ATIS-1000049

ATIS Standard on -

End-to-End NGN GETS Call Flows

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ATIS Standard on

End-to-End NGN Gets Call Flows

Alliance for Telecommunications Industry Solutions

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Abstract

This Standard describes end-to-end call/session flows for various wireline and wireless access technologies, in addition to the IMS Core Network call/session flows in support of NGN GETS [Emergency Telecommunications Service (ETS)]. These call/session flows illustrate how an NGN GETS call/session can be processed, and address call/session set-up, termination, and on-going activities of the call/session for the various NGN GETS service types and access technologies. The call/session flows are based on various wireline and wireless Standards/Specifications.

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

M. Dolly, PTSC Chair (AT&T)

V. Shaikh, PTSC Vice-Chair (Peraton Labs)

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1 Scope, Purpose, & Application

This Standard describes end-to-end call/session flows for various wireline and wireless access technologies, in addition to the IMS Core Network call/session flows in support of NGN GETS [Emergency Telecommunications Service (ETS)]. These call/session flows illustrate how an NGN GETS call/session can be processed, and address call/session set-up, termination, and on-going activities of the call/session for the various NGN GETS service types and access technologies. The call/session flows are based on various wireline and wireless Standards/Specifications. This Standard describes call/session flows for the following:

- Wireline access technologies:
  - Digital Subscriber Line (DSL)
  - Fiber
  - Cable
  - Ethernet.
- Wireless access technologies:
  - Evolved Universal Terrestrial Radio Access Network (E-UTRAN)
  - Universal Terrestrial Radio Access Network (UTRAN)
  - High Rate Packet Data (HRPD)
  - evolved High Rate Packet Data (eHRPD)
  - Worldwide Interoperability for Microwave Access (WiMAX).

The material in this Standard is meant to provide a high-level illustrative description and is not intended to be exhaustive. If inconsistencies are found between this material and NGN GETS (ETS) requirements contained within other Standards/Specifications, the requirements in those Standards/Specifications take precedence.

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] 3GPP TS 22.011, *Service Accessibility* (Release 10).

[TS 22.153] 3GPP TS 22.153, *Multimedia Priority Service (MPS)* (Release 10).

[TS 23.002] 3GPP TS 23.002, *Network Architecture* (Release 10).

[TS 23.060] 3GPP TS 23.060, *General Packet Radio Service (GPRS); Service description; Stage 2* (Release 10).

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

[TS 23.203] 3GPP TS 23.203, *Policy and Charging Control Architecture* (Release 10).

[TS 23.228] 3GPP TS 23.228, *IP Multimedia Subsystem (IMS); Stage 2* (Release 10).

[TS 23.401] 3GPP TS 23.401, *General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access* (Release 10).

[TS 23.402] 3GPP TS 23.402, *Architecture enhancements for non-3GPP accesses* (Release 10).

[TS 24.229] 3GPP TS 24.229, *Internet Protocol (IP) multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3* (Release 10).

[TR 24.930] 3GPP TR 24.930, *Signalling flows for the session setup in the IM CN subsystem (IMS) based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3* (Release 10).

[TS 25.321] 3GPP TS 25.321, *Medium Access Control (MAC); Protocol Specification* (Release 10).

[TS 25.322] 3GPP TS 25.322, *Radio Link Control (RLC); Protocol Specification* (Release 10).

[TS 25.323] 3GPP TS 25.323, *Packet Data Convergence Protocol (PDCP) Specification* (Release 10).

[TS 25.331] 3GPP TS 25.331, *Radio Resource Control (RRC); Protocol Specification* (Release 10).

[TS 25.413] 3GPP TS 25.413, *UTRAN Iu interface Radio Access Network Application Part (RANAP) Signalling* (Release 10).

[TS 25.423] 3GPP TS 25.423, *UTRAN Iur interface Radio Network Subsystem Application Part (RNSAP) Signalling* (Release 10).

[TS 25.426] 3GPP TS 25.426, *UTRAN Iur and Iub interface data transport and transport signalling for DCH data streams* (Release 10).

[TS 25.433] 3GPP TS 25.433, *UTRAN Iub interface Node B Application Part (NBAP) Signalling* (Release 10).

[TS 29.212] 3GPP TS 29.212, *Policy and charging control over Gx reference point* (Release 10).

[TS 29.213] 3GPP TS 29.213, *Policy and charging control signaling flows and Quality of Service (QoS) parameter mapping* (Release 10).

[TS 29.214] 3GPP TS 29.214, *Policy and charging control over Rx reference point* (Release 10).

[TS 36.331] 3GPP TS 36.331, *Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification* (Release 10).

3GPP2[2]

[A.S0008] 3GPP2 A.S0008-C (TIA-878), *Interoperability Specification (IOS) for High Rate Packet Data (HRPD) Radio Access Network Interfaces with Session Control in the Access Network*, Version 2.0, January 2009.

[A.S0009] 3GPP2 A.S0009-C (TIA-1878-C-1), *Interoperability Specification (IOS) for high Rate Packet Data (HRPD) Radio Access Network Interfaces with Session Control in the Packet Control Function*, Version 2.0, January 2009.

[A.S0017] 3GPP2 A.S0017-C, *Interoperability Specification (IOS) for cdma2000 Access Network Interfaces – Part 7 (A10 and A11 Interfaces)*, Version 2.0, December 2005.

[A.S0022] 3GPP2 A.S0022-0, *Interoperability Specification (IOS) for Evolved High Rate Packet Data (eHRPD) Radio Access Network Interfaces and Interworking with Enhanced Universal Terrestrial Radio Access Network (E-UTRAN)*, Version 1.0, March 2009.

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

[C.R1001] 3GPP2 C.R1001-F, *Administration of Parameter Value Assignments for cdma2000 Spread Spectrum Standards – Release F*, Version 1.0, December 8, 2006.

[C.S0016-D] 3GPP2 C.S0016-D, *Over-the-Air Service Provisioning of Mobile Stations in Spread Spectrum Standards*, Release D, January 2010.

[C.S0024] 3GPP2 C.S0024-A (TIA-856), *cdma2000 High Rate Packet Data Air Interface Specification*, Version 3.0, September 2006.

[C.S0024-B] 3GPP2 C.S0024-B, *cdma2000 High Rate Packet Data Air Interface Specification*, Version 2.0, March 2007

[C.S0063] 3GPP2 C.S0063-A, *cdma2000 High Rate Packet Data Supplemental Services*, Version 2.0, April 2007.

[C.S0063-B] 3GPP2 C.S0063-B, *cdma2000 High Rate Packet Data Supplemental Services*, Version 1.0, May 2010.

[C.S0087] 3GPP2 C.S0087-0, E-*UTRAN – cdma2000 Connectivity and Interworking: Air Interface Specification*, Version 1.0, May 2009.

[S.R0117-0] 3GPP2 S.R0117-0, *Multimedia Priority Service (MMPS) for MMD-based Networks - Stage 1 Requirements*. June 2006.

[X.S0011] 3GPP2 X.S0011-D (TIA-835), *cdma2000 Wireless IP Network Standard*, Version 2.0, November 2008.

[X.S0057] 3GPP2 X.S0057-0, *E-UTRAN – HRPD Connectivity and Interworking: Core Network Aspects*, Version 1.0, February 2009.

[X.S0013-000] 3GPP2 X.S0013-000, *All-IP Core Network Multimedia Domain; IP Multimedia Call Control Protocol Based on SIP and SDP – Overview*.

[X.S0013-002] 3GPP2 X.S0013-002, *All-IP Core Network Multimedia Domain; IP Multimedia Subsystem – Stage 2*.

[X.S0013-004] 3GPP2 X.S0013-004, *All-IP Core Network Multimedia Domain; IP Multimedia Call Control Protocol Based on SIP and SDP – Stage 3*.

[X.S0013-012] 3GPP2 X.S0013-012-0, *All-IP Core Network Multimedia Domain; Service Based Bearer Control – Stage 2*.

[X.S0013-013] 3GPP2 X.S0013-013-0, *All-IP Core Network Multimedia Domain; Service Based Bearer Control – Tx Interface Stage 3*.

[X.S0013-014] 3GPP2 X.S0013-014-0, *All-IP Core Network Multimedia Domain; Service Based Bearer Control – Ty Interface Stage 3*.

ATIS[3]

[ATIS-1000010.2006] ATIS-1000010.2006 (R2011), *Support of Emergency Telecommunications Service (ETS) in IP Networks*.

[ATIS-1000023.2008] ATIS-1000023.2008, *ETS Network Element Requirements for a NGN IMS Based Deployments*.

[ATIS-1000679.2004] ATIS-1000679.2004 (R2010), *Interworking between Session Initiation Protocol (SIP) and Bearer Independent Call Control or ISDN User Part*.

[ATIS-1000018] ATIS-1000018, *NGN Architecture*.

---

[3] These documents are available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005. < https://www.atis.org/ >

IEEE[4]

[802.16-2009] IEEE 802.16, *Part 16: Air Interface for Broadband Wireless Access Systems*, July 2009.

IETF[5]

[RFC 1661] IETF RFC 1661, *The Point-to-Point Protocol (PPP).*

[RFC 1994] IETF RFC 1994, *PPP Challenge Handshake Authentication Protocol (CHAP)*.

[RFC 2475] IETF RFC 2475, *An Architecture for Differentiated Services*.

[RFC 2865] IETF RFC 2865, *Remote Authentication Dial In User Service (RADIUS)*.

[RFC 3031] IETF RFC 3031, *Multiprotocol Label Switching Architecture*.

[RFC 3260] IETF RFC 3260, *New Terminology and Clarifications for Diffserv*.

[RFC 3261] IETF RFC 3261, *SIP: Session Initiation Protocol*.

[RFC 3270] IETF RFC 3270, *Multi-Protocol Label Switching (MPLS) Support of Differentiated Services*.

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

[RFC 3725] IETF RFC 3725, *Best Current Practices for Third Party Call Control (3pcc) in the Session Initiation Protocol (SIP)*.

[RFC 3986] IETF RFC 3986, *Uniform Resource Identifier (URI): Generic Syntax*.

[RFC 4412] IETF RFC 4412, *Communications Resource Priority for the Session Initiation Protocol (SIP)*.

[RFC 4733] IETF RFC 4733, *RTP Payload for DTMF Digits, Telephony Tones, and Telephony Signals*.

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

ITU-T[6]

[ITU-T Q.812] ITU-T Recommendation Q.812, *Upper layer protocol profiles for the Q and X interfaces*, February 2004.

WiMAX[7]

[NWG PCC] WMF-T33-109-R016v01: WiMAX Forum NWG: *WiMAX Forum Network Architecture: Policy and Charging Control*, Release 1.6, November 2010.

[NWG Stage 2] WMF-T32-001-R016v01: WiMAX Forum, *WiMAX End-to-End Network Systems Architecture. Stage 2: Architecture Tenets, Reference Models, and Reference Points*. Release 1.6, Version 1.0, November 2010.

[NWG Stage 3] WMF-T33-001-R016v01: WiMAX Forum, *WiMAX End-to-End Network Systems Architecture. Stage 3: Detailed Protocols and Procedures*. Release 1.6, Version 1.0, November 2010.

---

[4] This document is available from the Institute of Electrical and Electronics Engineers (IEEE). < http://shop.ieee.org/store/ >

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

[6] This document is available from the International Telecommunications Union. < http://www.itu.int/ITU-T/ >

[7] These documents are available from the WiMax Forum. < http://www.wimaxforum.org/>

ETSI TISPAN[8]

[TS 183.017] *Telecommunications and Internet Converged Services and Protocols for Advanced Networking (TISPAN); Resource and Admission Control: DIAMETER protocol for session based policy set-up information exchange between the Application Function (AF) and the Service Policy Decision Function (SPDF); Protocol specification*, March 2006.

Broadband Forum[9]

[TR-058] *Multi-Service Architecture and Framework Requirements*, September 2003.

[TR-059] *DSL Evolution – Architecture Requirements for the Support of QoS Enabled IP Services*, September 2003.

[TR-098] *DSLHomeTM Internet Gateway Device Version 1.1, Data Model for TR-069*, September 2005.

[TR-101] *Migration to Ethernet-Based DSL Aggregation*, April 2006.

[TR-156] *Using GPON Access in the Context of TR-101*, December 2008.

[TR-167] *GPON-fed TR-101 Ethernet Access Node*, February 2010.

CableLabs[10]

[CM-SP-MULPIv3.0-I08-080522] *Data-Over-Cable Service Interface Specification, DOCSIS 3.0, MAC and Upper Layer Protocols Interface Specification*, May 2008.

[PKT-SP-MM-I04-080522] *PacketCableTM Specification, Multimedia Specification*, May 2008.

[PKT-SP-MM-WS-I02-080522] *PacketCable Multimedia Specification, PacketCable Multimedia Web Service Interface Specification*, May 2008.

[PKT-SP-QOS-I02-080425] *PacketCableTM 2.0 Quality of Service Specification*.

[PKT-TR-ARCH-FRM-V04-071106] PacketCableTM *2.0 Architecture Framework Technical Report*, November 2007.

Metro Ethernet Forum[11]

[MEF 4] *Technical Specification MEF 4 – Metro Ethernet Network Architecture Framework – Part 1: Generic Framework*, May 2004.

[MEF 7] *Technical Specification MEF 7 – EMS-NMS Information Model*, October 2004.

[MEF 15] *Technical Specification MEF 15 – Requirements for Management of Metro Ethernet Phase 1 Network Elements*, November 2005.

[MEF 16] *Technical Specification MEF 16 – Ethernet Local Management Interface*, January 2006.

---

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

[9] These documents are available via the Broadband Forum. < http://www.broadband-forum.org/>.

[10] These documents are available via CableLabs. < http://www.cablelabs.com/>

[11] These documents are available via the Metro Ethernet Forum. < http://metroethernetforum.org/index.php>

[MEF 17] *Technical Specification MEF 17 – Service OAM Requirements & Framework – Phase 1*, April 2007.

3 Definitions, Acronyms, & Abbreviations

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

3.1 Definitions

3.1.1 Service User: Service User is an individual authorized by the government agency to use NGN GETS and to whom a priority assignment has been granted by the government agency.

3.1.2 NGN GETS Service Provider: NGN GETS Service Provider is a Service Provider offering NGN GETS service.

3.2 Acronyms & Abbreviations

3G	3rd Generation
3GPP	3rd Generation Partnership Project
3PCC	Third-Party Call Control
AAA	AA-Answer, or Authentication, Authorization, and Accounting
AAR	AA-Request
AK	Authorization Key
ARP	Allocation Retention Priority
AS	Application Server
ASN	Access Service Network
ATIS	Alliance for Telecommunications Industry Solutions
AVP	Attribute Value Pair
B2BUA	Back-to-Back User Agent
BE	Best Effort
BFE	Bearer Functional Entity
BGCF	Breakout Gateway Control Function
BS	Base Station
CCFE	Call Control Functional Entity
CDMA	Code Division Multiple Access
CHAP	Challenge-Handshake Authentication Protocol
CID	Connection Identifier

CMIP	Client Mobile IP
CPC	Calling Party's Category (ISUP)
CPLT	Complete
CSCF	Call Session Control Function
CSN	Connectivity Service Network
DDS	Data Delivery Service
DH	Diffie-Hellman
DHCP	Dynamic Host Configuration Protocol
DiffServ	Differentiated Services
DL	Down Link
DN	Directory Number
DNS	Domain Name System
DSA	Dynamic Service Addition
DSC	Dynamic Service Change
DSL	Digital Subscriber Line
DSCP	DiffServ Code Point
eAN	Evolved Access Network
EAP	Extensible Authentication Protocol
eHRPD	Evolved High Rate Packet Data
EIP-GW	Egress IP Gateway
ENUM	E.164 NUmber Mapping
eRT-VR	Enhanced Real-Time Variable Rate
ePCF	Evolved Packet Control Function
EPS	Evolved Packet System
ETS	Emergency Telecommunications Service
E-UTRAN	Evolved Universal Terrestrial Radio Access Network
FC	Feature Code
FE	Functional Entity
GBR	Guaranteed Bit Rate
GETS	Government Emergency Telecommunication Service
GETS-AN	GETS Access Number

GETS-FC	GETS Feature Code
GW	Gateway
HA	Home Agent
HRPD	High Rate Packet Data
HSGW	HRPD Serving Gateway
HSS	Home Subscriber Server
HTTP	Hypertext Transfer Protocol
IAM	Initial Address Message (ISUP)
IBCF	Interconnection Border Control Function
I-CSCF	Interrogating CSCF
IEEE	Institute of Electrical and Electronic Engineers
IETF	Internet Engineering Task Force
iFC	Initial Filter Criteria
IMS	IP Multimedia Subsystem
IP	Internet Protocol
IP-CAN	IP Connectivity Access Network
ISF	Initial Service Flow
LCP	Link Control Protocol
LMA	Local Mobility Anchor
MGCF	Media Gateway Control Function
MIP	Mobile IP
MME	Mobility Management Entity
MLPP	Multi Level Precedence and Pre-emption
MPLS	Multi-Protocol Label Switching
MRFC	Media Resource Function Controller
MRFP	Media Resource Function Processor
MS	Mobile Station
NAI	Network Access Identifier
NCS	National Communication System
NE	Network Element
NGN	Next Generation Network

NRT-VR	Non-Real Time – Variable Rate
NS/EP	National Security and Emergency Preparedness
NWG	Network Working Group
OLT	Optical Line Termination
ONT	Optical Network Termination
OMCI	ONT Management and Control Interface
PCC	Policy and Charging Control
PCEF	Policy and Charging Enforcement Function
PCRF	Policy and Charging Rules Function
P-CSCF	Proxy CSCF
PF	Policy Function
PDF	Policy Distribution Function
PDN-GW	PDN Gateway
PMIP	Proxy Mobile IP
PSF	Pre-Provisioned Service Flow
PSN	Public Switched Network
QCI	QoS Class Identifier
QoS	Quality of Service
RAA	Re-Auth-Answer
RADIUS	Remote Authentication Dial In User Service
RAN	Radio Access Network
RAR	Re-Auth-Request
RFC	Request For Comment
RPH	Resource-Priority Header
RTP	Real-Time Transport Protocol
RT-VR	Real Time – Variable Rate
SBC	Session Border Controller
S-CSCF	Serving CSCF
SDP	Session Description Protocol
SF	Service Flow
S-GW	Signaling Gateway

SIP	Session Initiation Protocol
SPR	Subscriber Profile Repository
TAU	Tracking Area Update
TOD	Time of Day
UE	User Equipment
UGS	Unsolicited Grant Service
UL	Up Link
UMTS	Universal Mobile Telecommunications System
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
UTRAN	Universal Terrestrial Radio Access Network
WiMAX	Worldwide Interoperability for Microwave Access

4 Functional Reference Models

Figure 4-1 illustrates a reference model composed of different access networks and IP-based core networks for describing end-to-end NGN GETS call/session flows. The technology-specific access network interconnects User Equipment (UE) with one or more technology-agnostic core networks by interfacing with the UE in a manner specific to the technology, and interfacing with the core networks in a manner independent of the access technology. Core networks can be categorized as those with IMS capability and those without IMS capability. An access network connects to a core network and the core network may be interconnected to other core networks which in turn support other access networks. Additionally, a core network could serve only as a transit network between other core networks that support access networks. A view of various possible arrangements is shown in Figure 4-1, with the access networks shown in the shaded areas.

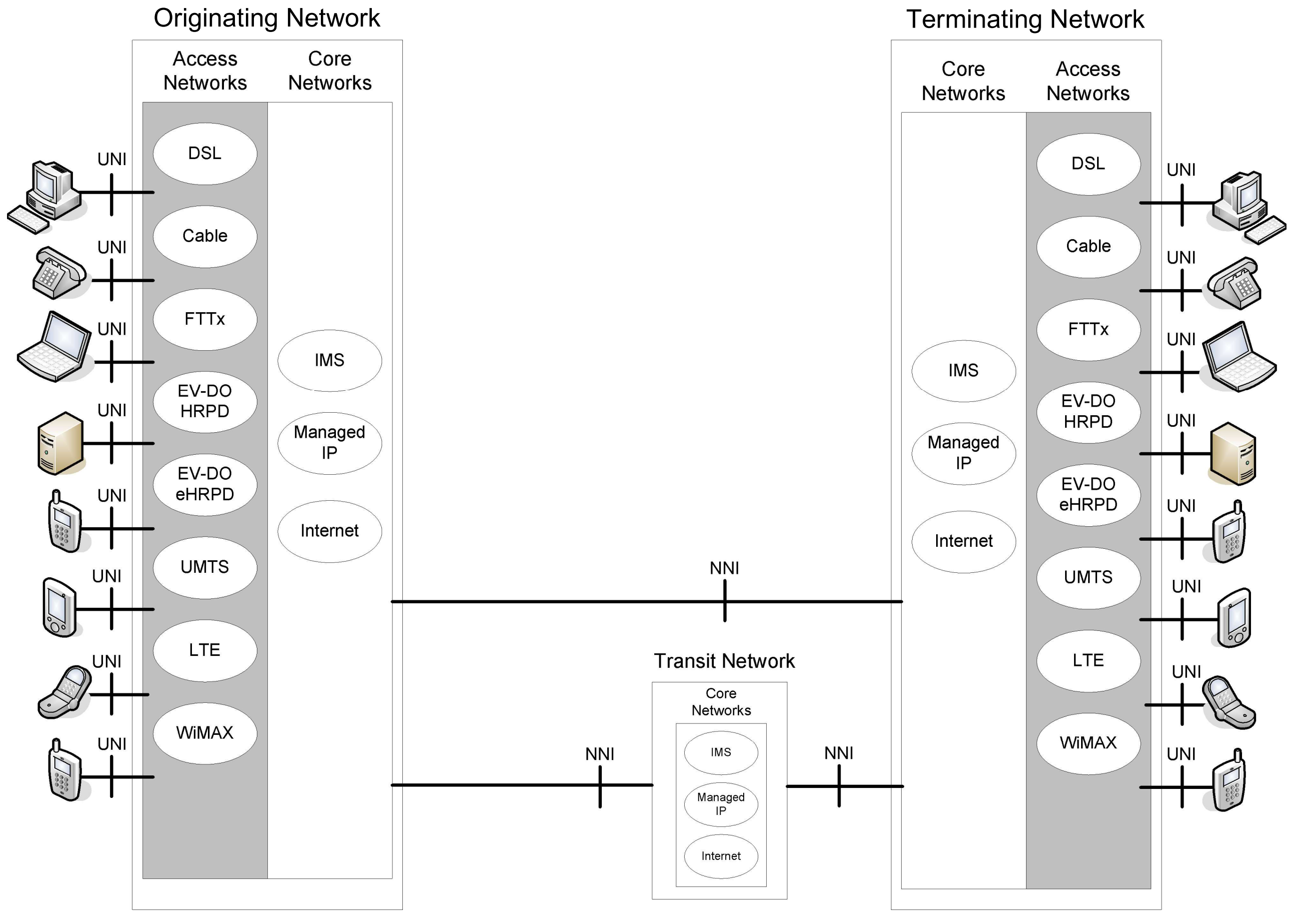

Figure 4-1 – Functional Reference Model

This document makes use of the network functional entities (e.g., P-CSCF, S-CSCF, I-CSCF, HSS, AS) described in [ATIS-1000018], [TS 23.002], and [TS 23.203]. Refer to [ATIS-1000018], [TS 23.002], and [TS 23.203] for definitions of the functional entities referenced in this document.

5 Assumptions and General Principles

5.1 Assumptions

1. Within an IP domain, an NGN GETS call/session is assigned one of five user priority levels associated with the calling Service User.
2. SIP messages are only processed by SIP proxies/UAs, and therefore the SIP Resource-Priority Header (RPH) is not processed by IP transport elements (e.g., routers).
3. Two types of core networks are considered in this document: IP-based and TDM-based.
4. An NGN GETS call/session can traverse multiple IP and TDM core networks.
5. An NGN GETS call/session originating over an IP access is authorized either in an IP or a TDM core network.
6. If both GETS Feature Code (GETS-FC) and GETS Access Number (GETS-AN) authorization occur (i.e., the calling user dials GETS-FC+ GETS-AN), the GETS-FC authorization occurs before the GETS-AN authorization.
7. The NGN GETS Service Provider’s managed access and core networks are secure.

8. The DTMF tones are carried across an IP core network in accordance with [RFC 4733].
9. The Network Elements implementing the Resource-Priority Header in SIP signaling are configured to only recognize and act upon the ets and wps namespaces within the NGN GETS Service Provider's network. Other namespaces are passed in the Resource-Priority Header but are not acted upon within the public network.
10. Use of other namespaces within private IP networks is not addressed.
11. The priority level is not available to P-CSCF at registration.
12. The Policy and Charging Rules Function (PCRF) provides functionality to support both wireline and wireless access networks.

5.2 General Principles

1. Two types of authorization functions are considered in this document.
   - GETS-AN authorization – This type of authorization is invoked when the calling user dials a GETS-AN.
     a. If the call/session is authorized in the TDM domain, after the call/session is authorized,
        i. The ISUP Calling Party's Category (CPC) parameter in the ISUP IAM is set to "NS/EP Call".
        ii. Existing TDM authorization mechanisms do not have the calling user's priority value, so the Precedence parameter is not included in the ISUP IAM. If future authorization mechanisms have the calling user's priority value, the Precedence parameter will be included in the ISUP IAM.

     b. If the call/session is authorized in the IP domain, after the call/session is authorized,
        - If the calling Service User's priority level is not available, only ets.x is created in the SIP RPH, where x is based on NGN GETS Service Provider policy[12], or
        - If the calling Service User's priority level is available, both ets.x and wps.y namespaces are created in the SIP RPH, where y is set to the calling Service User's priority level and x is based on NGN GETS Service Provider policy.
        - The value for the SIP RPH ets namespace is provisioned to a default value (referred to as "DF", with a default value of 0).
   - GETS-FC authorization – This type of authorization is invoked when the calling user dials a GETS-FC+DN.
     a. If the call/session is authorized in the TDM domain, after the call/session is authorized,
        i. The CPC parameter in the ISUP IAM is set to "NS/EP Call".
        ii. If the calling Service User's priority level is available, the ISUP Precedence parameter is included in the ISUP IAM and the Precedence level (in the Precedence parameter) indicates the Service User's priority level (precedence levels 0 – 4 corresponding to user priorities 1 – 5, respectively).

     b. If the call/session is authorized in the IP domain, after the call / session is authorized, both ets.x and wps.y namespaces are created in the SIP RPH, where y is set to the calling Service User's priority level and x is based on NGN GETS Service Provider policy.

        Successful NGN GETS authorization may result in changing the value in the wps namespace, e.g., for a GETS-FC + GETS-AN invoked call/session.

2. The ets namespace indicates an NGN GETS (GETS-AN or GETS-FC) call/session.
   - For a call/session traversing from a circuit-switched network to an IP network, the Ingress IP Gateway (IIP-GW) creates the SIP RPH ets namespace based on the presence of GETS-AN in the ISUP Called Party Number parameter or the ISUP CPC parameter coded as "NS/EP Call" in the received ISUP IAM. The IIP-GW assigns the default ets value.

[12] Policy is defined by government agency.

- The Application Server (AS) rejects the call / session request if authorization is denied.
- If the call / session cannot be authorized (e.g., due to an inability to access the authorization database in a timely manner), the AS treats the call / session request as authorized, and logs the request for subsequent analysis.
- If an NGN GETS-compliant entity cannot access the GETS AS for call / session authorization (e.g., due to a network failure), it treats the call / session request as authorized, and logs the request for subsequent analysis.

3. A successfully authorized NGN GETS call/session includes the SIP RPH with the ets namespace in addition to the “wps.y” namespace, with the priority level (y) associated with the calling Service User. For an NGN GETS call/session traversing from a circuit-switched network to an IP network, the IIP-GW maps the precedence level in the received ISUP Precedence parameter, containing an approved Multi Level Precedence and Pre-emption (MLPP) Service Domain, to the priority value in the wps namespace. The precedence level is determined during authorization of the calling Service User. The presence of the ets namespace indicates an NGN GETS call/session and triggers priority treatment. However, the priority value (x) in the “ets.x” may be used for priority treatment only in the IP domain and is not used for priority treatment on the wireless access. The wps namespace value (y) is used for priority treatment on the wireless access.
4. The wps.y namespace in the SIP RPH is transported through the IP domain to facilitate priority treatment on the wireless ingress and egress access.
    - A GETS AS may modify a received wps priority level in the SIP RPH or, if a wps namespace is not received, create a wps namespace in the SIP RPH based on Authorization Processing.
    - For a call/session traversing from an IP network to a circuit-switched network, the Egress IP Gateway (EIP-GW) shall use the priority level in the wps namespace in the SIP RPH, if present, to populate the precedence level and MLPP Service Domain of the Precedence parameter in the outgoing ISUP IAM.
    - For a call/session traversing from an IP network to a circuit-switched network, if the ets namespace is present in the SIP RPH but the wps.y namespace is not present, the EIP-GW shall not send the Precedence parameter in the outgoing ISUP IAM.

5. Processing of NGN GETS calls/sessions, including the associated signaling and media, are provided priority treatment over non-NGN GETS calls, based on the presence of ets.x in the SIP RPH of the NGN GETS signaling.
6. The ets.x RPH priority value may be used for priority treatment of NGN GETS traffic at certain interfaces, such as IP access-to-core and IP network-to-network interfaces, when connection admission control may be applied.
7. The ets.x RPH priority value may be used by SIP proxies and Back-to-Back User Agents (B2BUAs) to make routing decisions.
8. Based on NGN GETS Service Provider policy, the Session Border Control function (i.e., CCFE and BFE) facing a user may modify a received RPH ets priority level by replacing the received priority level with the provisioned default priority value.
    - The SBC function may reject a call / session with an ets RPH if the interface is not provisioned to accept call / session requests with an ets RPH. An NGN GETS call /session using an NGN GETS destination number (i.e., GETS-AN) is permitted across such interfaces.

9. All packets associated with an NGN GETS call/session shall receive priority handling:
    - In Network Elements (NEs),
    - For access to the IP backbone, and
    - Within the IP backbone.

    This priority handling is based on the presence of an ets namespace in a SIP RPH.
10. A secure mechanism that validates the identity of the far end sending network is required in order to support priority handling of packets on an IP-NNI.
11. The interaction between NEs in the processing of invalid ets namespace RPHs is based on identifying errors during testing and normal operation and by terminating the session request. This approach allows the problem NE to be identified and fixed before an NS/EP event occurs. Removing the ets and wps namespaces and using the default ets namespace value are also specified as configuration options for invalid headers.

Selection of the appropriate configuration option is via contractual arrangement between the National Communication System (NCS) and the NGN GETS Service Provider.

5.3 High Level End-to-End Call / Session Flows

Figure 5-1 illustrates an example high level end-to-end NGN GETS call/session flow. The following key steps are illustrated:

1. **Network Attachment:** This is the normal procedure for the device attachment to the access network.
2. **Device Registration:** This is the normal procedure for a device to register for services with the service provider.
3. **NGN GETS Call/Session Setup Request:** This is the request from a UE to invoke an NGN GETS call/session setup:
    - Policy control procedures may be invoked.
    - The NGN GETS call/session request is initially routed with ETS indication (and possibly default priority) for NGN GETS authentication / authorization.
4. **NGN GETS User/Subscription Authentication and Authorization:** This step involves authentication of the NGN GETS Service User or user subscription, and verifies authorization for NGN GETS.
5. **NGN GETS Call/Session Setup:** Upon NGN GETS authorization (either based on user subscription or user PIN based) and if the calling party is authorized, the NGN GETS call/session request is progressed with the Service User's priority level towards the destination UE.
    - Policy control procedures are invoked.
    - Based on policy, the priority information may be passed, removed, or modified.
    - Processing of the NGN GETS call/session, including the associated signalling and media, is provided priority treatment over a non-NGN GETS call/session based on the presence of the priority information with NGN GETS.
    - An NGN GETS call/session may transverse from an IP network to a circuit-switched network.
6. **NGN GETS Setup Completion across NNI:** This step involves NGN GETS call/session setup completion across an NNI. Priority is honored across NNI based on security policy. A secure mechanism that validates the identity of the far end sending network is required in order to support priority handling of packets on an NNI. Based on policy, the priority information may be passed, removed, or modified across the NNI.
7. **NGN GETS Call/Session Setup:** The NGN GETS call/session request is progressed towards the destination UE.

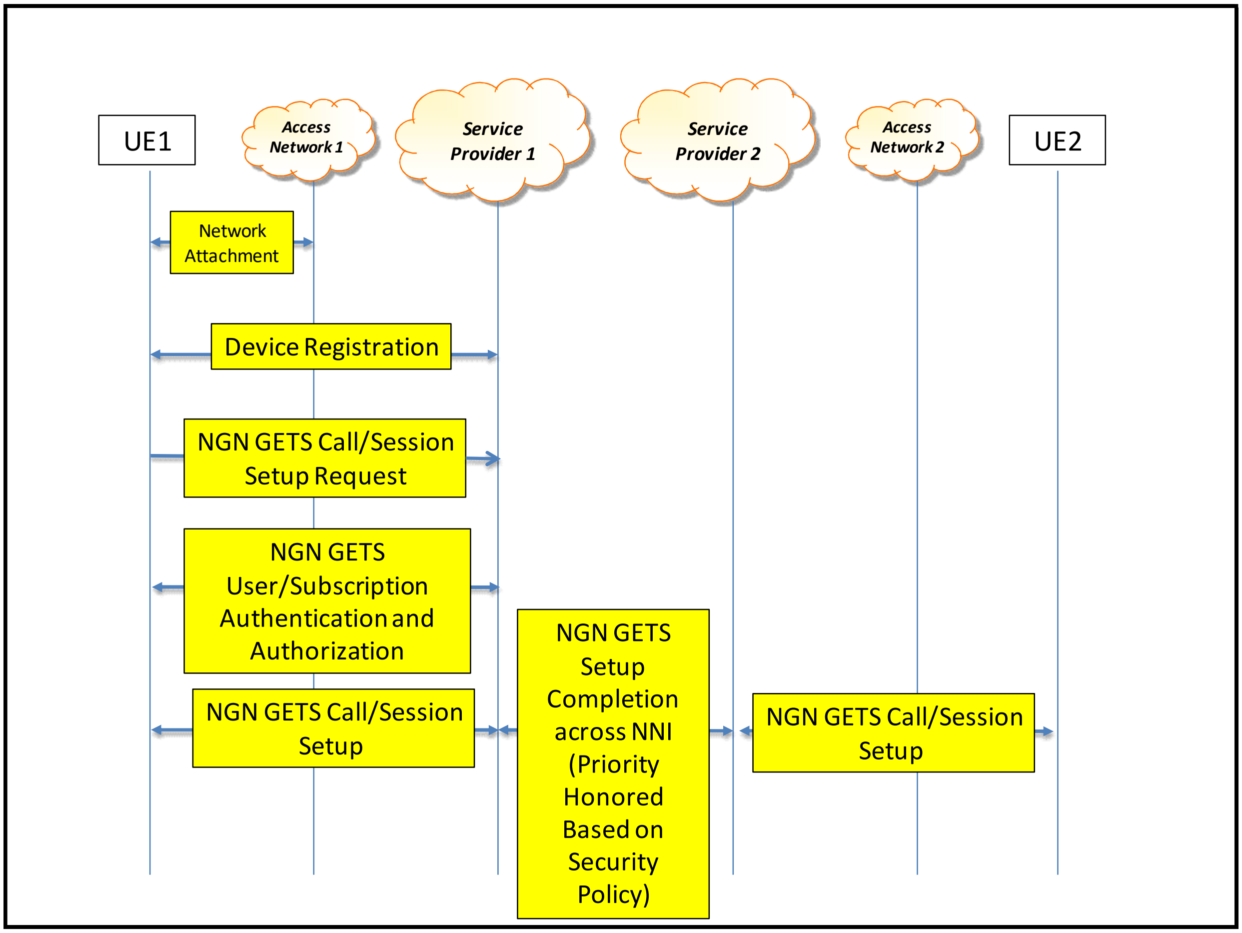

Figure 5-1 – High Level End-to-End NGN GETS Call/Session Flow

6 Detailed Segment Call/Sessions Flows

6.1 Core Network to Core Network

6.1.1 NGN GETS Call/Session Origination for GETS-FC + DN with Policy Control

This section describes the flow associated with an originating NGN GETS call/session from a Service User who enters a GETS-FC + DN to invoke NGN GETS Voice processing with policy control. For this flow, the NGN GETS call/session is originated from a UE that has previously been registered with the Core Network. The media is handled end-to-end as NGN GETS Voice traffic, and all network processing of the NGN GETS call/session is handled within a single NGN GETS Service Provider's network.

For this NGN GETS call/session flow, the SIP preconditions mechanism is used. Multiple negotiation steps are used to establish the media bearer, and the called party is not alerted until these negotiations are completed. Mechanisms are applied for the reliable transport of provisional SIP responses.

To complete the end-to-end NGN GETS call/session flow, please refer to Section 6.1.2. Figure 6-1 illustrates the associated signaling used to establish the NGN GETS call/session to the called party.

The normal IMS-based procedures as provided in 3GPP specifications are not repeated in this section.

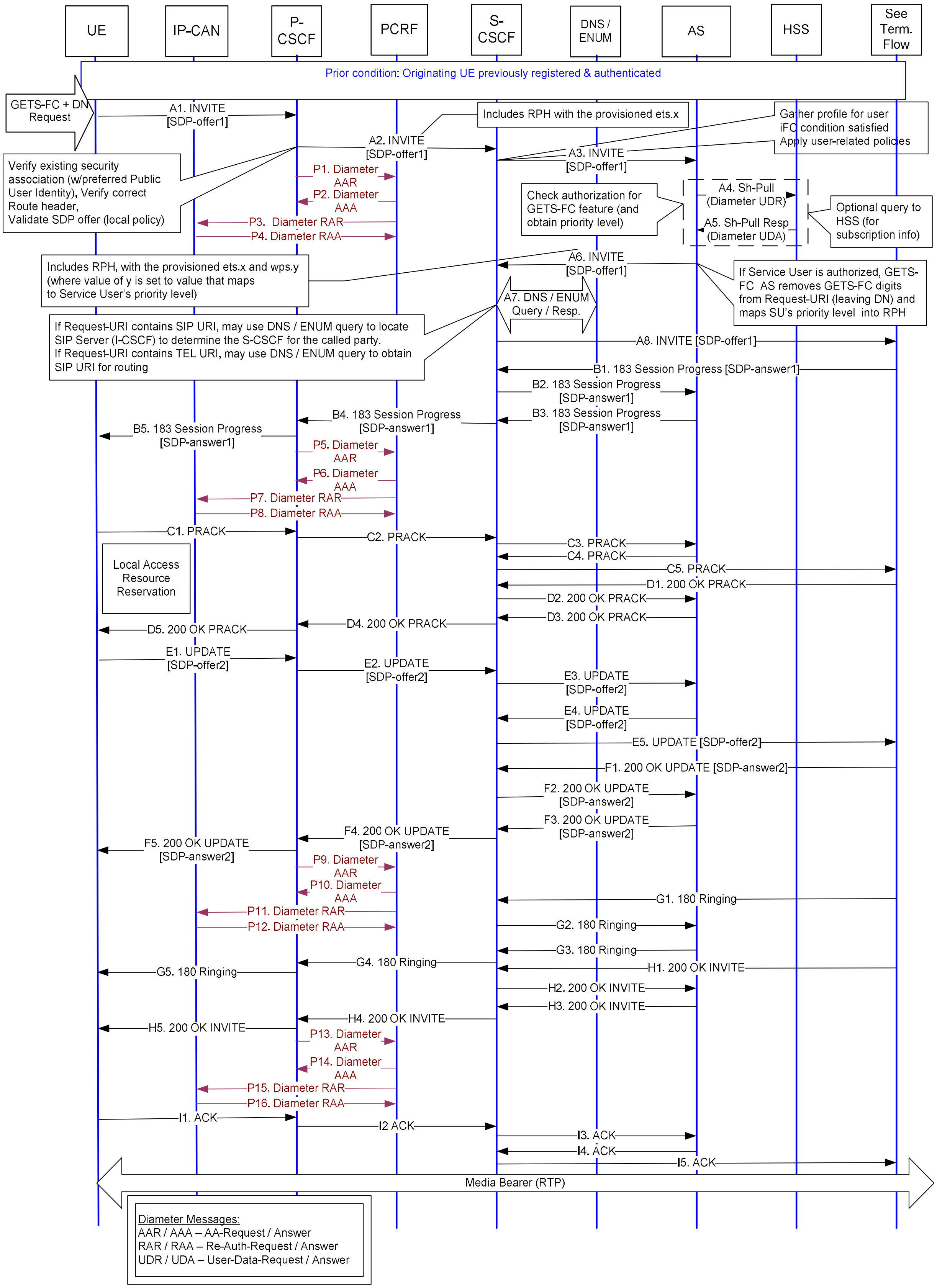

Figure 6-1 – NGN GETS Call/Session Origination for GETS-FC + DN – Policy Control

A summary of this processing is provided below:

When the originating Service User enters a GETS-FC + DN, the UE sends a SIP INVITE request to the Proxy CSCF (P-CSCF) [step A1]. Note that SIP 100 Trying responses are excluded (throughout this and subsequent figures), to minimize clutter.

At this point, NGN GETS Voice-specific processing is required to allow the P-CSCF to detect the GETS-FC invoked call/session origination, in order to apply priority treatment and to include NGN GETS priority marking(s). This processing is discussed further in Section 6.1.1.1.

The P-CSCF may contact the Policy and Charging Rules Function (PCRF) to enforce Policy and Charging Control (PCC). The P-CSCF provides information concerning the flow(s) of interest to the PCRF in the Diameter Authentication/Authorization (AA) Request (AAR) message [step P1]. The Diameter AAR message includes Session Information which uses the MPS-Identifier AVP (to indicate that this is an MPS call/session) and a Reservation-Priority AVP [TS 183.017] (set to a default value when the priority level of the originating Service User is unknown) at the session level. Since the PCC interaction is based on the Session Description Protocol (SDP) offer from the SIP INVITE request, the Diameter AAR message includes the Service-Info-Status AVP set to the "PRELIMINARY SERVICE INFORMATION" value.

Upon receipt of the MPS-Identifier AVP, the PCRF recognizes that this request is associated with an NGN GETS call / session and should be given priority treatment consistent with the Service User's priority level contained within the Reservation-Priority AVP. The PCRF stores the Media-Component-Description AVP values (e.g., media type and maximum required bandwidth), in addition to the MPS-Identifier AVP and Reservation-Priority AVP values, and identifies the affected IP-CAN session. The PCRF responds to the P-CSCF [step P2] with a Diameter AA-Answer (AAA) message, indicating the disposition of the Diameter AAR message.

As an option for NGN GETS Voice originations for particular wireless access technologies, the PCRF checks if the Default Bearer and IMS Signalling Bearer are set for the appropriate priority treatment. If the Allocation-Retention-Priority (ARP) of the Default Bearer and IMS Signalling Bearer is not appropriate for the Service Users priority level, then the PCRF modifies the ARP of the Default and IMS Signalling Bearer to a value appropriate for the Service Users priority level for this NGN GETS session, via appropriate population of the QoS-Class-Identifier (QCI) and ARP AVPs in the Diameter Re-Auth-Request (RAR) message [step P3].

The IP-CAN installs the policy information received from the PCRF, and applies the policy to subsequent packets. The IP-CAN responds to the PCRF with a Diameter Re-Auth-Answer (RAA) [step P4].

The P-CSCF routes the SIP INVITE request (with the SIP RPH indicating NGN GETS) to the Serving CSCF (S-CSCF) [step A2], and the S-CSCF checks whether any initial Filter Criteria (iFC) (as set for the originating user) are satisfied.

> NOTE: Whereas Figure 6-1 illustrates [step A2] at the same time as the PCC processing, [step A2] can alternately occur after [step P2]. Similarly, other SIP signaling steps can occur at the same time or after PCC processing is performed.

At this point, the iFC condition associated with GETS-FC + DN invoked call/session originations (as established during the prior IMS registration) is detected. Thus, the S-CSCF sends the SIP INVITE request to the AS [step A3]. Unique aspects of the S-CSCF processing for NGN GETS Voice are discussed further in Section 6.1.1.1.

Note that other originating supplementary services may be invoked at this point in the NGN GETS call/session flow.

The AS invokes NGN GETS Voice-specific processing to determine if the calling party is authorized to originate the NGN GETS call/session. Various options can be used by the AS to obtain subscription information to enable this authorization:

1. The AS may use locally-stored information (specific to the GETS-FC capability) to authorize the calling party (and to determine their priority level).
2. Subscription information may optionally be maintained in the HSS, separate from the corresponding iFC information. The AS (via the Sh interface) can fetch such information from the HSS via the Diameter User-Data-Request (UDR) message (as depicted in steps A4 and A5), with the subscription information returned via the User-Data AVP of the corresponding UDA message.

If the calling party is authorized (as illustrated in Figure 6-1), the AS applies priority treatment and includes the SIP RPH (with an ets.x value indicating NGN GETS, and with an appropriate wps.y value associated with the Service User's priority level) in the SIP INVITE request returned to the S-CSCF [step A6] and on towards the destination UE. Note that the SIP RPH is maintained in all subsequent SIP messages, resulting in associated priority treatment (as defined for each SIP-capable FE that is traversed by this and subsequent SIP messages for this NGN GETS call/session).

The S-CSCF subsequently applies normal IMS procedures to route the SIP INVITE request to the called party. In this scenario, the called party is located in the same NGN GETS Service Provider network as the originating Service User.

Upon sending a SIP INVITE request containing an initial SDP offer, a SIP 183 Session Progress response is received, containing the initial SDP answer from the destination end. In this scenario, the SIP 183 response provides the final codec selection. When the P-CSCF receives this response [step B4], containing the SIP RPH which indicates that this is an NGN GETS call /session, the P-CSCF sends a Diameter AAR message [step P5] that includes the MPS-Identifier AVP and the Reservation-Priority AVP (mapped based on the wps.y value in the SIP RPH) at the session level.

Upon receiving the Diameter AAR message, the PCRF checks the request against the policy rules and, if the request is approved, updates the policies for the IP-CAN [step P7]. In determining the policy for the IP-CAN, the PCRF may apply local network policy. The policy will affect the allocation of bearer resources. The PCRF provides policy information (i.e., PCC rules) to the IP-CAN via the Charging-Rule-Definition AVP in the Diameter Re-Auth-Request (RAR) message. PCC rules can define gate functions that enable or disable the forwarding of service flow packets via the IP-CAN. The PCRF can activate or deactivate a PCC rule that is predefined in the IP-CAN, can install or modify a PCRF-provisioned PCC rule, or remove a previous PCRF-provisioned PCC rule. Based on inclusion of the MPS-Identifier AVP in the Diameter AAR message, the PCRF recognizes that this request is associated with an NGN GETS call / session and determines that the associated media bearer (based on the Media-Type AVP value) should be given priority treatment consistent with the Service User's priority level (as reflected in the value of the Reservation-Priority AVP). For NGN GETS Voice, the PCRF triggers the IP-CAN to subsequently apply priority treatment for transport layer voice packets, via appropriate population of the QCI and ARP AVPs in a Diameter RAR message [step P7]. This processing is illustrated in steps P5 through P8.

Note that parallel operation can be invoked at steps P5 and B5, leading to the exchange of SIP PRACK and SIP 200 OK messages (steps C and D) while policy control (steps P5 through P8) is performed.

Steps C through G are as described in 3GPP specification [TS 23.228].

Note that Diameter interactions (and PCC processing) may be initiated at other points in the flow (e.g., after [step E1] in Figure 6-1). This and other call/session flows in this document are illustrative, and are not intended to be exhaustive.

The UE may be preconfigured to set the QoS preconditions in the SIP INVITE request to meet the desired resource reservations. Similarly, the SIP 183 Progress message may include preconditions set by the remote UE. The UE waits until resource allocation is completed, before sending the SIP UPDATE request.

When the P-CSCF receives a SIP 200 OK UPDATE [step F4], the P-CSCF may again contact the appropriate PCRF to update the policy information. This processing is illustrated in steps P9 through P12, analogous to steps P5 through P8 above. Note that the P-CSCF can send the SIP 200 OK UPDATE to the UE at the same time that the PCC processing (Diameter messages exchanged in steps P9 through P12) is performed.

When the P-CSCF subsequently receives a SIP 200 OK response (indicating that the called party has answered) in step H4, the P-CSCF requests the PCRF to open the corresponding gate for the media flow.

The P-CSCF requests the PCRF to enable the media flow via the Diameter AAR message. This message [step P13] includes the Media-Component-Description AVP that contains the flow status information for the flow to be enabled. The PCRF responds to the P-CSCF with a Diameter AAA message [step P14], indicating the disposition of the request, and directs the IP-CAN [step P15] to open the gate via the Diameter RAR message. The IP-CAN responds to the PCRF with a Diameter RAA message [step P16]. Note that the P-CSCF can send the SIP 200 OK INVITE to the UE the same time that the PCC processing (Diameter messages exchanged in steps P13 through P16) is performed.

Note that session release steps are analogous to those as illustrated in steps J, P17 through P20, and K in Figure 6-2 and are not illustrated.

6.1.1.1 Relevant NGN GETS Aspects

This section highlights NGN GETS Voice–specific processing for each FE, based on the NGN GETS call/session flow as described in Figure 6-1.

P-CSCF

A. ***Recognize a received SIP INVITE request that corresponds to a GETS-FC invoked call/session request***
This is based on detection of the GETS-FC in the Request-URI of the SIP INVITE request.

B. ***Apply priority treatment for processing and signaling related to an NGN GETS call/session***
The P-CSCF applies priority treatment, in processing the signaling messages and NGN GETS call/session.

C. ***Mark the outgoing SIP INVITE request for a GETS-FC invoked call/session with NGN GETS priority marking(s)***
The SIP RPH is added to the outgoing SIP INVITE request. The priority of the transport layer signaling packets is set appropriately.

D. ***Control Usage of NGN GETS priority marking(s) received in SIP messages from a UE***
The P-CSCF should inspect messages that contain the RPH with the ets namespace and perform policing of those messages.

E. ***Mark Diameter messages related to an NGN GETS call/session with NGN GETS priority marking(s)***
To support policy control, the P-CSCF queries the PCRF. For an NGN GETS call / session, the MPS-Identifier, Reservation-Priority, and Media-Type AVPs are included in the Diameter AAR message that requests priority handling in the PCRF. Priority treatment is applied for the marking and transport of these messages. The priority of the transport layer signaling packets is set appropriately. When the PCC interaction is based on the Session Description Protocol (SDP) Offer from the SIP INVITE, the Diameter AAR message includes the Service-Info-Status AVP set to the “PRELIMINARY SERVICE INFORMATION” value.

S-CSCF

A. ***Apply iFC to trigger on GETS-FC for recognition and routing***
The S-CSCF applies iFC to recognize a GETS-FC invocation. Depending on Service Provider configuration, the trigger results in routing to the AS.

B. ***Recognize a received SIP message that corresponds to an NGN GETS call/session***
This is based on detection of the RPH (with a valid ets namespace) in a received SIP message.

C. ***Apply priority treatment for processing and signaling related to an NGN GETS call/session***
The S-CSCF applies priority treatment, in processing the signaling messages and NGN GETS call/session.

D. ***Mark the outgoing SIP messages for an NGN GETS call/session with NGN GETS priority marking(s)***
The RPH, with the ets and wps namespaces (if available) as received from the AS, is sent to all subsequent FEs involved in the NGN GETS call/session. The priority of the transport layer signaling packets is set appropriately.

NOTE: The ets namespace may be present without a corresponding wps namespace in the SIP RPH.

PCRF

A. ***Apply priority treatment for processing and signaling related to an NGN GETS call/session***
The PCRF applies priority treatment, in processing the signaling messages related to an NGN GETS call/session.

B. ***Mark Diameter messages related to an NGN GETS call/session with NGN GETS priority marking(s)***
To support policy control, priority treatment is applied for the marking and transport of the Diameter messages exchanged between the PCRF and the P-CSCF and between the PCRF and the IP-CAN. For an NGN GETS call/session, the Reservation-Priority AVP (for wireline access) or the Allocation-Retention-Priority AVP (for wireless access) is included in the Diameter message to request preferential

handling in the IP-CAN for the corresponding bearer connection. The priority of the transport layer signaling packets is set appropriately.

AS

The AS functionality supports the NGN GETS Voice-specific service logic required to control the processing of a GETS-FC invoked call/session. The following list summarizes some of its primary roles and highlights several unique aspects (potentially requiring capabilities that might not otherwise be supported on a general AS platform for use by other applications).

A. ***Control a GETS–FC call/session***
Upon receipt of a SIP INVITE request that contains a GETS-FC within the Request-URI, the AS applies service logic to authorize and control the GETS–FC invoked call/session. If the GETS-FC invoked call/session is authorized, the AS removes the GETS-FC prefix from the received Request-URI, and populates the outgoing Request-URI with the DN. If the AS uses shared resources that are also used for other applications, priority processing is applied, as noted in item D, below.

B. ***Access NGN GETS Voice subscription information (e.g., Service User's priority level) for NGN GETS-FC Service Users***
This may entail local storage of such information at the AS. Optionally, this may entail the retrieval of such information from an HSS (see related item C, below).

C. ***Mark Diameter messages related to an NGN GETS call/session with NGN GETS priority marking(s)***
If the option of information retrieval from an HSS is chosen, priority treatment is applied for the marking and transport of these Diameter messages. The priority of the transport layer signaling packets is set appropriately.

D. ***Apply priority treatment for processing and signaling related to an NGN GETS call/session***
If the AS uses shared resources that are also used for other applications, the AS applies priority treatment, in processing the signaling messages and NGN GETS call/session.

E. ***Mark the outgoing SIP messages for an NGN GETS call/session with NGN GETS priority marking(s)***
After NGN GETS authorization, the AS includes the RPH in the outgoing SIP INVITE request, populated with the ets.x and with wps.y. The value of y in the wps.y is set to the value corresponding to the Service User's priority level. The RPH, with the ets and wps namespaces, is propagated to all subsequent FEs involved in the NGN GETS call/session. The priority of the transport layer signaling packets is set appropriately.

HSS

A. ***Maintain user profiles for NGN GETS-FC Service Users***
The HSS stores the user profile for an NGN GETS-FC Service User. An important component of those user profiles is the inclusion of (appropriately-populated) iFC, as required to trigger the corresponding AS processing. Note that this represents normal IMS behavior for an HSS – and thus does not require any NGN GETS Voice-specific capabilities.

B. ***Storage of NGN GETS Voice subscription information (e.g., Service User's priority level) for NGN GETS-FC Service Users***
The HSS may optionally store such information, to allow the AS to retrieve it.

C. ***Detect Diameter messages containing NGN GETS priority marking(s)***
This is based on detection of the Session-Priority AVP in a received Diameter message.

D. ***Apply priority treatment for processing and signaling related to an NGN GETS call/session***
The HSS applies priority treatment, in processing the signaling messages related to an NGN GETS call/session.

6.1.2 NGN GETS Call/Session Termination

This section describes the flow associated with the called party portion of an NGN GETS call/session. This material only illustrates the signaling within the home network of the called party, and onward toward the called party's access network.

For the flow illustrated in Figure 6-2, the NGN GETS call/session is terminated at a UE that has previously been registered with the Core Network.

This section covers the NGN GETS call/session establishment for the scenario when a calling Service User has entered a GETS-FC + DN. The NGN GETS call/session flow described in this section also applies to GETS-AN invoked call/session establishment scenarios.

The normal IMS-based procedures as provided in 3GPP specifications are not repeated in this section.

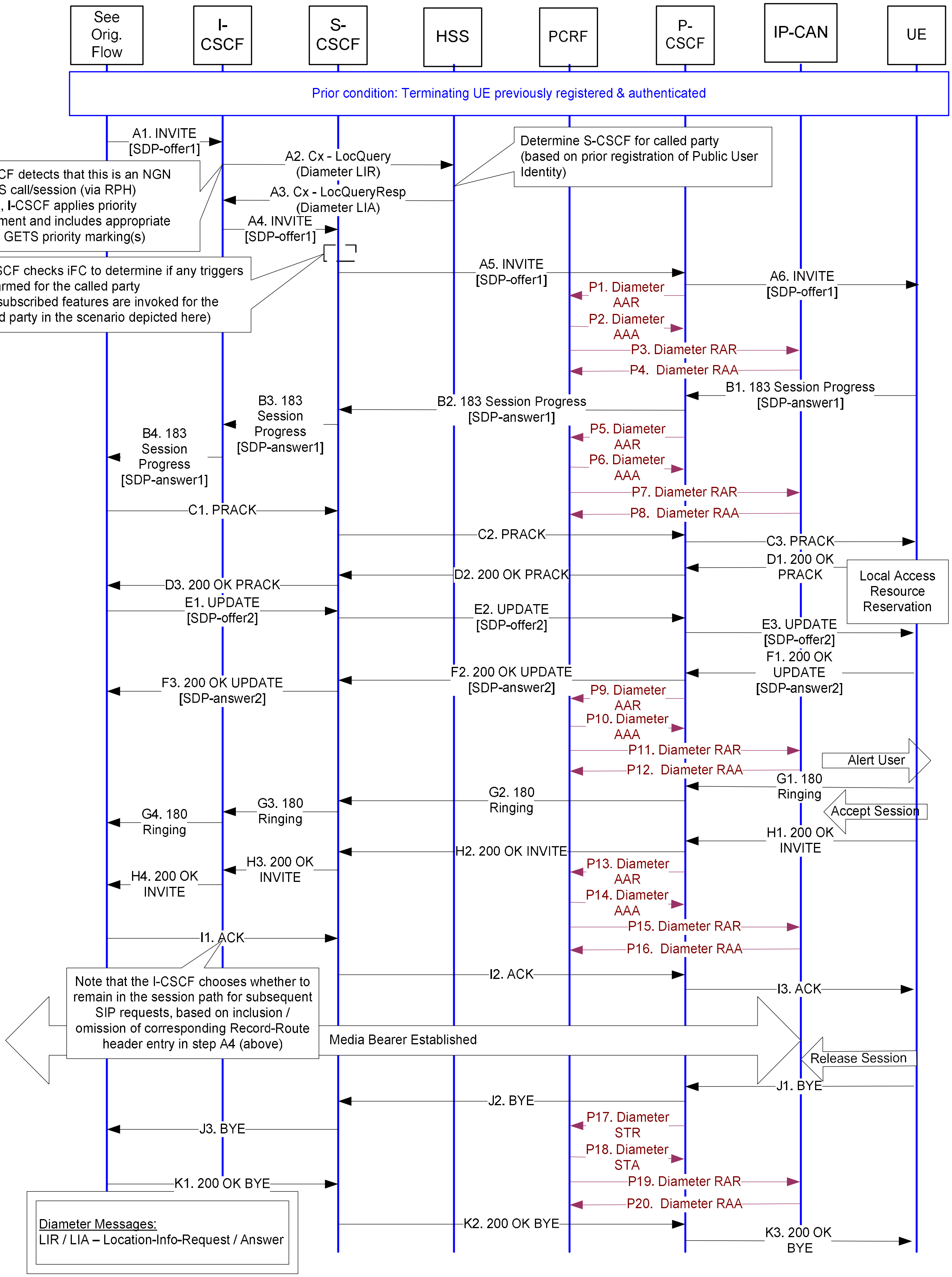

Figure 6-2 – NGN GETS Call/Session Termination

A summary of this processing is provided below:

When a SIP INVITE request arrives at the Interrogating CSCF (I-CSCF) in the called party's home network [step A1], NGN GETS Voice-specific processing is required to allow the I-CSCF to detect the NGN GETS call/session origination, in order to apply priority treatment and to include NGN GETS priority marking(s). This processing is described in Section 6.1.2.1. The I-CSCF queries the called party's HSS to determine which S-CSCF is currently assigned to the called party. The I-CSCF and the HSS apply priority treatment to the corresponding Diameter LIR/LIA message processing, as discussed in Section 6.1.2.1. When the SIP INVITE request is routed from the I-CSCF to the S-CSCF, the S-CSCF retrieves the called party's user profile, and determines if any iFC conditions are satisfied. This would result in the invocation of supplementary services on behalf of the called party, if any are active. No such features are presumed active in the scenario depicted in Figure 6-2.

The S-CSCF then routes the SIP INVITE request to the P-CSCF [step A5], based on information retained from the prior registration. When the P-CSCF receives the SIP INVITE request, the P-CSCF may initiate PCC processing [steps P1 through P4], analogous to the corresponding steps as described in Section 6.1.1. Note that the P-CSCF can send the SIP INVITE request onward (to the terminating IP-CAN) at the same time that the PCC processing (Diameter messages exchanged in steps P1 through P4) is performed. The SIP INVITE request contains an SDP offer, used to request particular media capabilities for the new session. This may cause a sequence of offer/answer message exchanges, as illustrated in steps A/B and E/F in Figure 6-2. The SIP INVITE request is sent by the P-CSCF to the terminating UE through the IP-CAN. When the SIP 183 Session Progress response is received by the P-CSCF [step B1], the P-CSCF invokes policy control procedures [steps P5 through P8]. Note that some of the messages illustrated in Figure 6-2 (e.g., SIP UPDATE request and SIP 200 OK response in steps E and F) may be omitted for particular scenarios. When the SIP 200 OK UPDATE response is received by the P-CSCF [step F1], the P-CSCF may invoke policy control procedures [steps P9 through P12].The called party is alerted [step G] and eventually answers [step H]. Policy control procedures are invoked in order to open [steps P13 through P16] the gate when the P-CSCF receives the SIP 200 OK response to the SIP INVITE request [step H1]. In this scenario, NGN GETS call/session release is subsequently initiated by the called party, resulting in the SIP BYE request [step J]. Policy control procedures are invoked again [steps P17 through P20] when the P-CSCF receives the SIP BYE request [step J1] to close the corresponding gate.

6.1.2.1 Relevant NGN GETS Aspects

This section highlights NGN GETS Voice–specific processing for each FE, based on the NGN GETS call/session flow as described in Figure 6-2.

I-CSCF

A. ***Recognize a received SIP INVITE request that corresponds to an NGN GETS call/session request***
For scenarios involving the reception of a SIP INVITE request from a trusted entity, the I-CSCF recognizes the call/session request as an NGN GETS call/session based on the presence of an RPH (with a valid ets namespace) in the SIP INVITE request.

B. ***Apply priority treatment for processing and signaling related to an NGN GETS call/session***
The I-CSCF applies priority treatment, in processing the signaling messages and NGN GETS call/session (e.g., allocating local resources in a priority fashion).

C. ***Mark the outgoing SIP messages for an NGN GETS call/session with NGN GETS priority marking(s)***
The SIP RPH, with the ets and wps namespaces (if available) as received, is sent to all subsequent FEs involved in the NGN GETS call/session. The priority of the transport layer signaling packets is set appropriately.

NOTE: The ets namespace may be present without a corresponding wps namespace in the RPH.

D. ***Mark Diameter messages related to an NGN GETS call/session with NGN GETS priority marking(s)***
For NGN GETS call/session terminations, the I-CSCF queries the HSS to locate the S-CSCF associated with the called party (as illustrated in steps A2 and A3 of Figure 6-3). Priority treatment is applied for the marking and transport of these messages.

E. ***Control Usage of NGN GETS priority marking(s) received in SIP messages from other networks***
When the I-CSCF functionality is incorporated into an entity that provides interconnection with another VoIP network, that entity needs to control the usage of NGN GETS priority marking(s) in SIP messages exchanged with other networks. Such functionality is supported via corresponding IBCF functionality. Note that the IBCF and I-CSCF functionality may be combined into a common element for some deployments or if the I-CSCF is connected to the NNI, it will need the IBCF functions.

S-CSCF

No additional S-CSCF capabilities are required, beyond the S-CSCF capabilities as described for S-CSCF in Section 6.1.1.1.

