ATIS-1000065.2015(R2020)

Emergency Telecommunications Service (ETS) Evolved Packet Core (EPC) Network Element Requirements

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Emergency Telecommunications Service (ETS) Evolved Packet Core (EPC) Network Element Requirements

Alliance for Telecommunications Industry Solutions

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American National Standard

Abstract

This standard specifies Emergency Telecommunications Service (ETS) requirements for an Evolved Packet System (EPS) consisting of the Evolved UMTS (Universal Mobile Telecommunications System) Terrestrial Radio Access Network (E-UTRAN) and the Evolved Packet Core (EPC) for support of NGN GETS Voice, NGN GETS Video, NGN GETS Guaranteed Bit Rate (GBR) Data, and NGN GETS Data Transport.

Foreword

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ANSI guidelines specify two categories of requirements: mandatory and recommendation. The mandatory requirements are designated by the word SHALL and recommendations by the word SHOULD. Where both a mandatory requirement and a recommendation are specified for the same criterion, the recommendation represents a goal currently identifiable as having distinct compatibility or performance advantages.

Suggestions for improvement of this document are welcome. They should be sent to the Alliance for Telecommunications Industry Solutions, PTSC, 1200 G Street NW, Suite 500, Washington, DC 20005.

At the time of consensus on this document, PTSC, which was responsible for its development, had the following leadership:

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1 Scope

1.1 Scope

This standard specifies Emergency Telecommunications Service (ETS) requirements for an Evolved Packet System (EPS) consisting of the Evolved UMTS (Universal Mobile Telecommunications System) Terrestrial Radio Access Network (E-UTRAN) and the Evolved Packet Core (EPC) for support of:

- NGN GETS Voice,
- NGN GETS Video,
- NGN GETS Guaranteed Bit Rate (GBR) Data, and
- NGN GETS Data Transport.

This standard describes requirements for NGN GETS treatments for:

- E-UTRA access for an NGN GETS session initiated from, or terminated to the UE via the E-UTRA air interface and the E-UTRAN access network;
- Advance Priority-SPR and Advance Priority-HSS;
- Congestion control;
- Circuit Switched Fallback (CSFB) to UTRAN/GERAN;
- CSFB to 1xRTT;
- Intra-RAT E-UTRAN handover;
- Inter-RAT (IRAT) handover to/from the UMTS PS domain; and
- IRAT handover to/from eHRPD.

This standard assumes a 3GPP Release 10 system.

2 Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

3GPP[1]

[TS 22.011] TS 22.011, Service accessibility (Release 8).

[1] These documents are available from the Third Generation Partnership Project (3GPP) at < http://www.3gpp.org/specs/specs.htm>.

[TS 23.203] TS 23.203, Policy and Charging Control Architecture (Release 10).

[TS 23.272] TS 23.272, Circuit Switched (CS) fallback in Evolved Packet System (EPS); Stage 2 (Release 10).

[TS 23.401] TS 23.401, General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access (Release 11).

[TS 24.008] TS 24.008, Mobile radio interface Layer 3 specification; Core network protocols; Stage 3 (Release 10).

[TS 24.301] TS 24.301, Non-Access Stratum (NAS) protocol for Evolved Packet System (EPS) – Stage 3 (Release 11).

[TS 25.331] TS 25.331, Radio Resource Control (RRC); Protocol specification (Release 10).

[TS 25.413] TS 25.413, UTRAN Iu interface Radio Access Network Application Part (RANAP) signalling (Release 10).

[TS 29.018] TS 29.018, General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR); Gs interface layer 3 specification (Release 8).

[TS 29.060] TS 29.060, GPRS Tunnelling Protocol (GTP) across the Gn and Gp interface (Release 8).

[TS 29.118] TS 29.118, Mobility Management Entity (MME) - Visitor Location Register (VLR) SGs interface specification (Release 8).

[TS 29.212] TS 29.212, Policy and charging control over Gx reference point (Release 8).

[TS 29.214] TS 29.214, Policy and charging control over Rx reference point (Release 10).

[TS 29.215] TS 29.215, Policy and Charging Control (PCC) over S9 reference point – Stage 3 (Release 8).

[TS 29.272] TS 29.272, Mobile Management Entity (MME) and Serving GPRS Support Node (SGSN) related interfaces based on Diameter protocol (Release 10).

[TS 29.273] TS 29.273, Evolved Packet System (EPS); 3GPP EPS AAA interfaces (Release 8).

[TS 29.274] TS 29.274, Evolved General Packet Radio Service (GPRS) Tunnelling Protocol for Control plane (GTPv2-C) – Stage 3 (Release 10).

[TS 29.275] TS 29.275, Proxy Mobile IPv6 (PMIPv6) based Mobility and Tunnelling protocols – Stage 3 (Release 8).

[TS 29.277] TS 29.277, Optimised handover procedures and protocol between EUTRAN access and non-3GPP accesses (S102); Stage 3 (Release 10).

[TS 29.281] TS 29.281, General Packet Radio System (GPRS) Tunnelling Protocol User Plane (GTPv1-U) (Release 8).

[TS 36.213] TS 36.213, Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures (Release 8).

[TS 36.300] TS 36.300, Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2 (Release 8).

[TS 36.321] TS 36.321, Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification (Release 8).

[TS 36.331] TS 36.331, Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification (Release 10).

[TS 36.413] TS 36.413, Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP) (Release 10).

[TS 36.422] TS 36.422, Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 signalling transport (Release 8).

[TS 36.423] TS 36.423, X2 application protocol (X2AP) (Release 8).

3GPP2[2]

[A.S0008] 3GPP2 A.S0008-D v1.0, Interoperability Specification (IOS) for High Rate Packet Data (HRPD) Radio Access Network Interfaces with Session Control in the Access Network, TBD.

[A.S0014] 3GPP2 A.S0014-D v4.0, Interoperability Specification (IOS) for cdma2000 Access Network Interfaces - Part 4 (A1, A1p, A4, and A5 Interfaces), August 2012.

[X.S0057] 3GPP2 X.S0057-B v1.0, E-UTRAN – eHRPD Connectivity and Interworking Core Network Aspects, October 2012.

ETSI[3]

[ETSI TS 183 017] ETSI TS 183 017, DIAMETER protocol for session based policy set-up information exchange between the Application Function (AF) and the Service Policy Decision Function (SPDF); Protocol Specification, February 2010.

IETF[4]

[RFC 3588] IETF RFC 3588, Diameter Base Protocol.

[RFC 4005] IETF RFC 4005, Diameter Network Access Server Application.

[RFC 4006] IETF RFC 4006, Diameter Credit-Control Application.

[RFC 4831] IETF RFC 4831, Goals for Network-Based Localized Mobility Management (NETLMM).

[RFC 5213] IETF RFC 5213, Proxy Mobile IPv6.

ITU[5]

[M.3060] ITU-T Recommendation M.3060, Principles for the Management of Next Generation Networks, March 2006.

[M.3400] ITU-T Recommendation M.3400, TMN Management Functions, February 2000.

OTHER[6]

[GSMA IR.92] IMS Profile for Voice and SMS, Version 6.0, May 2012.

[GSMA IR.94] IMS Profile for Conversational Video Service, Version 3.0, July 2012.

3 Definitions, Acronyms, & Abbreviations

For a list of common communications terms and definitions, please visit the *ATIS Telecom Glossary*, which is located at < http://www.atis.org/glossary>.

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[2] These documents are available from 3GPP2 at < http://www.3gpp2.org/public_html/specs/>

[3] This document is available from the European Telecommunications Standards Institute (ETSI). < http://www.etsi.org/getastandard/home.htm >

[4] These documents are available from the Internet Engineering Task Force (IETF). < http://www.ietf.org >

[5] These documents are available from the International Telecommunications Union. < http://www.itu.int/ITU-T/ >

[6] These documents are available from GSMA. < http://www.gsma.com/>

3.1 Definitions

3.1.1 Advance Priority: is the Access Network Signaling priority provided to an NGN GETS subscribed UE (including priority treatment before user invocation of NGN GETS), to improve the probability of an NGN GETS invocation being successfully sent to the Core Network.

3.1.2 NGN GETS Credentials: are credentials assigned to an authorized Service User that can be used to authenticate an NGN GETS invocation from any UE, regardless of whether or not the Service User has an NGN GETS subscription with the Service Provider (although this assumes the UE has a regular subscription for the comparable non-priority service).

3.1.3 NGN GETS subscribed UE: is a UE associated with Subscription Credentials.

3.1.4 Public UE: is a UE not associated with Subscription Credentials.

3.1.5 Service Provider: (initial capital letters) is a public telecommunications service provider authorized to provide ETS (Legacy GETS, WPS, and/or NGN GETS). When “service provider” (without initial capital letters) is used, it refers to the normal provider of telecommunications services.

3.1.6 Service User: (initial capital letters) is an individual authorized to use ETS (Legacy GETS, WPS, or NGN GETS) and to whom a user priority level assignment has been granted. When “service user” (without initial capital letters) is used, it refers to the normal user of telecommunication services.

3.1.7 Service User’s priority level: is a number from one to five where one has the highest priority for ETS (Legacy GETS, WPS, or NGN GETS) services and five has the lowest priority for ETS (Legacy GETS, WPS, or NGN GETS) services. The Service User’s priority level is assigned to a Service User.

3.1.8 Subscription Credentials: are credentials assigned by a Service Provider to a Service User who has a subscription to NGN GETS with the Service Provider and allow the Service User to successfully invoke NGN GETS using the subscription-based authentication without having to submit NGN GETS Credentials.

3.2 Acronyms & Abbreviations

1x BS	cdma2000-1x Base Station
1x IWS	cdma2000-1x Interworking System
1x MSC	cdma2000-1x Mobile Switching Center
1x PN	cdma2000-1x Psuedo-Noise
1x RTT	cdma2000-1x Radio Transmission Technology
2G	2nd Generation
3G	3rd Generation
3GPP	3rd Generation Partnership Project
3GPP2	3rd Generation Partnership Project 2
AAA	Authentication, Authorization, and Accounting
AC	Access Class
AF	Application Function
AN	Access Network
ANS	American National Standard
ANSI	American National Standards Institute

AP	Application Protocol
APN	Access Point Name
ARP	Allocation and Retention Priority
AS	Application Server
ATIS	Alliance for Telecommunications Industry Solutions
AVP	Attribute Value Pair
BS	Base Station
BTS	Base Transceiver System
CDMA	Code Division Multiple Access
CMRS	Commercial Mobile Radio Service
CN	Core Network
CS	Circuit Switched (as in CS domain)
CSFB	Circuit Switched Fallback
CS-MGW	Circuit Switched Media Gateway
CSCF	Call Session Control Function
DiffServ	Differentiated Services
DSCP	DiffServ Code Point
DTS	Data Transport Service
eAN	enhanced Access Network
EAP	Extensible Authentication Protocol
ECM	EPS Connection Management
eCSFB	Enhanced CSFB
EDGE	Enhanced Data rates for Global Evolution
eHRPD	evolved High Rate Packet Data
eMLPP	enhanced Multi-Level Precedence and Pre-emption
EMM	EPS Mobility Management
eNB	eNodeB
EPC	Evolved Packet Core
EPS	Evolved Packet System
E-RAB	Evolved Radio Access Bearer
ESM	EPS Session Management
ETS	Emergency Telecommunications Service
ETSI	European Telecommunications Standards Institute
E-UTRA	Evolved UMTS Terrestrial Radio Access

E-UTRAN	Evolved UMTS Terrestrial Radio Access Network
EUTRAN	Evolved UMTS Terrestrial Radio Access Network
EV-DO	Evolution-Data Optimized
FCC	Federal Communications Commission
FE	Functional Entity
GBR	Guaranteed Bit Rate
GCSNA	Generic Circuit Services Notification Application
GERAN	GSM EDGE Radio Access Network
GETS	Government Emergency Telecommunication Service
GETS-AN	GETS-Access Number
GETS-FC	GETS-Feature Code
GETS-NT	GETS-Number Translation
GPRS	General Packet Radio Service
GSM	Global System for Mobile communications
GSMA	GSM Association
GTP	GPRS Tunnelling Protocol
GTP-C	GPRS Tunnelling Protocol for Control plane
GTP-U	GPRS Tunnelling Protocol for User plane
GTPv1-C	GPRS Tunnelling Protocol version 1 for Control plane
GTPv1-U	GPRS Tunnelling Protocol version 1 for User plane
GTPv2-C	GPRS Tunnelling Protocol version 2 for Control plane
hPCRF	home Policy and Charging Rules Function
HPLMN	Home Public Land Mobile Network
HRPD	High Rate Packet Data
HSGW	eHRPD Serving Gateway
HSPA	High Speed Packet Access
HSS	Home Subscriber Server
HTTPS	Hypertext Transfer Protocol Secure
ID	Identifier
IE	Information Element
IETF	Internet Engineering Task Force
IMS	IP Multimedia Subsystem
IOS	Interoperability Specification
IP	Internet Protocol

IP-CAN	IP-Connectivity Access Network
IPv6	Internet Protocol Version 6
IR	Industry Requirements
IRAT	Inter-Radio Access Technology
ISDN	Integrated Services Digital Network
ISR	Idle mode Signaling Reduction
ISUP	ISDN User Part
ITU	International Telecommunication Union
ITU-R	International Telecommunication Union – Radiocommunication Sector
ITU-T	International Telecommunication Union – Telecommunication Standardization Sector
IWS	Interworking Solution
LMA	Local Mobility Anchor
LTE	Long Term Evolution
MAC	Medium Access Control
MAG	Mobile Access Gateway
MCC	Machine Congestion Control
MME	Mobility Management Entity
MPS	Multimedia Priority Service (3GPP)
MSC	Mobile Switching Center
MSCe	Mobile Switching Center Emulation
NAS	Non Access Stratum
NE	Network Equipment
NGN	Next Generation Network
NS/EP	National Security and Emergency Preparedness
OAM&P	Operations, Administration, Maintenance, and Provisioning
PCC	Policy and Charging
PCEF	Policy and Charging Enforcement Function
PCF	Packet Control Function
PCI	Pre-emption Capability Indicator
PCRF	Policy and Charging Rules Function
P-CSCF	Proxy CSCF
PDN	Packet Data Network
PDN-GW	Packet Data Network Gateway
PDP	Packet Data Protocol

PDU	Protocol Data Unit
PIN	Personal Identification Number
PL	Priority Level
PLMN	Public Land Mobile Network
PMIP	Proxy Mobile Internet Protocol
PS	Packet Switched (as in PS domain)
PVI	Pre-emption Vulnerability Indicator
QCI	QoS Class Identifier
QoS	Quality of Service
RACH	Random Access Channel
RAN	Radio Access Network
RANAP	Radio Access Network Application Part
RAND	Random number
R&O	Report and Order
RAN	Radio Access Network
RAT	Radio Access Technology
RFC	Request For Comment
RNC	Radio Network Controller
RNS	Radio Network Subsystem
RPH	Resource-Priority Header
RRC	Radio Resource Control
S1-AP	S1 Application Protocol
S1AP	S1 Application Protocol
SDF	Service Data Flow
SDP	Session Description Protocol
SGs-AP	SGs Application Protocol
SGSN	Serving GPRS Support Node
S-GW	Serving Gateway
SIB	System Information Block
SIB2	System Information Block 2
SIP	Session Initiation Protocol
SLA	Service Level Agreement
SMS	Short Message Service
SPDF	Service Policy Decision Function

SPR	Subscription Profile Repository
SRB1	Signalling Radio Bearer 1
SRVCC	Single Radio Voice Call Continuity
SUPL	Service User Priority Level
TAU	Tracking Area Update
TMN	Telecommunication Management Network
TS	Technical Specification
UDR	User Data Repository
UE	User Equipment
UMTS	Universal Mobile Telecommunications System
UTRA	Universal Terrestrial Radio Access
UTRAN	Universal Terrestrial Radio Access Network
VLR	Visitors Location Register
vPCRF	visited Policy and Charging Rules Function
VPLMN	Visited Public Land Mobile Network
WPS	Wireless Priority Service
X2-AP	X2 Application Protocol
X2AP	X2 Application Protocol

4 Reference Architecture

4.1 Architectures for 3GPP Access

This section presents three reference architectures for 3GPP Access to the EPC: the non-roaming architecture, the roaming architecture with home routed traffic, and the roaming architecture with local breakout. Each reference architecture is presented in the subsections below.

In the reference architectures:

- The Gxc Interface is present only when S5/S8 is Proxy Mobile Internet Protocol (PMIP)-based rather than General Packet Radio Service (GPRS) Tunneling Protocol (GTP)-based.
- The SGSN represents either an S4-SGSN or a Gn/Gp SGSN. In the case of an S4-SGSN, the S3, S4, and S12 Interfaces are supported, and the Gn and Gp Interfaces are not supported. In the case of a Gn/Gp SGSN, the Gn, and when required, Gp Interfaces are supported, and the S3, S4, and S12 Interfaces are not supported.

A description of each of the Functional Entities (FEs) shown in Sections 4.1.1, 4.1.2, and 4.1.3 may be found in Section 4.4.

4.1.1 Non-Roaming Architecture

The non-roaming reference architecture for 3GPP Access is shown in Figure 4-1. It is based on Figure 4.2.1-1 of [TS 23.401].

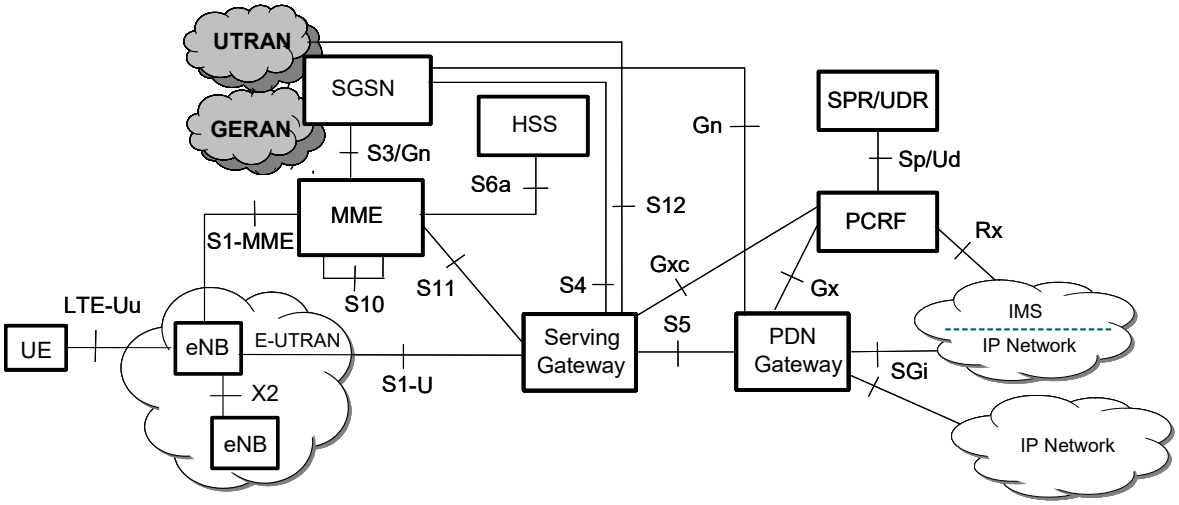

Figure 4-1 - Non-Roaming Reference Architecture for 3GPP Access.

4.1.2 Roaming Architecture with Home Routed Traffic

The roaming reference architecture for 3GPP Access with home routed traffic is shown in Figure 4-2. It is based on Figure 4.2.2-1 of [TS 23.401]. The S9 Interfaces and visited Policy and Charging Rules Function (vPCRF) are present only when S8 is PMIP-based rather than GTP-based. The vPCRF and the S9 interconnection to the home PCRF (hPCRF) result from the introduction of the Gxc. The dotted line shows the separation between the visited and home networks.

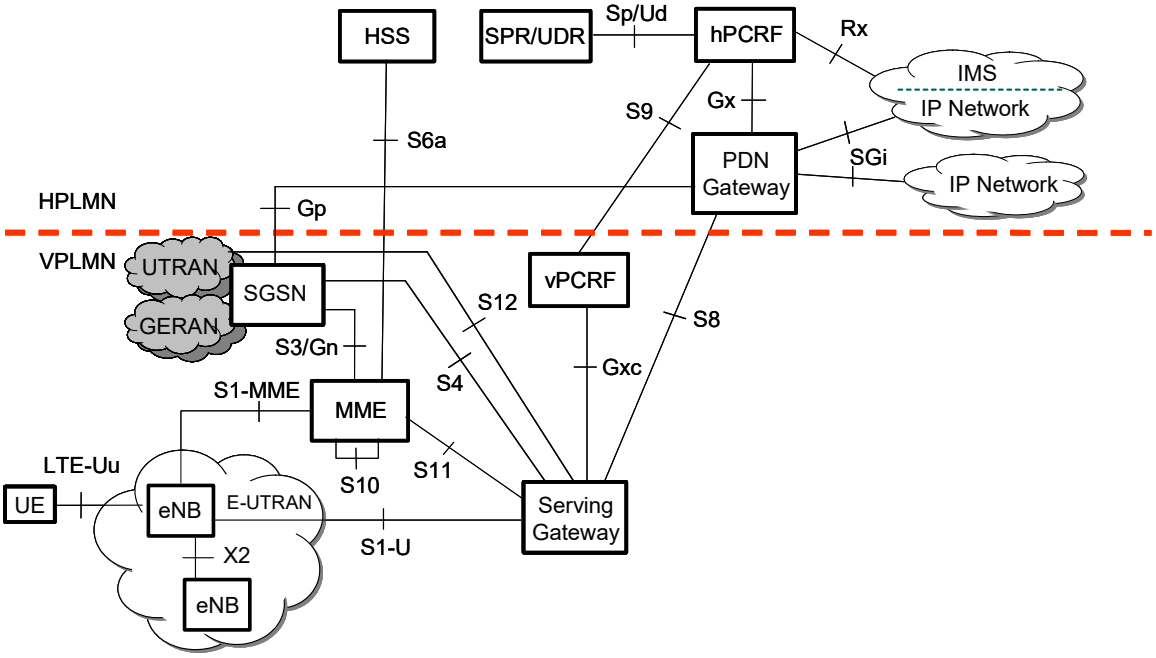

Figure 4-2 - Roaming Reference Architecture with Home Routed Traffic for 3GPP Access.

4.1.3 Roaming Architecture with Local Breakout

The roaming reference architecture for 3GPP Access with local breakout is shown in Figure 4-3. It is based on Figures 4.2.2-2 and 4.2.2-3 of [TS 23.401]. In this architecture, the user traffic is routed via a visited Packet Data Network Gateway (PDN-GW), unlike home-routed traffic where the user traffic is routed to and anchored at the home PDN-GW. The Rx Interface is present in the Home or Visited networks depending upon the location of the Application Function (AF), which normally resides in the IMS Core Network. The dotted line shows the separation between the visited and home networks.

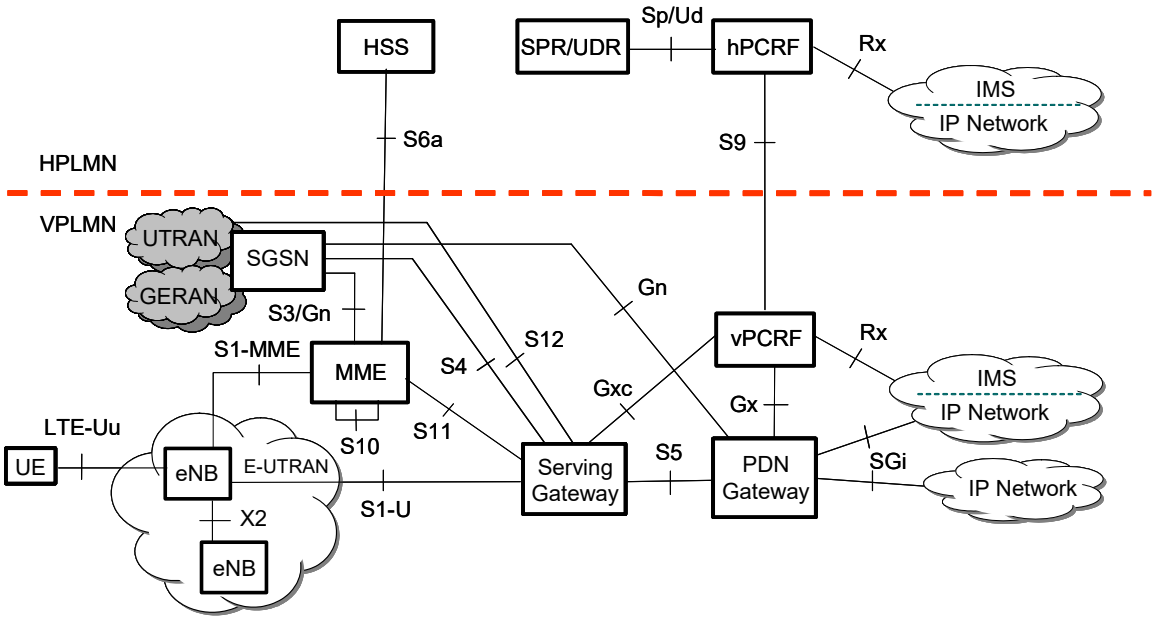

Figure 4-3 - Roaming Reference Architecture with Local Breakout for 3GPP Access.

4.2 Architectures for eHRPD Access

This section presents three reference architectures for evolved High Rate Packet Data (eHRPD) Access to the EPC: the non-roaming architecture, the roaming architecture with home routed traffic, and the roaming architecture with local breakout. Each is presented in the subsections below. As the eHRPD access network is the only non-3GPP Access for which optimized handover for a single radio is defined, these architectures include elements specific to the eHRPD network as defined in Revision B of [X.S0057] which aligns with 3GPP Release 10.

In the reference architectures:

- The Gxc Interface is present only when S5/S8 is Proxy Mobile Internet Protocol (PMIP)-based rather than General Packet Radio Service (GPRS) Tunneling Protocol (GTP)-based.

A description of each of the FEs shown in Sections 4.1.1, 4.1.2, and 4.1.3, may be found in Section 4.4.

4.2.1 Non-Roaming Architecture

The non-roaming reference architecture for eHRPD Access is shown in Figure 4-4. The dotted line shows the separation between 3GPP and non-3GPP networks.

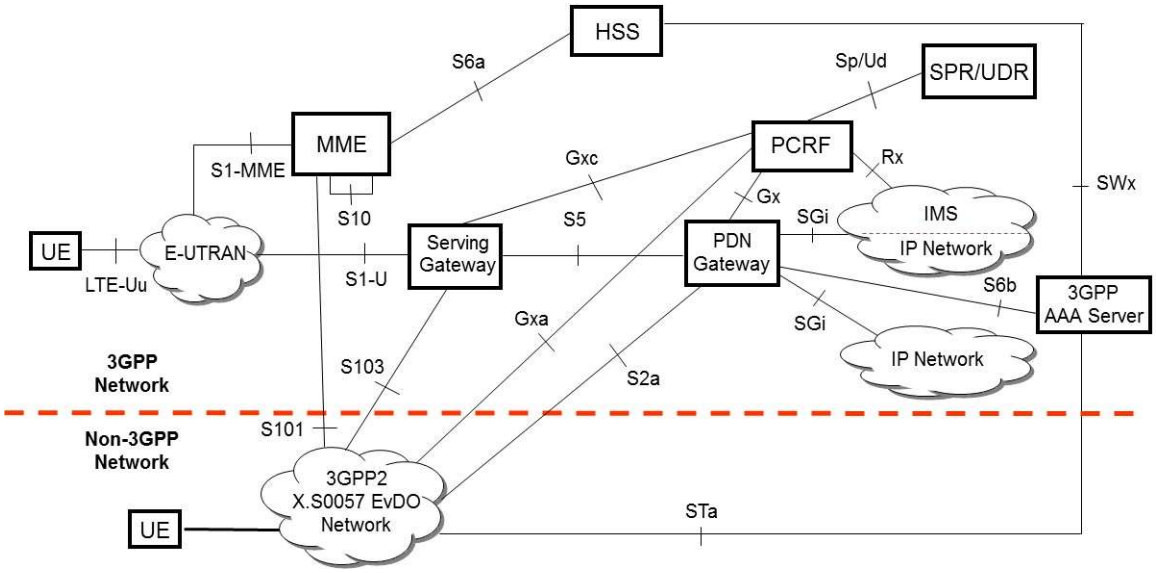

Figure 4-4 - Non-Roaming Reference Architecture for eHRPD Access.

4.2.2 Roaming Architecture with Home Routed Traffic

The roaming reference architecture for eHRPD Access with home routed traffic is shown in Figure 4-5. The dotted lines show the separation between the Visited Public Land Mobile Network (VPLMN) and the Home Public Land Mobile Network (HPLMN) as well as between 3GPP and non-3GPP networks.

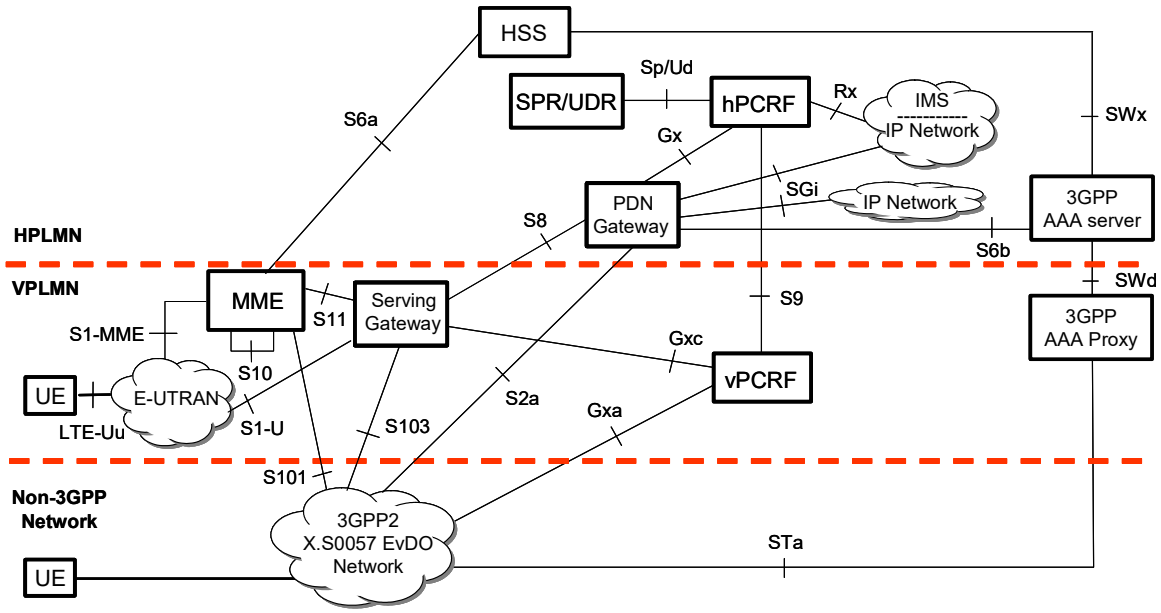

Figure 4-5 - Roaming Reference Architecture with Home Routed Traffic for eHRPD Access.

