

3GPP2 S.R0124-0

Version Date: June 2009

Version 2.0



3RD GENERATION  
PARTNERSHIP  
PROJECT 2  
"3GPP2"

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## ***Ultra Mobile Broadband Network Architecture Model***

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## REVISION HISTORY

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<b>Revision</b>	<b>Description</b>	<b>Date</b>
S.R0124-0 v1.0	Initial publication	April 2008
S.R0124-0 v2.0	per accepted contributions: S20-20080721-056A, S20-20081027-005Ar1, S20-20081027-056.	June 2009

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## SCOPE

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This document provides the Network Architecture Model (NAM) for the Ultra Mobile Broadband (UMB) system.

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# 1 PURPOSE

This document provides the Network Architecture Model (NAM) for the Ultra Mobile Broadband™ (UMB™)<sup>1</sup> system. The NAM supports the requirements in S.R0121 [1] and the Phase II requirements in S.R0113 [2].

The UMB system provides an additional Access Network (AN) to the overall architecture document in the All-IP NAM [3]. Except as documented in this document, all reference points and network entities in [3] are hereby incorporated by reference. Note: If not explained in this document, then refer to All-IP NAM [3].

This document was developed in conjunction with the network reference model of X.S0054-000-A [4] and TSG-X updates.

## 1.1 References

### 1.1.1 Informative References

- [1] 3GPP2 S.R0121-0 v1.0, *Network Evolution for cdma2000 Networks – System Requirements Document*, May 2007.
- [2] 3GPP2 S.R0113-0 v2.0, *cdma2000 Enhanced Packet Data Air Interface System – System Requirements Document*, May 2007.
- [3] 3GPP2 S.R0037-B v2.0, *IP Network Architecture Model for cdma2000 Spread Spectrum Systems*, June 2009.
- [4] 3GPP2 X.S0054-000-A v1.0, *CAN Wireless IP Network Overview and List of Parts*, August 2008.
- [5] IETF RFC5213, *Proxy Mobile IPv6*, August 2008.

## 1.2 Acronyms

AAA	Authentication, Authorization and Accounting
AGW	Access Gateway
AN	Access Network
AS	Application Server
AT	Access Terminal
BCMCS	Broadcast-Multicast Service
BGCF	Breakout Gateway Control Function
BR	Border Router
BSC	Base Station Controller
BTS	Base Transceiver System
CAN	Converged Access Network

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<sup>1</sup> Ultra Mobile Broadband™ and (UMB™) are trade and service marks owned by the CDMA Development Group (CDG).

		1
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CDG	CDMA Development Group	3
CDMA	Code Division Multiple Access	4
CMIP	Client Mobile Internet Protocol	5
CSCF	Call Session Control Function	6
DB	Database	7
DSI	Dynamic Subscriber Information	8
eBS	Evolved Base Station	9
ePDIF	Evolved Packet Data Interworking Function	10
EIR	Equipment Identity Register	11
EML	Element Management Layer	12
HA	Home Agent	13
HLRe	Home Location Register Emulation	14
HRPD	High Rate Packet Data	15
HRPD-AN	High Rate Packet Data Access Network	16
HSS	Home Subscriber Server	17
IMS	IP Multimedia Subsystem	18
IP	Internet Protocol	19
LMA	Local Mobility Anchor	20
LMSDS	Legacy Mobile Station Domain Support	21
LTE	Long Term Evolution	22
MGCF	Media Gateway Control Function	23
MGW	Media Gateway	24
MM	Mobility Manager	25
MMD	Multimedia Domain	26
M-NE	Managed-Network Entity	27
MRFC	Media Resource Function Controller	28
MRFP	Media Resource Function Processor	29
MS	Mobile Station	30
MSCe	Mobile Switching Center Emulation	31
NAM	Network Architecture Model	32
NML	Network Management Layer	33
OSA	Open Service Access	34
OSF	Operations Systems Function	35
OSS	Operations Support System	36
PCC	Policy and Charging Control	37
PCF	Packet Control Function	38
PCRF	Policy and Charging Rules Function	39
PDE	Position Determining Entity	40
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PDSN	Packet Data Service Node
PMIP	Proxy Mobile Internet Protocol
PSTN	Public Switched Telephone Network
QoS	Quality of Service
RLP	Radio Link Protocol
RNC	Radio Network Controller
SAE	System Architecture Evolution
SCPe	Service Control Point Emulation
SGW	Signaling Gateway
SIP	Session Initiation Protocol
SMS-GW	Short Message Service Gateway
SRNC	Session Reference Network Controller
UMB	Ultra Mobile Broadband
UMB-AN	Ultra Mobile Broadband Access Network
VAAA	Visiting Authentication, Authorization and Accounting Server
VCC AS	Voice Call Continuity Applications Server