HSS

A. ***Apply priority treatment for processing and signaling related to an NGN GETS call/session***
Priority HSS processing is applied for this operation, analogous to that described in item [C] for HSS in Section 6.1.1.1.

B. ***Mark Diameter messages related to an NGN GETS call/session with NGN GETS priority marking(s)***
For NGN GETS call/session terminations, the HSS is queried by the I-CSCF to locate the S-CSCF associated with the called party (as illustrated in steps A2 and A3 of Figure 6-2). Priority treatment is applied for the marking and transport of the Diameter messages, analogous to that described for item [D] of HSS in Section 6.1.1.1.

P-CSCF

A. ***Recognize a received SIP message that corresponds to an NGN GETS call/session***
This is based on detection of the RPH (with a valid ets namespace) in a SIP message received from another FE or based on RPH state information previously retained for that SIP dialog.

B. ***Apply priority treatment for processing and signaling related to an NGN GETS call/session***
The P-CSCF applies priority treatment, in processing the signaling messages and NGN GETS call/session (e.g., allocating local resources in a priority fashion).

C. ***Control Usage of NGN GETS priority marking(s) received in SIP messages from a UE***
Same as item [D] of P-CSCF in Section 6.1.1.1.

D. ***Mark the outgoing SIP messages for an NGN GETS call/session with NGN GETS priority marking(s)***
The SIP RPH, with the ets and wps namespaces (if available), is included in subsequent SIP messages associated with the NGN GETS call/session. The priority of the transport layer signaling packets is set appropriately.

NOTE: The ets namespace may be present without a corresponding wps namespace in the RPH.

E. ***Mark Diameter messages related to an NGN GETS call/session with NGN GETS priority marking(s)***
For an NGN GETS call/session, the MPS-Identifier and Reservation-Priority AVPs are included in the Diameter AAR message that requests priority handling in the PCRF. Priority treatment is applied for the marking and transport of these messages. The priority of the transport layer signaling packets is set appropriately.

PCRF

No additional PCRF capabilities are required, beyond the PCRF capabilities as described in Section 6.1.1.1.

6.1.3 NGN GETS Call/Session Origination for GETS-AN

This section describes the flow associated with an originating NGN GETS call/session from a Service User who enters a GETS-AN to invoke NGN GETS service processing. For this flow, the NGN GETS call/session is originated from a UE that has previously been registered with the Core Network. The media is handled end-to-end as NGN GETS Voice traffic, and all network processing of the NGN GETS call/session is handled within an NGN GETS Service Provider network.

This flow is based on 3GPP specifications, but has been simplified to exclude specific references to the SIP provisional messages used to convey interim information prior to call/session establishment and has been expanded to illustrate how an AS is invoked to control the NGN GETS Voice processing for this NGN GETS call/session.

The normal IMS-based procedures as provided in 3GPP specifications are not repeated in this section.

This section illustrates the use of an AS for supporting a GETS-AN invoked call/session. This flow is sub-divided into three separate figures.

- Figure 6-3 illustrates the overall procedures associated with processing on behalf of the originating Service User.
- Figure 6-4 illustrates the use of a Media Resource Function Controller (MRFC) and Media Resource Function Processor (MRFP), to collect PIN and DN digits from the calling party.
- Figure 6-5 illustrates the subsequent establishment of an NGN GETS call/session to the called party, using Third-Party Call Control (3PCC) procedures.

Note that Figure 6-3 through Figure 6-5 only illustrate the signaling that is encountered on behalf of the originating Service User. Signaling within the home network of the called party, and onward toward the called party's access network, is analogous to that illustrated in Figure 6-2 of Section 6.1.2, and is not repeated here.

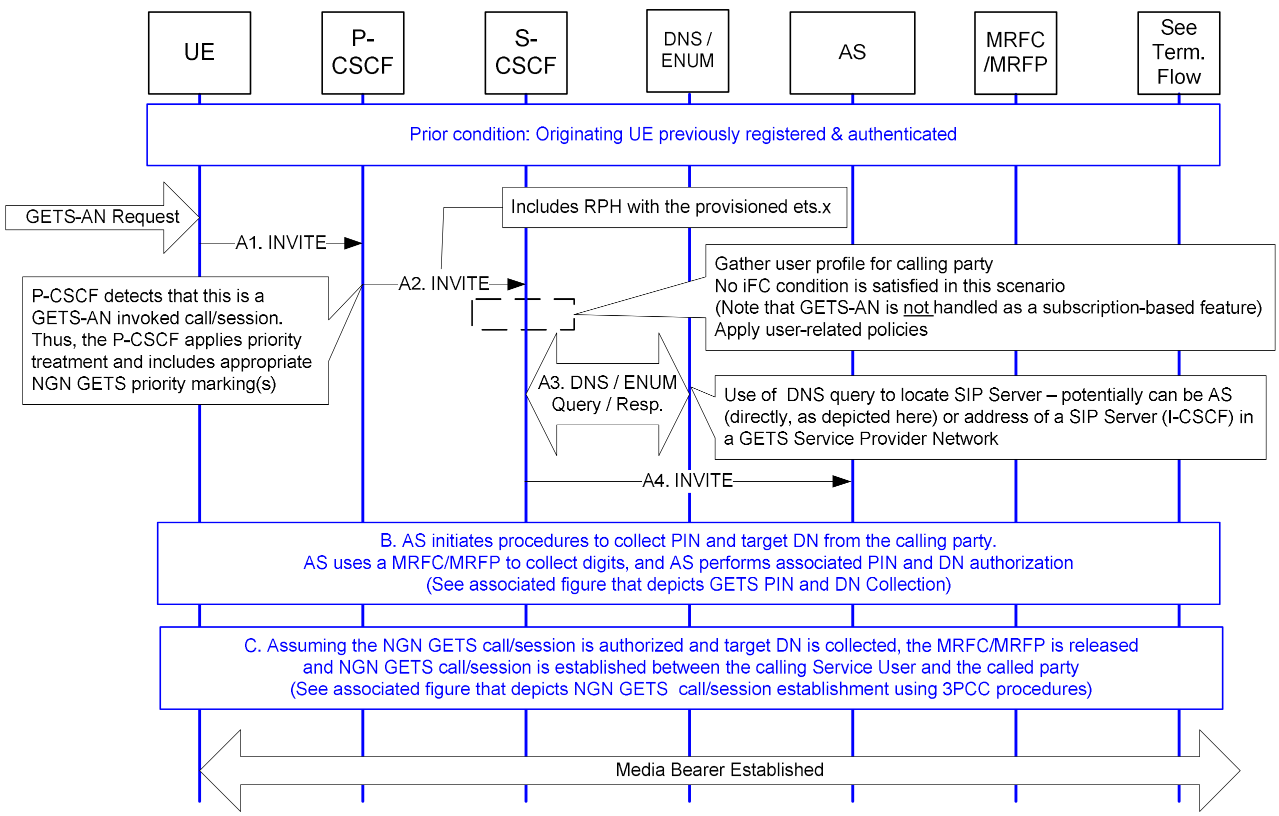

Figure 6-3 – NGN GETS Call/Session Origination for GETS-AN

A summary of this processing is provided below:

When the originating Service User enters a GETS-AN, the UE sends a SIP INVITE request to the P-CSCF [step A1].

At this point, the P-CSCF detects the GETS-AN invoked call/session origination, applies priority treatment, and includes NGN GETS priority marking(s). This processing is discussed further in Section 6.1.3.1.

The P-CSCF routes the SIP INVITE request (with the NGN GETS priority marking(s)) on to the S-CSCF [step A2]. The S-CSCF checks the originating Service User's profile to determine if any iFC conditions are satisfied. This would result in the invocation of supplementary services on behalf of the originating Service User, if any are active. No such features are presumed active in the scenario depicted in Figure 6-3. Note that GETS-AN is not a subscription-based feature, so the iFC triggering mechanism is not used to detect the GETS-AN trigger condition for the scenario depicted here.

Treating the GETS-AN as the destination number, the S-CSCF applies normal IMS procedures to route the SIP INVITE request to an appropriate FE. A DNS/ENUM query for an address associated with the GETS-AN [step A3] yields the address of the AS that has the GETS feature, causing the S-CSCF to route the SIP INVITE request directly to the AS [step A4].

Note that Figure 6-3 illustrates one possible mechanism for implementing what might be viewed as the IMS equivalent of an "office-based feature". Since the GETS-AN invocation is not subscription-based, Figure 6-3 avoids the need to populate associated iFC in the user profile for all individual IMS subscribers. In Figure 6-3, the S-CSCF is instructed to route the SIP INVITE request on toward the AS when it attempts to locate (via the DNS/ENUM query in step A3) the destination number. (In this case, the destination number corresponds to the GETS-AN.)

As an alternative to the above, Figure 6-6 in Section 6.1.4 illustrates a scenario where the GETS-AN is treated as a Public Service Identity (PSI). Such a scenario would enable the AS processing (i.e., control of user interactions for PIN collection and DN collection, plus associated authorization procedures) to be performed outside the home network of the calling user. This might enable a GETS-AN call/session to be handled in a centralized manner for authorization and authentication. Whereas Figure 6-6 describes such processing for an inter-network scenario, that same flow (excluding any IBCFs that might be used for an inter-network scenario) is also valid for an intra-network scenario, as an alternative to the NGN GETS call/session flow illustrated in Figure 6-3.

Upon receiving the SIP INVITE request, the AS invokes GETS-AN-specific processing to collect PIN and DN digits from the calling party. This processing, as illustrated in step B of Figure 6-3, is expanded in Figure 6-4. For the scenario illustrated in Figure 6-4, the signaling between the AS and the MRFC/MRFP is sent via the S-CSCF. Such signaling can alternately be exchanged directly between the AS and the MRFC/MRFP.

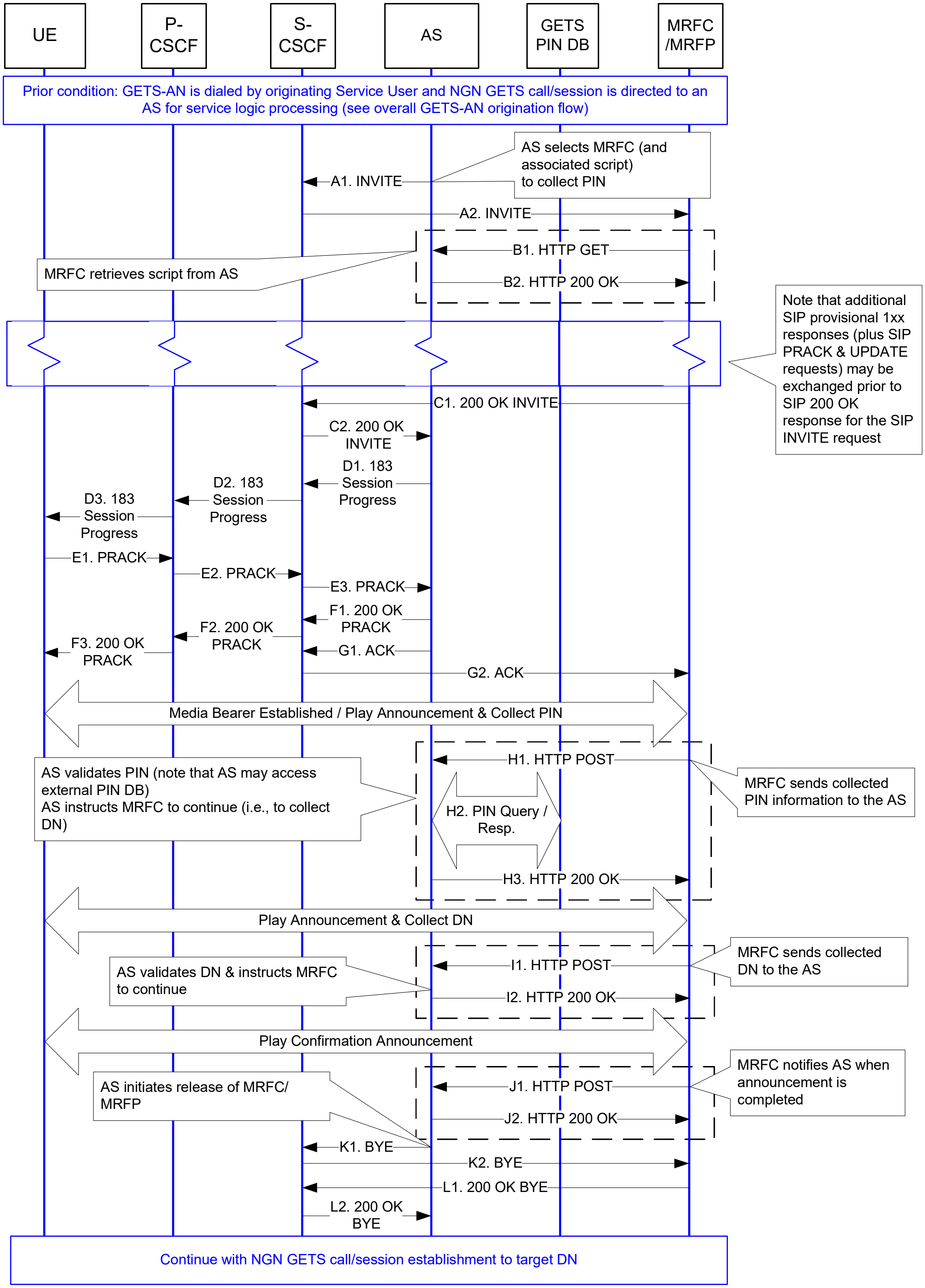

Figure 6-4 – Collection of GETS PIN and DN (step [B] of Figure 6-3)

For the scenario depicted in this section, the AS controls the use of an MRFC/MRFP for collection of dialled digits (representing the PIN and the target DN, entered by the calling party) via scripts (transported via HTTP). In this case, the MRFC/MRFP is capable of playing announcements and collecting dialled digits, with the PIN validation performed by the AS.

Note that the use of scripts and HTTP is not required, but is used to illustrate one potential realization of the required GETS-AN functionality. Other protocols and procedures can be used to support these user-MRFP interactions (e.g., based on other AS and MRFC/MRFP technologies as deployed for other applications).

Upon receipt of the SIP INVITE request, the AS determines the particular MRFC (and selects a service script) to be used for the GETS-AN processing. The AS applies priority treatment and includes NGN GETS priority marking(s) when sending a new SIP INVITE request to the MRFC via the S-CSCF [steps A1 and A2], as discussed in Section 6.1.3.1. Similarly, the MRFC/MRFP applies priority treatment when supporting these GETS-AN user interactions, as discussed in Section 6.1.3.1. The MRFC retrieves the script from the AS [steps B1 and B2]. After a series of provisional SIP responses (and any associated SIP PRACK or other SIP messages) are optionally exchanged, the MRFC returns a SIP 200 OK response to the AS [steps C1 and C2]. The AS, acting in B2BUA mode, manages the NGN GETS call/session establishment towards the originating side, using the SDP information supplied by the MRFC. The AS sends a SIP 183 Session Progress response for the original SIP INVITE request [steps D1 through D3]. In the scenario illustrated in Figure 6-6, reliable transport of provisional responses is used, where the SIP 183 response is acknowledged via a SIP PRACK message [steps E1 through E3]. The AS sends a SIP 200 OK response to the received SIP PRACK message [steps F1 through F3]. The AS sends a SIP ACK to the MRFC [steps G1 and G2]. Priority treatment is applied when establishing a media bearer between the calling party and the MRFC/MRFP and for the subsequent digit collection. The MRFC controls the collection of a PIN from the calling party, using capabilities of the MRFP.

Once the resulting (PIN) digits are received by the MRFP, they are passed by the MRFC to the AS, via an HTTP POST operation [step H1]. The AS validates the received PIN and, if valid, gathers the associated Service User profile information. The AS may use locally-stored information (specific to the GETS-AN processing) to validate the PIN (and to retrieve the corresponding GETS-AN profile), or such information may optionally be maintained in a centralized GETS PIN DB (allowing the AS to fetch such information from the GETS PIN DB [step H2]). If a centralized GETS PIN DB is used, the AS queries the GETS PIN DB, requesting the retrieval of the profile information associated with a particular PIN. If the PIN is valid, the GETS PIN DB responds with the requested information. The AS then responds with an HTTP 200 OK, instructing the MRFC to proceed [step H3].

If the PIN is valid, the MRFC collects a target DN from the calling party, in a similar manner to that described above. This is passed to the AS via another HTTP POST operation [step I1]. The AS validates this target DN and again responds with an HTTP 200 OK, instructing the MRFC to proceed [step I2].

If the target DN is valid, the MRFC/MRFP plays a confirmation announcement to the calling party and notifies the AS when the announcement is completed [steps J1 and J2]. The AS initiates the release of the media bearer, by sending a SIP BYE request to the MRFC/MRFP [steps K1 and K2]. The MRFC/MRFP sends a SIP 200 OK response to complete the release of the MRFC session [steps L1 and L2]. The AS then initiates NGN GETS call/session establishment towards the target DN. This processing is illustrated in Figure 6-5, as an expansion of step [C] in Figure 6-3.

Figure 6-5 illustrates the procedures used to subsequently establish an NGN GETS call/session to the target DN, and to establish the media bearer path between the calling party and the called party. (This corresponds to the final step [C] of Figure 6-3.)

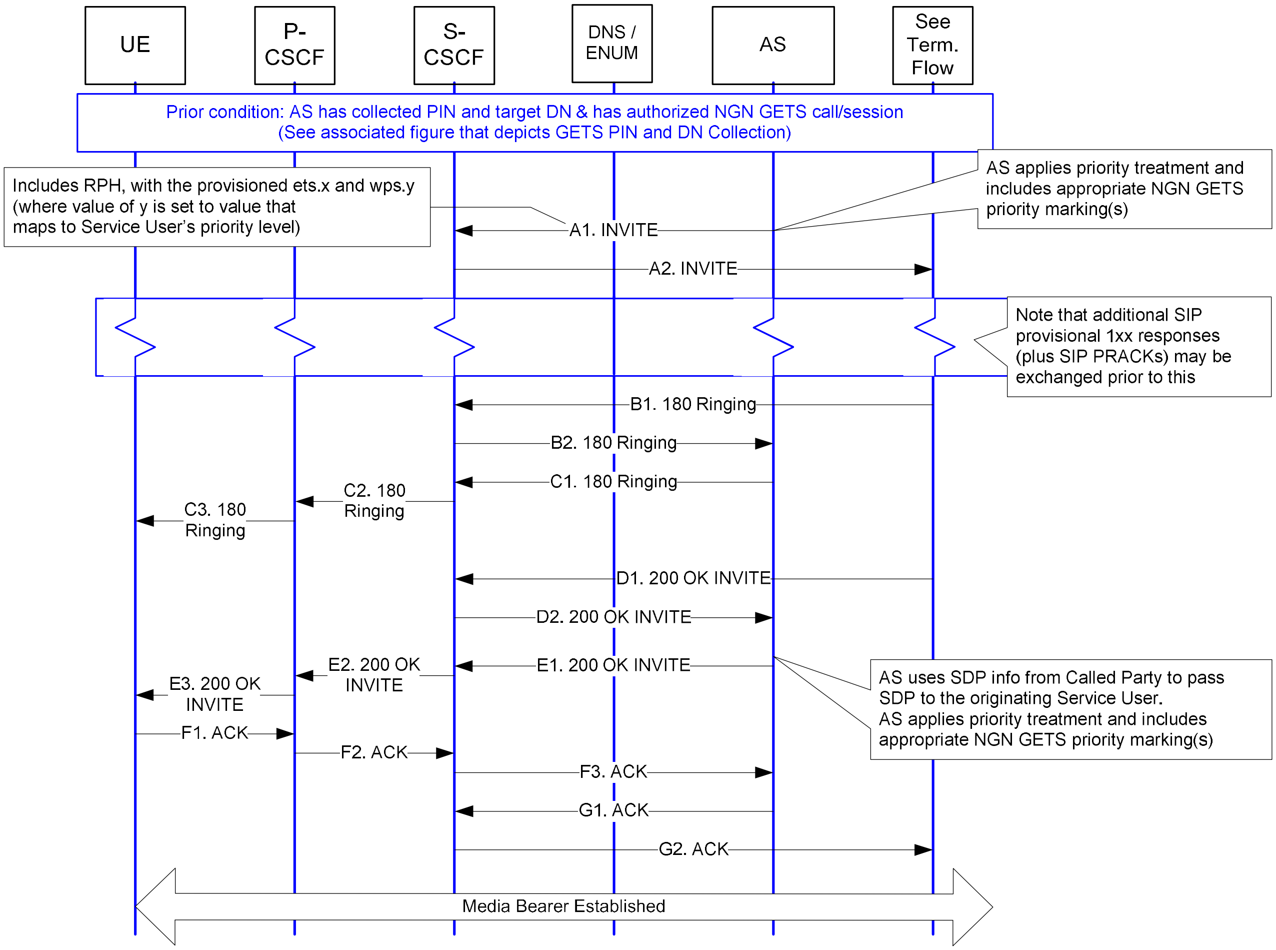

Figure 6-5 – Establishment of NGN GETS Call/Session between Service User and Called Party (step [C] of Figure 6-3)

If the calling party is authorized and the target DN is collected and validated, the AS initiates an NGN GETS call/session on behalf of the Service User. In the scenario depicted in Figure 6-5, the AS applies priority treatment and includes NGN GETS priority marking(s) when routing the SIP INVITE request forward toward the target DN via the S-CSCF [steps A1 and A2]. A query to the DNS/ENUM can be generated either by the AS or by the S-CSCF. Other options are possible and are not illustrated.

If preconditions are used prior to ringing and if mechanisms for the reliable transport of provisional responses are applied, a series of provisional responses and SIP PRACKs/200 OK responses may be exchanged (analogous to those illustrated in Section 6.1.1), as noted above step B1 in Figure 6-5.

In this scenario, a SIP 180 Ringing response [steps B1 and B2] is received by the AS when the called party is alerted. The AS, acting in B2BUA mode, sends a corresponding SIP 180 Ringing response toward the originating Service User [steps C1 through C3], used to generate local ringback at the originating UE. The SIP 180 Ringing response (or another SIP message sent prior to step B1) includes SDP information related to the called party to enable the UE to remove the bearer connection to the MRFP and establish a bearer connection to the called party. Note that NGN GETS priority marking(s) are maintained in this and subsequent SIP messages, resulting in associated priority treatment (as defined for each SIP-capable FE that is traversed by this and subsequent SIP messages related to this NGN GETS call/session).

When the called party answers, a SIP 200 OK response to the SIP INVITE request [steps D1 and D2] is received by the AS. The AS, acting in B2BUA mode, sends a corresponding SIP 200 OK response toward the originating Service User [steps E1 through E3]. A SIP ACK is sent back to the AS [steps F1 through F3] and on toward the called party [steps G1 and G2].

[RFC 3725] provides further guidance concerning the flow illustrated in Figure 6-5. [RFC 4733] describes how to carry dual-tone multifrequency (DTMF) signaling, other tone signals, and telephony events in RTP packets.

As discussed previously, the processing within the terminating home network is analogous to that illustrated in Figure 6-2, and is not repeated here.

6.1.3.1 Relevant NGN GETS Aspects

This section highlights NGN GETS Voice–specific processing for each FE, based on the NGN GETS call/session flow as described in Figure 6-3 through Figure 6-5.

P-CSCF

This is the same as described in Section 6.1.1.1, with the exception that a GETS-AN (rather than a GETS-FC) is used to recognize that the received SIP INVITE request corresponds to an NGN GETS call/session request.

S-CSCF

The S-CSCF capabilities are as described in Section 6.1.1.1. The iFC mechanism is not used to trigger to the AS.

AS

It is assumed that the AS supports the NGN GETS Voice-specific service logic as required to control the processing of a GETS-AN invoked call/session. The following list summarizes some of its primary roles and highlights several unique aspects.

A. ***Control GETS–AN call/session***
Upon receipt of a SIP INVITE request, the AS applies service logic to authorize and control the GETS–AN invoked call/session. For this application, the AS is expected to operate as a Back-to-Back User Agent (B2BUA) and to perform Third-Party Call Control (3PCC) procedures. If the AS uses shared resources that are also used for other applications, priority processing is applied for this operation, as noted in item [F], below.

B. ***Control MRFC/MRFP interactions***
For this application, the AS is expected to support specific procedures for controlling an MRFC/MRFP. Scripts are used for the scenario depicted in Figure 6-4, with resource information transported via HTTP. The use of scripts and HTTP is not required, but is merely used to illustrate one potential realization of the required GETS-AN functionality.

C. ***Apply priority treatment for resource-control messages exchanged between AS and MRFC***
To support the signaling interactions between the AS and the MRFC, priority treatment is needed for the marking and transport of these messages. Such priority treatment is applied throughout these interactions, including prior to PIN validation and GETS service authorization.

D. ***Access GETS PIN DB information (e.g., Service User's priority level and calling privileges) for GETS-AN Service Users***
This may entail local storage of such information at the AS, or the retrieval of such information from an external GETS PIN DB. The AS may interact with a GETS PIN DB, containing the Service User's PIN and associated service profile information (e.g., Service User's priority level and calling privileges). The GETS PIN DB may be located within the Service User's home network, or may be centralized and provided by a third party. This GETS PIN DB needs to be accessed by the AS on a per-call/session basis for PIN validation and NGN GETS service authorization. See also related item [E].

E. ***Apply priority treatment for GETS PIN DB information retrieval***
If the option of information retrieval from an external GETS PIN DB is chosen (as noted in item [D]), priority treatment is needed for the marking and transport of these messages.

F. ***Apply priority treatment for processing and signaling related to an NGN GETS call/session***
Same as item [D] of AS in Section 6.1.1.1.

G. ***Mark the outgoing SIP messages for a GETS-AN invoked call/session with NGN GETS priority marking(s)***
Same as item [E] of AS in Section 6.1.1.1.

GETS PIN DB

A. ***Maintain GETS PIN DB information (e.g., Service User's priority level and calling privileges) for GETS-AN Service Users***
See description of item [D] in Section 6.1.3.1.

B. ***Apply priority treatment for GETS PIN DB information retrieval***
See description of item [E] in Section 6.1.3.1.
If the GETS PIN DB uses shared resources that are also used for other applications, priority processing is applied for information retrieval. The GETS PIN DB applies priority treatment, in processing GETS PIN DB query messages (e.g., allocating local resources in a priority fashion).

MRFC/MRFP

A. ***Recognize a received SIP message that corresponds to an NGN GETS call/session***
This is based on detection of the RPH (with a valid ets namespace) in a received SIP message.

B. ***Perform MRFC/MRFP interactions***
See description of item [B] in Section 6.1.3.1.

C. ***Apply priority treatment for resource-control messages exchanged between AS and MRFC***
See description of item [C] in Section 6.1.3.1.

D. ***Apply priority treatment to allocation of media resources***
If the MRFP uses shared resources that are also used for other applications, the MRFP prioritizes the playing of media resources and the capture of dialled digits associated with an NGN GETS call/session. The MRFP also marks the bearer media packets appropriately.

E. ***Mark the outgoing SIP messages for a GETS-AN invoked call/session with NGN GETS priority marking(s)***
The MRFC includes the RPH, populated with ets.x, in SIP messages associated with the NGN GETS call/session.

6.1.4 NGN GETS Call/Session Origination f GETS-AN – Multi-Network Scenario

This section describes the flow associated with an originating NGN GETS call/session from a Service User who enters a GETS-AN set of digits to invoke NGN GETS service processing. It corresponds to the same scenario as discussed in Section 6.1.3, but is herein applied to the case where the calling party is located in a visited network, different from its home network.

The corresponding flow is similar to that described in Section 6.1.3, with the insertion of two IBCFs between the P-CSCF and the S-CSCF. The use of such FEs is dependent on the choices made for the visited NGN GETS Service Provider network and the calling party's home NGN GETS Service Provider network. Either (or both) of those NGN GETS Service Providers may optionally require that all messages entering/leaving their respective networks must traverse an IBCF.

In addition, there may be further modifications to the GETS-AN flow, in the case where the GETS-AN invoked call/session authorization processing (including collection of the PIN and the target DN) is performed outside the home network. This scenario is depicted in Figure 6-6, as a deviation from the corresponding Figure 6-3 in Section 6.1.3.

The call/session termination, as referenced in Figure 6-6, follows procedures as described in Section 6.1.2 (for an IMS termination) or Section 6.1.5 (for a PSTN termination).

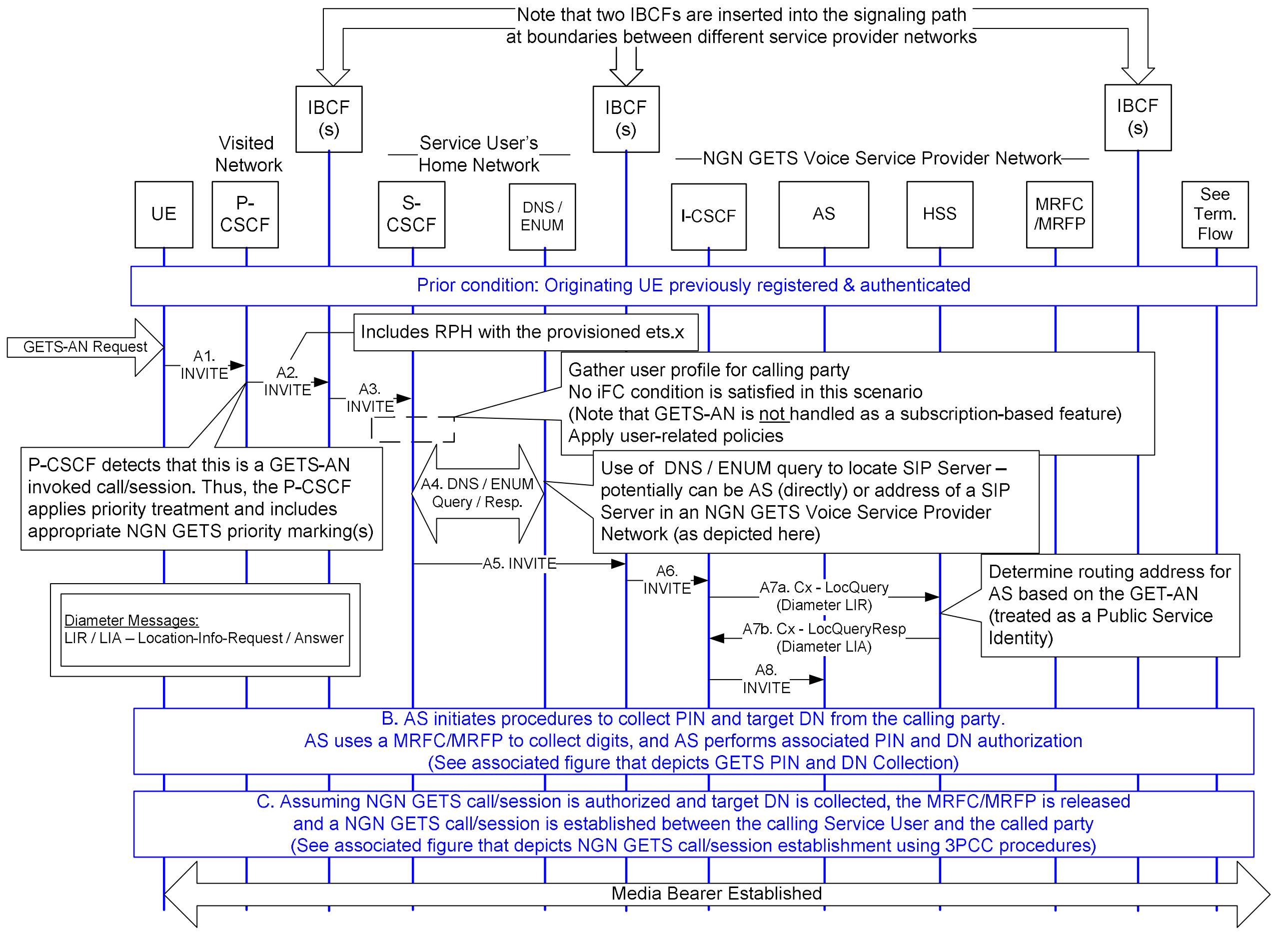

Figure 6-6 – NGN GETS Call/Session Origination for GETS-AN with AS Located in External Network

A summary of the above processing, focusing on the differences from the corresponding flow illustrated in Section 6.1.3 (notably steps A2 through A8 in Figure 6-6), is provided below. Step [B] of Figure 6-6 is illustrated in Figure 6-4 and step [C] of Figure 6-6 is illustrated in Figure 6-5.

As discussed in Section 6.1.3, the S-CSCF uses the GETS-AN as the destination number [received in step A3], and applies normal IMS procedures to route the SIP INVITE request to the appropriate FE. In the Figure 6-6 scenario, a DNS/ENUM query [step A4] for an address (associated with the GETS-AN) yields the address of a designated entry point (IBCF) within an external (NGN GETS Service Provider) network. Therefore, the SIP INVITE request is routed to that IBCF [step A5], instead of being routed directly to a local AS (as was illustrated in Figure 6-3 of Section 6.1.3).

When the I-CSCF receives the SIP INVITE request [step A6], the I-CSCF queries the HSS [step A7a] to determine the S-CSCF assigned for that number. However, in this particular case, the number is treated as a Public Service Identity (PSI). These identities are different from Public User Identities, and identify services that are hosted by ASs. Thus, the HSS returns the address of the AS [step A7b], allowing the I-CSCF to route the SIP INVITE request on to the AS [step A8].

Subsequent processing of this NGN GETS call/session is analogous to that described in Section 6.1.3, with the potential insertion of IBCFs between the S-CSCF of the Service User's home network and the I-CSCF located within the external NGN GETS Service Provider network. In step [C], if the calling party is authorized and the target DN is collected and validated, the AS initiates an NGN GETS call/session on behalf of the Service User.

The normal IMS-based procedures as provided in 3GPP specifications are not repeated in this section.

6.1.4.1 Relevant NGN GETS Aspects

This section highlights NGN GETS Voice–specific processing for IBCF based on the NGN GETS call/session flow as described in Figure 6-6.

IBCF

The IBCF processing is similar to that defined for a P-CSCF (as discussed in Sections 6.1.1.1, 6.1.2.1, and 6.1.3.1), with item [D] of Section 6.1.1.1 replaced with the following item.

A. Control Usage of NGN GETS priority marking(s) in SIP messages exchanged with other networks
The IBCF controls the usage of RPH in SIP messages exchanged with other networks.

6.1.5 NGN GETS Call/Session – PSTN Termination

This section describes the flow associated with the terminating portion of an NGN GETS call/session when the NGN GETS Service Provider network, after completing its NGN GETS Voice processing (including authentication and authorization of the calling party), routes the NGN GETS call/session to the PSTN (for call completion).

This material only illustrates the signaling that is encountered on behalf of the called party. Thus, this material complements the corresponding material that is illustrated in Section 6.1.1, which describes the related processing on behalf of the originating Service User, as it pertains to the signaling over the originating Service User's access and within the home network of the originating Service User.

For the flow in Figure 6-7, the NGN GETS call/session is terminated to a UE via the PSTN. The media is handled as NGN GETS Voice (RTP) bearer traffic in the originating network, with transcoding performed by the T-MGF in the IMS Core Network to support (TDM) bearer transport in the PSTN.

Whereas this section covers the call/session termination processing for an NGN GETS originated call/session, the call/session flow is also applicable to other (non-GETS) call/session terminations as well.

The normal IMS-based procedures as provided in 3GPP specifications are not repeated in this section.

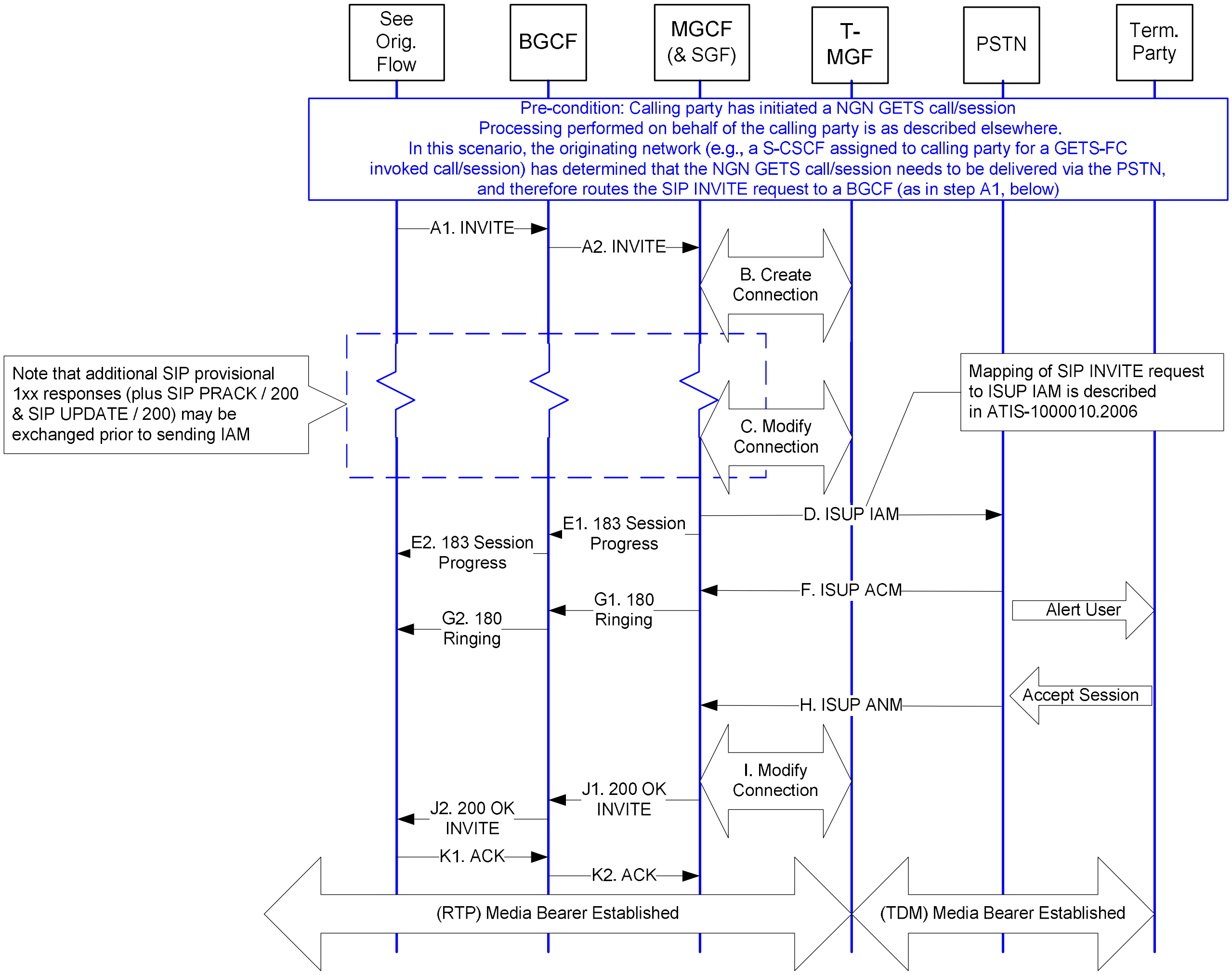

Figure 6-7 – NGN GETS Call/Session Termination to PSTN

This flow has been simplified to exclude specific references to the SIP provisional messages (used to convey interim information prior to call/session establishment). Section 6.1.8 describes various flows associated with queuing an NGN GETS call/session request, including the SIP provisional messages used to support such processing. Note that functional representations are provided for the H.248 messages that are exchanged between the MGCF and the T-MGF.

In the following scenario, the originating party has initiated an NGN GETS call/session, has already been authenticated and authorized, and the originating network (e.g., a S-CSCF assigned to the originating Service User for a GETS-FC invoked call/session) has determined that the NGN GETS call/session needs to be delivered via the PSTN. The SIP INVITE request is sent to a BGCF. If the NGN GETS call/session is to be handled by a remote MGCF, the BGCF may relay the SIP INVITE request to another BGCF in the remote network. However, this does not impact the processing at the remote BGCF (as illustrated in step A1 of Figure 6-7).

When a SIP INVITE request arrives at the BGCF [step A1], the BGCF determines whether this request is related to an NGN GETS call/session based on the RPH (with a valid ets namespace) in the received SIP INVITE request. For an NGN GETS call/session, the BGCF selects an MGCF and sends a SIP INVITE request containing the received NGN GETS priority marking(s) to the MGCF [step A2]. Further details concerning this BGCF processing are provided in Section 6.1.5.1. Based on the SDP offer contained within the SIP INVITE request, the MGCF chooses an outgoing channel and selects the media capabilities for the call/session (using H.248 interactions with the T-MGF [step B]). The MGCF determines whether this request is related to an NGN GETS call/session based on the RPH (with a valid ets namespace) in the received SIP INVITE request. For an NGN GETS call/session, the MGCF applies priority treatment and includes the corresponding NGN GETS priority marking(s) for this and subsequent H.248 interactions with the T-MGF. Further details concerning this MGCF processing are provided in Section 6.1.5.1.

A number of additional offer/answer message exchanges may be used, as noted (but not explicitly shown) in Figure 6-7. (See the flow as discussed in Section 6.1.1, for an illustration of these additional messages.) Based on the SDP information contained within these offer/answer message exchanges, the MGCF may modify the connection and request the T-MGF to reserve the resources necessary for the media streams (using H.248 interactions with the T-MGF) [step C].

When preconditions have been satisfied (i.e., resources have been reserved), the MGCF uses information from the received SIP INVITE request to construct an ISUP IAM. This mapping is specified in [ATIS-1000010.2006]. The MGCF applies priority treatment to send the ISUP IAM message to the PSTN [step D] and sends a SIP 183 Session Progress response to the BGCF [step E1] to establish the bearer path.

Subsequent processing follows normal SIP/ISUP interworking procedures, as specified in [ATIS-1000679.2004]. These procedures are not repeated in this section (beyond the basic description provided above), but references to the relevant material are instead provided below.

6.1.5.1 Relevant NGN GETS Aspects

Beyond the impacts on other FEs (as identified in previous sections), BGCF, MGCF, and T-MGF impacts are summarized below for the NGN GETS call/session flow as described in Figure 6-7.

BGCF

A. ***Recognize a received SIP message that corresponds to an NGN GETS call/session***
This entails capabilities similar to those described for I-CSCF of Section 6.1.2.1.

B. ***Apply priority treatment for processing and signaling related to an NGN GETS call/session***
This entails capabilities similar to those described for I-CSCF of Section 6.1.2.1.

C. ***Mark the outgoing SIP messages for an NGN GETS call/session with NGN GETS priority marking(s)***
This entails capabilities similar to those described for I-CSCF of Section 6.1.2.1.

MGCF

A. ***Recognize a received SIP message that corresponds to an NGN GETS call/session***
This entails capabilities similar to those described for I-CSCF of Section 6.1.2.1.

B. ***Apply priority treatment for processing and signaling related to an NGN GETS call/session***
This entails capabilities similar to those described for I-CSCF of Section 6.1.2.1.

C. ***Apply Legacy GETS priority treatment***
The MGCF provides legacy GETS priority treatment (e.g., trunk queuing and exemption from network management controls) to a call/session traversing between NGN GETS Service Provider and legacy GETS Service Provider networks.

D. ***Perform mapping between SIP messages and associated ISUP messages***
The MGCF supports interworking between SIP and ISUP. This includes the exchange of messages related to excessive delays and queuing. [ATIS-1000010.2006] summarizes the MGCF mapping of SIP INVITE request header fields to corresponding ISUP IAM parameters.

E. ***Apply priority treatment for H.248 messages related to an NGN GETS call/session***
For an NGN GETS call/session, the MGCF instructs the T-MGF to create/modify the media connection (as illustrated in steps B, C, and I of Figure 6-7). Priority MGCF treatment is needed for the marking and transport of these messages. See the corresponding description of item [A] for T-MGF.

   Steps B, C, and I of Figure 6-7 depict interactions between the MGCF and T-MGF for an NGN GETS call/session. If the MGCF has determined that this is an NGN GETS call/session, the International Emergency Preference Scheme (IEPS) call indicator is included in the H.248 message to request preference handling in the T-MGF for the corresponding bearer connection. In addition, the Priority indicator is included in the message to indicate the priority value for the NGN GETS call/session.

T-MGF

A. ***Apply priority treatment for H.248 messages related to an NGN GETS call/session***
For an NGN GETS call/session, the T-MGF is instructed by the MGCF to create/modify the media connection (as illustrated in steps B, C, and I of Figure 6-7). Priority T-MGF treatment is needed for the marking and transport of these messages. See the corresponding description of item [E] for MGCF.

B. ***Apply priority treatment to transport layer voice packets***
The T-MGF provides priority treatment (in processing) to transport layer packets carrying voice for an NGN GETS call/session, and marks the outgoing packets appropriately.

6.1.6 Call Origination from PSTN without GETS Authorization

This section describes the flow associated with a Legacy GETS call that originates in a PSTN that does not perform GETS authorization. This includes the following two alternative scenarios for GETS-AN call invocations originated via the PSTN:

1. The originating PSTN is a Legacy GETS LEC that detects the GETS call and applies priority treatment (but not GETS authorization) and routes the call to the NGN GETS Service Provider network (for NGN GETS Voice processing and subsequent NGN GETS call/session completion).
2. The originating PSTN does not perform the Legacy GETS processing and priority treatment (including authorizing the originating Service User), but routes the voice call to the NGN GETS Service Provider network (for NGN GETS Voice processing and subsequent NGN GETS call/session completion).

The normal IMS-based procedures as provided in 3GPP specifications are not repeated in this section.

Note that the flows are illustrative and options on allowing cut-through while interworking with PSTN exist.

Figure 6-8 illustrates the flow associated with an originating GETS call from a Service User who enters a GETS-AN to invoke NGN GETS Voice processing and authorization. Figure 6-8 corresponds to a scenario that is similar to that illustrated in Figure 6-6 of Section 6.1.4, but is herein applied to the case where the GETS call is originated from the PSTN (rather than from an NGN GETS Service Provider network). Section 6.1.8 describes various flows associated with the queuing of an NGN GETS call/session request.

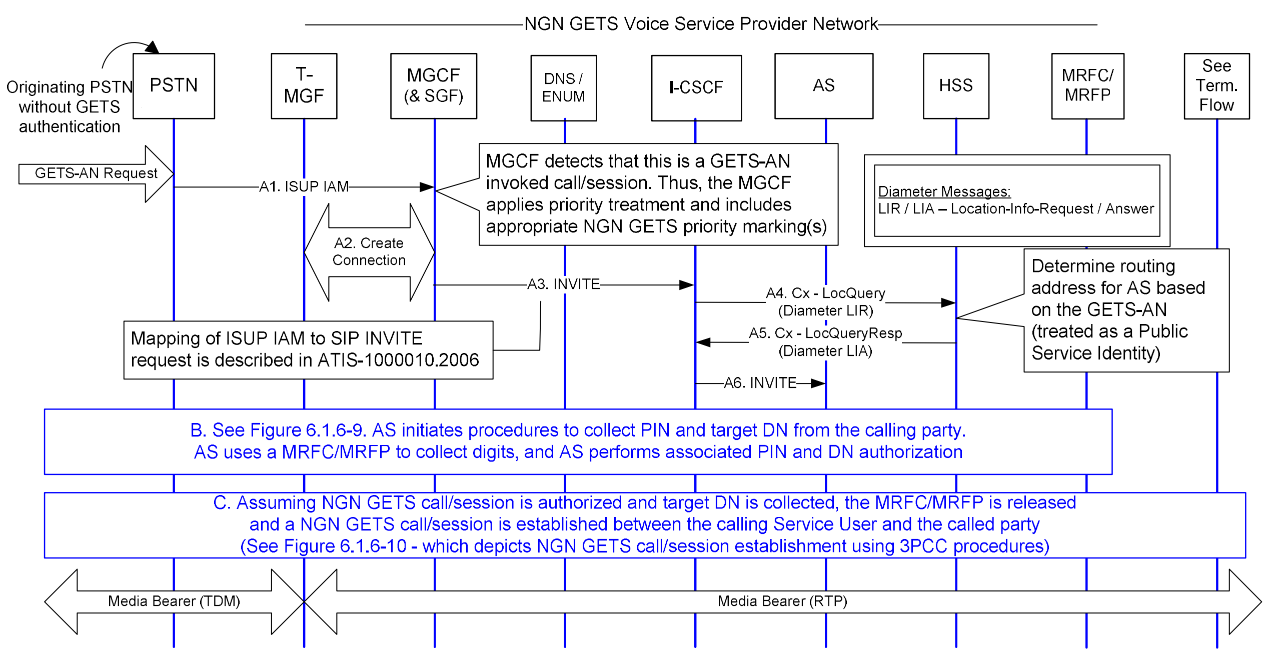

Figure 6-8 – Call/Session Origination for GETS-AN – PSTN Origination without GETS Authorization (1 of 3)

A summary of the above processing, focusing on the differences from the corresponding Figure 6-6 of Section 6.1.4 (notably steps A1 through A3 in Figure 6-8), is provided below:

The originating PSTN is not GETS-capable, but is capable of recognizing the GETS-AN and routing that GETS call to an NGN GETS Service Provider network. This results in the delivery of an ISUP IAM (containing the GETS-AN as the Called Party Number) from the PSTN to an MGCF located in the NGN GETS Service Provider network [step A1].

Based on the trunk identity and destination information (i.e., GETS-AN) contained in the ISUP IAM, the MGCF instructs the T-MGF to seize the trunk and an outgoing IP port (using H.248 interactions with the T-MGF [step A2]). NGN GETS Voice-specific processing is required to allow the MGCF to detect the NGN GETS call/session origination (based on GETS-AN digits in the received ISUP IAM), in order to apply priority treatment and to include NGN GETS priority marking(s) for this and subsequent H.248 interactions with the T-MGF. The MGCF creates a SIP INVITE request. The MGCF applies priority treatment to send the SIP INVITE request to the designated FE (e.g., to a configured I-CSCF) [step A3]. The MGCF processing is described in Section 6.1.6.1.

Subsequent processing is analogous to that described in the previous sections (with the exception that the MGCF and T-MGF are used in the current scenario to control the bearer stream). This processing is illustrated in Figure 6-9 and Figure 6-10.

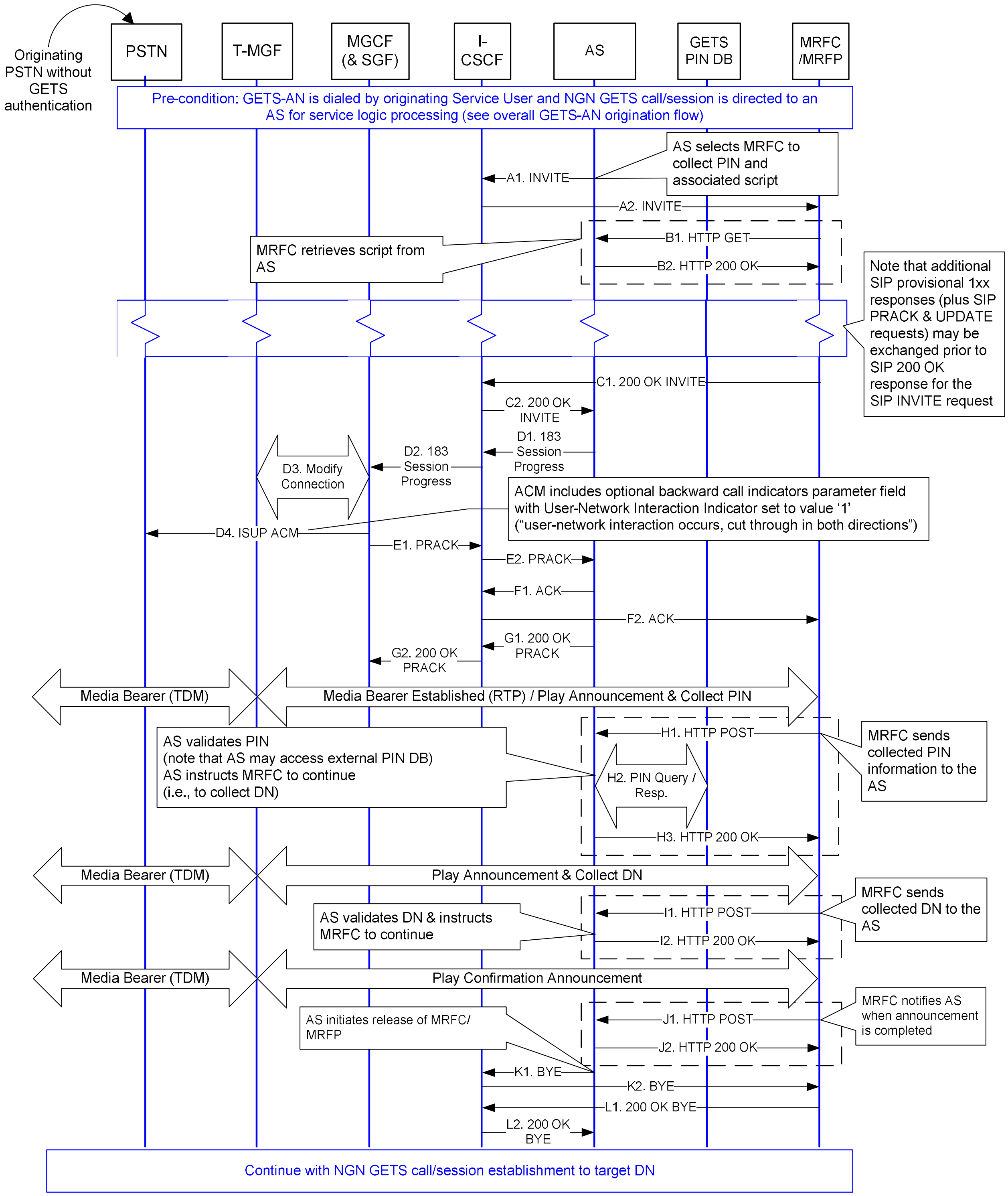

Figure 6-9 – Call/Session Origination for GETS-AN – PSTN Origination without GETS Authorization (2 of 3)

Figure 6-9 illustrates the processing used to connect the Service User to an MRFC/MRFP, to support user interactions. This processing is analogous to that illustrated in Figure 6-4, but is applied to a PSTN origination.

Figure 6-10 illustrates the processing used to subsequently connect the Service User to the target DN. This processing is analogous to that illustrated in Figure 6-5, but is applied to a PSTN origination.

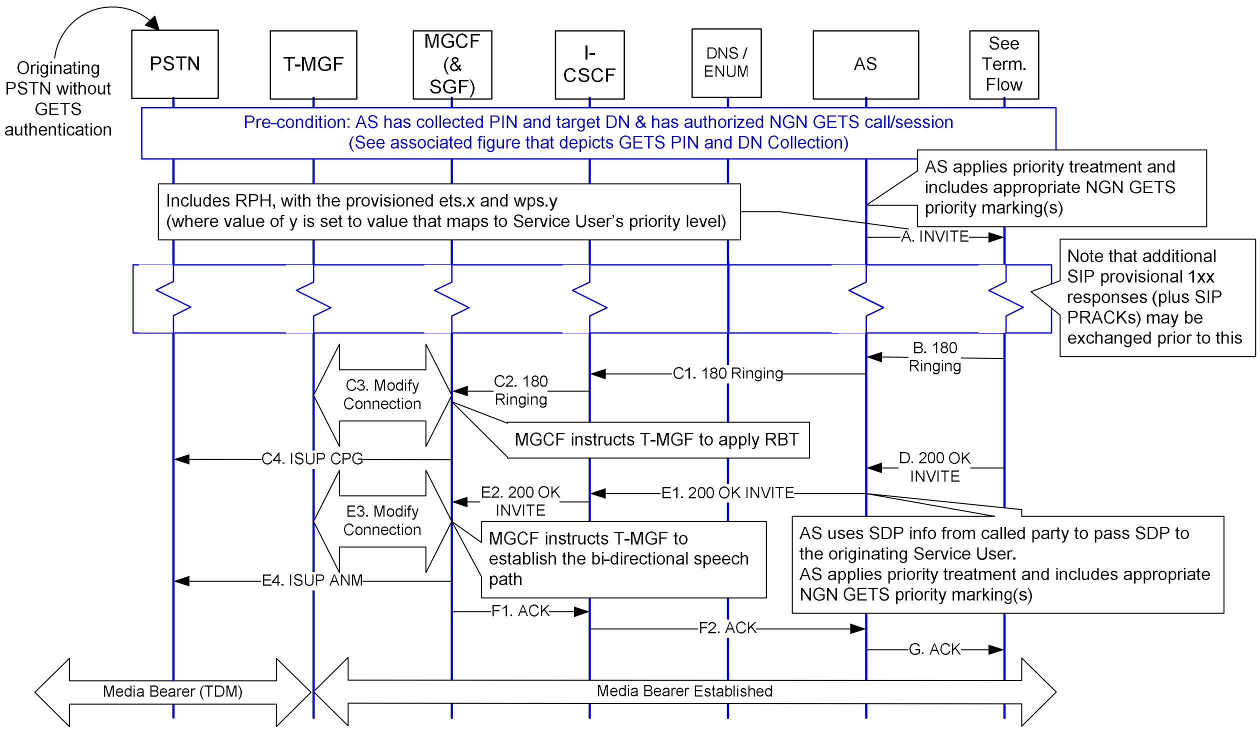

Figure 6-10 – Call/Session Origination for GETS-AN – PSTN Origination without GETS Authorization (3 of 3)

At step C3, the MGCF instructs the T-MGF to apply Ringback Tone (RBT) to the calling party. At step E3, the MGCF instructs the T-MGF to establish a bi-directional speech path between the calling and called parties. The call termination is as described in Section 6.1.2 (for an IMS termination) or Section 6.1.5 (for a PSTN termination).

6.1.6.1 Relevant NGN GETS Aspects

Beyond the impacts on other FEs (as identified in previous sections), MGCF and T-MGF impacts are summarized below.

MGCF

Beyond the MGCF capabilities as described for MGCF in Section 6.1.5.1, the following discusses the MGCF mapping of received ISUP IAM parameters to associated SIP INVITE requests.

A. ***Recognize a received ISUP IAM that corresponds to an NGN GETS call/session request***
Corresponding requirements are specified in [ATIS-1000023.2008].

B. ***Perform mapping between ISUP messages and associated SIP messages***
The MGCF supports interworking between ISUP and SIP. For received ISUP IAM, the MGCF detects an NGN GETS call /session based on parameters of the ISUP IAM. This includes the exchange of messages related to excessive delays and queuing. [ATIS-1000010.2006] specifies the MGCF mapping of SIP INVITE request header fields to corresponding ISUP IAM parameters.

T-MGF

T-MGF capabilities are as described for T-MGF in Section 6.1.5.1.

6.1.7 NGN GETS Termination of a Legacy GETS/WPS Call

This section describes the flow associated with a Legacy GETS call that originates in a GETS-capable PSTN. In this scenario, the PSTN performs Legacy GETS processing, including authorization, and then routes the call/session to the NGN GETS Service Provider network (for NGN GETS call/session completion).

This flow is similar to the NGN GETS call/session termination flow illustrated in Figure 6-2 of Section 6.1.2. However, whereas Figure 6-2 illustrates a scenario when the media is handled end-to-end as NGN GETS Voice traffic, the current section describes the case when the NGN GETS Service Provider network provides interworking with the circuit-switched technologies in the originating PSTN.

This material only illustrates the signaling that is encountered on behalf of the called party. This includes signaling within the home network of the called party, and onward toward the called party's access network.

Although this section is intended to cover the NGN GETS call/session termination for the scenario when a calling Service User has invoked Legacy GETS within the originating PSTN, the call/session flow described in this section is also applicable to other call/session termination scenarios. In particular, it also applies to an originating WPS call or a non-GETS call (with MGCF mapping of ISUP IAM parameters to corresponding SIP INVITE request header fields as specified in [ATIS-1000010.2006]).

Figure 6-11 is based on 3GPP material, but has been simplified to exclude references to specific SIP provisional messages (used to convey interim information prior to call/session establishment).

The normal IMS-based procedures as provided in 3GPP specifications are not repeated in this section.

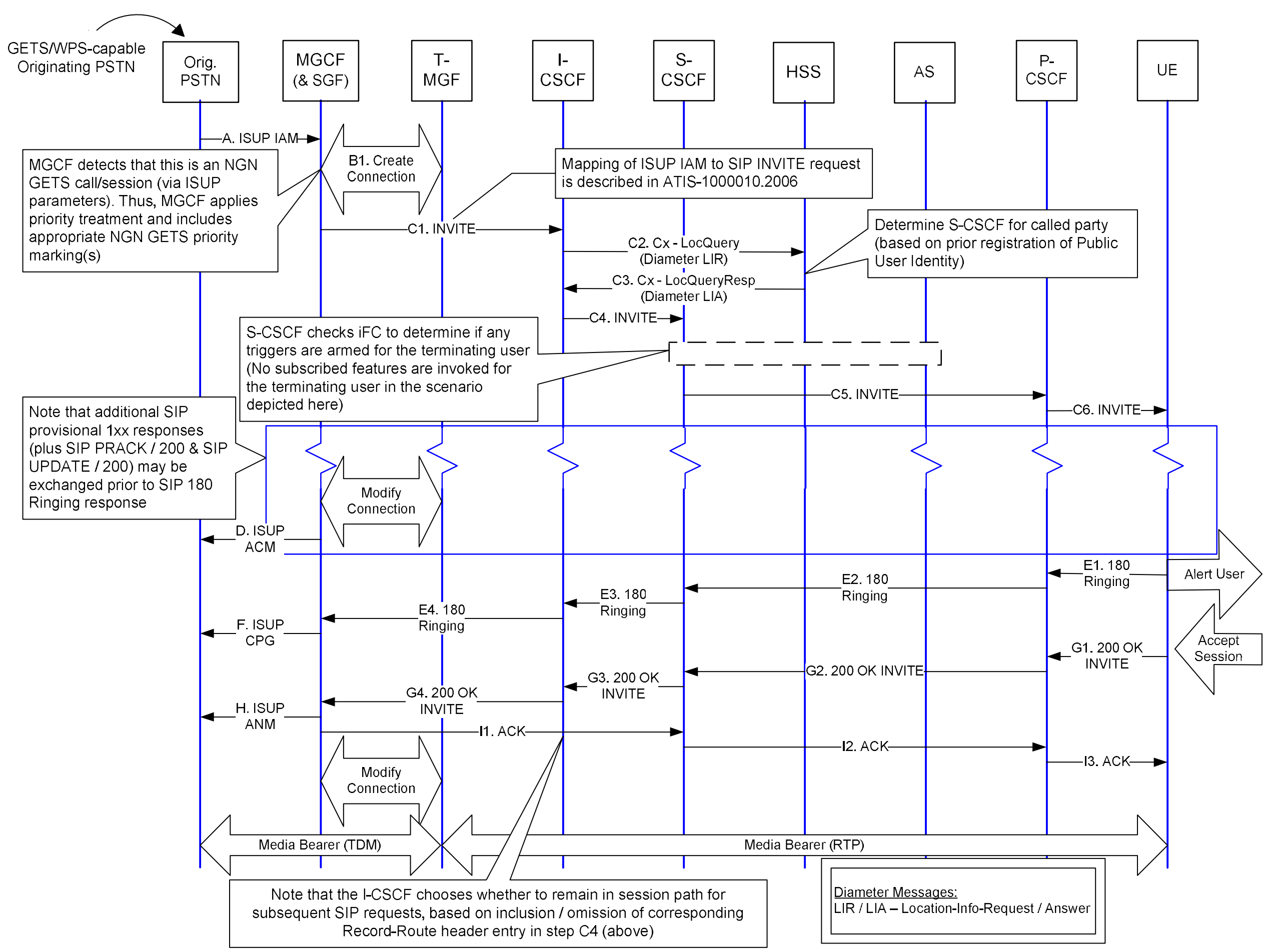

Figure 6-11 – NGN GETS Termination of a Legacy GETS/WPS Call

A summary of the above processing, focusing on the differences from the corresponding Figure 6-2 of Section 6.1.2, is provided below.