4.2.3 Roaming Architecture with Local Breakout

The roaming reference architecture for eHRPD Access with local breakout is shown in Figure 4-6. The Rx Interface is also present in the Visited network if the user is served by an AF in the Visited network. The dotted lines show the separation between the Visited Public Land Mobile Network (VPLMN) and the Home Public Land Mobile Network (HPLMN) and between 3GPP and non-3GPP networks.

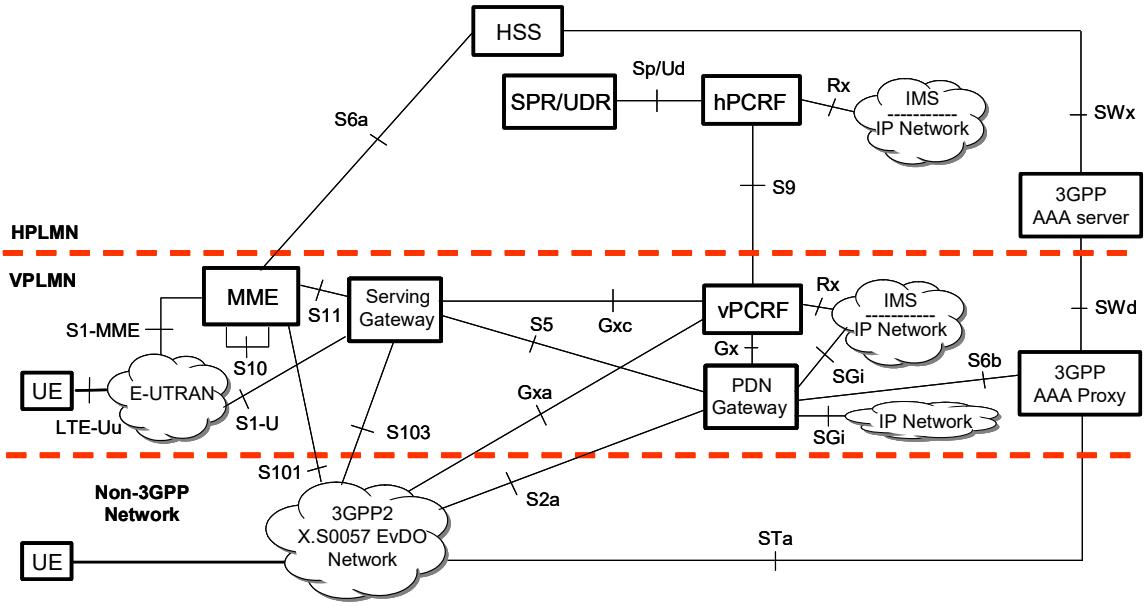

Figure 4-6 - Roaming Reference Architecture with Local Breakout for eHRPD Access.

4.3 Reference Architectures for CSFB

This section presents two reference architectures for CSFB from the E-UTRAN to a RAN supporting CS domain service: the architecture for CSFB to UMTS, and the architecture for CSFB to 1xRTT (cdma2000). Each reference architecture is presented in the subsections below.

A description of each of the FEs shown in Sections 4.3.1 and 4.3.2 may be found in Section 4.4.

4.3.1 Architecture for CSFB to UMTS CS

The reference architecture for CSFB to UMTS is shown in Figure 4-7. It is based on Section 4.2 of [TS 23.272] applied to the Non-Roaming Architecture of Figure 4-1 of Section 4.1.1 of this document. The architecture includes the Radio Network Subsystem (RNS) and the Mobile Switching Center (MSC) to enable the UE to establish voice calls in the UMTS system. The SGs interface [TS 29.118] between the MSC and the MME allows the MSC, for a mobile terminating call, to send the paging request to the MME to page the UE in the E-UTRAN. The SGs interface functionality is based on mechanisms specified for Gs interface in [TS 29.018]. The Gxc Interface is present only when S5 is PMIP-based rather than GTP-based.

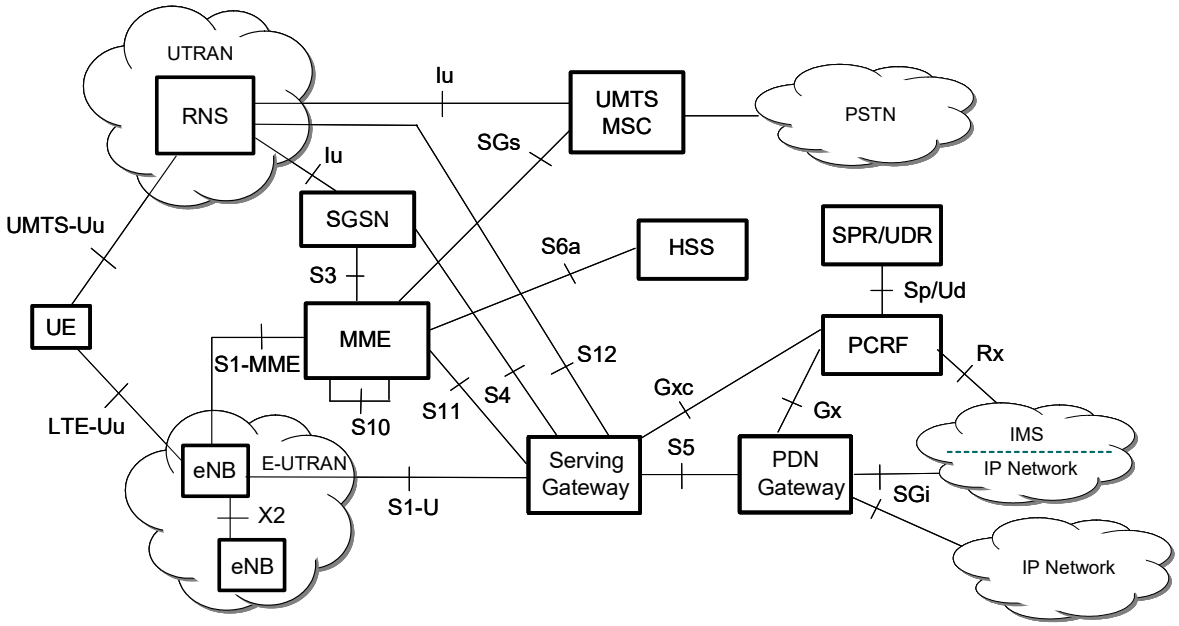

Figure 4-7 - Reference Architecture for CSFB to UMTS.

4.3.2 Architecture for CSFB to 1xRTT (cdma2000)

The reference architecture for CSFB to 1xRTT (cdma2000) is shown in Figure 4-8. It is based on Section B.1.2 of [TS 23.272] applied to the Non-Roaming Architecture of Figure 3-4 of Section 4.2.1 of this document. The reference architecture in [TS 23.272] corresponds to the 3GPP2 specific architecture described in Annex F of 3GPP2 [A.S0008]. The 1x IWS function may be collocated at the 1x BS or it may be standalone. Figure 4-8 shows the case where the A1 interface connects the 1x MSC with a standalone 1x IWS or a 1x IWS collocated with a 1x BS. The Gxc Interface is present only when S5 is PMIP-based rather than GTP-based. The dotted line shows the separation between 3GPP and non-3GPP networks.

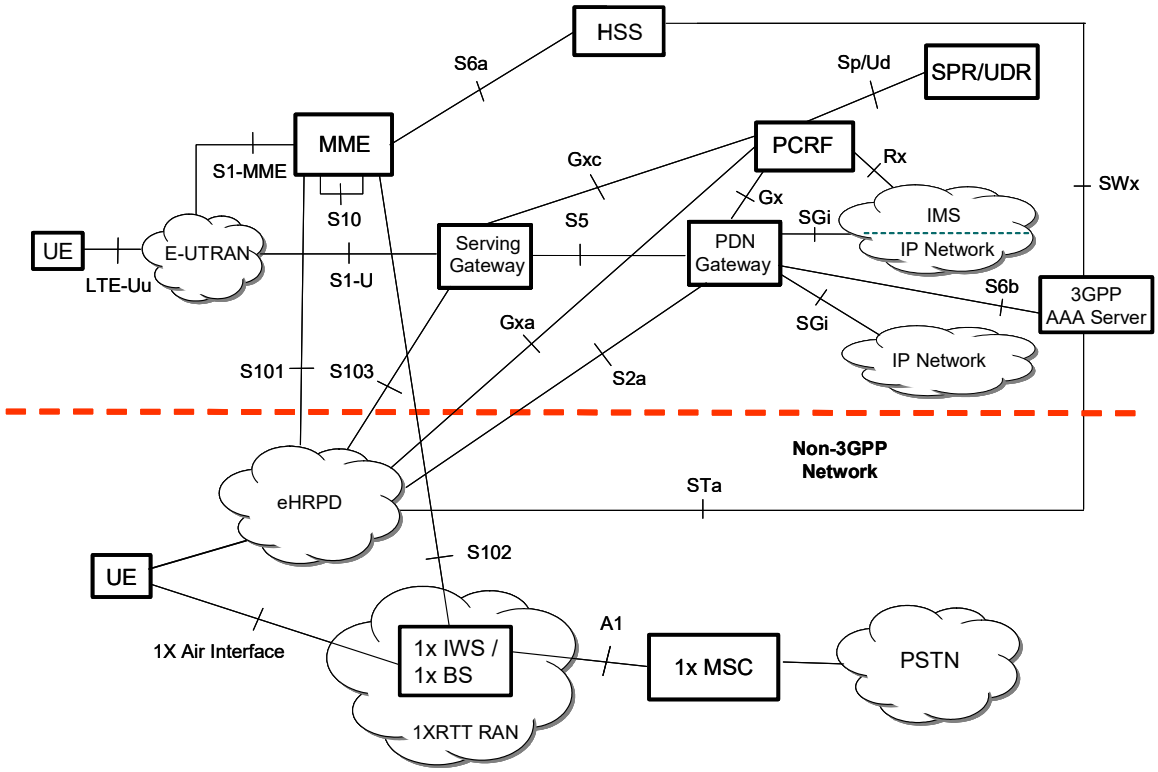

Figure 4-8 - Reference Architecture for CSFB to 1xRTT (cdma2000).

4.4 Functional Entities

The reference architectures presented in Sections 4.1, 4.2, and 4.3 contain FEs as described in the subsections that follow.

FE-specific requirements are provided in Section 5.3; common requirements are provided in Sections 5.1 and 5.2.

FE-Specific OAM&P requirements are provided in Section 6.2; common OAM&P requirements are provided in Section 6.1.

4.4.1 User Equipment (UE)

The UE is a mobile device providing E-UTRA connectivity to a user. A UE may be connected to a computing device such as a laptop personal computer or it may be a self-contained device such as a mobile phone or a personal digital assistant.

Two forms of dual mode UEs are considered in this document. A UE may support both the UMTS/HSPA and E-UTRA air interface technologies. Alternatively a UE may support both the eHRPD and E-UTRA air interfaces. Other combinations are possible, but are not in scope of this document.

The UE connects to the eNodeB over the Uu interface when using the E-UTRA air interface.

4.4.2 eNodeB (eNB)

The eNodeB is a base station providing the E-UTRA user plane and control plane protocol terminations towards the UE. The functions provided by the eNodeB include radio resource management including radio bearer control and radio admission control, connection mobility control, IP header compression and encryption of user data streams, selection of an MME at UE attachment when no routing to an MME can be determined from the information provided by the UE, routing of user plane data towards the S-GW, scheduling and transmission of uplink and

downlink traffic including paging messages originated from the MME and broadcast information originated from the MME, and signal quality measurements and measurement reporting.

The eNodeB connects to the UE over the Uu interface, to other eNodeBs using the X2 interface, to MMEs using the S1-MME interface, and to S-GWs using the S1-U interface.

4.4.3 Mobility Management Entity (MME)

The MME is a signaling-only FE (i.e., user-plane IP packets are not exchanged with the MME) responsible for Non Access Stratum (NAS) signaling to the UE via the E-UTRAN. The main function of the MME is to manage UE mobility. It is responsible for idle-mode UE tracking area management and paging procedures. The MME manages and stores UE context, generates temporary identities and allocates them to the UE, performs authentication and authorization, and provides bearer management functions including dedicated bearer establishment, S-GW and PDN-GW selection, and MME selection for handovers requiring an MME change. Network management functions will direct a UE entering an MME Pool Area to an appropriate MME to achieve load balancing between MMEs. Load rebalancing is performed by moving a UE registered on an MME to another MME. The MME can control overload by requesting eNodeBs to reject Radio Resource Control (RRC) connection requests according to selected groups of Establishment Cause values.

The MME connects to eNodeBs using the S1-MME interface, to other MMEs using the S10 interface, to S-GWs using the S11 interface, to SGSNs using the S3 or Gn interfaces, and to the HSS using the S6a interface.

In support of non-3GPP access networks using the eHRPD air interface, as defined in [X.S0057], the MME also connects to the enhanced Access Network/Packet Control Function (eAN/PCF) via the S101 Interface, allowing the UE to tunnel cdma2000 air link signaling via the E-UTRAN. This tunneling supports seamless mobility (i.e., fast handoff) between the two systems.

In support of CSFB to UTRAN, the MME connects to the MSC over the SGs Interface.

In support of CSFB to 1xRTT, the MME connects to the 1X IWS over the S102 Interface.

4.4.4 Serving Gateway (S-GW)

The S-GW is the gateway within the EPC that terminates the user plane interface towards the E-UTRAN. The S-GW routes and forwards user data packets, and acts as the mobility anchor for the user plane during inter-eNodeB handovers and as the anchor for mobility between LTE and other 3GPP technologies which support the S4 Interface (relaying traffic between 2G/3G systems and the PDN Gateway). In addition, when PMIP-based S5 or S8 is used, the S-GW functions as a Mobile Access Gateway (MAG) as specified in PMIP specifications.

The S-GW connects to eNodeBs using the S1-U interface, to MMEs using the S11 interface, to PDN-GWs using the S5 or S8 interface, and to SGSNs using the S4 (and optionally the S12) interface. In addition, for those cases in which the S5/S8 interface is PMIP-based rather the GTP-based, the S-GW connects to the PCRF using the Gxc interface.

For support of non-3GPP systems using eHRPD, as defined in [X.S0057], the S-GW connects to the eHRPD Serving Gateway (HSGW) via the S103 interface.

4.4.5 Packet Data Network Gateway (PDN-GW)

The PDN-GW supports connectivity between the UE and external PDNs by being the point of exit and entry of traffic for the UE. A UE may have simultaneous connectivity with more than one PDN-GW for accessing multiple PDNs and may establish a Default Bearer (and optionally one or more dedicated bearers) with each PDN. The PDN-GW performs policy enforcement, packet filtering for each UE traffic stream, charging support, UE IP address allocation, and packet screening.

The PDN-GW contains the Local Mobility Anchor (LMA) for PMIP-based location management. LMA functionality is defined in [RFC 4831]. The LMA is a router that maintains a collection of host routes and associated forwarding information for UEs within a localized mobility management domain under its control. The LMA, interoperating with associated MAGs, manages IP device mobility within the localized mobility management domain. UE traffic is

routed through an anchor at the LMA as the UE moves within the localized mobility management domain. For UEs attached to the E-UTRAN the MAG is contained within the S-GW.

The PDN-GW connects to the S-GW via the S5/S8 interface, to the PCRF via the Gx interface, and to the external PDN via the SGi interface.

For support of interworking with the GPRS Core, the PDN-GW connects to the SGSN over the Gn/Gp Interface.

For support of eHRPD, as defined in [X.S0057], the PDN-GW connects to the HSGW via the PMIP-based S2a Interface.

4.4.6 Home Subscriber Server (HSS)

The HSS stores static and dynamic information for a subscriber. It keeps a list of features and services associated with a subscriber, and also the location and means of access to the subscriber. In addition, an HSS keeps credentials related to authentication and information related to registration of the subscriber.

The HSS connects to the MME using the S6a Interface.

For support of non-3GPP systems using eHRPD, as defined in [X.S0057], the HSS connects to the 3GPP AAA server via the SWx Interface.

4.4.7 Serving GPRS Support Node (SGSN)

In addition to functionalities provided to the Packet Switched (PS) Core for GPRS and UMTS PS services, the 3GPP Release 8 SGSN provides signaling for mobility between 2G/3G GSM EDGE Radio Access Network (GERAN)/Universal Terrestrial Radio Access Network (UTRAN) and E-UTRAN 3GPP access networks. For 3GPP GERAN/UTRAN access network attachment, the 3GPP Release 8 SGSN provides for S-GW and PDN-GW selection as performed by the MME, as well as MME selection for handovers to the E-UTRAN access network.

The S4-SGSN connects to the MME via the S3 Interface and to the S-GW via the S4 Interface.

The Gn/Gp SGSN connects to the MME via the Gn Interface and to the PDN-GW via the Gn/Gp Interface.

4.4.8 Policy and Charging Rules Function (PCRF)

As defined in [ATIS-1000023], the PCRF supports policy control decisions for the IP-Connectivity Access Network (IP-CAN) and data/media flow-based charging control functions. The PCRF provides IP-CAN control regarding the media/data flow detection, gating (e.g., admission control), QoS, and media/data flow-based charging. The PCRF provides management of IP-CAN QoS resources necessary to support services to network users. The PCRF communicates with the IP-CAN FEs (e.g., PDN-GW) to authorize resource allocations. It enforces policy decisions with regard to use of the IP-CAN QoS resources, including consideration of Service Level Agreements (SLAs).

In roaming scenarios PCRFs in both home and visited domains may be involved. The home PCRF (hPCRF) is an FE in the HPLMN that includes policy and charging control functionalities. The visited PCRF (vPCRF) is an FE in the VPLMN that includes policy and charging control functionalities. The hPCRF is always involved in policy decisions while the vPCRF is involved in policy decisions for roaming scenarios with local breakout and also in the home routed scenario when PMIP is used over the S8 interface.

The PCRF connects to the PDN-GW using the Gx interface. In addition, when the S5/S8 interface is PMIP-based rather than GTP-based, the PCRF connects to the S-GW via the Gxc interface. The hPCRF connects to the vPCRF using the S9 interface. The PCRF and Gx interface are in scope of this document.

For support of non-3GPP systems using eHRPD, as defined in [X.S0057], the PCRF connects to the HSGW via the Gxa interface.

This document assumes the PCRF can access the Subscription Profile Repository (SPR), if one is deployed by the Service Provider.

4.4.9 Authentication, Authorization and Accounting (AAA)

The 3GPP AAA applies only in the case of non-3GPP access to the EPC.

The 3GPP AAA server handles user requests for network access and provides authentication, authorization, and accounting (AAA) services. Authentication is used to verify the identity of the target, authorization defines the set of actions the target is allowed (or not allowed) to perform, and accounting tracks the actions that are performed.

The 3GPP AAA Server connects to the HSS via the SWx interface and to the 3GPP2 AAA via the STa interface. To support roaming operations, the 3GPP AAA Server may first connect to an intermediary, the 3GPP AAA Proxy via the SWd interface which in turn connects to the 3GPP2 AAA via the STa interface.

4.4.10 Subscription Profile Repository/User Data Repository (SPR/UDR)

The SPR is a logical entity that contains all subscriber/subscription related information needed by the PCRF for subscription-based policies and IP-CAN bearer level PCC rules. The PCRF connects to the SPR via the Sp interface. The SPR may be combined with or distributed across other databases in the operator's network, but those FEs and their requirements for the SPR as well as the Sp interface are not defined in 3GPP. More information on SPR can be found in [TS 23.203].

The UDR is an FE that acts as a single logical repository storing user data. As such it may contain all subscriber/subscription related information needed by the PCRF. In deployment scenarios where the UDR is used it replaces the SPR. The interface between the PCRF and the UDR is named Ud. The Ud provides a unique reference point to fetch the subscriber/subscription data. More information on the UDR can be found in [TS 23.335].

The SPR/UDR and the Sp/Ud interface are outside the scope of this document.

4.4.11 Radio Network Subsystem (RNS)

The RNS provides radio network functions in the UMTS and consists of one or more base stations (NodeBs) and a radio network controller. The RNS interfaces to the MSC using the Iu interface.

4.4.12 UMTS Mobile Switching Center (MSC)

The UMTS MSC provides the interface between the RNS and fixed CS networks. The MSC performs all necessary functions to handle the circuit switched services to and from the UEs. The MSC is an exchange, which performs all the switching and signaling functions for UEs located in a geographical area designated as the MSC area. An MSC can be implemented in two different entities: the MSC Server, handling only signaling, and the Circuit Switched Media Gateway (CS-MGW), handling the user's data. An MSC Server and a CS-MGW make up the full functionality of an MSC. In addition to normal MSC functions, the CSFB-enabled MSC maintains the SGs association towards the MME for UEs attached to both EPS and UMTS.

4.4.13 3GPP2 Interworking Solution (1x IWS)

The 3GPP2 IWS Function implements the necessary functionality needed in the cdma2000 network to support the eHRPD interworking solution, the E-UTRAN to cdma2000 1x CSFB and E-UTRAN to cdma2000 1x Single Radio Voice Call Continuity (SRVCC) solutions. The 1x IWS supports message translation between messaging received from/sent to the 1x MSC and 1x air interface signaling messages sent/received over tunneled air interfaces (e.g., E-UTRAN). The 1x IWS also supports the storage of 1x radio parameters required for Generic Circuit Services Notification Application (GCSNA) support, the mapping of 1xPN pilot information and HRPD sector information into 1x BTS Cell ID for assigning 1x traffic channels and the ability to provide RAND values used for 1x authentication.

4.4.14 1x Mobile Switching Center (1x MSC)

The 1x MSC provides processing, control, and bearer path for calls and services. The term 1x MSC refers to either the circuit switched 1x MSC or a Mobile Switching Center Emulation (MSCe). The circuit switched 1x MSC provides signaling capability via an SS7-based connection to a 1xRTT (cdma2000) BS on the A1 interface and bearer paths

via terrestrial circuits on the A2 and A5 interfaces. The 1x MSC provides the interface for user traffic between the 1x MSC and other 1x MSCs or other networks. The MSCe provides processing and control for calls and services. An MSCe connected to a 1xRTT (cdma2000) BS provides signaling capabilities equivalent to a 1x MSC on the A1p interface. The MSCe connects to an Access Network (AN) via IP-based protocols.

4.5 Interfaces

This section is informative and describes the protocols, messages, and parameters for the signaling interfaces

- between the UE and the E-UTRAN,
- within the E-UTRAN,
- between the E-UTRAN and the EPC,
- among FEs in the EPC,
- between the EPC and the IMS Core Network,
- between the EPC and an eHRPD trusted non-3GPP Access network,
- between the EPC and the UMTS GPRS Core,
- between the EPC and the UMTS MSC, and
- between the EPC and the 1x IWS.

These interfaces are required to support NGN GETS service. Only those messages which have specific NGN GETS usage are included in this section.

In some cases, a figure is provided which shows the construction of the message as a hierarchy of information elements to identify the precise location of the key parameters relevant to NGN GETS.

The message contents, unless noted otherwise, are based on 3GPP Release 8 Specifications, and have been verified to still apply in 3GPP Release 10 Specifications as of November 2012. In cases where capabilities newer than Release 8 are required, the message descriptions explicitly mark the required Release.

4.5.1 Parameters with NGN GETS Usage

4.5.1.1 ARP

The ARP parameter is used in the context of NGN GETS to mark an EPS bearer to be established/modified with NGN GETS priority. The use of the NGN GETS ARP includes the following:

- A Service Provider selects a set of ARPs and assigns them for NGN GETS use.
- When Advance Priority is enabled, the PCRF modifies the ARP assigned to the Default Bearer and IMS Signaling Bearer during the Attach procedure and passes it to other nodes within the EPC/E-UTRAN.
- With respect to the establishment of a bearer for a media flow, when the PCRF recognizes that a policy authorization request from an AF is associated with an NGN GETS call/session, it derives the “Allocation-Retention-Priority” AVP through a Service Provider specific mapping algorithm using priority information received over the Rx interface (i.e., user priority level, priority indication, media type, etc.), and includes it in the “Re-Auth-Request” command sent to the EPC.
- When establishing the media bearer for an NGN GETS call/session, PCC interactions indicate to the EPS nodes (PDN-GW, S-GW, MME, and eNodeB) the priority level and treatment to apply to the EPS bearer via the ARP parameter.

- At the time an RRC_IDLE UE needs to transmit PS data to the eNodeB, it performs a RRC Connection Establishment followed by a Service Request for the purpose of reestablishing bearers associated with NGN GETS at the eNodeB.
- At the time a downstream IP packet arrives on a bearer upgraded for NGN GETS and the eNodeB provides paging, and following the page response, the eNodeB is instructed to reestablish bearers associated with NGN GETS.
- At the time an RRC_IDLE UE needs to transmit SIP signaling to the eNodeB to place an NS/EP call/session, the UE performs RRC Connection Establishment followed by a Service Request for the purpose of reestablishing bearers associated with NGN GETS at the eNodeB.
- At the time of handover, bearers associated with NGN GETS are established at the target eNodeB.
- At the time congestion management/overload control procedures require established bearers to be released, certain exemptions are possible for bearers associated with NGN GETS.

Table 4-1 shows how mappings occur between parameters representing the ARP. Column 1 enumerates the interfaces for which the named parameters are used. Column 2 provides the name of the parameter which carries the ARP value and Column 3 lists the allowed values for each ARP parameter name. Column 4 provides the name of the parameters which carry the Pre-emption Vulnerability Indicator (PVI) and Pre-emption Capability Indicator (PCI) indicators and Column 5 lists the allowed values for each parameter. Note that the Rx Interface does not carry the PVI and PCI parameters.

Table 4-1 - Mapping/Listing of ARP Priority Level, PCI, and PVI Parameters Among Various EPS Interfaces.

Interface	ARP Priority Level		PVI and PCI	
	Parameter Name	**Allowed Values**	**Parameter Name**	**Allowed Values**
S1, X2, S10, S11, S5/S8	"Priority Level" IE in "Allocation and Retention Priority" IE	Int (0..15) where 0 is a logical error and 1 is the highest priority	"Pre-emption Vulnerability" IE and "Pre-emption Capability" IE, both in "Allocation and Retention Priority" IE	PVI: PRE-EMPTION_VULNERABILITY_ENABLED (0) PRE-EMPTION_VULNERABILITY_DISABLED (1) PCI: PRE-EMPTION_CAPABILITY_ENABLED (0) PRE-EMPTION_CAPABILITY_DISABLED (1)
S6a, Gx, Gxa, Gxc, SWx, SWd, STa	"Priority-Level" AVP in "Allocation-Retention-Priority" AVP	Unsigned32 (1..15), 1 highest priority	"Pre-emption-Vulnerability" AVP and "Pre-emption-Capability" AVP, both in "Allocation-Retention-Priority" AVP	
Rx	"Reservation-Priority" AVP at session and media component level.	Enum(0..15), Default 0, lowest priority	N/A	N/A

The ARP parameter includes three elements: 1) Priority Level, 2) Pre-emption Capability, and 3) Pre-emption Vulnerability. For NGN GETS services, the Pre-emption Capability is set to "shall-not-trigger-pre-emption" and the Pre-emption Vulnerability is set to "not-pre-emptable." Allowed values for the Priority Level of the ARP are chosen from the set allowed in [TS 23.401] for intra-domain use (ARP 1-8) entitled by NGN GETS when setting up the corresponding PDN connection and via PCC mechanisms when establishing EPS bearers for NGN GETS use within the PDN connection.

Information elements which contain the ARP parameter are as shown in column 1 of Table 4-2. Column 2 specifies the interface on which each message described in Column 3 is exchanged. Column 4 provides the section number(s) within Section 4.3 where the particular message containing the ARP parameter can be found.

Table 4-2 -Information Elements Containing the ARP Parameter.

IE	Interface	Messages	Section
EPS-Subscribed-QoS-Profile	S6a	Update-Location-Answer	4.3.2.8.1
	SWx	Server-Assignment-Answer	4.3.4.3.1
	SWd	Diameter-EAP-Answer	4.3.4.4.2
Bearer Level QoS	S11, S5/S8	Create Bearer Request	4.3.2.12.1
	S11, S5/S8	Create Session Request	4.3.2.12.3
	S11, S5/S8	Update Bearer Request	4.3.2.12.9
	S10	Context Response	4.3.2.11.3
	S10	Forward Relocation Request	4.3.2.11.4
	S3	Forward Relocation Request	4.3.2.4.1
Default-EPS-Bearer-QoS	Gx, Gxx	CC-Request	4.3.3.1.1, 4.3.3.2.1
	Gx, Gxx	CC-Answer	4.3.3.1.2, 4.3.3.2.2
	Gxx	Re-Auth-Request	4.3.3.2.3
QoS-Information	Gx, Gxx	CC-Answer	4.3.3.1.2, 4.3.3.2.2
	Gx, Gxx	Re-Auth-Request	4.3.3.1.3, 4.3.3.2.3
E-RAB Level QoS Parameters	S1	Initial Context Setup Request	4.3.2.2.9
	S1	E-RAB Modify Request	4.3.2.2.2
	S1	E-RAB Setup Request	4.3.2.2.4
	S1, X2	Handover Request	4.3.2.2.6, 4.3.2.3.1

4.5.1.2 QCI

No additional QCI values are defined for NGN GETS in 3GPP Release 10.