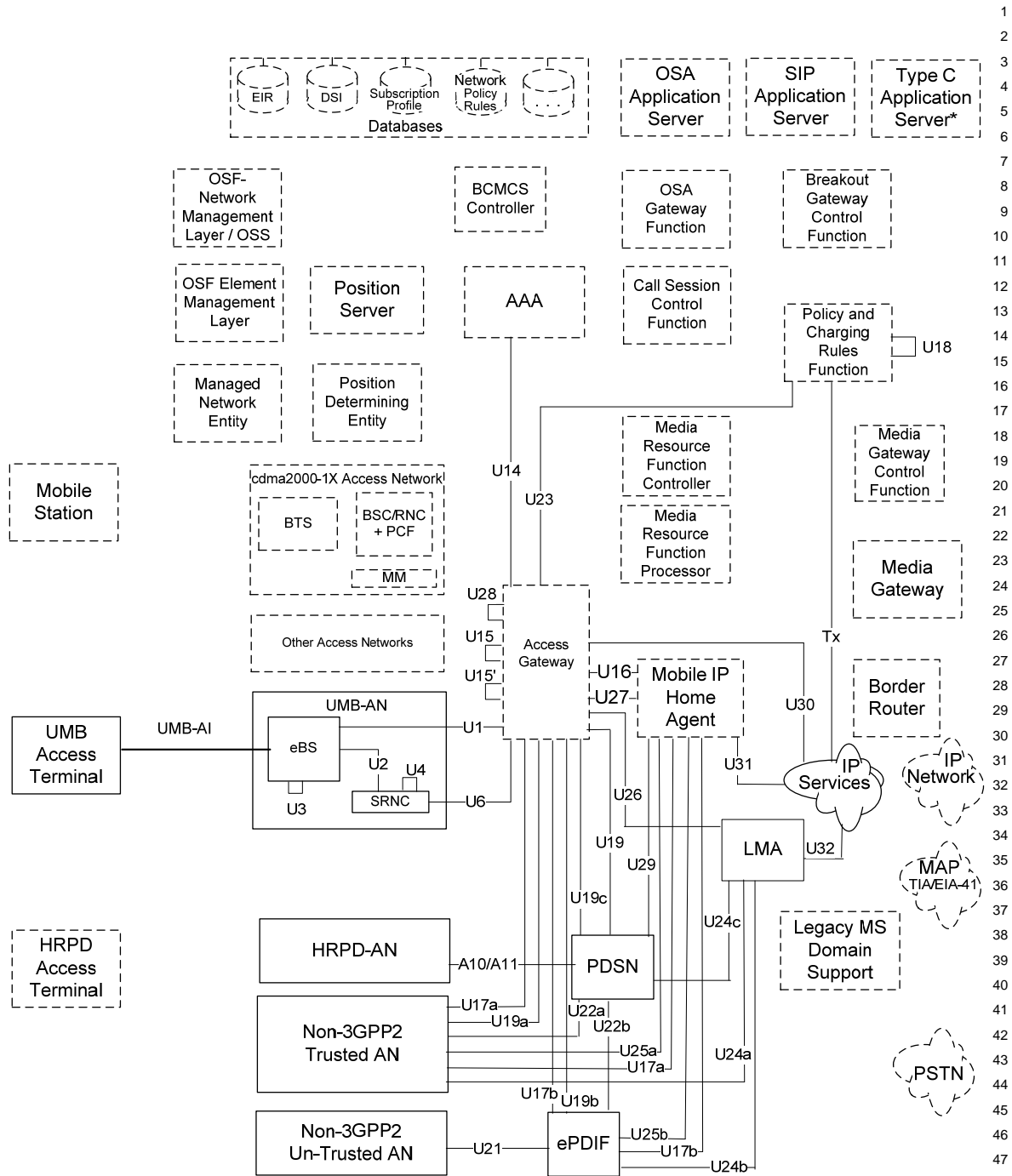
## 2 ARCHITECTURE MODELS

### 2.1 3GPP2 UMB Network Architecture Model

Figure 2.1-1 presents the network entities and associated reference points that comprise an Internet Protocol (IP)-based evolved network architecture model for the UMB system.