In this scenario, the originating PSTN provides Legacy GETS or WPS processing. This results in the delivery of an ISUP IAM (containing a target DN as the Called Party Number) from the PSTN to an MGCF located in the NGN GETS Service Provider network [step A].

Based on the trunk identity and destination information contained in the ISUP IAM, the MGCF instructs the T-MGF to seize the trunk and an outgoing IP port (using H.248 interactions with the T-MGF [step B1]. NGN GETS Voice-specific processing is required to allow the MGCF to detect the NGN GETS call/session origination, in order to apply priority treatment and to include NGN GETS priority marking(s) for H.248 interactions with the T-MGF.

The MGCF creates a SIP INVITE request by mapping the received ISUP IAM parameters to corresponding SIP INVITE request header fields (as specified in [ATIS-1000010.2006]). The MGCF applies priority treatment to send the SIP INVITE request to the designated FE (e.g., to an I-CSCF) [step C1].

Subsequent processing is analogous to that described in Section 6.1.2 (with the exception that the MGCF and T-MGF are used in the current scenario to control the bearer stream).

6.1.7.1 Relevant NGN GETS Aspects

NGN GETS Voice impacts on the various FEs are the same as identified in previous sections. Notably, the MGCF and T-MGF impacts are the same as those described in Section 6.1.6.1.

6.1.8 Queuing of an NGN GETS Call/Session

This section describes various flows associated with queuing of an NGN GETS call/session at the MGCF.

6.1.8.1 Queuing at FE within IMS Core Network

This section describes the processing of an NGN GETS call/session that is originated in the PSTN and queued at an FE within the IMS Core Network. When resources are available within the IMS Core Network, the NGN GETS call/session is successfully established.

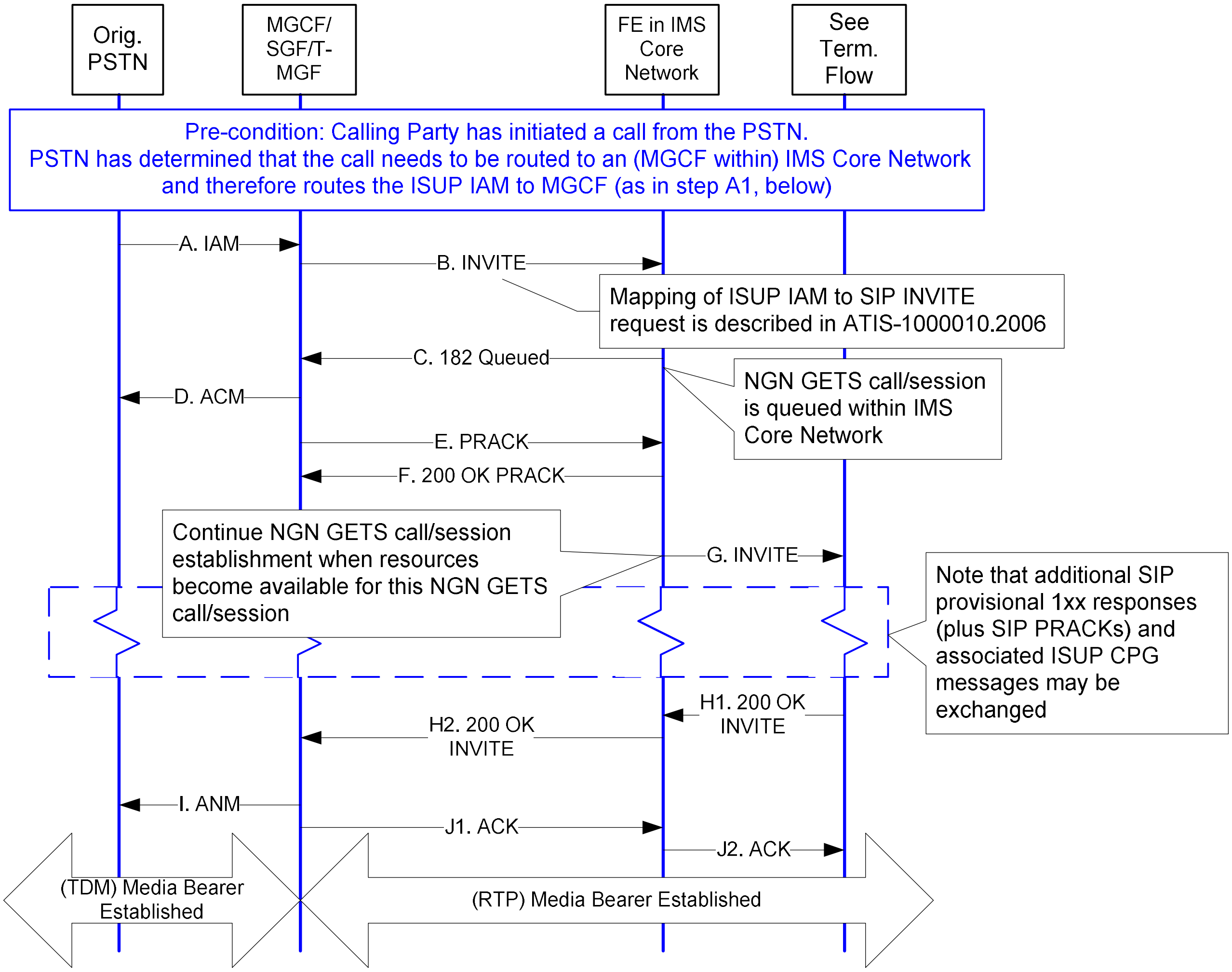

Figure 6-12 – NGN GETS Call/Session – Queuing at FE within IMS Core Network

Figure 6-12 illustrates the processing of an NGN GETS call/session that is queued at an FE within the IMS Core Network. The flow illustrates the scenario when the NGN GETS call/session is originated from the PSTN, in order to also highlight the corresponding ISUP/SIP interworking that is performed at the ingress MGCF when queuing is encountered within the IMS Core Network.

Steps [A] and [B] depict the normal processing of a received ISUP IAM by the ingress MGCF. The MGCF sends a SIP INVITE request to another FE within the IMS Core Network (e.g., to an I-CSCF, as illustrated in Figure 6-11). For the scenario depicted in Figure 6-12, the NGN GETS call/session is queued by an FE within the IMS Core Network, resulting in the sending of a SIP 182 Queued response [step C] toward the ingress MGCF. Assuming the use of preconditions and the reliable transport of provisional responses, a SIP PRACK message and an associated SIP 200 OK response are exchanged, as illustrated in steps [E] and [F]. When the ingress MGCF receives the SIP 182 Queued response, the ingress MGCF sends a corresponding ISUP ACM toward the PSTN [step D]. The ISUP ACM is populated with a Called Party's Status indicator in the Backward Call Indicators parameter set to binary value '11' ("excessive delay").

When resources become available for use by the NGN GETS call/session, the FE attempts to progress the NGN GETS call/session, by sending the SIP INVITE request on toward the called party [step G]. Beyond that point, the NGN GETS call/session is processed with priority, following procedures similar to those discussed in Section 6.1.7.

6.1.8.2 Queue Timeout at FE within IMS Core Network

This section describes the processing of an NGN GETS call/session that is queued for the last route available at an FE within the IMS Core Network. In this scenario, a queue timer expires and the NGN GETS call/session is released.

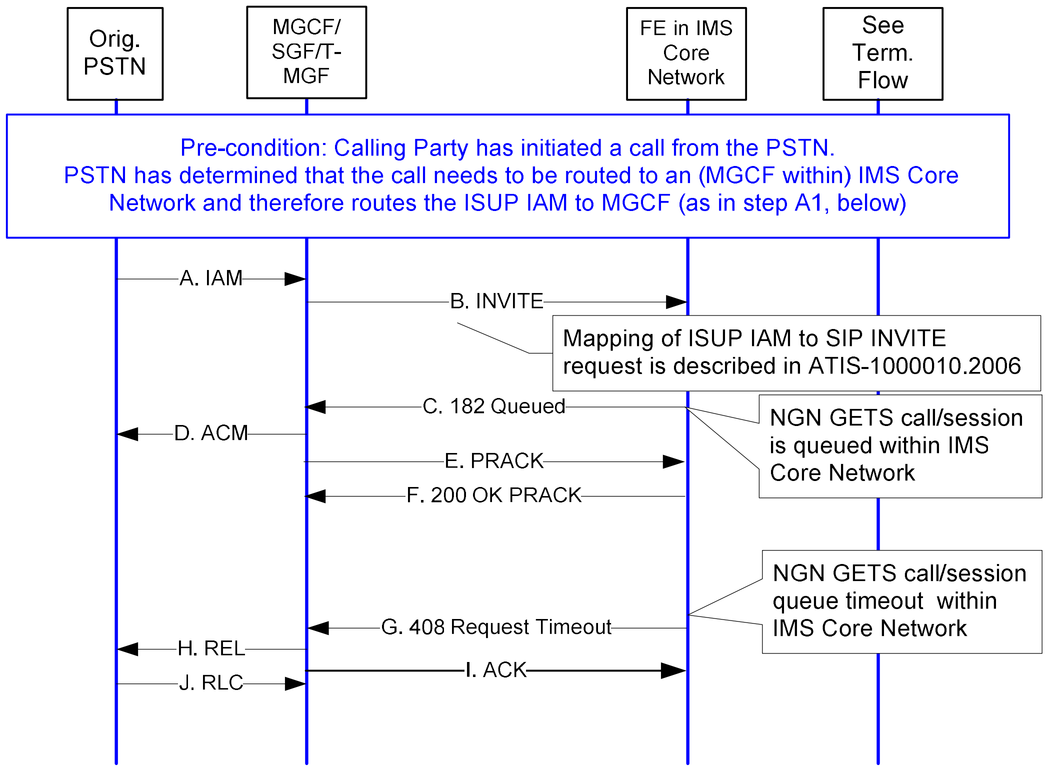

Figure 6-13 – NGN GETS Call/Session – Queue Timeout at FE within IMS Core Network

Figure 6-13 illustrates the processing of an NGN GETS call/session that is queued at an FE within the IMS Core Network, when no other routes are available.

Steps [A] through [F] are the same as depicted in Figure 6-12. However, in the Figure 6-11, a queue timer (started when the received NGN GETS call/session request is queued at step [C]) expires before the associated resource becomes available for this NGN GETS call/session. When the queue timer expires before the last route becomes available, a SIP 408 Request Timeout response is sent towards the ingress MGCF [step G]. This response includes a Reason header field with a Q.850 cause value of 102 (recovery of timer expiry). When the ingress MGCF receives this response, the ingress MGCF invokes ISUP release procedures (via the exchange of ISUP REL and RLC messages [steps H and J]).

6.1.8.3 Queuing at Egress MGCF within IMS Core Network

This section describes the processing of an NGN GETS call/session that is queued at an egress MGCF within the IMS Core Network. When an outgoing trunk to the PSTN becomes available for use by this NGN GETS call/session, the NGN GETS call/session is successfully established.

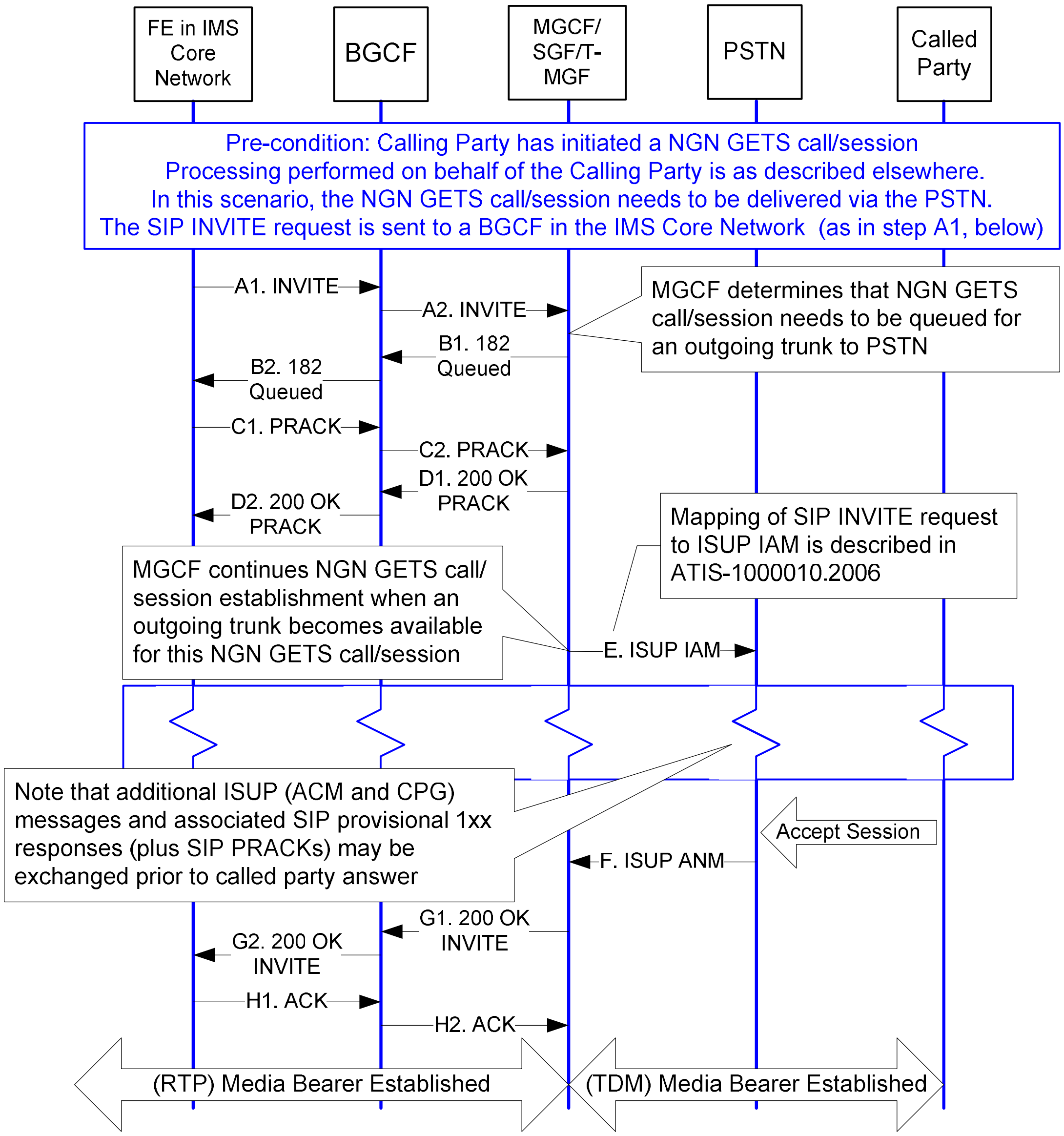

Figure 6-14 – NGN GETS Call/Session – Queuing at Egress MGCF within IMS Core Network

Figure 6-14 illustrates the processing of an NGN GETS call/session that is queued at an egress MGCF within the IMS Core Network. In this case, an NGN GETS call/session is initially processed within the IMS Core Network. Since the NGN GETS call/session is destined for a called party served by the PSTN, the SIP INVITE request is routed to an egress MGCF via a BGCF [steps A1 and A2].

For the scenario depicted in Figure 6-14, the egress MGCF determines that an outgoing trunk is not available to handle the NGN GETS call/session. Therefore, the egress MGCF queues for an outgoing trunk and sends a SIP 182 Queued response [steps B1 and B2] toward the calling party. The SIP 182 Queued response is sent toward the calling party, and may be sent over the UNI, to allow the UE to display a queuing indicator to the Service User. Assuming the use of preconditions and the reliable transport of provisional responses, a SIP PRACK message and an associated SIP 200 OK response are exchanged, as illustrated in steps [C1/C2] and [D1/D2].

When an outgoing trunk to the PSTN becomes available for use by the NGN GETS call/session, the egress MGCF attempts to progress the NGN GETS call/session, by sending an ISUP IAM on toward the called party [step E]. The NGN GETS call/session is processed with priority, following basic procedures as defined for SIP/ISUP interworking.

6.1.8.4 Queue Full at Egress MGCF within IMS Core Network

This section describes the processing of an NGN GETS call/session that encounters a queue-full condition at an egress MGCF within the IMS Core Network.

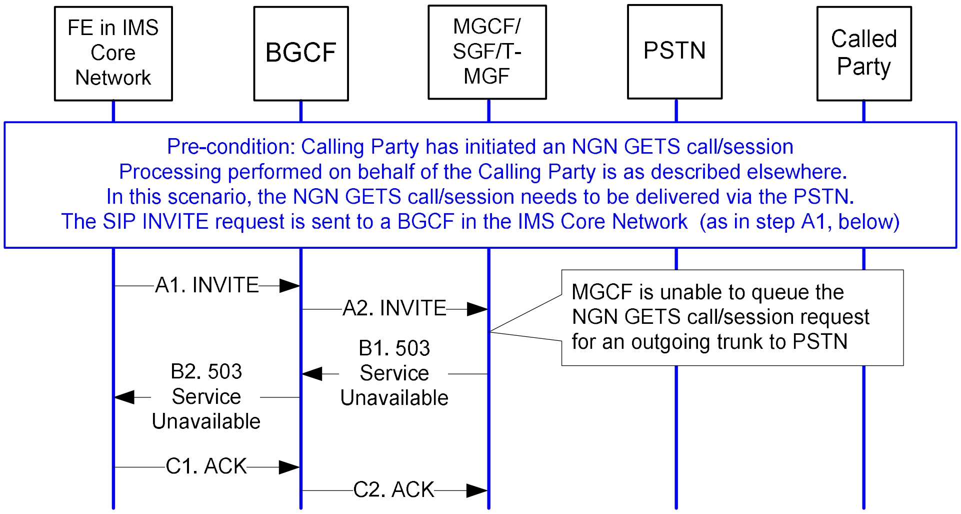

Figure 6-15 – NGN GETS Call/Session – Queuing at Egress MGCF within IMS Core Network

Steps [A1] and [A2] are the same as depicted in Figure 6-14. However, in Figure 6-15, the MGCF is unable to queue the call/session request for an outgoing trunk to the PSTN. The MGCF sends a SIP 503 Service Unavailable response to the BGCF [step B1]. This SIP 503 Service Unavailable response includes a Reason header field with a Q.850 cause value of 34 (no circuit available). The SIP 503 Service Unavailable response is acknowledged with a SIP ACK message (steps C1 and C2).

6.2 Wired Access-to-Core

6.2.1 DSL

This section is informative and describes various call/session flows intended to illustrate how an NGN GETS call/session could be processed in a DSL access network. This material is meant to provide a high-level description and is not intended to be exhaustive. If inconsistencies exist between this section and DSL specifications ([TR-058], [TR-059], [TR-098], [TR-101], [TR-156], and [TR-167]), the DSL specifications take precedence. Alternative call/session flows are possible.

Section 6.2.1.1 presents a basic message sequence for an NGN GETS-AN session focusing on the policy control aspects. Section 6.2.1.2 presents a message sequence for the NGN GETS Data Transport. Section 6.2.1.3 describes an NGN GETS call/session termination where resources are available.

Note that the Broadband Forum has a work item on policy in the DSL Access Network. However, this work is not reflected in this section.

6.2.1.1 GETS-AN Call/Session Sequence

The basic message sequence (call/session flow)for an NGN GETS-AN call/session focusing on the policy control aspects is shown in Figure 6-16 and Figure 6-17. Note that the Policy Server / PDP is located at the border of the DSL access network and the IMS Core Network. These flows also assume that the user's Access Gateway has no NGN GETS capabilities.

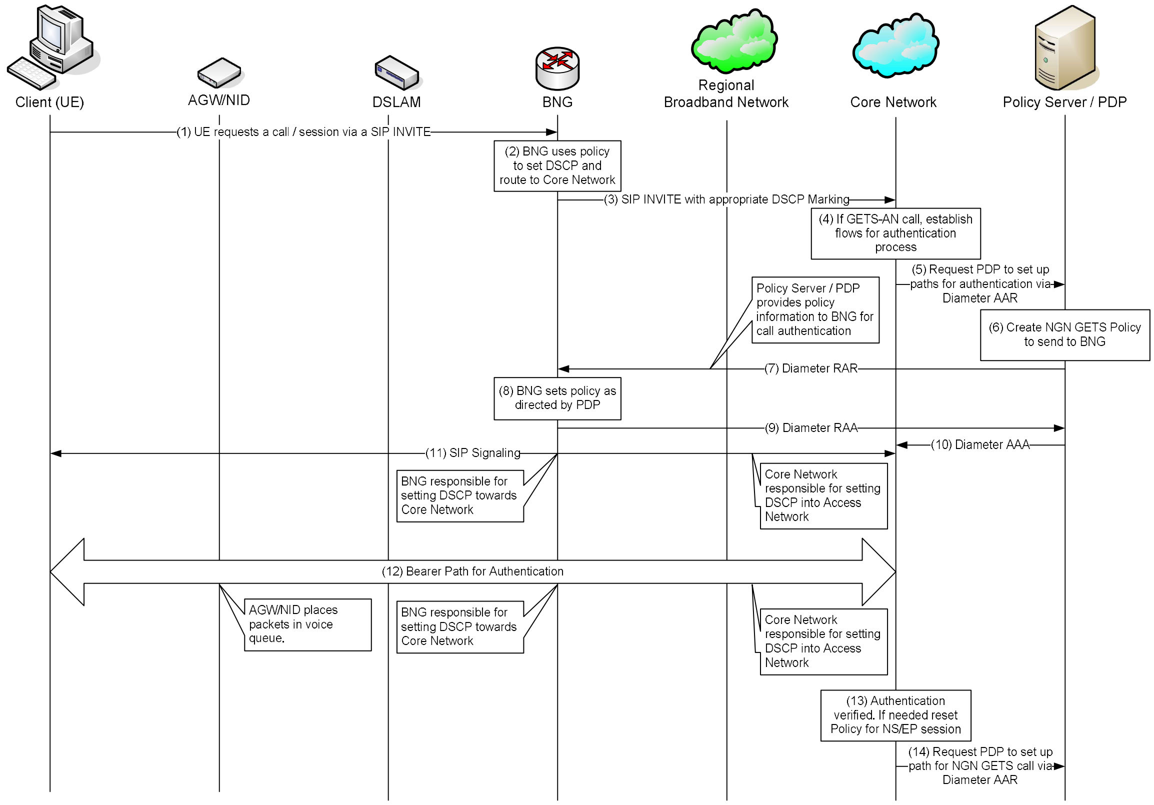

Figure 6-16 – GETS-AN Message Flow (Part 1 of 2)

1. The UE client sends a GETS-AN call / session setup request to the IMS Core Network. The Access Gateway (AGW) / NID's classifier identifies the packet as a SIP packet and places it in the signaling queue for transmission to the DSLAM. The DSLAM routes the packet to the Broadband Network Gateway (BNG).
2. The BNG uses its default signaling policy to mark the SIP INVITE with the appropriate DSCP for transmission into the IMS Core Network.
3. The SIP INVITE is routed across the Regional Broadband Network into the IMS Core Network.
4. Within the IMS Core Network, the S-CSCF and AS determine that a bearer path is needed to perform authorization. (Neither the S-CSCF nor the AS are shown in the figure.) The IMS Core Network is the first point at which the call/session request is recognized as an NGN GETS call/session request.
5. The IMS Core Network, via the P-CSCF (not shown in the figure), requests that the Policy Server / PDP set up a priority bearer path to obtain PIN and DN information. Depending on the NGN GETS Service Provider's implementation, the Policy Server / PDP may also be requested to set up a priority signaling channel for the rest of the NGN GETS signaling flow. The request includes the IPv4 or IPv6 address and port number of the subscriber for this service request.[13]

   The IMS Core Network contacts the Policy Server / PDP to enforce policy controls. The IMS Core Network provides information concerning the flow(s) of interest to the Policy Server / PDP in the Diameter AAR message. The Policy Server / PDP stores the Media-Component-Description AVP values (e.g., media type and maximum required bandwidth) for the call / session. For NGN GETS, the MPS-Identifier and Reservation-Priority AVPs in the Diameter AAR message triggers the Policy Server / PDP to provide priority handling in the Policy Server / PDP.
6. Upon receiving the request, the Policy Server / PDP checks the request against the policy rules and if the request is approved, updates the policies for the BNG. In determining the policy for the BNG, the Policy Server / PDP may apply local network policy. The policy will affect the allocation of bearer resources. The

[13] The parameters for classifying a packet as belonging to a policy are source IP address and port, destination IP address and port, and protocol type. "Wildcards" can be used, so that, for example, a policy could apply to all packets from a given source IP address.

Policy Server / PDP provides policy information (i.e., PCC rules) to the BNG via the Charging-Rule-Definition AVP in the Diameter RAR message. PCC rules can define gate functions that enable or disable the forwarding of service flow packets via the BNG. The Policy Server / PDP can activate or deactivate a PCC rule that is predefined in the BNG, can install or modify a Policy Server / PDP-provisioned PCC rule, or remove a previous Policy Server / PDP-provisioned PCC rule. Note that the Policy Server / PDP may be part of the IMS Core Network's PCRF.

7. The Policy Server / PDP passes a set of authorized policy parameters to the BNG via a Diameter RAR message. The parameters include the source IP address and port, and may include the destination IP address and port, and the protocol used.
8. The BNG installs the policy information received from the Policy Server / PDP. For NGN GETS, the Diameter RAR message triggers the BNG to apply priority treatment for transport layer packets, and to apply this policy to subsequent packets.
9. The BNG responds to the Policy Server / PDP with a Diameter RAA message, indicating that the policy was successfully updated and implemented.
10. The Policy Server / PDP instructs the IMS Core Network that priority flows are available for use for the authentication and authorization process. The Policy Server / PDP responds to the IMS Core Network with a Diameter AAA message, indicating the disposition of the previous Diameter AAR message.

    Note that the Diameter AAA message may optionally precede the Diameter RAR message in the PCC interaction.
11. The IMS Core Network continues a SIP dialog with the UE to establish a bearer path for authorization. The IMS Core Network is responsible for setting the signaling DSCP for packets transmitted to the BNG across the Regional Broadband Network, and the BNG is responsible for setting the signaling DSCP for packets transmitted to the IMS Core Network across the Regional Broadband Network.
12. A bearer path for authorization is set up between the UE and the IMS Core Network. The AGW / NID places the bearer packets in the queue for transmission to the BNG. Since the AGW / NID is assumed to be non-GETS aware, it cannot distinguish between NGN GETS bearer packets and normal bearer packets.

    The IMS Core Network is responsible for setting the NGN GETS bearer DSCP for packets transmitted to the BNG across the Regional Broadband Network, and the BNG is responsible for setting the NGN GETS bearer DSCP for packets transmitted to the IMS Core Network across the Regional Broadband Network.

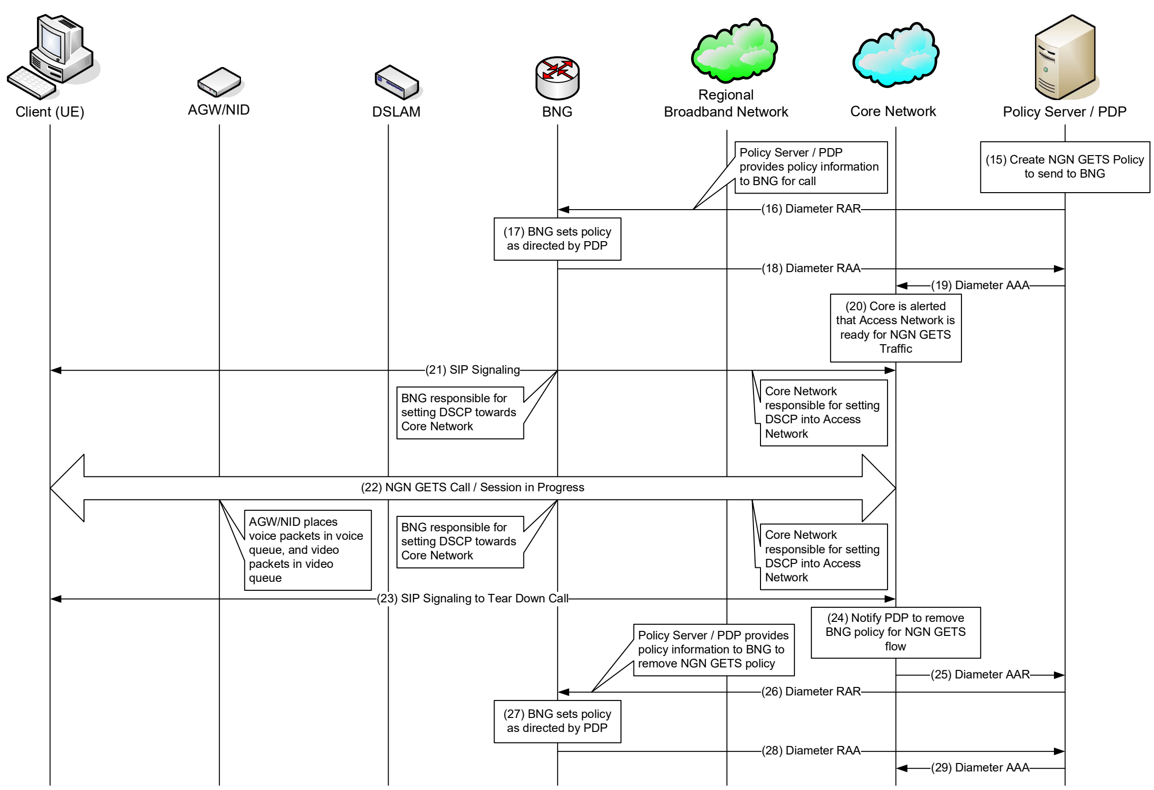

Figure 6-17 – GETS-AN Message Flow (Part 2 of 2)

13. After successful authorization, the IMS Core Network may need to reset the NGN GETS policy for the call/session. This may occur if additional bandwidth is required for the NGN GETS call/session. If this is not required, then the next step in the flow is Step 20.
14. The IMS Core Network requests that the Policy Server / PDP set up a priority bearer path. The IMS Core Network provides information concerning the flow(s) of interest to the Policy Server / PDP in the Diameter AAR message.
15. Upon receiving the request, the Policy Server / PDP checks the request against the policy rules and if the request is approved, updates the policies for the BNG.
16. The Policy Server / PDP passes a set of authorized policy parameters to the BNG via a Diameter RAR message.
17. The BNG installs the policy information received from the Policy Server / PDP, and applies the policy to subsequent packets.
18. The BNG responds to the Policy Server / PDP with a Diameter RAA message.
19. The Policy Server / PDP instructs the IMS Core Network that priority flows are available for use. The Policy Server / PDP responds to the IMS Core Network with a Diameter AAA message, indicating the disposition of the previous Diameter AAR message. Note that the Diameter AAA message may optionally precede the Diameter RAR message in the PCC interaction.
20. The IMS Core Network knows that an NGN GETS bearer path is available from the UE.
21. The IMS Core Network informs the UE through SIP signaling that an NGN GETS call / session is now possible.
22. The NGN GETS call / session is in progress. The BNG uses the user's IP address and port number to identify priority NGN GETS packets, to place these packets into the appropriate "priority" queues, and to mark the packets with the appropriate "priority" DSCP and COS values. (Note that the NID and DSLAM are not involved in priority processing.)
23. When the client is finished with the session, it notifies the IMS Core Network via the SIP signaling.
24. The IMS Core Network terminates the session and sends a request to the Policy Server / PDP.
25. The request to the Policy Server / PDP is sent in a Diameter AAR message.
26. Upon receiving the request, the Policy Server / PDP updates the policies for the BNG and the policy control procedures are invoked again. The Policy Server / PDP sends the Diameter RAR message towards the BNG.
27. The BNG installs the policy information received from the Policy Server / PDP, and applies them to subsequent packets.
28. The BNG responds to the Policy Server / PDP with a Diameter RAA message.
29. The Policy Server / PDP informs the IMS Core Network that NGN GETS call / session has been terminated via a Diameter AAA message. Note that the Diameter AAA message may optionally precede the Diameter RAR message in the PCC interaction.

6.2.1.1.1 Relevant NGN GETS Aspects

This section highlights incremental NGN GETS specific processing for each FE, based on the NGN GETS call / session flow as described above.

UE, NID, and DSLAM

No changes are required.

IMS Core Network (e.g., P-CSCF)

The IMS Core Network FE capabilities are as described in Section 6.1.1.1.

Policy Server / PDP

The Policy Server / PDP capabilities are as described in Section 6.1.1.1 for PCRF.

Broadband Network Gateway (BNG)

A. Apply priority treatment for Diameter messages related to an NGN GETS call / session

For an NGN GETS call / session, the BNG applies the policy received from the Policy Server / PDP when creating or modifying the media connection. Priority treatment is needed for the marking and transport of these messages.

B. Apply priority treatment to transport layer packets

The BNG provides priority treatment (in processing) to transport layer packets for an NGN GETS call / session, and marks the outgoing packets appropriately.

Policy Server / PDP processing for Call Admission Control (CAC) and BNG control is for future specification.

6.2.1.2 NGN GETS Data Transport

The message sequence to set up an NGN GETS Data Transport session from an NGN GETS Service User is shown in Figure 6-18. The example flow uses a commercial web browser to communicate with an NGN GETS HTTPS server within the NGN GETS Service Provider's managed network for authentication and authorization. This flow assumes an Rx interface between the NGN GETS HTTPS server and the Policy Server / PDP[14].

[14] A SIP-based approach is also possible. There is no change to the Rx interface for the SIP-based approach versus the HTTPS approach shown here.

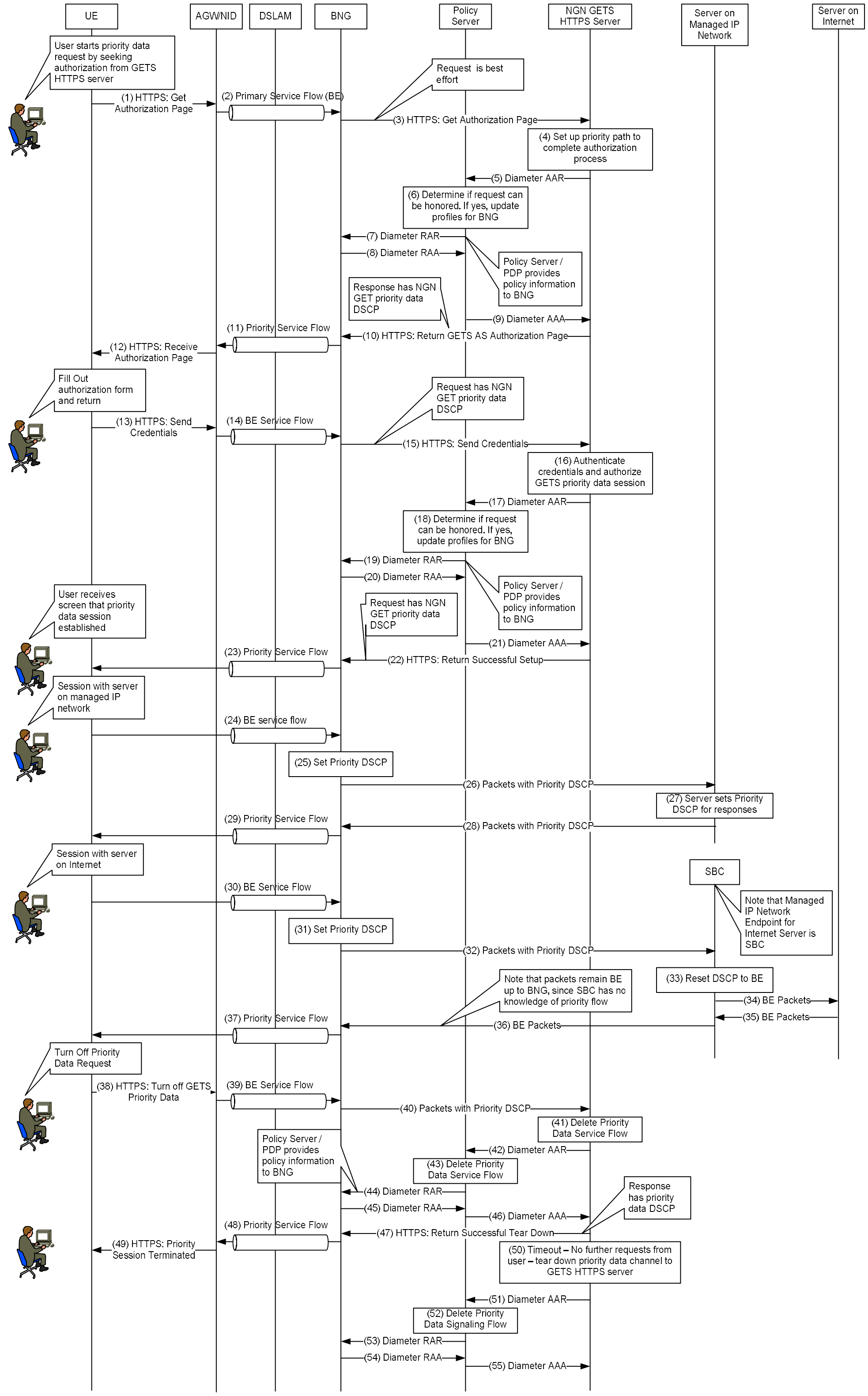

Figure 6-18 – NGN GETS Data Transport Session

NGN GETS Data Transport Session Establishment

1. The Service User starts an NGN GETS Data Transport transfer request by seeking authorization from an NGN GETS HTTPS server.

2. When the AGW / NID receives the message, it forwards the request over its Best Effort (BE) data queue to the DSLAM, which passes the request to the BNG. The AGW / NID is typically configured to treat all data transfers from the UE into the access network as BE.
3. For the case where the HTTPS request is coming from a UE not registered as an NGN GETS UE, the BNG will treat the request as a normal data flow and send it to the NGN GETS HTTPS server. Congestion in the Regional Broadband Network or IMS Core Network, or in resources required for Uniform Resource Locator (URL) resolution, could cause the HTTPS request to be lost. If the initial HTTPS request was split into multiple IP packets by the UE, Steps 2 and 3 would be repeated until the entire request was sent to the NGN GETS HTTPS server.

   If the UE is registered as an NGN GETS UE, and if the Policy Server / PDP pushes a policy into the BNG after UE registration allowing HTTPS traffic from the UE to an NGN GETS HTTPS server priority treatment, then the Step 3 packets would have the NGN GETS Data Transport DSCP marking. In this latter case, Steps 4 through 9 could be bypassed, and Steps 50 through 55 would only occur after the UE's registration times out.
4. The NGN GETS HTTPS server recognizes the need to set up an NGN GETS Data Transport path between itself and the UE to complete the authentication and authorization process.
5. The NGN GETS HTTPS server issues a Diameter AAR message to the Policy Server / PDP to reserve bearer resources for HTTPS traffic between itself and the UE with the following NGN GETS enhancements: (1) it sets the MPS-Identifier and Reservation-Priority AVPs to the appropriate NGN GETS values and (2) it may include a special NGN GETS DSCP value to be used for transmitting IP packets in the NGN GETS Service Provider's network.
6. Upon receiving the request, the Policy Server / PDP checks the request against its own policy rules and, if the request is approved, updates the policies for the BNG. The Policy Server / PDP may apply local network policy. The policy will affect the allocation of bearer resources. The Policy Server / PDP passes a set of authorized policy parameters to the BNG.
7. The Policy Server / PDP provides policy information (e.g., PCC rules) to the BNG via the Charging-Rule-Definition AVP in the Diameter RAR message.
8. The BNG installs the policy information received from the Policy Server / PDP. The BNG responds to the Policy Server / PDP with a Diameter RAA message.

   The Policy Server / PDP informs the NGN GETS HTTPS server that priority flows are available for its use. The Policy Server / PDP responds to the NGN GETS HTTPS server with a Diameter AAA message, indicating the disposition of the previous Diameter AAR message. Note that the Diameter AAA message may optionally precede the Diameter RAR message in the PCC interaction.
9. The NGN GETS HTTPS server communicates with the UE using HTTPS to obtain the user's credentials. The NGN GETS HTTPS server is responsible for marking the HTTPS packets it sends into the network with the appropriate NGN GETS DSCP marking.
10. Due to the policy push of Step 7, the BNG provides priority to the HTTPS response being sent to the UE. This response may be sent in the AF queue typically used by video, rather than the BE queue normally used for data.
11. The AGW / NID returns the HTTPS response to the UE.
12. The Service User fills out the request for credentials and returns the information.
13. The AGW / NID treats the data response as BE.
14. Due to the policy push of Step 7, the BNG provides priority to the HTTPS packets being sent to the NGN GETS HTTPS server.
15. The NGN GETS HTTPS server authenticates the user's credentials and determines what policy it needs to push for the NGN GETS Data Transport transfer request.
16. The NGN GETS HTTPS server issues a Diameter AAR message to the Policy Server / PDP to reserve bearer resources, as normal, with the following NGN GETS enhancements: (1) it sets the MPS-Identifier and Reservation-Priority AVPs to the appropriate NGN GETS values and (2) it may include a special NGN GETS DSCP value to be used for transmitting IP packets in the NGN GETS Service Provider's network.
17. Upon receiving the request, the Policy Server / PDP checks the request against its own policy rules and, if the request is approved, updates the policies for the BNG. In determining the policy for the BNG, the Policy Server / PDP may apply local network policy. The policy will affect the allocation of bearer resources. The

Policy Server / PDP passes a set of authorized policy parameters (i.e., PCC rules) to the BNG. PCC rules can define gate functions that enable or disable the forwarding of service flow packets via the BNG. The Policy Server / PDP can activate or deactivate a PCC rule that is predefined in the BNG, can install or modify a Policy Server / PDP-provisioned PCC rule, or remove a previous Policy Server / PDP-provisioned PCC rule.

18. The Policy Server / PDP provides policy information (e.g., PCC rules) to the BNG via the Charging-Rule-Definition AVP in the Diameter RAR message.
19. The BNG installs the policy information received from the Policy Server / PDP. For NGN GETS service, the Diameter RAR message triggers the BNG to subsequently apply priority treatment for transport layer packets. The BNG responds to the Policy Server / PDP with a Diameter RAA message.

    The Policy Server / PDP instructs the NGN GETS HTTPS server that the Service User's NGN GETS Data Transport is ready for use. The Policy Server / PDP responds to the AS with a Diameter AAA message, indicating the disposition of the previous Diameter AAR message. Note that the Diameter AAA message may optionally precede the Diameter RAR message in the PCC interaction.
20. The NGN GETS HTTPS server returns a "priority data session established message" to the UE. The NGN GETS HTTPS server is responsible for marking the HTTPS packets it sends into the network with the appropriate NGN GETS DSCP marking. If the NGN GETS HTTPS server does not set a DSCP, the response is treated as best effort until it reaches the BNG.
21. At the BNG, the response is placed on the GETS priority service flow for transmission to the UE.

NGN GETS Data Transport – Communication with Servers on the NGN GETS Service Provider's Managed Network

22. When the user communicates with a server on the managed IP network, the packets from the UE to the BNG are BE.
23. The BNG provides priority to the NGN GETS packets and sets the NGN GETS DSCP marking before forwarding the packets into the Regional Broadband Network.
24. Based on the DSCP markings, the access and IMS Core Network transmit the packets to the server with the appropriate treatment.
25. The server provides the appropriate treatment to the Service User's request.
26. In responding to the user, the server is responsible for marking its packets with the appropriate DSCP. If the server does not set a DSCP, the response is treated as best effort until it reaches the BNG.
27. At the BNG, the response is placed on the NGN GETS priority service flow for transmission to the UE.

NGN GETS Data Transport – Communication with Servers on the Internet

28. When the Service User communicates with a server on the Internet, the packets from the UE to the BNG are BE.
29. The BNG provides priority to the NGN GETS packets and sets the NGN GETS DSCP marking.
30. The BNG forwards the packets into the Regional Broadband Network. Based on the DSCP markings, the access and IMS Core Network transmit the packets with the appropriate treatment to a Session Border Controller (SBC) connected to the Internet.
31. The SBC typically remarks packets to BE before sending them into the Internet.
32. The packets are transmitted to the server with BE treatment. If the Internet or server is congested, packets may be lost.
33. Packets are returned to an SBC with best effort treatment. It is important to note that multiple SBCs may be used during the session for communications between the UE and the server on the Internet.
34. The packets travel from the SBC to the BNG with BEtreatment. Mechanisms to provide NGN GETS priority treatment from the SBC to the BNG are for future study.
35. At the BNG, the response is placed on the GETS priority service flow for transmission to the UE.

NGN GETS Data Transport Session Tear-Down

36. The user sends a session termination request to the NGN GETS HTTPS server.
37. The packets from the UE to the BNG are BE.

38. Due to the policy push of Step 7, the BNG provides priority to the HTTPS packets being sent to the NGN GETS HTTPS server.
39. The NGN GETS HTTPS server requests that the policy associated with the NGN GETS Priority Data Transport session be terminated. The server does not request termination of the policy allowing priority communications between the UE and itself, in order to allow the user to establish another session.
40. The NGN GETS HTTPS server issues a Diameter AAR message to the Policy Server / PDP requesting deletion of the NGN GETS Data Transport session.
41. Upon receiving the request, the Policy Server / PDP updates the policies for the BNG.
42. The Policy Server / PDP provides policy information (e.g., PCC rules) to the BNG via the Charging-Rule-Definition AVP in the Diameter RAR message.
43. The BNG installs the policy information received from the Policy Server / PDP. The BNG responds to the Policy Server / PDP with a Diameter RAA message.

    The Policy Server / PDP instructs the NGN GETS HTTPS server that priority flows have been terminated. The Policy Server / PDP responds to the NGN GETS HTTPS server with a Diameter AAA message, indicating the disposition of the previous Diameter AAR message. Note that the Diameter AAA message may optionally precede the Diameter RAR message in the PCC interaction.
44. The NGN GETS HTTPS server returns a “priority data session terminated message” to the UE. The NGN GETS HTTPS server is responsible for marking the HTTPS packets it sends into the network with the appropriate NGN GETS DSCP marking. If the NGN GETS HTTPS server does not set a DSCP, the response is treated as BE until it reaches the BNG.
45. At the BNG, the response is placed on the NGN GETS priority service flow for transmission to the UE.
46. The AGW / NID returns the HTTPS response to the UE.
47. After a registration timeout, or after a provisioned time duration[15], the NGN GETS HTTPS server will terminate the NGN GETS Data Transport path between itself and the UE.
48. The NGN GETS HTTPS server issues a Diameter AAR message to the Policy Server / PDP requesting deletion of the NGN GETS Data Transport channel between itself and the UE.
49. Upon receiving the request, the Policy Server / PDP updates the policies for the BNG.
50. The Policy Server / PDP provides policy information (e.g., PCC rules) to the BNG via the Charging-Rule-Definition AVP in the Diameter RAR message.
51. The BNG installs the policy information received from the Policy Server / PDP. The BNG responds to the Policy Server / PDP with a Diameter RAA message.

    The Policy Server / PDP instructs the NGN GETS HTTPS server that the priority channel has been terminated. The Policy Server / PDP responds to the NGN GETS HTTPS server with a Diameter AAA message, indicating the disposition of the previous Diameter AAR message. Note that the Diameter AAA message may optionally precede the Diameter RAR message in the PCC interaction.

6.2.1.2.1 Relevant NGN GETS Aspects

UE, NID, and DSLAM

No changes are required.

BNG

No additional changes are required beyond those described for the GETS-AN session flow.

[15] Unless it is acting as a proxy, the GETS HTTPS server has no way of tracking UE activity. The approach shown here is to have the GETS HTTPS server allow the UE to request a duration for the NGN GETS Data Transport when the UE invokes the service. The UE can terminate the service before the duration runs out (steps 38 – 49). A short time (e.g., 5 minutes) before the NGN GETS Data Transport is to expire, the GETS HTTPS server will notify the UE of the pending termination and request if the UE would like to extend the process. If the UE does not extend the time for the service, then steps 51 – 55 would occur when the timer expires.

Policy Server / PDP

No additional changes are required beyond those described for the GETS-AN session flow.

NGN GETS HTTPS Server

A. Send messages to the Policy Server / PDP over the Diameter Rx reference point associated with the desired NGN GETS priority service flows when it detects that the request is an NGN GETS Data Transport transfer request.

   Include the MPS-Identifier and Reservation-Priority AVPs with the appropriate NGN GETS values in all requests to the Policy Server / PDP.

B. Keep track of priority signaling channels established between itself and UEs. Keep track of which of these channels were established with NGN GETS registered UEs, and which were established with non-NGN GETS registered UEs. Receive registration and registration time-out information from the Registrar and use this information to establish and tear down priority signaling channels between itself and the UEs.

C. Keep track of NGN GETS Data Transport channels established for a UE. Allow UEs to establish duration for the NGN GETS Data Transport to be active. Notify the UE when the NGN GETS Data Transport is about to be terminated and allow the UE to extend the NGN GETS priority data transport duration. Tear down the NGN GETS Data Transport channels when the duration for the NGN GETS Data Transport has expired.

6.2.1.3 NGN GETS Call / Session Termination

This call/session flow covers the case when a user is the terminating party in a call/session that was originated by a Service User as an NGN GETS call/session. Note that the terminating UE can either be an NGN GETS UE or a public UE; priority will be given to the NGN GETS call/session to the terminating UE in both cases. The flow (Figure 6-19) is similar to that found in Figure 6-16, with the exception that Step 1 comes from the IMS Core Network as opposed to the UE.

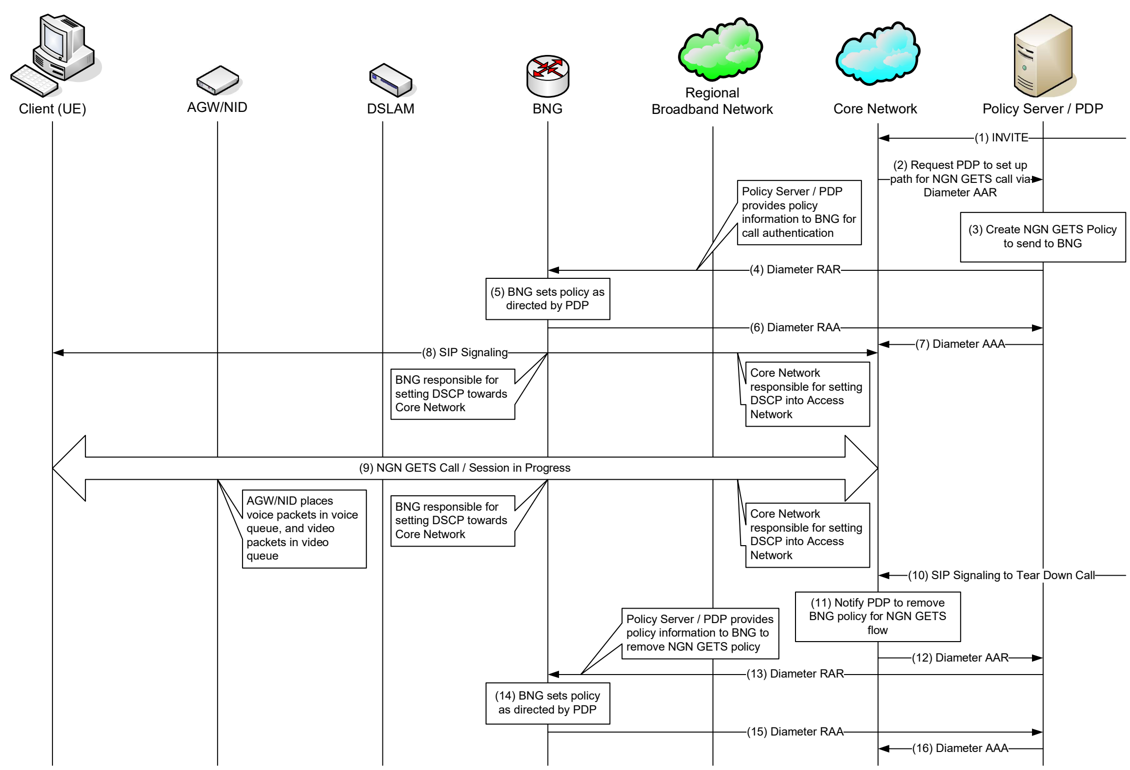

Figure 6-19 – NGN GETS Call / Session Termination

1. An authenticated NGN GETS INVITE is received by the terminating P-CSCF of the IMS Core Network. (Note: the P-CSCF is not shown in the above figure.)
2. The IMS Core Network requests that the Policy Server / PDP set up a priority bearer path. The IMS Core Network provides information concerning the flow(s) of interest to the Policy Server / PDP in the Diameter AAR message.
3. Upon receiving the request, the Policy Server / PDP checks the request against the policy rules and if the request is approved, updates the policies for the BNG.
4. The Policy Server / PDP passes a set of authorized policy parameters to the BNG via a Diameter RAR message.
5. The BNG installs the policy information received from the Policy Server / PDP, and applies them to subsequent packets.
6. The BNG responds to the Policy Server / PDP with a Diameter RAA message.
7. The Policy Server / PDP instructs the IMS Core Network that priority flows are available for use. The Policy Server / PDP responds to the IMS Core Network with a Diameter AAA message, indicating the disposition of the previous Diameter AAR message. Note that the Diameter AAA message may optionally precede the Diameter RAR message in the PCC interaction.
8. The IMS Core Network informs the terminating UE through SIP signaling that a call / session is being requested. The call / session is established with the terminating UE.
9. The NGN GETS call / session is in progress. The BNG uses the IP address and port number of the called user to identify priority NGN GETS packets. The BNG marks packets received from the called user with the appropriate NGN GETS DSCP and COS values, and places these packets into the appropriate queues for transmission into the Regional Broadband Network[16]. (Note that the NID and DSLAM are not involved in priority processing.)
10. When the originating UE is finished with the call/session, it notifies the IMS Core Network via the SIP signaling.
11. The IMS Core Network terminates the session and sends a request to the Policy Server / PDP.
12. The request to the Policy Server / PDP is sent in a Diameter AAR message.
13. Upon receiving the request, the Policy Server / PDP updates the policies for the BNG and the policy control procedures are invoked again. The Policy Server / PDP sends the Diameter RAR message towards the BNG.
14. The BNG installs the policy information received from the Policy Server / PDP, and applies them to subsequent packets.
15. The BNG responds to the Policy Server / PDP with a Diameter RAA message.
16. The Policy Server / PDP informs the IMS Core Network via a Diameter AAA message that the NGN GETS call / session has been terminated. Note that the Diameter AAA message may optionally precede the Diameter RAR message in the PCC interaction.

6.2.1.3.1 Relevant NGN GETS Aspects

The NGN GETS features described in Section 6.2.1.1.1 also apply to the NGN GETS call / session termination.

6.2.2 Fiber

This section is informative and describes various call/session flows intended to illustrate how an NGN GETS call/session could be processed in a fiber access network. This material is meant to provide a high-level description and is not intended to be exhaustive. If inconsistencies exist between this section and fiber specifications, the fiber specifications take precedence. Alternative call/session flows are possible.

[16] The called UE is not trusted, so the BNG will mark all packets from the called UE with the appropriate DSCP based upon whether the call is a normal call or an NGN GETS call.

Section 6.2.1 described the various flows that illustrated how an NGN GETS call / session could be processed in a DSL access network. Those call / session flows are applicable to the fiber access network with the following modifications:

- The Policy Server is called an Access Node Management System (ANMS)
- Rather than communicate with a BNG using the Diameter protocol, the ANMS communicates with both the Optical Network Termination (ONT) and the Optical Line Termination (OLT) using the CMISE and ROSE protocols.

Section 6.2.2.1 presents an NGN GETS-AN call/session sequence found in Section 6.2.1.1, highlighting the basic message sequence for adding and deleting service flows in a Gigabit PON (GPON) access network.

6.2.2.1 NGN GETS-AN Call/Session Sequence

The basic message sequence (call/session flow) for an NGN GETS-AN call/session focusing on the policy control aspects is shown in Figure 6-20, Figure 6-21, and Figure 6-22. Note that the Policy Server (ANMS) is located at the border of the Fiber access network and the IMS Core Network.

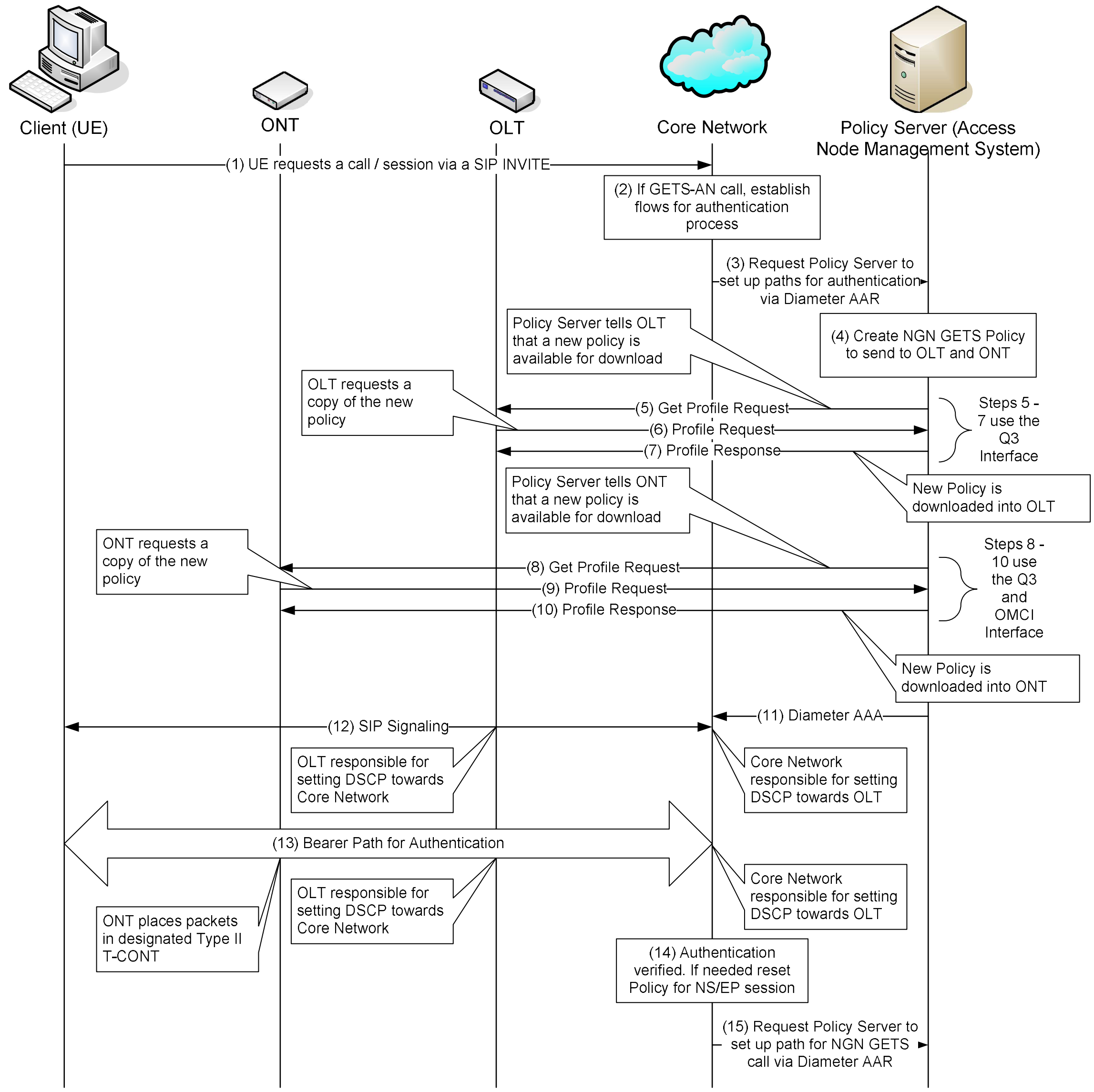

Figure 6-20 – NGN GETS-AN Message Flow (Part 1 of 3)

1. The UE issues a GETS-AN call / session setup request to the IMS Core Network. The ONT's classifier identifies the packet as a SIP packet and places it in the signaling queue for transmission to the OLT. The OLT uses its default signaling policy to mark the SIP INVITE with the appropriate DSCP for transmission into the IMS Core Network.
2. Within the IMS Core Network, the S-CSCF and AS determine that a bearer path is needed to perform authentication and authorization. (Neither the S-CSCF nor the AS are shown in the figure.) The IMS Core Network is the first point at which the call / session request is recognized as an NGN GETS request.
3. The IMS Core Network, via the P-CSCF (not shown in the figure), requests that the Policy Server (ANMS) set up a priority bearer path to obtain PIN and DN information. Depending on the NGN GETS Service Provider's implementation, the Policy Server may also be requested to set up a priority signaling channel for the rest of the NGN GETS signaling flow. The request includes:
    a. Subscriber Identifier – identifies the IPv4 or IPv6 address of the subscriber for this service request.
    b. Transaction Identifier –contains a token that is used by the IMS Core Network to match responses from the Policy Server.
    c. Classifier – specifies the packet matching rules associated with the priority flow. The Basic Classifier is an eight-tuple identifying:

i. Protocol
ii. Source IP
iii. Source Port
iv. Destination IP
v. Destination Port
vi. Priority
vii. DSCP/Type of Service (TOS)
viii. DSCP/TOS Mask

d. Traffic Profile for Flow

The IMS Core Network contacts the ANMS to enforce policy controls. The IMS Core Network provides information concerning the flow(s) of interest to the ANMS in the Diameter AAR message. The ANMS stores the Media-Component-Description AVP values (e.g., media type and maximum required bandwidth) for the call / session. For NGN GETS service, the MPS-Identifier and Reservation-Priority AVPs in the Diameter AAR message triggers the ANMS to provide priority handling in the ANMS.

4. Upon receiving the request, the ANMS checks the request against the policy rules and if the request is approved, updates the policies for the OLT and the ONT.
5. The ANMS uses the Q3 interface, as defined in [ITU-T Q.812], to tell the OLT that a new policy is available for it to download.
6. The OLT requests the new policy over the Q3 interface.
7. The new policy is returned to the OLT over the Q3 interface.
8. The ANMS tells the ONT that a new policy is available for it to download. The message is sent via the Q3 interface to the OLT, and then via the OMCI interface from the OLT to the ONT.
9. The ONT requests the new policy via the OMCI and Q3 interfaces.
10. The new policy is returned to the ONT via the Q3 and OMCI interfaces.
11. The ANMS tells the IMS Core Network that priority flows are available for use. The ANMS responds to the IMS Core Network with a Diameter AAA message, indicating the disposition of the previous Diameter AAR message.
12. The IMS Core Network continues a SIP dialog with the UE to establish a bearer path for authentication and authorization. The IMS Core Network is responsible for setting the signaling DSCP for packets transmitted to the OLT, and the OLT is responsible for setting the signaling DSCP for packets transmitted to the IMS Core Network.
13. A bearer path for authentication and authorization is set up between the UE and the IMS Core Network. The ONT places the voice bearer packets into the appropriate Type II T-CONT for transmission to the OLT.

    The IMS Core Network is responsible for setting the NGN GETS bearer DSCP for packets transmitted to the OLT, and the OLT is responsible for setting the NGN GETS bearer DSCP for packets transmitted to the IMS Core Network.
14. After successful authentication and authorization, the IMS Core Network may need to reset the NGN GETS policy for the call/session. This may occur if additional bandwidth is required for the NGN GETS call/session. If this is not required, then the next step in the flow is Step 24.
15. The IMS Core Network requests that the ANMS set up a priority bearer path. The IMS Core Network provides information concerning the flow(s) of interest to this Policy Server in the Diameter AAR message.
16. Upon receiving the request, the ANMS checks the request against the policy rules and if the request is approved, updates the policies for the OLT and the ONT.
17. The ANMS uses the Q3 interface to tell the OLT that a new policy is available for it to download.
18. The OLT requests the new policy over the Q3 interface.
19. The new policy is returned to the OLT over the Q3 interface.
20. The ANMS tells the ONT that a new policy is available for it to download. The message is sent via the Q3 interface to the OLT, and then via the OMCI interface from the OLT to the ONT.
21. The ONT requests the new policy via the OMCI and Q3 interfaces.
22. The new policy is returned to the ONT via the Q3 and OMCI interfaces.