NGN GETS services use the same QCI as assigned by the Service Provider for commercial grade services unless a service provider specific QCI is assigned by the Service Provider.

The “NGN GETS Data Transport service” service is realized by either a change of the QCI of the Default Bearer or the establishment of a separate dedicated bearer with an appropriate QCI.

4.5.1.3 Establishment Cause

The “Establishment Cause” IE is a 3-bit field in the “RRCConnectionRequest” message with enumerated values of {emergency, highPriorityAccess, mt-Access, mo-Signalling, mo-Data, delayTolerantAccess-v1020, spare2, spare1}.

The encoding of the “Establishment Cause” IE in the S1-AP “Initial UE Message” message is the same as that of the “Establishment Cause” IE in the RRC “RRCConnectionRequest” message.

An Establishment Cause marked as “highPriorityAccess” indicates that the access request is originated from a UE operating as AC 11-15. NGN GETS subscribed UEs are assigned to Access Class (AC) 14, and inherit automatically the benefits awarded to the “highPriorityAccess” marking.

Sample procedures which illustrate the usage of the “Establishment Cause” include: Layer 1 and 2 Connection Establishment, Attach procedures, Tracking Area Update procedures, Service Request procedures; and Paging procedures.

4.5.1.4 Paging Priority

Beginning with 3GPP Release 10, as part of the Paging procedure, priority marking of the S1-AP “Paging” message by including the “Paging Priority” IE results in the priority handling of the “Paging” message in times of congestion at the MME and eNodeB. NGN GETS priority is achieved by setting the “Paging Priority” IE to the “PrioLevel1” value.

4.5.1.5 MPS EPS Priority

Beginning with 3GPP Release 10, the “MPS EPS Priority” is stored in the HSS and in the SPR and is used to indicate that the user is subscribed to MPS (NGN GETS) in the EPS domain.

The HSS delivers the “MPS EPS Priority” indicator to the MME at the time of Attach in the S6a “Update-Location-Answer” command.

The PCRF receives the “MPS EPS Priority” from the SPR at the time of Attach via the unspecified Sp Interface.

4.5.1.6 MPS Priority Level

Beginning with 3GPP Release 10, the “MPS Priority Level” is stored in the SPR and is used to indicate the priority level associated with Service User’s MPS. It provides the priority level of NGN GETS service and is used when the user invokes NGN GETS service.

The PCRF receives the “MPS Priority Level” from the SPR at the time of Attach via the unspecified Sp Interface.

4.5.1.7 IMS Signalling Priority

Beginning with 3GPP Release 10, the “IMS Signalling Priority” is stored in the SPR and is used to indicate that the user is subscribed to Advance Priority-SPR.

The PCRF receives the “IMS Signalling Priority” from the SPR at the time of Attach via the unspecified Sp Interface.

4.5.1.8 Relationship of Service User’s Priority Level & Access Classes

For every value of the Service User’s priority level, an NGN GETS subscribed UE is assigned to AC 14 in addition to other access classes. See [TS 22.011]. AC 14 is used for all Service User’s priority levels.

4.5.1.9 Sample Mapping of Service User’s Priority Level, Reservation-Priority AVP, & ARP Priority Level

Table 4-3 shows a sample mapping of the Service User’s priority level to the session level “Reservation-Priority” AVP over the Rx Interface, and to the ARP Priority Level.

For NGN GETS subscribers, the Default Bearer and IMS Signaling Bearer get the highest priority ARP from the set allocated by the Service Provider for NGN GETS use, in this example a value of 2. The Media Bearer ARP is determined based on the session-level “Reservation-Priority” AVP received over the Rx interface. An example of ARP values assigned for voice media bearer as a function of the “Reservation-Priority” AVP received over the Rx interface is also shown in Table 4-3.

Table 4-3 - Sample mapping of NGN GETS Priority Level vs. Session Level Reservation-Priority AVP and ARP Priority Level Assignments.

Service User's priority level	Reservation-Priority AVP over Rx	ARP Priority Level for voice
1 (highest)	15	2
2	14	3
3	13	4
4	12	5
5 (lowest)	11	6
None	other	

4.5.1.10 eMLPP Priority

If the call is received with priority, the "eMLPP Priority" IE is included by the MSC in the "SGsAP-Paging-Request" message as part of Mobile Terminated CSFB to UTRAN/GERAN. The "eMLPP Priority" is defined in Section 18.4.4 of [TS 29.018] which extends the "eMLPP Priority" defined in Section 3.2.2.56 of [TS 48.008] by the inclusion of information element length indication. The priority of the call is coded in "call priority" using 3 bits as defined in Table 10.5.8 in Section 10.5.1.9 of [TS 24.008]. The mapping of Service User's priority level to eMLPP Priority level and the coding of the "call priority" field in [TS 24.008] are shown in Table 4-4.

Table 4-4 - Mapping of NGN GETS Service User's priority level with eMLPP Priority Level and [TS 24.008] call priority.

Service User's priority level	eMLPP Priority Level	[TS 24.008] call priority
1 (highest)	B	6
2	0	5
3	1	4
4	2	3
5 (lowest)	3	2

4.5.1.11 Call Priority

The "A21-1x Air Interface Signaling" message defined in Section 5.1.6.1 in 3GPP2 [A.S0008] carries a "GCSNA Status" IE that contains the "Call Priority" field, as defined in Section 5.2.4.15 in 3GPP2 [A.S0008]. The "Call Priority" is used as part of the Mobile Terminated CSFB to 1xRTT procedure.

Table 4-5 summarizes the mapping of the Service User's priority level to the "Call Priority" field. The Service User's priority level has 5 levels, with "1" being the highest priority level. The "Call Priority" is a 4-bit field with 16 possible values with range 0-15, with "0" the highest priority and "15" the lowest priority, as described in Section 4.2.15 of [A.S0014].

Table 4-5 - Mapping of NGN GETS Service User's priority level to Call Priority.

Service User's priority level	Call Priority
	0 (Reserved)
1 (highest)	1
2	2
3	3
4	4
5 (lowest)	5
	7-15 (Reserved)

4.5.2 Interfaces for 3GPP Access

This section describes the following interfaces for 3GPP Access: E-UTRA Uu, S1, X2, S3, S4, S5/S8, S6a, S10, S11, and Gn/Gp.

4.5.2.1 E-UTRA Uu Interface

This section presents the Uu Interface between the UE and the eNodeB.

The Uu Interface is specified in the TS 36.2xx series and the TS 36.3xx series of 3GPP specifications. Description of relevant protocol stacks is given in [TS 36.300].

4.5.2.1.1 RRC: RRCConnectionRelease

The RRC Layer "RRCConnectionRelease" message is specified in Sections 5.8.3 and 6.2.2 of [TS 36.331].

Figure 4-9 shows key information elements contained within the RRC "RRCConnectionRequest" message.

The NGN GETS Voice call setup procedure may employ the Release with Redirection approach or the PS Handover approach to transition the UE to the UTRAN/GERAN. For the Release with Redirection approach, the eNodeB will set the "ReleaseCause" IE to the "cs-FallbackHighPriority" value to indicate to the UE that priority treatments need be provided for this call during the RRC Connection Establishment procedure within the UTRAN. The "RedirectedCarrierInfo" IE provides the carrier over which the UE will execute the RRC Connection Establishment procedure.

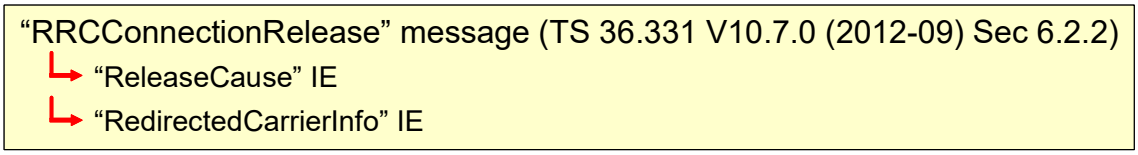

Figure 4-9 - Key Parameters within the RRC "RRCConnectionRelease" message.

4.5.2.1.2 RRC: RRCConnectionRequest

The RRC Layer "RRCConnectionRequest" message is specified in Sections 5.3.3 and 6.2.2 of [TS 36.331].

Figure 4-10 shows key information elements contained within the RRC "RRCConnectionRequest" message.

An NGN GETS subscribed UE is assigned AC14; additional AC values may also be assigned. It will therefore use an Establishment Cause of "highPriorityAccess" as specified in Annex D1 Table D.1.1 of [TS 24.301]. When AC14 is not subject to Access Class Barring, NGN GETS calls/sessions will not be subject to delays in access caused by

Access Class-related network controls. For a Public UE this priority treatment is not provided.

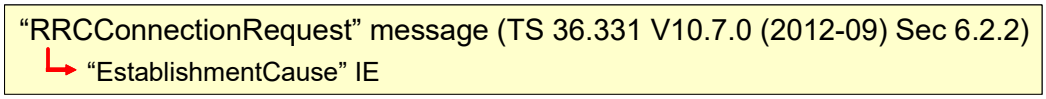

Figure 4-10 - Key Parameters within the RRC "RRCConnectionRequest" message.

4.5.2.1.3 RRC: SystemInformationBlockType2

The RRC Layer "SystemInformationBlockType2" message is specified in Section 6.3.1 of [TS 36.331].

An NGN GETS subscribed UE is provisioned with AC14. As such the E-UTRAN can be configured to give preferential access to NGN GETS subscribed UEs, while barring non-NGN GETS subscribed UEs. Barring information is transmitted in SIB2.

4.5.2.1.4 NAS ESM: Activate Dedicated EPS Bearer Context Request

The NAS ESM "Activate Dedicated EPS Bearer Context Request" message is specified in Sections 6.4.2 and 8.3.3 of [TS 24.301].

The QCI for the dedicated bearer or bearers to be activated is delivered from the MME to the UE (via eNodeB) in this message.

The structure of this message is shown in Figure 4-12 of Section 4.5.2.2.2 where it is carried in the S1-AP "E-RAB Setup Request" message. The message is also carried within the S1-AP "Initial Context Setup Request" message as shown in Figure 4-16 of Section 4.3.2.2.6. Over the Uu Interface, the NAS "Activate Dedicated EPS Bearer Context Request" message is carried in the RRC "RRCConnectionReconfiguration" message.

4.5.2.1.5 NAS ESM: Activate Default EPS Bearer Context Request

The NAS ESM "Activate Default EPS Bearer Context Request" message is specified in Sections 6.4.1 and 8.3.6 of [TS 24.301].

The QCI for the Default Bearer to be activated is delivered from the MME to the UE (via eNodeB) in this message.

The structure of this message is shown in Figure 4-16 of Section 4.5.2.2.6 where it is carried within the NAS EMM "Attach Accept" message which is in turn included in the S1-AP "Initial Context Setup Request" message.

4.5.2.1.6 NAS ESM: Modify EPS Bearer Context Request

The NAS ESM "Modify Dedicated EPS Bearer Context Request" message is specified in Sections 6.4.3 and 8.3.18 of [TS 24.301].

The QCI for the dedicated bearer or bearers to be modified is delivered from the MME to the UE (via eNodeB) in this message encapsulated in the "RRC Connection Reconfiguration" message. For example, this is applied during a SIP call/session in which the initially negotiated SDP is changed.

The structure of this message is shown in Figure 4-11 of Section 4.5.2.2.1 where it is carried in the S1-AP "E-RAB Modify Request" message.

4.5.2.2 S1 Interface

This section presents the S1 Interface between the eNodeB and the EPC. The S1 Interface consists of two separate logical interfaces. The S1-MME Interface between the eNodeB and the MME is the interface for the control plane. The S1-U Interface between the eNodeB and the S-GW is for the user plane and for inter eNodeB path switching during handover.

The S1 Interface is specified in [TS 36.41x] with the S1-AP specified in [TS 36.413].

4.5.2.2.1 E-RAB Modify Request

The S1-AP "E-RAB Modify Request" message is defined in Sections 8.2.2 and 9.1.3.3 of [TS 36.413] to modify an existing EPS bearer. The message is transmitted by the MME and is received by the eNodeB.

Figure 4-11 shows key information elements contained within the "E-RAB Modify Request" message.

The "E-RAB Modify Request" message is used by the MME to request a change of QoS parameters in the eNodeB for one or more of the existing dedicated bearers. During the setup of an NGN GETS session, if the PDN-GW determines that the bearer requested by the PCRF requires that an existing dedicated bearer should be modified, rather than a new dedicated bearer established, it triggers an "Update Bearer Request" which when received by the MME will trigger the "E-RAB Modify Request" message. Each bearer is described via the "E-RAB Level QoS Parameters" IE which contains the "Allocation and Retention Priority" IE and "QCI" IE.

This message also encapsulates the "Modify EPS Bearer Context Request" message which is used by the MME to request a change of QoS parameters in the UE for one of more of the existing dedicated bearers.

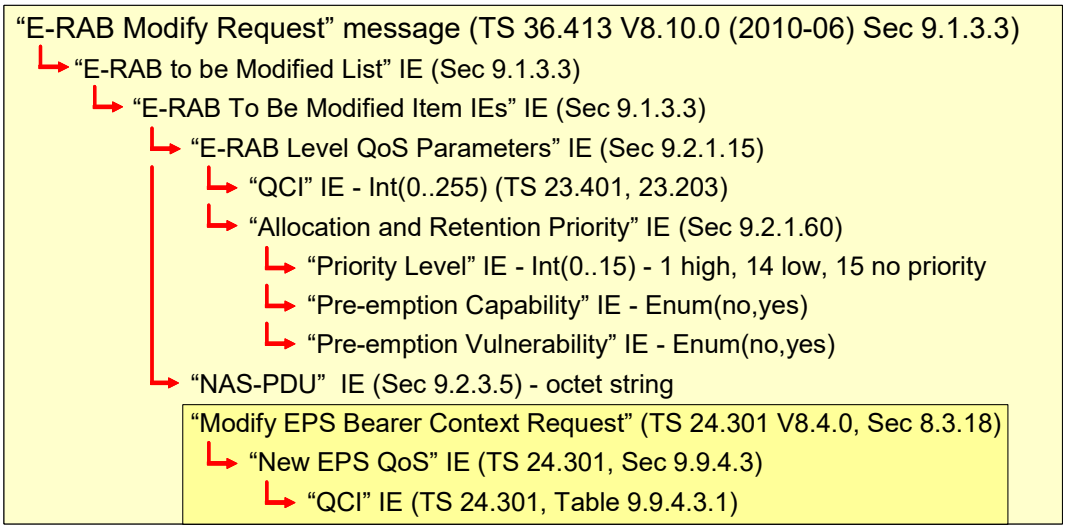

Figure 4-11 - Key Parameters within the S1-AP "E-RAB Modify Request" message.

4.5.2.2.2 E-RAB Setup Request

The S1-AP "E-RAB Setup Request" message is defined in Sections 8.2.1 and 9.1.3.1 of [TS 36.413] to establish a new dedicated bearer or bearers. The message is transmitted by the MME and is received by the eNodeB.

Figure 4-12 shows key information elements contained within the "E-RAB Setup Request" message.

The "E-RAB Setup Request" message is used by the MME to request the activation of one or more new dedicated bearers, e.g., during the setup of an NGN GETS session. Each bearer is described via the "E-RAB Level QoS Parameters" IE which contains the "Allocation and Retention Priority" IE and "QCI" IE.

This message encapsulates the "Activate Dedicated EPS Bearer Context Request" message which is used by the MME to request the UE to activate one or more dedicated bearers.

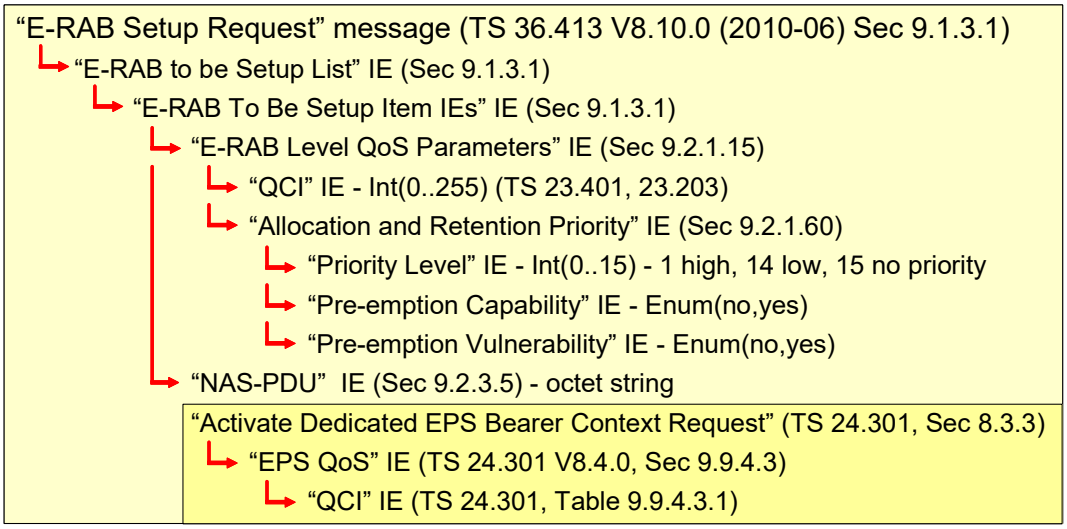

Figure 4-12 - Key Parameters within the S1-AP "E-RAB Setup Request" message.

4.5.2.2.3 Handover Request

The S1-AP "Handover Request" message is defined in Sections 8.4.2 and 9.1.5.4 of [TS 36.413] to request bearers to be setup at a Target eNodeB during S1 Handover or IRAT Handover towards the E-UTRAN. The message is transmitted by the MME to the Target eNodeB.

Figure 4-13 shows key information elements contained within the S1-AP "Handover Request" message. The list of bearers to be setup is provided in the "E-RAB To Be Setup List" IE which contains an "E-RABs To Be Setup Item IEs" IE for each bearer. Each bearer is described via the "E-RAB Level QoS Parameters" IE which contains the "Allocation and Retention Priority" IE and "QCI" IE.

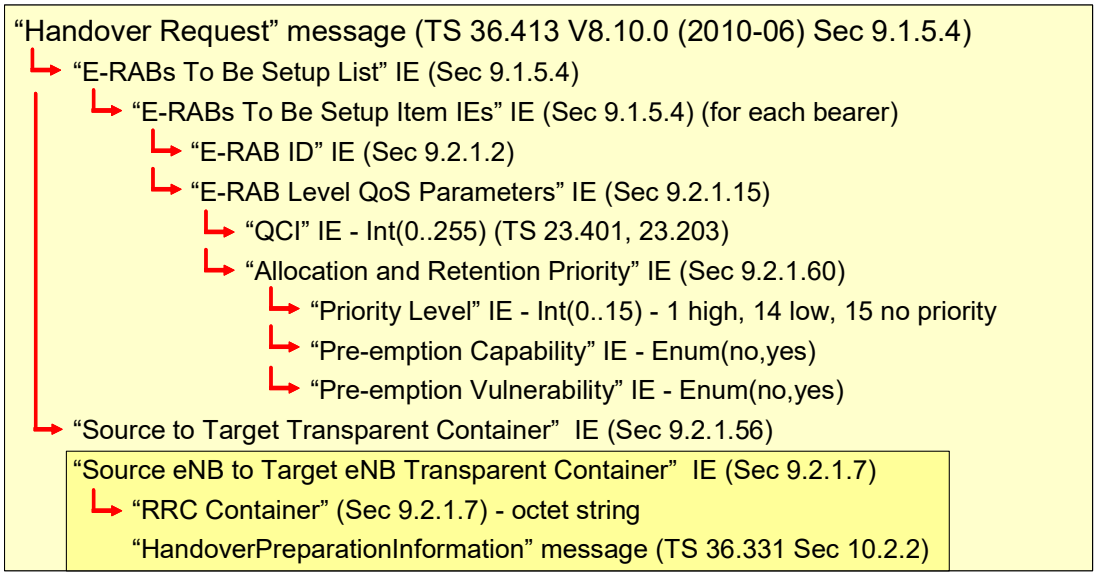

Figure 4-13 - Key Parameters within the S1-AP "Handover Request" message.

4.5.2.2.4 Handover Request Acknowledge

The S1-AP "Handover Request Acknowledge" message is defined in Sections 8.4.2 and 9.1.5.5 of [TS 36.413] to provide the list of bearers to setup at a Target eNodeB during S1 Handover, or IRAT Handover towards the E-UTRAN. The message is transmitted by the eNodeB to the MME.

Figure 4-14 shows key information elements contained within the S1-AP "Handover Request Acknowledge" message. The list of bearers to be setup is provided in the "E-RAB Admitted List" IE which contains "E-RABs Admitted Item IEs" IE for each bearer. Each bearer is referenced via the "E-RAB ID" IE which corresponds to the "E-RAB ID" provided in the "Handover Request" message in Section 4.5.2.2.3.

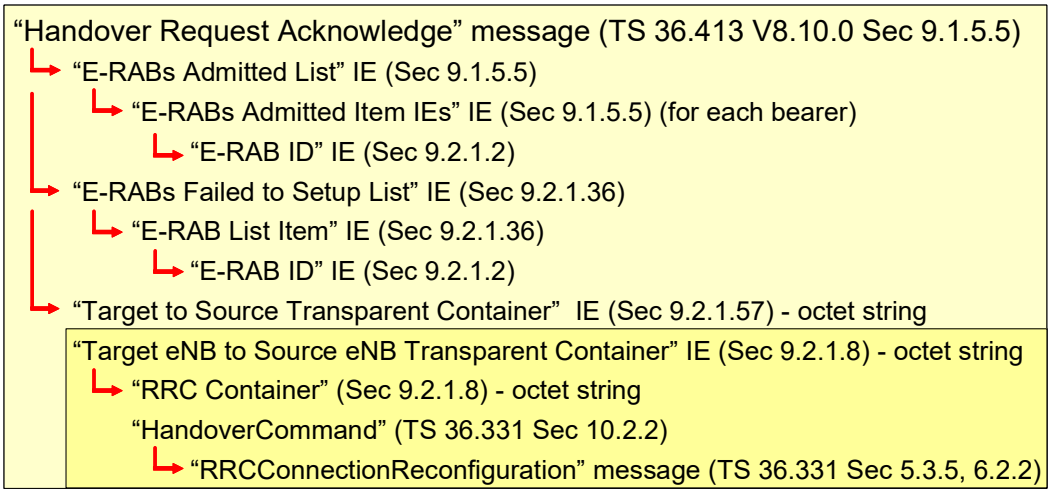

Figure 4-14 - Key Parameters within the S1-AP "Handover Request Acknowledge" message.

4.5.2.2.5 Handover Required

The S1-AP "Handover Required" message is defined in Sections 8.4.1 and 9.1.5.1 of [TS 36.413] is sent from the eNodeB to the MME over the S1-AP Interface to invoke the Handover Preparation procedure.

Figure 4-15 shows key information elements contained within the S1-AP "Handover Required" message when it is used as part of the CSFB to UMTS procedures. The "Handover Required" message includes the "CSFB Information" IE within the "Source RNC to Target RNC Transparent Container" IE, both defined in Section 9.2.1.28 of [TS 25.413]. The "CSFB High Priority" value of the "CSFB Information" IE marks this PS Handover request as supporting an NGN GETS CSFB call. The "Source RNC to Target RNC Transparent Container" IE is carried with the "Source to Target Transparent Container" IE defined in Section 9.2.1.56 of [TS 36.413].

There is no specific NGN GETS usage for this message when it is used as part of the S1 Handover or IRAT Handover procedures.

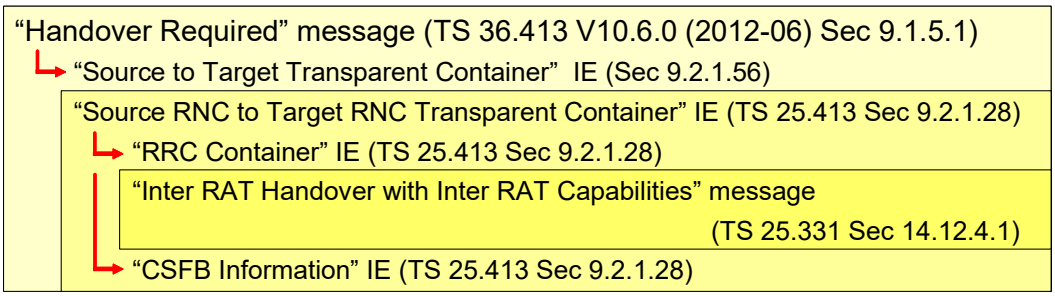

Figure 4-15 - Key Parameters in the S1-AP "Handover Required" message.

4.5.2.2.6 Initial Context Setup Request

The S1-AP "Initial Context Setup Request" message is defined in Sections 8.3.1 and 9.1.4.1 of [TS 36.413] to establish initial contexts for a UE in the eNodeB. The message is transmitted by the MME to the eNodeB.

Figure 4-16 shows key information elements contained within the "Initial Context Setup Request" message.

The “Initial Context Setup Request” message contains, for each bearer to be established, an “E-RAB to Be Setup Item” IE which contains the “E-RAB Level QoS Parameters” IE defined in Section 9.2.1.15 of [TS 36.413], and the “NAS-PDU” IE defined in Section 9.2.3.5 of [TS 36.413].

The “Initial Context Setup Request” message contains, for each bearer to be established, the “E-RAB Level QoS Parameters” IE containing the “Allocation and Retention Priority” IE which is used to convey the priority needs of the bearers, and the “QCI” IE. The priority indication is conveyed to the eNodeB via NGN GETS specific values contained in the “Priority Level” IE, “Pre-emption Capability” IE, and “Pre-emption Vulnerability” IE.

For those UEs with subscription to IMS service, the IMS Signaling Bearer is established at the time of Attach. This requires that an additional “E-RAB to Be Setup Item” IE is added to the message.

During the Attach procedure or the Non Optimized Handover from eHRPD to the E-UTRAN procedure, the “Initial Context Setup Request” message also contains, within the “E-RAB to Be Setup Item” IE associated with the Default Bearer, within the “NAS-PDU” IE, the “Attach Accept” message which in turn contains the “Activate Default EPS Bearer Context Request” message which does not contain the ARP of the Default Bearer. This NAS PDU with “Attach Accept” message is forwarded to the UE only if the “E-RAB Level QoS Parameters” requested are granted by the eNodeB. It also contains within a second “E-RAB to Be Setup Item” IE, the “Activate Dedicated EPS Bearer Context Request” message, which is also forwarded to the UE only if the “E-RAB Level QoS Parameters” requested are granted by the eNodeB.

During the CSFB to UTRAN/GERAN or CSFB to 1x RTT procedures, the “Initial Context Setup Request” message also contains the “CS Fallback Indicator” IE set to the “CS Fallback High Priority” value, rather than the “CS Fallback Required” value, to mark this request for CSFB as associated with NGN GETS. The eNodeB recognizes this marking and will provide priority handling of this request, which as specified in [TS 23.272], may include selecting amongst available approaches to perform the CSFB procedure.

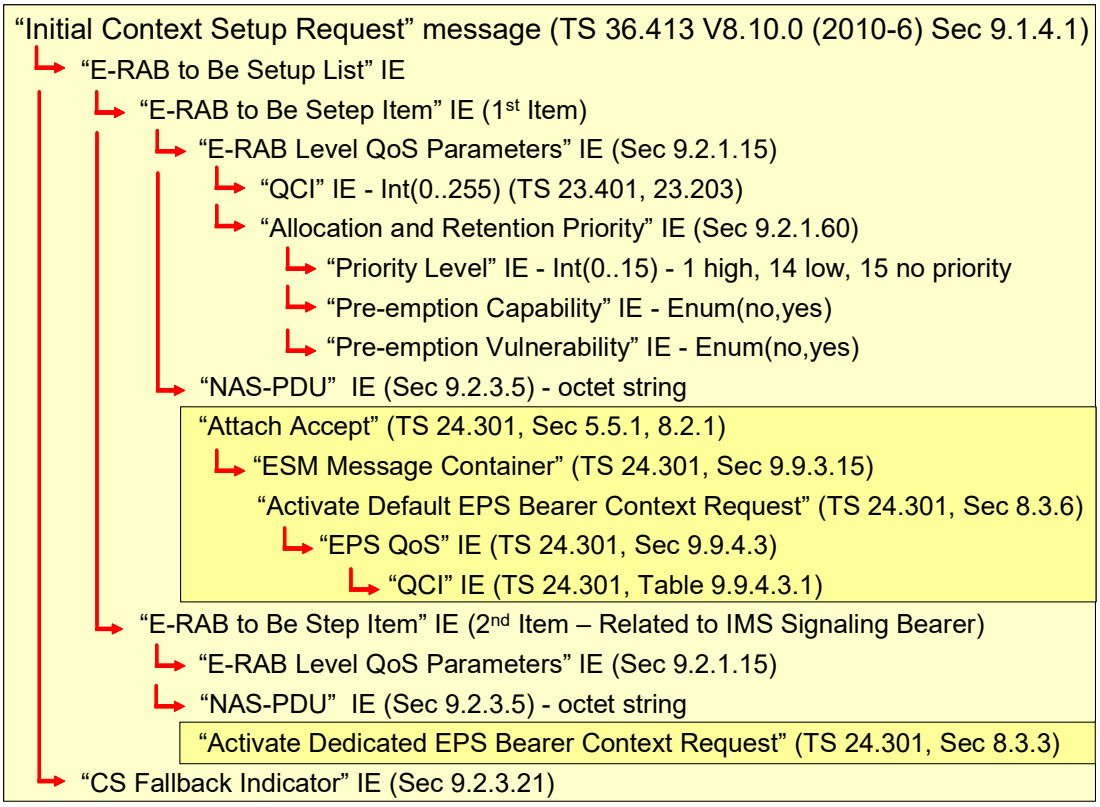

Figure 4-16 - Key Parameters within the S1-AP “Initial Context Setup Request” message.

4.5.2.2.7 Initial UE Message

The S1-AP "Initial UE Message" message is defined in Sections 8.6.2.1 and 9.1.7.1 of [TS 36.413]. It is the first message sent to the MME after the UE establishes an RRC Connection.

This message includes an "Establishment Cause" copied from the RRC "Establishment Cause" IE by the eNodeB. For an NGN GETS subscribed UE, the MME receives the "highPriorityAccess" Establishment Cause and can provide priority treatment in the event of congestion.

