOWN_EPS_SUBSCRIPTION (5420)
Supported-Features	Yes	O	Supported by the HSS in this release:
Vendor-ID	Yes	O	0 ODB-all-APN
Feature-List-ID	Yes	O	1 ODB-HPLMN-APN
Feature-List	Yes	O	2 ODB-VPLMN-APN 3 ODB-all-OG 4 ODB-all-InternationalOG 5 ODB-all-InternationalOGNotToHPLMN-Country 6 ODB-all-InterzonalOG 7 ODB-all-InterzonalOGNotToHPLMN-Country 8 ODB-all-InterzonalOGAndInternationalOGNotToHPLMN-Country 9 RegSub 21 SM-MO-PP 22 Barring-OutgoingCalls 23 BAOC 24 BOIC 25 BOICExHC The HSS will not send any Supported Features in an AIR.
Authentication-Info	Yes	C	
E-UTRAN-Vector	Yes	C	Returned by the HSS when E-UTRAN Authentication is requested
Item-Number	Yes	C	
RAND	Yes	C	
XRES	Yes	C	
AUTN	Yes	C	
KASME	Yes	C	
UTRAN-Vector	Yes	C	Returned by the HSS when UTRAN Authentication is requested
Item-Number	Yes	C	
RAND	Yes	C	
XRES	Yes	C	
AUTN	Yes	C	
Confidentiality-Key	Yes	C	
Integrity-Key	Yes	C	
GERAN-Vector	Yes	C	Returned by the HSS when GERAN Authentication is requested
Item-Number	Yes	C	
RAND	Yes	C	
SRES	Yes	C	
Kc	Yes	C	

6. Fault Recovery Procedures

6.1 Reset Procedure

This procedure is supported in R 5.3.3.

(Documentation not complete)

6.1.1 HSS Behavior

6.1.2 RSR message

6.1.3 RSA message

7. Notification Procedures

7.1 Notification Procedure

The Notification Procedure shall be used between the MME and the HSS in the following situations:

- When an inter MME location update does not occur but the HSS needs to be notified about an update of terminal information
- To notify the HSS about an assignment/change/removal of PDN GW for an APN
- 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.
- To notify the HSS that the UE has become reachable again.

The Notification Procedure shall be used between the SGSN and the HSS in the following situations:

- When an inter SGSN location update does not occur but the HSS needs to be notified about an update of terminal information
- To notify the HSS about an assignment/change/removal of PDN GW for an APN
- To notify the HSS about the UE is present or the UE has memory capacity available to receive one or more short messages.

This procedure uses the commands Notify-Request/Answer (NOR/NOA) in the Diameter application.

7.1.1 HSS Behavior

When receiving a Notify request the HSS will 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 will set the result code to DIAMETER_SUCCESS and

- Store the new terminal information if present in the request
- Store the new PDN GW for an APN if present in the request and the APN is present in the subscription
- Store the new PDN GW 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
- Delete the stored PDN GW for an APN, if the APN IE or the Context Identifier IE is present in the request and the PDN GW Identity IE is not present in the request and there is the APN configuration; If the Context Identifier IE is received, the HSS may use it to locate the APN Configuration
- Delete the stored PDN GW and the APN itself, if the APN IE is present in the request without the PDN GW Identity IE being present, and the subscriber has a wild card APN 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

7.1.1.1 Not supported in current release

- Send an indication to the Service Related Entity; if the UE has become reachable again

- 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;

7.1.2 NOR MESSAGE

The table below provides the supported NOR AVPs.

AVP	Supported	Cat	Notes
Session-Id	Yes	M	Specified by MME
Auth-Session-State	Yes	M	NO_STATE_MAINTAINED
Origin-Host	Yes	M	Specified by MME
Origin-Realm	Yes	M	Specified by MME
Destination-Host	Yes	M	HSS host
Destination-Realm	Yes	M	HSS realm
User-Name	Yes	M	IMSI
Supported-Features	Yes	O	Supported by the HSS in this release: 0 ODB-all-APN 1 ODB-HPLMN-APN 2 ODB-VPLMN-APN 3 ODB-all-OG 4 ODB-all-InternationalOG 5 ODB-all-InternationalOGNotToHPLMN-Country 6 ODB-all-InterzonalOG 7 ODB-all-InterzonalOGNotToHPLMN-Country 8 ODB-all-InterzonalOGAndInternationalOGNotToHPLMN-Country 9 RegSub 21 SM-MO-PP 22 Barring-OutgoingCalls 23 BAOC 24 BOIC 25 BOICExHC The HSS understands the above features but does not expect to get any Supported Feature from the MME in an NOR.
Vendor-ID	Yes	O	
Feature-List-ID	Yes	O	
Feature-List	Yes	O	
Terminal-Information	Yes	C	
IMEI	Yes	O	
Software-Version	Yes	O	
MIP6-Agent-Info	Yes	C	
MIP-Home-Agent-Address	Yes	C	PDN GW address
MIP-Home-Agent-Host	Yes	C	Supported and saved into the DB
MIP6-Home-Link-Prefix	Yes	C	Supported and saved into the DB
Context-Identifier	Yes	O	Context Id of the APN for which the PDN GW Identity will be modified
Service-Selection	Yes	C	APN
Alert-Reason	*No*	*C*	*Ignored by HSS, not supported*
NOR-Flags	*No*	*C*	*Ignored by HSS, not supported*

7.1.3 NOA MESSAGE

The table below provides the supported NOA AVPs.

AVP	Supported	Cat	Notes
Session-Id	Yes	M	As received by MME
Auth-Session-State	Yes	M	NO_STATE_MAINTAINED
Origin-Host	Yes	M	Specified by HSS
Origin-Realm	Yes	M	Specified by HSS
Result-Code	Yes	M	DIAMETER_SUCCESS DIAMETER_ERROR_USER_UNKNOWN (5001)
Supported-Features	Yes	O	Supported by the HSS in this release: 0 ODB-all-APN 1 ODB-HPLMN-APN 2 ODB-VPLMN-APN 3 ODB-all-OG 4 ODB-all-InternationalOG 5 ODB-all-InternationalOGNotToHPLMN-Country 6 ODB-all-InterzonalOG 7 ODB-all-InterzonalOGNotToHPLMN-Country 8 ODB-all-InterzonalOGAndInternationalOGNotToHPLMN-Country 9 RegSub 21 SM-MO-PP 22 Barring-OutgoingCalls 23 BAOC 24 BOIC 25 BOICExHC The HSS will not send any Supported Features in a NOA.
Vendor-ID	Yes	O	
Feature-List-ID	Yes	O	
Feature-List	Yes	O	

Subscriber Data Management

LTE S6a/S6d Interface Description
910-6880-001
Revision B