23. The ANMS tells the IMS Core Network that priority flows are available for use. The ANMS responds to the IMS Core Network with a Diameter AAA message, indicating the disposition of the previous Diameter AAR message.

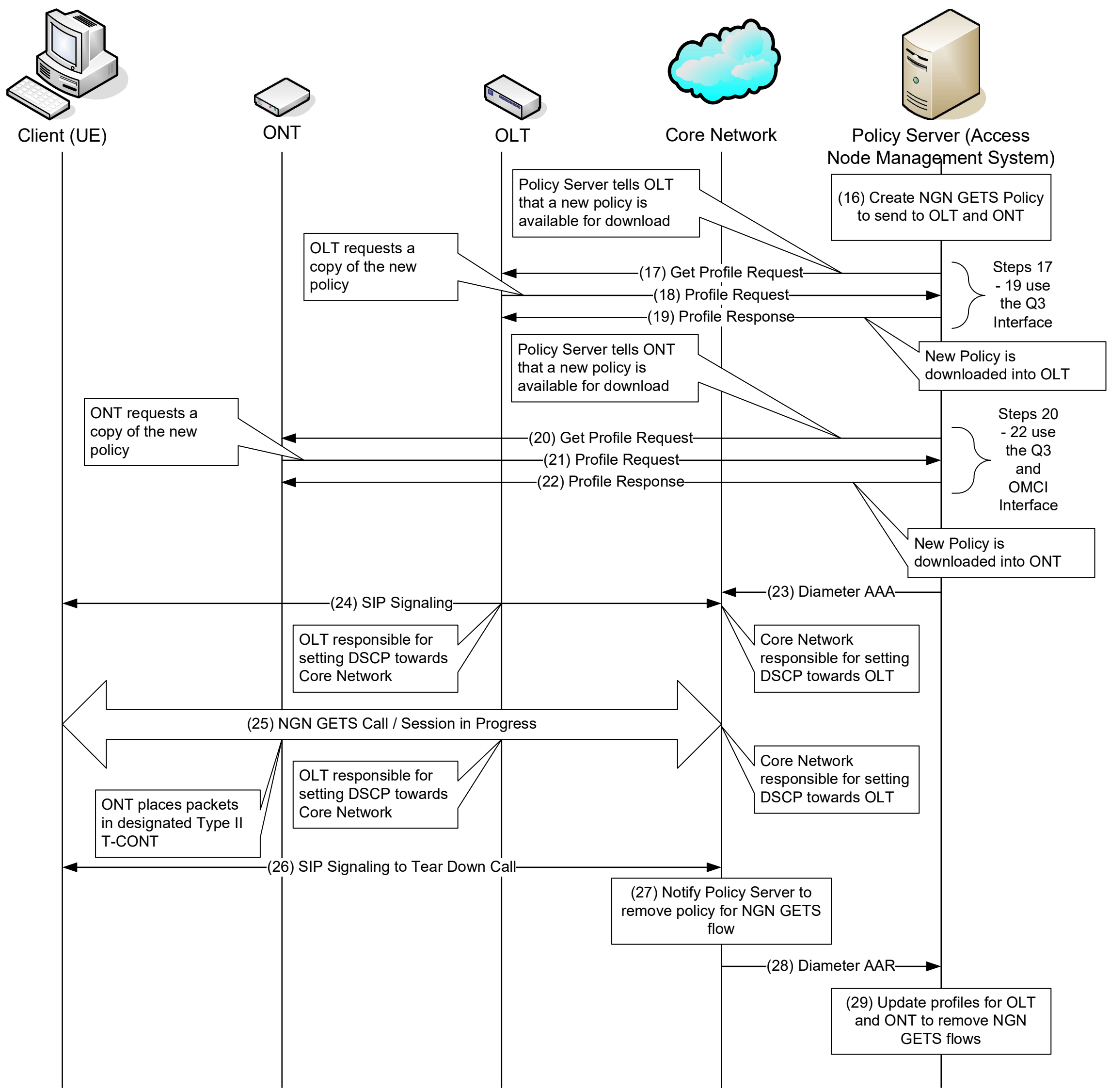

Figure 6-21 – NGN GETS-AN Message Flow (Part 2 of 3)

24. The IMS Core Network knows that an NGN GETS bearer path is available from the UE. The IMS Core Network informs the UE through SIP signaling that an NGN GETS call / session is now possible.
25. The NGN GETS call / session is in progress. The OLT and ONT use the eight-tuple classifier (Protocol, Source IP, Source Port, Destination IP, Destination Port, Priority, DSCP/TOS, and DSCP/TOS Mask) to identify priority NGN GETS packets, to place these packets into the appropriate T-CONTs, and to mark the packets with the appropriate “priority” DSCP and COS values.
26. When the UE is finished with the session, it notifies the IMS Core Network via the SIP signaling.
27. The IMS Core Network terminates the session and sends a request to the Policy Server.
28. The request to the Policy Server is sent in a Diameter AAR message.
29. Upon receiving the request, the ANMS updates the policies for the OLT and the ONT.

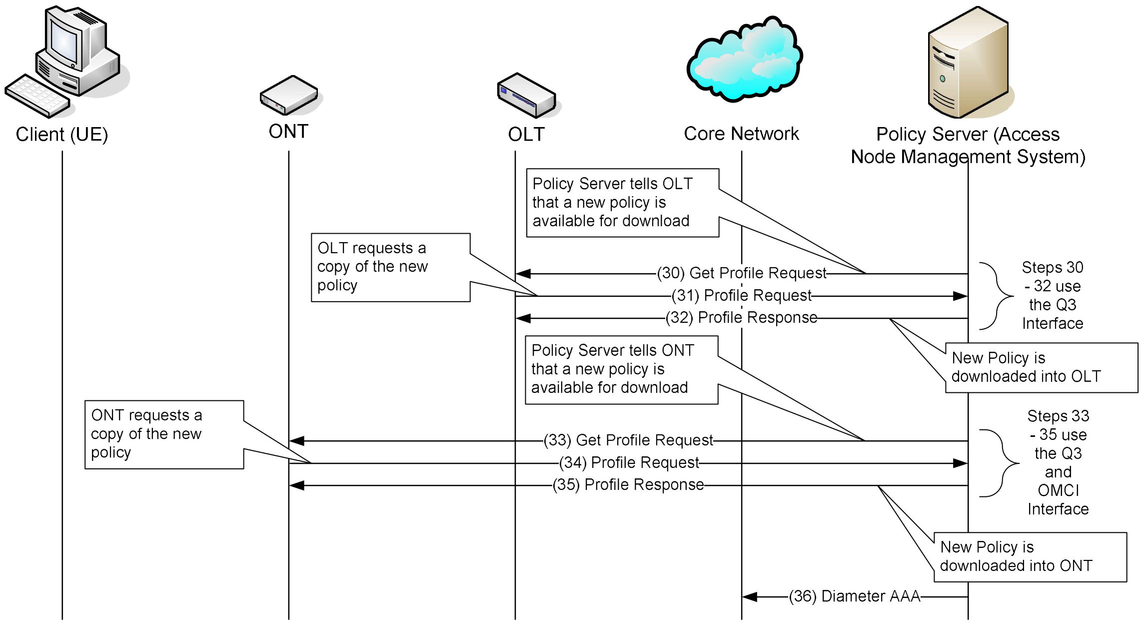

Figure 6-22 – NGN GETS-AN Message Flow (Part 3 of 3)

30. The ANMS tells the OLT that a new policy is available for it to download via the Q3 interface.
31. The OLT requests the new policy via the Q3 interface.
32. The new policy is returned to the OLT via the Q3 interface.
33. The ANMS tells the ONT that a new policy is available for it to download. The message is sent via the Q3 interface to the OLT, and then via the OMCI interface from the OLT to the ONT.
34. The ONT requests the new policy via the OMCI and Q3 interfaces.
35. The new policy is returned to the ONT via the Q3 and OMCI interfaces.
36. The ANMS tells the IMS Core Network that priority flows have been terminated via a Diameter AAA message.

6.2.2.1.1 Relevant NGN GETS Aspects

This section highlights incremental NGN GETS specific processing for each FE, based on the NGN GETS call / session flow as described above.

IMS Core Network (e.g., P-CSCF)

The IMS Core Network FE capabilities are as described in Section 6.1.1.1.

Access Node Management System (Policy Server)

A. Apply priority treatment for processing and signaling related to an NGN GETS call / session

The Access Node Management System applies priority treatment in processing the signaling messages related to an NGN GETS call / session (e.g., allocating local resources in a priority fashion). The Access Node Management System must ensure that NGN GETS policies are retrieved by the ONT and OLT in a timely manner consistent with the real-time nature of the service.

Policy Server processing for CAC control is not addressed in this document.

B. Mark messages across the Q3 and OMCI interfaces related to an NGN GETS call / session with NGN GETS priority marking(s)

The control messages across the Q3 and OMCI interfaces should be marked with the appropriate NGN GETS DSCP / TOS values, if these values are used for the priority transport of NGN GETS signaling messages across the IMS Core Network.

*C. **Determine if resources are available for the NGN GETS call / session request***

The ANMS determines if resources are available to support the NGN GETS call / session request. If resources are available, it pushes policy to the OLT and ONT to establish the appropriate NGN GETS flows, and notifies the P-CSCF when the flows have been established. If resources are not available, the ANMS notifies the P-CSCF.

OLT and ONT

There is no impact to the OLT and ONT, as these devices are not “NGN GETS aware”.

6.2.3 Cable

This section is informative and describes various call/session flows intended to illustrate how an NGN GETS call/session could be processed in a cable access network. This material is meant to provide a high-level description and is not intended to be exhaustive. If inconsistencies exist between this section and cable specifications ([CM-SP-MULPIv3.0-I08-080522], [PKT-SP-MM-I04-080522], [PKT-SP-MM-WS-I02-080522], [PKT-SP-QOS-I02-080425], [PKT-TR-ARCH-FRM-V04-071106]), the cable specifications take precedence. Alternative call/session flows are possible.

6.2.3.1 NGN GETS Call / Session Origination – Resources Available

This flow is based on the NGN GETS Call / Session Origination for GETS-FC + DN flow contained in Section 6.1. It has been modified to show only the access network aspects of the call/session and has been expanded to include details of the access network. The details shown in this flow for setting up QoS-based service flows in the cable access network are applicable to any NGN GETS service over PacketCable 2.0 flows. The key items illustrated are (1) how the Cable Modem (CM) forwards the initial SIP INVITE request from the UE, before the P-CSCF requests priority signaling resources, (2) how the P-CSCF reserves and activates NGN GETS priority resources for the bearer, and (3) how the cable access network implements requests from the P-CSCF for priority resources.

This flow illustrates the early bearer reservation option. This will improve the probability that resources are available for the NGN GETS bearer.

The message sequence to set up a call/session from an NGN GETS Service User is shown in Figure 25. The flow only shows the steps through setting up the bearer resources. The remaining steps as discussed in Section 6.1 use the illustrated call/session flows for signaling and bearer between the CM and the CMTS.

In order to allow the UE to communicate with the P-CSCF to establish priority communications, the CM and CMTS must be given policy to recognize priority signaling and bearer traffic to and from the UE. The following figure shows how priority flows are established between the CM and CMTS. Note that in these flows, the CM and CMTS do not act upon the SIP INVITE or 183 Session Progress, rather, the CM and CMTS compare the source and destination information in their policies to determine into what signaling flow the packets associated with these messages should be sent.

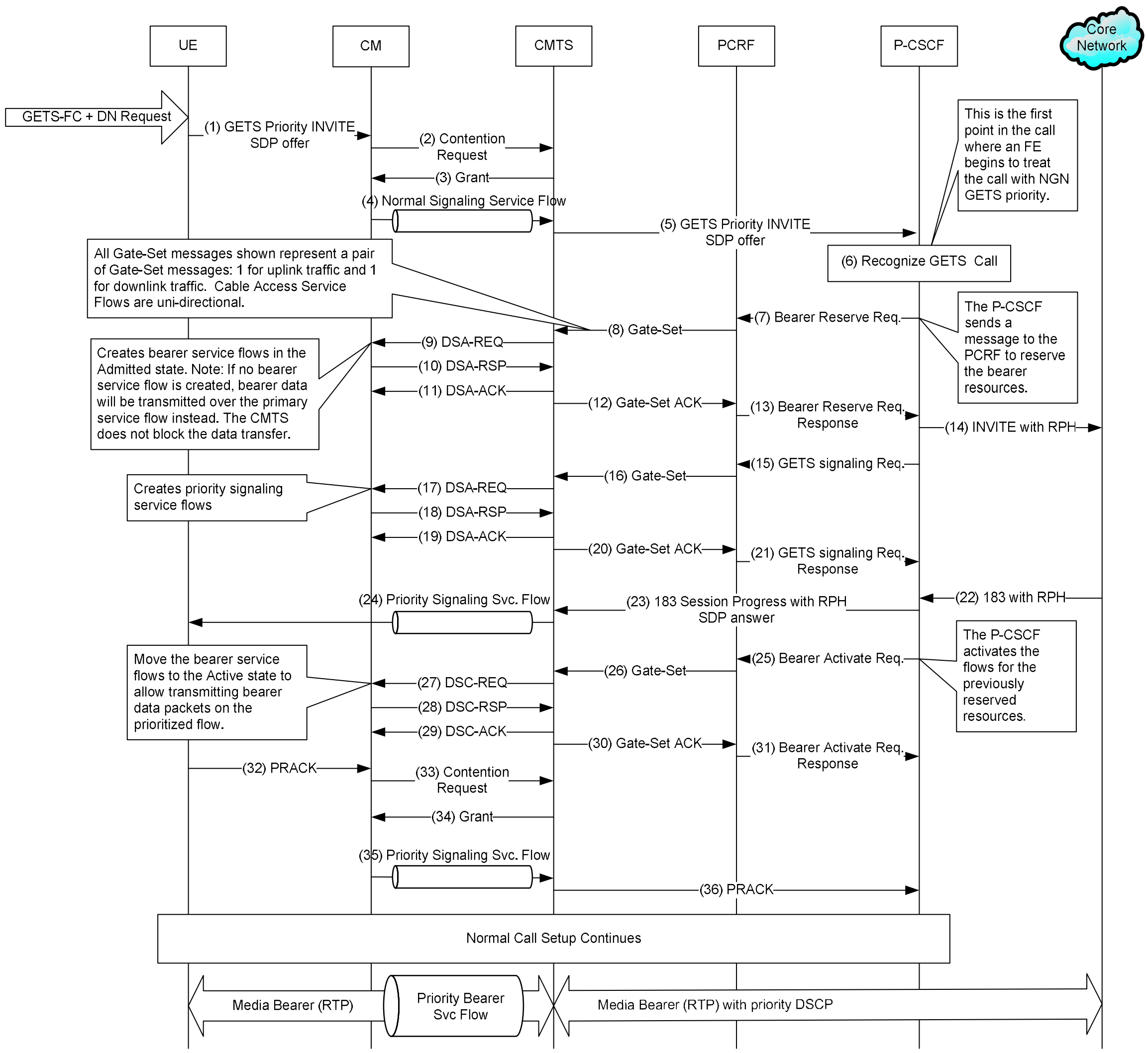

Figure 6-23 – NGN GETS Call / Session Origination for GETS-FC + DN

1. The UE's creation of the initial SIP INVITE request is unchanged from the description in Section 6.1.
2. When the CM receives the SIP INVITE request, the CM does normal processing to request permission to send a packet on the upstream channel. It waits for the Cable Modem Termination System (CMTS) to provide a slot for a contention request opportunity. When the CM sees a slot that allows it to send the request to the CMTS, it sends the request. Other CMs may also be sending requests at the same time in contention with this CM. If the request does not get through the first time, the CM follows back off procedures and retries when the CMTS provides another opportunity.
3. The CMTS does normal processing and includes a grant in a subsequent Messaging Access Protocol (MAP) message.
4. The Grant message allows the CM to send the packet over the primary service flow.

   Note: the service provider may configure a BE signaling service flow with higher priority than the primary service flow.
5. Having received a packet, the CMTS processes it and then sends a completed IP packet to the P-CSCF. If the IP packet had to be segmented or if the initial SIP INVITE request was split into multiple IP packets by the UE, Steps 2 – 5 would be repeated until the entire SIP INVITE request was sent to the P-CSCF. The only difference is that the CM could include a follow-up request to send in the data packet in Step 4, which would eliminate the need to wait for another contention request opportunity. Since an NGN GETS priority

signaling service flow is not used in these steps, there could be delay in the presence of overload before the SIP INVITE request arrives at the P-CSCF.

6. When the P-CSCF receives the SIP INVITE request, the P-CSCF recognizes that this is an NGN GETS request and at this point special processing is invoked. For the remainder of the session, the P-CSCF gives priority over normal sessions in processing messages related to this session.
7. The P-CSCF issues a Diameter AAR message to the PCRF to reserve bearer resources, as normal, with the following NGN GETS enhancements: (1) it includes the MPS-Identifier AVP and sets the value of the Reservation-Priority AVP to the default NGN GETS priority and (2) it sets the NGN GETS IP header DSCP value to be used for IP packets transmitting Diameter messages in the NGN GETS Service Provider's network.
8. The PCRF recognizes the MPS-Identifier and Reservation-Priority AVPs and gives priority in processing the message. The resulting Gate-Set messages sent to the CMTS include the NGN GETS SessionClassID value. Since the Cable Access network service flows are unidirectional, the PCRF prepares a pair of Gate-Set messages: upstream and downstream.
9. The CMTS recognizes the NGN GETS SessionClassID value and gives priority in processing the requests. If resources are available, it sends DSA-REQ messages to the CM.
10. The CM configures itself to support the requested flows and acknowledges success via DSA-RSP messages.
11. The CMTS acknowledges the CM responses with DSA-ACK messages.
12. The CMTS sends Gate-Set ACK messages acknowledging that the requested bearer flows have been allocated.
13. The PCRF forwards the reservation response to the P-CSCF in a Diameter AAA message.
14. The P-CSCF sends the SIP INVITE request with the RPH.
15. While the bearer reservation processing is occurring, the P-CSCF also requests establishment of priority signaling flows for subsequent signaling messages between it and the UE. It does this by sending two Diameter AA-requests to the PCRF to create a new priority upstream signaling flow and a new priority downstream signaling flow that will be assigned the NGN GETS Traffic Priority value. The Diameter AAR messages have the MPS-Identifier AVP and the default NGN GETS priority in the Reservation-Priority AVP.
16. The PCRF recognizes the MPS-Identifier and Reservation–Priority AVPs and gives priority in preparing Gate-Set messages to the CMTS. This is a request to create and activate new priority service flows with the Traffic Priority and the SessionClassID values assigned for NGN GETS. The classifier in the Gate-Set messages identifies the appropriate signaling IP addresses and ports.
17. The CMTS recognizes the NGN GETS SessionClassID value and gives priority in processing the requests. It creates two priority signaling service flows that have the NGN GETS Traffic Priority value. This Traffic Priority value will be used by the CMTS to give priority to upstream requests to send data packets and to give priority in processing data packets destined to the CM for downstream traffic. The classifier in the service flow distinguishes SIP signaling messages from other data traffic. The CMTS sends the service flow requests to the CM in DSA-REQ messages.
18. The CM configures itself to support the requested flow and acknowledges success via DSA-RSP messages.
19. The CMTS acknowledges the CM responses with DSA-ACK messages.
20. When the flows are set up, the CMTS responds back to the PCRF.
21. The PCRF responds back to the P-CSCF. All future signaling messages in this call / session will use the priority signaling service flows. When the session is terminated, messages are sent to delete the signaling service flows.
22. After the SIP INVITE request has been processed in the core network (which is also known as the PacketCable 2.0 core by Multiple System Operators (MSOs)), a message is sent back to the P-CSCF with the answer to the offer. In IMS Core Network, this is shown in the SIP 183 Session Progress message. The same sequence occurs in the cable access network whenever the answer is received.

23. The P-CSCF forwards the answer to the CMTS using the DSCP for NGN GETS signaling.
24. The CMTS forwards the answer to the UE using the priority signaling flow that was just established.
25. The P-CSCF will also activate the bearer resources that had been previously reserved in Steps 7 – 13. Note that the answer may modify the original offer, but the same sequence of messages occurs.
26. Since the activation request includes the MPS-Identifier and Reservation-Priority AVPs, the PCRF treats this as a priority request and creates the appropriate Gate-Set messages.
27. The CMTS processes the Gate-Set messages with priority and sends Dynamic Service Change-Request (DSC-REQ) messages to the CM to activate the flows.
28. The CM activates the flows and returns Dynamic Service Change-Response (DSC-RSP) messages to the CMTS.
29. The CMTS acknowledges the CM responses with Dynamic Service Change-Acknowledgement (DSC-ACK) messages.

    In Steps 27 – 29, since the resources have already been reserved, the pre-assigned resources are activated. Since the Unsolicited Grant Service (UGS) upstream service flow has defined QoS parameters, there is no need for any additional NGN GETS priority. The QoS parameters in the downstream flow guarantee the CMTS will transmit downstream traffic correctly. The downstream flow will be assigned the NGN GETS Traffic Priority value to allow cable modems to give priority when sending the data packets to the UE.
30. After the flows are activated, the CMTS responds to the PCRF.
31. The PCRF responds to the P-CSCF. At this point, the bearer stream is active for the session.
32. The UE responds with a SIP PRACK or other suitable response message.
33. Since the priority signaling flow is now active, the CM uses the service flow classifiers to send the request on that flow. It will either use a normal contention request or a special contention request opportunity to send a request to send.
34. The CMTS recognizes that the Traffic Priority for this service flow has the NGN GETS Traffic Priority value and gives this request priority over other BE service flow requests. It sends a grant message to the CM to allow the CM to forward the response message from the UE.
35. The CM sends the response message in the slot provided.
36. The response message is forwarded by the CMTS to the P-CSCF. The IP packet may be assigned an NGN GETS DSCP value to ensure the packet has priority in the NGN GETS Service Provider’s network.

The remainder of the call/session setup proceeds normally using the service flows that have been set up for signaling and bearer.

6.2.3.1.1 Relevant NGN GETS Aspects

This section highlights incremental NGN GETS specific processing for each FE, based on the NGN GETS call / session flow as described above.

UE and CM

No changes are required in the UE or CM to activate NGN GETS priority. The UE does normal call/session set up after the Service User has entered the appropriate dial dgits. The CM responds to normal requests from the CMTS to set up and activate service flows.

CMTS

1. Recognize the NGN GETS SessionClassID value in messages from the PCRF and give priority in processing and honoring Gate requests based on the priority level in the SessionClassID. The NGN GETS SessionClassID value has a higher priority than any other SessionClassID value with the possible exception of network maintenance values.

2. Recognize the Traffic Priority value associated with an upstream service flow and provide additional contention request opportunities to the CM if needed for flows that have the NGN GETS Traffic Priority value assigned. Give priority when processing upstream requests and received data from flows that are assigned the NGN GETS Traffic Priority value. The NGN GETS Traffic Priority value has a higher priority than any other Traffic Priority value with the possible exception of network maintenance values.
3. Recognize the Traffic Priority value associated with a downstream service flow and give priority in processing and transmitting packets to the CM based on the assigned NGN GETS Traffic Priority level.

PCRF

1. Recognize the MPS-Identifier and the Reservation-Priority AVPs in the request messages from the P-CSCF over the Rx reference point and give priority in processing those requests based on the MPS-Identifier AVP and the NGN GETS priority level in the Reservation-Priority AVP.
2. Use the NGN GETS value in the Reservation-Priority AVP to set (1) the NGN GETS SessionClassID priority level when sending messages to the CMTS, (2) the NGN GETS DSCP value in generating requests, and (3) the NGN GETS Traffic Priority value.

P-CSCF

The P-CSCF capabilities are as described in Section 6.1.1.1 with the following additions:

1. Send a message to the PCRF to create NGN GETS signaling upstream and downstream service flows when an NGN GETS priority call/session is detected.
2. When receiving the SDP offer in the SIP INVITE, send the service information to the PCRF for the purpose of performing an early bandwidth authorization check.

6.2.3.2 NGN GETS Call / Session Termination – Resources Available

This flow is based on the NGN GETS Call / Session Termination flow contained in Section 6.1. It has been modified to only show the access network aspects of the call/session and has been expanded to include details of the access network. This call/session flow covers the case when the user is the terminating party in a call/session that was originated by a Service User as an NGN GETS call/session.

The message sequence to set up the call/session is shown in Figure 6-24. The flow only shows the steps through setting up the bearer resources. The remaining steps as discussed in Section 6.1 use the illustrated Service Flows for signaling and bearer between the CM and the CMTS.

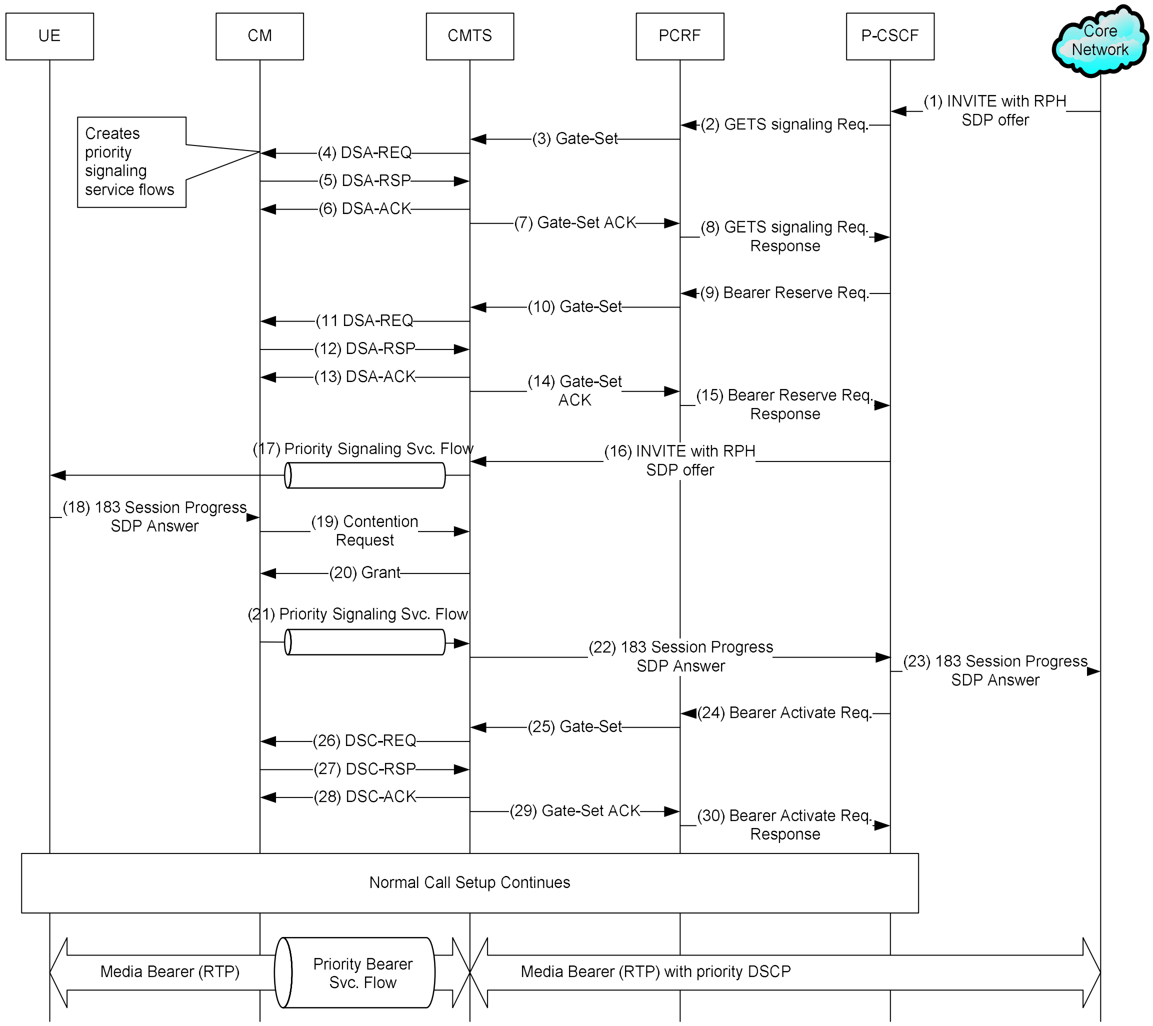

Figure 6-24 – NGN GETS Call / Session Termination

1. The P-CSCF receives a SIP INVITE request from the S-CSCF.
2. The P-CSCF requests creation of priority signaling flows by sending a Diameter AAR with the MPS-Identifier AVP and Reservation-Priority AVP to the PCRF.
3. The PCRF sends a pair of Gate-Set messages to the CMTS to set up the priority signaling flows. Note that as stated above for the UE origination case, each Gate-Set message shown is really a pair of messages, since DOCSIS flows are unidirectional.
4. The CMTS sends a DSA-REQ message to the CM to set up each priority signaling flow.
5. The CM responds with a DSA-RSP message when each flow is established.
6. The CMTS acknowledges the DSA-RSP message from the CM.
7. The CMTS acknowledges that the priority signaling flows have been set up via Gate-Set ACK messages.
8. The PCRF acknowledges that the priority signaling flows have been set up via a Diameter AAA message.
9. The P-CSCF does a resource reservation in a similar fashion to the origination flow before forwarding the SIP INVITE request to the UE. It starts the resource reservation process by sending a Diameter AAR message to the PCRF to reserve media resources.
10. The PCRF sends a pair of Gate-Set messages to the CMTS to set up the priority bearer flows.
11. The CMTS sends DSA-REQ messages to the CM to set up the priority bearer flows.
12. The CM responds with DSA-RSP messages when the flows are established.
13. The CMTS acknowledges the DSA-RSP messages from the CM.

14. The CMTS acknowledges that the priority bearer flows have been set up via Gate-Set ACK messages.
15. The PCRF acknowledges that the priority bearer flows have been set up via a Diameter AAA message.
16. The P-CSCF forwards the SIP INVITE request to the CMTS. An NGN GETS signaling DSCP is used for the message.
17. The CMTS delivers the SIP INVITE request to the UE via a priority signaling service flow established in Steps 2 – 8.
18. The UE responds with a SIP 183 Session Progress message.
19. Since the priority signaling flow is now active, the CM uses the service flow classifiers to send the request on that flow. It will either use a normal contention request or a special contention request opportunity to send the request.
20. The CMTS recognizes that the Traffic Priority for this service flow has the NGN GETS Traffic Priority value and give this request priority over other BE service flow requests. It sends a grant message to the CM to allow the CM to forward the 183 Session Progress message from the UE.
21. The CM sends the SIP 183 Session Progress message in the slot provided.
22. The 183 Session Progress message is forwarded by the CMTS to the P-CSCF. The IP packet may be assigned a special NGN GETS DSCP value to ensure the packet has priority in the NGN GETS Service Provider's network.
23. The SIP 183 Session Progress message is forwarded to the originating caller.
24. The P-CSCF now activates the bearer resources for the call/session that have been previously reserved in Steps 9 – 15.
25. Since the activation request includes the MPS-Identifier AVP, the PCRF treats this as a priority request and creates the appropriate Gate-Set messages.
26. The CMTS processes the Gate-Set messages with priority and sends DSC-REQ messages to the CM to activate the flows.
27. The CM activates the flows and returns DSC-RSP messages to the CMTS.
28. The CMTS acknowledges the CM responses with DSC-ACK messages.
29. After the flows are activated, the CMTS responds to the PCRF.
30. The PCRF responds to the P-CSCF. At this point, the bearer stream is active for the session.

After this point, call/session processing continues in a normal fashion. As in the origination flows, the FEs treat all messages with the appropriate NGN GETS priority.

6.2.3.2.1 Relevant NGN GETS Aspects

This section highlights incremental NGN GETS specific processing for each FE, based on the NGN GETS call / session flow as described above.

UE and CM

No additional changes are required beyond those described Section 6.2.3.1.1.

CMTS

No additional changes are required beyond those described in Section 6.2.3.1.1.

PCRF

No additional changes are required beyond those described in Section 6.2.3.1.1.

P-CSCF

No additional changes are required beyond those described in Section 6.2.3.1.1.

6.2.4 Ethernet

This section is informative and describes various call/session flows intended to illustrate how an NGN GETS call/session could be processed in an Ethernet Access Network. This material is meant to provide a high-level description and is not intended to be exhaustive. If inconsistencies exist between this section and Ethernet specifications ([MEF 4], [MEF 7], [MEF 15], [MEF 16], [MEF 17]), the Ethernet specifications take precedence. Alternative call/session flows are possible.

The NGN GETS voice and video call / session flows and the NGN GETS Data Transport flows for an Ethernet Access Network are identical to the call / session flows for a DSL Access Network with one exception. While the Policy Server supporting a DSL Access Network only needs to push policy to the Broadband Network Gateway (BNG), the Policy Server supporting an Ethernet Access Network needs to push policy not only to the Broadband Network Gateway, but also to the Edge Ethernet Switch and the Ethernet Switch.

6.2.4.1 GETS-AN Call/Session Sequence

The basic message sequence (call/session flows) for DSL Access Networks can be found in Section 6.2.1. The corresponding call/session flow for an Ethernet Access Network is shown in Figure 6-25, Figure 6-26, and Figure 6-27 below. Comparison of the two flows shows the differences required in the Policy Server for the Ethernet Access Network technology. Flows for NGN GETS video calls / sessions and for NGN GETS Priority Data Transport are not provided in this section.

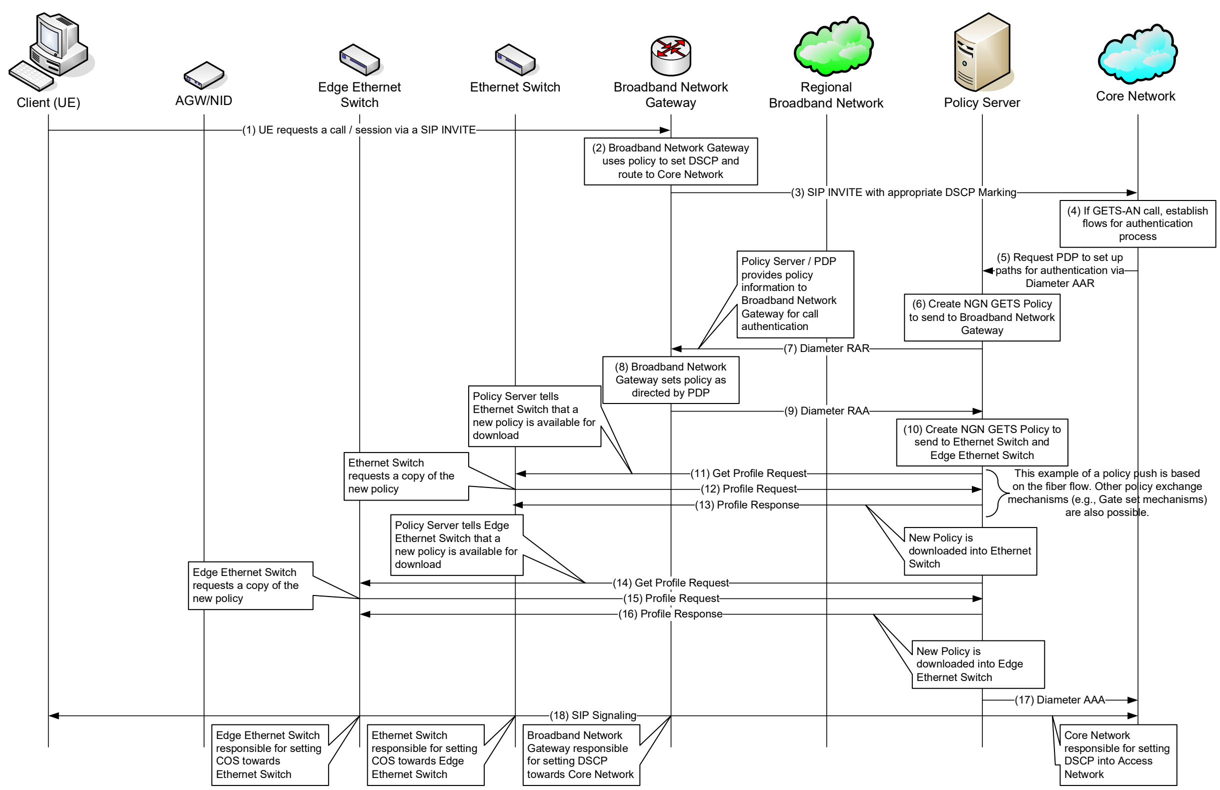

Figure 6-25 – GETS-AN Call/Session Flow (Part 1 of 3)

The call/session flow assumes that communications between the IMS Core Network and the Policy Server uses Diameter. In addition, the call/session flow assumes that the communications between the Policy Server and the Edge and "central" Ethernet Switches uses a Q3 interface as defined in [ITU-T Q.812]. For NGN GETS, this policy push must occur dynamically. This flow also assumes that the user's Access Gateway has no NGN GETS capabilities.

1. The client issues a GETS-AN call / session setup request to the IMS Core Network. The Access Gateway (AGW) / NID's classifier identifies the packet as a SIP packet and places it in the signaling queue for transmission to the Edge Ethernet Switch. The packet is routed through the Metro Ethernet Network (MEN) to the Broadband Network Gateway.
2. The Broadband Network Gateway uses its default signaling policy to mark the SIP INVITE request with the appropriate DSCP for transmission into the IMS Core Network.
3. The SIP INVITE request is routed across the Regional Broadband Network into the IMS Core Network.
4. Within the IMS Core Network, the S-CSCF and AS determine that a bearer path is needed to perform authentication and authorization. (Neither the S-CSCF nor the AS are shown in the figure.) The IMS Core Network is the first point at which the call/session request is recognized as an NGN GETS request. Because of this, if there is congestion in the access network, it is possible that the SIP INVITE request may be discarded. In this case, the user will need to retry his request until it is successfully transmitted to the IMS Core Network and recognized by the IMS Core Network as an NGN GETS request.
5. The IMS Core Network, via the P-CSCF (not shown in the figure), requests that the Policy Server / PDP set up a priority bearer path to obtain PIN and Directory Number (DN) information. Depending on the NGN GETS Service Provider's implementation, the Policy Server / PDP may also be requested to set up a priority signaling channel for the rest of the NGN GETS signaling flow. The request includes the IPv4 or IPv6 address and port number of the subscriber for this service request.

   The IMS Core Network provides information concerning the flow(s) of interest to the Policy Server / PDP in the Diameter AAR message. The Policy Server / PDP stores the Media-Component-Description Attribute Value Pair (AVP) values (e.g., media type and maximum required bandwidth) for the call / session. For NGN GETS service, the MPS-Identifier and Reservation-Priority AVPs in the Diameter AAR message trigger the Policy Server / PDP to provide priority handling in the Policy Server / PDP.
6. Upon receiving the request, the Policy Server / PDP checks the request against the policy rules and if the request is approved, updates its record of the policy for the Broadband Network Gateway.
7. The Policy Server / PDP passes a set of authorized policy parameters to the Broadband Network Gateway via a Diameter RAR message. The parameters include the source IP address and port, and may include the destination IP address and port, and the protocol used.
8. The Broadband Network Gateway installs the policy information received from the Policy Server / PDP. ***For NGN GETS service, the Diameter RAR message triggers the Broadband Network Gateway to apply priority treatment for transport layer packets,*** and to apply this policy to subsequent packets in this flow.
9. The Broadband Network Gateway responds to the Policy Server / PDP with a Diameter RAA message, indicating that the policy was successfully updated and implemented.
10. The Policy Server / PDP updates the policies for the Ethernet Switch and the Edge Ethernet Switch to provide priority treatment for the NGN GETS Ethernet frames.
11. The Policy Server / PDP instructs the Ethernet Switch that a new policy is available for it to download.
12. The Ethernet Switch requests the new policy.
13. The new policy is returned to the Ethernet Switch.
14. The Policy Server / PDP instructs the Edge Ethernet Switch that a new policy is available for it to download.
15. The Edge Ethernet Switch requests the new policy.
16. The new policy is returned to the Edge Ethernet Switch.
17. The Policy Server / PDP instructs the IMS Core Network that priority flows are available for use for the authentication and authorization process. The Policy Server / PDP responds to the IMS Core Network with a Diameter AAA message, indicating the disposition of the previous AAR message (from Step 5).
18. The IMS Core Network continues a SIP dialog with the UE to establish a bearer path for authentication. The IMS Core Network is responsible for setting the signaling DSCP for packets transmitted to the Broadband Network Gateway across the Regional Broadband Network, and the Broadband Network Gateway is responsible for setting the signaling DSCP for packets transmitted to the IMS Core Network across the Regional Broadband Network. The Ethernet Switch is responsible for setting the COS value for

frames transmitted towards the Edge Ethernet Switch, while the Edge Ethernet Switch is responsible for setting the COS value for frames transmitted towards the Ethernet Switch.

19. A bearer path for authentication and authorization is set up between the UE and the IMS Core Network. The AGW / NID places the bearer packets in the voice queue for transmission into the network. Since the AGW / NID is assumed to be non-NGN GETS aware, it cannot distinguish between NGN GETS bearer packets and normal bearer packets.

    The Edge Ethernet Switch marks frames received from the AGW / NID with the NGN GETS COS value and forwards the frames to the Ethernet Switch. The Broadband Network Gateway marks the packets with the NGN GETS DSCP value and forwards the packets across the Regional Broadband Network.

    The IMS Core Network is responsible for setting the NGN GETS bearer DSCP for packets transmitted to the Broadband Network Gateway across the Regional Broadband Network. The Ethernet Switch marks frames destined for the Edge Ethernet Switch with the NGN GETS COS value and forwards the frames to the Edge Ethernet Switch.

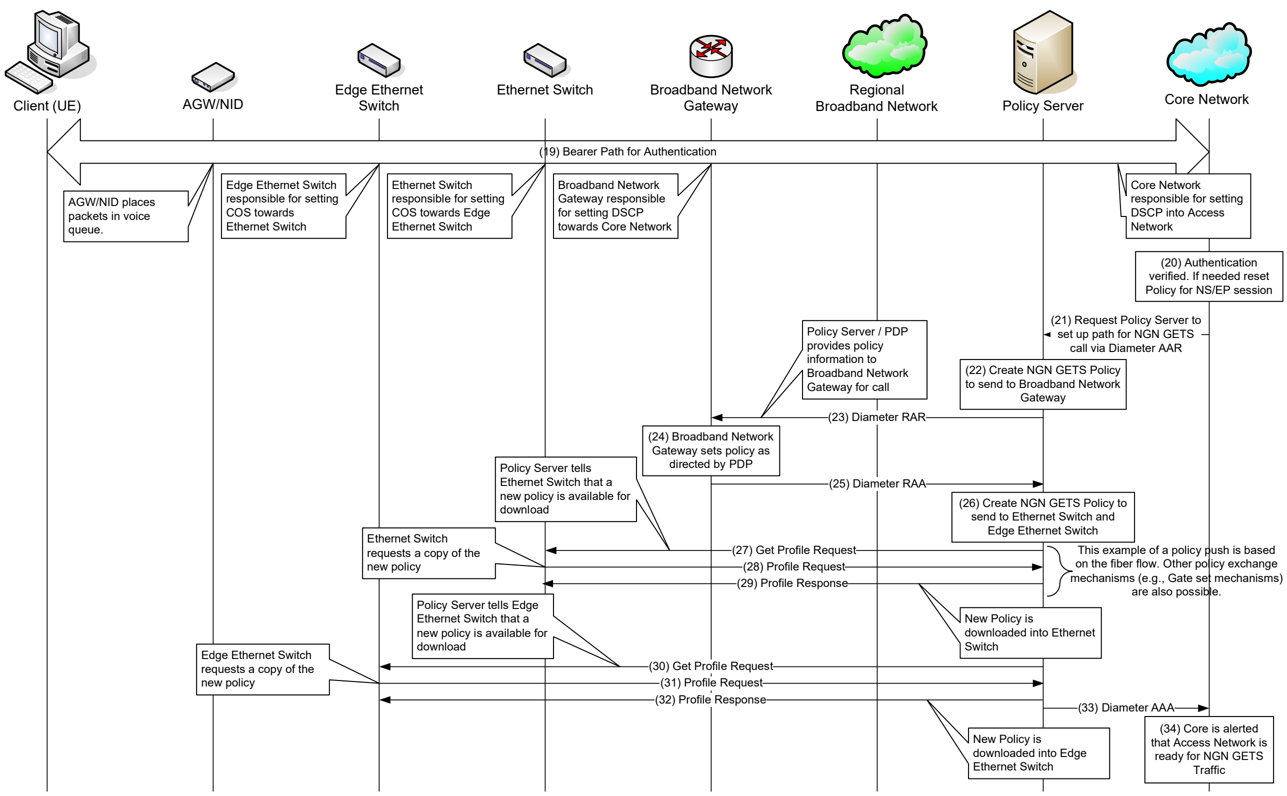

Figure 6-26 – GETS-AN Call/Session Flow (Part 2 of 3)

20. After successful authentication and authorization, the IMS Core Network may need to reset the NGN GETS policy for the call/session if additional bandwidth is required for the NGN GETS call/session. If this is not required, then the next step in the flow is Step 34.

21. The IMS Core Network requests that the Policy Server / PDP set up a priority bearer path for the call/session. The IMS Core Network provides information concerning the flow(s) of interest to the Policy Server / PDP in the Diameter AAR message.

22. Upon receiving the request, the Policy Server / PDP checks the request against the policy rules and if the request is approved, updates the policies for the Broadband Network Gateway.

23. The Policy Server / PDP passes a set of authorized policy parameters to the Broadband Network Gateway via an RAR message.

24. The Broadband Network Gateway installs the policy information received from the Policy Server / PDP, and applies them to subsequent packets.
25. The Broadband Network Gateway responds to the Policy Server / PDP with a Diameter RAA.
26. The Policy Server / PDP updates the policies for the Ethernet Switch and the Edge Ethernet Switch to provide priority treatment for the NGN GETS Ethernet frames.
27. The Policy Server / PDP instructs the Ethernet Switch that a new policy is available for it to download.
28. The Ethernet Switch requests the new policy.
29. The new policy is returned to the Ethernet Switch.
30. The Policy Server / PDP instructs the Edge Ethernet Switch that a new policy is available for it to download.
31. The Edge Ethernet Switch requests the new policy.
32. The new policy is returned to the Edge Ethernet Switch.
33. The Policy Server / PDP instructs the IMS Core Network that priority flows are available for use. The Policy Server / PDP responds to the IMS Core Network with a Diameter AAA message, indicating the disposition of the previous AAR message (from Step 21).
34. The IMS Core Network knows that an NGN GETS bearer path is available from the UE.
35. The IMS Core Network informs the UE through SIP signaling that an NGN GETS call / session is now possible.
36. The NGN GETS call / session is in progress. The AGW / NID places the bearer packets in the voice queue for transmission into the network. Since the AGW / NID is assumed to be non-NGN GETS aware, it cannot distinguish between NGN GETS bearer packets and normal bearer packets.

    The Edge Ethernet Switch marks frames received from the AGW / NID with the NGN GETS COS value and forwards the frames to the Ethernet Switch. The Broadband Network Gateway marks the packets with the NGN GETS DSCP value and forwards the packets across the Regional Broadband Network.

    The IMS Core Network is responsible for setting the NGN GETS bearer DSCP for packets transmitted to the Broadband Network Gateway across the Regional Broadband Network. The Ethernet Switch marks frames destined for the Edge Ethernet Switch with the NGN GETS COS value and forwards the frames to the Edge Ethernet Switch.

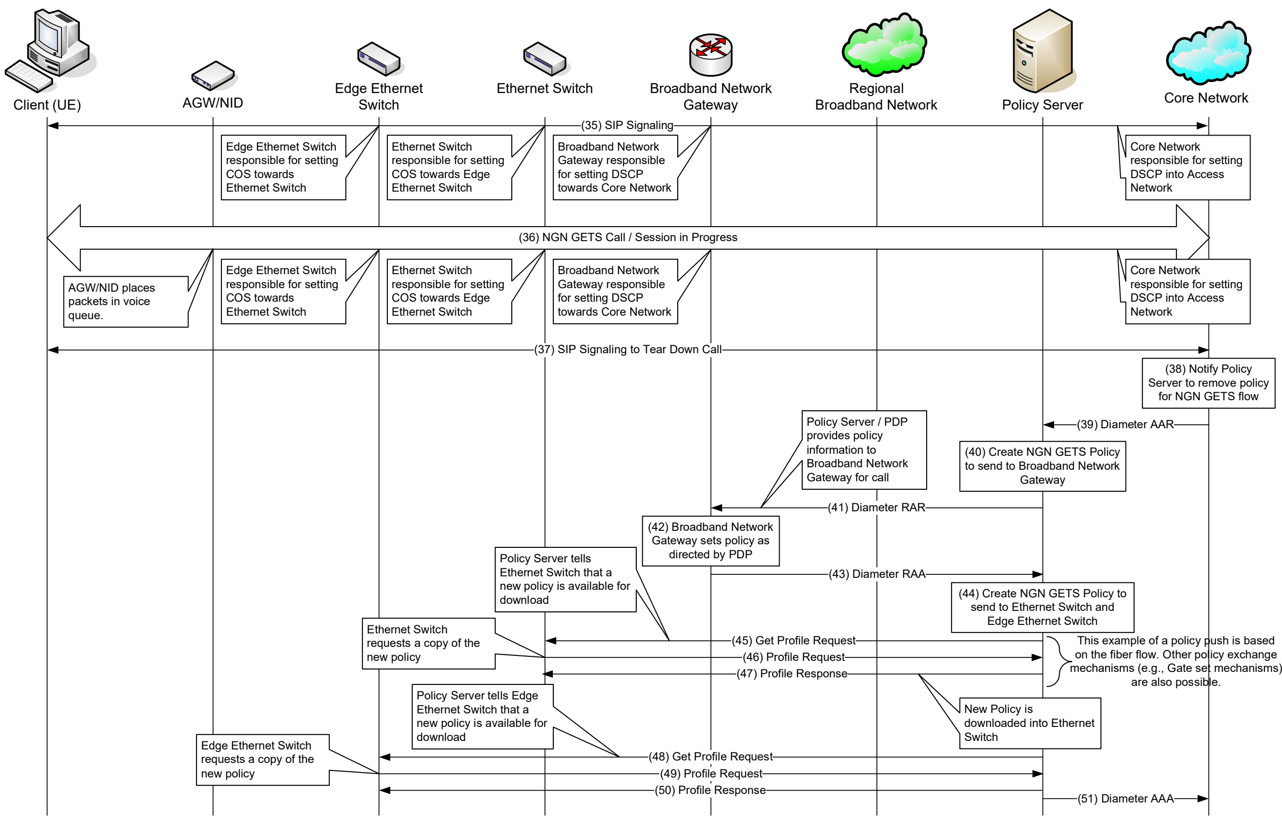

Figure 6-27 – GETS-AN Call/Session Flow (Part 3 of 3)

37. When the UE is finished with the session, it notifies the IMS Core Network via SIP signaling.
38. The IMS Core Network terminates the session and sends a request to the Policy Server / PDP.
39. The request to the Policy Server / PDP is sent in a Diameter AAR message.
40. Upon receiving the request, the Policy Server / PDP updates the policies for the Broadband Network Gateway and the policy control procedures are invoked again.
41. The Policy Server / PDP sends the Diameter RAR message towards the Broadband Network Gateway.
42. The Broadband Network Gateway installs the policy information received from the Policy Server / PDP, and applies them to subsequent packets.
43. The Broadband Network Gateway responds to the Policy Server / PDP with a Diameter RAA message.
44. The Policy Server / PDP updates the policies for the Ethernet Switch and the Edge Ethernet Switch.
45. The Policy Server / PDP instructs the Ethernet Switch that a new policy is available for it to download.
46. The Ethernet Switch requests the new policy.
47. The new policy is returned to the Ethernet Switch.
48. The Policy Server / PDP instructs the Edge Ethernet Switch that a new policy is available for it to download.
49. The Edge Ethernet Switch requests the new policy.
50. The new policy is returned to the Edge Ethernet Switch.
51. The Policy Server / PDP informs the IMS Core Network that NGN GETS call / session has been terminated via a Diameter AAA message.

6.2.4.1.1 Relevant NGN GETS Aspects

This section highlights incremental NGN GETS specific processing for each FE, based on the NGN GETS call / session flow as described above.

UE, NID, Edge Ethernet Switch, and Ethernet Switch

No changes are required.

IMS Core Network (e.g., P-CSCF)

The IMS Core Network FE capabilities are as described in Section 6.1.1.1.

Policy Server / PDP

The Policy Server / PDP capabilities are as described in Section 6.1.1.1 for PCRF.

Broadband Network Gateway

The Broadband Network Gateway capabilities are as described in Section 6.2.1.1.1.

6.3 Wireless Access – Core

6.3.1 E-UTRAN

This section is informative and describes various call / session flows intended to illustrate how an NGN GETS call / session could be processed in E-UTRAN. This material is meant to provide a high-level informative description and is not intended to be normative. If inconsistencies exist between this section and 3GPP specifications, the 3GPP specifications take precedence. Alternative call / session flows are possible.

Section 6.3.1.1 through Section 6.3.1.9 provide the flows associated with priority treatment for RRC establishment, attach procedure, tracking area update, bearer establishment and modification for signalling and media bearers, paging procedure, and NGN GETS call/session origination and termination.

6.3.1.1 Layer 1 and 2 Connection Establishment

This section describes the lower layer (Layer 1 and 2) procedures by which a UE establishes an RRC Connection with an eNodeB. This action transitions a UE from RRC_IDLE to RRC_CONNECTED.

The establishment of an RRC Connection requires procedures at the Physical, Medium Access Control (MAC), and RRC Layers of the Uu Interface. Physical Layer procedures define the initial sequence of random access transmissions from the UE including the timing and power of the transmissions. MAC Layer procedures invoke the physical layer procedures and provide the means by which a single UE is identified by the eNodeB and is granted an RRC Connection. The specific RRC messages in addition to supporting the RRC Layer, provide the messaging required to achieve the contention resolution function of the MAC Layer.

6.3.1.1.1 General Description

Figure 6-28 illustrates the flow associated with Layer 1 and 2 procedures for contention based random access leading to RRC connection establishment consisting of Physical Layer (labelled PHY), MAC Layer (labelled MAC) and RRC Layer (labelled RRC) procedures.

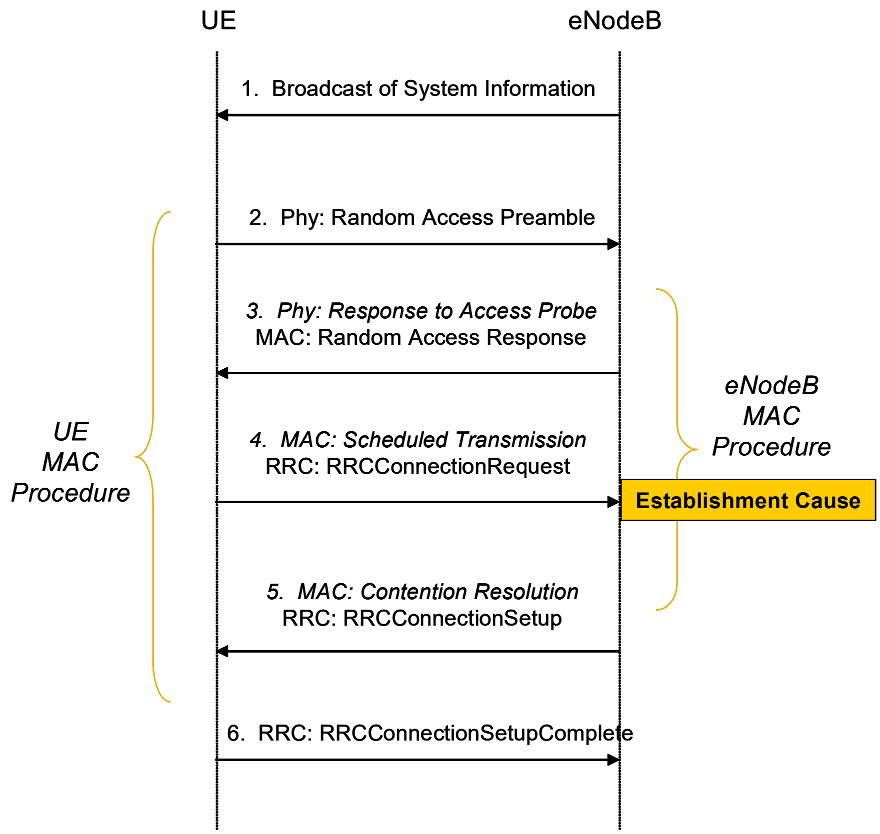

Figure 6-28 – Physical Layer, MAC Layer, and RRC Connection Establishment

1. Broadcast of System Information: Rules governing the first transmission of a mobile device (access parameters) are transmitted in system broadcast message(s).

   Access Class Barring applies to transmissions initiated by a UE in RRC_IDLE mode and is used to bar the UE from gaining access to the network (radio resources) during network congestion. In E-UTRA, each Access Classes 11-15 can be independently marked as exempt from access class barring.

   An NGN GETS subscribed UE is provisioned with AC14 to gain prioritized access to the radio resources during the congestion. 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.

2. Physical Layer Random Access Preamble: The initial uplink transmission using contention based random access is the Physical Layer Random Access Preamble. A UE identifies itself only via one of 32 randomly chosen values.

3. The MAC Layer Random Access Response message serves a dual role, acting also as the Physical Layer Response to the Random Access Preamble. It includes an Uplink (UL) Grant which schedules the next uplink transmission from the UE. The MAC Layer procedure requires an additional transmission from the UE to uniquely identify itself to the eNodeB as two or more UEs may have selected the exact same Random Access Preamble.

4. The RRC Layer RRCConnectionRequest message also serves a dual role, acting as the MAC Layer “Scheduled Transmission” required for contention resolution among terminals who have selected the same random value in the Random Access Preamble. By sending this message, the UE is requesting allocation of SRB1 resources on a Dedicated Control Channel (DCCH) for the delivery of either signalling or uplink Application Data.

   NGN GETS Priority treatment for the layer-2 signalling connection (SRB1) is applied as follows. The RRCConnectionRequest includes an Establishment Cause marked as “highPriorityAccess”

indicating the access request is originated from a UE operating as AC11-15. As with Access Class Barring, this capability applies to NGN GETS subscribed UEs that are configured with AC14.

5. The RRC Layer RRCConnectionSetup also serves a dual role as the MAC Layer Contention Resolution message. The RRC RRCConnectionSetup is transmitted in transparent mode over SRB0 on the Downlink (DL) CCCH. It contains an allocation of the SRB1 signalling channel for use in Acknowledged Mode on the UL DCCH. It concludes the MAC Layer procedure by uniquely addressing this message to a single UE, thereby resolving any contentions amongst UEs which selected the same random number for the Random Access Preamble.

6. The RRC Layer RRCConnectionSetupComplete is the first message transmitted by the UE on the UL DCCH. It is sent over SRB1 in Acknowledged mode.

   Following the transmission of this message the UE can begin the NAS Signalling or Data Transfer function that prompted the initial contention based random access procedure. Examples of such procedures include the Attach procedure and the Service Request procedure.

6.3.1.1.2 Relevant NGN GETS Aspects

A number of techniques provide priority treatment during congestion to NGN GETS subscribed UE signalling prior to the invocation of a priority session. They include methods to control congestion on the random access channel and to give priority access to signalling resources, and are summarized here.

NGN GETS subscribed UEs are assigned to AC14. As the congestion in the radio network progresses, the E-UTRAN would first bar users with Access Class values 0-9 from accessing the radio network before barring users with Access Class values 11-15. Barring a user means that the user is given access to the radio network resources in a random fashion through the access class barring test.

For the UE operating as AC 11-15, the RRCConnectionRequest includes an Establishment Cause marked using the “highPriorityAccess” value.

6.3.1.2 E-UTRAN Attach with GTP-based S5/S8

The Attach procedure allows a UE to register with the network to receive services that require registration and is performed at terminal power up. The Attach procedure is described in Section 5.3.2 of [TS 23.401], and in Section 5.5.1 of [TS 24.301].

Always-on IP connectivity is enabled by establishing the Default Bearer, which remains established for the lifetime of the PDN connection. In the EPS, unlike in existing GPRS and UMTS PS services on the GPRS core, the Attach and Initial PDP Context Activation procedures are combined into a single procedure, called Attach.

When dynamic policy is used, well defined procedures and interfaces exist to convey PCRF policy to the Policy and Charging Enforcement Function (PCEF)/PDN-GW, deliver it to the S-GW, MME, E-UTRAN, and UE, and to trigger dedicated bearer establishment procedures, if desired.

6.3.1.2.1 General Description

Figure 6-29 shows the E-UTRAN Attach procedure for a GTP-based S5/S8 Interface. This flow is based on Figure 5.3.2.1-1 from [TS 23.401]. In Figure 6-29, red italics font marks those messages related to the establishment of an additional dedicated bearer as per Annex F of [TS 23.401]. If these messages are eliminated, only a Default Bearer is established at the time of Attach.

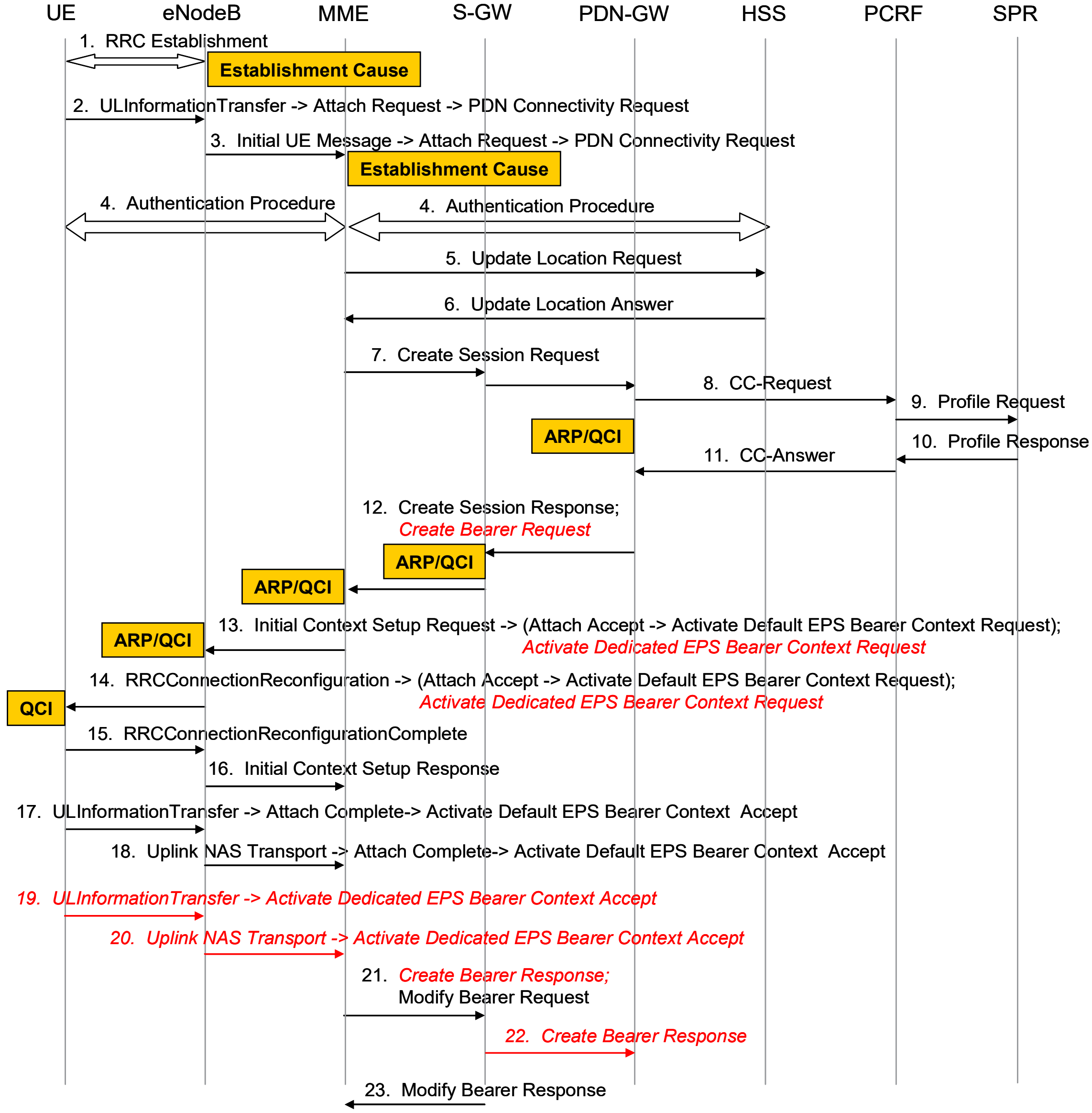

Figure 6-29 – E-UTRAN Attach procedure with GTP-based S5/S8

1. RRC Establishment: If the UE is in RRC_CONNECTED state, this step is not required. If the UE is in RRC_IDLE state, a procedure is required to access the system via a random access procedure, transition to RRC_CONNECTED state, and to establish a signalling channel for the transport of the EMM messages which follow.
2. Attach Request on the Uu Interface: The Attach Request is the EMM message which initiates an Attach procedure. The Attach Request contains an ESM PDN Connectivity Request message which initiates the UE requested PDP Connectivity Procedure. Thus, the message requesting the establishment of the Default Bearer, the PDN Connectivity Request, is included within the ESM Message Container of the Attach message. The Attach Request is transported over the Uu Interface in the RRC ULInformationTransfer message defined in Section 6.2.2 of [TS 36.331].
3. Attach Request on the S1 Interface: The Attach Request message is the same message delivered from the UE to the eNodeB. The Attach Request message is transported over the S1 in the S1-AP Initial UE Message message also includes the RRC Establishment Cause received by the eNodeB during RRC establishment and set to “highPriorityAccess.”