4.5.2.2.8 Paging

The S1-AP "Paging" message is defined in Sections 8.5 and 9.1.6 of [TS 36.413]. The message is sent by the MME to the eNodeB.

Figure 4-17 shows key information elements contained within the S1-AP "Paging" message. Beginning in Release 10, the "Paging Priority" information element is added to the S1-AP "Paging" message and set to the "PrioLevel1" value when:

a) A GTP-C "Downlink Data Notification" message arrives at the MME from the S-GW containing an ARP associated with an NGN GETS EPS bearer, or
b) A GTP-C "Create Bearer Request" or GTP-C "Update Bearer Request" message arrives at the MME from the S-GW containing an ARP associated with an NGN GETS call/session.
c) For the case of CSFB to the UTRAN/GERAN, the "Paging Priority" information element is added to the S1-AP "Paging" message and set to the "PrioLevel1" value when an SGs "SGsAP-Paging-Request" message arrives containing the "eMLPP Priority" IE with "call priority" bits set to the value 7-SUpl, where SUpl is the Service User's priority level.
d) For the case of CSFB to 1xRTT, the "Paging Priority" information element is added to the S1-AP "Paging" message and set to the "PrioLevel1" value when an S102 "A21-1x Air Interface Signaling" message arrives containing the "GCSNA Status" IE with "Call Priority" bits set to the value SUpl, where SUpl is the Service User's priority level.

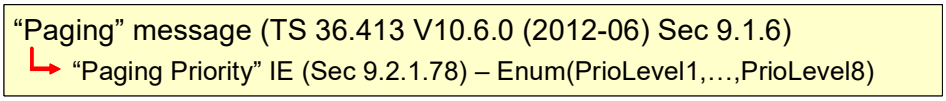

Figure 4-17 - Key Parameters within the S1-AP "Paging" message.

4.5.2.2.9 Path Switch Request

The S1-AP "Path Switch Request" message is defined in Sections 8.4.4 and 9.1.5.8 of [TS 36.413] to notify the MME that the serving eNodeB has changed during X2 Handover. The message is transmitted by the eNodeB to the MME.

Figure 4-18 shows key information elements contained within the S1-AP "Path Switch Request" message. The list of E-RABs setup at the Target eNodeB is provided in the "E-RAB To Be Switched in Downlink List" IE which contains an "E-RABs Switched in Downlink Item IEs" IE for each bearer. Each bearer is referenced via the "E-RAB ID" IE which corresponds to the "E-RAB ID" provided in the "Handover Request" message of Section 4.3.2.3.1.

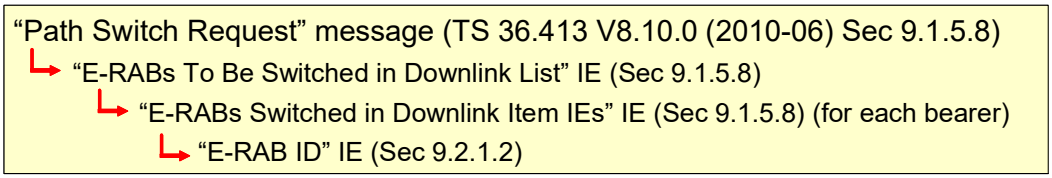

Figure 4-18 - Key Parameters within the S1-AP "Path Switch Request" message.

4.5.2.2.10 UE Context Modification Request

The S1-AP "UE Context Modification Request" message is defined in Sections 8.3.4 and 9.1.4.8 of [TS 36.413] to modify contexts for a UE in the eNodeB. The message is transmitted by the MME to the eNodeB.

Figure 4-19 shows key information elements contained within the "UE Context Modification Request" message.

During the CSFB to UTRAN/GERAN or CSFB to 1x RTT procedures, the "UE Context Modification Request" message contains the "CS Fallback Indicator" IE set to the "CS Fallback High Priority" value, rather than the "CS Fallback Required" value, to mark this request for CSFB as associated with NGN GETS. The eNodeB recognizes this marking and will provide priority handling of this request, which as specified in [TS 23.272], may include selecting amongst available approaches to perform the CSFB procedure.

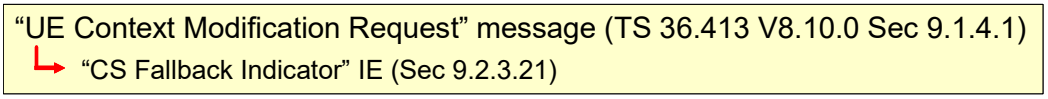

Figure 4-19 - Key Parameters within the S1-AP "UE Context Modification Request" message.

4.5.2.3 X2 Interface

This section presents the X2 Interface between a pair of eNodeBs.

The X2 Interface is specified in [TS 36.42x].

4.5.2.3.1 Handover Request

The X2-AP "Handover Request" message is defined in Sections 8.2.1 and 9.1.1.1 of [TS 36.423] to an eNodeB to request bearer resource from a second eNodeB during an X2 Handover. The message is transmitted by the current Source eNodeB to a new Target eNodeB.

Figure 4-20 shows key information elements contained within the X2-AP "Handover Request" message. The list of bearers to be setup is provided in the "E-RAB To Be Setup List" IE which contains "E-RABs To Be Setup Item" IE for each bearer. Each bearer is described via the "E-RAB Level QoS Parameters" IE which contains the "Allocation and Retention Priority" IE and "QCI" IE.

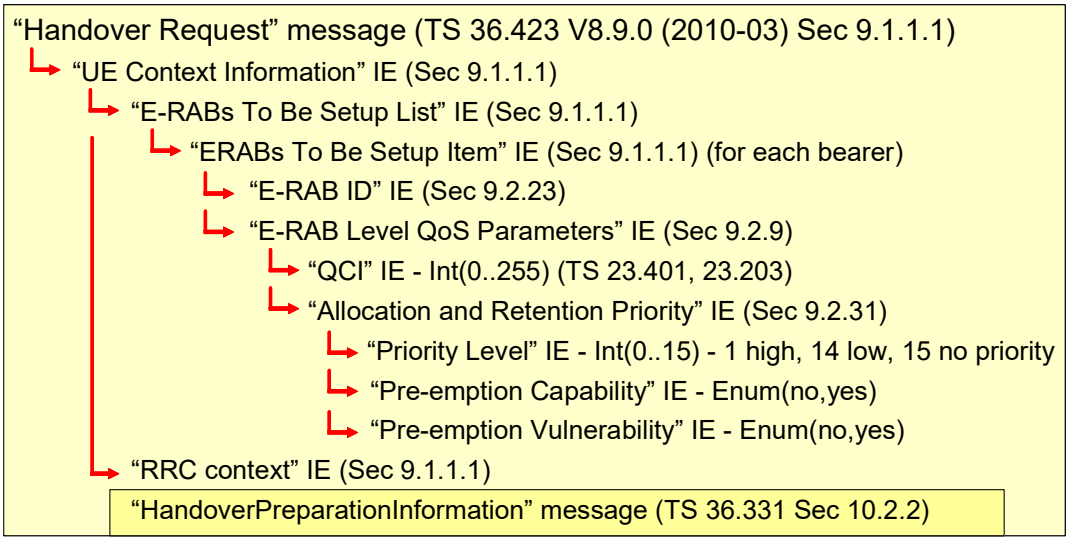

Figure 4-20 - Key Parameters within the X2-AP "Handover Request" message.

4.5.2.4 S3 Interface

This section presents the S3 Interface between the MME and the S4-SGSN. It supports the control plane using GTPv2-C.

The S3 Interface is specified in [TS 29.274].

4.5.2.4.1 Forward Relocation Request

The S3 "Forward Relocation Request" message is defined in Section 7.3.1 of [TS 29.274] to deliver the list of bearers from the Old MME to the New S4-SGSN to be setup at a Target RNS during IRAT Handover from the E-UTRAN to the UTRAN. It is also used to deliver the list of bearers from the Old S4-SGSN to the New MME to be setup at a Target eNodeB during IRAT Handover from the UTRAN to the E-UTRAN.

Figure 4-21 shows key information elements contained in the S3 "Forward Relocation Request" message. The list of bearers setup is provided in the "MME/SGSN UE EPS PDN Connections" IE which contains a "Bearer Contexts" IE for each bearer. Each bearer is described via the "Bearer Level QoS" IE which contains the "ARP" IE and "QCI" IE.

When used as part of a CSFB procedure, the S3 "Forward Relocation Request" message includes the "CSFB Information" IE within the "Source RNC to Target RNC Transparent Container" IE, both defined in Section 9.2.1.28 of [TS 25.413]. The "CSFB High Priority" value of the "CSFB Information" IE marks this PS Handover request as supporting an NGN GETS CSFB call.

For the case of IRAT handover from the UTRAN to the E-UTRAN, the "Forward Relocation Request" of Figure 4-27 applies.

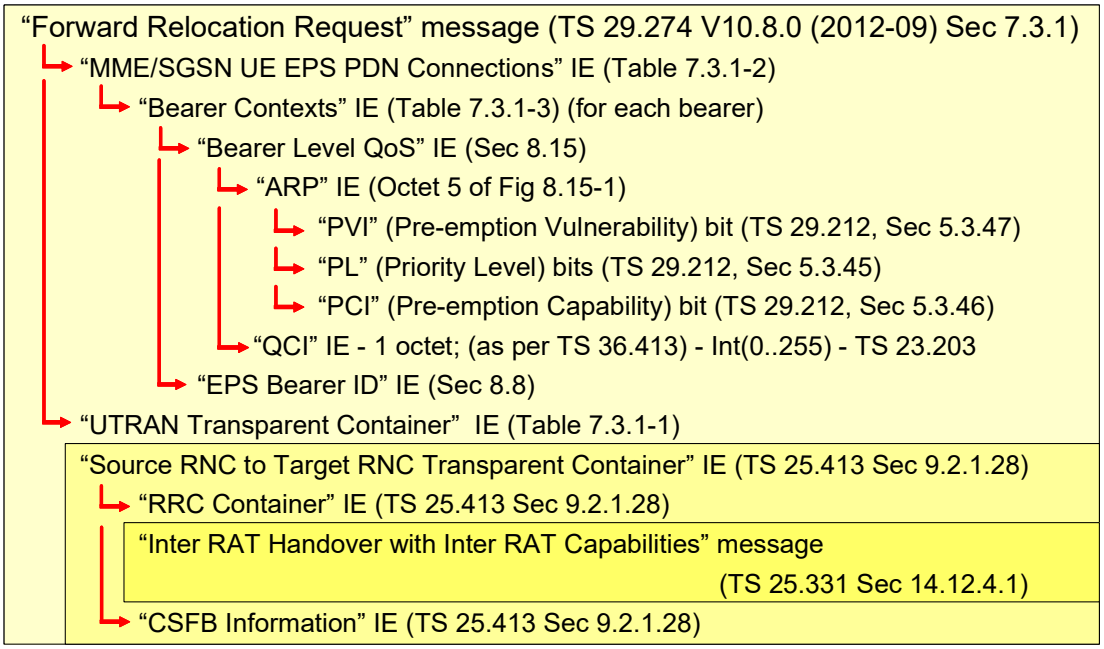

Figure 4-21 - Key Parameters within the S3 "Forward Relocation Request" message.

4.5.2.5 S4 Interface

This section presents the S4 Interface between the S-GW and the S4-SGSN. It supports the control plane using GTPv2-C as specified in [TS 29.274].

4.5.2.5.1 Create Session Request

The S4 “Create Session Request” message is defined in Section 7.2.1 of [TS 29.274] for the handover of all established bearers during mobility from the E-UTRAN to the UTRAN which results in a change of the S-GW. On the S4 Interface, the message is transmitted by the S4-SGSN and is received by the S-GW.

The S4 “Create Session Request” message is the same as the S5 “Create Session Request” message.

The “Create Session Request” message is the means by which priority subscription indication is transferred from the S4-SGSN to the S-GW over the S4 Interface during the IRAT Handover procedure from the E-UTRAN to the UTRAN. The priority session indication is conveyed via NGN GETS specific settings of the “ARP” IE included in the “Bearer Level QoS” IE.

4.5.2.6 GTP-based S5 & S8 Interfaces

This section presents the GTP-based S5 and S8 Interfaces between the S-GW and the PDN-GW. It provides user plane tunneling and tunnel management between the S-GW and the PDN-GW. It is used for S-GW relocation due to UE mobility and if the S-GW needs to connect to a non-collocated PDN-GW for the required PDN connectivity.

The GTP-based S5and S8 Interfaces utilize GPRS Tunneling Protocol version 1 for User plane (GTPv1-U) [TS 29.281] for the user plane and utilizes GPRS Tunneling Protocol version 2 for Control plane (GTPv2-C) [TS 29.274] for the control plane.

4.5.2.6.1 Create Bearer Request

The S5/S8 “Create Bearer Request” message is defined in Section 7.2.3 of [TS 29.274] for the establishment of a new dedicated bearer. The message is transmitted by the PDN-GW to the S-GW.

Figure 4-22 shows key information elements contained within the “Create Bearer Request” message.

The “Create Bearer Request” is the means by which priority indication for the establishment of a dedicated bearer is transferred from the PDN-GW to the S-GW over the S5/S8 Interface to support the needs of an NGN GETS call/session. The priority indication is conveyed via settings of the “ARP” IE and “QCI” IE in the QoS profile included in the “Bearer Level QoS” IE.

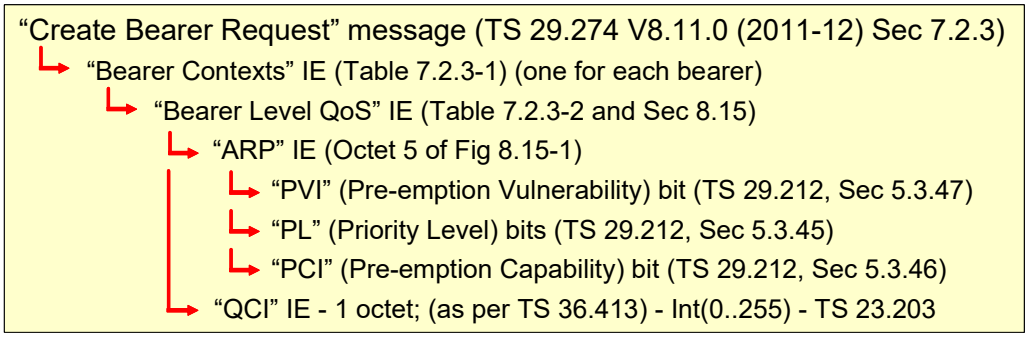

Figure 4-22 - Key Parameters within the S5/S8/S11 “Create Bearer Request” message.

4.5.2.6.2 Create Session Response

The S5/S8 “Create Session Response” message is defined in Section 7.2.2 of [TS 29.274] for the acknowledgment of the “Create Session Request” message. The message is transmitted by the PDN-GW to the S-GW.

Figure 4-23 shows key information elements contained within the “Create Session Response” message.

The “Create Session Response” message is the means by which priority indication is transferred from the PDN-GW to the S-GW over the S5/S8 Interface during the Attach procedure. During the TAU Procedure, the delivery of priority indication in the “Create Session Request” message via the “ARP” IE is acknowledged by the “Create Session Response” message. The “Create Session Response” message contains the mandatory “Bearer Contexts

created" IE which corresponds to the Bearer Contexts sent in "Create Session Request" message. The "Bearer Contexts created" IE contains the "Bearer Level QoS" IE, which includes among other parameters the "ARP" IE and "QCI" IE.

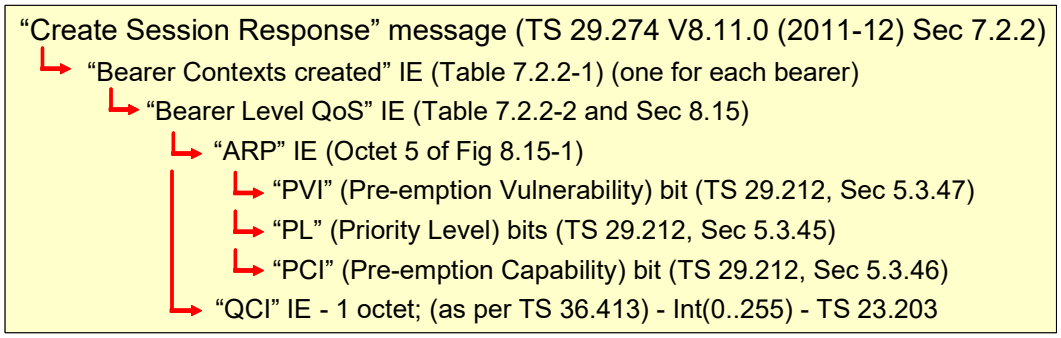

Figure 4-23 - Key Parameters within the S5/S8/S11 "Create Session Response" message.

4.5.2.6.3 Update Bearer Request

The S5/S8 "Update Bearer Request" message is defined in Section 7.2.15 of [TS 29.274] for the update of an existing bearer. The message is transmitted by the PDN-GW to the S-GW.

Figure 4-24 shows key information elements contained within the "Update Bearer Request" message.

The "Update Bearer Request" is the means by which priority indication for the update of an existing dedicated bearer is transferred (via the ARP parameter) from the PDN-GW to the S-GW over the S5/S8 Interface to support the needs of an NGN GETS call/session. The priority subscription indication is conveyed via settings of the "ARP" IE and "QCI" IE in the QoS profile included in the "Bearer Level QoS" IE.

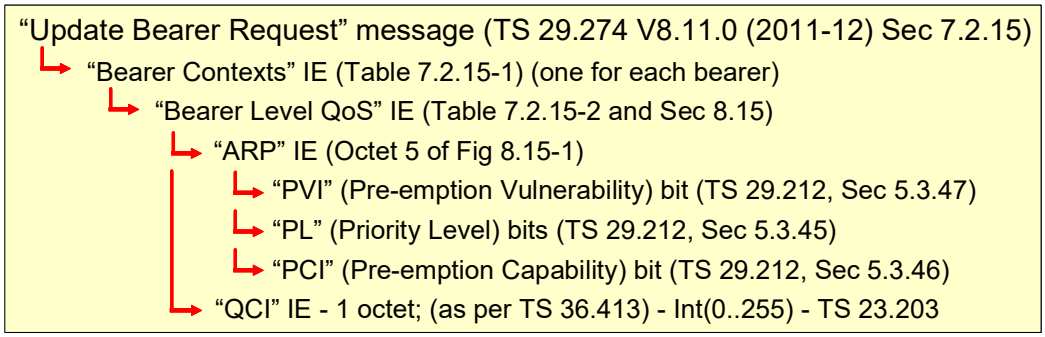

Figure 4-24 - Key Parameters within the S5/S8/S11 "Update Bearer Request" message.

4.5.2.7 S6a Interface

This section presents the S6a Interface between the MME and the HSS. It enables transfer of subscription and authentication data for authenticating and authorizing user access to the EPS.

The S6a Interface is specified in [TS 29.272].

4.5.2.7.1 Update-Location-Answer

The S6a "Update-Location -Answer" command is defined in Sections 5.2.1.1 and 7.2.4 of [TS 29.272].

Figure 4-25 shows key information elements contained within the "Update-Location-Answer" command.

Subscription to MPS is indicated within the "Subscription-Data" AVP which contains the "MPS-Priority" AVP. The

"MPS-EPS-Priority" bit of the "MPS-Priority" AVP marks a UE as subscribed to MPS within the EPS. The "MPS-CS-Priority" bit of the "MPS-Priority" AVP marks a UE as subscribed to CSFB MPS within the EPS.

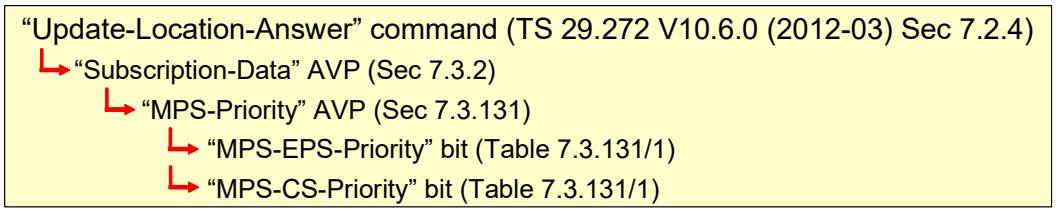

Figure 4-25 - Key Parameters within the S6a "Update-Location-Answer" command.

4.5.2.8 S10 Interface

This section presents the S10 Interface between a pair of MMEs. This interface supports MME relocation and MME information transfer.

The S10 Interface is specified in [TS 29.274].

4.5.2.8.1 Context Response

The S10 "Context Response" message is defined in Section 7.3.6 of [TS 29.274] to deliver the contexts from the old MME in response to a request received in the "Context Request" message. The message is transmitted by the old MME and is received by the new MME.

Figure 4-26 shows key information elements contained within the "Context Response" message. A complete listing of all established bearer contexts in the MME is transferred in this message. Within each context, the "Bearer Level QoS" IE contains the "ARP" IE and the "QCI" IE. This message allows NGN GETS specific QoS parameters to be transferred between MMEs as the NGN GETS subscribed UE moves through the system coverage area while in idle mode.

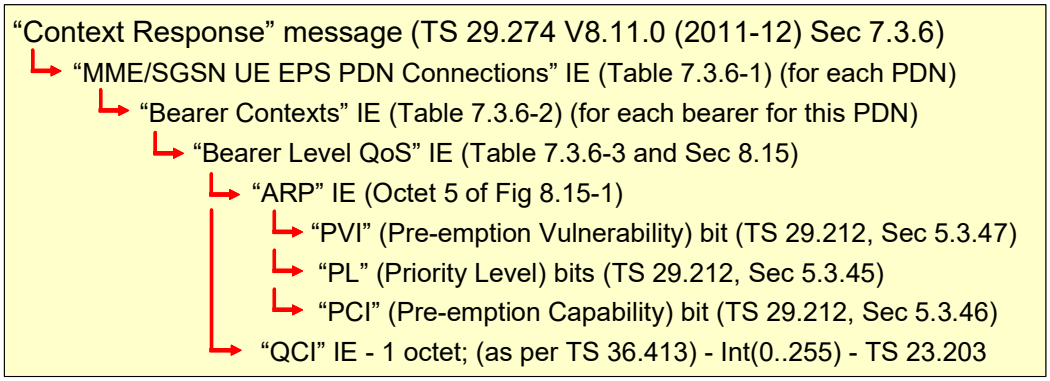

Figure 4-26 - Key Parameters within the S10 "Context Response" message.

4.5.2.8.2 Forward Relocation Request

The S10 "Forward Relocation Request" message is defined in Section 7.3.1 of [TS 29.274] to deliver the list of bearers from the Old MME to the New MME to be setup at a Target eNodeB during S1 Handover, or for IRAT handover in either direction between the UTRAN and the E-UTRAN.

Figure 4-27 shows key information elements contained within the GTPv2-C "Forward Relocation Request" message, assuming that the target system is the E-UTRAN. The list of bearers setup is provided in the "MME/SGSN UE EPS PDN Connections" IE which contains a "Bearer Contexts" IE for each bearer. Each bearer is described

via the “Bearer Level QoS” IE which contains the “ARP” IE and “QCI” IE.

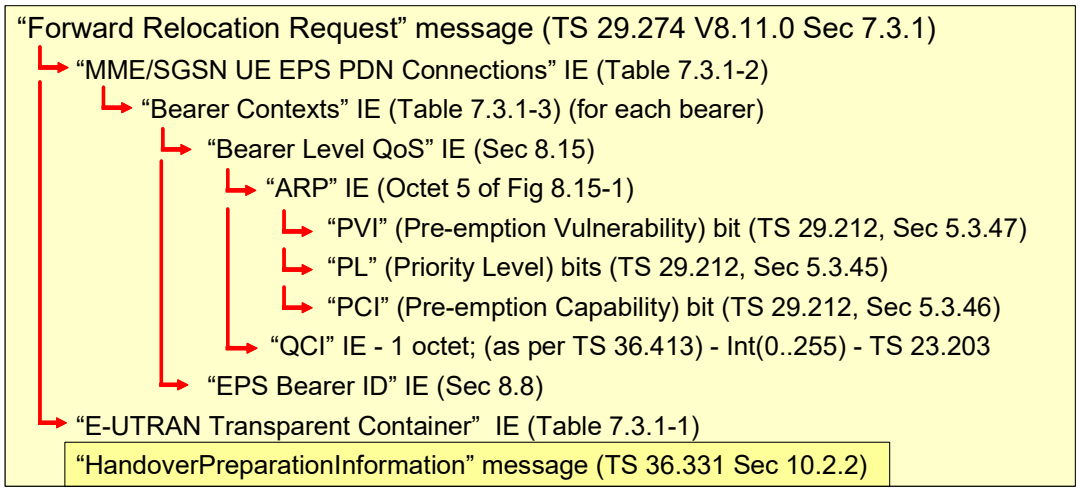

Figure 4-27 - Key Parameters within the S10 “Forward Relocation Request” message.

4.5.2.9 S11 Interface

This section presents the S11 Interface between the MME and the S-GW. It supports the control plane using GTPv2-C.

The S11 Interface is specified in [TS 29.274].

4.5.2.9.1 Create Bearer Request

The S11 “Create Bearer Request” message is defined in Section 7.2.3 of [TS 29.274] for the establishment of a new dedicated bearer. The message is transmitted by the S-GW to the MME.

The S11 “Create Bearer Request” message is the same as the S5 “Create Bearer Request” message.

The “Create Bearer Request” message is the means by which priority indication for the establishment of a dedicated bearer is transferred from the S-GW to the MME over the S11 Interface to support the needs of an NGN GETS call/session or for the creation of the NGN GETS Data Transport service non-GBR Bearer. The priority indication is conveyed via NGN GETS specific settings of the “ARP” IE in the “Bearer Level QoS” IE.

4.5.2.9.2 Create Session Request

The S5 “Create Session Request” message is defined in Section 7.2.1 of [TS 29.274]. The message is transmitted by the S-GW to the PDN-GW.

Figure 4-28 shows key information elements contained within the “Create Session Request” message.

The “Create Session Request” message is the means by which priority subscription indication is transferred from the MME to the S-GW over the S11 Interface during the TAU, X2 Handover, and S1 Handover procedures. The priority session indication is conveyed via NGN GETS specific settings of the “ARP” IE included in the “Bearer Level QoS” IE.

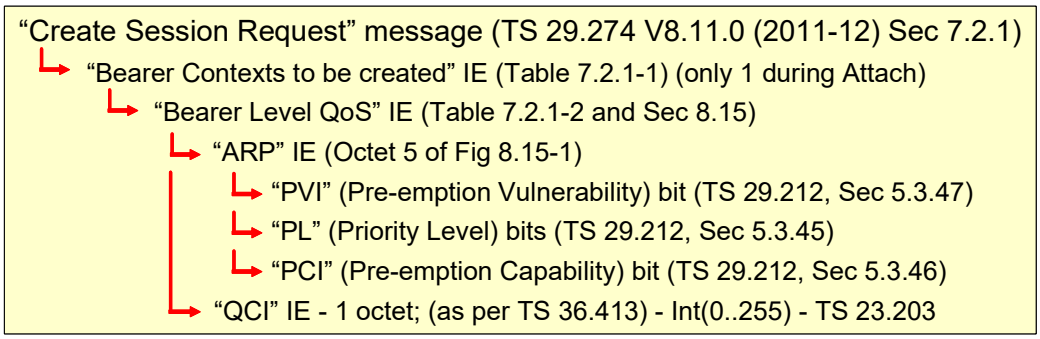

Figure 4-28 - Key Parameters within the S5/S8/S11 "Create Session Request" message.

4.5.2.9.3 Create Session Response

The S11 "Create Session Response" message is defined in Section 7.2.2 of [TS 29.274] for the acknowledgment of the "Create Session Request" message. The message is transmitted by the S-GW to the MME.

The S11 "Create Session Response" message is the same as the S5 "Create Session Response" message.

The "Create Session Response" message is the means by which priority subscription indication is transferred from the S-GW to the MME over the S11 Interface during the Attach procedure. During the TAU procedure, the delivery of priority subscription indication in the "Create Session Request" message via the "ARP" IE is acknowledged by the "Create Session Response" message. The "Create Session Response" message contains the mandatory "Bearer Contexts created" IE which corresponds to the Bearer Contexts sent in "Create Session Request" message. The "Bearer Contexts created" IE contains the "Bearer Level QoS" IE, which includes among other parameters the "ARP" IE and "QCI" IE.

4.5.2.9.4 Downlink Data Notification

The S11 "Downlink Data Notification" message is defined in Section 7.2.11.1 of [TS 29.274] to notify the MME that a downlink Application Layer data packet has been received from the PDN and has been buffered in the S-GW. It is also used in the case when Idle mode Signaling Reduction (ISR) is active and the S-GW receives either a GTPv2-C "Create Bearer Request" or a GTPv2-C "Update Bearer Request" from the PDN-GW. The "Downlink Data Notification" message is transmitted on the S11 Interface from the S-GW to the MME.

Figure 4-29 shows key information elements contained within the S11 "Downlink Data Notification" message.

Beginning in Release 10, the "Allocation/Retention Priority" IE is added to the "Downlink Data Notification" message and is populated with the ARP of the bearer for which data is queued at the S-GW. When data arrives on multiple bearers at the S-GW, the ARP included is the highest priority one among all bearers for which data is queued at the S-GW. In the case that a bearer is one which is assigned an ARP from the set associated with NGN GETS service, the inclusion of the "Allocation/Retention Priority" IE in the "Downlink Data Notification" message conveys NGN GETS priority indication.

When a "Downlink Data Notification" message that includes the "Allocation/Retention Priority" IE is received by the MME, if the ARP corresponds to an NGN GETS ARP, it generates a "Paging" message and includes a "Paging Priority" IE set to the "PrioLevel1" value. The "Paging Priority" IE indicates that the "Paging" message should receive priority treatment at the eNodeB in times of congestion.