NGN GETS subscribed UEs, by virtue of being assigned an Access Class within the range of 11-15, access the system using the "highPriorityAccess" Establishment Cause. The MME provides priority handling of an Initial UE Message message if it includes the "highPriorityAccess" Establishment Cause.

If Advance Priority-MME is enabled within the MME, and the Initial UE Message contains the "highPriorityAccess" Establishment Cause, the MME will set the Pre-emption Vulnerability Indicator to "not-pre-emptable" for the default and, if applicable, IMS Signalling Bearers. The bearer establishment occurs in Step 11.

4. The Authentication Procedure and Security exchanges precede registration.
5. Update Location Request (ULR): If the MME has changed since the last Detach, or if there is no valid subscription context for the UE in the MME, or if the MME identity has changed, the MME sends the Diameter ULR message to the HSS over the S6a Interface.
6. Update Location Answer (ULA): The Diameter ULA message is sent by the HSS to the MME over the S6a Interface to acknowledge the Diameter ULR message. The message contains the list of all APNs the UE is permitted to access, an indication about which of those APNs is the default APN, and the EPS Subscribed QoS profile for each permitted APN. The EPS Subscribed QoS profile from the HSS includes, for each subscribed APN, the QCI, ARP for the APN`s Default Bearer, and the Aggregate Maximum Bit Rate (AMBR) for non-Guaranteed Bit Rate (GBR) bearers. The message also includes indication if the UE is subscribed to MPS in the EPS domain.
7. Create Session Request: The GTPv2 Create Session Request message is sent by the MME to the S-GW over the S11 Interface, and by the S-GW to the PDN-GW over the S5/S8, to establish a Default Bearer. The Create Session Request message on the S11 Interface includes the Bearer Level QoS information element which contains the subscribed QoS delivered to the MME from the HSS. The Create Session Request message on the S5/S8 Interface also contains the subscribed QoS within the Bearer Level QoS information element.
8. CC-Request (CCR): If dynamic policy is used, policy interaction on Gx begins at this point by transmission of the Diameter CCR message over the Gx Interface from the PDN-GW to the PCRF to initiate the IP-CAN session establishment procedure. If dynamic policy is not used, this message is not transmitted. The Diameter CCR message includes the Default-EPS-Bearer-QoS AVP which contains the subscribed QoS delivered to the PDN-GW in the Create Session Request message. It may also include the QoS-Negotiation AVP, which signals whether the PCRF is allowed to change the QoS description of the Default Bearer from that originally provided by the HSS. If the QoS-Negotiation AVP is included, it is set to the QoS_Negotiation_Supported" value to allow the PCRF to modify the QoS of the Default Bearer.
9. The PCRF sends a Profile Request to the SPR in order to receive the information related to the IP-CAN session. The PCRF provides the subscriber ID and, if applicable, the PDN identifier to the SPR. The PCRF may request notifications from the SPR on changes in the subscription information.
10. The SPR sends a Profile Response to the PCRF that may include MPS EPS Priority, MPS Priority Level and IMS Signalling Priority for establishing a PS session with priority. The PCRF stores the subscription related information containing the information about the allowed service(s) and PCC Rules information.
11. CC-Answer (CCA): If dynamic policy is used, the Diameter CCA message is sent by the PCRF to the PDN-GW over the Gx Interface to acknowledge the Diameter CCR message and to conclude the IP-CAN establishment procedure. If dynamic policy mechanisms specify that the characteristics of the Default Bearer should be changed from that specified in the Diameter CCR message and the authorization to do so was granted by appropriate setting of the QoS-Negotiation AVP in the Diameter CCR message, the Diameter CCA will include the QoS description in the Default-EPS-Bearer-QoS AVP.

    If dynamic policy mechanisms specify that one or more dedicated bearers are to be established at the time of Attach, the Diameter CCA message will include an occurrence of the QoS-Information AVP for each dedicated bearer to be established.

    When IMS Signalling Priority is enabled, the ARP for the Default Bearer provided by the HSS is modified by the PCRF using a PCC rule which considers the Service User's priority level, and is included in the Default-EPS-Bearer-QoS AVP within the Gx Diameter CCA message.

For NGN GETS subscribed UEs with subscription to IMS Services, when IMS Signalling Priority is enabled, the IMS Signalling Bearer is established with an ARP chosen by the PCRF from the set allocated by the NGN GETS Service Provider for NGN GETS use, and is included in the QoS-Information AVP within the Gx Diameter CCA message.

This point in the flow marks the start of the bearer activation procedure. If only the Default Bearer is established at the time of Attach, the explanation of the flow is much simpler than if additional dedicated bearers are established. To separate out the functionality required for the establishment of additional dedicated bearers, a red italics font in used in Figure 6-29 to mark those messages associated with the establishment of a single additional dedicated bearer. The establishment of more than one dedicated bearer further complicates the flow and is not discussed. The message descriptions that follow are structured to first discuss the contents that apply to the establishment of the Default Bearer. A paragraph that begins with the text “In the case when a dedicated bearer is established at the time of Attach” marks the transition of the discussion from the default to the dedicated bearer.

12. Create Session Response: The GTPv2 Create Session Response message is the response to the Create Session Request message. The Create Session Response message is sent from the PDN-GW to the S-GW over the S5/S8 Interface and from the S-GW to the MME over the S11 Interface.

    The ARP/QCI assigned to the Default Bearer of an NGN GETS subscribed UE is transferred from the PDN-GW to the S-GW, and then to the MME, in the Create Session Response message over the S5/S8 and S11 Interfaces respectively.

    In the case when a dedicated bearer is established at the time of Attach, the Create Session Response message is marked with the “P” flag set to “1” to indicate that a second GTPv2 message.

    The ARP/QCI assigned to the IMS Signalling Bearer of an NGN GETS subscribed UE is transferred from the PDN-GW to the S-GW, and then to the MME in the Create Bearer Request message over the S5/S8 and S11 Interfaces respectively.

13. Attach Accept on the S1 Interface. The EMM Attach Accept message is the acknowledgement to the EMM Attach Request message. The Attach Accept message contains an ESM Message Container which is used to piggyback the ESM Activate Default EPS Bearer Context Request message which initiates the Default EPS Bearer Activation procedure. The Activate Default EPS Bearer Context Request message includes the EPS QoS parameter which contains the QoS parameters for the Default Bearer.

    On the S1 Interface the Attach Accept message is carried in the S1-AP Initial Context Setup Request message which contains the Evolved Radio Access Bearer (E-RAB) Level QoS Parameters information element. The eNodeB determines if / how bearers should be admitted based on the radio conditions and the QoS associated with each of the bearers that are requested.

    The ARP/QCI assigned to the Default Bearer of an NGN GETS subscribed UE is transferred from the MME to the eNodeB, in the Initial Context Setup Request message over the S1 Interface.

    The QCI assigned to the Default Bearer of an NGN GETS subscribed UE is transferred from the MME to the UE (via eNodeB), in the Activate Default EPS Bearer Context Request message encapsulated in the Initial Context Setup Request message over the S1 Interface.

    In the case when a dedicated bearer is established at the time of Attach, the S1-AP Initial Context Setup Request message will also contain the Activate Dedicated EPS Bearer Context Request message defined in Section 8.3.3 of [TS 24.301] which initiates the Dedicated EPS Bearer Activation procedure defined in Section 6.4.2 of [TS 24.301]. The Activate Dedicated EPS Bearer Context Request message includes the EPS QoS parameter which contains the QoS parameters for each dedicated bearer.

    The ARP/QCI assigned to the IMS Signalling Bearer of an NGN GETS subscribed UE is transferred from the MME to the eNodeB, in the Initial Context Setup Request message over the S1 Interface.

    The QCI assigned to the IMS Signalling Bearer of an NGN GETS subscribed UE is transferred from the MME to the UE (via eNodeB), in the Activate Default EPS Bearer Context Request message encapsulated in the Attach Accept message over the Uu Interface.

14. Attach Accept on the Uu Interface: The Attach Accept message on the Uu Interface is the same message delivered from the MME to the eNodeB over the S1 Interface. The Attach Accept message is transported over the Uu Interface in the RRC RRCConnectionReconfiguration message.

The QCI assigned to the Default Bearer of an NGN GETS subscribed UE is transferred from the MME to the UE (via eNodeB), in the Activate Default EPS Bearer Context Request message encapsulated in the Attach Request message over the Uu Interface.

In the case when a dedicated bearer is established at the time of Attach, the Activate Dedicated EPS Bearer Context Request message is also transported over the Uu Interface in the RRC RRCConnectionReconfiguration message.

The QCI assigned to the IMS Signalling Bearer of an NGN GETS subscribed UE is transferred from the MME to the UE (via eNodeB), in the Activate Dedicated EPS Bearer Context Request message encapsulated in Attach Accept message over the Uu Interface.

15. RRCConnectionReconfigurationComplete: The RRCConnectionReconfigurationComplete message acknowledges the RRC RRCConnectionReconfiguration message.
16. Initial Context Setup Response: The Initial Context Setup Response message acknowledges the Initial Context Setup Request message.
17. Attach Complete: The EMM Attach Complete message is the response to the Attach Accept. message The Attach Complete message contains the ESM Activate Default EPS Bearer Context Accept message to complete the Default EPS Bearer Activation Procedure. The Attach Complete message is transported over the Uu Interface from the UE to the eNodeB in the RRC ULInformationTransfer message. Upon transmission of this message the UE can begin to send uplink Application Layer Data on the Default Bearer.
18. Attach Complete: The EMM Attach Complete message on the S1 Interface is the same message as the Attach Complete message delivered to the eNodeB by the UE over the Uu Interface. The EMM Attach Complete message is transported over the S1 Interface in the S1-AP Uplink NAS Transport".
19. In the case when a dedicated bearer is established at the time of Attach, the UE acknowledges the request for a dedicated bearer using an ESM Activate Dedicated EPS Bearer Context Accept message. The Activate Dedicated EPS Bearer Context Accept message is transported over the Uu Interface from the UE to the eNodeB in the RRC ULInformationTransfer message.
20. In the case when a dedicated bearer is established at the time of Attach, the ESM Activate Dedicated EPS Bearer Context Accept message received from the UE is forwarded on to the MME in the S1-AP Uplink NAS Transport message.
21. Modify Bearer Request: The GTPv2 Modify Bearer Request message is sent from the MME to the S-GW to complete the Attach procedure, and to therefore enable the flow of Application Layer Data in the downstream direction. The Modify Bearer Request message is not subsequently sent from the S-GW to the PDN-GW.

    In the case when a dedicated bearer is established at the time of Attach, a GTPv2 Create Bearer Response message is sent from MME to S-GW to acknowledge the Create Bearer Request message. The Create Bearer Response message is marked with the "P" flag set to "1" to indicate that a second GTPv2 message, in this case the Modify Bearer Request message, follows in the same UDP message. Note that the order here is different than message 10.
22. In the case when a dedicated bearer is established at the time of Attach, the Create Bearer Response message received from the MME is forwarded on to the PDN-GW to acknowledge the Create Bearer Request message.
23. Modify Bearer Response: The GTPv2 Modify Bearer Response message is sent from the S-GW to the MME to acknowledge the Modify Bearer Request message.

When the S5/S8 interface is PMIP based, the policy interaction between the PDN-GW and the PCRF is replaced by the Gateway Control Establishment between the Serving-GW and the PCRF. The PCRF passes the QoS parameters to the Serving Gateway based on the policy decision. In addition, the Serving Gateway performs PMIP Proxy Binding Update with the PDN-GW to establish a PMIP tunnel. The PDN-GW and the PCRF perform IP CAN session establishment and the PCRF associates the IP CAN session with the Gateway Control Session established by the S-GW.

6.3.1.2.2 Relevant NGN GETS Aspects

NGN GETS aspects were described in the flow description for the Attach procedure for a GTP-based S5/S8 Interface.

The following treatment applies by virtue of being assigned an Access Class (AC) within the range of 11-15:

NGN GETS subscribed UEs, by virtue of being assigned an AC within the range of 11-15, access the system using the “highPriorityAccess” Establishment Cause. The MME provides priority handling of an Initial UE Message message if it includes the “highPriorityAccess” Establishment Cause.

The following treatments apply only if Advance Priority-MME is enabled:

If the Initial UE Message contains the “highPriorityAccess” Establishment Cause, the MME will set the Pre-emption Vulnerability Indicator to “not-pre-emptable” for the default and, if applicable, IMS Signalling Bearers.

The remaining treatments apply only if IMS Signalling Priority is enabled:

The ARP for the Default Bearer provided by the HSS is modified by the PCRF using a PCC rule which considers the Service User’s priority level, and is included in the Default-EPS-Bearer-QoS AVP within the Gx Diameter CCA message.

For NGN GETS subscribed UEs with subscription to IMS Services, the ARP used for establishing the IMS Signalling Bearer is derived in a PCC rule per NGN GETS Service Provider’s policy, is an ARP chosen by the PCRF from the set allocated by the NGN GETS Service Provider for NGN GETS use, and is included in the QoS-Information AVP within the Gx Diameter CCA message.

The ARP/QCI assigned to the Default Bearer of an NGN GETS subscribed UE is transferred from the PDN-GW to the S-GW, and then to the MME, in the Create Session Response message over the S5/S8 and S11 Interfaces respectively.

The ARP/QCI assigned to the IMS Signalling Bearer of an NGN GETS subscribed UE is transferred from the PDN-GW to the S-GW, and then to the MME in the Create Bearer Request message over the S5/S8 and S11 Interfaces respectively.

The ARP/QCI assigned to the Default Bearer of an NGN GETS subscribed UE is transferred from the MME to the eNodeB, in the Initial Context Setup Request message over the S1 Interface.

The QCI assigned to the Default Bearer of an NGN GETS subscribed UE is transferred from the MME to the UE (via eNodeB), encapsulated in the Activate Default EPS Bearer Context Request message over the S1 Interface.

The ARP/QCI assigned to the IMS Signalling Bearer of an NGN GETS subscribed UE is transferred from the MME to the eNodeB, in the Initial Context Setup Request message over the S1 Interface.

The QCI assigned to the IMS Signalling Bearer of an NGN GETS subscribed UE is transferred from the MME to the UE (via eNodeB), encapsulated in the Activate Dedicated EPS Bearer Context Request message over the S1 Interface.

The QCI assigned to the Default Bearer of an NGN GETS subscribed UE is transferred from the MME to the UE (via eNodeB), encapsulated in the Activate Default EPS Bearer Context Request message over the Uu Interface.

The QCI assigned to the IMS Signalling Bearer of an NGN GETS subscribed UE is transferred from the MME to the UE (via eNodeB), encapsulated in the Activate Dedicated EPS Bearer Context Request message over the Uu Interface.

6.3.1.3 Tracking Area Update w/ MME and S-GW Change for GTP-Based S5/S8

The Tracking Area Update (TAU) Procedure allows a UE to report its location to the E-UTRAN as it moves about the coverage area of the system. The TAU Procedure is described in Section 5.3.3 of [TS 23.401] and Section 5.5.3 of [TS 24.301]. The call/session flows assume that the TAU Request does not have the active flag set. As a result no bearers will be setup in conjunction with these procedures.

The procedure shown in this section focuses on the case that the TAU results in a change of both the MME and the S-GW for the case of a GTP-based S5/S8 Interface.

When IMS Signalling Priority as defined in Section is not enabled, the TAU procedure for an NGN GETS subscribed UE requires no special treatment. NGN GETS treatment may still be provided to the RRC Connection Establishment procedure resulting from the Establishment Cause set to High Priority Access" based on the Access Class Value.

When IMS Signalling Priority is enabled, special NGN GETS treatments during the TAU procedure shown in this section are:

- **The ARP for the Default Bearer, established previously with an ARP chosen by the PCRF from the set allocated by the NGN GETS Service Provider for NGN GETS use, is retained in the EPS bearer context as the user moves between tracking areas,**
- **For NGN GETS subscribed UEs with subscription to IMS Services, the IMS Signalling Bearer established previously with an ARP chosen by the PCRF from the set allocated by the NGN GETS Service Provider for NGN GETS use, is retained in the EPS bearer context as the user moves between tracking areas, and**
- **When a TAU occurs in which the TAU Request message includes the "active flag" set within the EPS update type IE, the bearers are activated by the eNodeB with the priority appropriate for the ARP values stored in the EPS bearer context(s).**

6.3.1.3.1 General Description

Figure 6-30 shows the TAU Procedure for the case in which both the MME and S-GW are changed for the case of a GTP-based S5/S8 Interface. This flow is based on Figure 5.3.3.1-1 of [TS 23.401].

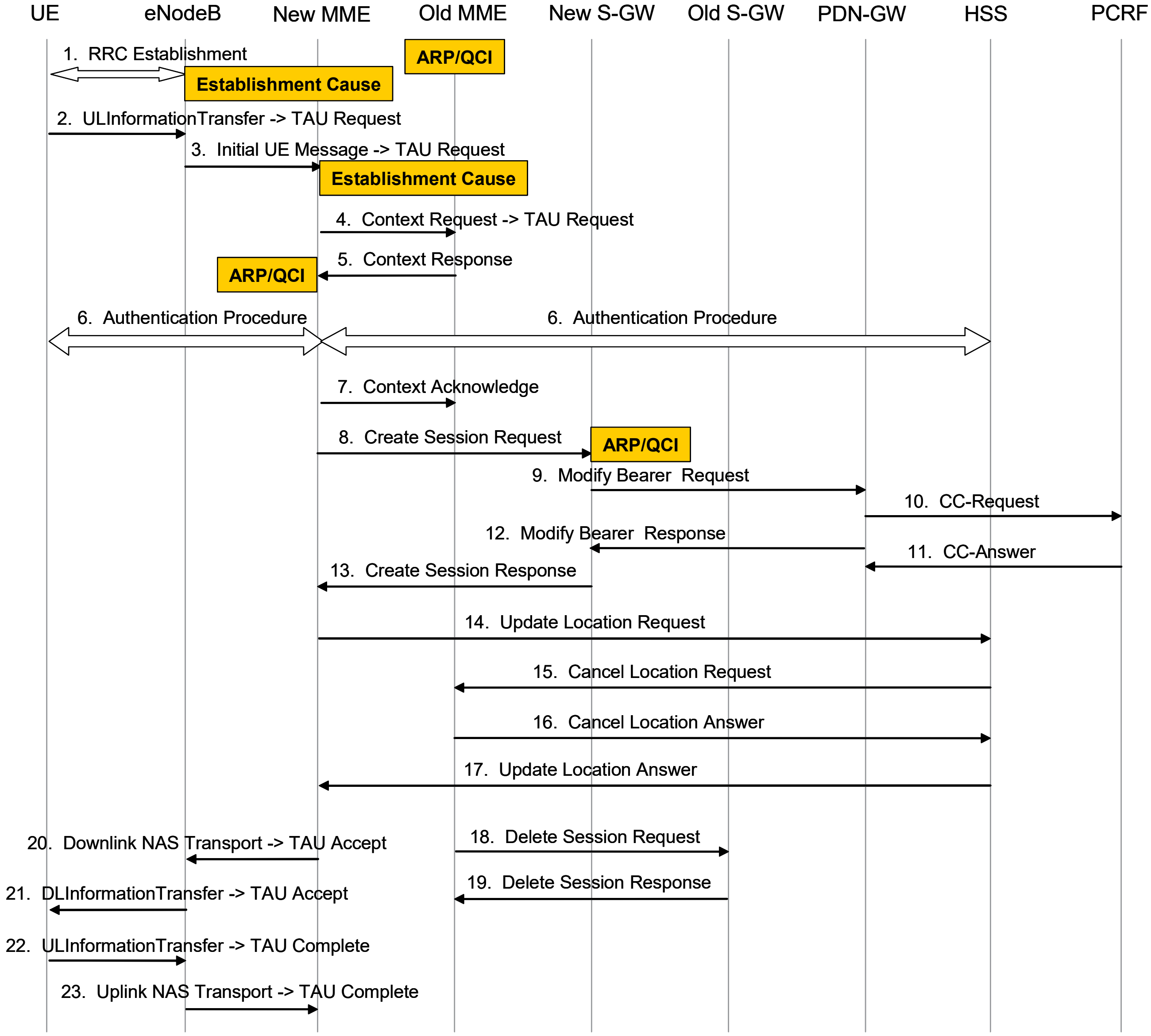

Figure 6-30 – TAU with both MME and S-GW Change for GTP-based S5/S8

1. RRC Establishment: If the UE is in RRC_CONNECTED state, this step is not required. If the UE is in RRC_IDLE state, a procedure is performed to access the system via a random access procedure with the "highPriorityAccess" marking, to transition to RRC_CONNECTED state, and to establish a signalling channel for the transport of the EMM messages which follow.

   See Section 6.3.1.1 for a discussion of NGN GETS treatments that are applied during the RRC Connection Establishment procedure.

2. TAU Request on the Uu Interface: The EMM TRACKING AREA UPDATE REQUEST message is sent from the UE to the MME to begin the TAU Procedure. Over the Uu Interface it is included in the RRC ULInformationTransfer message.

   If the EMM TRACKING AREA UPDATE REQUEST message contains the "active flag" within the EPS update type IE, the bearers defined within the EPS bearer contexts are established following completion of the TAU procedure and transmission of the TRACKING AREA UPDATE ACCEPT message.

3. TAU Request on the S1 Interface: The EMM TRACKING AREA UPDATE REQUEST message is sent from the UE to the MME to begin the TAU Procedure. Over the S1 Interface it is included in the S1-AP Initial UE Message message.

See Section 6.3.1.2 for a discussion of NGN GETS treatments that are applied by MME upon receipt of the Initial UE Message message.

4. Context Request: The GTPv2-C Context Request message is sent on the S10 Interface from the new MME to the old MME to request transfer of contexts of all established PDN connections. The Context Request message includes the entire EMM TRACKING AREA UPDATE REQUEST message received by the new MME.

5. Context Response: The GTPv2-C Context Response message is sent on the S10 Interface from the old MME to the new MME in response to the Context Request message received from the new MME. The Context Response message includes the contexts for all established PDN connections.

   When ARP belongs to the set assigned by the NGN GETS Service Provider for NGN GETS use, the ARP for the Default Bearer, established previously with an ARP chosen by the PCRF from the set allocated by the NGN GETS Service Provider for NGN GETS use, is retained in the EPS bearer context and is included in the Bearer Level QoS IE within the Context Response message.

   When ARP belongs to the set assigned by the NGN GETS Service Provider for NGN GETS use, for NGN GETS subscribed UEs with subscription to IMS Services, the IMS Signalling Bearer established previously with an ARP chosen by the PCRF from the set allocated by the NGN GETS Service Provider for NGN GETS use, is retained in the EPS bearer context and is included in the Bearer Level QoS IE within the Context Response message.

6. The Authentication and Security Procedures are completed prior to accepting the TAU Request.

7. Context Acknowledge: The GTPv2-C Context Acknowledge message is sent on the S10 Interface from the new MME to the old MME to acknowledge receipt of the contexts for all established PDN connections in the Context Response message.

8. Create Session Request: The GTPv2-C Create Session Request message is sent on the S11 Interface from the new MME to the new S-GW to transfer all bearer contexts and to inform the new S-GW of the address of the new MME.

   When ARP belongs to the set assigned by the NGN GETS Service Provider for NGN GETS use, the ARP for the Default Bearer, established previously with an ARP chosen by the PCRF from the set allocated by the NGN GETS Service Provider for NGN GETS use, is transferred from the MME to the S-GW in the Create Session Request message on the S11 Interface using the Bearer Level QoS IE.

   When ARP belongs to the set assigned by the NGN GETS Service Provider for NGN GETS use, for NGN GETS subscribed UEs with subscription to IMS Services, the IMS Signalling Bearer established previously with an ARP chosen by the PCRF from the set allocated by the NGN GETS Service Provider for NGN GETS use, is transferred from the MME to the S-GW in the Create Session Request message on the S11 Interface using the Bearer Level QoS IE.

9. Modify Bearer Request: The GTPv2-C Modify Bearer Request message is sent on the S5/S8 Interface from the new S-GW to the PDN-GW to notify the PDN-GW of the address of the new S-GW.

Messages 10 and 11 are needed only in case of IRAT handover.

12. Modify Bearer Response: The GTPv2-C Modify Bearer Response message is sent on the S5/S8 Interface from the PDN-GW to the new S-GW to acknowledge the Modify Bearer Request message.

13. Create Session Response: The GTPv2-C Create Session Response message is sent on the S11 Interface from the new S-GW to the new MME to acknowledge the Create Session Request message.

14. Update Location Request (ULR): If there is no valid subscription context for the UE in the MME, the MME sends the Diameter ULR message to the HSS over the S6a Interface. If valid subscription context for the UE exists in the MME, then messages 14 through 17 are not needed.

15. Cancel Location Request (CLR): The Diameter CLR message is sent by the HSS to the old MME over the S6a Interface to remove the subscription context for the UE. No further discussion of the Diameter CLR is provided in this document.

16. Cancel Location Answer (CLA): The Diameter CLA message is sent by the old MME to the HSS over the S6a Interface to acknowledge receipt of the Diameter CLR message. No further discussion of the Diameter

CLA message is provided in this document.

17. Update Location Answer (ULA): The Diameter ULA message is sent by the HSS to the new MME over the S6a Interface to acknowledge receipt of the Diameter ULR message.
18. Delete Session Request: The GTPv2-C Delete Session Request message is sent on the S11 Interface from the old MME to the old S-GW to delete the session and remove all contexts for this UE. No further discussion of the Delete Session Request message is provided in this document.
19. Delete Session Response: The GTPv2-C Delete Session Response message is sent on the S11 Interface from the old S-GW to the old MME to acknowledge the Delete Session Request message. No further discussion of the Delete Session Response" is provided in this document.
20. TAU Accept on the S1 Interface: The EMM TRACKING AREA UPDATE ACCEPT message is sent from the MME to the UE (via eNodeB) to acknowledge successful completion of the TAU Procedure. Over the S1 Interface it is included in the S1-AP Downlink NAS Transport message.
21. TAU Accept on the Uu Interface: The EMM TRACKING AREA UPDATE ACCEPT message is sent from the MME to the UE (via eNodeB) to acknowledge successful completion of the TAU Procedure. Over the Uu Interface it is included in the RRC DLInformationTransfer message.

    As no NAS PDU may be carried in the TRACKING AREA UPDATE REQUEST message, it is assumed that there is a separate message sent by the MME, that is, no piggybacking is used.

    When ARP belongs to the set assigned by the NGN GETS Service Provider for NGN GETS use, and a TAU procedure occurs in which the TAU Request message includes the "active flag" set within the EPS update type IE, the bearers are activated by the eNodeB with the priority appropriate for the ARP values stored in the EPS bearer context(s) which were chosen from the set allocated by the NGN GETS Service Provider for NGN GETS use.

The remaining messages are required only if a new GUTI was assigned to the UE in the TAU Accept message.

22. TAU Complete on the Uu Interface: The EMM TRACKING AREA UPDATE COMPLETE message is sent from the UE to the MME to acknowledge receipt of the new GUTI. Over the Uu Interface it is included in the RRC ULInformationTransfer message.
23. TAU Complete on the S1 Interface: The EMM TRACKING AREA UPDATE COMPLETE message is sent from the UE to the MME to acknowledge receipt of the new GUTI. Over the S1 Interface it is included in the S1-AP Uplink NAS Transport message.

When the S5/S8 interface is PMIP based, the policy interaction between the PDN-GW and the PCRF is replaced by the Gateway Control Establishment between the Serving-GW and the PCRF. The PCRF passes the QoS parameters to the Serving Gateway based on the policy decision. In addition, the Serving Gateway performs PMIP Proxy Binding Update with the PDN-GW to establish a PMIP tunnel. The PDN-GW and the PCRF perform IP CAN session establishment and the PCRF associates the IP CAN session with the Gateway Control Session established by the S-GW.

6.3.1.3.2 Relevant NGN GETS Aspects

During the TAU Procedure with a change of both the MME and the S-GW, the EPS bearer contexts must be provided over the S10 Interface to the new MME in the Bearer Level QoS IE within the GTPv2-C Context Response message, and then over the S11 Interface to the new S-GW using the Bearer Level QoS IE within the GTPv2-C Create Session Request message.

In the case when the "active flag" is set in the TAU Request message, and the bearer or bearers to be established have, within the EPS bearer contexts, an ARP which belongs to the set assigned by the NGN GETS Service Provider for NGN GETS use, the bearers are reactivated by the eNodeB with the priority appropriate for the ARP.

6.3.1.4 Service Request for GTP-based S5/S8

The Service Request procedure is the means by which to transition the EMM Mode from EMM-IDLE to EMM-CONNECTED, and when Application Layer data is to be sent, to establish the S1 and Radio bearers.

The Service Request procedure is needed when the UE is EMM-IDLE and one or more of the following are true:

- The UE has uplink NAS signalling pending,
- The network has downlink NAS signalling pending at the MME, and the UE was notified over the Uu Interface via the RRC Paging message,
- The UE has uplink Application Layer data pending, or
- The network has Downlink Application Layer data buffered in the S-GW, and the UE was notified over the Uu Interface via the RRC Paging message.

6.3.1.4.1 General Description

Figure 6-31 shows the E-UTRAN Service Request procedure. This flow is based on Figure 5.3.4.1-1 of [TS 23.401].

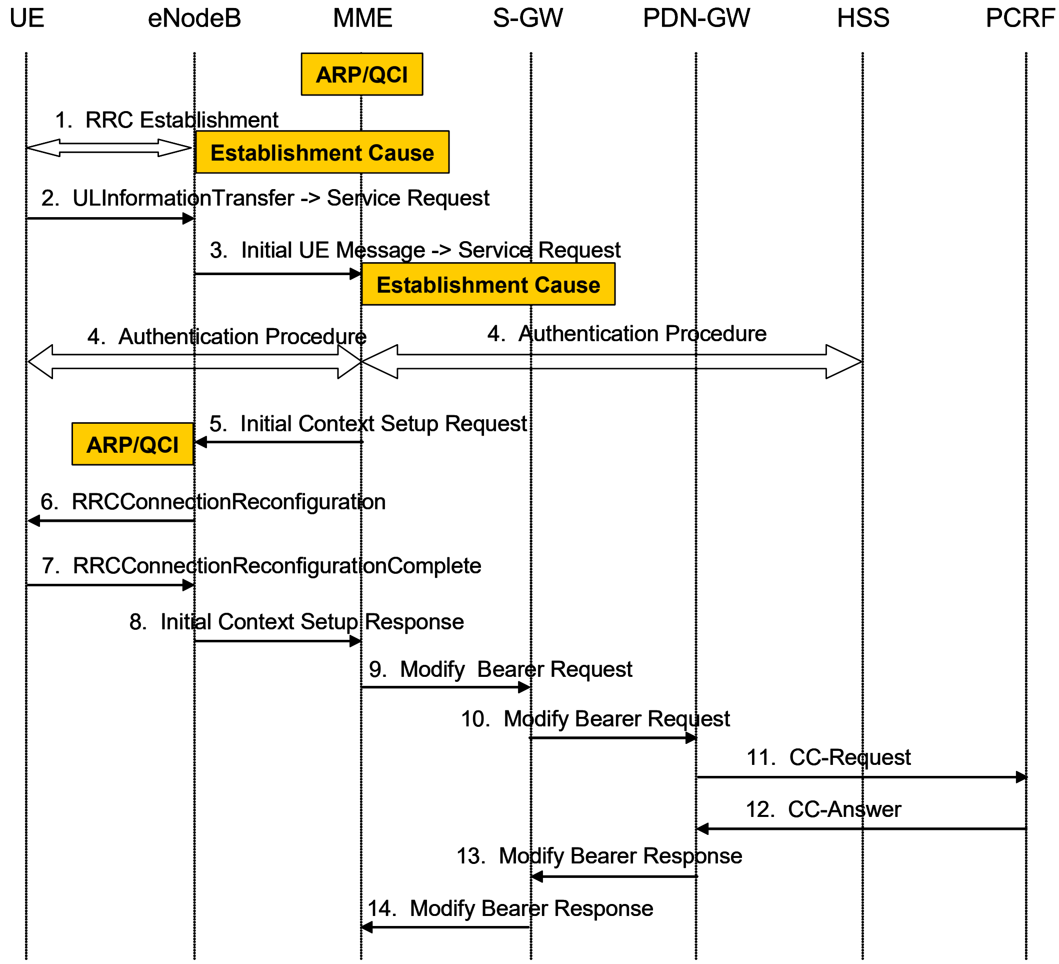

Figure 6-31 – Service Request procedure with a GTP-based S5/S8 Interface

1. RRC Establishment: If the UE is in RRC_CONNECTED state, this step is not required. If the UE is in RRC_IDLE state, the procedure to access the system via a random access procedure, to transition to RRC_CONNECTED state, and to establish a signalling channel for the transport of the EMM messages which follow is required.

For an NGN GETS subscribed UE, because the USIM includes AC14, the Establishment Cause includes the "highPriorityAccess" marking. Inclusion of this marking signals the eNodeB to treat this request for SRB1 resources with priority.

2. Service Request on the Uu Interface: The EMM Service Request message is sent either to request the transmission of uplink NAS Signalling or uplink Application Layer data, or to respond to a RRC Paging message. The Service Request" is transferred over the Uu Interface from the UE to the eNodeB in the RRC ULInformationTransfer message. The Service Request message is supervised by timer T3417.
3. Service Request on the S1 Interface: The EMM Service Request message on the S1 Interface is the same message sent from the UE to the eNodeB over the Uu Interface. The Service Request" is transferred over the S1 Interface within a S1-AP Initial UE Message message, which includes the Establishment Cause, if provided in the RRCConnectionRequest.

   For an NGN GETS subscribed UE, as the "highPriorityAccess" indication is included in the RRCConnectionRequest, it will be copied to the Establishment Cause of the S1-AP Initial UE Message message which will signal the MME to process this request with priority, including preferential treatment in times of congestion.
4. The Authentication Procedure and Security exchanges may precede the setup of the S1 and radio bearers.
5. Initial Context Setup Request: The S1-AP Initial Context Setup Request message invokes the activation of radio and S1 bearers. Note that unlike the Attach procedures, this message does not contain a piggybacked message to be forwarded to the UE as the bearers being requested are already known to the UE, they are merely being reactivated.

   For an NGN GETS subscribed UE, for which IMS Signalling Priority is enabled, the default, and IMS Signalling Bearer (if separate from the default) established at the time of Attach include an ARP chosen to provide priority treatment for the allocation of the bearer.

   For a Mobile-Termination to a Public UE, the MME updates the bearer contexts of the terminating UE based on the ARP received in the Update Bearer Request or in the Downlink Data Notification. The MME includes these values within the Initial Context Setup Request message that were provided by the PCRF such that the eNodeB re-establishes the bearers with priority.

   For the case of the Public UE for a Mobile Origination, or for termination of a non-NGN GETS call/session, no additional NGN GETS priority treatment is specified at this point.
6. RRCConnectionReconfiguration: The RRC RRCConnectionReconfiguration message is used for the Radio Resource Configuration Procedure to reactivate the previously established SRB2 signalling and / or Data Radio Bearer (DRB) data bearers known to exist in the UE and MME. The RRCConnectionReconfiguration message also serves as an implicit acknowledgement for the Service Request message. Timer T3417 is stopped by the UE on receipt of this message.
7. RRCConnectionReconfigurationComplete: The RRC RRCConnectionReconfigurationComplete message serves to acknowledge completion of the Radio Resource Configuration Procedure. Following the transmission of this message, uplink NAS signalling, or uplink Application Layer data transfer may begin.
8. Initial Context Setup Response: The Initial Context Setup Response message acknowledges the Initial Context Setup message and indicates the establishment of S1 and Radio Bearers is complete.
9. Modify Bearer Request: The GTPv2-C Modify Bearer Request message is sent by the MME to the S-GW over the S11 Interface. Following receipt of this message by the S-GW, Downlink Application Layer data may be transmitted over the S1 Interface and delivered to the UE.
10. Modify Bearer Request: The GTPv2-C Modify Bearer Request message is sent by the S-GW to the PDN-GW over the S5/S8 Interface. This message is not transmitted unless the RAT type has changed since the last reported RAT type.
11. CC-Request (CCR): The Diameter CCR message is sent by the PDN-GW to the PCRF over the Gx Interface. This opportunity for dynamic policy interaction applies only when the RAT Type has changed since the last reported RAT type.
12. CC-Answer (CCA): The Diameter CCA message is sent by the PCRF to the PDN-GW over the Gx Interface in response to the Diameter CCR message.
13. Modify Bearer Response: The GTPv2-C Modify Bearer Response message is sent by the PDN-GW to the S-GW over the S5/S8 Interface to acknowledge the Modify Bearer Request message received previously from the S-GW over the S5/S8 Interface.
14. Modify Bearer Response: The GTPv2-C Modify Bearer Response message is sent by the S-GW to the MME over the S11 Interface to acknowledge the Modify Bearer Request message received previously from the MME over the S11 Interface.

When the S5/S8 interface is PMIP based, the policy interaction between the PDN-GW and the PCRF is replaced by the Gateway Control Establishment between the Serving-GW and the PCRF. The PCRF passes the QoS parameters to the Serving Gateway based on the policy decision. The PDN-GW and the PCRF perform IP CAN session establishment and the PCRF associates the IP CAN session with the Gateway Control Session established by the S-GW.

6.3.1.4.2 Relevant NGN GETS Aspects

Priority treatment is discussed separately for subscribed and Public UEs. Priority treatment is also different depending upon whether a call/session is being originated or terminated. Four cases are described below.

In all cases we assume the UE has previously attached to the network using the Attach procedures and that any required Tracking Area updates have completed successfully.

It is observed that there is a significant benefit during the Service Request procedure applied to the NGN GETS subscribed UE during an overload condition.

<u>Case of Mobile Origination from an NGN GETS subscribed UE</u>:

For an NGN GETS subscribed UE originating a call/session, the following priority treatments apply prior to making a determination that the call/session is NGN GETS or not:

- Since an NGN GETS subscribed UE has AC14, it has been previously granted priority treatment in the establishment of SRB1 resources by virtue of inclusion of the Establishment Cause marked as “highPriorityAccess”.
- As the “highPriorityAccess” Establishment Cause is copied from the RRCConnectionRequest message to the S1-AP Initial UE Message message which will signal the MME to process this request with priority, including preferential treatment in times of congestion.
- An NGN GETS subscribed UE which attaches to a network on which IMS Signalling Priority is enabled, has a Default Bearer ARP, and if applicable an IMS Signalling Bearer ARP, chosen from the set allocated by the NGN GETS Service Provider for NGN GETS use. In the event of congestion, these bearers associated with NGN GETS users / service will be treated with priority as indicated by the ARP parameter assigned to each bearer.

Following determination that the call/session is an NGN GETS call/session, priority treatment is applied for the dedicated bearer for media setup.

<u>Case of Mobile Termination to an NGN GETS subscribed UE:</u>

For a call/session terminating to an NGN GETS subscribed UE, priority treatment in the establishment of SRB1 resources, and the MME processing the request with priority are applied similar to call/session origination because of the presence of “highPriorityAccess” Establishment Cause. However, if the terminating UE is an NGN GETS subscribed UE with IMS Signalling Priority enabled, there is no need for the PCRF to trigger a bearer update procedure. The priority treatment applied to the media bearer establishment will depend on the originating Service User’s priority level.

<u>Case of Mobile Origination from a Public UE</u>:

For a Public UE originating a call/session, no priority treatment prior to or during the Service Request procedure is applied even if the call/session is an NGN GETS call/session unless the UE is assigned to AC 11-15. Priority treatment for an NGN GETS call/session is only applied for the upgrade of default and IMS Signalling Bearer and for the establishment of the media bearer once the call/session is identified as an NGN GETS call/session.

<u>Case of Mobile Termination to a Public UE:</u>

- As with the case of the NGN GETS subscribed UE, the eNodeB will treat the request for SRB1 resources with priority based on the Paging Priority Indicator received from the MME.
- As with the case of the NGN GETS subscribed UE, the MME upon receipt of the S1-AP Initial UE Message message will process this request with priority, including preferential treatment in times of congestion.

The MME overwrites the ARP values of the default and IMS Signalling Bearer, associated with the terminating UE and instead includes NGN GETS ARP values within the Initial Context Setup Request message such that the eNodeB establishes the bearers with priority. The specific values to use are provided in the GTP-C Update Bearer Request message received by the MME.

6.3.1.5 Paging

The Paging procedure is needed when the UE is EMM-IDLE and one or more of the following are true:

- The network has Downlink Application Layer data buffered in the S-GW, or
- The network has downlink NAS signalling pending.

In either case the UE must be notified over the Uu Interface via the RRC Paging message. The procedures are slightly different in that in the case of downlink NAS signalling the message awaits processing at the MME, while for the case of Downlink Application Layer data, the packets are buffered at the S-GW, and the MME is notified of this via a GTP-C Downlink Data Notification message. Due to this they are described separately.

NGN GETS priority treatment during the Service Request procedure for a Mobile Terminated call/session to a Public UE (or an NGN GETS subscribed UE without IMS Signalling Priority enabled) is enabled by the delivery of NGN GETS priority indication from the S-GW to the MME during the Paging procedure. Without such delivery, no priority during the Service Request procedure is provided to a Public UE (or an NGN GETS subscribed UE without IMS Signalling Priority enabled) when terminating an NGN GETS call/session unless the UE is assigned to AC 11-15.

Specific priority treatment mechanisms shown in this section are:

- **The MME is notified of the need to initiate the Paging procedure and to treat subsequent RRC Connection Establishment and Service Request procedures with priority.**
    - **Delivery of indication of the arrival of priority downlink data is done using the ARP in the GTP-C Downlink Data Notification message over the S11 Interface.**
    - **A GTP-C Update Bearer Request message which includes an ARP chosen from the set allocated by the NGN GETS Service Provider for NGN GETS use reflects the priority needs of the incoming session. In this case, the MME updates the context of the corresponding bearer when it receives an Update Bearer Request message from the S-GW prior to requesting the eNodeB to reestablish the bearers**
- **Priority handling by the MME in the event of congestion for the S1-AP Paging message is based on priority indication delivered to the MME.**
- **Delivery of priority indication from the MME to the eNodeB is done by including a Paging Priority Indicator in the S1-AP Paging message.**
- **Priority handling in the event of congestion of the S1-AP Paging message within the eNodeB is based on receiving the Paging Priority Indicator from the MME.**

6.3.1.5.1 General Description

The E-UTRAN Paging procedure is shown in Figure 6-32 and Figure 6-33 for the cases of paging for the delivery of downlink data, and paging for the delivery of downlink control signalling to a UE (either an NGN GETS subscribed UE with IMS Signalling Priority enabled or a Public UE) that is idle.

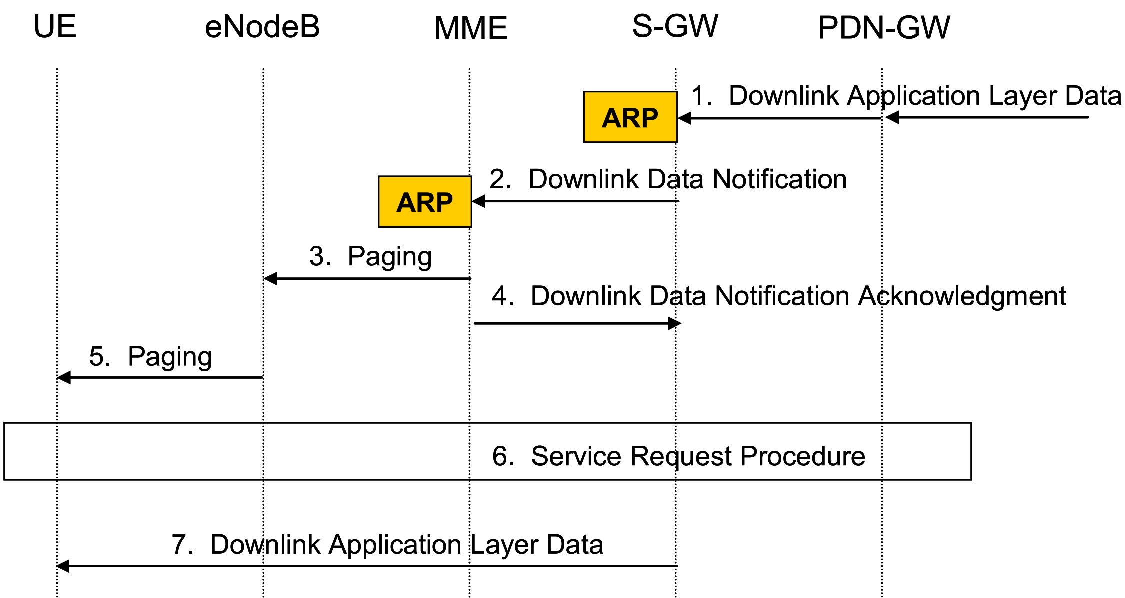

Figure 6-32 – Paging procedure for GTP-U data

1. Downlink Application Layer Data: An IP packet arrives for a user at the PDN-GW and is delivered to the S-GW. If the user is in active mode, the packet is delivered to the eNodeB serving the UE, and transmitted over the air interface to the UE. For a user in active mode, the E-UTRAN Paging procedure is not required. If the user is in idle mode, the packet is buffered in the S-GW while the system invokes the E-UTRAN Paging procedure to attempt to locate the UE.

   When the IP packet arrives at the PDN-GW, the installed Traffic Flow Templates (TFTs) determine which EPS bearer the packet is sent on towards the S-GW. The ARP of the bearer on which the packet arrives will be included in the Downlink Data Notification message that follows to notify the MME of the ARP of the bearer on which traffic is queued at the S-GW. When this bearer has been upgraded for the incoming priority call/session, this ARP belongs to the set assigned for NGN GETS.

2. Downlink Data Notification: The GTP-C Downlink Data Notification message defined in Section 7.2.11.1 of [TS 29.274] is transmitted by the S-GW to the MME over the S11 Interface to notify the MME of the arrival of the initial downlink application layer data.

   The ARP is added to the Downlink Data Notification message. If the ARP belongs to the set associated with NGN GETS service, it conveys NGN GETS priority indication.

3. Paging: The S1-AP Paging message is transmitted by the MME to the eNodeB over the S1 Interface. A Paging Priority Indicator is included in the S1-AP Paging message.

   If due to congestion the MME cannot transmit all S1-AP Paging messages over the S1 Interface, the Paging Priority Indicator is used to determine the relative importance of one Paging message over another to insure that Paging messages associated with NGN GETS calls/sessions are not dropped prior to Paging messages associated with non-NGN GETS calls/sessions. If due to congestion the eNodeB cannot handle all S1-AP Paging messages, those which include the Paging Priority Indicator are given priority handling and are not dropped prior to Paging messages which do not include a Paging Priority Indicator marking.

4. Downlink Data Notification Acknowledgment: The GTP-C Downlink Data Notification Acknowledgement message defined in Section 7.2.11.2 of [TS 29.274] is transmitted by the MME to the S-GW over the S11 Interface to acknowledge receipt of the Downlink Data Notification message.

5. Paging: The RRC Paging message is transmitted by the eNodeB to the UE over the Uu Interface.

6. Service Request procedure: The Service Request procedure described in the previous section is included here in its entirety. The Service Request message indicates that the procedure is initiated as a page

response.

7. Downlink Application Layer Data: The IP packet buffered in the S-GW is delivered to the eNodeB and subsequently to the UE.

Figure 6-33 applies when paging is done for delivery of downlink control signalling, which for example is shown as a GTP-C Update Bearer Request message.

- A Public UE or an NGN GETS subscribed UE with IMS Signalling Priority disabled, for which the bearer update procedure signalling arrives at the S-GW.

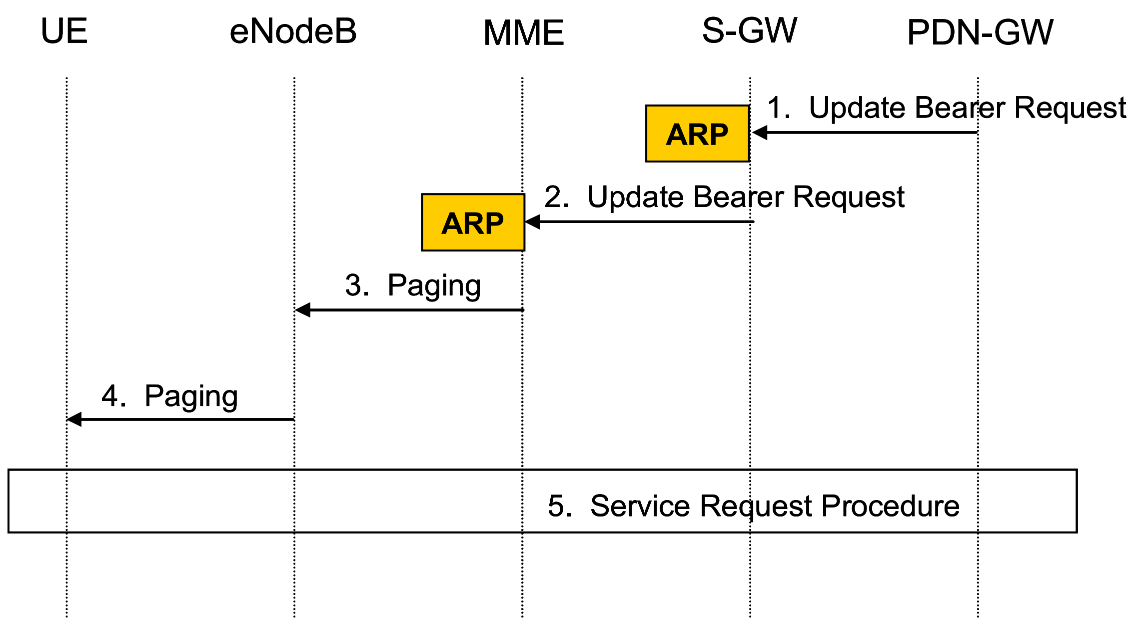

Figure 6-33 – Paging procedure for GTP-C Signalling

1. Update Bearer Request: In the example shown a downlink control signalling message, in this case an Update Bearer Request message, originates at the PDN-GW and is sent to the S-GW. As it is a GTP-C packet, it is not buffered at the S-GW but automatically sent on to the MME.

   For Mobile Terminated NGN GETS calls/sessions to a Public UE or an NGN GETS UE without IMS Signalling Priority enabled, the PCRF signals the modification of the default and IMS Signalling Bearer to have an ARP priority chosen from the set allocated for NGN GETS use. This is done using the GTP-C Update Bearer Request message.
2. Update Bearer Request: As with any GTP-C packet, the Update Bearer Request message is not buffered at the S-GW but is automatically sent on to the MME.

   The transmission of the Update Bearer Request" containing an ARP value chosen from the set allocated by the NGN GETS Service Provider for NGN GETS use, completes the delivery of NGN GETS priority indication to the MME for the case of a Mobile Terminated call/session.
3. Paging: The S1-AP Paging message is transmitted by the MME to the eNodeB over the S1 Interface. The message includes a Paging Priority Indicator.

   If due to congestion the MME cannot transmit all S1-AP Paging messages over the S1 Interface, the priority indication received by the MME via an ARP belonging to the set allocated for NGN GETS use is used to determine the relative importance of one Paging message over another to insure that Paging messages associated with NGN GETS calls/sessions are not dropped prior to Paging messages associated with non-NGN GETS calls/sessions. If due to congestion the eNodeB cannot handle all S1-AP Paging messages, those which include a Paging Priority Indicator are given

priority handling and are not dropped prior to Paging messages which do not include the Paging Priority Indicator marking.

The remaining messages in Figure 6-33 are as described in Figure 6-32.

For the case of a Public UE or an NGN GETS subscribed UE with IMS Signalling Priority disabled, for which the bearer update procedure signalling arrives at the S-GW after the downlink application layer data packet, no priority treatment is shown during the Paging and Service Request procedures as priority paging is already initiated because of the Downlink Data Notification including ARP appropriate for NGN GETS.

6.3.1.5.2 Relevant NGN GETS Aspects

Specific priority indication and treatment mechanisms applied during the Paging procedure are:

- Delivery of indication of the arrival of priority downlink data in the GTP–C Downlink Data Notification message over the S11 Interface is done by inclusion of the ARP of the bearer on which the downlink data arrives,
- Priority handling of paging at the MME in times of congestion based on receipt of priority indication via an ARP belonging to the set allocated for NGN GETS use in the GTP-C Update Bearer Request message,
- Delivery of priority indication for paging over the S1 Interface using a Paging Priority Indicator over S1-AP,
- Priority handling of the Paging message in times of congestion at the eNodeB is based on receipt of priority indication via the Paging Priority Indicator,
- Priority for RRC Connection Establishment and Service Request procedures are done by eNodeB identifying that the Paging Response is from a UE that was sent a priority page.

6.3.1.6 Bearer Establishment (GTP)

Figure 6-34 shows the Bearer Establishment procedure for a GTP-based S5/S8 interface. Bearer establishment procedures are used when an EPS bearer needs to be established for a service.

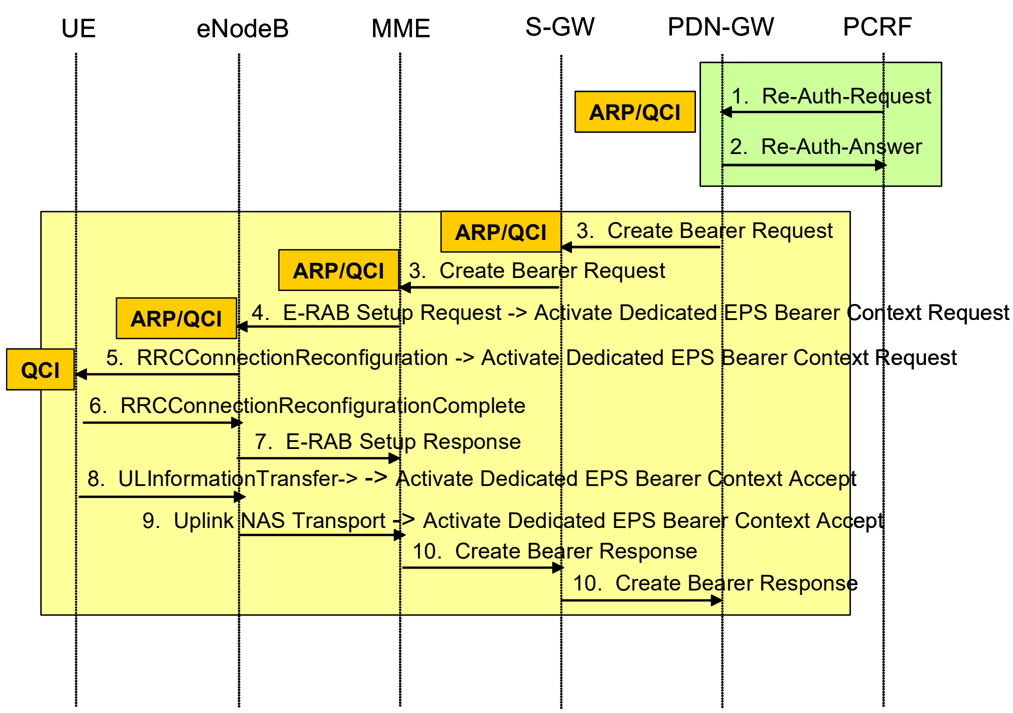

Figure 6-34 – Bearer Establishment procedure for a GTP-based S5/S8 Interface

1. Re-Auth-Request: The PCRF receives an external message to evaluate PCC Rules and policy decision to establish a bearer. The external message includes parameters to indicate if the request is associated with an NGN GETS call / session or not. An example of an external message is a Diameter AAR message from the P-CSCF during a SIP session setup. The PCRF sends a Diameter RAR message to the PDN-GW requesting it to install the PCC rules and to update the policy decision. The Diameter RAR message includes the QoS-Information AVP that defines the authorized QoS information for the IP-CAN bearer or a service data flow, and includes the Allocation-Retention-Priority AVP that includes Priority-Level AVP (which defines the priority of the service data flow), QCI and other QoS parameters.

   When the PCRF recognizes that a request is associated with an NGN GETS call / session or NGN GETS Data Transport invocation, it derives the Allocation-Retention-Priority AVP through a NGN GETS Service Provider specific mapping algorithm and includes it in the Diameter RAR message within the QoS-Information AVP. The Allocation-Retention-Priority AVP is derived using priority information received over the Rx interface (i.e., MPS-Identifier AVP, Reservation-Priority AVP, media type, etc.) and indicates the appropriate priority treatment that should be applied by the EPC for the bearer. The PDN-GW determines if a bearer should be established based on the QoS information received from the PCRF and if so propagates the QoS information (ARP, QCI, etc.) towards the eNodeB.

2. Re-Auth-Answer: The PDN-GW installs the identified PCC rules and sends a Diameter RAA message to the PCRF to acknowledge the Diameter RAR message.

In the remainder of this call/session flow we assume that the PDN-GW establishes a new EPS bearer to satisfy the QoS policy received from the PCRF.

3. Create Bearer Request: The PDN-GW uses the QoS policy obtained from the Diameter RAR message to assign the EPS Bearer QoS, i.e., it assigns the values to the bearer level QoS parameters QCI, ARP, GBR and Maximum Bit Rate (MBR). The PDN-GW sends a Create Bearer Request message to the S-GW. The Linked EPS Bearer Identity (LBI) is the EPS Bearer Identity of the Default Bearer between the PDN-GW and the UE. The S-GW forwards the Create Bearer Request message to the MME.
4. E-RAB Setup Request: The MME sends an E-RAB Setup Request message encapsulating the Activate Dedicated EPS Bearer Context Request message to the eNodeB. The Activate Dedicated EPS Bearer Context Request message includes the EPS QoS IE, the EPS Bearer Identity and the LBI.
5. RRCConnectionReconfiguration: The eNodeB sends an RRCConnectionReconfiguration message encapsulating the Activate Dedicated EPS Bearer Context Request message (does not contain the ARP) to the UE. The eNodeB maps the EPS Bearer QoS to the Radio Bearer QoS. The UE stores the EPS Bearer Identity and links the dedicated bearer to the Default Bearer indicated by the LBI.
6. RRCConnectionReconfigurationComplete: The UE acknowledges the radio bearer activation to the eNodeB with an RRCConnectionReconfigurationComplete message.
7. E-RAB Setup Response: The eNodeB acknowledges the bearer activation to the MME with an E-RAB Setup Response message. The eNodeB indicates whether the requested EPS Bearer QoS could be allocated or not.
8. UL Information Transfer: The UE NAS layer builds a response encapsulating the Activate Dedicated EPS Bearer Context Accept message and sends it to the eNodeB.
9. UL NAS Transport: The eNodeB sends a S1-AP Uplink NAS Transport message encapsulating the Activate Dedicated EPS Bearer Context Accept message to the MME.
10. Create Bearer Response: Upon receiving the Activate Dedicated EPS Bearer Context Accept message, the MME acknowledges the bearer activation to the S-GW by sending a Create Bearer Response message. The S-GW acknowledges the bearer activation to the PDN-GW by sending a Create Bearer Response message.

When the S5/S8 interface is PMIP-based, the PCRF initiates a Gateway Control and QoS Rules Provision procedure with the Serving GW to install the QoS rules and even triggers before sending the PCC rules to the PDN-

GW.

6.3.1.7 Bearer Modification (GTP)

Figure 6-35 shows the Bearer Modification procedure for GTP-based S5/S8 interface. Bearer modification procedures are used to modify the QoS characteristics of an existing EPS bearer. The bearer to be modified may be a Default Bearer or a dedicated bearer.

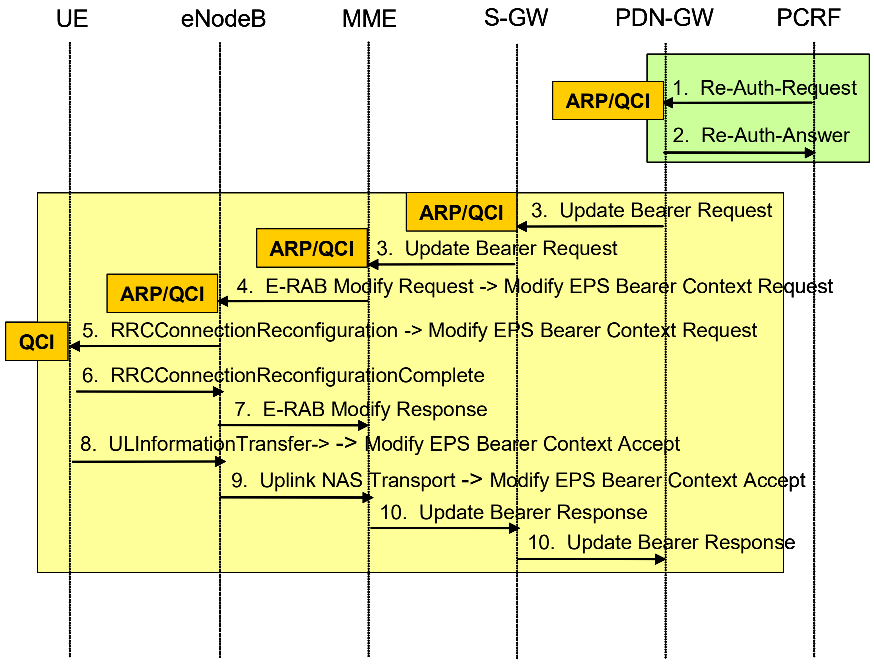

Figure 6-35 – Bearer Modification procedure for a GTP-based S5/S8 interface

1. Re-Auth-Request (RAR): The PCRF receives an external message to evaluate PCC Rules and policy decision to establish a session. The external message includes parameters to indicate if the request is associated with an NGN GETS call / session or not. An example of an external message is a Diameter AAR message from the P-CSCF during a SIP session setup. The PCRF recognizes the need to modify an existing bearer and sends a Diameter RAR message to the PDN-GW requesting it to modify the PCC rules and to update the policy decision. The Diameter RAR message includes the QoS-Information AVP that defines the authorized QoS information for the bearer or a service data flow and includes the Allocation-Retention-Priority AVP that includes the Priority-Level AVP (which defines the priority of the service data flow), QCI and other QoS parameters.

   When the PCRF recognizes that a request is associated with an NGN GETS call / session or NGN GETS Data Transport invocation, it derives the Allocation-Retention-Priority AVP through an NGN GETS Service Provider specific mapping algorithm and includes it in the Diameter RAR message within the QoS-Information AVP. The Allocation-Retention-Priority AVP is derived using priority information received over the Rx interface (i.e., user priority level/indication, media type, etc.) and indicates the appropriate priority treatment that should be applied by the EPC for the bearer. The PDN-GW determines if a bearer should be modified based on the QoS information received from the PCRF and if so propagates the QoS information (ARP, QCI, etc.) towards the eNodeB.

2. Re-Auth-Answer (RAA): The PDN-GW installs the identified PCC rules and sends a Diameter RAA message to the PCRF to acknowledge the Diameter RAR message.

In the remainder of this call/session flow we assume that the PDN-GW modifies an existing EPS bearer to satisfy the QoS policy received from the PCRF.

3. Update Bearer Request: The PDN-GW sends an Update Bearer Request message over the S5/S8 interface to the S-GW to modify the ARP of the existing bearer. The S-GW forwards the Update Bearer Request message to the MME. The message includes the QCI and ARP for the bearer to be modified.
4. E-RAB Modify Request: The MME sends an E-RAB Modify Request message encapsulating the Modify EPS Bearer Context Request message to the eNodeB. The Modify EPS Bearer Context Request message includes the New EPS QoS IE, the EPS Bearer Identity and the LBI.
5. RRCConnectionReconfiguration: The eNodeB sends an RRCConnectionReconfiguration message encapsulating the Modify EPS Bearer Context Request message (does not contain the ARP) to the UE. The eNodeB maps the EPS Bearer QoS to the Radio Bearer QoS. The UE stores the EPS Bearer Identity and links the dedicated bearer to the Default Bearer indicated by the LBI.
6. RRCConnectionReconfigurationComplete: The UE acknowledges the radio bearer modification to the eNodeB with an RRCConnectionReconfigurationComplete message.
7. E-RAB Modify Response: The eNodeB acknowledges the bearer modification to the MME with an E-RAB Modify Response message. The eNodeB indicates whether the requested EPS Bearer QoS could be modified or not.
8. UL Information Transfer: The UE encapsulates a NAS Modify EPS Bearer Context Accept message within an RRC UL Information Transfer message and sends it to the eNodeB.
9. UL NAS Transport: The eNodeB sends an S1-AP Uplink NAS Transport message encapsulating the Modify EPS Bearer Context Accept message to the MME.
10. Update Bearer Response: Upon receiving the Modify EPS Bearer Context Accept message, the MME acknowledges the updating of the bearer to the S-GW by sending an Update Bearer Response message. The S-GW acknowledges updating the bearer to the PDN-GW by sending an Update Bearer Response message.

When the S5/S8 interface is PMIP-based, the PCRF initiates a Gateway Control and QoS Rules Provision procedure with the Serving GW to install the QoS rules and even triggers before sending the PCC rules to the PDN-GW.

6.3.1.8 Mobile Origination for NGN GETS–FC + DN

Section 6.1.1 describes the NGN GETS call/session origination for GETS-FC+DN with policy control, which is also applicable for E-UTRAN with minor differences relating to IP-CAN session establishment/modification. This section discusses steps that are specific to the access network. For general call/session origination aspects including policy control, refer to Section 6.1.1.

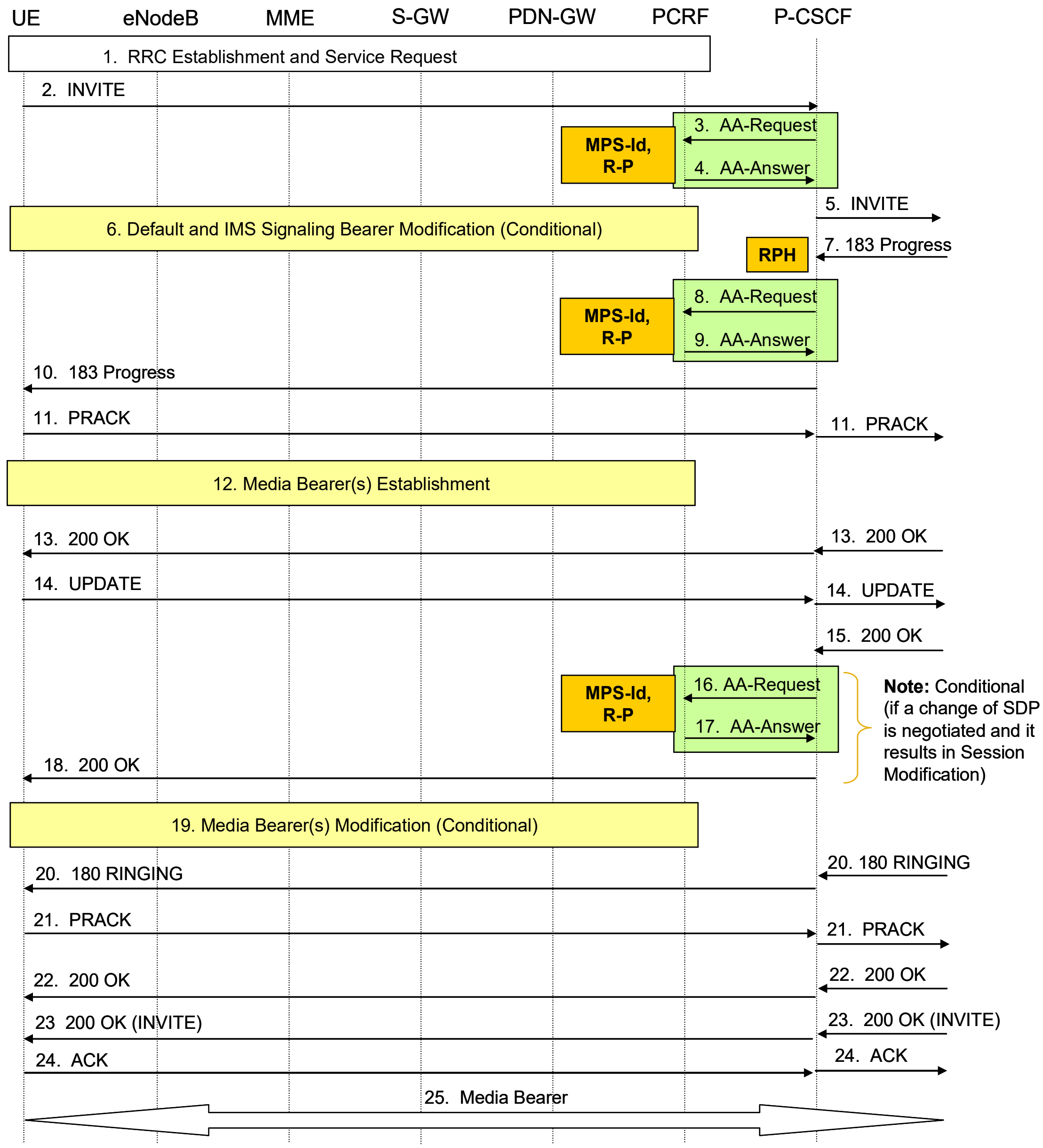

Figure 6-36 – Mobile Originated SIP Call / Session

1. RRC Establishment and Service Request: If the UE is in EMM-CONNECTED state, this step is not required. If the UE is in EMM-IDLE state, then procedures are performed to move the UE to EMM-CONNECTED state. In this state, the UE has a secure connection to the network for transporting NAS signalling and IMS signalling in the upstream and / or downstream directions.

6. Default and IMS Signalling Bearer Modification: If the PCRF received policy control message from the P-CSCF and if the ARP of the Default Bearer and IMS Signalling Bearer is not appropriate for the Service User's priority level, then the PCRF modifies the ARP of the Default and IMS Signalling Bearer to a value appropriate for the Service User's priority level (if Service User's priority level is not available, then a default priority level is used) for this NGN GETS session. This is done by Bearer Modification procedure described in Section 6.3.1.7. Step 6 proceeds in parallel with steps 5 and 7-11. Based on operator policy, default and IMS signalling bearer modification may be combined with step 12 (media bearer establishment).

12. Media Bearer Establishment: Based on the MPS-Identifier AVP, Reservation-Priority AVP and Media Type received from the P-CSCF, the PCRF identifies the priority of the session and initiates establishing media bearer(s) for the session. This is done by Media Bearer Establishment procedure described in Section 6.3.1.6.

19. Media Bearer Modification: If the QoS negotiation between the UE and the remote network does not result in a change of SDP, then steps 16, 17 and 19 are skipped. Else, the PCRF initiates modifying media bearer(s) for the session. This is done by Bearer Modification procedure.

6.3.1.8.1 Relevant NGN GETS Aspects

The IMS Signalling Priority Indicator is stored in the SPR. During the Attach procedure, the PCRF queries the SPR for the user profile and if IMS Signalling Priority is enabled for the UE, the PCRF modifies the QoS characteristics of the Default and IMS Signalling Bearers to the specific APN as discussed in the Attach procedures.

The PCRF checks if the ARP of the Default Bearer and ARP and QCI of IMS Signalling Bearer have appropriate values for the Service User Priority Level. If it is not appropriate, the PCRF initiates modification of the ARP of the Default Bearer and the ARP of the IMS Signalling Bearer to values appropriate for NGN GETS usage. The upgraded Default and IMS Signalling Bearers will be maintained during the call / session.

The PCRF uses the Reservation Priority AVP from both session and the media level to generate the Allocation-Retention-Priority AVP over the Gx interface for media bearers. The PCRF also generates the QCI per service data flow based on the Media Type AVP. Multiple Service Data Flows (SDFs) may map to one QCI [TS 29.212]. The ARP is then forwarded to the PDN-GW using the Diameter RAR message over the Gx interface. The ARP will be used in the admission control of the dedicated bearer to be established for the media and the QCI will be used for packet forwarding treatment over the air. The ARP and QCI may be used to map the bearer to the appropriate DSCP in the E-UTRAN over the S1 and X2 Interfaces to control the per hop behavior.

6.3.1.9 Mobile Termination

Section 6.1.2 describes the NGN GETS call/session termination procedure, which is also applicable for E-UTRAN with minor differences relating to IP-CAN session establishment/modification. This section discusses the access network-specific details. For general call/session termination aspects, refer to Section 6.1.2.

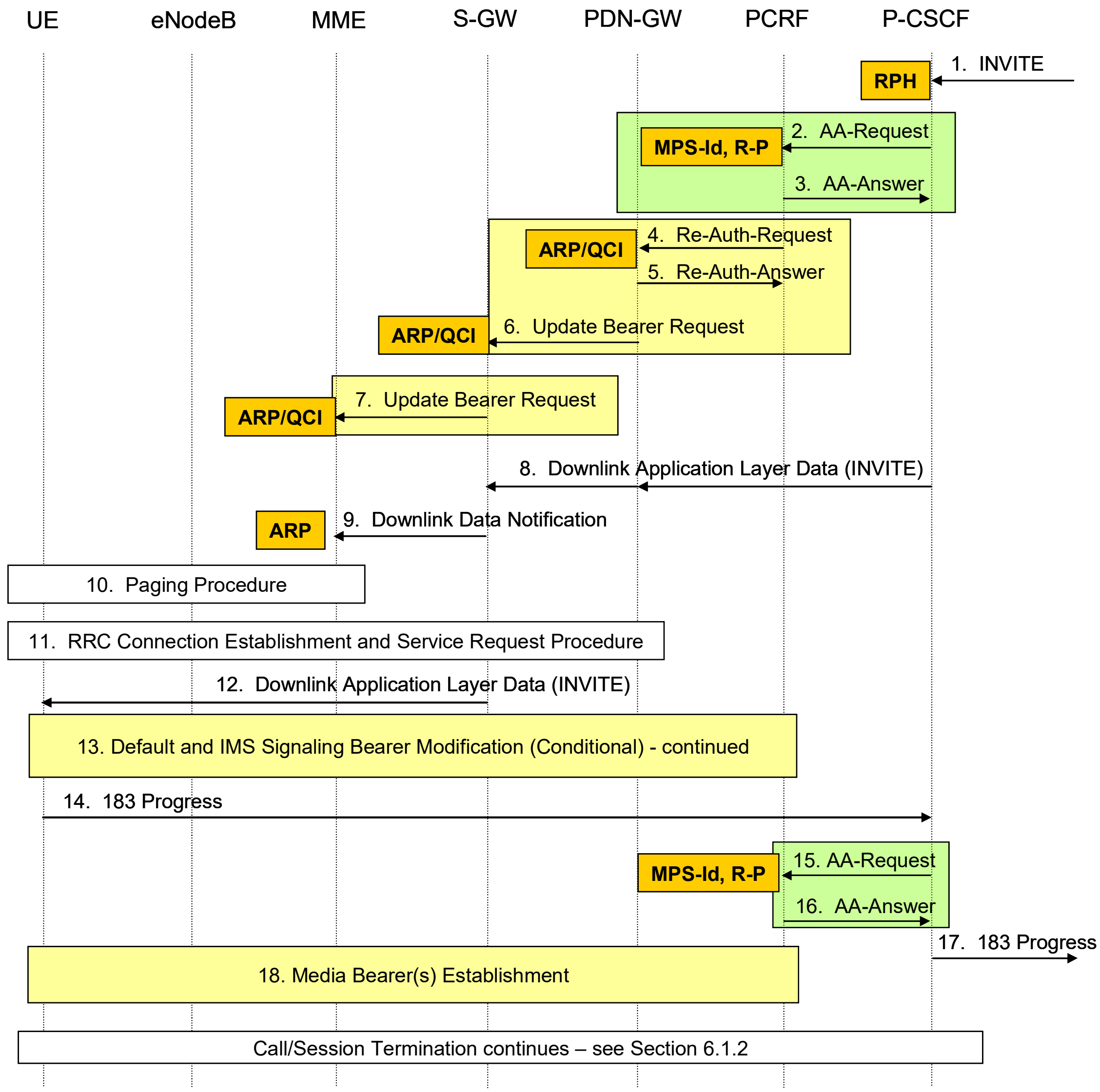

Figure 6-37 – Mobile Terminated SIP Call / Session

4. Re-Auth-Request: If the PCRF receives the Diameter AAR message from the P-CSCF that includes the MPS-Identifier AVP and Reservation-Priority AVP indicating that the call/session is from a Service User, the PCRF checks if the terminating UE already has appropriate settings of ARP for Default Bearer and ARP and QCI for IMS Signalling Bearer for NGN GETS. If the UE already has appropriate settings for NGN GETS, steps 4-6, 7 and 13 are not required. Otherwise, the PCRF recognizes the need to modify the ARP of the Default Bearer and the ARP and QCI of the IMS Signalling Bearer and sends a Diameter RAR message to the PDN-GW. The message includes QCI = 5 for the IMS Signalling Bearer and a modified ARP to indicate that this is an NGN GETS call/session. Since the Diameter AAR message includes the Service-Info-Status AVP set to the "PRELIMINARY SERVICE INFORMATION" value, the PCRF does not initiate establishing dedicated bearer for the media at this time.
5. The PDN-GW installs the identified PCC rules and sends a Diameter RAA message to the PCRF to acknowledge the Diameter RAR message.
6. Update Bearer Request: The PDN-GW sends an Update Bearer Request message to the S-GW to modify the ARP of the existing Default Bearer and the ARP/QCI of the existing IMS Signalling Bearer. The ARP received in this message is derived by the PCRF based on the Reservation-Priority AVP that reflects the Service User Priority Level of the originating NGN GETS user.
7. Update Bearer Request: The S-GW sends an Update Bearer Request message to the MME to modify the ARP of the Default Bearer and the ARP/QCI of the existing IMS Signalling Bearer. The ARP in the message

reflects an NGN GETS priority call/session. The MME updates the context based on the ARP included in the message. Steps 8 and 9 may happen in parallel with Steps 2-7 and 10.

8. Downlink Application Layer Data: The P-CSCF sends the SIP INVITE request as Downlink Application Layer Data to the PDN-GW. The PDN-GW forwards it to the S-GW. The S-GW queues the Downlink Application Layer Data until the Service Request procedure is completed.
9. Downlink Data Notification: The S-GW sends a Downlink Data Notification message to the MME to inform that Application Layer Data is queued in its buffer for delivery. The Downlink Data Notification message includes the ARP of the bearer over which the packet arrived.

When the UE is in EMM-CONNECTED state, steps 10 and 11 are skipped.

10. Paging procedure: If the ARP in the Update Bearer Request or Downlink Data Notification belongs to the set allocated for NGN GETS use, the MME initiates paging to all eNodeBs in the tracking area where the UE resides including a Priority Paging Indicator appropriate to indicate that it is an NGN GETS call / session.
11. RRC Connection Establishment and Service Request: The UE responds to the page with a Service Request procedure.
12. Downlink Application Layer Data: Once the UE has moved to EMM-CONNECTED state, it has a secure connection to the network for transporting NAS signalling including page response and a Default Bearer for signalling in the upstream and downstream directions. The S-GW forwards the SIP INVITE request to the UE as Downlink Application Layer Data.
13. Default and IMS Signalling Bearer Modification: Steps 4- 6 and step 11 comprise part of the Bearer Modification procedure for modifying the Default and IMS Signalling Bearer for terminating UE that does not have appropriate settings of ARP and QCI for NGN GETS use. The remaining steps of Bearer Modification procedure described in Section 6.3.1.7 are completed. Based on operator policy, the remaining steps of default and IMS signalling bearer modification may be combined with step 18 (media bearer establishment).
18. Media Bearer(s) Establishment: The PCRF initiates establishing media bearer(s) for the session. This is done by Media Bearer Establishment procedure.
19. The rest of the call/session termination procedure is as described in Section 6.1.2.

6.3.1.9.1 Relevant NGN GETS Aspects

When the PCRF receives a policy control message from the P-CSCF, it checks the MPS-Identifier AVP and Reservation-Priority AVP to verify if it requires priority treatment. If the call/session requires priority treatment, the PCRF checks if the terminating UE has appropriate settings of ARP for Default Bearer and ARP and QCI for the IMS Signalling Bearer. If the settings are not appropriate for NGN GETS usage, the PCRF sends a Diameter RAR message to modify the ARP of the Default Bearer and ARP/QCI of the IMS Signalling Bearer consistent with the priority level of the originating NGN GETS Subscriber. The PCRF will not initiate setting up media bearer(s) as the service negotiation is not completed. Update Bearer Request message or the Downlink Data Notification message from the S-GW to the MME will include an ARP value appropriate for NGN GETS. The MME will initiate Paging including a Paging Priority Indicator to indicate that it is an NGN GETS call/session.

6.3.2 UTRAN

6.3.2.1 Originating

This section is informative and describes various call / session flows intended to illustrate how an NGN GETS call / session could be processed in UTRAN. This material is meant to provide a high-level informative description and is not intended to be normative. If inconsistencies exist between this section and 3GPP specifications, the 3GPP specifications take precedence. Alternative call / session flows are possible.

Figure 6-38 provides an overview of the relationship among call / session flows for a UTRAN mobile originated NGN GETS call / session. These call / session flows may occur in various other sequences depending on radio and network conditions and on the service invoked.

Section 6.3.2.1.1 through Section 6.3.2.1.7 provide the flows associated with priority radio access bearer establishment and modification for signalling and media bearers for an NGN GETS call/session.

PCC interactions with the IMS Core Network using Diameter messages are as described in Figure 6-11.

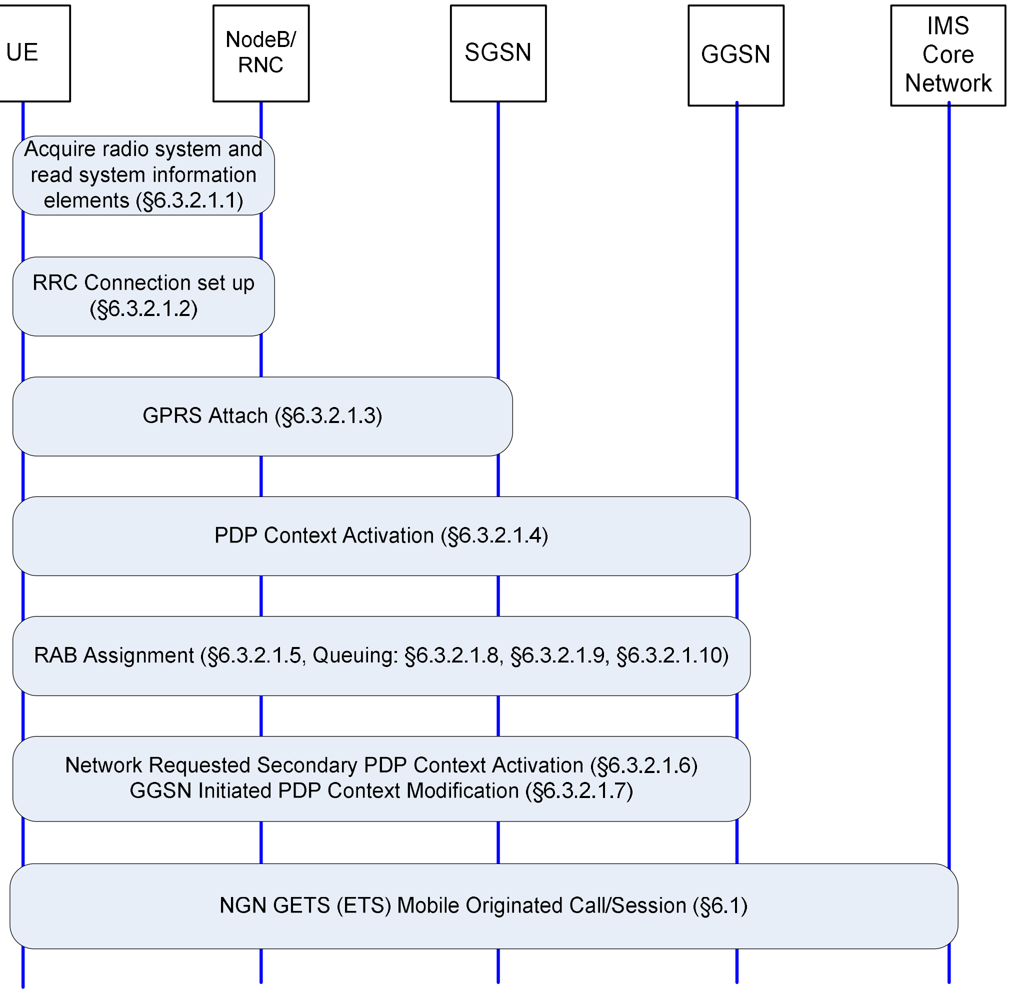

Figure 6-38 – Relationship among Call / Session Flows

6.3.2.1.1 System Information Broadcast

Figure 6-39 illustrates the flow associated with broadcast of System Information. This processing is described further in clause 8.1.1 of [TS 25.331].

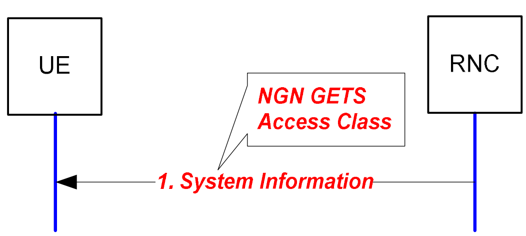

Figure 6-39 – System Information Broadcast

This flow is used to broadcast system information from a Node B to UEs in a cell.

1. The RNC periodically broadcasts system information in System Information Blocks transmitted in a *System Information* message. System Information Block type 3 contains Domain Specific Access Class Barring information used for NGN GETS. The Domain Specific Access Class Barring mechanism is used to limit access from UEs that are not configured / provisioned with an NGN GETS Access Class, while offering preferential access to the UTRAN for a UE with an NGN GETS Access Class. Clause 8.1.1.6.3 of [TS 25.331] specifies the UE procedures for processing Access Class Barring information in System Information Block type 3. Domain Specific Access Class Barring addresses both the PS Domain and CS Domain. System Information Block type 5 contains the mapping of Access Class to Access Service Class. A UE with an NGN GETS Access Class has an Access Service Class used for preferential RRC Connection Establishment. Clause 11.2.1 of [TS 25.321] specifies the procedures for Access Service Class selection. Clause 8.5.12 of [TS 25.331] specifies the procedures for establishment of Access Service Classes. Clause 8.5.13 of [TS 25.331] specifies the mapping of Access Classes to Access Service Classes.

6.3.2.1.1.1 Relevant NGN GETS Aspects

Access Class Barring allows the UTRAN to reduce the volume of contention based random access requests for signaling or uplink data transfer. The Domain Specific Access Class Barring mechanism is used to limit access from UEs that are not configured / provisioned with an NGN GETS Access Class, while offering preferential access to the UTRAN for a UE with an NGN GETS Access Class.

6.3.2.1.2 Radio Resource Control (RRC) Connection Establishment

Figure 6-40 illustrates the flow associated with RRC connection establishment. This processing is described further in clause 8.1.3 of [TS 25.331] and in [TS 25.426] and [TS 25.433].

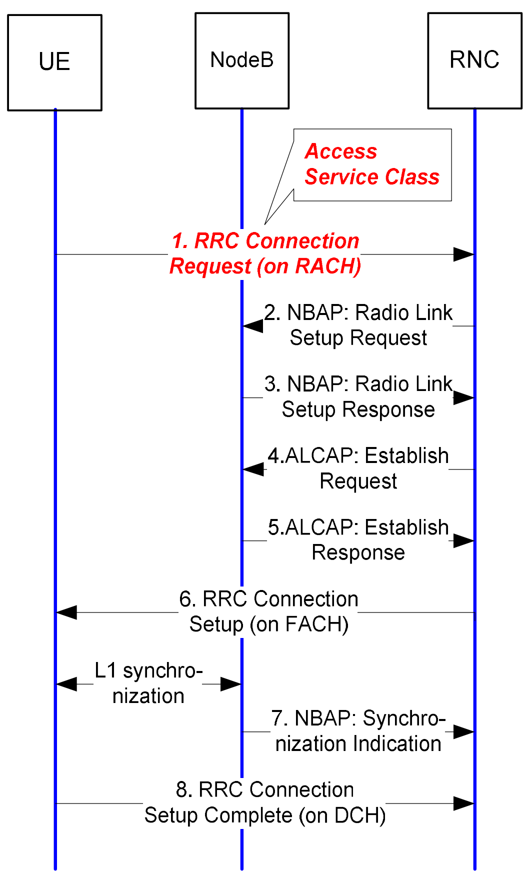

Figure 6-40 – RRC Connection Establishment

This flow is used to establish an RRC connection between a UE and an RNC.

1. The UE sends an *RRC Connection Request* message to the RNC on the Random Access Channel (RACH) to request a signaling connection. The UE performs a mapping of the Access Class to an Access Service Class as specified in clause 8.5.13 of [TS 25.331] and applies the given Access Service Class when accessing the RACH. Service Users are assigned specific NGN GETS Access Classes in the USIM for NGN GETS, which provides UE preferential access to the RACH through the Access Service Class mapping. NGN GETS Access Class information provides over-the-air preferential treatment for a Service User UE access regardless of the service invoked (i.e., NGN GETS or another service).
2. The RNC sends a Node B Application Part (NBAP) *Radio Link Setup Request* message to the serving Node B to establish the necessary air interface resources for a Dedicated Channel (DCH).
3. The Node B sends a NBAP *Radio Link Setup Response* message to the RNC.
4. The RNC sends an Access Link Control Application Part (ALCAP) *Establish Request* message to the serving Node B.
5. The Node B sends an ALCAP *Establish Response* message to the RNC.
6. The RNC sends an *RRC Connection Setup* message to the UE on the Forward Access Channel (FACH) to indicate setup of a signaling connection.
7. The Node B sends a NBAP *Synchronization Indication* message to the RNC.
8. The UE sends an *RRC Connection Setup Complete* message to the RNC on the DCH to establish a signaling connection.

During RRC Connection Establishment, it is not envisioned to have any congestion for the steps shown in this flow since UEs that do not have an NGN GETS Access Class are barred from initiating an RRC Connection Request through Domain Specific Access Class Barring. Hence, no other priority mechanisms for NGN GETS are indicated.

6.3.2.1.2.1 Relevant NGN GETS Aspects

Service Users are assigned a specific NGN GETS Access Class in the USIM for NGN GETS, which provides UE preferential access to the RACH through the Access Service Class mapping. NGN GETS Access Class information provides over-the-air preferential treatment for a Service User UE access regardless of the service invoked (i.e., NGN GETS or another service).

6.3.2.1.3 GPRS Attach

Figure 6-41 illustrates the flow associated with a combined GPRS / International Mobile Subscriber Identity (IMSI) Attach. The GPRS Attach procedure allows a UE to request an SGSN for access to GPRS services. This processing is described further in clause 6.5 of [TS 23.060].

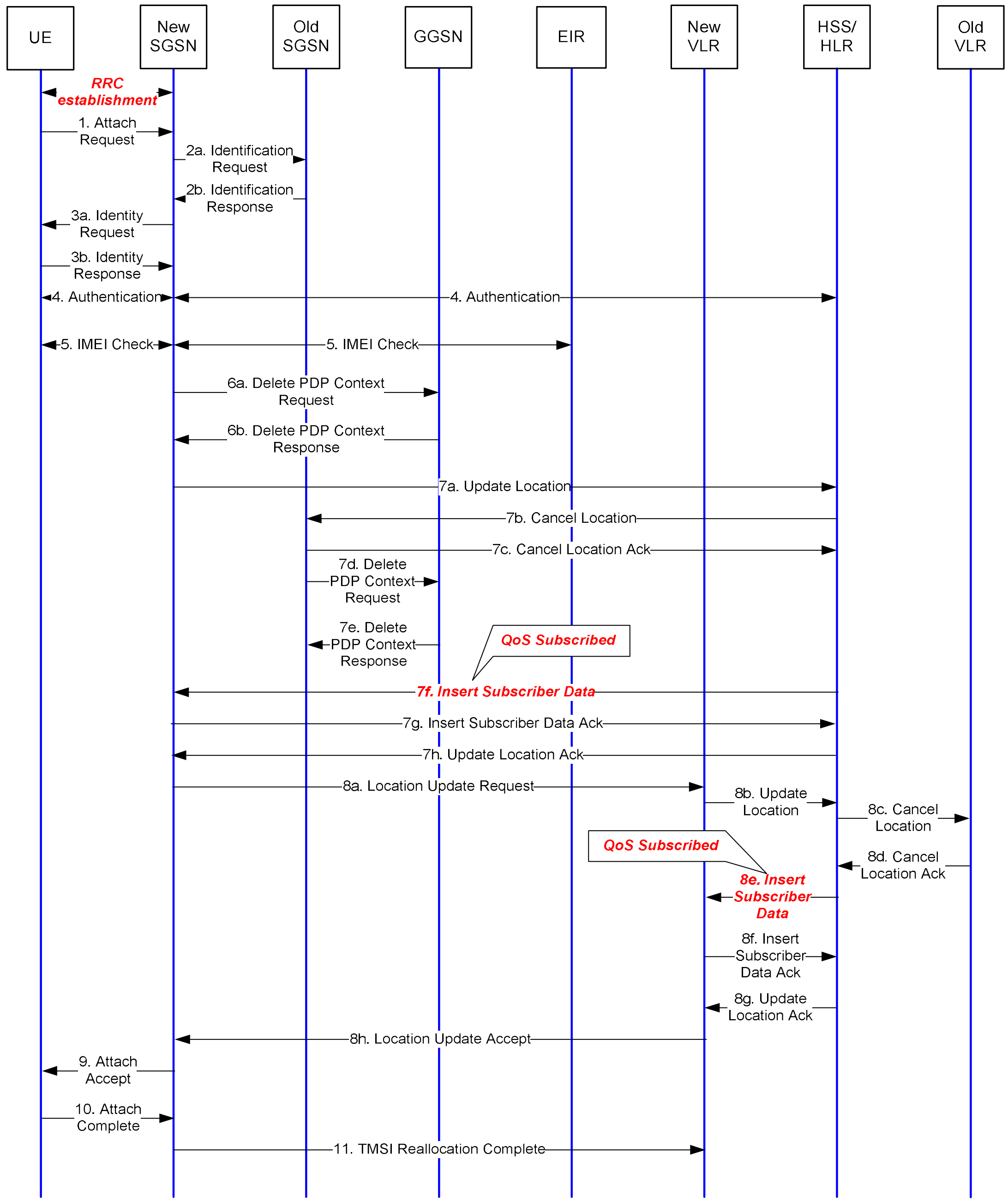

Figure 6-41 – Combined GRPS / IMSI Attach

This flow is used to perform a combined GPRS / IMSI Attach to the SGSN for a UE to obtain access to GPRS services. An RRC Connection is established before this procedure is performed.

1. A UE initiates the attach procedure by the transmission of an *Attach Request* message to the SGSN. The Attach Type indicates which type of attach is to be performed, i.e., GPRS attach only, GPRS Attach while already IMSI attached, or combined GPRS / IMSI attach.
2. If the UE identifies itself with Packet Temporary Mobile Subscriber Identity (P-TMSI) and the SGSN has changed since detach, the new SGSN sends an *Identification Request* message to the old SGSN to request the IMSI. The old SGSN responds with *Identification Response* message (IMSI, Authentication Triplets or Authentication Quintets). If the UE is not known in the old SGSN, the old SGSN responds with an appropriate error cause. The old SGSN also validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old SGSN.

3. If the UE is unknown in both the old and new SGSN, the new SGSN sends an *Identity Request* message (Identity Type = IMSI) to the UE. The UE responds with an *Identity Response* message (IMSI).
4. The new SGSN authenticates the UE.
5. Optionally, the new SGSN performs equipment checking.
6. If there are active PDP contexts in the new SGSN for this particular UE (i.e., the UE re-attaches to the same SGSN without having properly detached before), the new SGSN deletes these PDP contexts by sending *Delete PDP Context Request* messages to the GGSNs involved. The GGSNs acknowledge with *Delete PDP Context Response* messages.
7. If the SGSN number has changed since the GPRS detach, or if it is the very first attach, or if the Automatic Device Detection (ADD) function is supported and the International Mobile Equipment Identity Software Version (IMEISV) has changed, or if the UE provides an IMSI or the UE provides an old P-TMSI/ Routing Area Identity (RAI) which does not point to a valid context in the SGSN, then the new SGSN informs the HSS/HLR:
    a. The new SGSN sends an *Update Location* message to the HSS/HLR.
    b. The HSS/HLR sends *Cancel Location* message to the old SGSN with Cancellation Type set to Update Procedure.
    c. The old SGSN acknowledges with a *Cancel Location Ack* message.
    d. If there are active PDP contexts in the old SGSN for this particular UE, the old SGSN deletes these PDP contexts by sending *Delete PDP Context Request* messages to the GGSNs involved.
    e. The GGSNs acknowledge with *Delete PDP Context Response* messages.
    f. The HSS/HLR sends an *Insert Subscriber Data* message to the new SGSN providing the GPRS profile, which includes the priority level of the NGN GETS call / session represented by the priority level of the Allocation/Retention Priority in the Ext4-QoS-Subscribed field. This priority level maps to the Allocation/Retention Priority to provide subsequent priority treatment for RAB assignment.
    g. The new SGSN validates the UE presence in the (new) Routing Area (RA). If due to regional subscription restrictions or access restrictions the UE is not allowed to attach in the RA, the new SGSN rejects the Attach Request with an appropriate cause, and may return an *Insert Subscriber Data Ack* message to the HSS/HLR. If subscription checking fails for other reasons, the SGSN rejects the Attach Request with an appropriate cause and returns an *Insert Subscriber Data Ack* message to the HSS/HLR. If all checks are successful, then the new SGSN constructs a Mobility Management (MM) context for the UE and returns an *Insert Subscriber Data Ack* message to the HSS/HLR.
    h. The HSS/HLR acknowledges the *Update Location* message by sending an *Update Location Ack* message to the new SGSN after the cancelling of old MM context and insertion of new MM context are finished. If the Update Location is rejected by the HSS/HLR, the new SGSN rejects the Attach Request from the UE with an appropriate cause.
8. If Attach Type in step 1 indicated GPRS Attach while already IMSI attached, or combined GPRS / IMSI attached, then the Visitor Location Register (VLR) is updated if the Gs interface is deployed. The new SGSN starts the location update procedure towards the new VLR upon receipt of the first *Insert Subscriber Data* message from the HSS/HLR in step 7f. This operation marks the UE as GPRS-attached in the VLR.
    a. The new SGSN sends a *Location Update Request* message to the VLR. Location Update Type indicates IMSI attach if Attach Type indicated combined GPRS / IMSI attach. Otherwise, Location Update Type indicates normal location update. The VLR creates an association with the new SGSN by storing SGSN Number.
    b. If the Location Area update is inter-Mobile Switching Center (MSC), the new VLR sends an *Update Location* message to the HSS/HLR.
    c. If the Location Area update is inter-MSC, the HSS/HLR sends a *Cancel Location* message to the old VLR.
    d. The old VLR acknowledges with a *Cancel Location Ack* message.
    e. If the Location Area update is inter-MSC, the HSS/HLR sends an *Insert Subscriber Data* message to the new VLR providing the GPRS profile, which includes the priority level of the NGN GETS call / session within the existing subscriber data fields.
    f. The VLR acknowledges with an *Insert Subscriber Data Ack* message.

g. After finishing the inter-MSC location update procedures, the HSS/HLR responds with an *Update Location Ack* message to the new VLR.

h. The VLR responds with a *Location Update Accept* message to the new SGSN.

9. The new SGSN sends an *Attach Accept* message to the UE. P-TMSI is included if the SGSN allocates a new P-TMSI.
10. If P-TMSI or VLR Temporary Mobile Subscriber Identity (TMSI) was changed, the UE acknowledges the received TMSI(s) by returning an *Attach Complete* message to the new SGSN.
11. If VLR TMSI was changed, the new SGSN confirms the VLR TMSI re-allocation by sending a *TMSI Reallocation Complete* message to the VLR.

6.3.2.1.3.1 Relevant NGN GETS Aspects

The *Insert Subscriber Data* message to the new SGSN providing the GPRS profile includes the priority level of the NGN GETS call / session represented by the priority level of the Allocation/Retention Priority in the Ext4-QoS-Subscribed field. This priority level maps to the Allocation/Retention Priority to provide subsequent priority treatment for RAB assignment.

6.3.2.1.4 PDP Context Activation

Figure 6-42 illustrates the flow associated with PDP Context Activation. This processing is described further in clause 9.2.2.1 of [TS 23.060].

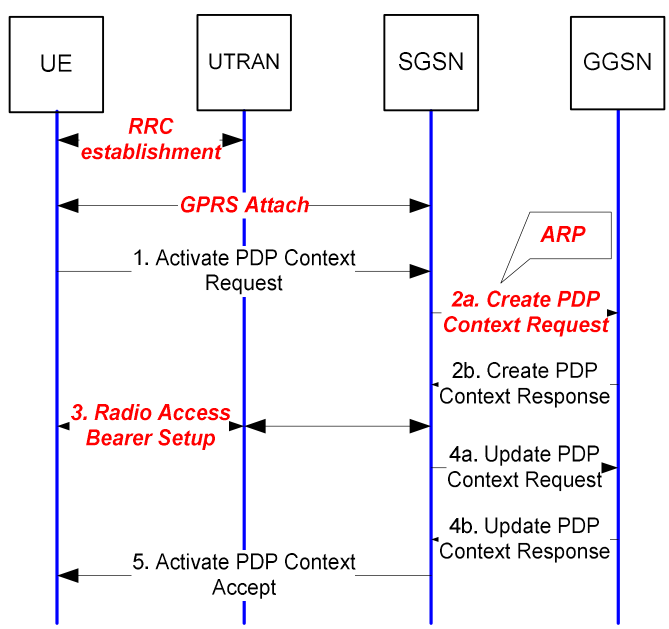

Figure 6-42 – PDP Context Activation

This flow is used to establish a PDP Context from a UE to a GGSN. An RRC Connection is established and GPRS Attachment occurs before this procedure is performed. Radio Access Bearer (RAB) Assignment occurs during this procedure.

1. A UE sends an *Activate PDP Context Request* (Network Service Access Point Identifier (NSAPI), Transaction Identifier (TI), PDP Type, PDP Address, Access Point Name, QoS Requested, Protocol Configuration Options) message to the SGSN.
2. The SGSN validates the *Activate PDP Context Request* message using PDP Type (optional), PDP Address (optional), and Access Point Name (APN) (optional) provided by the UE and the PDP context subscription

records. The validation criteria, the APN selection criteria, and the mapping from APN to a GGSN are described in Annex A of [TS 23.060].

   a. The SGSN sends a *Create PDP Context Request* message to the affected GGSN. The GGSN may use Access Point Name to find a packet data network and optionally to activate a service for this APN. The *Create PDP Context Request* message contains Quality of Service (QoS) Profile Information Element (IE), which contains the Allocation/Retention Priority IE indicating the priority level of the NGN GETS call / session, as received from the HSS/HLR during GPRS Attach. The Allocation/Retention Priority IE is used to indicate preferential treatment for RAB assignment (step 3). The GGSN/PCEF may apply PCC procedures if the Advance Priority capability applies.
   b. The GGSN creates a new entry in its PDP context table and sends a *Create PDP Context Response* message.
3. Radio Access Bearer (RAB) setup is done by the RAB Assignment procedure.
4. The SGSN determines whether the QoS attributes have been downgraded.
   a. If the QoS attributes have been downgraded during step 3, the SGSN may inform the GGSN about the downgraded QoS attributes by sending an *Update PDP Context Request* message to the affected GGSN. The GGSN/PCEF may apply PCC procedures. Any PCC procedures which may be applied by GGSN/PCEF must not trigger any QoS renegotiation.
   b. The GGSN confirms the new QoS attributes by sending an *Update PDP Context Response* message to the SGSN.
5. The SGSN returns an *Activate PDP Context Accept* message to the UE. The SGSN is now able to route PDP Protocol Data Units (PDUs) between the GGSN and the UE, and start charging.

6.3.2.1.4.1 Relevant NGN GETS Aspects

As part of the Activate PDP Context procedure, the SGSN forwards the priority level of the NGN GETS call / session reflected in the Allocation/Retention Priority IE under QoS Profile IE in the *Create PDP Context Request* message to the GGSN.

6.3.2.1.5 Paging for Session Establishment

Figure 6-43 illustrates the flow associated with paging to establish a session. This processing is described further in clause 6.12.2 of [TS 23.060].

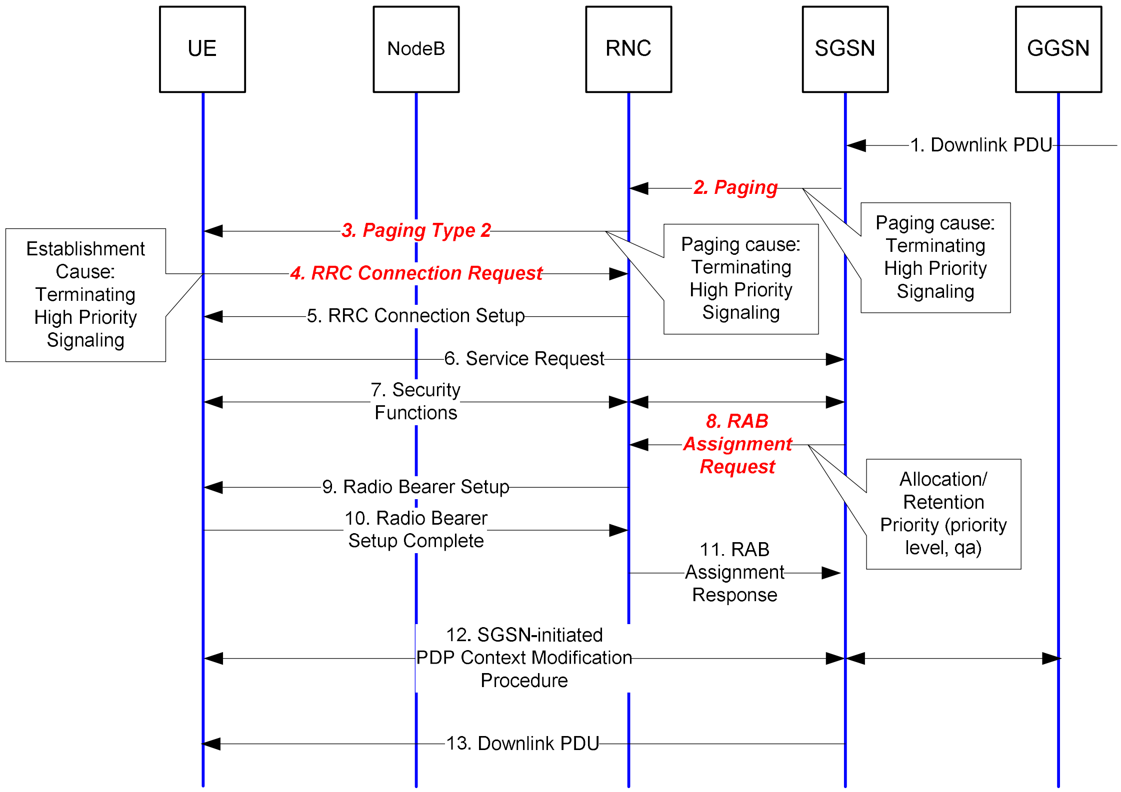

Figure 6-43 – Paging for Session Establishment

This flow is used to establish a radio resource connection between a UE and an RNC.

1. The SGSN receives a downlink PDU for a UE in PMM-IDLE state.
2. The SGSN sends a *Paging* message to the RNC. For a PDU associated with an NGN GETS call / session, as indicated by reception of an *Update PDP Context Request* message with an ARP value within the range configured for NGN GETS, the SGSN sets the Paging Cause to “Terminating High Priority Signaling”.
3. The RNC pages the UE by sending a *Paging* message, with the Paging Cause set to “Terminating High Priority Signaling”.
4. The UE establishes an RRC connection if none exists, with the Establishment Cause set to “Terminating High Priority Signaling”. Priority treatment based on an Establishment Cause “Terminating High Priority Signaling” is implementation specific.
5. The RNC acknowledges the RRC connection setup.
6. The UE sends a *Service Request* message to the SGSN.
7. The SGSN performs security procedures.
8. If resources for the PDP contexts are re-established, the SGSN sends a *Radio Access Bearer Assignment Request* message to the RNC.
9. The RNC sends a *Radio Bearer Setup* message to the UE.
10. The UE responds with a *Radio Bearer Setup Complete* message to the RNC.
11. The RNC sends a *Radio Access Bearer Assignment Response* message to the SGSN.
12. For each RAB re-established with a modified QoS profile, the SGSN initiates a PDP Context Modification procedure to inform the UE and the GGSN of the new negotiated QoS profile for the corresponding PDP context.
13. The SGSN sends the downlink PDU to the UE.

6.3.2.1.5.1 Relevant NGN GETS Aspects

The SGSN sets the Paging Cause to "Terminating High Priority Signaling" in the *Paging* message to the RNC when the ARP value within the range configured for NGN GETS in the *Update PDP Context Request* message.

The RNC sets the Paging Cause set to "Terminating High Priority Signaling" in the *Paging* message sent to the UE.

The UE sets the Establishment Cause set to "Terminating High Priority Signaling" to establish a new RRC connection.

The SGSN forwards the priority level of the NGN GETS call / session reflected in the ARP IE in the *RAB Assignment Request* message to the RNC to establish, modify, or release one or several RABs. For each requested RAB to be established or modified, if the ARP IE in the *RAB Assignment Request* indicates "queuing allowed" and the resource situation requires it, then the RNC places the *RAB Assignment Request* in the establishment queue.

6.3.2.1.6 Network Requested Secondary PDP Context Activation

Figure 6-44 illustrates the flow associated with a network requested establishment of a Secondary PDP Context. This processing is described further in clause 9.2.2.3 of [TS 23.060].

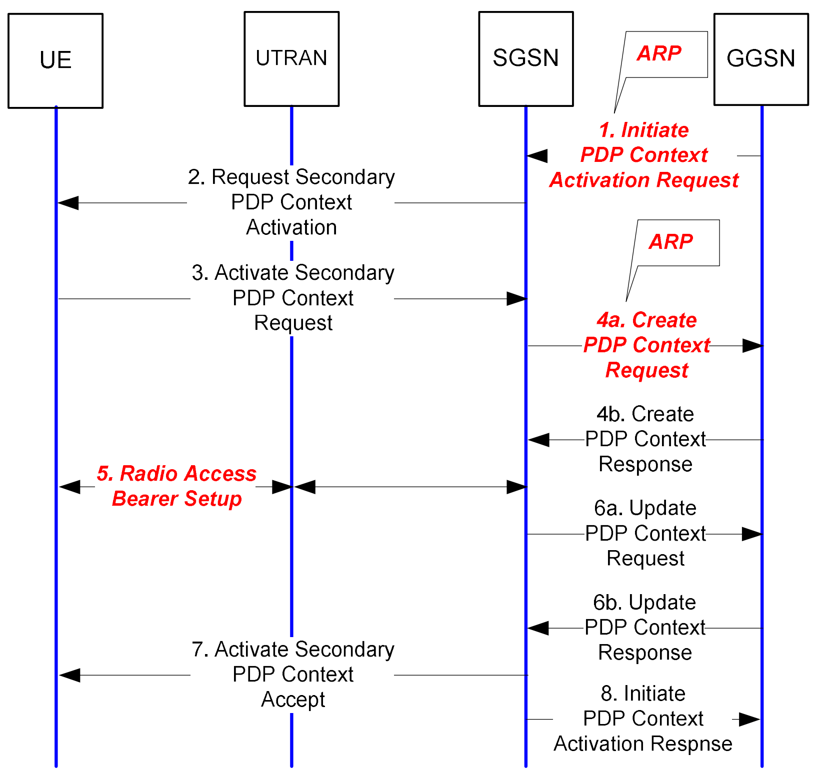

Figure 6-44 – Network Requested Secondary PDP Context Activation

This flow is used to establish a network initiated secondary PDP Context between a GGSN and a UE. RAB Assignment occurs during this procedure (step 5) with preferential treatment for NGN GETS.

1. The GGSN sends an *Initiate PDP Context Activation Request* (Linked NSAPI, QoS Requested, Traffic Flow Template (TFT), Protocol Configuration Options, Correlation-ID) message to the SGSN. The QoS Requested, TFT, and Protocol Configuration Options are sent transparently through the SGSN to the UE. The QoS Requested (Quality of Service Profile IE) contains the Allocation/Retention Priority IE indicating the NGN GETS call / session priority level as received from the PCRF. The Allocation/Retention Priority IE is used to indicate preferential treatment for RAB assignment (step 5).

2. The SGSN sends a *Request Secondary PDP Context Activation* (Linked TI, TI, QoS Requested, TFT, Protocol Configuration Options) message to the UE.
3. The UE sends an *Activate Secondary PDP Context Request* message to the SGSN that initiates the Secondary PDP Context activation procedure. The QoS Requested, sent in the *Activate Secondary PDP Context Request* message contains the same information as previously received in step 2.
4. The SGSN validates the *Activate Secondary PDP Context Request* message using the TI indicated by Linked TI.
    a. The SGSN sends a *Create PDP Context Request* message to the affected GGSN. The *Create PDP Context Request* message contains the Quality of Service (QoS) Profile IE, which contains the Allocation/Retention Priority IE indicating the NGN GETS call / session priority level. The GGSN/PCEF applies PCC procedures.
    b. The GGSN creates a new entry in its PDP context table and sends a *Create PDP Context Response* message.
5. RAB setup is done by the RAB Assignment procedure.
6. The SGSN determines whether the QoS attribute have been downgraded.
    a. If the QoS attributes have been downgraded, the SGSN may inform the GGSN about the downgraded QoS attributes by sending an *Update PDP Context Request* message to the affected GGSN. The GGSN/PCEF applies PCC procedures. Any PCC procedures which may be applied by GGSN/PCEF must not trigger any QoS renegotiation.
    b. The GGSN confirms the new QoS attributes by sending an *Update PDP Context Response* message to the SGSN.
7. The SGSN returns an *Activate Secondary PDP Context Accept* message to the UE. The SGSN is now able to route PDUs between the GGSN and the UE using the secondary PDP context.
8. The SGSN returns an *Initiate PDP Activation Response* message to the GGSN. This acknowledges the PDP context activation request to the GGSN.

6.3.2.1.6.1 Relevant NGN GETS Aspects

The GGSN forwards the priority level of the NGN GETS call / session reflected in the ARP IE contained in the QoS Profile IE in the *Initiate PDP Context Activation Request* message to the SGSN.

As part of the Activate PDP Context procedure, the SGSN forwards the priority level of the NGN GETS call / session reflected in the ARP IE under QOS Profile IE in the *Create PDP Context Request* message to the GGSN.

The SGSN forwards the priority level of the NGN GETS call / session reflected in the ARP IE in the *RAB Assignment Request* message to the RNC to establish, modify, or release one or several RABs. For each requested RAB to be established or modified, if the ARP IE in the *RAB Assignment Request* indicates “queuing allowed” and the resource situation requires it, then the RNC places the *RAB Assignment Request* in the establishment queue.

6.3.2.1.7 GGSN Initiated PDP Context Modification

Figure 6-45 illustrates the flow associated with a network initiated modification of a PDP Context. This processing is described further in clause 9.2.3.2 of [TS 23.060].

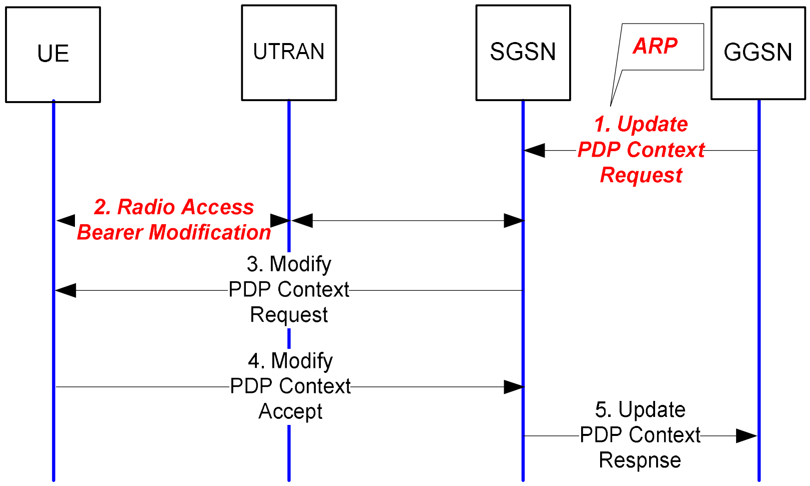

Figure 6-45 – GGSN Initiated PDP Context Modification

This flow is used by the network to modify a PDP Context between a GGSN and a UE.

1. The GGSN sends an *Update PDP Context Request* (Tunnel Endpoint IDentifier (TEID), NSAPI, PDP Address, QoS Requested, Prohibit Payload Compression, APN Restriction, CGI/SAI/RAI change report required, TFT, Protocol Configuration Options, Bearer Control Mode (BCM)) message to the SGSN. QoS Requested indicates the desired QoS profile. The QoS Requested may be equal to, an upgrade or a downgrade compared to the current QoS of the PDP context. The QoS Requested (Quality of Service Profile IE) contains the Allocation/Retention Priority IE indicating the NGN GETS call / session priority level. The Allocation/Retention Priority IE is used to indicate preferential treatment for RAB assignment (step 2).
2. RAB modification may be performed by the RAB Assignment procedure.
3. The SGSN sends a *Modify PDP Context Request* (TI, PDP Address, QoS Negotiated, Radio Priority, Packet Flow Id, TFT, Protocol Configuration Options (PCO)) message to the UE.
4. For a successful modification, the UE acknowledges by returning a *Modify PDP Context Accept* message.
5. Upon receipt of the *Modify PDP Context Accept* message, or upon completion of the RAB modification procedure, the SGSN returns an *Update PDP Context Response* (TEID, QoS Negotiated) message to the GGSN.

6.3.2.1.7.1 Relevant NGN GETS Aspects

The GGSN forwards the priority level of the NGN GETS call / session reflected in the ARP IE contained in the QoS Profile IE in the *Update PDP Context Request* message to the SGSN.

The SGSN forwards the priority level of the NGN GETS call / session reflected in the ARP IE in the *RAB Modification Request* message to the RNC to modify one or several RABs. For each requested RAB to be modified, if the ARP IE in the *RAB Assignment Request* indicates "queuing allowed" and the resource situation requires it, then the RNC places the *RAB Assignment Request* in the establishment queue.

6.3.2.1.8 RAB Assignment – Queued, Success

Figure 6-46 illustrates the flow associated with RAB assignment that is queued and subsequent RAB successful assignment. This processing is described further in clause 8.2 of [TS 25.413] and clause 12.7.4 of [TS 23.060]. For an NGN non-GETS call / session, this procedure typically does not apply.

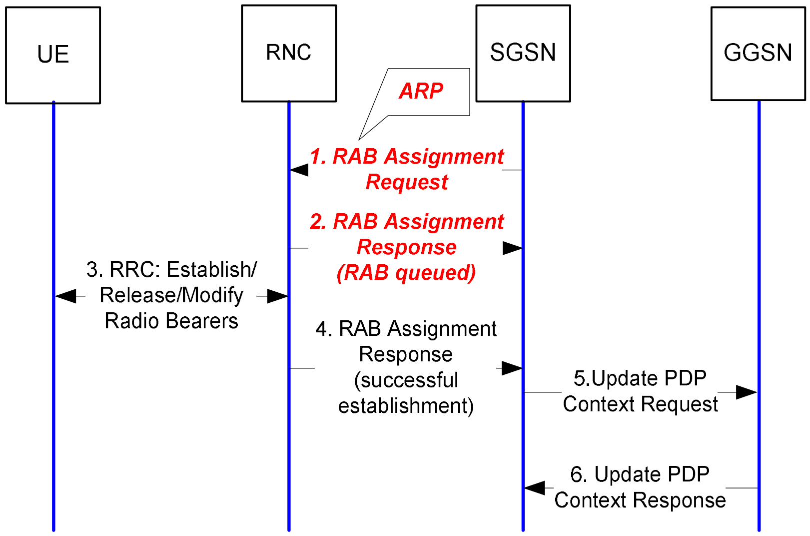

Figure 6-46 – RAB Assignment – Queued, Success

This flow is used to establish a radio access bearer for a UE.

1. The SGSN sends a *RAB Assignment Request* message to the RNC to establish, modify, or release one or several RABs. The *RAB Assignment Request* message contains the Allocation/Retention Priority IE, which indicates the NGN GETS call / session priority level, pre-emption indicators, and queuing indicator. For each requested RAB to be established or modified, when the Allocation/Retention Priority IE in the *RAB Assignment Request* indicates "queuing allowed" and the resource situation requires it, then the RNC places the *RAB Assignment Request* in the establishment queue.
2. The RNC determines that the needed resources are not available, queues the *RAB Assignment Request* message, sets the $T_{queuing}$ timer for all requested RABs, and sends a *RAB Assignment Response* message to the SGSN indicating the RAB(s) queued.
3. After resources are available, the RNC and UE establish the appropriate radio bearers.
4. The RNC stops the $T_{queuing}$ timer and sends a *RAB Assignment Response* message to the SGSN indicating successful RAB establishment. The $T_{RABAssgt}$ timer in the SGSN is stopped.
5. If the SGSN established a Direct Tunnel, then the SGSN sends an *Update PDP Context Request* message to the GGSN(s) concerned.
6. The GGSN(s) return(s) an *Update PDP Context Response* message.

6.3.2.1.8.1 Relevant NGN GETS Aspects

The SGSN forwards the priority level of the NGN GETS call / session reflected in the ARP IE in the *RAB Assignment Request* message to the RNC to establish, modify, or release one or several RABs. For each requested RAB to be established or modified, if the ARP IE in the *RAB Assignment Request* indicates "queuing allowed" and the resource situation requires it, then the RNC places the *RAB Assignment Request* in the establishment queue.

6.3.2.1.9 RAB Assignment – Queue Full

Figure 6-47 illustrates the flow associated with RAB assignment when the queue is full. This processing is described further in clause 8.2 of [TS 25.413] and clause 12.7.4 of [TS 23.060]. For an NGN non-GETS call / session, this procedure typically does not apply.

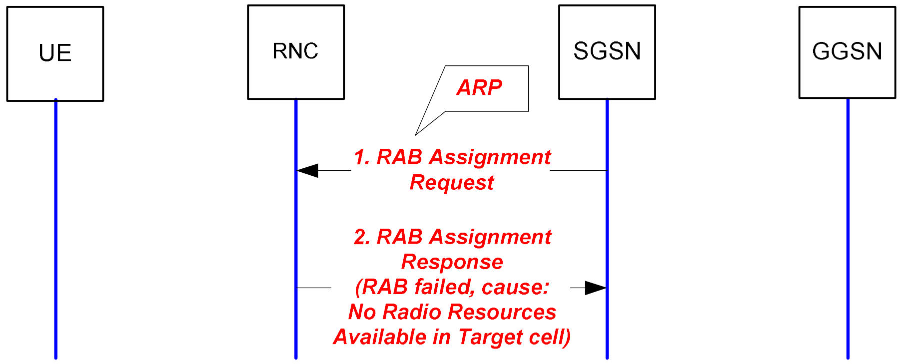

Figure 6-47 – RAB Assignment – Queue Full

This flow is used to attempt to establish a radio access bearer for a UE.

1. The SGSN sends a *RAB Assignment Request* message to the RNC to establish, modify, or release one or several RABs. The *RAB Assignment Request* message contains the Allocation/Retention Priority IE, which indicates the NGN GETS call / session priority level, pre-emption indicators, and queuing indicator. For each requested RAB to be established or modified, when the Allocation/Retention Priority IE in the *RAB Assignment Request* indicates "queuing allowed" and the resource situation requires it, then the RNC attempts to place the *RAB Assignment Request* in the establishment queue.
2. The RNC determines that the needed resources are not available and the establishment queue is full (i.e., no lower priority request in queue). The RNC sends a *RAB Assignment Response* message to the SGSN indicating the RAB assignment failed because no radio resources were available in the target cell. For NGN GETS, no additional preferential treatment applies for this procedure.

6.3.2.1.9.1 Relevant NGN GETS Aspects

The SGSN forwards the priority level of the NGN GETS call / session reflected in the ARP IE in the *RAB Assignment Request* message to the RNC to establish, modify, or release one or several RABs. For each requested RAB to be established or modified, if the ARP IE in the *RAB Assignment Request* indicates "queuing allowed" and the resource situation requires it, then the RNC attempts to place the *RAB Assignment Request* in the establishment queue.

6.3.2.1.10 RAB Assignment – Queue Timeout

Figure 6-48 illustrates the flow associated with RAB assignment when a queue timeout occurs. This processing is described further in clause 8.2 of [TS 25.413] and clause 12.7.4 of [TS 23.060]. For an NGN non-GETS call / session, this procedure typically does not apply.

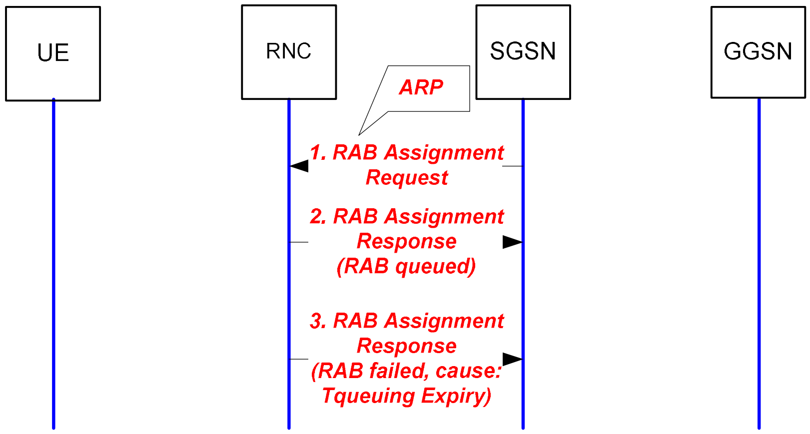

Figure 6-48 – RAB Assignment – Queue Timeout

This flow is used to attempt to establish a radio access bearer for a UE.