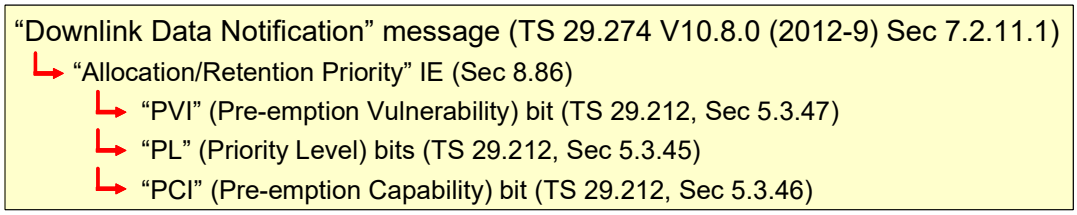

Figure 4-29 - Key Parameters within the S11 "Downlink Data Notification" message.

4.5.2.9.5 Update Bearer Request

The S11 "Update Bearer Request" message is defined in Section 7.2.15 of [TS 29.274] for the update of an existing bearer. On the S11 Interface, the message is transmitted by the S-GW to the MME.

The S11 "Update Bearer Request" message is the same as the S5 "Update Bearer Request" message.

The "Update Bearer Request" message is the means by which priority indication for the update of an existing dedicated bearer is transferred from the S-GW to the MME over the S11 Interface to support the needs of an NGN GETS call/session. The priority session indication is conveyed via NGN GETS specific settings of the "ARP" IE included in the "Bearer Level QoS" IE.

4.5.2.10 Gn/Gp Interface

This section presents the Gn Interface between the MME and the Gn/Gp SGSN, and the Gn and Gp Interfaces, for the non-roaming and roaming cases respectively, between the Gn/Gp SGSN and the PDN-GW. The Gn and Gp Interfaces use GTPv1-C for the control plane.

The Gn/Gp Interface is specified in [TS 29.060].

4.5.2.10.1 Forward Relocation Request

The GTPv1-C "Forward Relocation Request" message is defined in Section 7.5.6 of [TS 29.060] to deliver during handover the list of PDP contexts from the Old Gn/Gp SGSN to the New Gn/Gp SGSN to be setup at a Target RNS. In the case where the MME uses a Gn Interface to connect to the Gn/Gp SGSN, the MME behaves and appears as a Gn/Gp SGSN.

Figure 4-30 and Figure 4-31 show key information elements contained within the GTPv1-C "Forward Relocation Request" message. Figure 4-30 applies in the UTRAN to E-UTRAN direction, while Figure 4-31 applies in the E-UTRAN to UTRAN direction.

Each PDP context description includes a "Quality of Service (QoS) Profile" IE which includes the "Allocation/Retention Priority" octet which may take values 1, 2, or 3, and represents the Legacy ARP defined in [TS 23.107]. In addition, beginning with 3GPP Release 9, the PDP context description also includes the "Evolved Allocation/Retention Priority II" IE which is designed to align with the ARP used in LTE and is defined in [TS 29.212]. It is preferred for NGN GETS to use the Evolved ARP rather than the Legacy ARP as it provides for conveyance of more complete priority information with support of 15 Priority Level values as well as PCI and PVI indications.

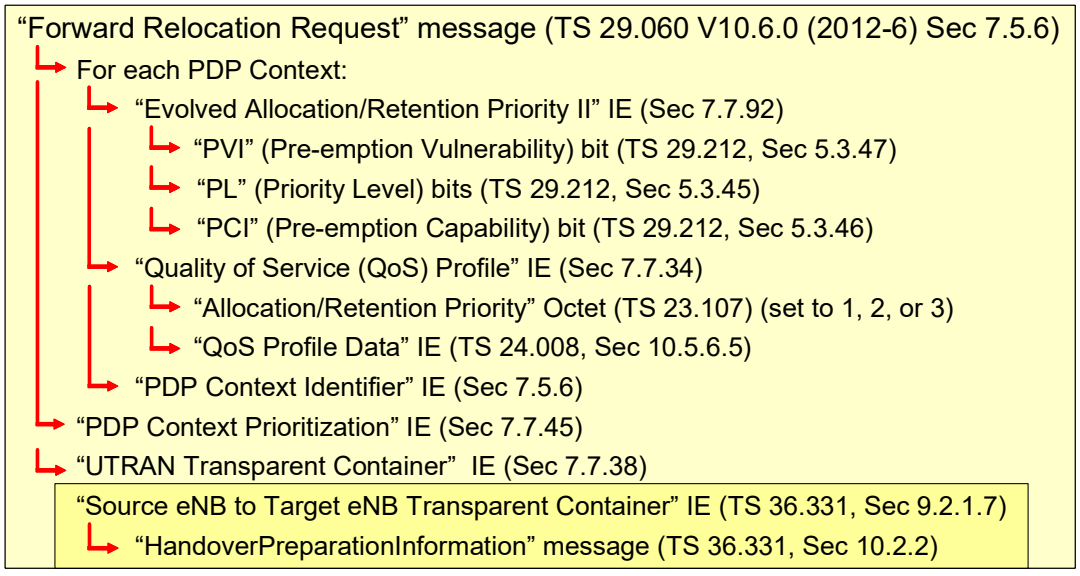

Figure 4-30 - Key Parameters within the Gn "Forward Relocation Request" message sent from the UTRAN to the E-UTRAN.

For the case of IRAT Handover from the E-UTRAN to the UTRAN, the “Forward Relocation Request” message in Figure 4-31 differs slightly from that described in Figure 4-30 in that the “UTRAN Transparent Container” IE carries, within the “RRC Container” IE of the “Source RNC to Target RNC Transparent Container” IE defined in Section 9.2.1.28 of [TS 25.413], the “Inter RAT Handover with Inter RAT Capabilities” IE defined in Section 14.12.4.1 of [TS 25.331].

When used as part of a CSFB to UTRAN procedure, the Gn/Gp “Forward Relocation Request” message includes the “CSFB Information” IE within the “Source RNC to Target RNC Transparent Container” IE, both defined in Section 9.2.1.28 of [TS 25.413]. The “CSFB High Priority” value of the “CSFB Information” IE marks this PS Handover request as supporting an NGN GETS CSFB call.

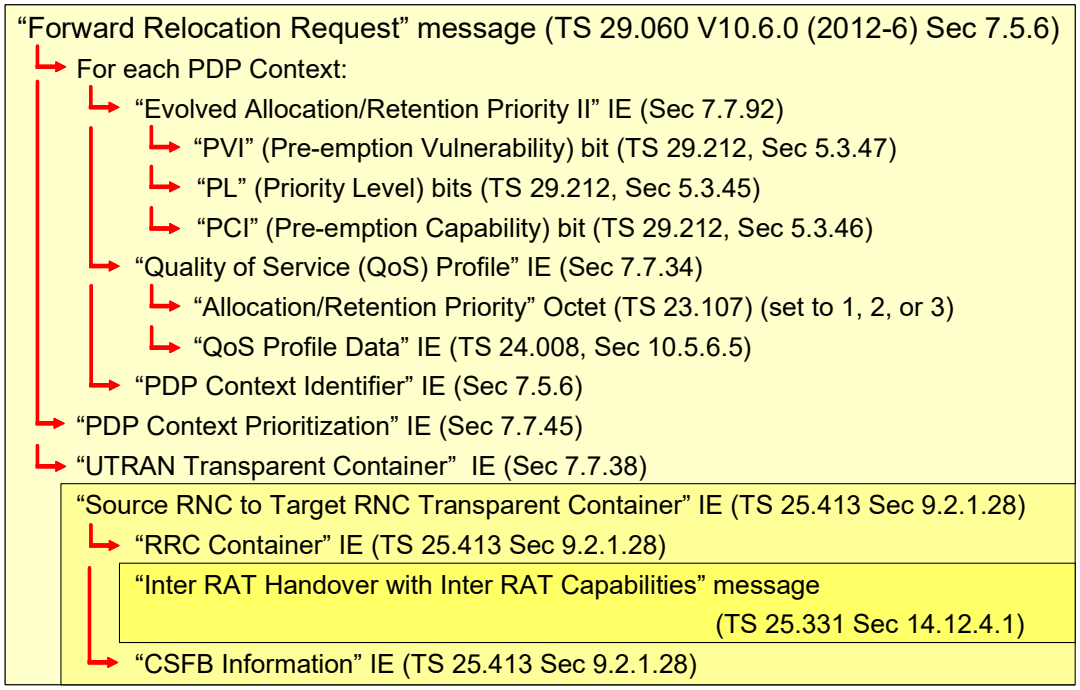

Figure 4-31 - Key Parameters within the Gn “Forward Relocation Request” message sent from the E-UTRAN to the UTRAN.

4.5.3 PCC Interfaces

This section describes the following interfaces for the delivery of dynamic policy: Gx, Gxa, Gxc, and Rx.

4.5.3.1 Gx Interface

This section presents the Gx Interface between the PDN-GW and the PCRF. The Gx Interface provides transfer of (QoS) policy and charging rules from the PCRF to the PCEF in the PDN-GW.

The Gx Interface is specified in [TS 29.212].

4.5.3.1.1 CC-Answer

The Gx “CC-Answer” command, sent by the PCRF to the PDN-GW in response to the “CC-Request” command, is used to provision the PCC rules and event triggers for the bearer/session and to provide the selected bearer control information for the IP-CAN session.

Figure 4-32 shows an example of key information elements contained within the “CC-Answer” command when used in the Attach procedure. If the characteristics of the Default Bearer are changed, the “CC-Answer” command

includes the “Default-EPS-Bearer-QoS” AVP. The command includes, for each dedicated bearer to be established at the time of attach, the “QoS-Information” AVP. Both the “Default-EPS-Bearer-QoS” AVP and the “QoS-Information” AVP include the “QoS-Class-Identifier” AVP and the “Allocation-Retention-Priority” AVP.

The “CC-Answer” is the means by which priority subscription indication is transferred from the PCRF to the PDN-GW over the Gx Interface during the Attach procedure, when Advance Priority-SPR is enabled. This includes the QoS characteristics for the Default Bearer. For either form of Advance Priority, for NGN GETS subscribed UEs with subscription to IMS Services, the IMS Signaling Bearer is established at the time of Attach with NGN GETS appropriate QoS.

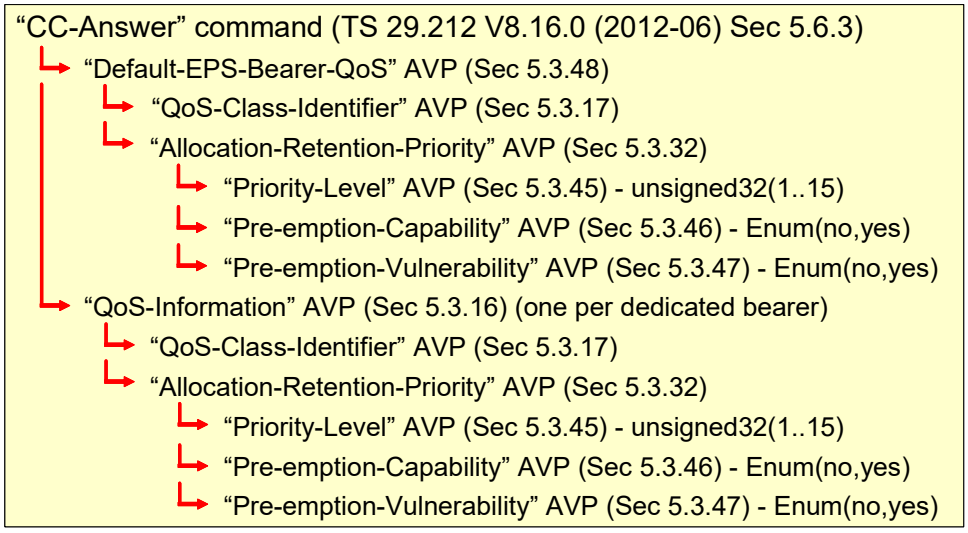

Figure 4-32 - Key Parameters within the Gx “CC-Answer” command.

4.5.3.1.2 Re-Auth-Request

The Gx “Re-Auth-Request” command is sent by the PCRF to the PDN-GW to provision unsolicited QoS/PCC rules in the PUSH procedure. It is used to provision QoS/PCC rules, event triggers, and event report indications for the session.

Figure 4-33 shows key information elements contained within the “Re-Auth-Request” command used for the Bearer Establishment and Bearer Modification procedures. The “QoS-Information” AVP for each dedicated bearer contains the “QoS-Class-Identifier” AVP and the “Allocation-Retention-Priority” AVP. For NGN GETS calls/sessions, the “Allocation-Retention-Priority” AVP reflects the priority needs of the requested bearer.

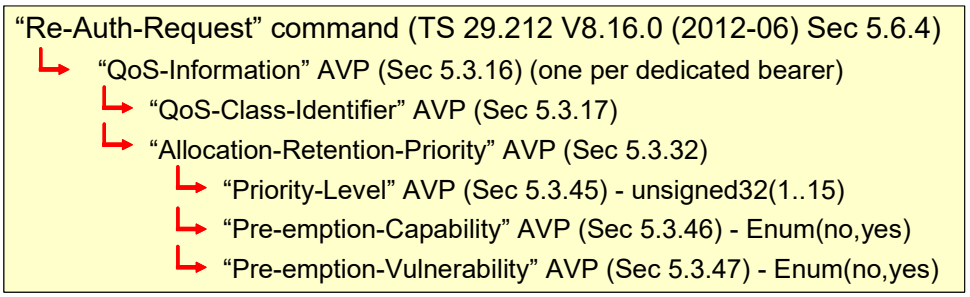

Figure 4-33 - Key Parameters within the Gx “Re-Auth-Request” command.

4.5.3.2 Gxa Interface

This section presents the Gxa Interface between the trusted non-3GPP Access Network and the PCRF. The Gxa Interface provides transfer of (QoS) policy and charging rules from the PCRF to the PCEF in the trusted non-3GPP Access Network.

The Gxa Interface is specified in [TS 29.212].

4.5.3.2.1 CC-Answer

The Gxa "CC-Answer" command, sent by the PCRF to the HSGW in response to the "CC-Request" command, is used, for both NGN GETS calls/sessions and non-NGN GETS calls/sessions, to provision the PCC rules and event triggers for the bearer/session and to provide the selected bearer control information for the Gateway Control Session.

Figure 4-34 shows key information elements contained within the Gxa "CC-Answer" command during the Attach procedure. If the characteristics of the Default Bearer are changed, the "CC-Answer" command includes "Default-EPS-Bearer-QoS" AVP. In addition, the command includes, for each dedicated bearer to be established at the time of Attach, a "QoS-Information" AVP. Both the "Default-EPS-Bearer-QoS" AVP and the "QoS-Information" AVP include the "QoS-Class-Identifier" AVP and the "Allocation-Retention-Priority" AVP.

The "CC-Answer" command is the means by which priority subscription indication is transferred from the PCRF to the HSGW over the Gxa Interface during the Attach procedure, when Advance Priority-SPR is enabled. This includes the QoS characteristics for the Default Bearer. For either form of Advance Priority, for NGN GETS subscribed UEs with subscription to IMS Services, the IMS Signaling Bearer is established at the time of Attach with NGN GETS appropriate QoS.

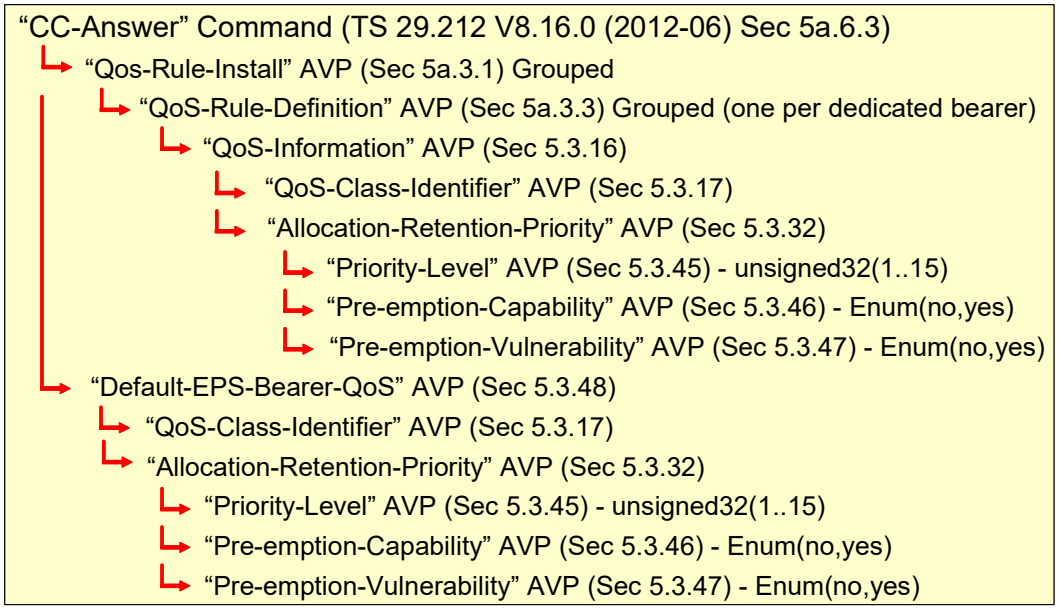

Figure 4-34 - Key Parameters within the Gxa/Gxc "CC-Answer" command.

4.5.3.2.2 Re-Auth-Request

The Gxa "Re-Auth-Request" command used with PMIP-based Attach is sent by the PCRF to the HSGW over the Gxa interface to initiate the Gateway Control and QoS Rules Provision procedure to keep the QoS rules aligned with the active PCC rules for the IP-CAN session and to update the event triggers.

As shown in Figure 4-35, the "Re-Auth-Request" command may include the "QoS-Rule-Install" AVP to install or modify any QoS rules, and the "QoS-Remove" AVP to remove any QoS rules. The command may also include the

"Default-EPS-Bearer-QoS" AVP to change the Default Bearer QoS.

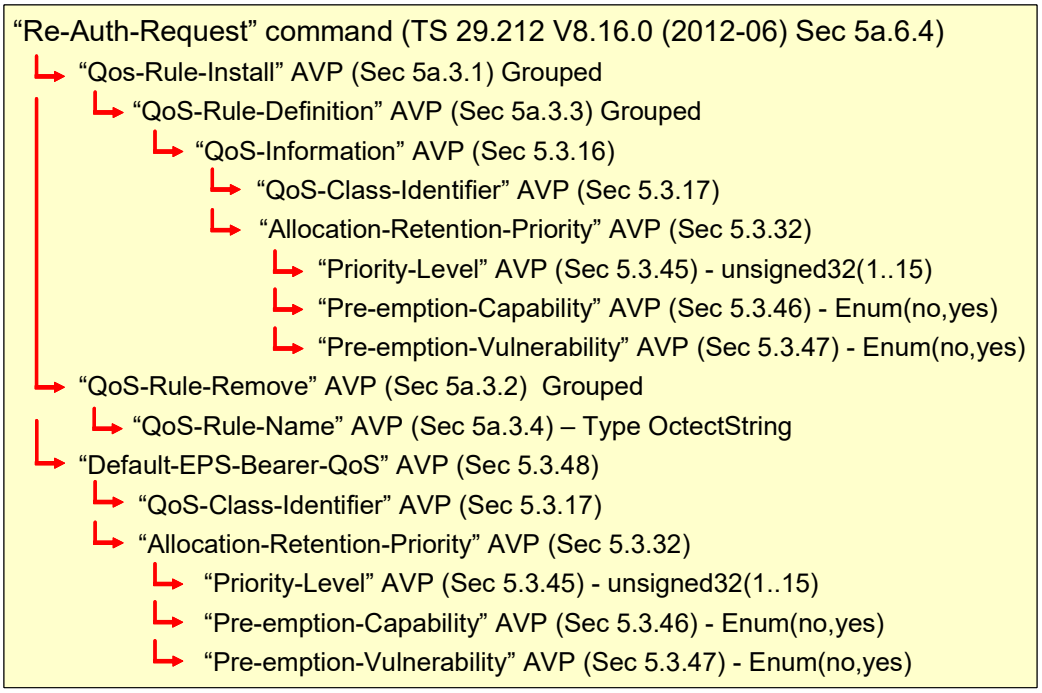

Figure 4-35 - Key Parameters within the Gxa/Gxc "Re-Auth-Request" command.

4.5.3.3 Gxc Interface

This section presents the Gxc Interface between the S-GW and the PCRF. It provides transfer of (QoS) policy and charging rules from the PCRF to the S-GW. This interface is only used when the S5/S8 Interface between the S-GW and PDN-GW is based on PMIP rather than on GTP.

The Gxc Interface is specified in [TS 29.212].

4.5.3.3.1 CC-Answer

The Gxc "CC-Answer" command, sent by the PCRF to the S-GW in response to the "CC-Request" command, is used to provision the PCC rules and event triggers for the bearer/session and to provide the selected bearer control information for the Gateway Control Session.

The format and usage of Gxc "CC-Answer" command is as described for the Gxa "CC-Answer" command in Section 4.5.3.2.1.

4.5.3.3.2 Re-Auth-Request

The Gxc "Re-Auth-Request" command is sent by the PCRF to the S-GW to provision unsolicited QoS/PCC rules in the PUSH procedure. It is used to provision QoS/PCC rules, event triggers, and event report indications for the session.

The format and usage of the Gxc "Re-Auth-Request" command is as described for the Gxa "Re-Auth-Request" command in Section 4.5.3.2.2.

4.5.3.4 Rx Interface

This section presents the Rx Interface between the PCRF and an AF (P-CSCF or AS in the IMS CN). The Rx

Interface is used to exchange application level session information between the AF and the PCRF.

The Rx Interface is specified in [TS 29.214].

The “Reservation-Priority” AVP is reused from European Telecommunications Standards Institute (ETSI) TS 183 017 [ETSI TS 183 017] which defines 15 values for priority from PRIORITY-ONE (1) to PRIORITY-FIFTEEN (15). DEFAULT (0) is the lowest level of priority and the priority associated with the reservation if no “Reservation-Priority” AVP is specified. NGN GETS does not reserve a set of values for “Reservation-Priority” AVP for the exclusive use of NGN GETS. However, the “MPS-Identifier” AVP marks the request as associated with NGN GETS service by inclusion of a national specific string.

4.5.3.4.1 AA-Request

The Rx “AA-Request” command is sent by an AF to the PCRF in order to provide it with the Session Information.

Figure 4-36 shows key information elements contained within the Rx “AA-Request” command for Mobile Origination and Mobile Termination Procedures. The key parameter is the “Reservation-Priority” AVP at the Session Level mapped from the SIP RPH header (by the P-CSCF) indicating the originating Service User’s priority level or a default level. The “MPS-Identifier” AVP marks the request as associated with NGN GETS service by inclusion of a national specific string. The PCRF uses this parameter and the “Reservation-Priority” AVP at the media level to derive the “Allocation-Retention-Priority” AVP to be used over the Gx Interface. The “Media-Type” AVP at the media level is mapped to “QoS-Class-Identifier” AVP over the Gx Interface.

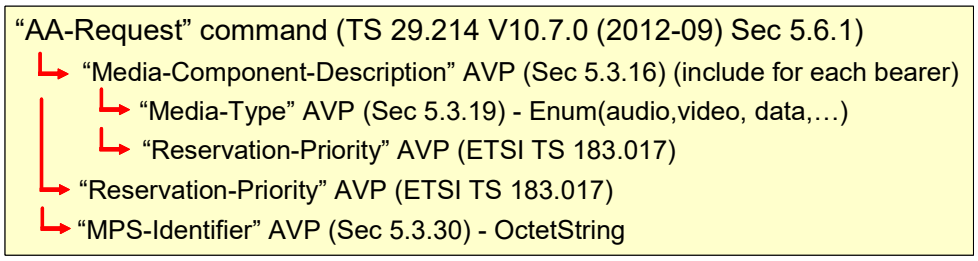

Figure 4-36 - Key Parameters within the Rx “AA-Request” command.

Figure 4-37 shows another example of key information elements contained within the Rx “AA-Request” command for the case where both a voice and a video bearer are being requested. The “Media-Component-Description” AVP is repeated for each media component. The “Reservation-Priority” AVP outside the “Media-Component” AVP is mapped from the SIP RPH header and indicates the Service User’s priority level. The “MPS-Identifier” AVP marks the request as associated with NGN GETS service by inclusion of a national specific string.

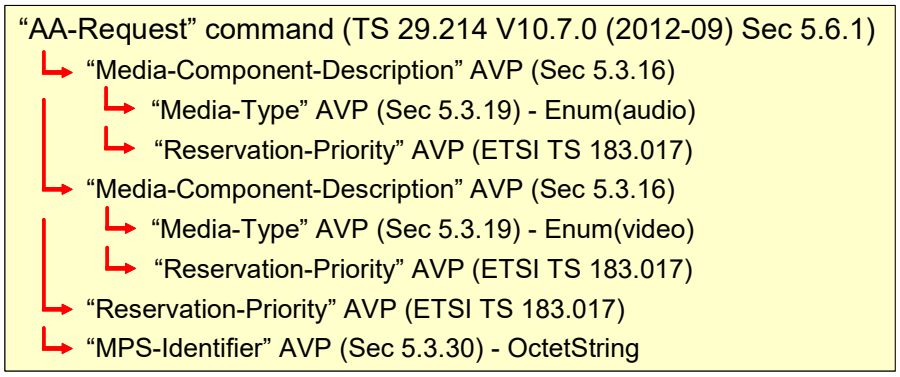

Figure 4-37 - Example of Key Parameters for the Rx “AA-Request” command for the case where two Bearers (one Voice and one Video) are to be setup within the EPC.

4.5.4 Interfaces for eHRPD Access

In addition to the interfaces for 3GPP Access, this section describes the following additional interfaces required for trusted non-3GPP Access excluding those required solely for the delivery of dynamic policy: SWx, SWd, and STa.

4.5.4.1 SWx Interface

This section presents the SWx Interface between the HSS and the 3GPP AAA Server. It is used for the transport of authentication data.

The SWx Interface is specified in [TS 29.273].

This interface is needed for the delivery of subscription parameters indicating support for NGN GETS for the case of eHRPD access to the EPC via the S2a Interface.

4.5.4.2 SWd Interface

This section presents the SWd Interface between the 3GPP AAA Server and the 3GPP AAA Proxy. In cases where a proxy is not required, this interface is not present in the flow.

The SWd Interface is specified in [TS 29.273].

This interface is needed for the delivery of subscription parameters indicating support for NGN GETS for the case of eHRPD access to the EPC via the S2a Interface.

4.5.4.3 STa Interface

This section presents the STa Interface between the trusted non-3GPP Access Network and the 3GPP AAA Proxy/Server. It transports access authentication, authorization, mobility parameters, and charging-related information in a secure manner.

The STa Interface is specified in [TS 29.273].

This interface is needed for the delivery of subscription parameters indicating support for NGN GETS for the case of eHRPD access to the EPC via the S2a Interface.

4.5.5 Interfaces for CSFB

This section presents the following additional interfaces required for CSFB: SGs, and S102.

4.5.5.1 SGs Interface for CSFB to the UTRAN/GERAN

This section presents the SGs Interface between the MME and the 3GPP MSC.

The SGs Interface is specified in [TS 29.118].

4.5.5.1.1 SGsAP-Paging-Request

The SGs-AP “SGsAP-Paging-Request” message is used to deliver paging indication from the 3G MSC to the MME over the SGs Interface.

Figure 4-38 shows key information elements contained within the “SGsAP-Paging Request” message. The “Service Indicator” IE marks the message as associated with CS service (rather than SMS) by setting the “CS Call Indicator” bit. The “eMLPP Priority” IE contains the “call priority” bits which are used to convey NGN GETS priority indication from the 3G MSC to the MME.

Note the 3GPP “call priority” defined in this section is not the same as the 3GPP2 “Call Priority” defined in Section 4.5.1.11.

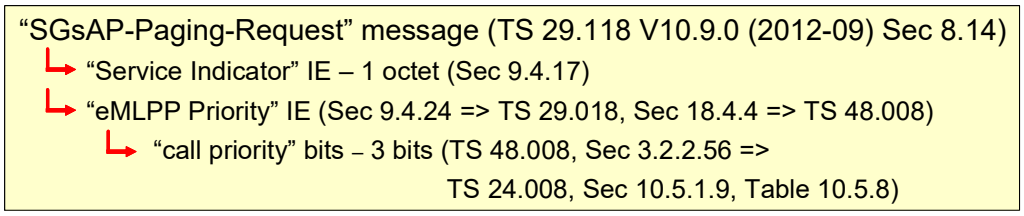

Figure 4-38 - Key Parameters within the SGs “SGsAP-Paging-Request” message.

4.5.5.2 S102 Interface for CSFB to 1xRTT (cdma2000)

This section presents the S102 Interface between the MME and the 1x IWS.

The S102 Interface is specified in [TS 29.277] which refers to the A21 Interface specified in 3GPP2 [A.S0008]. The S102 Interface adopts a subset of A21 Interface messages.

4.5.5.2.1 A21-1x Air Interface Signaling

The S102 “A21-1x Air Interface Signaling” message is used to deliver paging indication from the 1x IWS to the MME over the S102 Interface.

Figure 4-39 shows key information elements contained within the “A21-1x Air Interface Signaling” message. The “GCSNA Status” IE contains the “Call Priority” bits which are used to convey NGN GETS priority indication from the 1x IWS to the MME for mobile terminated scenarios.

Note the 3GPP2 “Call Priority” defined in this section is not the same as the 3GPP “call priority” defined in Section 4.5.1.10.

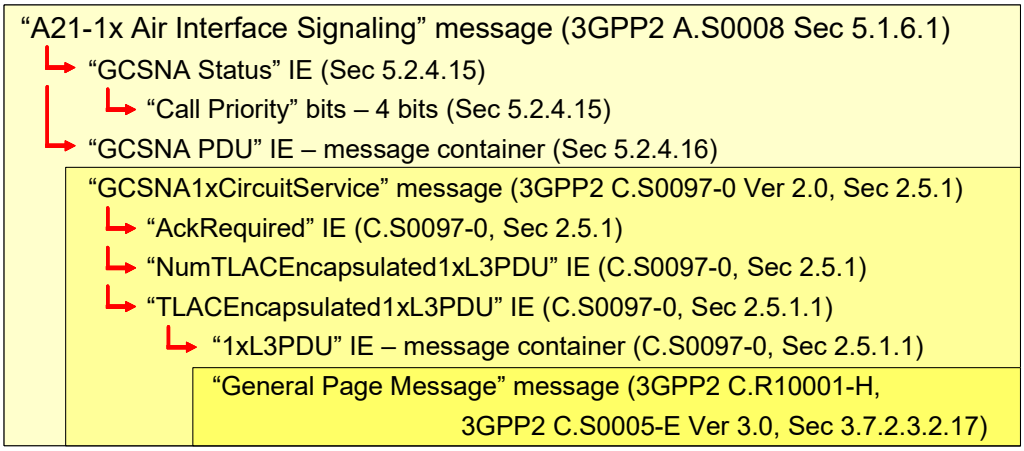

Figure 4-39 - Key Parameters within the S102 “A21-1x Air Interface Signaling” message.