1. The SGSN sends a *RAB Assignment Request* message to the RNC to establish, modify, or release one or several RABs. The *RAB Assignment Request* message contains the Allocation/Retention Priority IE, which indicates the NGN GETS call / session priority level, pre-emption indicators, and queuing indicator. For each requested RAB to be established or modified, when the Allocation/Retention Priority IE in the *RAB Assignment Request* indicates "queuing allowed" and the resource situation requires it, then the RNC places the *RAB Assignment Request* in the establishment queue.
2. The RNC determines that the needed resources are not available, queues the *RAB Assignment Request* message, sets the $T_{queuing}$ timer for all requested RABs, and sends a *RAB Assignment Response* message to the SGSN indicating the RAB(s) queued.
3. The RNC determines that the needed resources are not available and the $T_{queuing}$ timer expires. The RNC sends a *RAB Assignment Response* message to the SGSN indicating the RAB assignment failed because the $T_{queuing}$ timer expired. For NGN GETS, no additional preferential treatment applies for this procedure.

If the SGSN timer $T_{RABassgt}$ expires before the RNC returns a *RAB Assignment Response* message, then the SGSN considers the RAB Assignment procedure terminated and the RABs not reported are considered as failed.

6.3.2.1.10.1 Relevant NGN GETS Aspects

The SGSN forwards the priority level of the NGN GETS call / session reflected in the ARP IE in the *RAB Assignment Request* message to the RNC to establish, modify, or release one or several RABs. For each requested RAB to be established or modified, if the ARP IE in the *RAB Assignment Request* indicates "queuing allowed" and the resource situation requires it, then the RNC places the *RAB Assignment Request* in the establishment queue.

6.3.2.2 Terminating

The call/session flows in Section 6.3.2.1 also pertain to a Mobile Terminating call/session.

6.3.3 HRPD

The NGN GETS call / session flows for HRPD and eHRPD access network are very similar. Therefore, only flows for the eHRPD access network are described in this document. Please refer to Section 6.3.4 for the eHRPD flows.

6.3.4 eHRPD

This section is informative and describes various call / session flows intended to illustrate how an NGN GETS call / session could be processed in eHRPD. This material is meant to provide a high-level informative description and is not intended to be normative. If inconsistencies exist between this section and 3GPP2 specifications, the 3GPP2 specifications take precedence. Alternative call / session flows are possible.

6.3.4.1 Layer 1 and 2 Connection Establishment

This section describes the flow associated with the establishment of an air-interface connection (and associated main link flow) between the UE and the eAN/ePCF.

6.3.4.1.1 General Description

Figure 6-49 illustrates the establishment of an air-interface connection and an associated main link flow. This flow is sub-divided into multiple sub-tasks (identified as A through E), each of which is in turn partitioned into a series of one or more messages. This decomposition of the overall processing into a series of sub-tasks is intended to convey a clearer understanding of the overall flow. It also facilitates the identification / isolation of particular sub-tasks that are most relevant to NGN GETS specific behavior.

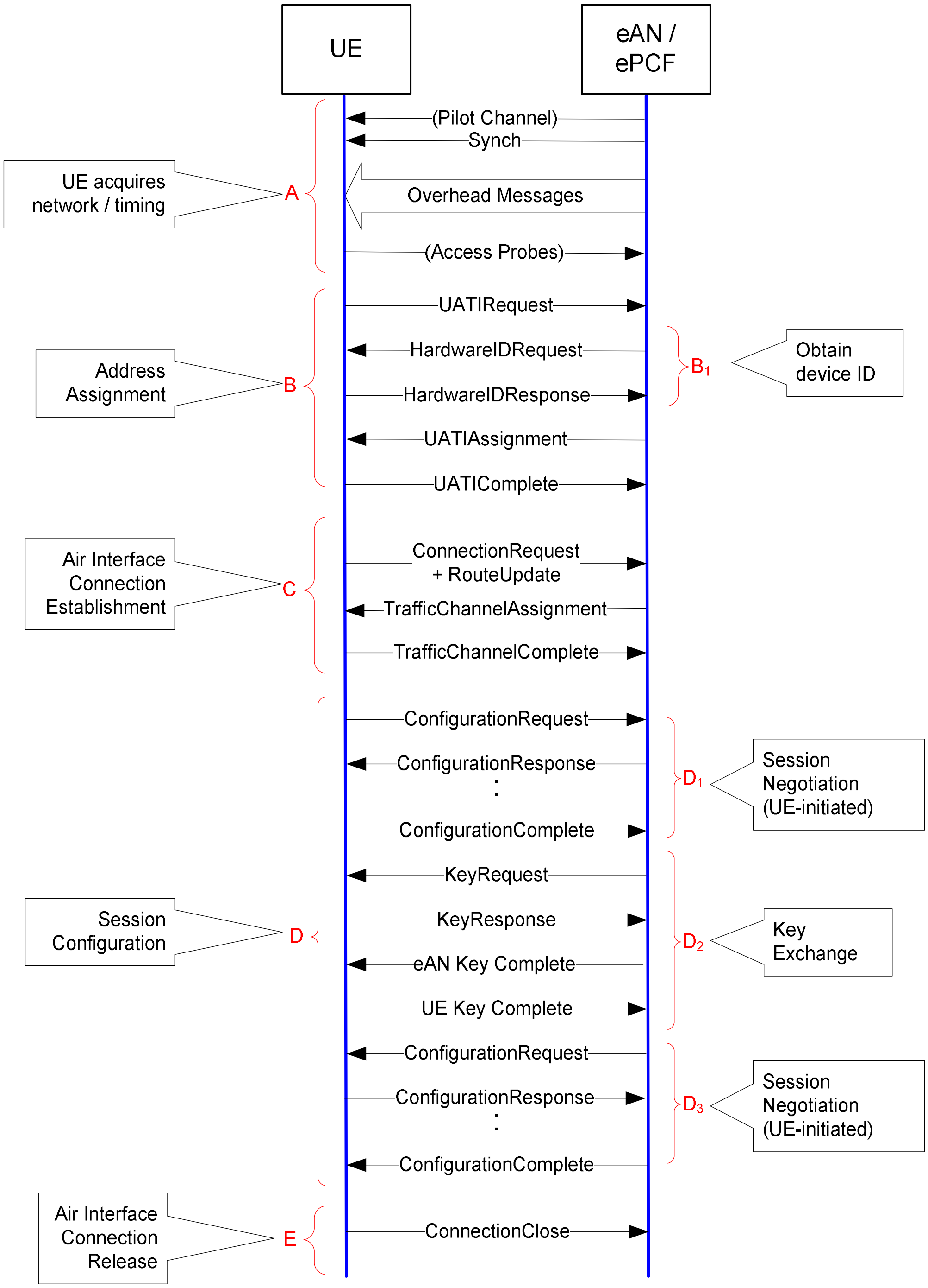

Figure 6-49 – Air-Interface Connection Establishment

Each of the sub-tasks illustrated in Figure 6-49 are briefly described below.

A. UE Acquires Network / Timing

When the UE initially powers on, the UE enters the Initialization State of the Air Link Management Protocol, as described in Section 8.2.6.1.2 of [C.S0024]. In this state, the UE selects a serving access network, acquires a Forward Pilot Channel, and obtains time synchronization from the access network. The Default Initialization State Protocol processing is described in Section 8.3 of [C.S0024]. This processing is depicted within Step A in Figure 6-49.

The Sector Parameters and the Quick Config messages are collectively referred to as the overhead messages, as described in Section 8.9.1 of [C.S0024]. The eAN/ePCF broadcasts these messages, and also periodically broadcasts the Access Parameters message, via the Forward Control Channel. Step A of Figure 6-49 includes the use of overhead messages to convey system information to UEs located within the sector.

B. *Address Assignment*

The UE requests the eAN/ePCF to assign a Unicast Access Terminal Identifier (UATI) to the UE. This involves the exchange of UATIRequest, UATIAssignment, and UATIConfirm messages, as illustrated within Step B in Figure 6-49. For the initial UATI assignment as depicted in Figure 6-49, these messages are exchanged via the Access Channel (from UE to eAN/ePCF) and the Control Channel (from eAN/ePCF to UE).

The eAN/ePCF may optionally send a HardwareIDRequest message to the UE and obtain the unique terminal ID (assigned to the terminal by the manufacturer) in a HardwareIDResponse message. Note that the HardwareIDRequest message can be sent via the Control Channel (as depicted based on its placement in Figure 6-49) or might be sent later via the Forward Traffic Channel. (The HardwareIDResponse message is sent via the Access Channel or the Reverse Traffic Channel, for the corresponding cases.)

Details concerning the corresponding processing are provided in Section 7.3 of [C.S0024], which describes the Default Address Management Protocol.

C. *Air Interface Connection Establishment*

The UE and eAN/ePCF maintain air interface connection state information that dictates how those entities can communicate.

- When an air interface connection is closed, the UE is not assigned any dedicated air-link resources, and communications are conducted via the Access Channel (from UE to eAN/ePCF) and the Control Channel (from eAN/ePCF to UE).
- After an air interface connection is open, Forward and Reverse Traffic Channels as well as a Forward MAC Reverse Power Control Channel are assigned to the UE. The eAN/ePCF can also communicate with the UE via the Forward Control Channel.

Step C in Figure 6-49 illustrates the opening of a connection between the UE and the eAN/ePCF. The UE sends bundled ConnectionRequest and RouteUpdate messages to the eAN/ePCF, receives a TrafficChannelAssignment message from the eAN/ePCF, and responds with a TrafficChannelComplete message.

Details concerning the corresponding processing are provided in Section 8.4.6.1.6 (and in Section 8.5.6.1.7) of [C.S0024]. This material describes processing within the Connection Setup State of the Enhanced Idle State Protocol (and the Enhanced Idle State Protocol).

D. *Session Configuration*

During the session establishment procedure, the UE and the eAN/ePCF negotiate protocols and protocol configurations for the session. This processing is illustrated in Step D of Figure 6-49. The UE and the eAN/ePCF use the ConfigurationRequest and ConfigurationResponse messages (sent via the Forward and Reverse Traffic Channels) to select the protocols and to configure associated parameters to be used for the session.

Details concerning this processing are described in Section 7.4 (Default Session Configuration Protocol) of [C.S0024]. This processing involves multiple stages of negotiation (see Steps D_1 through D_3 in Figure 6-49), and spans a transition through the UE Initiated and the eAN Initiated States.

Step D_2 of Figure 6-39 illustrates the use of the Diffie-Hellman (DH) Key Exchange Protocol. This protocol allows the UE and the eAN/ePCF to exchange public session keys, and to calculate a secret session key. Details are provided in Section 9.6 of [C.S0024]. This supports security for the air interface.

E. *Air Interface Connection Release*

Once the UE and the eAN/ePCF have completed the session negotiation procedures, the UE may optionally send a ConnectionClose message to the eAN/ePCF (in Step E of Figure 6-49) to close the air interface connection. The ConnectionClose message is described in Section 8.6.6.2.1 of [C.S0024].

6.3.4.1.2 Relevant NGN GETS Aspects

The following summarizes the various NGN GETS aspects associated with the establishment of a link flow between the UE and the eAN/ePCF, and provides pointers to corresponding sections where particular capabilities are described in greater detail.

- As indicated in Section 10.5.6.1.4.2 of [C.S0024], the eAN/ePCF monitors and controls the load on the Reverse Access Channel and eAN/ePCF as a whole by adjusting the Access Persistence vector, APersistence, sent as part of the AccessParameters message. Figure 6-50 illustrates the use of the AccessParameters message to set the Access Persistence values.

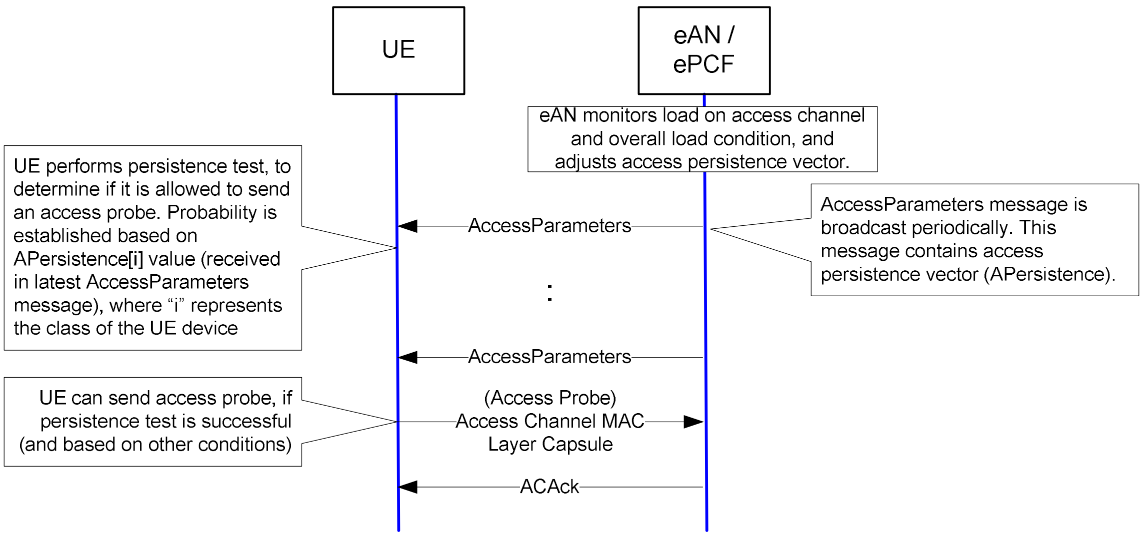

Figure 6-50 – Use of AccessParameters Message to Set Access Persistence Values

The AccessParameters message is broadcast via the Forward Control Channel. The AccessParameters message is important for NGN GETS, since it enables the Access Persistence mechanism to be applied. By setting lower access-probability values for UEs that are not subscribed to NGN GETS (via the Access Persistence vector), the eAN/ePCF can selectively throttle new access attempts from particular classes of UEs. This provides an effective mechanism for the eAN/ePCF to control the total offered load received on the Reverse Access Channel and the aggregate load during periods of overload, while not impeding access probes from UEs that are subscribed for NGN GETS.

- The following material includes discussion of the use of the APersistenceOverride and the AccessTerminalClassOverride attributes, for use with the Enhanced Access Channel MAC Protocol. As noted in Section 10.5.7 of [C.S0024], these attributes are set using the Generic Attribute Update Protocol, as described in Section 14.10 of [C.S0024]. The AttributeUpdateRequest and AttributeUpdateAccept messages are used for this purpose, as illustrated in Figure 6-51. The AttributeUpdateRequest message is sent to a particular UE via the Forward Traffic Channel and the AttributeUpdateAccept message is sent via the Reverse Traffic Channel.

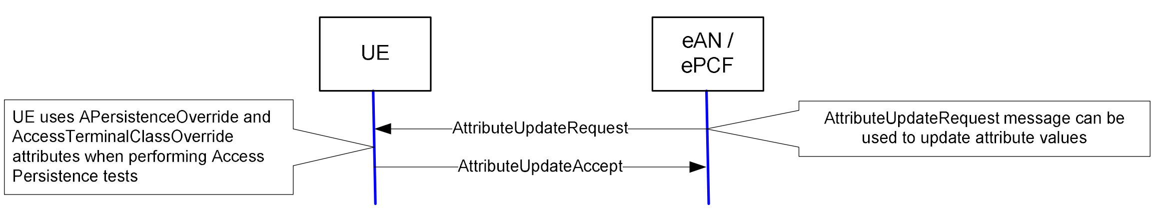

Figure 6-51 – Use of AttributeUpdateRequest message to adjust Access Persistence settings

The AccessTerminalClassOverride and APersistenceOverride capabilities may be used to upgrade the APersistence behavior of a UE that is not subscribed to NGN GETS. This capability could enable a public UE to be treated like a UE with Subscription Credentials until NGN GETS is released / revoked. Such treatment may, for example, enable a public UE to activate a data bearer when the UE has data to send after being in a dormant state.

6.3.4.2 Service Connection Establishment

This section describes the establishment of a main service connection between the UE and the HSGW, including registration with the P-GW / LMA (using PMIP v6). This processing is described further in Sections 5.2 and 5.4 of [X.S0057]. The PMIP registration is described in [RFC 5213]. It is assumed that a link flow has been established between the UE and the eAN/ePCF prior to this processing.

6.3.4.2.1 Flow Description

PMIPv6 signaling is used to establish an S2a connection between the HSGW and the P-GW. The call/session flow below illustrates the establishment of the PMIPv6 based S2a connection when the UE attaches to the eHRPD network for the first time. Figure 6-52 and Figure 6-53 are based on Figure 27 in [X.S0057-v2.0].

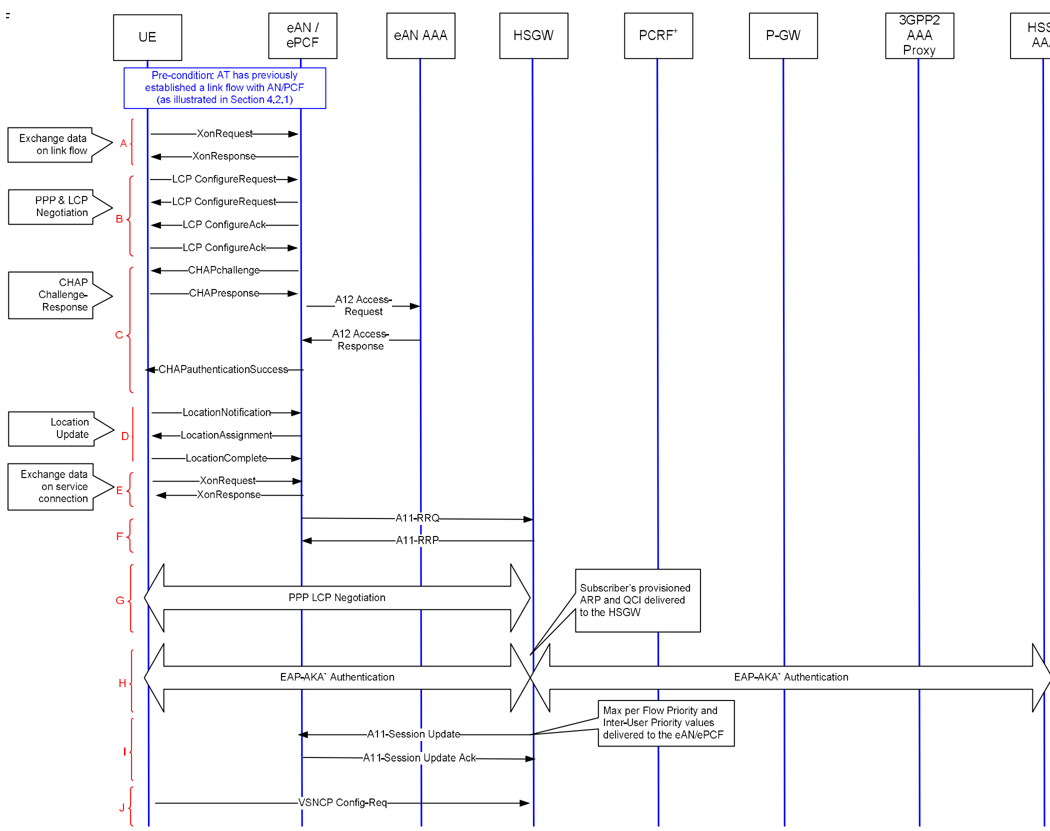

Figure 6-52 – Main Service Connection Establishment (1 of 2)

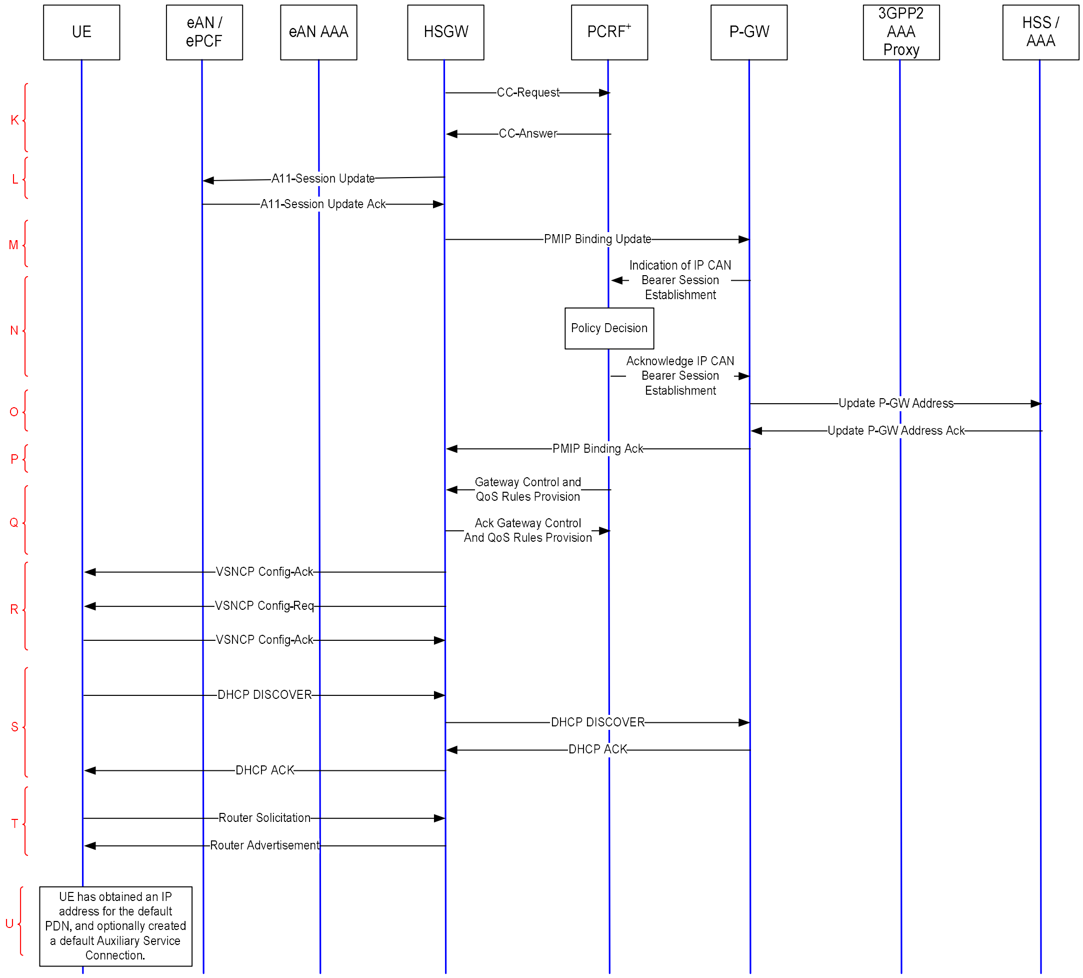

Figure 6-53 – Main Service Connection Establishment (2 of 2)

Each of the sub-tasks illustrated in Figure 6-52 and Figure 6-53 are described below.

A. *Exchange of Data on Link Flow*

The UE indicates that it is ready to exchange data via the main link flow, by sending an XonRequest message to the eAN/ePCF. The eAN/ePCF responds with an XonResponse message, to acknowledge the reception of this message. Upon completion of this interaction, the UE and the eAN/ePCF transition to the Open state, allowing the Packet Application to exchange RLP packets.

The Flow Control Protocol for the Enhanced Multi-Flow Packet Application is described in Section 3.6 (and in Section 4.7) of [C.S0024]. Note that other mechanisms may be used in place of the XonRequest message (e.g., sending of an RLP packet or a DataOverSignaling message), as discussed in [C.S0024].

B. *PPP and LCP Negotiation*

The UE and the eAN/ePCF initiate PPP and Link Control Protocol (LCP) negotiations. PPP is used to transport multi-protocol datagrams over point-to-point links. PPP procedures are specified in [RFC 1661].

As illustrated in Step B of Figure 6-52, the UE and the eAN/ePCF exchange LCP ConfigureRequest / ConfigureAck messages to establish communications over the point-to-point link. Assuming that the (optional) access authentication is to be performed, the eAN/ePCF proposes CHAP in the LCP ConfigureRequest message that it sends to the UE.

C. *CHAP Callenge / Response (Optional)*

If the optional access authentication is performed, the eAN/ePCF generates a random challenge and sends it to the UE in a CHAP Challenge message. These procedures are described in [RFC 1994]. When the eAN/ePCF receives the CHAP response message from the UE, it sends an AccessRequest message on the A12 interface to the AN-AAA. The AN-AAA acts as a Remote Authentication Dial-In User Service (RADIUS) server in accordance with [RFC 2865] to perform the access authentication. If the access authentication passes, the AN-AAA sends an Access-Accept message to the eAN/ePCF. The eAN/ePCF returns an indication of CHAP access authentication success to the UE.

D. *Location Update (Optional)*

If the eAN/ePCF supports the Location Update procedure, the eAN/ePCF updates the Access Network ID (ANID) in the UE using the Location Update procedure. Upon receipt of the LocationNotification message (potentially including the previous ANID), the eAN/ePCF sends a LocationAssignment message, containing the ANID. The UE responds with a LocationComplete message. Additional detail concerning these location update procedures and messages is provided in Section 3.5.4 of [C.S0024].

E. *Exchange of Data on Service Connection*

The UE indicates that it is ready to exchange data on the main service connection, using procedures analogous to those discussed previously for Step A.

F. *A10 connection Setup*

Because there is no A10 connection for the UE, the ePCF selects an HSGW and sends an A11-Registration Request message to the HSGW to set up the main A10 service connection with SO 59, and optionally set up the BE auxiliary service connection with SO 72. The A11-Registration Request is validated and the HSGW accepts the connection by returning an A11-Registration Reply message.

For NGN GETS, it is desirable to create an auxiliary service connection with SO 72 to support BE traffic. This will enable the Best Effort traffic to be offloaded to the BE auxiliary service connection. Removing the BE traffic from the Main Service connection will prevent contention between BE traffic and signaling traffic. The creation of an auxiliary service connection for BE traffic is an NGN GETS Service Provider's choice and it is recommended that the NGN GETS Service Provider choose this provisioning option to better service NGN GETS.

It is important to note that at this point in the call/session flow, the RAN is not aware that the attached subscriber is an NGN GETS subscriber. The recommendation to create a Main Service Connection and a BE Auxiliary Service Connection would apply to all subscribers.

G. *PPP and LCP Negotiation*

The UE and HSGW perform LCP negotiation and select EAP-AKA as the authentication protocol.

H. *EAP-AKA' Authentication*

The authentication procedures are initiated and performed between UE, HSGW, 3GPP2 AAA Server and 3GPP AAA Server. The subsequent paragraph summarizes the process.

The AAA/HSS sends subscription data to the HSGW. The Subscription Data contains the list of all Access Point Names (APNs) that the UE can access, an indication about which of those APNs is the Default APN, and the EPS subscribed QoS profile for each permitted APN. This information is cached at the HSGW on behalf of the attaching UE. EAP-AKA' is then performed for mutual authentication between UE and the network. At the end of this step, the PPP Link Establishment and Authentication phases are complete. Also, the HSGW has received the subscription profile of the UE from the HSS/AAA.

EPS subscribed QoS profile contains the provisioned ARP and QoS Class Identifier (QCI) for the subscriber. The EPS subscribed QoS profile for a NGN GETS subscriber will have the same default ARP and QCI as that of a commercial subscriber.

I. *Sending Authorized Flow Profile IDs*

Based on the information received in the EPS QoS subscriber profile, the HSGW determines for which FlowProfileIDs the user is authorized. The mapping of QoS parameters can be found in [Appendix A, X.S0057]. The HSGW sends the list of authorized FlowProfileIDs to the eAN/ePCF in an A11-Session Update message. The eAN/ePCF sends an A11-Session Update Ack message to the HSGW.

The A11-Session Update message includes the Subscriber QoS profile that contains the Maximum Per Flow Priority attribute that is used to convey a specific Flow Priority value to the eAN/ePCF (this Flow Priority value is not an NGN GETS specific value).

J. *VSNCP Config-Req*

The UE sends a Vendor Specific Network Control Protocol (VSNCP) Config-Req message over the main service connection. The VSNCP includes PPP vendor extensions for 3GPP2 conforming to [RFC 3772]. The VSNCP packet format is illustrated in [Section 10.1.4, X.S0057]. The information in the message includes a PDN-ID, PDN Type, APN, Address Allocation Preference, PDN Address = 0, Protocol Configuration Options, and Attach Type = "Initial Attach". The Address Allocation Preference indicates whether the UE wants to perform the IP address allocation during the attach procedure and, when known, PDN Type indicates the UE's IP capability (IPv4, IPv4/IPv6, IPv6).

K. *Gateway Control Session Setup*

CC-Request: The Gateway Control Establishment Procedure begins with the transmission of the Diameter CC-Request message on the Gxa Interface. As defined in Section 5a.6.2 of [TS 29.212], the Diameter CC-Request message includes the Default-EPS-Bearer-QoS AVP defined in Section 5.3.48 of [TS 29.212] which contains the subscribed QoS delivered to the HSGW during the Authentication Procedure. As previously mentioned, the Default-EPS-Bearer-QoS AVP will contain the non NGN GETS-specific/commercial ARP and QoS Class Identifier (QCI) for the user.

To associate this Gateway Control Session with the soon-to-be established IP CAN Session from the PDN-GW, the Diameter CC-Request message includes the UE identity (International Mobile Subscriber Identity [IMSI]) and the PDN identifier received during the Authentication Procedure. The IMSI is carried in the Subscription-ID-Data AVP within the Subscription-ID AVP. These two AVPs are defined in Section 8.46 and Section 8.48 of [RFC 4006]. The APN is carried in the Called-Station-ID AVP defined in Section 4.5 of [RFC 4005].

The PCRF/Subscriber Profile Repository will have an indication that will indicate that the user is an NGN GETS subscriber and it also will have an indication that IMS Signaling Priority is allowed.

CC-Answer: The Diameter CC-Answer message defined for the Gxa Interface in Section 5a.6.3 of [TS 29.212] acknowledges the Diameter CC-Request message and concludes the Gateway Control Establishment Procedure.

Since the PCRF is now aware that the user is an NGN GETS users, the PCRF will request to upgrade the IP CAN QoS by supplying that authorized QoS in the QoS-Information AVP within the QoS-Rule-Definition AVP to HSGW. The QoS-Information AVP will contain an NGN GETS ARP. The Diameter CC-Answer message may include the QoS-Rule-Install AVP defined in Section 5a.3.1 of [TS 29.212] if any dedicated bearers are to be established at the time of Attach.

L. *A11 Session Update/Ack*

The HSGW initiates procedures to install the QoS policy information received from the PCRF. To accomplish this, the HSGW sends an A11-Session Update message to the eAN/ePCF (via the A11 interface), as discussed in Section 3.9.5 of [A.S0008] and [A.S0009]. For NGN GETS, the A11-Session Update message triggers the IP-CAN to apply priority treatment to the Main Service Connection and the SIP signaling bearer. The A11-Session Update message is extended to include the FLOW_PRIORITY (within the Forward / Reverse Flow Priority Update Information), used to trigger an update for the flow priority to be assigned for this auxiliary service connection flow – in order to trigger priority processing in the eAN/ePCF. The FLOW_PRIORITY is used as the granted priority level for the associated flow(s), overriding any value that might be requested by the UE.

The A11-Session Update message includes the Subscriber QoS profile that contains the Maximum Per Flow Priority attribute that is used to convey the NGN GETS specific Flow Priority value to the eAN/ePCF. For NGN GETS Subscribed UEs, the main service connection is offered priority treatment, based on appropriate population of the Maximum Per Flow attribute in the Subscriber QoS Profile. The Maximum Per Flow Priority, as defined in Standards, is used by the RAN to determine what Flow Priority can be requested by the UE. For NGN GETS Subscribed UEs, the Maximum Per Flow attribute is used to apply priority to the Main Service Connection.

The eAN/ePCF returns an A11-Session Update Acknowledge message to the HSGW.

M. *PMIP Binding Update*

If the UE subscription context contains no P-GW identifier, the HSGW can select a P-GW using the associated APN. If the PDN subscription profile contains a P-GW address and the UE is not attaching through the S101 tunnel and the Attach Type is set to Initial Attach, the HSGW may select a new P-GW. The HSGW sends a Proxy Binding Update (PBU) to the P-GW in order to establish the new registration.

N. *Retrieving QoS Policy Parameters*

The P-GW performs a PCRF interaction to retrieve the QoS policy parameters. The P-GW sends an Indication of IP-CAN Bearer Session Establishment message to the PCRF. The message includes Mobile Node-Network Access Identifier (MN-NAI), PDN identifier, IP-CAN type and IP address. The PCRF makes the authorization and policy decision. The Acknowledge IP-CAN Bearer Session Establishment message includes Policy rules and event triggers.

O. *Address Update*

The P-GW sends an update message to the 3GPP AAA Server to update the UE profile with its address. The 3GPP AAA server acknowledges the updated P-GW address.

P. *PMIP Binding Acknowledgement*

The P-GW responds with a PMIP Proxy Binding Acknowledgement (PBA) message to the HSGW.

Q. *Gateway Control Session Ack*

In case the QoS rules have been changed, the PCRF updates the QoS rules at the HSGW by sending a Gateway Control and QoS Rules Provision message to the HSGW. This message includes QoS Rules and Event Triggers. Details are described in [TS 23.203]. The HSGW sends a Gateway Control and QoS Rules Provision Ack message to the PCRF. The Result information element indicates whether the indicated QoS Rules could be implemented.

R. *VSNCP Messages*

The HSGW sends a VSNCP Config-Ack message to the UE over the main service connection. Note that the PDN Address Information may contain an IPv4 address for IPv4 and / or an IPv6 Interface Identifier for IPv6.

The HSGW sends a VSNCP Config-Req message again to complete the protocol as that specified in [RFC 3772]. The UE responds with a VSNCP Config-Ack message.

S. *DHCP Discover (Optional)*

The UE may issue a Dynamic Host Configuration Protocol (DHCP) Discover message on the BE service connection toward the P-GW if the UE did not request an IP address in Step G. The message is relayed to the P-GW by the HSGW. The P-GW functions as a DHCP Server, and the HSGW functions as a DHCP Relay Agent. After receiving the DHCP Discover, the P-GW responds with a DHCP ACK.

T. *Router Solicitation and Router Advertisement (Optional)*

The UE may send a Router Solicitation message. The HSGW will send a Router Advertisement message if the P-GW sends the IPv6 prefix to the HSGW and the UE indicates in the PDN-Type that it is capable of IPv6.

U. *Obtaining IP Address and Creating Auxiliary Service Connections*

The UE obtains an IP address. The IP address allocation details are described in [Section 5.2, X.P0057]. Based on information stored at the UE or obtained from the network, the UE can start creating the required auxiliary service connections (needed for the bearer transport) for a particular QoS flow per PDN. Details are described in Section 10.3 of [X.S0057].

6.3.4.2.2 Relevant NGN GETS Aspects

The following summarizes the various NGN GETS aspects associated with the establishment of a main service connection between the UE and the HSGW.

- The A11-Session Update message contains key parameters for NGN GETS.
    a. The Maximum Per Flow Priority field indicates the maximum priority that can be assigned to a packet flow for the subscriber. ***For NGN GETS, the Maximum Per Flow Priority value is also used to designate the priority that is assigned to the main service connection.***

   b. The Inter-User Priority field indicates the inter-user priority that is assigned to a user's BE packet data.

- An NGN GETS Service Provider network may provide mechanisms to increase the probability of successful transport (within specified QoS limits) of signaling and encoded media packets for NGN GETS when there is congestion in the transport links and in network elements such as routers, which do not have IP flow awareness.

For the flow illustrated in Figure 6-52 and Figure 6-53, many of the messages can be transported with priority, once the FEs are alerted to the priority nature of the UE.

6.3.4.3 NGN GETS Voice Call / Session Origination

This section describes the flow for a successful NGN GETS Voice call / session origination. This material only illustrates the signaling that is encountered on behalf of the calling party. This includes signaling from the calling party's access network toward the IMS Core Network.

6.3.4.3.1 Flow Description

Figure 6-54 and Figure 6-55 illustrate the flow for an NGN GETS Voice call / session origination. For this flow, the NGN GETS call / session is originated from a UE that has previously established a main link flow (based on processing as described in Section 6.3.4.1), established a main service connection to the HSGW (based on processing as described in Section 6.3.4.2),been allocated an IP address and registered with the IMS Core Network. The UE has transitioned to the dormant state, and an A10 connection remains established between the eAN/ePCF and the HSGW.

Note: Policy-related processing is shown as shaded step in the following figures, to aid the reader in isolating those aspects and for consistency with the corresponding convention used in other access technologies in this Standard.

Each of the sub-tasks illustrated in Figure 6-54 and Figure 6-55 are briefly described below.

A. Link Flow (Re-)Establishment

To originate a voice call / session, the UE must exchange higher layer (SIP) messages with the IMS Core Network. If the UE has transitioned to the dormant state prior to initiating the voice call / session, then the UE will first need to re-establish a radio-interface connection.

As described previously, the Access Persistence mechanism offers preferential access to the eHRPD access channel for NGN GETS Subscribed UEs. This mechanism allows NGN GETS Subscribed UEs to have a greater probability of being allocated a control channel than other UEs during periods of congestion.

The processing associated with the (re-)establishment of the main link flow is as discussed earlier. The UE sends bundled ConnectionRequest and RouteUpdate messages to the eAN/ePCF, receives a TrafficChannelAssignment message from the eAN/ePCF, and responds with a TrafficChannelComplete message.

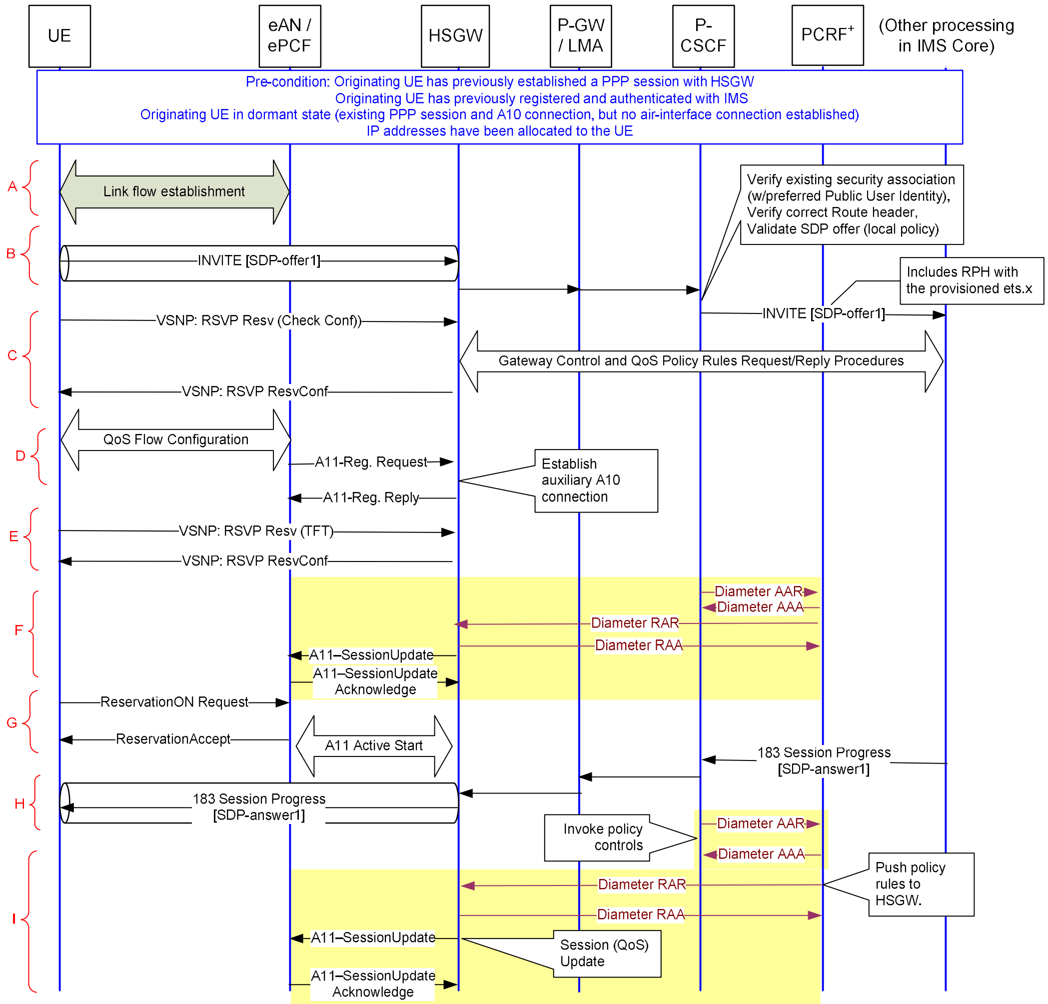

Figure 6-54 – Originating Call / Session (1 of 2)

B. Call / Session Invocation & Initial SDP Offer

After an air-interface connection is established between the UE and the eAN/ePCF, packets can be transmitted between the UE and the HSGW by using the PPP session established earlier. The UE initiates the call / session origination by sending a SIP INVITE request. **For NGN GETS Subscribed UEs, the SIP messages used for call / session establishment are exchanged via a service connection that is configured for priority use (either on the Main Service Connection or on an auxiliary service connection created for SIP signaling). Priority treatment is thereafter applied during the subsequent processing of the originating call / session.** (For UEs that are not subscribed to NGN GETS, the SIP messages used for call / session establishment are exchanged via a service connection that is configured for normal [non-priority] use – although priority treatment can subsequently be invoked based on PCC processing)

As illustrated in Step B of Figure 6-54, the UE sends a SIP INVITE request to initiate call / session establishment. The message body of the SIP INVITE request contains a Session Description Protocol (SDP) offer, containing a description of the requested media for this call / session. **The SIP INVITE request is sent to the IMS Core Network, where the P-CSCF detects that this is a priority call / session origination, applies priority treatment, and routes the SIP INVITE request with a special SIP RPH priority indication. The SIP INVITE request is directed to an AS within the IMS Core Network, where NGN GETS processing is performed.**

C. Vendor Specific Network Protocol (VSNP) RSVP Resv and ResvConf Message – Requesting Bearer Resources

The UE sends a Resv message to the HSGW with OpCode set to 'Check QoS'. This message contains the UE requested R-QoS-Sub-BLOB. The HSGW maps the received FlowProfileID(s) into a single set of QCI/Maximum Bit Rate (MBR)/ (GBR) parameters. The HSGW uses Gateway Control and QoS Rules procedures to validate UE requested QoS with the PCRF. After receiving the validated policy rules, the HSGW sends a ResvConf message to the UE with the OpsCode set to 'Check QoS'. The ResvConf message contains the Up Link (UL)/Down Link (DL) TFT, and the authorized QoS R-QoS-Sub-BLOB.

D. Establishment of air interface / Auxiliary A-10 Connection

The UE performs the standard QoS establishment procedures using the authorized FlowProfileID and creates a new air interface link flow. The eAN sends an A11-Registration Request message to the HSGW indicating the Requested QoS information and the Granted QoS information for the flow. The A11 message includes the FLOW_ID.

E. Establishment of Traffic Flow Template

The UE sends a Resource Reservation Protocol (RSVP) Resv message to the HSGW, to establish a Traffic Flow Template for the new auxiliary service connection. The HSGW responds with an RSVP ResvConf message.

F. Call / session Invocation – Policy Control Request

When the P-CSCF receives a SIP INVITE request (in Step B), the P-CSCF contacts the appropriate PCRF (via Diameter messages) to enforce QoS controls. This processing is as discussed in Steps P1 through P4 in Section 6.1. Note that this Diameter AAR message (in Step C) can be sent at the same time that the P-CSCF sends the SIP INVITE request in Step B.

The HSGW initiates procedures to install the QoS policy information received from the PCRF in the Diameter RAR message. To accomplish this, the HSGW sends an A11-Session Update message to the eAN/ePCF (via the A11 interface), as discussed in Section 3.9.5 of [A.S0008] and [A.S0009]. **For NGN GETS, the A11-Session Update message triggers the IP-CAN to apply priority treatment for establishment of the media bearer and to provide priority treatment for the transport of subsequent voice packets.** ***The A11-Session Update message is extended to include the FLOW_PRIORITY (within the Forward / Reverse Flow Priority Update Information), used to trigger an update for the flow priority to be assigned for this auxiliary service connection flow – in order to trigger priority processing in the eAN/ePCF. The FLOW_PRIORITY is used as the granted priority level for the associated flow(s), overriding any value that might be requested by the UE.***

The eAN/ePCF returns an A11-Session Update Acknowledge message to the HSGW.

G. Reservation On

In Step G the newly created bearer is transitioned to an Open state. The eAN will trigger an A11-Registration Request (Active Start) message to initiate accounting for this bearer connection.

H. SIP 183 Session Progress response

After the SIP INVITE request, containing an initial SDP offer, is received at the destination end in Step B, a SIP 183 Session Progress response is returned, containing the initial SDP answer.

I. Additional PCC Interactions

When the P-CSCF receives the SIP 183 Session Progress response (in Step F), the P-CSCF again contacts the appropriate PCRF (via Diameter messages) to update the QoS information. **Since the SIP 183 Session Progress response includes an RPH that includes the Service User's priority level, the Reservation-Priority AVP value in the Diameter AAR message in Step G is set to the appropriate value for that priority level*****, and the MPS-Identifier AVP is included*****. *****This allows the PCRF to set the correct Allocation-Retention-Priority Priority-Level in the Diameter RAR message, based on the specific Service User's priority level plus the media information specified for this call / session. The HSGW maps that information into the corresponding FLOW_PRIORITY that is passed on to the eAN/ePCF in the A11-Session Update message.***

J. Call / session Invocation – Acknowledgement of Provisional Response

The UE confirms the reception of the SIP 183 Session Progress response containing an SDP answer (received in Step C), by responding with a SIP PRACK. This results in a SIP 200 OK response back to the UE.

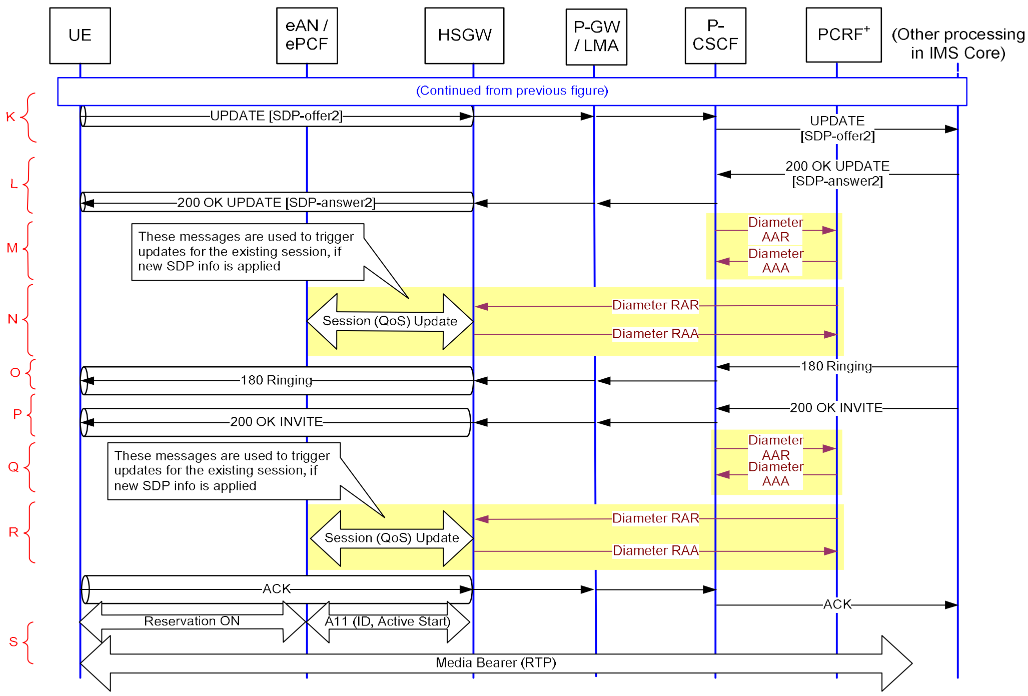

Figure 6-55 – Originating Call / Session (2 of 2)

K-N. Call / session Invocation – Subsequent SDP Offers / Answers

As illustrated in Figure 6-55, the UE may subsequently send a SIP UPDATE request containing an alternate SDP offer. A sequence of such offer / answer message exchanges may be applied to support bearer negotiation (or these messages may be omitted for particular scenarios).

If subsequent offer / answer exchanges require modifications to the associated policy rules, additional Diameter messages may be used (as illustrated in Steps M and N) to update the policy controls for the call / session. The details associated with the Session Negotiation double arrow in Step N corresponds to the UE-eAN/ePCF messages in Step G of Figure 6-54. The details associated with the Session (QoS) Update double arrow in Step N corresponds to the A11 RegRequest/Response messages in Step H of Figure 6-54.

O-R. Call / session Invocation – Ringing and Answer

When the P-CSCF subsequently receives a SIP 200 OK response (indicating that the called party has answered, the P-CSCF requests the PCRF to open the corresponding gate. The P-CSCF requests the PCRF to enable the media flow via the Diameter AAR message. This message includes the Media-Component-Description AVP that contains the flow status information for the flow to be enabled. The PCRF responds to the P-CSCF with a Diameter AAA message, indicating the disposition of the request. The PCRF directs the HSGW to open the gate via the Diameter RAR message. The HSGW responds to the PCRF with a Diameter RAA message.

6.3.4.3.2 Flow Description – Successful Call / Session Origination with Queuing

The call / session origination flow illustrated in Section 6.3.4.3 had assumed that the eAN/ePCF was able to allocate the required resources when it received the ReservationOnRequest message. However, since the ReservationOnRequest message may be received by the eAN/ePCF before the A11-Session Update message is received, the eAN/ePCF (in the absence of any NGN GETS extensions to the basic procedures) processes the ReservationOnRequest message with "normal" priority, which could result in a failure condition. This section illustrates the addition of queuing procedures to promote a greater likelihood of successful NGN GETS call / session origination.

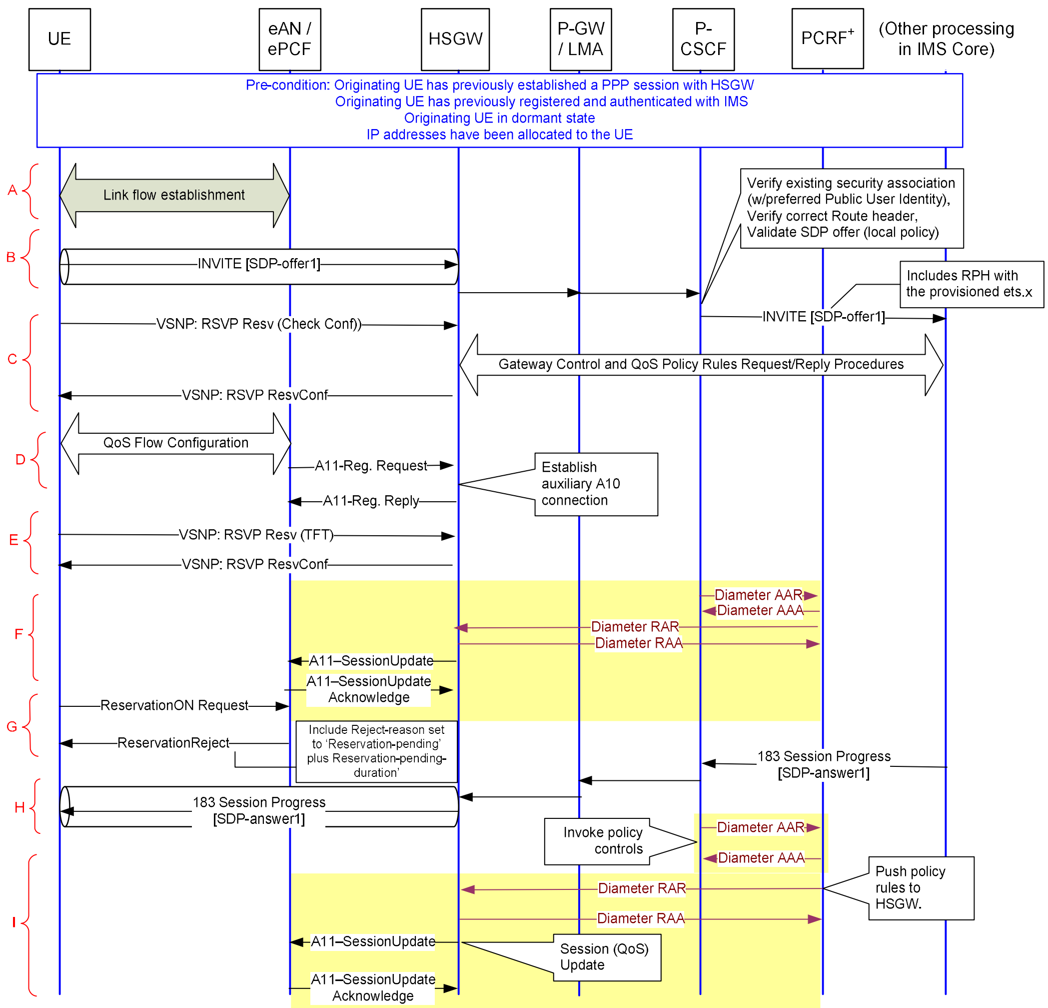

Figure 6-56 – Call/session Origination with Queueing (1 of 2)

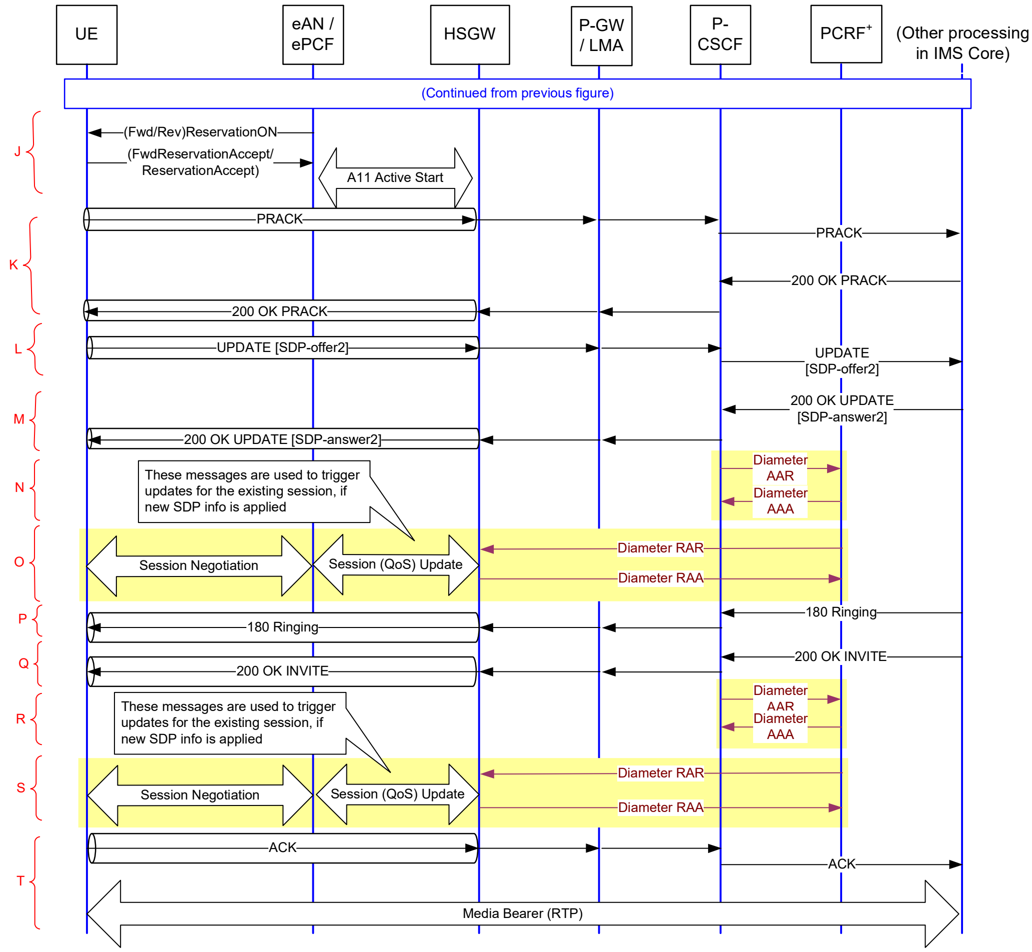

Figure 6-57 – Call/session Origination with Queueing (2 of 2)

Figure 6-56 and Figure 6-57 illustrate how queuing is applied if the eAN/ePCF is unable to allocate the necessary resources for an NGN GETS call / session. Since the majority of the steps in Figure 6-56 are the same as those illustrated in Figure 6-54, the following material only describes those steps which differ from the corresponding processing as described in Figure 6-54. These modified steps are described below.

G. ReservationOnRequest Message

The UE sends a ReservationOnRequest to the eAN/ePCF asking the RAN to allocate resources associated with the Flow ID. If the eAN/ePCF determines that resources are unavailable to handle the ReservationOnRequest message, the eAN/ePCF sends a ReservationReject message to the UE. Figure 6-56 illustrates the case where an A11-Session Update message (with the FLOW_PRIORITY set to trigger an elevated flow priority) is received by the eAN/ePCF prior to the ReservationOnRequest message. ***Based on knowledge that this a priority call/session, the eAN/ePCF includes the RejectReason code set to "Reservation pending" and queues the request for a certain period of time. The eAN/ePCF includes a PendingDuration in the ReservationReject message to instruct the UE what time period the UE should wait before retrying the ReservationOnRequest message.***

J. Resources Become Available - Establishment of Auxiliary Service Connection

The eAN/ePCF queues the ReservationOnRequest request while waiting for resources to become available. In Step J, the resources become available (prior to expiration of the PendingDuration). The eAN/ePCF recognizes the need to establish an auxiliary A10 connection to handle the voice call / session, and sends an A11-Registration Request to the HSGW. The auxiliary service connection is established, and the HSGW responds to the eAN/ePCF with an A11-Registration Reply. The eAN/ePCF sends corresponding FwdReservationOn (RevReservationOn) messages to inform the UE that the corresponding forward (reverse) Reservations have transitioned to the Open state. The UE sends FwdReservationAccept (ReservationAccept) messages to confirm the corresponding forward (reverse) Reservations.

Subsequent processing is consistent with that illustrated in Figure 6-54 and Figure 6-55.

6.3.4.3.3 Flow Description – Call / Session Release

This section illustrates the procedures associated with UE-initiated release of a call / session.

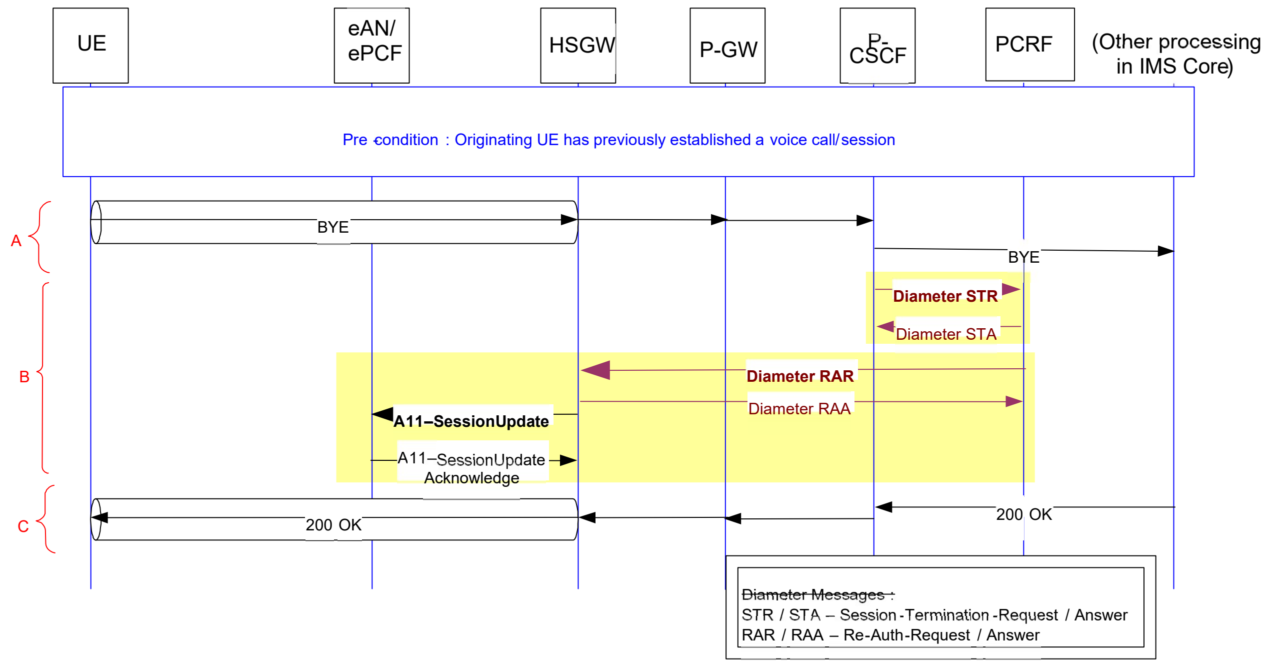

Figure 6-58 – Call / Session Release

Figure 6-58 illustrates the release of an NGN GETS Voice call / session.

A. UE-Initiation of Call / session Release

In the case of an NGN GETS Voice or Video call / session, release of the NGN GETS call / session begins when the UE sends SIP BYE message.

B. PCC Interactions

When the P-CSCF receives the SIP BYE message of an established call / session, the P-CSCF sends a Diameter Session-Termination-Request (STR) message to the PCRF to inform the PCRF that an established session is to be terminated. (This processing is described in Section B.4.1 of [TS 29.213].) When the PCRF receives the Diameter STR message, the PCRF sends a Diameter RAR message to the HSGW. (This processing is described in Section 4.3.1.2.3 of [TS 29.213].) The Diameter RAR message causes the HSGW to send an A11-Session Update message to the eAN/ePCF, indicating the IP flow that the HSGW wants to release. **The HSGW also restores the Subscriber QoS Profile entries for the Maximum Per Flow Priority, causing the eAN/ePCF to apply the appropriate priorities for the main service connection (i.e., based on elevated priorities for Service Users or non-GETS priorities for other users).**

C. Call / session Release - Acknowledgement

The SIP BYE request is processed within the IMS Core Network, resulting in a SIP 200 OK response that is passed to the UE via the access network. The above does not affect any priority treatment that may persist, as applied to other IP flows or to the BE flows.

6.3.4.3.4 Relevant NGN GETS Aspects

Various priority mechanisms offer Service Users a greater probability of successful NGN GETS Voice call / session originations. The following summarizes the various priority mechanisms associated with NGN GETS Voice call / session originations.

- The Access Persistence mechanism allows the eAN/ePCF to control the total offered load received on the Reverse Access Channel and the aggregate load during periods of overload, while not impeding access for UEs that are subscribed for NGN GETS.
- The SIP messages used for call / session establishment are exchanged via a service connection that is configured for priority use by GETS Subscribed UEs. The SIP messages are sent via the main service connection (established with priority based on the Subscriber QoS Profile) or via an auxiliary service connection that is established for this purpose.
- The A11-Session Update message contains key parameters for NGN GETS. *The A11-Session Update message is extended to contain the FLOW_PRIORITY field (within the Forward / Reverse Flow Priority Update Information).*
- *eAN/ePCF queuing is applied upon the reception of a ReservationOnRequest message if resources are temporarily unavailable to handle such requests from a GETS Subscribed UE.*

6.3.4.4 NGN GETS Voice Call / Session Termination

This section describes the flow associated with the terminating portion of an NGN GETS voice call / session. This material illustrates only the signaling that is encountered on behalf of the called party. This includes signaling from the Core IMS Network toward the called party's access network.