5 Functional Entity Requirements

This section provides FE requirements for an LTE Access Network in support of the NGN GETS services. Common, EPS Bearer, and FE-specific requirements are provided in separate sections.

The FE requirements specify that the FE must support recognition of the standard priority indicators, provide

corresponding priority treatment, and provide a means for the Service Provider to relate NGN GETS flows to the priorities provided in the specifications.

5.1 Common Requirements

This section specifies requirements that are applicable to multiple FEs within the LTE Access Network.

Priority treatment for an NGN GETS call/session (including an NGN GETS Data Transport service invocation and revocation) applies to:

a. call/session processing, including resource allocation,

b. processing and transport of signaling messages, and

c. processing and transport of the media packets.

5.1.1 Common Priority Treatment Related to Machine Congestion Controls

Most FEs have some form of MCCs to optimize the number and importance of signaling messages successfully processed when overload prevents processing of all signaling messages, e.g., after all permitted non-signaling load has been shed and the FE is still in an overload condition. This typically involves shedding a significant portion of the incoming signaling load during the extreme overload.

[141] If an FE that is NGN GETS-aware implements machine-congestion-based overload controls, then the FE shall recognize arriving NGN GETS traffic, and provide NGN GETS traffic priority treatment with respect to its machine-congestion-based overload controls (e.g., exemption from load shedding).

5.2 EPS Bearer Requirements for NGN GETS

In LTE, QoS is defined down to the level of the EPS bearer. All SDFs mapped onto the same EPS bearer receive the same QoS treatment. See [TS 23.203] for a detailed description of the LTE QoS parameters and usage.

The objective of this section is to specify how a subset of QoS parameters, specifically the ARP and QCI, must be set to meet the needs of NGN GETS.

Within LTE, there is great flexibility in the management of the EPS bearer QoS parameters. For this reason, EPS bearer requirements are addressed separately from specific FE requirements, as the actual FE charged with implementing them can vary within the bounds of the standard.

The set of ARP values allocated by the Service Provider for NGN GETS bearers are denoted as “ARP_NGNGETS”. It is assumed that these ARPs contain different Priority Levels but all contain the same PCI and PVI.

To support NGN GETS services, it is necessary for the Service Provider to select a set of ARP values to be used for NGN GETS. This selection will directly impact the priority given for bearer admission at initial establishment and again during establishment at a Target eNodeB required as a result of a handover. It will also determine the priority given to the bearer when congestion control mechanisms require the removal of the bearer.

[64] The Service Provider shall select, ARP_NGNGETS, the set of ARP values to be used for any bearer that requires NGN GETS treatment subject to the following Requirements:

a) The Pre-emption Capability of each ARP shall be set to “shall-not-trigger-pre-emption” so that the NGN GETS bearer cannot pre-empt any other bearer,

b) The Pre-emption Vulnerability of each ARP shall be set to “not-pre-emptable” so that the NGN GETS bearer cannot be pre-empted by any other bearer,

c) The Priority Level of each ARP shall be within the range standardized for intra-domain use, that is, within the range of 1 through 8 inclusive,

d) The Priority Level of each ARP shall be set to a lower integer value than that used for any

non-NGN GETS service, with the exception of bearers to support Service Provider management,

e) The set shall contain at least three ARPs, and

f) The set shall contain no more than five ARPs.

For example, ARP Priority Level values 2, 3, and 4 with Pre-emption Capability set "shall-not-trigger-pre-emption" and Pre-emption Vulnerability set "not-pre-emptable" form a set which meet the above requirements if all other services are assigned ARP Priority Level values greater than 4.

To support IRAT Handover to/from the UMTS PS network, it is necessary to have an assignment of ARPs in the UMTS system that can be mapped from the assignment in the LTE system.

When the GPRS Core supports the Evolved ARP [TS 29.060], [TS 23.107], the ARP used in the UTRAN can be derived directly from the GPRS Core ARP. The interworking between the EPS ARP and the GPRS Core ARP is specified in Annex E of [TS 23.401] as a direct copy. The set of ARPs selected by the Service Provider for NGN GETS use within the UMTS network are the same as and mapped one-to-one with the set of ARPs selected by the Service Provider for NGN GETS use within the EPS.

When the GPRS Core does not support the Evolved ARP, there is a collapsed mapping between the 15 ARP Priority Levels supported in the EPS to the three ARP Priority Levels supported by the Legacy ARP. The specific mapping is specified in Annex E of [TS 23.401]. With only three Priority Levels available, it is not realistic to expect more than one to be made available for NGN GETS, but the one selected should be the highest priority of the three. The ARP=1 value of the Legacy ARP is selected for use by NGN GETS use and all ARP values used within the EPS system are mapped to this single value. When moving from the GPRS Core to the EPS, NGN GETS users are all mapped to a single EPS ARP, and cannot be distinguished based on Service User's priority level. Furthermore, NGN GETS users cannot be distinguished from other users who may also be assigned the UMTS Legacy ARP=1 value, e.g., network management users.

The implementation details for mapping the ARP between the EPS and the GPRS Core depend upon capability of the SGSN within the GPRS Core. In the case of an S4-SGSN, the requirements are implemented in the S4-SGSN. In the case of a Gn/Gp SGSN, the requirements are implemented in the MME.

5.2.1 NGN GETS Priority Treatment for the Media Bearer

This section defines NGN GETS priority treatment for a media bearer, defined in this standard as any bearer other than:

- the Default Bearer, or
- the IMS Signaling Bearer (may be the same as a Default Bearer in some commercial implementations).

NGN GETS priority treatment for a Media Bearer results in a change of ARP but not QCI, and applies only for the duration of the call/session that uses the bearer.

[65] The Service Provider's network shall enable priority treatment for a Media Bearer (any bearer other than the Default Bearer, or the IMS Signaling Bearer) by the following QoS parameter settings:

a) The Media Bearer ARP shall be a member of the set ARP_NGNGETS, and

b) Except as noted for specific NGN GETS services, the QCI of an NGN GETS Media Bearer shall be the same as the QCI used for a commercial public Media Bearer.

[66] The Service Provider's network shall enable priority treatment for a Media Bearer for an NGN GETS call/session upon authentication and authorization of the call/session. To support GETS-AN and GETS-NT invocation, the Service Provider shall enable priority treatment prior to the collection of the PIN.

[67] Upon the release of the last NGN GETS call/session, the Service Provider's network shall restore

the ARP of the bearer carrying the media to a non-NGN GETS value.

Whenever NGN GETS priority treatment for a media bearer is enabled on any bearer to a particular APN, the Default Bearer to that APN is also upgraded, and the Default Bearer to the Attach/default APN is also upgraded.

NGN GETS Voice, as required in [GSMA IR.92], is supported using a QCI = 1 EPS bearer.

[161] The Service Provider's network shall provide NGN GETS Voice with an EPS bearer with QCI = 1 and an ARP chosen from the set ARP_NGNGETS using a rule which considers the Service User's priority level.

NGN GETS Video, consistent with [GSMA IR.94], is supported using a QCI = 2 EPS bearer for the video component. Note [GSMA IR.94] also permits the use of a non-GBR EPS bearer for video.

[162] The Service Provider's network shall provide NGN GETS Video with an EPS bearer with QCI = 2 for the video component, an EPS bearer with a QCI = 1 for the audio component, and an ARP for both the audio and video bearers chosen from the set ARP_NGNGETS using a rule which considers the Service User's priority level. If the ARP for the audio and video components is set differently, the ARP of the audio component shall be set to a higher priority level (lower numeric value) than the ARP of the video bearer.

The following conditional requirements address situations in which both the audio and video components cannot be established. Specifically, audio should be allowed even if video cannot be supported.

[261] For an NGN GETS Video call/session request with both voice media and video media, if the video media cannot be established, then the Service Provider's network shall attempt to establish the call/session with priority for the voice media.

[262] For an established NGN GETS Video call/session with both voice media and video media, if the video media is lost mid-session, then the Service Provider's network shall continue to maintain the call/session with priority for the voice media.

NGN GETS GBR Data supports the priority treatment of services assigned to GBR bearers other than voice and video. Only QCI = 3 and QCI = 4 can be considered. The QCI = 3 is recommended for NGN GETS GBR Data since it is the higher priority value of the two available, and has a packet delay budget significantly less than QCI = 4, which is needed if encrypted voice is to be supported over the bearer.

[163] The Service Provider's network shall provide NGN GETS GBR Data with an EPS bearer with QCI = 3, denoted as QCI_NGNGETS_GBR, and an ARP chosen from the set ARP_NGNGETS using a rule which considers the Service User's priority level.

5.2.2 NGN GETS Priority Treatment for the Default Bearer

This section defines NGN GETS priority treatment for a Default Bearer.

NGN GETS priority treatment for a Default Bearer results in a change of ARP but not QCI.

[68] The Service Provider's network shall enable NGN GETS priority treatment for a Default Bearer by means of the following QoS parameter settings:

a) The Default Bearer ARP shall be the highest priority ARP within the set ARP_NGNGETS,

b) The Default Bearer QCI shall not be modified.

For the Attach/Default APN, the following two requirements apply.

[69] The Service Provider's network shall enable NGN GETS priority treatment for the Default Bearer to the Attach/Default APN when any of the following are true:

a) "NGN GETS priority treatment for the Media Bearer" is currently enabled for at least one media bearer to any APN, or

b) "NGN GETS priority treatment for the IMS Signaling Bearer" is currently enabled to any APN, or

c) "NGN GETS Data Transport service" is currently enabled to any APN, or

d) the UE is subscribed to NGN GETS and is therefore entitled to Advance Priority.

[70] The Service Provider's network shall disable NGN GETS priority treatment for the Default Bearer to the Attach/Default APN when all of the following are true:

a) "NGN GETS priority treatment for the Media Bearer" is currently not enabled for any media bearer to any APN, and

b) "NGN GETS priority treatment for the IMS Signaling Bearer" is currently not enabled to any APN, and

c) "NGN GETS Data Transport service" is currently not enabled to any APN, and

d) the UE is not subscribed to NGN GETS and is therefore not entitled to Advance Priority.

For an APN other than the Attach/Default APN, the following two requirements apply.

[71] The Service Provider's network shall enable NGN GETS priority treatment for a Default Bearer to a particular APN other than the Attach/Default APN when any of the following are true:

a) "NGN GETS priority treatment for the Media Bearer" is currently enabled for at least one media bearer to that APN, or

b) "NGN GETS priority treatment for the IMS Signaling Bearer" is currently enabled to that APN, or

c) "NGN GETS Data Transport service" is currently enabled to that APN, or

d) the UE is subscribed to NGN GETS and is therefore entitled to Advance Priority.

[72] The Service Provider's network shall disable NGN GETS priority treatment for a Default Bearer to a particular APN other than the Attach/Default APN when all of the following are true:

a) "NGN GETS priority treatment for the Media Bearer" is currently not enabled for any media bearer to that APN, and

b) "NGN GETS priority treatment for the IMS Signaling Bearer" is currently disabled to that APN, and

c) "NGN GETS Data Transport service" is currently not enabled to that APN, and

d) the UE is not subscribed to NGN GETS and is therefore not entitled to Advance Priority.

5.2.3 NGN GETS Priority Treatment for the IMS Signaling Bearer

This section defines NGN GETS priority treatment for an IMS Signaling Bearer.

NGN GETS priority treatment for an IMS Signaling Bearer results in a change of ARP and possibly QCI. The ARP is chosen to be the highest priority ARP from the set allocated by the Service Provider for NGN GETS use. QCI = 5 is designed to meet the needs of IMS signaling by providing the highest scheduling priority among all the QCI codes.

[73] The Service Provider's network shall enable NGN GETS priority treatment for IMS Signaling Bearer by the following QoS parameter settings:

a) The IMS Signaling Bearer ARP shall be the highest priority ARP from the set ARP_NGNGETS, and

b) The IMS Signaling Bearer QCI shall be set QCI = 5.

NGN GETS IMS Signaling traffic must be treated differently than background traffic from the same UE.

[74] The Service Provider's network shall ensure the EPS bearer used for IMS Signaling for NGN GETS is allocated exclusively for IMS Signaling and shall not carry other traffic.

5.2.3.1 PCC Control of IMS Signaling Bearer Priority for non-NGN GETS Subscribed UEs

This section applies to UEs not subscribed to NGN GETS which do not receive Advance Priority.

Whenever there is at least one ongoing NGN GETS SIP call/session to a particular APN, the priority of IMS Signaling remains enabled.

[75] The Service Provider's network shall enable NGN GETS priority treatment for the IMS Signaling Bearer associated with a particular APN, without consideration of the QoS parameters currently assigned to the IMS Signaling Bearer, upon establishment of an NGN GETS SIP call/session for that APN.

When the last NGN GETS SIP call/session to a particular APN is released, the priority of the IMS Signaling Bearer is disabled.

[76] For a non-NGN GETS subscribed UE, the Service Provider's network shall disable NGN GETS priority treatment for the IMS Signaling Bearer associated with a particular APN when there is no active NGN GETS SIP calls/sessions for that APN by restoring the QoS parameters assigned to the IMS Signaling Bearer to those values in place prior to the establishment of the NGN GETS SIP call/session which enabled priority treatment for the IMS Signaling Bearer.

5.2.4 Advance Priority at the Time of Attach

Advance Priority is a means to get priority for the transmission of the initial SIP INVITE for a call/session. Two forms of Advance Priority are specified in this standard: Advance Priority-SPR and Advance Priority-HSS.

[164] A network shall operate either Advance Priority-SPR or Advance Priority-HSS, but not both, and shall provide NGN GETS priority treatment at the time of Attach for the Default Bearer as per Requirement [68] and for the IMS Signaling Bearer as per Requirement [73].

The implementation of one form of Advance Priority precludes the other; which form is implemented will depend on Service Provider preference and network impacts. As a consequence, all requirements that follow in this section on Advance Priority are conditional on the form of Advance Priority selected.

Advance Priority-SPR may apply only in a network which includes an SPR.

Advance Priority-HSS may be applied in networks with or without an SPR.

5.2.4.1 Advance Priority-SPR

Subscription to Advance Priority-SPR is determined based on setting of the "IMS Signalling Priority" information in the SPR. When Advance Priority-SPR is enabled to a particular APN, NGN GETS treatment for the IMS Signaling Bearer is enabled at the time of Attach to that APN, and it remains enabled independent of the status of any ongoing SIP call/sessions.

[263] If a network supports Advance Priority-SPR, "IMS Signalling Priority" information shall be included in the SPR for each Service User with subscription to the service for each APN that supports IMS Signaling to indicate whether Advance Priority-SPR is enabled for a particular APN.

[264] If a network supports Advance Priority-SPR, the "IMS Signalling Priority" information shall be marked as either set or not set for all APNs that support IMS Signaling in the subscription profile of a Service User, and shall be delivered to the PCRF at the time of Attach (PDN Connection Establishment).

[265] If a network supports Advance Priority-SPR, NGN GETS priority treatment for the Default Bearer and for the IMS Signaling Bearer associated with a particular APN shall be enabled at the time of Attach (PDN Connection Establishment) when the "IMS Signalling Priority" information for that APN is set.

In the case of an EPC with a GTP-based S5/S8 Interface, the above requirement affects the transmission of the

"CC-Request" command from the PDN-GW to the PCRF at the time of Attach. For a PMIP-based S5/S8 Interface, the requirement instead applies to the transmission of the "CC-Request" command from the S-GW to the PCRF at the time of Attach.

5.2.4.2 Advance Priority-HSS

Advance Priority-HSS is a means to get priority for the transmission of the initial SIP INVITE for a call/session.

[266] If a network supports Advance Priority-HSS, the HSS shall provision the Default Bearer for each APN used for NGN GETS to contain the highest Priority Level (the lowest numeric value) among the set of ARP values reserved by the Service Provider for use by NGN GETS and to contain a Pre-emption Vulnerability set to the "not-pre-emptable" value.

[267] If a network supports Advance Priority-HSS, the HSS shall provide the NGN GETS ARP to the MME at the time of Attach using the "Update-Location-Answer" command.

[268] If a network supports Advance Priority-HSS, NGN GETS priority treatment for the IMS Signaling Bearer shall be enabled at the time of Attach (PDN Connection Establishment).

5.2.5 NGN GETS Data Transport Service

Denote "QCI_NGNGETS_NONGBR" to mean the QCI chosen by the Service Provider to support background class traffic for NGN GETS use, a means to get higher throughput of background traffic when compared to the commercial user.

[80] The Service Provider shall select "QCI_NGNGETS_NONGBR," subject to the following constraints:

a) The QCI shall be chosen from those which indicate the bearer is non-GBR;

b) A value of QCI = 5 shall not be used as this QCI is reserved for the NGN GETS IMS Signaling Bearer;

c) A value of QCI = 9 shall not be used as this QCI has the lowest scheduling priority of any QCI and is not suited to meet the scheduling needs of NGN GETS; and

d) The selected QCI shall not have a lower scheduling priority than the QCI used by the Service Provider for best effort traffic for a commercial service subscription.

[287] It is desirable to select a QCI value = 6 for the "QCI_NGNGETS_NONGBR" variable.

The service activation state is not retained following the detachment of the UE.

[165] The PCRF shall maintain the state of activation of the "NGN GETS Data Transport service" to a particular APN for the duration of the UE's attachment to that APN; upon Detach the state of activation shall be deleted such that upon a subsequent Attach the "NGN GETS Data Transport service" is not activated until explicitly requested by the Service User.

[84] The "NGN GETS Data Transport service" shall be enabled to a particular APN by the following configurations:

a) All other existing non-GBR bearers except the QCI = 5 bearer shall receive an upgraded ARP chosen from the set ARP_NGNGETS;

b) All subsequent SDFs which require a non-GBR bearer except QCI = 5 or QCI = 7 shall be mapped to the Default Bearer; and

c) Existing SDFs shall continue to use the bearer previously assigned, that is, applications are not forced to move between bearers.

NOTE: requirement "a" above assumes the QCI of the established non-GBR dedicated bearer will not be changed by activation of NGN GETS priority treatment.

[85] When the NGN GETS Data Transport service is disabled, the following actions shall be taken:

a) The Default Bearer QCI shall be downgraded to that appropriate for the UEs commercial service;

b) The Default Bearer ARP shall be downgraded if and only if both NGN GETS Priority for the IMS Signaling Bearer, and NGN GETS Priority for the media bearer are not enabled for that APN; and

c) All other existing non-GBR bearers except the QCI = 5 bearer shall downgrade their ARP from an ARP chosen from the set ARP_NGNGETS to one appropriate for commercial service.

5.2.6 NGN GETS GBR Data Service

The NGN GETS GBR Data service provides a Service User with a Guaranteed Bit Rate (GBR) bearer between the UE and the PDN-GW with a Service Provider specified QoS (including an NS/EP ARP consistent with the Service User's priority level and Service Provider policy) for this service.

Denote "QCI chosen from the set QCI_NGNGETS_GBR" to mean the QCI chosen by the Service Provider to support NGN GETS GBR Data on a Dedicated GBR Bearer.

The ARP chosen for the GBR bearer will be based on the Service User's priority level. The ARP chosen for the Default Bearer is the highest Priority Level (lowest numeric value) from the set of ARPs allocated by the Service Provider for NGN GETS use.

The NGN GETS GBR Data service can be invoked by a Service User from an NGN GETS subscribed UE or from a Public UE. An NGN GETS subscribed UE may invoke the NGN GETS Data service using Subscription Credentials via GETS-FC or using NGN GETS Credentials via the HTTPS interaction. A Public UE may invoke the NGN GETS GBR Data service using NGN GETS Credentials via HTTPS interaction only.

[166] Existing PCC mechanisms shall be used to interact with the PCRF to invoke and revoke NGN GETS GBR Data service.

The "NGN GETS GBR Data Bearer" may be established using Network-initiated or UE-initiated procedures.

[167] An "NGN GETS GBR Data service Bearer" shall be chosen by the Service Provider subject to the following constraints:

a) The "NGN GETS GBR Data service Bearer" shall be a GBR bearer,

b) The "NGN GETS GBR Data service Bearer" ARP shall be a member of the set ARP_NGNGETS, and

c) The "NGN GETS GBR Data service Bearer" QCI shall be set to QCI_NGNGETS_GBR = 3.

[168] The "NGN GETS GBR Data service" shall be invoked to a particular APN by the following configurations:

a) If the new GBR bearer is established to a dedicated APN and a Default Bearer does not exist to that APN, a Default Bearer shall be established to that APN prior to establishing the GBR bearer,

b) If the ARP of the Default Bearer is not already set to the highest Priority Level (lowest numeric value) from the set of ARPs allocated by the Service Provider for NGN GETS use, the ARP of the Default Bearer shall be upgraded to that level,

c) A new GBR bearer shall be established between the UE and the PDN-GW with an ARP consistent with the Service User's priority level and the QCI set to QCI_NGNGETS_GBR, and

d) All other existing bearers shall not change their ARP or QCI values.

[169] When the "NGN GETS GBR Data service" is revoked, the following actions shall be taken:

a) The GBR bearer established for NGN GETS GBR Data service shall be released. If the GBR bearer was established to a new APN, the connection to the new APN shall be released,

b) If the ARP of the Default Bearer was upgraded during NGN GETS GBR Data service invocation, the ARP shall be changed to the one used for that subscriber's subscription value if no other NGN GETS service is active, and

c) All other existing bearers shall not change their ARP or QCI values.

5.3 FE Specific Requirements

FE Specific Requirements are provided in the subsections that follow for each of the FEs defined in Section 4.4.

Table 5-1 provides a categorization of requirements that can be used to help understand the structure of the subsections that follow.

Table 5-1 - Mapping of FEs within the EPS and Topic Areas to Sub-subsections.

	UE	eNB	MME	S-GW	PDN-GW	PCRF
Access Class Barring	5.3.1.1	5.3.2.1				
Establishment Cause		5.3.2.2				
Bearer Control S1		5.3.2.3	5.3.3.2			
Bearer Control S11			5.3.3.3	5.3.4.2		
Bearer Control S5/S8				5.3.4.3	5.3.5	
Bearer Control Gx/Gxx						5.3.5.3
Paging		5.3.2.4	5.3.3.1	5.3.4.1		
TAU			5.3.3.4			
Handover		5.3.2.5	5.3.3.5			
DSCP Marking		5.3.2.6	5.3.3.1	5.3.4.4	5.3.5	
Advance Priority						5.3.6.1, 5.3.6.2
Relationship to Commercial Services		5.3.2.7				
Overload Control			5.3.3.6	5.3.4.5		
CSFB	5.3.1.2	5.3.2.8	5.3.3.7			

5.3.1 UE Requirements

5.3.1.1 Access Class Barring

Access Class Barring provides NGN GETS subscribed UEs priority to initiate the RRC Connection Establishment procedure. This preferential treatment is a property of subscription and does not apply to a UE that is not a member of Access Classes 11 through 15 inclusive.

[87] Access Class value 14 shall be reserved by the Service Provider for use exclusively by NGN

GETS subscribed UEs.

Priority treatment provided by Access Class Barring is limited to the control of mobile initiated transmissions and does not directly affect the behavior of a UE in response to a Page transmitted over the Uu interface.

5.3.1.2 CSFB

The transfer of NGN GETS indication from the E-UTRAN to the UTRAN during both Mobile Originated and Mobile Terminated CSFB without PS Handover support is required.

[170] A UE which receives a RRC "RRCConnectionRelease" message with a "CS Fallback Indicator" IE set to the "cs-FallbackHighPriority" value shall provide priority handling of the request and signal the UTRAN as follows:

a) In the case of Mobile Terminated calls, the UE notifies the UTRAN of the priority nature of the redirection using the "Establishment Cause" IE set to the "Terminating High Priority Signalling" value.

b) In the case of Mobile Originated calls, the UE notifies the UTRAN of the priority nature of the redirection using the "Establishment Cause" IE set to the "Originating High Priority Signalling" value.

5.3.2 eNodeB Requirements

5.3.2.1 Access Class Barring

Access Class Barring can be used to control both signaling and allocation of media channel resources during overload. Access Class Barring can be applied by the eNodeB to control the rate of requests from RRC_IDLE UEs accessing the E-UTRAN.

Access Class Barring provides NGN GETS subscribed UEs priority to initiate the RRC Connection Establishment procedure. This preferential treatment is a property of subscription and does not apply to a UE that is not a member of Access Classes 11 through 15 inclusive.

The Access Class Barring mechanism can be manually enabled or disabled in the eNodeB. When enabled, the Access Class Barring parameters will be automatically and dynamically adjusted.

[171] When the Access Class Barring mechanism is enabled, the eNodeB shall be able to automatically and dynamically control the Access Class Barring.

Because the load conditions causing loss of throughput might arise in as short an interval as tens of seconds (e.g., increased attempts upon experience of an earthquake), it is important that the application of Access Class Barring be dynamic in responding as needed to control the rate of access attempts.

[89] The modification of Access Class Barring parameters shall be sufficiently fast to give an NGN GETS subscribed UE a high likelihood of success for receipt of the RRC "RRCConnectionRequest" message and allocation of SRB1 resources by the eNodeB within 4 minutes of detection of overload by the eNodeB.

The rate of automatic control of the Access Class Barring parameters bounds the expected wait time to gain priority access to the system to place an NGN GETS call.

[269] When the eNodeB activates Access Class Barring, the eNodeB shall set the bit corresponding to AC=14 for the "ac-BarringForSpecialAC" field of each access "AC barring parameter" to zero to exempt from barring NGN GETS requests for RRC Connection Establishments. The "AC barring parameter" includes the following optional IEs: "ac-BarringForMO-Data," "ac-BarringForMO-Signalling," "ac-BarringForCSFB," "ssac-BarringForMMTEL-Voice," and "ssac-BarringForMMTEL-Video."

Access Class Barring treatments for the Special Access Classes 11-15 may be configured differently for various higher layer needs including: Mobile Originated Data, Mobile Originated Signaling, CSFB, and Service Specific Access Control for Voice and Video. The above requirement ensures that in all cases AC14 given to NGN GETS

UEs is exempted from Access Class Barring when Access Class Barring is activated.

NOTE**:** When during times of severe congestion for which access class barring need also be applied to the special Access Classes 10-15, AC 14 shall not be subject to barring until after AC 10, 11, 12, and 13 are subject to barring. This is done to provide priority to AC 14 over AC 10, 11, 12, and 13.

5.3.2.2 highPriorityAccess Establishment Cause

The "highPriorityAccess" Establishment Cause provides NGN GETS subscribed UEs priority treatment at the eNodeB during the RRC Connection Establishment procedure. This preferential treatment is a property of subscription and does not apply to a UE that is not a member of Access Classes 11 through 15 inclusive.

[90] The RRC "RRCConnectionRequest" message from an NGN GETS subscribed UE shall be handled with priority by the eNodeB to provide a high likelihood of success for allocation of SRB1 resources by the eNodeB as indicated by the presence of the "highPriorityAccess" Establishment Cause.

[91] For an RRC "RRCConnectionRequest" message from an NGN GETS subscribed UE, as indicated by inclusion of the "highPriorityAccess" value in the Establishment Cause of the RRC "RRCConnectionRequest" message, the eNodeB shall set the Establishment Cause to "highPriorityAccess" in the S1-AP "Initial UE Message" message, the eNodeB shall mark the S1-AP packet with the appropriate DSCP marking, and the S1-AP "Initial UE Message" message shall be handled with priority by the eNodeB.

5.3.2.3 Bearer Establishment and Modification

This section provides requirements related to priority treatments for bearer establishment and modification controlled via S1-AP procedures over the S1 Interface.

The following requirement specifies eNodeB priority treatment is applied upon receipt of bearer management messages associated with NGN GETS use, as marked with NGN GETS ARP.

[92] The request to establish a new bearer or to modify an existing bearer at the eNodeB for an NGN GETS call/session shall be handled (in the case of a new bearer, admitted) with priority by the eNodeB as marked by inclusion of an ARP Priority Level/PVI/PCI set appropriately by the network for NGN GETS services.

[93] The eNodeB shall support a priority mechanism for admission of GBR resource requests that includes an ARP corresponding to NGN GETS use.

NOTE: The priority mechanism is internal to the eNodeB and is considered implementation dependent.

5.3.2.4 Paging procedure and the Introduction of the Paging Priority

This section provides requirements related to priority treatments associated with the Paging procedure.

[172] The eNodeB shall provide priority treatment during times of congestion for a "Paging" message which contains the "Paging Priority" IE set to the "PrioLevel1" value.

[173] The eNodeB shall not drop or delay an S1-AP "Paging" message that includes a "Paging Priority" IE set to the "PrioLevel1" prior to dropping or delaying other "Paging" messages that do not include a "Paging Priority" IE or other "Paging" messages which include a "Paging Priority" IE set to a value other than the "PrioLevel1" value.

5.3.2.5 Handover

This section provides requirements related to priority treatments associated with handover of EPS bearers(s).

[95] The request to establish a new bearer at the eNodeB for handover of an ongoing NGN GETS

call/session in the X2-AP and S1-AP "Handover Request" messages consistent with standardized use of the ARP, shall be handled by the eNodeB as marked by inclusion of an ARP Priority Level/PVI/PCI chosen from the set allocated by the Service Provider for NGN GETS.

[96] The X2-AP/S1-AP "Handover Request Acknowledge" message associated with the establishment of bearers at a Target eNodeB for an existing NGN GETS call/session shall be handled with priority by the eNodeB when the corresponding X2-AP/S1-AP "Handover Request" includes one or more bearers whose ARP Priority Level/PVI/PCI is set appropriately by the network for NGN GETS.