6.3.4.4.1 Flow Description

Figure 6-59 and Figure 6-60 illustrate the flow for an NGN GETS voice call / session termination. For this flow, the NGN GETS voice call / session is terminated at a UE that has previously established a link, established a session to the HSGW and registered with the LMA, and registered with the IMS Core Network. The UE has transitioned to the dormant state, and an A10 connection remains established between the eAN/ePCF and the HSGW.

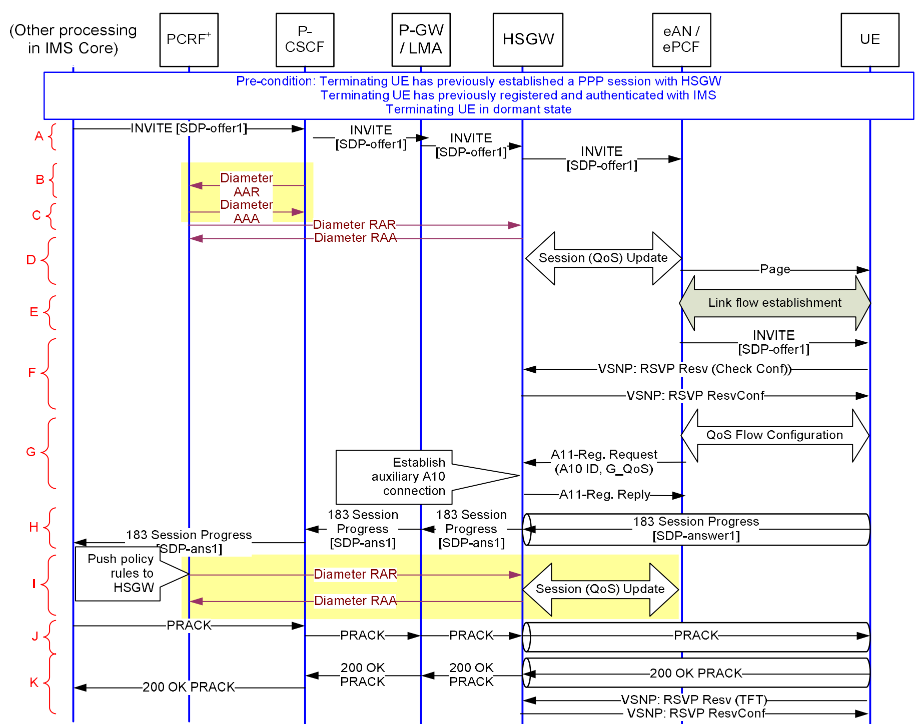

Figure 6-59 – Incoming Call / Session (1 of 2)

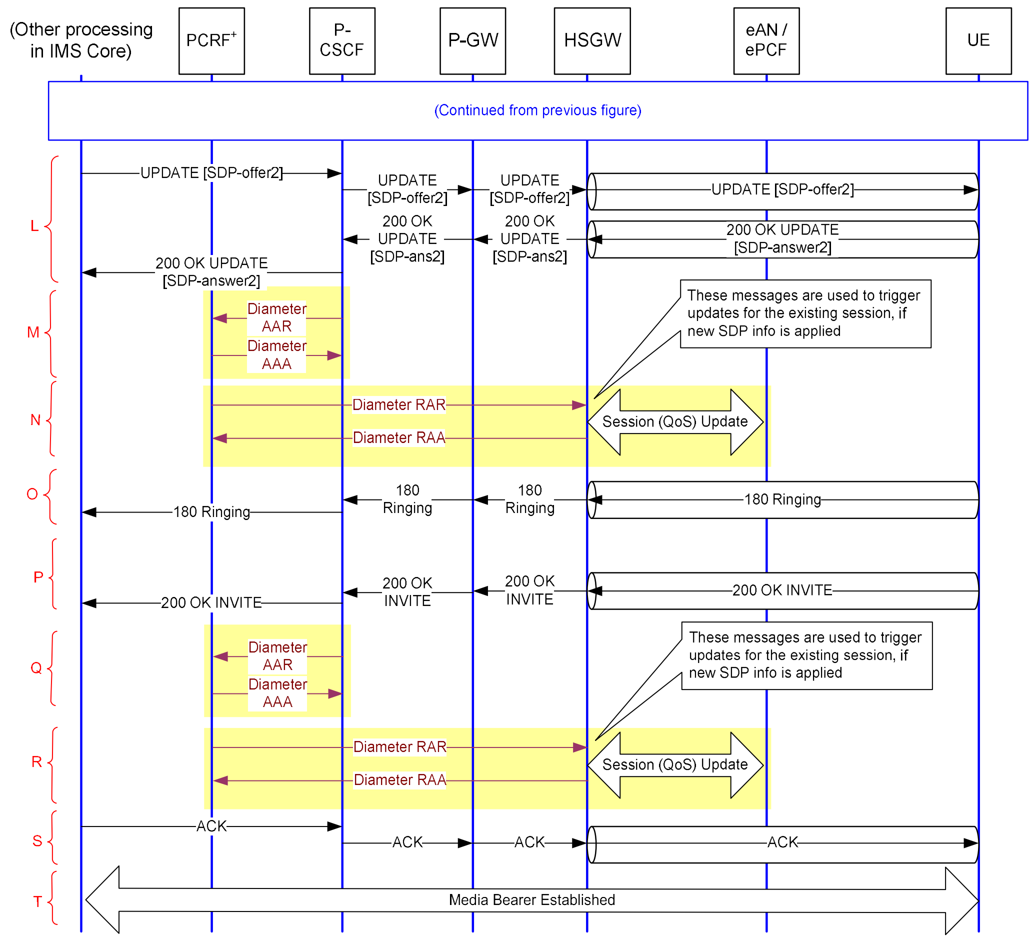

Figure 6-60 – Incoming Call / Session (2 of 2)

Each of the sub-tasks illustrated in Figure 6-59 and Figure 6-60 are briefly described below.

A. Call / Session Invocation & Initial SDP Offer

As illustrated in Step A of Figure 6-59, the P-CSCF receives a SIP INVITE request to initiate call / session establishment. The message body of the SIP INVITE request contains an SDP offer, containing a description of the requested media for this call / session. **For an NGN GETS Voice call / session, an RPH is included, populated with ets.x and wps.y priority information. The P-CSCF detects that this is a priority call / session and applies priority treatment.**

In order to locate the current position of the UE, the P-CSCF sends the SIP INVITE request to the P-GW associated with the UE. Since the UE/HSGW has registered with the P-GW, the P-GW knows which HSGW is currently serving the UE.

B&C. Call / Session Invocation – Policy Control

When the P-CSCF receives the SIP INVITE request (in Step A), the P-CSCF contacts the appropriate PCRF (via Diameter messages) to enforce QoS controls. **For NGN GETS Voice, the P-CSCF includes the Reservation-Priority AVP in the Diameter AAR message which reflects the priority level assigned to the incoming NGN GETS call / session. The MPS-Identifier AVP is also included.**

Upon receipt of the Diameter AAR message, the PCRF sends a Diameter RAR message to the HSGW. ***The Diameter RAR message includes the Allocation-Retention-Priority Priority-Level (within the QoS-Information AVP). The Allocation-Retention-Priority Priority-Level is populated with a value chosen from the range of values allocated for NGN GETS.*** The HSGW responds to the PCRF with a Diameter RAA message.

The HSGW initiates procedures to install the QoS policy information received from the PCRF. To accomplish this, the HSGW sends an A11-Session Update message to the eAN/ePCF (in Step C). This processing is analogous to that described in step C of Section **Error! Reference source not found.**. The A11-Session Update message is extended to include the FLOW_PRIORITY (within the Forward / Reverse Flow Priority Update Information). The eAN/ePCF returns an A11-Session Update Acknowledge message to the HSGW.

D. Call / Session Invocation – Paging

The eAN/ePCF receives the SIP INVITE request. This may be received before or after the A11-Session Update message in Step C.

As described in previous sections, the PPP session between the HSGW and the UE has been established already. If the UE is in the active state, the SIP INVITE request is forwarded to the UE without paging the UE. If the UE is in dormant state, the PPP session between the HSGW and the UE is maintained except that there is no air-interface connection between the eAN/ePCF and the UE. The SIP INVITE request is forwarded to the eAN/ePCF via the A10 connection. The eAN/ePCF then sends a Page message to page the UE.

For an NGN GETS call / session, assuming the A11-Session Update message was received (in Step C) prior to the SIP INVITE request, the eAN/ePCF may apply priority paging at this point.

E. Link Flow (Re-)Establishment

To establish the incoming voice call / session, the UE must exchange higher layer (SIP) messages with the IMS Core Network. If the UE has transitioned to the dormant state prior to receiving the Page, then the UE will first need to re-establish an air-interface connection. Once the location of the UE is identified and the air interface connection is re-established, the SIP INVITE request is sent to the UE.

For an NGN GETS call / session, if the eAN/ePCF is unable to allocate the necessary resources at this point, the eAN/ePCF may apply queuing.

F & G. Establishment of Auxiliary Service Connection

When it receives the SIP INVITE request, the UE determines the media type being requested (from the SDP-offer information). The UE sends a Resv message to the HSGW with OpCode set to 'Check QoS'. This message contains the UE requested R-QoS-Sub-BLOB. The HSGW maps the received FlowProfileID(s) into a single set of QCI/MBR/GBR parameters. The HSGW sends a ResvConf message to the UE with the OpsCode set to 'QoS Check'. The ResvConf message contains the UL/DL TFT, and the authorized QoS R-QoS-Sub-BLOB.

The UE performs the standard QoS establishment procedures using the authorized FlowProfileID and creates a new air interface link flow. The eAN sends an A11-Registration Request message to the HSGW indicating the Requested QoS information and the Granted QoS information for the flow. The A11 message includes the FLOW_ID.

H. Call / Session Invocation - Initial SDP Answer

Once the UE receives the SIP INVITE request (in Step E), the UE responds with SIP 183 Session Progress response, containing an SDP answer.

I. Additional PCC Interactions

When the P-CSCF receives the SIP 183 Session Progress response (in Step H), the P-CSCF may again contact the appropriate PCRF (via Diameter messages) to update the QoS information.

J. Call / Session Invocation – Acknowledgement of Provisional Response

The originating end confirms the reception of the SIP 183 Session Progress response containing an SDP answer (received in Step H), by responding with a SIP PRACK. The UE, upon receiving this message, sends a SIP 200 OK response.

K. Establishment of Traffic Flow Template

As illustrated in Step K, the UE sends an RSVP Resv message to the HSGW, to establish a Traffic Flow Template for the new auxiliary service connection. The HSGW responds with an RSVP ResvConf message.

6.3.5 WiMAX

This section is informative and describes various call / session flows intended to illustrate how an NGN GETS call / session could be processed in WiMAX. This material is meant to provide a high-level informative description and is not intended to be normative. If inconsistencies exist between this section and WiMAX specifications, the WiMAX specifications take precedence. Alternative call / session flows are possible.

Section 6.3.5.1 through Section 6.3.5.3 provide the main flows of initial network entry, NGN GETS voice/video call origination, and NGN GETS voice/video call termination. They refer to the key priority related procedures described in Section 6.3.5.4 for service flow addition and modification, Section 6.3.5.5 for PCC based dynamic QoS update, and Section 6.3.5.6 for paging.

6.3.5.1 Initial Network Entry

This section describes a representative WiMAX initial network entry flow, shown in Figure 6-61, with successful queuing of dynamic service addition (DSA-REQ) and dynamic service change (DSC-REQ) messages for the transport connection resources.

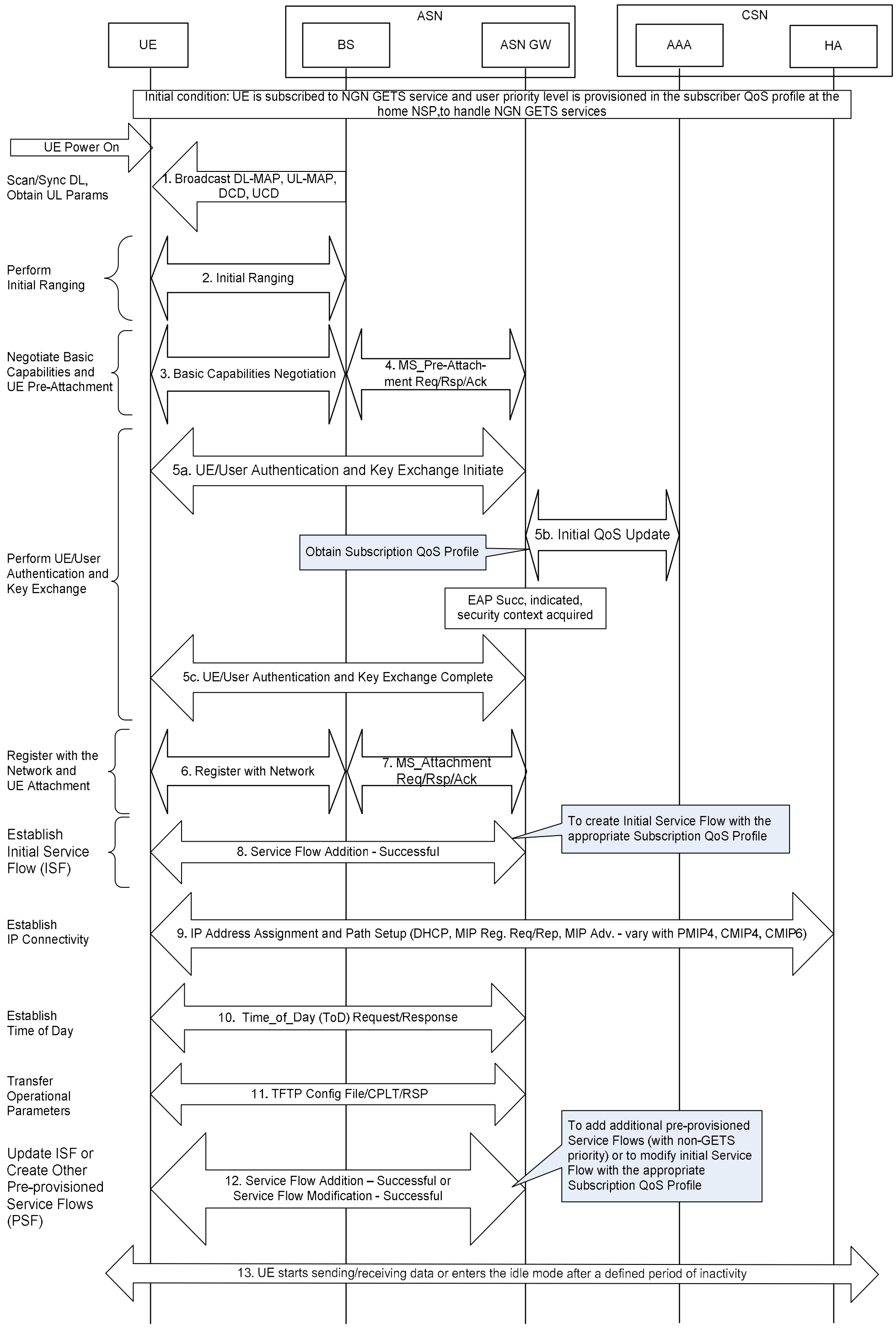

Figure 6-61 – Network Entry Flow with Successful Priority Queueing

The network entry flow is triggered by power-on of a UE in a WiMAX access network.

The following flow assumes that the UE is subscribed to NGN GETS. A summary of this flow, with the changes for NGN GETS, is described as follows:

1. The UE scans for downlink (DL) channel, establish synchronization with the Base Station (BS) [NWG Stage 2] and obtain DL and uplink (UL) parameters as described in Section 6.3.9.1, 6.3.9.2, and 6.3.9.4 of [802.16-2009] respectively.
2. The UE performs initial ranging as described in Section 6.3.9.5 of [802.16-2009].

3. The UE negotiates basic capability as described in step 4 and 6 of Section 4.5.1.1 in [NWG Stage 3].
4. The BS interacts with Access Service Network (ASN) [NWG Stage 2] Gateway (GW) for UE pre-attachment to the network as defined in steps 5, 7 and 8 of Section 4.5.1.1 in [NWG Stage 3].
5. After successful completion of the MS_PreAttachment procedure, the ASN GW initiates the Extensible Authentication Protocol (EAP) authentication procedure (step 5a) with the UE by exchanging the EAP Request/Response message for Identity data which contains the Network Access Identifier (NAI) via the BS. Then, the Initial QoS Update procedure is invoked (step 5b) and the EAP success result is forwarded to the BS which then relays to the UE (step 5c). Additional details are described in steps 9-22 of [NWG Stage 3].
6. Once authentication and key exchange are completed, the UE registers with the network as described in steps 23 and 26 of Section 4.5.1.1 in [NWG Stage 3].
7. The UE registration continues with attachment request to the ASN GW as described in steps 24, 25 and 27 of Section 4.5.1.1 in [NWG Stage 3].
8. After UE attachment (registration) is completed, the ASN GW invokes the Service Flow Addition (see Section 4.6.4 of [NWG Stage 3]) procedure to create the Initial Service Flow (ISF) – the first Pre-provisioned Service Flow (PSF) created for the UE completing the registration step in network entry.
9. The UE then establishes IP connectivity and is allocated an IP address as described in Section 6.3.9.10 of [802.16-2009].
10. The UE exchanges Time of Day (TOD) information with the BS via TOD Request/Response messages as described in Section 6.3.9.11 of [802.16-2009].
11. The UE then performs transfer of operational parameters as described Section 6.3.9.12 of [802.16-2009].
12. The ASN performs the Service Flow Modification (see Section 4.6.4 of [NWG Stage 3]) procedure (to update ISF) or Service Flow Addition (to establish PSF with non-GETS priority).
13. With successful network entry, the UE can start sending/receiving data or enters the idle mode after a defined period of inactivity. The UE exchanges the UL and DL data with entities in the ASN and the Connectivity Service Network (CSN) [Stage 2].

6.3.5.1.1 Relevant NGN GETS Aspect

In network entry, the NGN GETS priority indication is provided by the QoS parameter sets associated with a service flow or a data path from the Subscription QoS Profile. The NGN GETS priority treatment is provided by queuing *DSA-REQ* or *DSC-REQ* messages from a UE subscribed to NGN GETS based on the Priority Indication when no transport connection resources (with requested QoS) is available.

6.3.5.2 NGN GETS Voice/Video Call/session Origination

This section describes the flows associated with successful NGN GETS Voice or NGN GETS Video call/session.

Note that the subflows involving PF (PCRF) in this flow with Diameter AAR, AAA messages as well as Diameter RAR, RAA messages (part of the PCC based dynamic QoS update) are consistent with the policy control subflows using Diameter RAR and RAA messages in Figure 6-1.

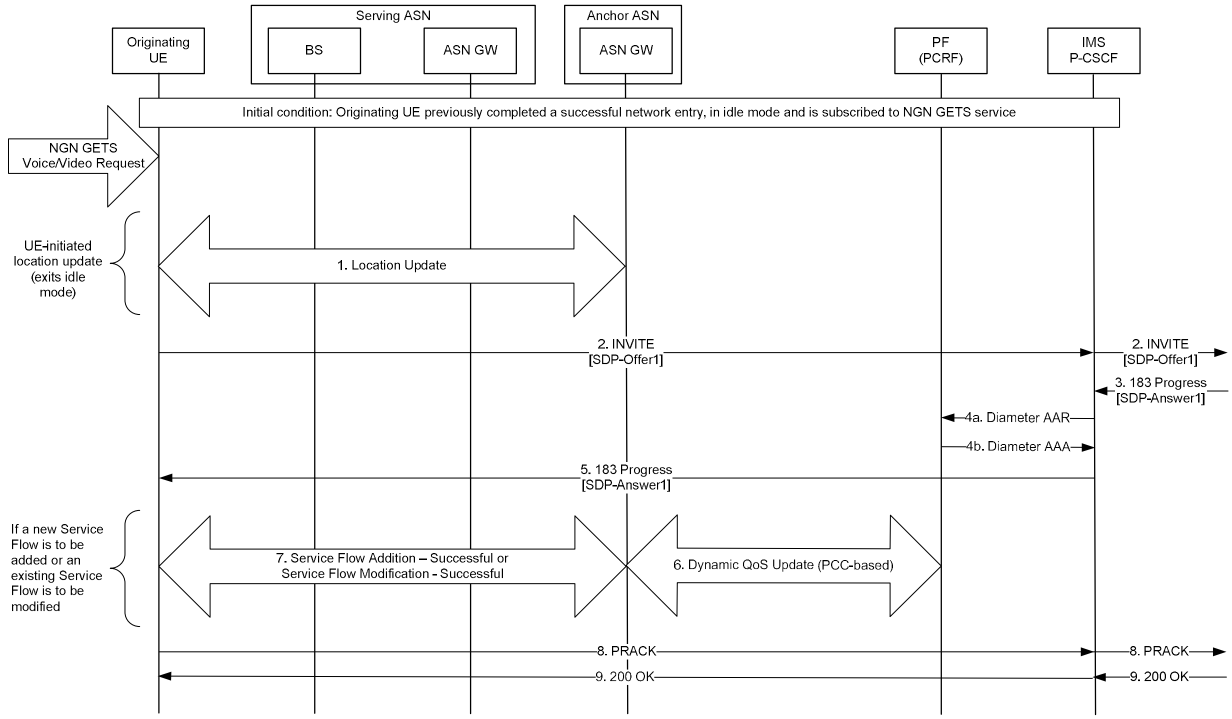

Figure 6-62 – Voice / Video Call / Session Origination – Successful (1 of 2)

The NGN GETS Voice or NGN GETS Video call / session origination assumes that the originating UE has completed network entry procedure to the WiMAX network as described above, has completed SIP [RFC 3261] registration and is associated with an NGN GETS subscription.

A summary of the flow is described below:

1. Location Update procedure is invoked if the UE is not in idle mode.
2. The originating UE sends a SIP *INVITE* message to the P-CSCF [TS 23.228]. The message is carried as Application Layer Data over IP in the ASN and CSN to the P-CSCF. The SIP *INVITE* includes Session Description Protocol (SDP)-Offer1 [TS 24.229] [TS 24.930] from the originating UE.

   The GETS Feature Code (FC)+Directory Number (DN) dialed by the user will be represented in the URI [RFC 3986]. The P-CSCF detects GETS-FC invoked voice call/session origination and applies Resource Priority Header (RPH) [RFC 4412] priority header markings. The SIP RPH will be propagated in all subsequent SIP messages within this SIP dialogue by all the FEs in the IMS Core Network processing the SIP message.

   SIP *100 Trying* and the SIP message flow from the P-CSCF to the AS and back to P-CSCF are covered in the IMS Core Network part.
3. A SIP *183 Progress* message in response to the SIP *INVITE*. The message includes the negotiated SDP parameters from the terminating side in an SDP Answer.
4. The PF /PCRF receives a Diameter [RFC 3588] *AAR* message with priority information and responds with a Diameter *AAA* message. For details on the priority information carried in the AAR message, refer to Clause 6.1.1**.**
5. Upon receipt of the Diameter *AAA* message, the SIP *183 Progress* is sent from the P-CSCF to the originating UE. The message includes the negotiated SDP parameters from the terminating side in an SDP Answer.
6. The PCC based Dynamic QoS Update procedure is invoked.
7. Based on the dynamic QoS procedure invocation, the Anchor ASN GW assigns the Priority Indication and the requested service type to the QoS parameter set. The Service Flow Addition procedure is invoked to create a service flow or the Service Flow Modification procedure is invoked to modify an existing service

flow for conversational voice or video.

8. After receiving SIP *183 Progress*, the originating *UE s*ends a SIP *PRACK* message to the P-CSCF as response to the SIP *183 Progress* message. The SIP *PRACK* message may contain another SDP Offer. The P-CSCF forwards the SIP *PRACK* message to the terminating network.
9. A SIP *200 OK* is received from the terminating network. The P-CSCF forwards the message to the originating UE.

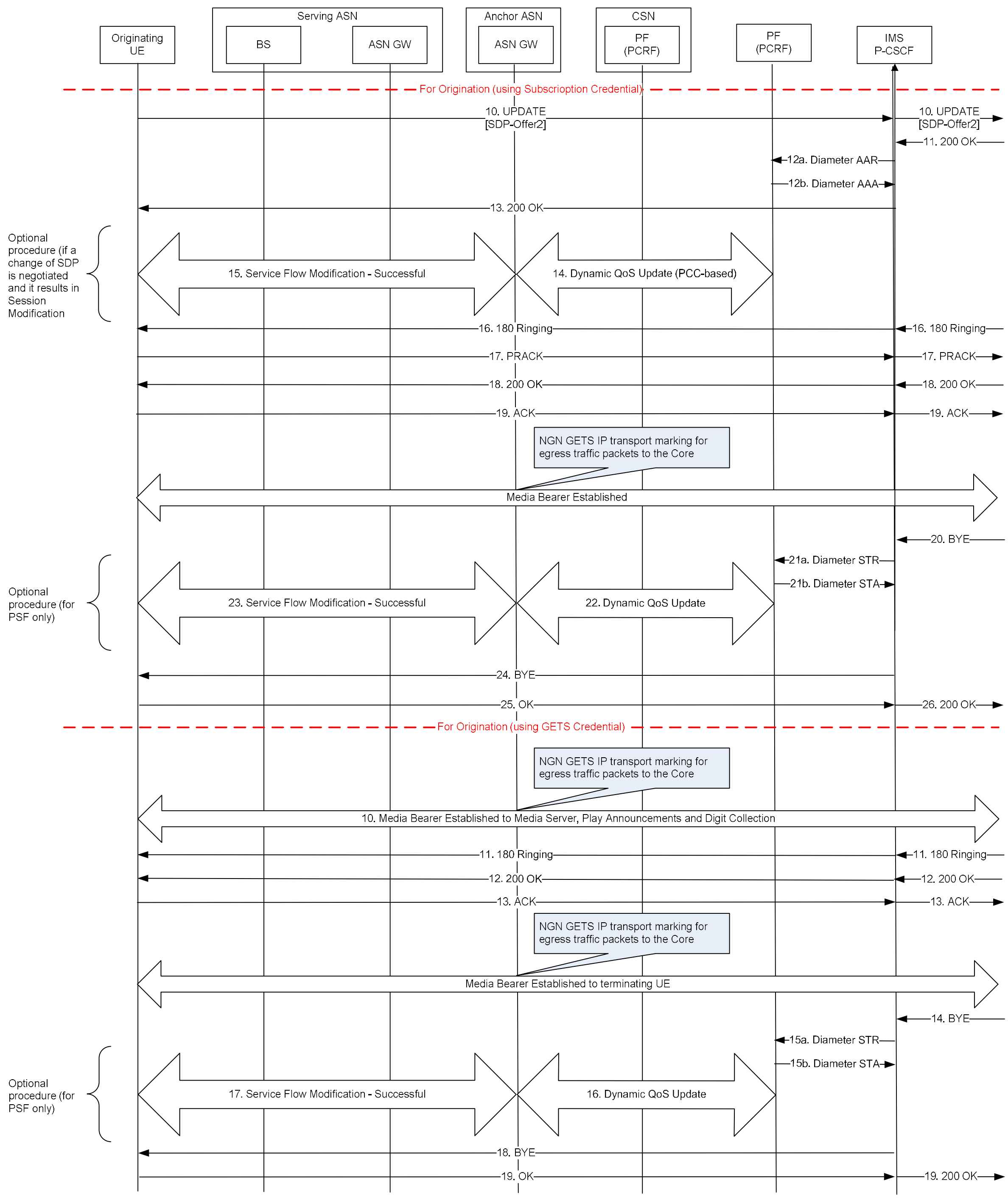

Figure 6-63 – Voice / Video Call / Session Origination – Successful (2 of 2)

For Origination using Subscription Credential,

10. The originating UE sends a SIP *UPDATE* message to the P-CSCF. The SIP *UPDATE* message may include an SDP-Offer2 indicating the resources reserved for the call/session. The P-CSCF forwards the message to the terminating network.
11. A SIP *200 OK* is received from the terminating network.
12. The PF / PCRF receives a Diameter *AAR* message and responds with a Diameter *AAA* message.
13. The P-CSCF forwards the SIP *200 OK* message to the originating UE.
14. The PCC based Dynamic QoS Update procedure is invoked. Based on the dynamic QoS procedure invocation, the Anchor ASN GW assigns the Priority Indication and the requested service type to the QoS parameter set.
15. The Service Flow Addition procedure is invoked to create a service flow or the Service Flow Modification procedure is invoked to modify an existing service flow for conversational voice or video.
16. The terminating network sends a SIP *180 Ringing* to the UE via the P-CSCF.
17. The originating UE generates a SIP *PRACK* message to provisionally acknowledge the receipt of SIP *180 Ringing*. The P-CSCF forwards the message to the terminating network.
18. A SIP *200 OK* is received from the terminating network. The P-CSCF forwards the message to the originating UE.
19. The originating UE responds to the SIP *200 OK* message by sending a SIP *ACK* to the P-CSCF which is forwarded to the terminating network.

    The media bearer is now established for service flow (between the originating UE and the terminating UE) over ASN.

    When the new Service Flow becomes active, its QoS information is stored in the ActiveQoSParamSet [802.16-2009] of the data structure associated with the Service Flow.

    The Anchor ASN GW performs IP transport marking for NGN GETS (e.g., DSCP, MPLS) in the mapping from the media (voice or video) packets for NGN GETS calls/sessions over established media bearer.
20. A SIP *BYE* with an RPH is received at the P-CSCF.

    The P-CSCF sets the QoS information to reflect non-GETS.
21. The PF / PCRF receives a Diameter *STR* message and respond with a Diameter *STA* message.
22. The PCC based procedure is invoked to reset the priority for the PSF previously modified for NGN GETS.
23. Based on the dynamic QoS procedure invocation, the Anchor ASN GW assigns the Priority Indication and the requested service type to the QoS parameter set. The Service Flow Addition procedure is invoked to create a service flow or the Service Flow Modification procedure is invoked to modify an existing service flow for conversational voice or video.
24. The P-CSCF forwards the SIP *BYE* message to the terminating UE.
25. The terminating UE respond with a SIP *200 OK* message to the P-CSCF which in turn forwards the message to the originating network.

For Origination using GETS Credentials,

10. The media bearer is now established for service flow between the UE and the media server for announcements and digits collection.

    The Anchor ASN GW performs IP transport marking for NGN GETS (e.g., DSCP [RFC 2475] [RFC 3260], MPLS[RFC 3031] [RFC 3270]) in the mapping from the media (voice or video) packets for NGN GETS calls/sessions over established media bearer.
11. The terminating network sends a SIP *180 Ringing* to the UE via the P-CSCF.
12. A SIP *200 OK* is received from the terminating network. The P-CSCF forwards the message to the UE.

13. The UE responds to the SIP *200 OK* by sending a SIP *ACK* to the *P-CSCF* which is forwarded to the terminating network.

    The media bearer is now established for service flow (between the originating UE and terminating UE) over the ASN.

    When the new Service Flow becomes active, the associated QoS information is stored in the ActiveQoSParamSet.

    The Anchor ASN GW performs IP transport marking for NGN GETS (e.g., DSCP, MPLS) in the mapping from the media (voice or video) packets for NGN GETS calls/sessions over established media bearer.

14. A SIP *BYE* with an RPH is received at the P-CSCF.

    The P-CSCF sets the QoS information to reflect non-GETS.

15. The PF / PCRF receives a Diameter *STR* message and respond with a Diameter *STA* message.
16. The PCC based dynamic QoS update procedure is invoked to reset the priority for the PSF previously modified for NGN GETS.
17. Based on the dynamic QoS procedure invocation, the Anchor ASN GW assigns the Priority Indication and the requested service type to the QoS parameter set. The Service Flow Addition procedure is invoked to create a service flow or the Service Flow Modification procedure is invoked to modify an existing service flow for conversational voice or video.
18. The P-CSCF forwards the SIP *BYE* message to the originating UE.
19. The originating UE respond with a SIP *200 OK* message to the P-CSCF which in turn forwards the message to the originating network.

6.3.5.2.1 Relevant NGN GETS Aspects

In setting a service flow for a NGN GETS voice/video call / session, the SIP RPH information is sent in the SIP INVITE message from the originating UE to the originating P-CSCF, propagated into the IMS Core Network, and kept in the PF/PCRF. The PCRF then invokes the PCC based dynamic QoS update procedure with the ASN GW, which then invokes the service flow addition/modification procedure with the BS. Priority indication and treatment for the service flow addition/modification procedure is detailed in Section 6.3.5.4 and for the PCC based dynamic QoS update procedure is detailed in Section 6.3.5.5.

After the connection between the originating UE and core network is established, the originating Anchor ASN GW performs IP transport marking (e.g., DSCP, MPLS) for NGN GETS media (voice or video) packets over established media bearer.

6.3.5.3 NGN GETS Voice/Video Call/Session Termination

This section describes the flow associated with a successful NGN GETS Voice or NGN GETS Video call/session termination.

Note that the subflows involving PF (PCRF) in this flow with Diameter *AAR*, *AAA* messages, as well as, Diameter *RAR*, *RAA* messages (part of the PCC based dynamic QoS update) are consistent with the policy control subflows using Diameter *RAR* and *RAA* messages in Figure 6-39.

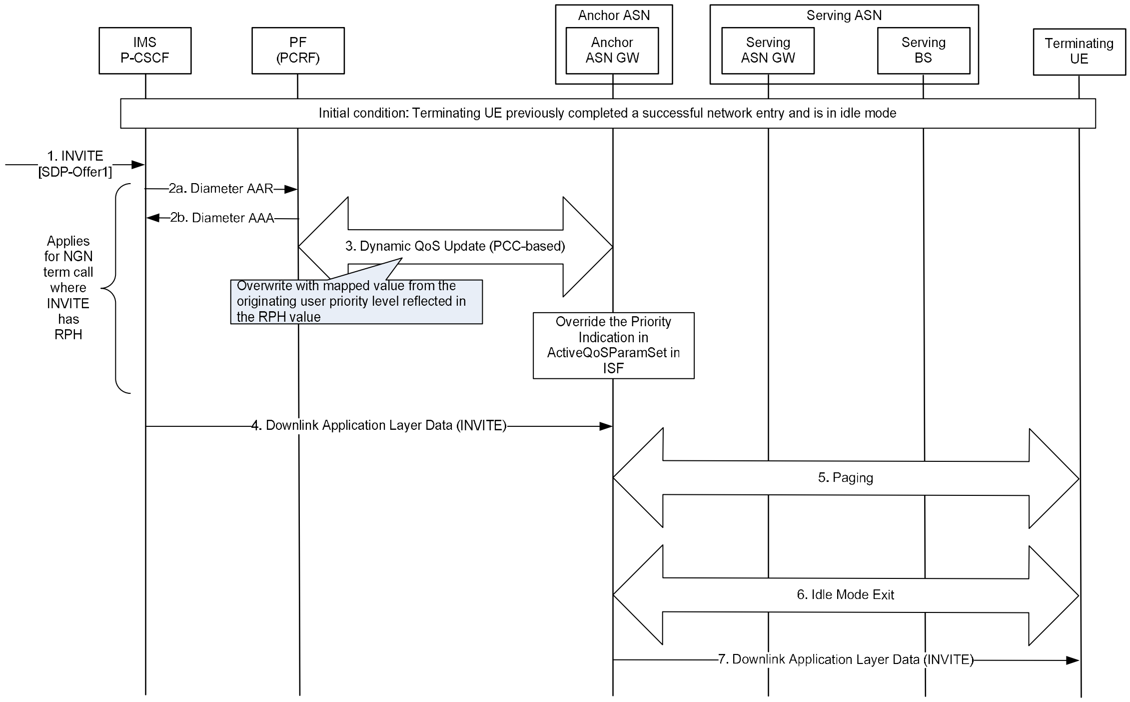

Figure 6-64 – Voice / Video Call/session Termination – Successful (1 of 4)

The NGN GETS Voice or NGN GETS Video call / session termination assumes that the terminating UE has completed network entry procedure to the WiMAX network as described in Section 4.5.1 of [NWG Stage 3] and has completed SIP registration.

1. A SIP *INVITE* with an RPH is received at the P-CSCF.

   The P-CSCF overwrites the QoS information associated with the terminating UE with the mapped value from the RPH resource values.

2. The PF / PCRF receives a Diameter *AAR* message and responds with a Diameter *AAA* message.
3. The PCC based Dynamic QoS Update procedure is invoked.

   The ASN GW updates the ActiveQoSParamSet for the ISF associated with the terminating UE.

4. The P-CSCF forwards the Downlink Application Layer Data of the SIP *INVITE* to the Anchor ASN GW.
5. The Anchor ASN GW invokes the Paging procedure for conversational voice or video.
6. If the terminating UE is in idle mode, the Anchor ASN GW invokes the Idle Mode Exit procedure.
7. When paging and idle mode exit procedures are complete, the Anchor ASN GW forwards the Downlink Application Layer Data of the SIP *INVITE* to the terminating UE.

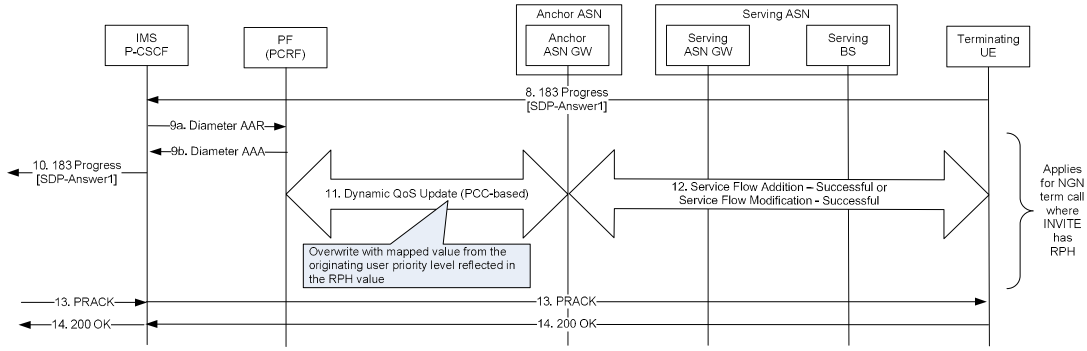

Figure 6-65 – Voice / Video Call/session Termination – Successful (2 of 4)

8. The terminating UE responds to the SIP *INVITE* with SIP *183 Progress* to the P-CSCF which includes the negotiated SDP parameters from the terminating side in an SDP Answer.

   The P-CSCF overwrites the QoS information associated with the terminating UE with the mapped value from the RPH resource values.

9. The PF / PCRF receives a Diameter *AAR* message and responds with a Diameter *AAA* message.
10. The P-CSCF forwards the SIP *183 Progress* message from the terminating side.
11. The PCC based Dynamic QoS update procedure is invoked.
12. Based on the dynamic QoS procedure invocation, the Anchor ASN GW assigns the Priority Indication and the requested service type to the QoS parameter set. The Service Flow Addition procedure is invoked to create a service flow or the Service Flow Modification procedure is invoked to modify an existing service flow for conversational voice or video.
13. The originating network responds with a SIP *PRACK.* The P-CSCF forwards the SIP *PRACK* message to the terminating network.
14. The terminating UE sends a SIP *200 OK* to the originating network via the P-CSCF.

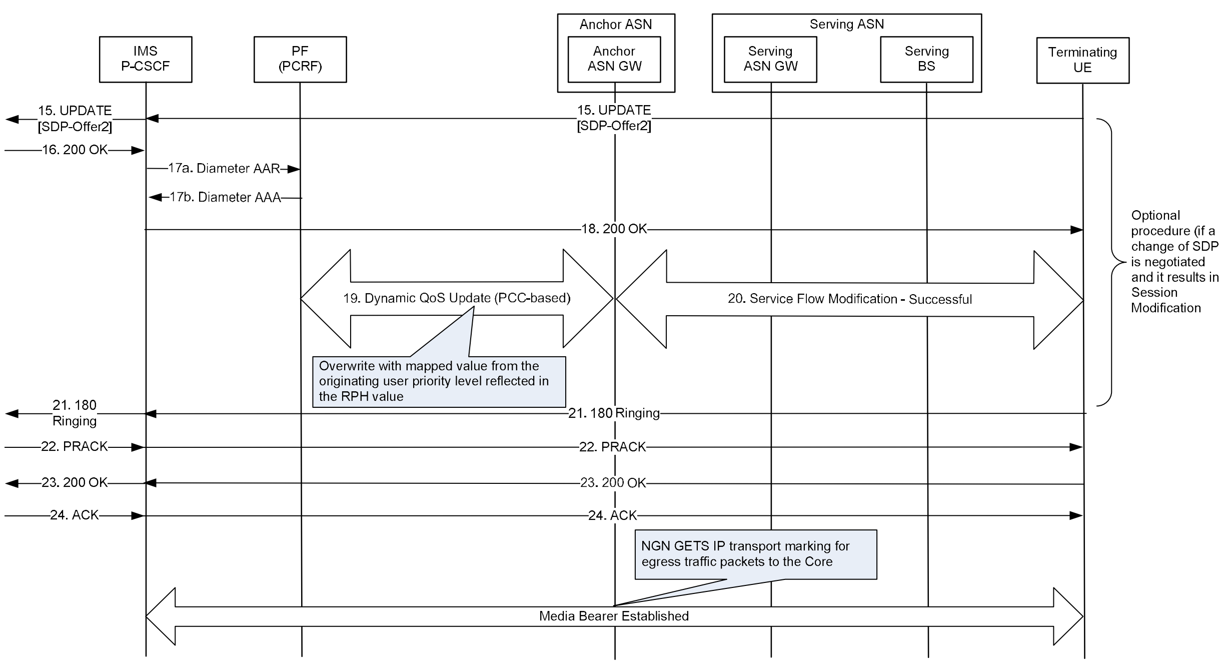

Figure 6-66 – Voice / Video Call/session Termination – Successful (3 of 4)

15. The terminating UE sends a SIP *UPDATE* message to the P-CSCF. The P-CSCF forwards the message to the originating network.

    The P-CSCF overwrites the QoS information associated with the terminating UE with the mapped value from the RPH resource values.

16. A SIP *200 OK* message is received from the originating network.
17. The PF / PCRF receives a Diameter *AAR* message and responds with a Diameter *AAA* message.
18. The P-CSCF forwards the SIP *200 OK* message to the terminating UE.
19. The PCC based Dynamic QoS update procedure (Section 6.3.5.5 later in this document) is invoked.
20. Based on the dynamic QoS procedure invocation, the Anchor ASN GW assigns the Priority Indication and the requested service type to the QoS parameter set. The Service Flow Modification procedure (Section 6.3.5.4 later in this document) is invoked to modify an existing service flow for conversational voice or video.
21. The terminating network sends a SIP *180 Ringing* to the originating UE via the P-CSCF.
22. The originating network responds with a SIP *PRACK* message to provisionally acknowledge the receipt of SIP *180 Ringing*. The P-CSCF forwards the message to the terminating UE.
23. The terminating UE sends a SIP *200 OK* message to the originating network via the P-CSCF.
24. The originating network responds with a SIP *ACK.* The P-CSCF forwards the SIP *ACK* to the terminating UE.

    The media bearer is now established for service flow (between the originating UE and the terminating UE) over ASN.

    When the new Service Flow becomes active, the session QoS information is stored in the ActiveQoSParamSet for the service flow.

    The Anchor ASN GW performs IP transport marking for NGN GETS (e.g., DSCP, MPLS) in the mapping from the media (voice or video) packets over WiMAX into the IP packets with DSCP for NGN GETS sessions over established media bearer.

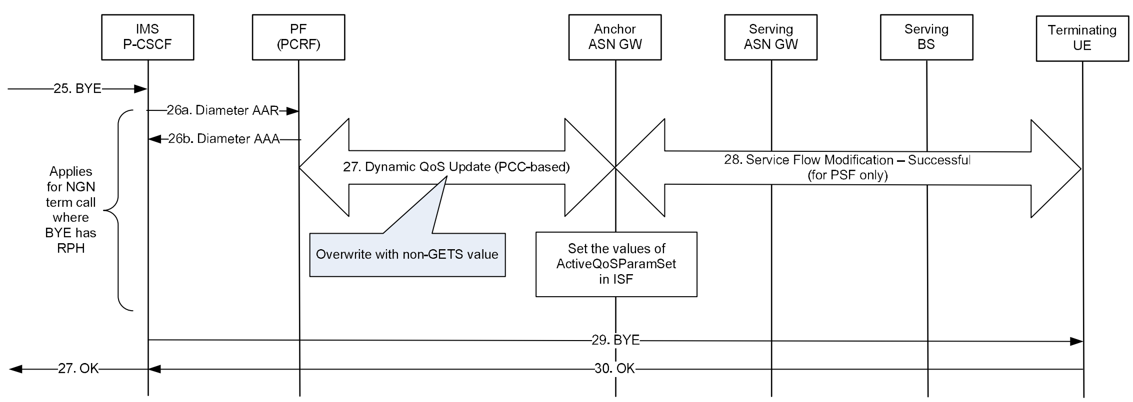

Figure 6-67 – Voice / Video Termination Call/session – Successful (4 of 4)

25. A SIP *BYE* with RPH is received at the P-CSCF.

    The P-CSCF sets the QoS information to reflect non-GETS.

26. The PF / PCRF receives a Diameter *AAR* message and responds with a Diameter *AAA* message.
27. The PCC based Dynamic QoS Update procedure is invoked.

    When non-GETS value is received and the ActiveQoSParamSet has priority indicated, the ASN GW sets the values in the ActiveQoSParamSet for the ISF associated with the terminating UE.

28. Based on the dynamic QoS procedure invocation, the Anchor ASN GW assigns the Priority Indication and

the requested service type to the QoS parameter set. The Service Flow Modification procedure is invoked to modify an existing service flow for conversational voice or video.

29. The P-CSCF forwards the SIP *BYE* message to the terminating UE.

The terminating UE respond with a SIP *200 OK* message to the P-CSCF which in turn forwards the message to the originating network.

6.3.5.3.1 Relevant NGN GETS Aspects

When the terminating P-CSCF receives a SIP *INVITE* with an RPH, the P-CSCF sends a Diameter *AAR* message to the PF/PCRF, which then overwrites the QoS information associated with the terminating UE with the mapped value from the RPH resource values in the Anchor ASN GW using the PCC based dynamic QoS update procedure detailed in Section 6.3.5.5 to set up paging priority.

Upon arrival of application layer data ("SIP *INVITE*") destined to the terminating UE, the Anchor ASN GW invokes a paging procedure with the Serving ASN GW, Serving BS, and UE at the terminating side if the terminating UE is in idle mode. Priority indication and treatment for the paging procedure is detailed in Section 6.3.5.6.

When paging and idle mode exit completes, the Anchor ASN GW forwards the Downlink Application Layer Data of the SIP *INVITE* to the terminating UE. The terminating UE responds to the SIP *INVITE* with SIP *183 Progress* to the terminating P-CSCF, which includes the negotiated SDP parameters from the terminating side in an SDP Answer. The P-CSCF overwrites the QoS information associated with the terminating UE with the mapped value from the RPH resource values for setting up a connection for voice/video call/session.

The P-CSCF sends the Diameter *AAR* message to the PF/PCRF, which then invokes the PCC based Dynamic QoS update procedure (detailed in Section 6.3.5.5) to overwrite the Priority Indication and the requested service type of the QoS parameter set with those of the originating side in the terminating Anchor ASN GW. The Anchor ASN GW uses the overwritten QoS parameter set to create or modify service flow(s) using the service flow addition/modification procedure (detailed in Section 6.3.5.4) for the voice/video call/session at the terminating side.

After the connection between the terminating UE and core network is established, the terminating Anchor ASN GW performs IP transport marking (e.g., DSCP, MPLS) for NGN GETS media (voice or video) packets over established media bearer.

When a SIP *BYE* with an RPH (call/session termination) is received at the P-CSCF, the P-CSCF sends the Diameter *AAR* message to the PF/PCRF, which then invokes the PCC based dynamic QoS update procedure (detailed in Section 6.3.5.5) to overwrite the Priority Indication and the requested service type of the QoS parameter set to reflect non-NGN-GETS in the terminating Anchor ASN GW. When non-GETS value is received and the ActiveQoSParamSet has priority indicated, the ASN GW sets the values in the ActiveQoSParamSet for the ISF associated with the terminating UE. The ASN GW then invokes the service flow modification procedure (detailed in Section 6.3.5.4) to reset the existing PSFs to the user priority level before promoted by the NGN GETS call / session.

6.3.5.4 Service Flow Addition and Modification

This section describes the service flow addition and modification procedures with successful queuing of messages for the transport connection resources.

The following is the service flow addition procedure with successful queuing.

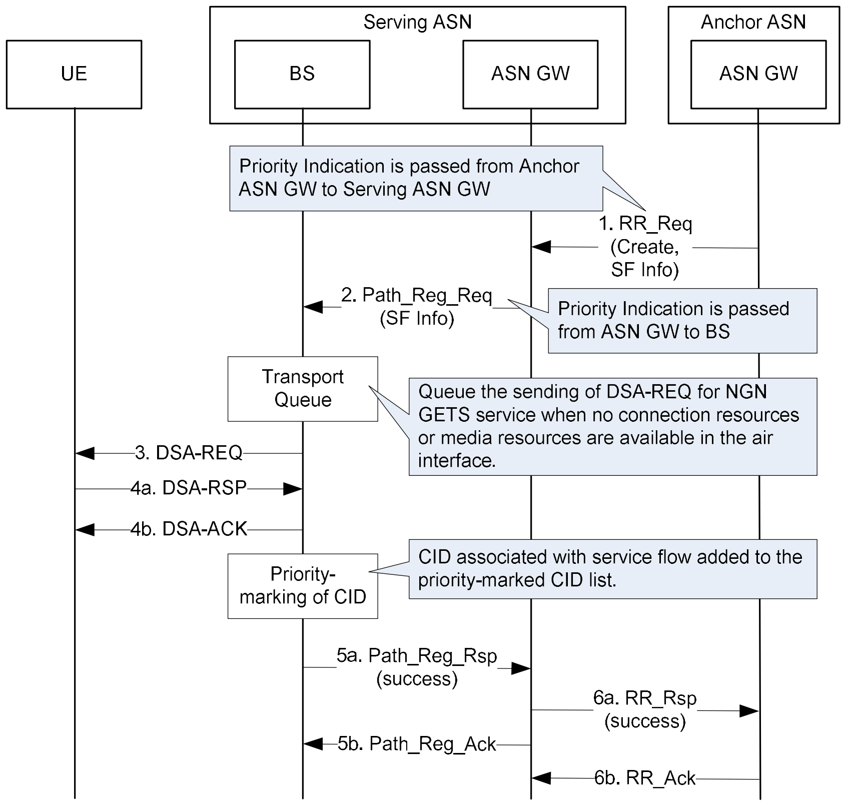

Figure 6-68 – Service Flow Addition - Successful

A summary of the successful addition of a service flow is described as follows:

1. The Anchor ASN GW sends an *RR_Req* (which includes the Priority Indication in the SF Info) to the Serving ASN GW to create a new service flow.

   The Anchor ASN GW will forward the RR_Req to the Serving ASN GW even if the aggregate bearer resource information indicates congestion at the Serving BS.

2. The Serving ASN GW determines that a new data path is to be created and sends a *Path_Reg_Req* which contains the same SF Info from *RR_Req* to the Serving BS.

   When there is no transport connection or media bearer resource available in the air interface, the Serving BS will attempt to place the new DSA-REQ message in the Transport Queue and to start a corresponding instance of $T_{qtransport}$ timer. The Serving BS may bump a previously queued message in the Transport Queue of lower priority if the queue is full.

3. The Serving BS sends *DSA-REQ* to the UE.

   The DSA-REQ is served from the Transport Queue when connection resources and the resource meeting the QoS requirement of the DSA-REQ become available in the Serving BS. Then, the corresponding timer instance of $T_{qtransport}$, is ended.

4. The originating UE responds to the Serving BS with *DSA-RSP* which is subsequently acknowledged with *DSA-ACK*.

   The QoS information is stored in the QoS Parameter Set for the newly created service flow with the appropriate Data Delivery Service (DDS) (e.g., Unsolicited Grant Service (UGS), Enhanced Real Time Variable Rate (eRT-VR) or Real Time Variable Rate (RT-VR)). When the Service Flow is successfully added to serve the NGN GETS service request, the associated Connection ID (CID) is added to the priority-marked CID list. All R1 messages with the associated CID will be treated with priority scheduling henceforth.

5. The Serving BS sends indication of successful creation of a new data path in the *Path_Reg_Rsp* message to the Serving ASN GW. The Serving ASN GW acknowledges with a *Path_Reg_Ack* message.
6. The Serving ASN GW forwards the indication of successful creation of a new service flow to the Anchor ASN GW in the *RR_Rsp* message. The Anchor ASN GW acknowledges with an *RR_Ack* message.

The following is the service flow modification procedure with successful queuing.

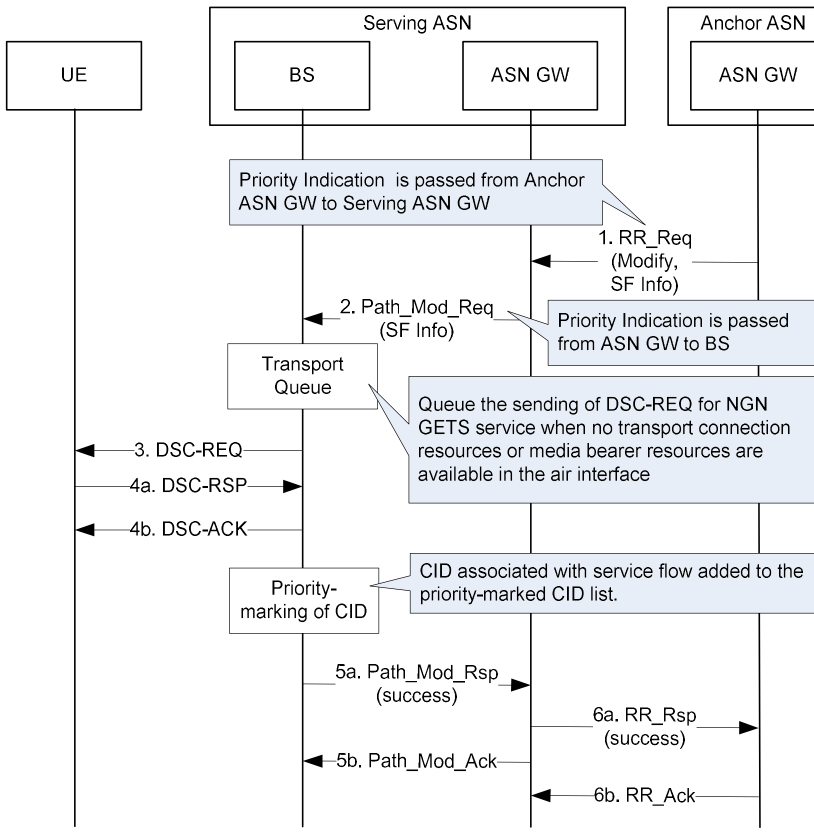

Figure 6-69 – Service Flow Modification – Successful

A summary of the successful modification of service flow is described as follows:

1. The Anchor ASN GW sends an *RR_Req* (which includes the Priority Indication in the SF Info) to the Serving ASN GW to modify existing service flow.

   The Anchor ASN GW will forward the RR_Req to the Serving ASN GW even if the aggregate bearer resource information indicates congestion at the Serving BS.

2. The Serving ASN GW determines that the existing data path is to be modified and sends a *Path_Modification_Req* which contains the same SF Info from *RR_Req* to the Serving BS.

   When there is no transport connection or media bearer resource available in the air interface, the Serving BS will attempt to place the new DSC-REQ message in the Transport Queue and to start a corresponding instance of $T_{qtransport}$ timer. The Serving BS may bump a previously queued message in the Transport Queue of lower priority if the queue is full.

3. The Serving BS sends *DSC-REQ* to the UE.

   The DSC-REQ is served from the Transport Queue when connection resources and the resource meeting the QoS requirement of the DSC-REQ become available in the Serving BS. Then, the corresponding timer instance of $T_{qtransport}$, is ended.

4. The originating UE responds to the Serving BS with *DSC-RSP* which is subsequently acknowledged with

DSC-ACK.

The QoS information is stored in the QoS Parameter Set for the modified service flow with the appropriate DDS (e.g., UGS, eRT-VR or RT-VR). When the Service Flow is successfully modified to serve the NGN GETS service request, the associated CID is added to the priority-marked CID list. All R1 messages with the associated CID will be treated with priority scheduling henceforth.

5. The Serving BS sends an indication of successful modification of the new data path in the *Path_Modification_Rsp* message to the Serving ASN GW. The Serving ASN GW acknowledges with a *Path_Modification_Ack* message.
6. The Serving ASN GW forwards the indication of successful modification of the service flow to the Anchor ASN GW in the *RR_Rsp* message. The Anchor ASN GW acknowledges with an *RR_Ack* message.

6.3.5.4.1 Relevant NGN GETS Aspects

The Anchor ASN GW sends the *RR_Req* message containing the “add or modify” flag as well as the Priority Indication and DDS type in the SF Info parameter structure to the Serving ASN GW. The *RR_Req* message is sent even if the aggregate bearer resource information indicates congestion at the Serving BS. The Serving ASN GW extracts the SF Info from the received *RR_Req* message and forwards it in a *Path_Reg_Req* (for “add” flag) or *Path_Modification_Req* message (for “modify” flag) to the Serving BS.

The Serving BS retrieves the Priority Indication from the QoS parameter set of a Path_Reg_Req message for service flow addition or a Path_Modification_Req message for service flow modification that is sent from the ASN and applies priority treatment by queuing DSA-REQ or DSC-REQ messages based on the Priority Indication during resource shortage. After a DSA-REQ or DSC-REQ is served from queue, the Serving BS sends *DSA-REQ* to the UE and the corresponding queue timer instance is ended. When the new Service Flow is successfully added or changed, the Serving BS adds or changes the associated CID to the priority-marked CID list. All R1 messages with the associated CID are handled with priority scheduling henceforth.

6.3.5.5 PCC Based Dynamic QoS Update

This section describes the dynamic QoS update procedure to ASN GW using 3GPP-based PCC [TS 23.203]. This procedure is the same as the policy control subflows using Diameter RAR and RAA messages in Figure 6-39.

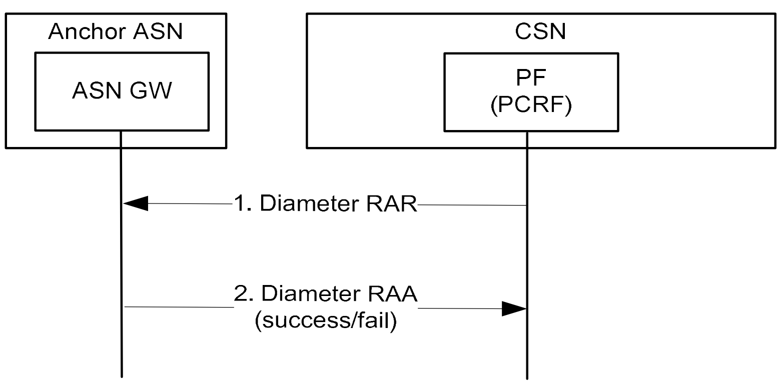

Figure 6-70 – PCC-Based Dyanmic QoS Update

A summary of the PCC based dynamic QoS update procedure is described as follows:

1. The PF forwards the derived session information in a Diameter *RAR* message to the Anchor ASN GW, via the Gxa [TS 29.212] interface, requesting the Anchor ASN GW to install or modify the PCC rules and to update the policy decision.

The Diameter RAR message shall include Attribute Value Pairs (AVPs) containing service type and QoS information (e.g., QoS-Class-Identifier AVP, Allocation-Resource-Priority AVP) with an event trigger for successful resource allocation.

2. The Anchor ASN GW responds with a Diameter *RAA* message to the PF via the Gxa interface.

6.3.5.5.1 Relevant NGN GETS Aspects

The PDF performs QoS and priority related mapping between the 3GPP Release 9 Gxa interface (containing QCI and ARP AVPs). The ASN GW performs the mapping between the priority parameter in the Gxa interface and the Priority Indication field in the SF Info used in the ASN.

6.3.5.6 Paging

This section describes the Paging procedure referenced in Figure 6-64 with successful queuing of the MOB_PAG-ADV message. The MOB_PAG-ADV is an R1 reference point message to advertise paging to UE.

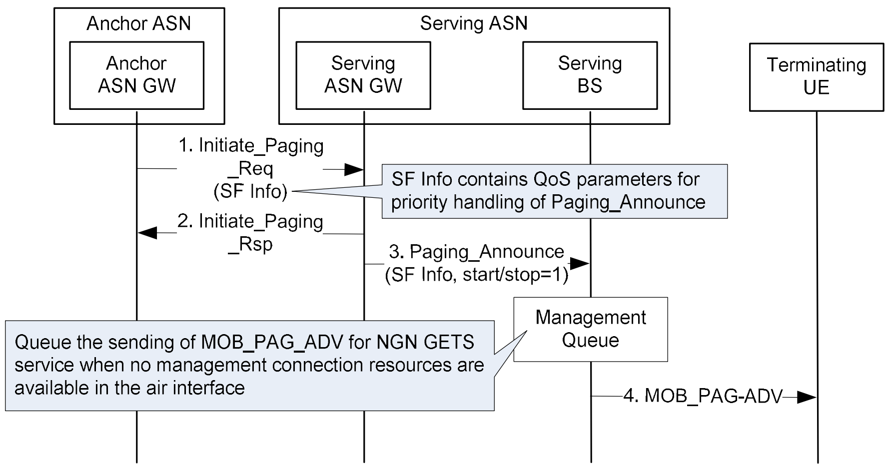

Figure 6-71 – Paging

A summary of the successful paging is described as follows:

1. When the terminating UE is in idle mode, the Anchor ASN GW sends *Initiate_Paging_Req* to the Serving ASN GW.
   The Anchor ASN GW passes the Priority Indication in the SF Info (associated with the ISF of the terminating UE).
2. The Serving ASN GW responds to the Anchor ASN GW with *Initiate_Paging_Rsp*.
3. The Serving ASN GW then initiate paging to the Serving BS by sending *Paging_Announce* (with start / stop=1 and SF Info from *Initiate_Paging_Req*).
   The SF Info (associated with the ISF of the terminating UE) contains the user level priority that is overwritten with the originating Priority Indication.
4. The Serving BS then pages the terminating UE by sending *MOB_PAG-ADV* with action code 0b10 (Enter Network).
   When there is no management connection available in the air interface, the Serving BS will attempt to place the new MOB_PAG-ADV message in the Management Queue (ordered by Priority Indication) and a corresponding instance of T_{qmgmt} timer is started. The Serving BS may bump a previously queued message in the Management Queue of lower priority if the queue is full.
5. The Serving BS sends *MOB_PAG-ADV* to the UE.

The MOB_PAG-ADV is served from the Management Queue when connection resources become available in the Serving BS. Then, the corresponding timer instance of T_{qmgmt} is ended.

6.3.5.6.1 Relevant NGN GETS Aspects

The Initiate_Paging_Req message from the Anchor ASN GW to the Serving ASN GW contains Priority Indication in the SF Info parameter structure. The Serving ASN GW then sends a Paging_Announce message to the Serving BS with Priority Indication in the SF Info parameter structure also.

The BS applies priority treatment by queuing MOB_PAG-ADV messages based on the Priority Indication during resource shortage for management connections and sends a MOB_PAG-ADV message to the terminating UE after a MOB_PAG-ADV is de-queued.