The following requirement relates to the execution phase of X2 handover. Specifically, the Target eNodeB provides the list of established bearers to the MME.

[97] The S1-AP "Path Switch Request" message associated with the establishment of bearers at a Target eNodeB for an existing NGN GETS call/session shall be handled with priority by the eNodeB when the corresponding X2-AP "Handover Request" message includes one or more bearers whose ARP Priority Level/PVI/PCI is set appropriately by the network for NGN GETS.

The following requirement relates to the usage of a dedicated RACH preamble for X2 or S1 Handover.

[98] A Target eNodeB which receives an X2-AP or S1-AP "Handover Request" message associated with the establishment of bearers for an existing NGN GETS call/session shall provide a dedicated RACH preamble for the UE in the X2-AP or S1-AP "Handover Request Acknowledge" message whenever there is one available in the pool at the Target eNodeB.

While suggested in [TS 35.300] for use in handover, the use of non-contention based random access cannot be mandated for all handovers as the pool of reserved RACH preambles is limited. Service Users should always be provided a dedicated RACH preamble when one is available within the pool at the Target eNodeB. Service Users apply the non-contention based procedure prior to sending the "RRCConnectionReconfigurationComplete" message as long as dedicated RACH preambles are available in the Target eNodeB.

5.3.2.6 Marking of GTP-U Messages to the S-GW

The following requirements relate to the use of the DSCP marking on the S1 and X2 Interfaces.

[99] The eNodeB shall mark GPRS Tunnelling Protocol for User plane (GTP-U) messages to the S-GW by inclusion of a DSCP appropriate for NGN GETS.

[100] The eNodeB shall mark messages sent over the X2 Interface by inclusion of a DSCP appropriate for NGN GETS.

5.3.2.7 Relationship to Commercial Services

In [FCC R&O], the FCC orders Service Providers that provide WPS to ensure that at all times a reasonable amount of Commercial Mobile Radio Service (CMRS) resources are made available for public use. The following requirement is intended to provide this assurance in the context of NGN GETS.

[101] The eNodeB shall include a means for the Service Provider to ensure that at all times a reasonable fraction of the total CMRS radio resources are made available for non-NGN GETS use as compared to NGN GETS use. If non-NGN GETS is not using all of the radio resources made available for it, the unused radio resources can be used by NGN GETS.

During times of severe overload, when the scheduler is not able to satisfy the QoS requirements of all bearers, it is necessary to begin to discard NGN GETS packets. The following high-level requirements describe the need to drop non-NGN GETS packets before NGN GETS packets.

[174] During times of severe congestion when it is necessary to drop packets on the IMS Signaling Bearers to ensure network stability, an eNodeB shall drop packets not associated with an NGN GETS QoS before dropping packets associated with an NGN GETS QoS.

[175] During times of severe congestion when it is necessary to drop packets on Media Bearers to

ensure network stability, an eNodeB shall drop packets not associated with an NGN GETS QoS before dropping packets associated with an NGN GETS QoS.

Similar requirements are provided for the S-GW in Section 5.3.4.4 and for the PDN-GW in Section 5.3.5.

5.3.2.8 CSFB

The requirements in this section apply to CSFB from the E-UTRAN.

The following requirement specifies how the eNodeB is instructed by the MME to perform CSFB with NGN GETS appropriate treatments.

[176] The eNodeB shall provide priority treatment in times of congestion for a S1-AP "Initial Context Setup Request" or S1-AP "UE Context Modification Request" message which includes the "CS Fallback Indicator" IE set to the "CS Fallback High Priority" value.

The following two requirements apply when CS domain service is provided by the UTRAN, and the PS Handover approach is used.

[270] If the Service Provider supports CSFB to UMTS CS, and the network supports the PS Handover approach, then the eNodeB shall use the "PS Handover" approach rather than the "Release with Redirection" approach for CSFB to UMTS CS for NGN GETS.

[271] If the Service Provider supports CSFB to UMTS CS, which is supported using the PS Handover approach, the eNodeB shall provide priority indication to the RNS in the UTRAN by setting the "CSFB Information" IE in the "Source RNC to Target RNC Transparent Container" to the "CSFB High Priority" value.

The following requirement provides the means to transfer NGN GETS indication from the eNodeB to the RNS via the UE when CSFB to UMTS CS uses the Release with Redirection approach.

[272] If the Service Provider supports CSFB to UMTS CS, which is supported using the Release with Redirection approach, the eNodeB shall signal the NGN GETS nature of CSFB to the UE within a RRC "RRCConnectionRelease" message using the "cs-FallbackHighPriority" value of the "CS Fallback Indicator" IE.

5.3.3 Mobility Management Entity (MME) Requirements

5.3.3.1 Paging Procedure & the Introduction of the Paging Priority

This section provides requirements related to priority treatments associated with the Paging procedure.

[177] When a GTP-C "Downlink Data Notification" message, GTP-C "Create Bearer Request" message, or GTP-C "Update Bearer Request" message received from the S-GW includes an ARP chosen from the set of values allocated by the Service Provider for NGN GETS, the MME shall handle the message with priority.

When data arrives on multiple bearers at the S-GW, the ARP included is the highest priority one among all bearers for which data is queued at the S-GW. The "Downlink Data Notification" is also used in the case when ISR is active and the S-GW receives either a GTP-C "Create Bearer Request" or a GTP-C "Update Bearer Request" from the PDN-GW, else if ISR is not active, these bearer management messages are forwarded to the MME. In all cases, if an ARP is one from the list associated with NGN GETS service, the inclusion of the "ARP" IE conveys NGN GETS priority indication.

The following three requirements relate to the "Paging Priority" IE.

[178] The MME shall use the "PrioLevel1" value of the "Paging Priority" IE only for NGN GETS.

[179] The MME shall include a "Paging Priority" IE set to the "PrioLevel1" value in the S1-AP "Paging" message sent to the eNodeB when either a GTP-C "Downlink Data Notification" or a GTP-C "Create Bearer Request" or a GTP-C "Update Bearer Request" message is received from S-GW that contains an ARP Priority Level chosen from the set of values allocated by the Service

Provider for NGN GETS.

[180] The MME shall not drop an S1-AP "Paging" message that includes a "Paging Priority" IE set to the "PrioLevel1" value prior to dropping S1-AP "Paging" messages that do not include a "Paging Priority" IE or S1-AP "Paging" messages which include a "Paging Priority" IE set to a value other than the "PrioLevel1" value.

5.3.3.2 Bearer Establishment & Modification - Messages to eNodeB

This section provides requirements related to priority treatments for bearer establishment and modification controlled via S1-AP procedures over the S1 Interface.

The following requirement applies to the S1-AP "Initial Context Setup Request" message, e.g., during Attach or Service Request.

[105] When the Priority Level value of the ARP IE is within the set of values configured for NGN GETS, the MME shall transmit with priority to the eNodeB the "Initial Context Setup Request" for an NGN GETS PDN connection that contains one or more bearer contexts, each including EPS bearer QoS (ARP, QCI) authorized for NGN GETS.

The following requirement applies to the S1-AP "E-RAB Setup Request" and S1-AP "E-RAB Modify Request" messages.

[181] The MME shall mark for priority treatment the S1-MME "E-RAB Setup Request" and "E-RAB Modify Request" messages from the MME to the eNodeB which contain a request to establish or modify a bearer context with an ARP corresponding to an NGN GETS call/session.

5.3.3.3 Bearer Establishment & Modification - Messages to/from S-GW

This section provides requirements related to priority treatments for bearer establishment and modification controlled via GTPv2-C procedures over the S11 Interface.

The following requirements relate to the "Create Session Request" message from the MME to the S-GW.

[106] An S11 "Create Session Request" message from the MME to the S-GW shall be handled with priority if it includes an ARP chosen from the set allocated by the Service Provider for use by NGN GETS.

[182] The MME shall mark for priority treatment an S11 "Create Session Request" message from the MME to the S-GW which contains an indication that a UE will establish a bearer or bearers for NGN GETS service.

If the S11 Interface supports DSCP markings, inclusion of the DSCP selected for NGN GETS use would meet the above requirement.

The following requirement relates to the "Create Session Response" message from the S-GW to the MME.

[107] When an S11 "Create Session Response" message from the S-GW to the MME acknowledges a request to establish a bearer or bearers with an ARP corresponding to an NGN GETS call/session, the MME shall handle the message with priority.

The following requirement relates to the "Create Bearer Request" message or "Update Bearer Request" message from the S-GW to the MME.

[108] When the MME receives a GTP-C "Create Bearer Request" message or "Update Bearer Request" message from the S-GW that includes an ARP from the set of values allocated by the Service Provider for NGN GETS, the MME shall handle the message with priority and include that ARP in the "E-RAB Setup Request" message or "E-RAB Modify Request" message sent to the eNodeB.

The following requirement relates to the "Create Bearer Response" message or "Update Bearer Response" message from the MME to the S-GW.

[183] The MME shall mark for priority treatment the S11 "Create Bearer Response" and "Update Bearer Response" messages from the MME to the S-GW which contains an indication that a UE currently has an established/updated bearer or bearers for NGN GETS service.

If the S11 Interface supports DSCP markings, inclusion of the DSCP selected for NGN GETS use would meet the above requirement.

5.3.3.4 Tracking Area Updates

This section provides requirements related to priority treatments for tracking area updates involving signaling over the S10 Interface.

[184] The MME shall mark for priority treatment the S10 "Context Response" message sent between a pair of MMEs (source and destination) which contains one or more bearers with an ARP corresponding to NGN GETS service.

If the S10 Interface supports DSCP markings, inclusion of the DSCP selected for NGN GETS use would meet the above requirement.

5.3.3.5 Handover

This section provides requirements related to priority treatments associated with handover of EPS bearers(s) involving signaling over the S1 and S10 Interfaces. This section also provides requirements related to priority treatments associated with Inter-RAT handover of EPS bearers(s) involving signaling over the S4 and Gn/Gp Interfaces.

The following requirement relates to the execution phase of X2 handover. Specifically, the Target eNodeB provides the list of established bearers to the MME.

[109] The S1-AP "Path Switch Request" message associated with the establishment of bearers at a Target eNodeB for an existing NGN GETS call/session with priority as indicated by the ARP chosen from the set allocated by the Service Provider for NGN GETS use shall be handled with priority by the MME.

The following two requirements relate to the admission of bearers at an eNodeB at the time of handover.

[110] The S1-AP "Handover Request" message sent from the MME to the eNodeB which requests the establishment of one or more bearers associated with NGN GETS service shall be handled with priority by the MME when marked by inclusion of an ARP chosen from the set allocated by the Service Provider for use by NGN GETS.

[111] The S1-AP "Handover Request Acknowledge" message associated with the establishment of bearers at a Target eNodeB for an existing NGN GETS call/session shall be handled with priority by the MME when the corresponding S1-AP "Handover Request" message includes one or more bearers whose ARP are chosen from the set allocated by the Service Provider for use by NGN GETS.

The following requirement relates to the transfer of NGN GETS indicators between MMEs using the S10 Interface for those Handover procedures which require a change of MME.

[112] A "Forward Relocation Request" sent between a pair of MMEs (source and destination) which contains one or more bearers established for NGN GETS service shall be handled with priority by the source MME and shall be handled with priority by the destination MME due to inclusion of an ARP chosen from the set allocated by the Service Provider for use by NGN GETS.

IRAT Handover between LTE and PS UMTS involves signaling between the MME and the SGSN. The SGSN may support an S4 Interface with the MME or a Gn/Gp Interface with the MME. The following requirements apply for the MME when it interfaces with an S4-SGSN.

[185] A "Forward Relocation Request" sent by the S4-SGSN to the MME which contains one or more bearers established for NGN GETS service shall be handled with priority by the MME due to

inclusion of an ARP chosen from the set allocated by the Service Provider for use by NGN GETS.

[186] A "Forward Relocation Request" sent by the MME to the S4-SGSN which contains one or more bearers established for NGN GETS service shall be handled with priority by the MME due to inclusion of an ARP chosen from the set allocated by the Service Provider for use by NGN GETS.

The following requirements apply for the MME when it interfaces with a Gn/Gp SGSN.

[187] A "Forward Relocation Request" sent by the Gn/Gp SGSN to the MME which contains one or more bearers established for NGN GETS service shall be handled with priority by the MME due to inclusion of an ARP chosen from the set allocated by the Service Provider for use by NGN GETS.

[188] A "Forward Relocation Request" sent by the MME to the Gn/Gp SGSN which contains one or more bearers established for NGN GETS service shall be handled with priority by the MME due to inclusion of an ARP chosen from the set allocated by the Service Provider for use by NGN GETS.

IRAT Handover between LTE and PS UMTS requires that certain QoS mapping rules be applied at the network boundaries. When the MME is connected to a Gn/Gp SGSN using the Gn Interface, rather than an S4-SGSN using the S4 Interface, the mapping rules are implemented in the MME.

[273] If the EPS network supports Gn/Gp connectivity to a Gn/Gp SGSN over the Gn Interface, and the Gn/Gp SGSN is configured to support the Evolved ARP, the MME shall map between the EPS ARP and the Evolved ARP as follows:

a) When converting from the EPS ARP to the Evolved ARP for the GPRS Core, the ARP Priority Level shall remain unchanged, and the Pre-emption Capability and Pre-emption Vulnerability shall remain unchanged.

b) When converting from the Evolved ARP for the GPRS Core to the EPS ARP, the ARP Priority Level shall remain unchanged, and the Pre-emption Capability and Pre-emption Vulnerability shall remain unchanged.

[274] If the EPS network supports Gn/Gp connectivity to a Gn/Gp SGSN over the Gn Interface, and the Gn/Gp SGSN is not configured to support the Evolved ARP (only supports the Legacy ARP), the MME shall map between the EPS ARP to the Legacy ARP as follows:

a) When converting from the EPS ARP to the Legacy ARP for the GPRS Core, the EPS ARP Priority Level shall be mapped to the Legacy ARP = 1 value. Note that the Pre-emption Capability and Pre-emption Vulnerability are not mapped as the Legacy ARP does not carry this information in the GPRS Core.

b) When converting from the Legacy ARP for the GPRS Core to the EPS ARP, the ARP Priority Level shall be mapped to the lowest EPS Priority Level from the set allocated by the Service Provider for NGN GETS, the Pre-emption Capability shall be set to the "shall-not-trigger-preemption" value, and the Pre-emption Vulnerability shall be set to the "not-preemptable" value.

5.3.3.6 Overload Control

This section provides MME requirements on overload control.

[189] An MME shall be able to activate Overload Control and instruct a subset of eNodeBs that have an S1 interface with the MME to restrict traffic based on RRC Establishment Cause.

One of the Overload Control actions defined in Section 9.2.3.20 of [TS 36.413] restricts requests that are not associated with Emergency Sessions or mobile terminated sessions. If the MME were to use such a "Permit Emergency Sessions and mobile terminated services only" action, NGN GETS originating requests would be rejected while other public services like emergency services and call terminations would be allowed. This is not permitted.

[190] An MME shall not use the "Permit Emergency Sessions and mobile terminated services only"

overload action.

The following requirements relate to the need for NAS level congestion and exemptions for NGN GETS.

[191] An MME shall support NAS level congestion control for EPS Session Management.

[192] An MME shall support NAS level congestion control for Mobility Management.

[193] An MME shall not apply NAS level congestion control for mobile initiated signaling with "Establishment Cause" IE set to "highPriorityAccess" value.

[194] An MME shall not apply NAS level congestion control for EPS Session Management for termination requests related with an ARP for NGN GETS use.

To ensure that an active NGN GETS call/session is not affected by congestion control, the MME must not perform load rebalancing when the UE is on an active NGN GETS call/session as indicated by a bearer having an ARP associated with NGN GETS use.

[195] When a UE is in ECM-CONNECTED mode with a bearer having an ARP for NGN GETS use, the MME shall not release the UE for load re-balancing, except under critical conditions such as when needed to perform an MME node restart.

The MME can reduce load by rejecting Downlink Data Notification messages from the S-GW. However, the MME must ensure that it does not reject "Downlink Data Notification" messages from the S-GW that are associated with an NGN GETS call/session termination.

[196] The MME shall not reject GTP-C "Downlink Data Notification" messages from the S-GW that include an ARP associated with NGN GETS use.

5.3.3.7 CSFB

The requirements in this section apply to CSFB from the E-UTRAN.

[197] For Mobile Originated CSFB calls, the MME shall verify subscription to NGN GETS service in the CS domain by checking the "MPS-CS-Priority" bit of the "MPS-Priority" AVP that was downloaded to the MME at the time of Attach.

[198] For both Mobile Originated and Mobile Terminated CSFB, the MME shall provide NGN GETS indication to the eNodeB using the "CS Fallback High Priority" value of the "CS Fallback Indicator" IE in the S1-AP "Initial Context Setup Request" and S1-AP "UE Context Modification Request" messages. The MME shall transmit these messages with priority when they are marked as indicated.

The remaining requirements in this section are specific to the RAN supporting CS domain service.

The following two requirements apply when CS domain service in provided by the UTRAN.

[199] An MME which receives an SGs "SGsAP-Paging-Request" message containing the "eMLPP Priority" IE set to the value 7-SUpl, where SUpl is the Service User's priority level, shall associate this request as one entitled to NGN GETS treatment, shall provide priority handling of this request in times of congestion, and when the UE is EMM-IDLE and needs to be paged, the MME shall signal the eNodeB(s) to page with priority by inclusion of the "Paging Priority" IE set to the "PrioLevel1" value in the S1-AP "Paging" message.

[275] If the Service Provider supports CSFB to UMTS CS, which is supported using the PS Handover approach, for those established EPS bearers which contain an ARP chosen from the set allocated by the Service Provider for NGN GETS, the MME shall include these bearers in the GTPv2-C "Forward Relocation Request" message sent from the MME to the SGSN as part of the CSFB procedure.

The following requirement applies when CS domain service in provided by 1xRTT (cdma2000).

[200] An MME which receives an S102 "A21-1x Air Interface Signaling" message containing the "GCSNA Status" IE with "Call Priority" bits set to the value SUpl, where SUpl is the Service

User's priority level, shall associate this request as one entitled to NGN GETS treatment, the MME shall provide priority handling of this request in times of congestion, and when the UE is EMM-IDLE and needs to be paged, shall signal the eNodeB(s) to page with priority by inclusion of the "Paging Priority" IE set to the "PrioLevel1" value in the S1-AP "Paging" message.

5.3.4 Serving Gateway (S-GW) Requirements

5.3.4.1 Paging Procedure

This section provides requirements related to priority treatments associated with the Paging procedure.

The need for priority paging is signaled from the S-GW to the MME.

[201] The S-GW shall include within the "ARP" IE in the "Downlink Data Notification" message, the ARP of the bearer over which an GTP-U packet has arrived at the S-GW and is buffered at the S-GW awaiting transmission, or in the case when ISR is active, the ARP contained in a GTP-C "Create Bearer Request" message or a GTP-C "Update Bearer Request" message from the PDN-GW that is buffered at the S-GW awaiting transmission.

[202] The S-GW shall transmit with priority a GTP-C "Downlink Data Notification" message or a GTP-C "Create Bearer Request" message or a GTP-C "Update Bearer Request" message, any of which contains an ARP chosen from the set allocated by the Service Provider for use by NGN GETS.

When data arrives on multiple bearers at the S-GW, the ARP included is the highest priority one among all bearers for which data is queued at the S-GW. The "Downlink Data Notification" is also used in the case when ISR is active and the S-GW receives either a GTP-C "Create Bearer Request" or a GTP-C "Update Bearer Request" from the PDN-GW.

5.3.4.2 Bearer Establishment & Modification – Messages to/from MME

This section provides requirements related to priority treatments for bearer establishment and modification controlled via GTPv2-C procedures over the S11 Interface.

The following requirement relates to the "Create Session Request" message to the S-GW.

[114] A "Create Session Request" message from the MME to the S-GW shall be handled with priority by the S-GW when the message includes an ARP chosen from the set allocated by the Service Provider for use by NGN GETS.

The following requirement relates to the "Create Session Response" message from the S-GW to the MME.

[204] The S-GW shall mark for priority treatment the S11 "Create Session Response" message from the S-GW to the MME which contains a request to establish a bearer or bearers with an ARP corresponding to an NGN GETS call/session.

If the S11 Interface supports DSCP markings, inclusion of the DSCP selected for NGN GETS use would meet the above requirement.

The following requirements relate to the "Create Bearer Request" message or "Update Bearer Request" message from the S-GW to the MME.

[115] A "Create Bearer Request" message or "Update Bearer Request" message from the S-GW to the MME which requests the establishment/update of a bearer or bearers for an NGN GETS service shall be handled with priority by the S-GW due to inclusion of an ARP chosen from the set allocated by the Service Provider for use by NGN GETS services.

[205] The S-GW shall mark for priority treatment the S11 "Create Bearer Request" and S11 "Update Bearer Request" messages from the S-GW to the MME which contains an indication that a UE currently has an established/updated bearer or bearers for NGN GETS service.

If the S11 Interface supports DSCP markings, inclusion of the DSCP selected for NGN GETS use would meet the above requirement.

The following requirement relates to the “Create Bearer Response” message or “Update Bearer Response” message from the MME to the S-GW.

[116] A “Create Bearer Response” and “Update Bearer Response” message from the MME to the S-GW which contains an indication that a UE currently has an established/updated bearer or bearers for NGN GETS service shall be handled with priority by the S-GW due to inclusion of an ARP chosen from the set allocated by the Service Provider for use by NGN GETS.

5.3.4.3 Bearer Establishment & Modification- Messages to/from PDN-GW

This section applies only to a system with a GTP-based S5/S8 Interface.

The following requirement relates to the “Create Session Request” message from the S-GW to the PDN-GW.

[206] In the case where the S5/S8 Interface is GTP-based, the S-GW shall mark for priority treatment the S5/S8 “Create Session Request” message from the S-GW to the PDN-GW which contains an indication that a UE will establish a bearer or bearers for NGN GETS.

If the S5/S8 Interface supports DSCP markings, inclusion of the DSCP selected for NGN GETS use would meet the above requirement.

The following requirement relates to the “Create Session Response” message from the PDN-GW to the S-GW.

[117] A “Create Session Response” message from the PDN-GW to the S-GW shall be handled with priority by the S-GW when the message includes an ARP chosen from the set allocated by the Service Provider for use by NGN GETS.

The following requirement relates to the “Create Bearer Request” and “Update Bearer Request” messages from the S-GW to the PDN-GW.

[118] In the case where the S5/S8 Interface is GTP-based, a “Create Bearer Request” message or “Update Bearer Request” message from the PDN-GW to the S-GW which requests the establishment/update of a bearer or bearers for an NGN GETS service shall be handled with priority by the S-GW due to inclusion of an ARP chosen from the set allocated by the Service Provider for use by NGN GETS.

The following requirement relates to the “Create Bearer Response” and “Update Bearer Response” messages from the S-GW to the PDN-GW.

[207] In the case where the S5/S8 Interface is GTP-based, the S-GW shall mark for priority treatment the S5/S8 “Create Bearer Response” and “Update Bearer Response” messages from the S-GW to the PDN-GW which contain an indication that a UE currently has established/updated a bearer or bearers for NGN GETS.

If the S5/S8 Interface supports DSCP markings, inclusion of the DSCP selected for NGN GETS use would meet the above requirement.

5.3.4.4 Handling of GTP-U Messages

The following requirement relates to the use of the DSCP marking on the S1 Interface.

[208] Prior to transmitting GTP-U messages to the eNodeB, the S-GW shall mark GTP-U messages that arrive at the S-GW on a bearer with an ARP from the set allocated by the Service Provider for NGN GETS use by inclusion of a DSCP appropriate for NGN GETS.

The following requirements relate to the handling of packets associated with NGN GETS. Similar requirements are applied at the eNodeB in Section 4.3.3.2.7 and for the PDN-GW in Section 4.3.3.5.

[209] During times of severe congestion when it is necessary to drop packets on the IMS Signaling Bearers to ensure network stability, an S-GW shall drop packets not associated with an NGN

GETS ARP before dropping packets associated with an NGN GETS ARP.

[210] During times of severe congestion when it is necessary to drop packets on Media Bearers to ensure network stability, an S-GW shall drop packets not associated with an NGN GETS ARP before dropping packets associated with an NGN GETS ARP.

5.3.4.5 Overload Control

This section provides S-GW requirements related to overload control and exemptions to overload control.

[211] The S-GW shall be able to throttle "Downlink Data Notification" messages for low-priority traffic based on the ARP associated with the bearer.

[212] The S-GW shall not throttle "Downlink Data Notification" messages arriving on bearers associated with ARP for NGN GETS use.

The MME can also reduce load by requesting the S-GW to selectively reduce the number of Downlink Data Notifications it sends to the MME.

5.3.4.6 Bearer Establishment & Modification- Messages to/from S4-SGSN

This section provides requirements related to priority treatments for bearer establishment and modification controlled via GTPv2-C procedures over the S4 Interface.

The following requirement relates to the "Create Session Request" message to the S4-SGSN.

[203] A "Create Session Request" message from the S4-SGSN to the S-GW shall be handled with priority by the S-GW if it includes an ARP chosen from the set allocated by the Service Provider for use by NGN GETS.

The following requirement relates to the "Create Session Response" message from the S-GW to the S4-SGSN.

[288] The S-GW shall mark for priority treatment the S4 "Create Session Response" message from the S-GW to the S4-SGSN which contains a request to establish a bearer or bearers with an ARP corresponding to an NGN GETS call/session.

If the S4 Interface supports DSCP markings, inclusion of the DSCP selected for NGN GETS use would meet the above requirement.

5.3.5 Packet Data Network Gateway (PDN-GW) Requirements

This section provides PDN-GW requirements.

[213] In the case where the S5/S8 Interface is GTP-based, the PDN-GW shall mark for priority treatment the S5/S8 "Create Session Response" message from the PDN-GW to the S-GW which contains a request to establish a bearer or bearers with an ARP corresponding to an NGN GETS call/session.

If the S5/S8 Interface supports DSCP markings, inclusion of the DSCP selected for NGN GETS use would meet the above requirement.

[214] In the case where the S5/S8 Interface is GTP-based, a "Create Bearer Response" message or "Update Bearer Response" message from the S-GW to the PDN-GW which contains an indication that a UE currently has an established bearer or bearers for NGN GETS service shall be handled by the PDN-GW with priority due to inclusion of an ARP chosen from the set allocated by the Service Provider for use by NGN GETS.

[215] In the case where the S5/S8 Interface is GTP-based, a "Create Bearer Request" message or "Update Bearer Request" message from the PDN-GW to the S-GW which requests the establishment/update of a bearer or bearers for an NGN GETS service shall be handled by the PDN-GW with priority due to inclusion of an ARP chosen from the set allocated by the Service

Provider for use by NGN GETS.

The following objective relates to the “Create Bearer Request” message or “Update Bearer Request” message from the S-GW to the MME.

[216] In the case where the S5/S8 Interface is GTP-based, the PDN-GW shall mark for priority treatment the S5/S8 “Create Bearer Request” and “Update Bearer Request” messages from the PDN-GW to the S-GW which contain an indication that a UE currently has an established/updated bearer or bearers for NGN GETS.

If the S5/S8 Interface supports DSCP markings, inclusion of the DSCP selected for NGN GETS use would meet the above requirement.

The following requirement relates to the use of the DSCP marking on the SGi Interface.

[120] The PDN-GW shall give NGN GETS packets priority transport over the SGi Interface.

If the SGi Interface supports DSCP markings, inclusion of the DSCP selected for NGN GETS use would meet the above requirement.

[217] During times of severe congestion when it is necessary to drop packets on the IMS Signaling Bearers to ensure network stability, a PDN-GW shall drop packets not associated with an NGN GETS QoS before dropping packets associated with an NGN GETS QoS.

[218] During times of severe congestion when it is necessary to drop packets on Media Bearers to ensure network stability, a PDN-GW shall drop packets not associated with an NGN GETS QoS before dropping packets associated with an NGN GETS QoS.

5.3.6 Policy & Charging Rules Function (PCRF) Requirements

5.3.6.1 Enabling Advance Priority-SPR: Interaction with SPR

The contents of this section relate to the delivery of information from the SPR to the PCRF, and are conditional upon the Service Provider’s network including an SPR.

At the time of Attach, the PCRF queries and obtains user subscription information from the SPR.

[276] If the Service Provider’s network includes an SPR, at the time of Attach, when the PCRF receives the “CC-Request” command, the PCRF shall query the SPR for additional subscription information to determine if the UE is subscribed to NGN GETS. If the response from the SPR includes the “MPS EPS Priority,” “MPS Priority Level,” and “IMS Signalling Priority,” the PCRF shall store the subscription information and consider them when deriving Policy for establishing the Default Bearer and IMS Signaling Bearer.

When the “IMS Signalling Priority” is set, the PCRF enables Advance Priority-SPR.

[277] If the Service Provider’s network includes an SPR, and Advance Priority-SPR is selected by the Service Provider, the PCRF shall subscribe to notification from SPR on changes in the subscription information.

5.3.6.2 Bearer Control Related to Advance Priority

The contents of this section relate to PCRF requirements to support the establishment and modification of EPS bearers as needed for Advance Priority. Some requirements in this section are conditional upon the Service Provider’s network supporting Advance Priority-SPR.

Depending upon the choice of Advance Priority-SPR or Advance Priority-HSS one and only one of the two conditional requirements that follow will apply.

[278] If the Service Provider’s network supports and enables Advance Priority-SPR, at the time of Attach, the PCRF shall modify the ARP of the Default Bearer delivered to the PCRF in the “CC-Request” command to the highest priority ARP from the set allocated by the Service Provider for NGN GETS use, and include the modified ARP in the “Default-EPS-QoS” AVP within the “CC-

Answer" command, and handle the message with priority.

[279] If the Service Provider's network supports Advance Priority-HSS, the PCRF shall include policy rules which prevent the altering of the ARP of a Default Bearer when the ARP assigned to that Default Bearer within the "Default-EPS-Bearer-QoS" AVP in the "CC-Request" command is from the set allocated by the Service Provider for NGN GETS use.

The following conditional requirement specifies that the PCRF needs to set the ARP of the IMS Signaling Bearer to an NGN GETS value for the case when IMS Signaling is carried on a separate dedicated bearer.

[144] If an implementation supports IMS signaling on a dedicated bearer, when Advance Priority is enabled for a UE with subscription to NGN GETS services, the PCRF shall request the establishment of a dedicated IMS Signaling bearer at the time of Attach using the "CC-Answer" command and the PCRF shall include the highest priority ARP from the set allocated by the Service Provider for NGN GETS use.

The following conditional requirement specifies that for the Advance Priority-SPR case, when the IMS Signaling is carried on the Default Bearer to an APN dedicated for IMS Signaling, the PCRF needs to set the ARP of the Default Bearer to an NGN GETS value.

[145] If the Service Provider's network supports Advance Priority-SPR, and if an implementation supports IMS signaling on the Default Bearer to an APN dedicated for IMS Signaling, when Advance Priority-SPR is enabled for a UE with subscription to IMS services, the PCRF shall modify the ARP of the Default Bearer to the APN dedicated for IMS Signaling at the time of Attach using the "CC-Answer" command and the PCRF shall include the highest priority ARP from the set allocated by the Service Provider for NGN GETS use.

The following requirement relates to the generic priority treatments afforded to commands from the PCRF related to NGN GETS Bearer control.

[280] If a "CC-Answer" command from the PCRF to the S-GW or PDN-GW includes reference to a bearer with an ARP chosen from the set allocated by the Service Provider for NGN GETS use, it shall be handled with priority by the PCRF.

5.3.6.3 Bearer Control for Media Requested via Rx Interface Signaling

The requirements in this section relate to the control of bearers during the establishment of a SIP call/session under IMS control.

The following requirement relates to the upgrade of the IMS Signaling Bearer for NGN GETS use.

[219] When the PCRF receives an "AA-Request" command from the P-CSCF that includes "MPS-Identifier" AVP, the PCRF shall consider that the request is associated with an NGN GETS call/session and if the current setting of the Default and IMS Signaling bearers is not appropriate for NGN GETS use, the PCRF shall modify the ARP of the Default Bearer and IMS Signaling Bearer. The modified ARP shall be the highest priority ARP from the set allocated by the Service Provider for NGN GETS use. The PCRF shall include the ARP in the "Re-Auth-Request" command sent to PDN-GW for GTP-based S5/S8 and to S-GW and PDN-GW for PMIP-based S5/S8. The PCRF shall retain the previous ARP value in place prior to the upgrade such that it can be restored following release of the NGN GETS session(s).

The following requirement relates to the handling an "AA-Request" command which contains the "Service-Info-Status" AVP set to the "PRELIMINARY SERVICE INFORMATION" value. Specifically, although media information is included in the "AA-Request" command, media bearers are not established at this time.

[220] When the PCRF receives an "AA-Request" command from the P-CSCF that includes the "MPS-Identifier" AVP and also includes the "Service-Info-Status" AVP set to the "PRELIMINARY SERVICE INFORMATION" value, the PCRF shall not initiate setting up media bearer(s), and shall upgrade the Default and IMS Signaling Bearer as specified in Requirement [219].

If the "Service-Info-Status" AVP is not provided in the "AA-Request" command, then the value "FINAL SERVICE INFORMATION" is assumed.

The following requirement relates to the PCRF requesting the establishment of EPS bearers for media to support an NGN GETS call/session under IMS control via the Rx Interface.

[221] When the PCRF receives an "AA-Request" command that includes the "MPS-Identifier" AVP, the PCRF shall consider that the request is associated with NGN GETS and shall derive the ARP and/or QCI of the required EPS bearer(s) based on some or all of the following: the value of the "MPS-Identifier" AVP, the Service User's priority level in the "Reservation-Priority" AVP, and the "Media Type" AVP. The PCRF shall include the selected ARP and QCI in the "Re-Auth-Request" command sent to PDN-GW for a GTP-based S5/S8 Interface or to both the S-GW and PDN-GW for a PMIP-based S5/S8 Interface.

a) If the "AA-Request" contains the "MPS-Identifier" AVP set to MPS_IDENTIFIER_DTS_INVOCATION, the value selected by the Service Provider to indicate invocation of the NGN GETS Data Transport service, the PCRF shall modify the ARP for the Default bearer to the highest priority ARP from the set allocated by the Service Provider for NGN GETS use, and the PCRF shall assign the QCI for the Default bearer to the value QCI_NGNGETS_NONGBR, the QCI selected by the Service Provider for the NGN GETS Data Transport service. Prior to modification of the ARP and/or QCI of the Default Bearer, the PCRF shall provide a means to reinstate the previous ARP and QCI at the time of NGN GETS Data Transport service revocation.

b) Else if the "AA-Request" contains the "MPS-Identifier" AVP set to MPS_IDENTIFIER_DTS_REVOCATION, the value selected by the Service Provider to indicate revocation of the NGN GETS Data Transport service, the PCRF shall modify the ARP and QCI of the Default Bearer to those values in place prior to NGN GETS Data Transport service invocation.

c) Else if the "AA-Request" contains the "MPS-Identifier" AVP set to MPS_IDENTIFIER_GBR_INVOCATION, the value selected by the Service Provider to indicate HTTPS invocation of the NGN GETS GBR Data service, the PCRF shall assign the ARP for the media bearer from the set allocated by the Service Provider for NGN GETS use based on the value in the session-level "Reservation-Priority" AVP, and the PCRF shall assign the QCI for the media bearer to the value QCI_NGNGETS_GBR, the QCI selected by the Service Provider for NGN GETS GBR Data.

d) Else if the "AA-Request" contains the "MPS-Identifier" AVP set to MPS_IDENTIFIER_NGN_PS, the value selected by the Service Provider to mark a request associated with NGN GETS under SIP control, and also contains the "Media Type" AVP set to the "Video" value, and optionally, a second "Media Type" AVP set to the "Audio" value, the PCRF shall assign the ARP for the media bearer from the set allocated by the Service Provider for NGN GETS use based on the value in the session-level "Reservation-Priority" AVP.

e) Else if the "AA-Request" contains the "MPS-Identifier" AVP set to MPS_IDENTIFIER_NGN_PS, the value selected by the Service Provider to mark a request associated with NGN GETS under SIP control, and also contains the "Media Type" AVP set to the "Audio" value, the PCRF shall assign the ARP for the media bearer from the set allocated by the Service Provider for NGN GETS use based on the value in the session-level "Reservation-Priority" AVP.

f) Else if the "AA-Request" contains the "MPS-Identifier" AVP set to MPS_IDENTIFIER_NGN_PS, the value selected by the Service Provider to mark a request associated with NGN GETS under SIP control, and also contains the "Media Type" AVP set to the "Application" value, the PCRF shall assign the ARP for the media bearer from the set allocated by the Service Provider for NGN GETS use based on the value in the session-level "Reservation-Priority" AVP, and the PCRF shall assign the QCI for the media bearer to the value QCI_NGNGETS_GBR, the QCI selected by the Service Provider for NGN GETS GBR Data.

The following requirement relates to the downgrade of the IMS Signaling Bearer upon release of an NGN GETS call/session, if it was previously upgraded upon establishment of the NGN GETS call/session. As multiple NGN GETS call/sessions may overlap in time, the IMS Signaling Bearer need only be upgraded at the time the first NGN GETS call/session is established, and downgraded at the time the last NGN GETS call/session is released.

[222] For a UE not subscribed to NGN GETS, when the last NGN GETS Mobile Originated or Terminated call/session under IMS control is released, the PCRF shall reset the ARP of the IMS Signaling Bearer to its commercial level, the value in place prior to the upgrade for NGN GETS use. This value was saved by the PCRF at the time of the initial upgrade.

The following requirement relates to the downgrade of the Default Bearer upon release of an NGN GETS call/session, if it was previously upgraded upon establishment of an NGN GETS call/session. As multiple NGN GETS call/sessions may overlap in time, and the NGN GETS Data Transport Service also upgrades the Default Bearer, the Default Bearer is downgraded when all NGN GETS call/sessions are released, and the NGN GETS Data Transport Service is also deactivated.

[223] For a UE not subscribed to NGN GETS, when the last NGN GETS Mobile Originated or Terminated call/session under IMS control is released, and the NGN GETS Data Transport Service is not enabled, the PCRF shall reset the ARP of the Default bearer to its commercial level, the value in place prior to the upgrade for NGN GETS use. This value was saved by the PCRF at the time of the initial upgrade.

The need for this clean up arises from the bearer modification that is triggered off the SIP INVITE at the time of call/session establishment which results in an upgrade of the ARP of the Default Bearer and IMS Signaling Bearer for a UE that does not have Advance Priority enabled.

5.3.6.4 Interaction between the hPCRF & the vPCRF

For roaming scenarios with local breakout and for roaming scenarios with home routed access in case of PMIP based S8 interface, the hPCRF needs to interact with vPCRF to transfer the policy rules. When Advance Priority-SPR is employed, the hPCRF interacts with the SPR to obtain additional NGN GETS related subscription information. The following requirements apply:

[224] For roaming scenarios, the hPCRF shall derive the ARP for the Default Bearer and IMS Signaling Bearer and transfer them to the vPCRF over the S9 interface.

[225] For roaming scenarios, the vPCRF shall obtain the ARP for the Default Bearer and IMS Signaling Bearer from the hPCRF over the S9 interface. The vPCRF shall map, according to VPLMN policy for NGN GETS, the ARP received from the hPCRF to the ARP configured for NGN GETS use in the vPLMN.

5.3.7 Home Subscriber Server (HSS) Requirements

The following requirement specifies how NGN GETS treatments are enabled by subscription for CSFB.

[226] The HSS shall set the "MPS-CS-Priority" bit for an NGN GETS subscribed UE which is entitled to NGN GETS in the CS domain.

5.3.8 Subscription Profile Repository/User Data Repository (SPR/UDR) Requirements

The following requirement turns off Advance Priority-SPR when Advance Priority-HSS is selected.

[281] If the Service Provider's network includes an SPR, but implements Advance Priority-HSS instead of Advance Priority-SPR, then the "IMS Signalling Priority" information shall not be set in the SPR.

5.3.9 S4-SGSN Requirements

IRAT Handover between LTE and PS UMTS with S4-SGSN involves signaling between the MME and the S4-SGSN.

[227] A "Forward Relocation Request" sent by the S4-SGSN to the MME which contains one or more bearers established for NGN GETS service shall be handled with priority by the S4-SGSN due to inclusion of an ARP chosen from the set allocated by the Service Provider for use by NGN

GETS.

[228] A "Forward Relocation Request" sent by the MME to the S4-SGSN which contains one or more bearers established for NGN GETS service shall be handled with priority by the S4-SGSN due to inclusion of an ARP chosen from the set allocated by the Service Provider for use by NGN GETS.

The following requirements relate to the S4 "Create Session Request" message from the S4-SGSN to the S-GW.

[229] A "Create Session Request" message from the S4-SGSN to the S-GW shall be handled with priority by the S4-SGSN if it includes an ARP chosen from the set allocated by the Service Provider for use by NGN GETS.

[289] The S4-SGSN shall mark for priority treatment an S4 "Create Session Request" message from the S4-SGSN to the S-GW which contains an indication that a UE will establish a bearer or bearers for NGN GETS service.

If the S4 Interface supports DSCP markings, inclusion of the DSCP selected for NGN GETS use would meet the above requirement.

The following requirement relates to the S4 "Create Session Response" message from the S-GW to the S4-SGSN.

[290] When an S4 "Create Session Response" message from the S-GW to the S4-SGSN acknowledges a request to establish a bearer or bearers with an ARP corresponding to an NGN GETS call/session, the S4-SGSN shall handle the message with priority.

IRAT Handover between LTE and PS UMTS requires that certain mapping rules be applied at the network boundaries.

[282] If the EPS network supports S4 connectivity to a S4-SGSN over the S4 Interface, and the S4-SGSN is configured to support the Evolved ARP, the S4-SGSN shall map between the EPS ARP and the Evolved ARP as follows:

a) When converting from the EPS ARP to the Evolved ARP for the GPRS Core, the ARP Priority Level shall remain unchanged, and the Pre-emption Capability and Pre-emption Vulnerability shall remain unchanged.

b) When converting from the Evolved ARP for the GPRS Core to the EPS ARP, the ARP Priority Level shall remain unchanged, and the Pre-emption Capability and Pre-emption Vulnerability shall remain unchanged.

[283] If the EPS network supports S4 connectivity to a S4-SGSN over the S4 Interface, and the S4-SGSN is not configured to support the Evolved ARP (only supports the Legacy ARP), the S4-SGSN shall map between the EPS ARP to the Legacy ARP as follows:

a) When converting from the EPS ARP to the Legacy ARP for the GPRS Core, the EPS ARP Priority Level shall be mapped to the Legacy ARP = 1 value. Note, the Pre-emption Capability and Pre-emption Vulnerability are not mapped as the Legacy ARP does not carry this information in the GPRS Core.

b) When converting from the Legacy ARP for the GPRS Core to the EPS ARP, the ARP Priority Level shall be mapped to the lowest EPS Priority Level from the set allocated by the Service Provider for NGN GETS, the Pre-emption Capability shall be set to the "shall-not-trigger-preemption" value, and the Pre-emption Vulnerability shall be set to the "not-preemptable" value.

5.3.10 Radio Network Subsystem (RNS) Requirements

The following requirement specifies how an RNS recognizes that a CSFB to UMTS call is entitled to NGN GETS treatment within the UTRAN.

[230] The RNS shall provide priority treatment in times of congestion for a RANAP "Relocation Request" message which contains a "Source RNC to Target RNC Transparent Container" IE with a "CSFB Information" IE set to the "CSFB High Priority" value.

5.3.11 UMTS Mobile Switching Center (MSC) Requirements

For a Mobile Originated CSFB to UMTS call, the following requirement specifies how the UMTS MSC is initially made aware of the NGN GETS needs for the call.

[231] The UMTS MSC shall provide priority handling for a "CM Service Request" message that includes a "Priority Level" IE set to a value from the set allocated by the Service Provider for NGN GETS.

For a Mobile Terminated CSFB to UMTS call, the following requirement specifies how the UMTS MSC detects that an incoming call is entitled to NGN GETS treatment, and how the UMTS MSC notifies the MME to provide NGN GETS treatment.

[232] The UMTS MSC shall recognize an ISUP "IAM" message that contains the "Calling Party's Category" parameter set to "NS/EP call" and optionally includes the "Precedence" parameter set to the value SUpl-1, where SUpl is the calling Service User's priority level. If the "Precedence" parameter is not received, then the default priority value of Precedence level 4 shall be used to derive SUpl.

[233] For an NGN GETS call, when paging the UE for CSFB by signaling the MME over the SGs Interface, the UMTS MSC shall include the "eMLPP Priority" IE within the SGs "SGsAP-Paging-Request" message and shall set the "call priority" bits of the "eMLPP Priority" IE to the value 7-SUpl, where SUpl is the calling Service User's priority level derived in Requirement [232].

5.3.12 1x Interworking Solution (IWS) Requirements

For a Mobile Terminated CSFB call to 1xRTT (cdma2000), the following requirement specifies how the 1x IWS detects that an incoming voice call is entitled to NGN GETS treatment, and how the IWS notifies the MME to provide NGN GETS treatment.

[234] A 1x IWS shall detect an NGN GETS Voice call by checking the "Call Priority" bits within the "Priority" IE of the A1 "Paging Request" message, and shall provide priority handling of this request in times of congestion.

[235] For an NGN GETS Voice call, a 1x IWS shall include the "GCSNA Status" IE within the "A21-1x Air Interface Signaling" message, and shall set the "Call Priority" bits of the "GCSNA Status" IE to the value SUpl, where SUpl is the calling Service User's priority level.

For both Mobile Originated and Mobile Terminated CSFB calls to 1xRTT (cdma2000) which use the "eCSFB" variant which relies on handoff signaling rather than redirection, the following requirement specifies how the 1x IWS detects that NGN GETS priority should be provided in the handoff to the 1x BS which will support the CS call.

[236] A 1x IWS which receives an A1 "Assignment Request" message containing a "Priority" IE whose "Call Priority" field is set to the value SUpl, where SUpl is the calling Service User's priority level, shall treat this request as associated with NGN GETS, and shall provide priority handling of this request in times of congestion.

5.3.13 1x Mobile Switching Center (MSC) Requirements

For a Mobile Terminated CSFB to 1xRTT (cdma2000) call, the following requirement specifies how the 1x MSC detects that an incoming voice call is entitled to NGN GETS treatment, and how the 1x MSC notifies the 1x IWS to provide NGN GETS treatment.

[237] A 1x MSC shall detect an NGN GETS call by checking an ISUP "IAM" message for the "Calling Party's Category" parameter set to "NS/EP call" and optionally includes the "Precedence" parameter set to the value SUpl-1, where SUpl is the calling Service User's priority level, and shall provide priority handling of this request in times of congestion. If the "Precedence" parameter is not received, then the default priority value of Precedence level 4 shall be used to derive SUpl.

[238] For an NGN GETS Voice call, when paging the UE for CSFB by signaling the 1x IWS over the A1 Interface, a 1x MSC shall include the "Priority" IE within the A1 "Paging Request" message, and shall set the "Call Priority" bits of the "Priority" IE to the value SUpl, where SUpl is the calling Service User's priority level derived in Requirement [237].

For both Mobile Originated and Mobile Terminated CSFB calls to 1xRTT (cdma2000) which use the "eCSFB" variant which relies on handoff signaling rather than redirection, the following requirement specifies how the 1x MSC notifies the 1x IWS to provide NGN GETS in the handoff to the 1x BS which will support the CS call.

[239] As part of the eCSFB procedure for NGN GETS, the 1x MSC shall provide priority treatment for the A1 "Assignment Request" message, and shall provide NS/EP NSN-PS indication to the 1x IWS by setting the "Call Priority" field of the "Priority" IE to the value SUpl, where SUpl is the calling Service User's priority level derived in Requirement [237].

6 OAM&P Requirements

This section specifies operations requirements to support NGN GETS services. Like any other technology and service, NGN GETS services will need to be managed for Operations, Administration, Maintenance, and Provisioning (OAM&P).

This section only includes OAM&P requirements related to the Service Provider's LTE access network that are specific to NGN GETS. Common and FE specific requirements are provided in separate subsections.

6.1 Common Requirements

This section specifies NGN GETS requirements that are applicable to multiple FEs within the Service Provider's access network.

When a Network Equipment (NE) implements multiple FEs, if the same requirement applies to each FE, the NE may need to implement the requirement only once; and if the FEs have a set of requirements that are non-overlapping, all the requirements in the set should apply to the NE.

NGN GETS relies on the existing QoS mechanisms defined for LTE, with NGN GETS generally assigned the highest priority, based on specifications.

[146] If an FE can recognize NGN GETS signaling and/or bearer traffic, it shall allow the configuration of the FE by the Service Provider to give the NGN GETS traffic priority transport.

[147] If an FE can recognize NGN GETS signaling and/or bearer traffic, it shall allow the configuration of the FE by the Service Provider to give the NGN GETS traffic priority treatment relative to Machine Congestion Controls.

6.2 FE Requirements

6.2.1 UE Requirements

6.2.1.1 Configuration Management

A special Access Class is reserved for NGN GETS-Subscribed UEs, in order to support the Access Class Barring mechanism.

[127] UEs deployed by the Service Provider for which NGN GETS may be subscribed and for which an Access Class can be configured shall allow configuration of an NGN GETS-unique Access Class.

[86] NGN GETS subscribed UEs shall be provisioned with AC value 14.

6.2.1.2 Overload Control

This section provides UE provisioning requirements related to overload control and exemptions to overload control.

Devices to support Machine Type Communications may be configured with a low access priority indicator. Such devices transmit the low access priority indicator to the MME during the appropriate NAS signaling procedures and also transmit the corresponding low access priority to the E-UTRAN during RRC connection establishment procedures. Overload control mechanisms may use the presence of low access priority indicator.

[240] An NGN GETS subscribed UE shall not be configured with a low access priority indicator.

6.2.2 eNodeB Requirements

6.2.2.1 Configuration Management

The following three requirements relate to Configuration Management for the Access Class Barring Mechanism.

[128] The eNodeB shall be configured to broadcast the Access Class Barring parameters over the air (as defined in [TS 36.331]).

[241] The eNodeB shall allow the configuration of a binary parameter to enable or disable the Access Class Barring mechanism. The factory default value shall be set to disable Access Class Barring.

[242] Based on commercial agreements, the Access Class Barring mechanism shall always be enabled, after some initial deployment transition period (with dates to be specified).

The following requirements ensure that a reasonable portion of radio resources is maintained for public service.

[129] The eNodeB shall support the provisioning of parameters to control the admission of NGN GETS bearers to ensure a specific limit on the fraction of radio resources available for non-NGN GETS.

a) When more than the specified limit of radio resources are available for non-NGN GETS, NGN GETS shall receive admission priority over non-NGN GETS.

b) When less than the specified limit of radio resources are available for non-NGN GETS, NGN GETS shall receive admission treatment equivalent to non-NGN GETS.

c) The limit shall allow settings from 1-100% inclusive in increments of 1%.

[130] The parameter(s) governing the reasonable share of the CMRS radio resources available for non-NGN GETS use shall be set to a default such that 75% of the CMRS radio resources are available for non-NGN GETS services.

The following requirements relate to the use of the DSCP markings on the S1 and X2 Interfaces.

[131] The eNodeB shall allow the configuration of the DSCP marking to be used for GTP-U messages over the S1 Interface for bearers configured for use by NGN GETS services.

[132] The eNodeB shall allow the configuration of the DSCP marking to be used for messages over the X2 Interface during the handover of bearers configured for use by NGN GETS services.

The following requirement relates to provisioning a set of QoS values reserved for NGN GETS use.

[243] The eNodeB shall support the provisioning of a set of QoS values reserved for NGN GETS use.

6.2.2.2 Performance Management

The following requirements apply to an eNodeB, with the required time intervals for eNodeB counting and reporting being based on the time intervals and practices currently used by the Service Provider.

[133] The eNodeB shall generate peg counts of the total number of received RRCConnectionRequest with Establishment Cause marked as "highPriorityAccess" for a specified interval (in minutes). This peg count shall be administered at the specific eNodeB level.

[134] For every instance when the access control is applied for access classes to which NGN GETS is specifically assigned, the eNodeB shall log the following parameters:

- **Access class barred,**
- **Start time,**
- **End time,**
- **Start Date,**
- **End Date.**

The report data shall be associated with the ID of the eNodeB.

[244] The eNodeB shall generate peg counts of the total number of received "Paging" messages which contain the "Paging Priority" IE for a specified interval (in minutes). This peg count shall be administered at the specific eNodeB level.

The following refers to messages containing an ARP and therefore applies to certain S1-AP messages from the MME, e.g., the S1-AP "Initial Context Setup Request" message. It cannot apply to any messages from the UE or any message from the S-GW.

[245] The eNodeB shall generate peg counts of the total number of received messages containing an ARP chosen from the set of values allocated for NGN GETS use, for a specified interval (in minutes). This peg count shall be administered at the specific eNodeB level.

6.2.3 MME Requirements

6.2.3.1 Configuration Management

The following requirement relates to the use of the DSCP marking on the S1-MME Interface.

[246] The MME shall allow the configuration of the DSCP marking to be used for S1-AP control messages over the S1-MME Interface for signaling required to support NGN GETS services.

The following requirement relates to the use of priority marking on the S10 and S11 Interfaces.

[247] The MME shall allow the configuration of priority marking to be used for messages over S10 and S11 Interfaces for bearers configured for use by NGN GETS services.

If the S10 and S11 Interfaces support DSCP markings, configuration of the DSCP selected for NGN GETS use would meet the above requirement.

The following requirement relates to provisioning the set of ARPs reserved for NGN GETS use.

[248] The MME shall support the provisioning of the set of ARPs reserved for NGN GETS use. This set shall contain 3, 4, or 5 values.

6.2.3.2 Performance Management

The following requirements apply to an MME, with the counting and reporting based on the time intervals and practices currently used by the Service Provider.

[136] The MME (possibly in conjunction with some off line system) shall generate peg counts of the total number of received messages containing an ARP chosen from the set of values allocated for NGN GETS, for a specified interval (in minutes). This peg count shall be administered at the specific MME level.

[157] For each ARP value within the set of values allocated for NGN GETS, it is desirable that the MME (possibly in conjunction with some off line system) provide a peg counter of received messages containing that specific ARP value. The peg counts shall be generated for a specified interval (in minutes) and be administered at the specific MME level.

6.2.3.3 Overload Control

The following requirement relates to MME overload control.

[249] The MME shall support the provisioning of Overload Control mechanisms, and includes the information needed to support the MME Requirements [189] through [196].

6.2.4 S-GW Requirements

6.2.4.1 Configuration Management

The following requirement relates to the use of the DSCP marking on the S1-U Interface.

[137] The S-GW shall allow the configuration of the DSCP marking to be used for GTP-U messages over the S1-U Interface for bearers configured for use by NGN GETS services.

The following requirement relates to the use of priority marking on the S5/S8 and S11 Interfaces.

[250] The S-GW shall allow the configuration of priority marking to be used for messages over S5/S8 and S11 Interfaces for bearers configured for use by NGN GETS services.

If the S5/S8 and S11 Interfaces support DSCP markings, configuration of the DSCP selected for NGN GETS use would meet the above requirement.

The following requirement relates to provisioning the set of ARPs reserved for NGN GETS use.

[251] The S-GW shall support the provisioning of the set of ARPs reserved for NGN GETS use. This set shall contain 3, 4, or 5 values.

6.2.4.2 Performance Management

The following requirement applies to an S-GW, with the counting and reporting based on the time intervals and practices currently used by the Service Provider.

The following requirement applies to GTP-C messages received by the S-GW, e.g., the S11 “Create Session Request” message. It does not apply to GTP-U messages.

[252] The S-GW (possibly in conjunction with some off line system) shall generate peg counts of the total number of received GTP-C messages containing an ARP chosen from the set of values allocated for NGN GETS use, for a specified interval (in minutes). This peg count shall be administered at the S-GW level.

6.2.5 PDN-GW Requirements

6.2.5.1 Configuration Management

The following requirement relates to the use of priority marking on S5/S8 Interface.

[253] The PDN-GW shall allow the configuration of priority marking to be used for messages over S5/S8 Interface for bearers configured for use by NGN GETS.

If the S5/S8 Interface supports DSCP markings, configuration of the DSCP selected for NGN GETS use would meet the above requirement.

The following requirement relates to the use of the DSCP marking on the SGi Interface.

[138] The PDN-GW shall allow configuration of the DSCP to support priority transport of NGN GETS packets over the SGi Interface.

The following requirement relates to provisioning a set of QoS values reserved for NGN GETS use.

[254] The PDN-GW shall support the provisioning of a set of QoS values reserved for NGN GETS use.

6.2.5.2 Performance Management

The following requirement applies to a PDN-GW, with the counting and reporting based on the time intervals and practices currently used by the Service Provider.

The following requirement applies to GTP-C messages received by the PDN-GW, e.g., the S5 "Create Session Request" message. It does not apply to GTP-U messages.

[255] The PDN-GW (possibly in conjunction with some off line system) shall generate peg counts of the total number of received GTP-C messages containing an ARP chosen from the set of values allocated for NGN GETS use, for a specified interval (in minutes). This peg count shall be administered at the specific PDN-GW level.

6.2.6 PCRF Requirements

6.2.6.1 Configuration Management

The PCRF is expected to permit the Service Provider to configure any set of ARP values within the allowed range.

[139] The PCRF shall allow the configuration of the "ARP_NGNGETS" parameter with the set of ARP parameters assigned for the NGN GETS use, within the allowed range.

The PCRF is expected to permit the Service Provider to configure any QCI value within the allowed range.

[256] The PCRF shall allow the configuration of the "QCI_NGNGETS_NONGBR" parameter to contain the QCI to be assigned to the Default Bearer when the NGN GETS Data Transport service is enabled.

The PCRF is expected to permit the Service Provider to configure any QCI value for the NGN GETS GBR Data service within the allowed range.

[257] The PCRF shall allow the configuration of the "QCI_NGNGETS_GBR" parameter to contain the QCI to be assigned to the Dedicated Bearer when the NGN GETS GBR Data service is enabled.

The PCRF must be able to recognize specific values of the "MPS-Identifier" AVP received over the Rx Interface to recognize the need to provide NGN GETS Priority treatment.

[258] The PCRF shall allow the configuration of the list of "MPS-Identifier" values to contain those values needed to support NGN GETS including:

a) MPS_IDENTIFIER_DTS_INVOCATION, the value to signal invocation of the NGN GETS Data Transport service,

b) MPS_IDENTIFIER_DTS_REVOCATION, the value to signal revocation of the NGN GETS Data Transport service,

c) MPS_IDENTIFIER_GBR_INVOCATION, the value to signal invocation of the NGN GETS GBR Data service under HTTPS control, and

d) MPS_IDENTIFIER_NGN_PS, the value to identify that the request is associated with an NGN GETS service under SIP control, including the NGN GETS Voice, NGN GETS Video and NGN GETS GBR Data services.

6.2.7 SPR/UDR Requirements

6.2.7.1 Configuration Management

The Service Provider whose network includes an SPR and who has chosen to support Advance Priority-SPR needs to configure setting of the "MPS EPS Priority," "MPS Priority Level," and "IMS Signalling Priority" parameters for NGN GETS use as per the following three conditional requirements.

[284] If the Service Provider supports Advance Priority-SPR, the SPR shall allow the configuration of the "MPS EPS Priority" parameter to mark the user as entitled to NGN GETS Service.

[285] If the Service Provider supports Advance Priority-SPR, the SPR shall allow the configuration of the "MPS Priority Level" parameter to contain the Service User's priority level.

[286] If the Service Provider supports Advance Priority-SPR, the SPR shall allow the configuration of the "IMS Signalling Priority" parameter to indicate that Advance Priority-SPR is enabled for each user.

6.2.8 HSS Requirements

6.2.8.1 Configuration Management

The following requirement provides for the configuration of subscription to NGN GETS which requires CSFB to the CS domain.

[259] The HSS shall support the provisioning of the "MPS-CS-Priority" bit.