The styles of lines and rectangles used in Figure 2.1-1 are:

Dashed Rectangle	Network Entity or group of entities defined in the All IP NAM [3]
Dashed Cloud	Network defined in [3]
Solid Line	Reference Point defined in this document.
Solid Rectangle	Network Entity or group of entities defined in this document.
Solid Cloud	Network defined in this document.



**Figure 2.1-1 UMB System Network Architecture Model**

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The NAM should be interpreted as follows:

- a. The network entities are functional representations.
- b. A network entity represents a group of functions, not necessarily a physical device. The physical realization of a network entity is an implementation issue. A manufacturer may choose any physical implementation of network entities, either individually or in combination, as long as the implementation meets the functional requirements. Sometimes, for practical specifications reasons, the functional network entity is interpreted as a physical device.
- c. A reference point is a conceptual point that divides two groups of functions. It is not necessarily a physical interface. One or more interfaces may be defined to support each reference point.
- d. Each reference point corresponds to at least one standardized interface.
- e. An interface is comprised of a standardized set of procedures, messages, and protocols. Interface specification is beyond the scope of this document.
- f. A “Collective Entity” contains encompassed network entities that are an instance of the collective (e.g., UMB Access Network).

## **2.2 Network Entities**

### **2.2.1 Access Gateway (AGW)**

The Access Gateway (AGW) is an entity that provides the user’s “point of IP connectivity” to the network. That is, the AGW is in effect the first-hop router for the mobile terminal. The AGW performs layer 3 services and above, including hot-lining, accounting, policy enforcement, etc.

Additional information regarding the AGW, IP Multimedia Domain, Legacy MS Domain, and Broadcast/Multicast Service (BCMCS) is contained in [3].

A split AGW configuration separates the AGW into a Serving-AGW (srv-AGW) and an Anchor-AGW (anc-AGW).

### **2.2.2 Access Network**

The Access Network is a network component that may support both the Multimedia and Legacy MS Domains.

The access network may perform mobility management functions for registering, authorizing, authenticating and paging IP based terminals, independent of circuit based terminals. The access network may perform handoffs within an access

network and between access networks of the same technology and may support handoffs between access networks of differing technologies.

### **2.2.2.1 cdma2000 Access Network**

The cdma2000 1X Access Network and the HRPD AN are known as the cdma2000<sup>®2</sup> Access Network contained in [3].

#### **2.2.2.1.1 cdma2000 1X Access Network**

The cdma2000 1X access network contains the Base Transceiver System (BTS), Base Station Controller (BSC), Radio Network Controller (RNC), Mobility Manager (MM), and the Packet Control Function (PCF).

#### **2.2.2.1.2 High-Rate Packet Data Access Network (HRPD-AN)**

The HRPD-AN is a node in the HRPD legacy packet data network.

### **2.2.2.2 Other Access Networks**

The Other Access Network is defined in [3].

### **2.2.2.3 UMB Access Network**

The UMB access network is group of network entities consisting of eBSs and SRNCs.

#### **2.2.2.3.1 Evolved Base Station (eBS)**

The Evolved Base Station (eBS) provides the over-the-air signaling and user data transport that is used by the Access Terminal (AT) for connectivity to the radio access network.

The functions of the eBS include:

- Over-the-air transmission of packets
- Encryption/decryption of packets at the Radio Link Protocol (RLP) level for over-the-air transmission/reception.
- Scheduling for over-the-air transmission
- Policy enforcement for over-the-air transport.
- Header Compression

#### **2.2.2.3.2 Session Reference Network Controller (SRNC)**

This functional entity is responsible for maintaining radio access specific information for the AT in the UMB radio converged access network. The SRNC

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<sup>2</sup> cdma2000<sup>®</sup> is the trademark for the technical nomenclature for certain specifications and standards of the Organizational Partners (OPs) of 3GPP2. Geographically (and as of the date of publication), cdma2000<sup>®</sup> is a registered trademark of the Telecommunications Industry Association (TIA-USA) in the United States.

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3 is responsible for maintaining the session reference (session storage point for  
4 negotiated air interface context) idle state management, and providing paging  
5 control functions when the AT is idle. The SRNC is an authenticator also  
6 responsible for access authentication of the AT.  
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#### 9 **2.2.2.4 Non-3GPP2 Access Network**

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11 This is not a functional entity, but a representation of non-3GPP2 access network  
12 that may be either trusted or un-trusted.  
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14

##### 15 **2.2.2.4.1 Non-3GPP2 Un-trusted Access Network**

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17 If the access network is un-trusted, then the AT can use the Evolved Packet Data  
18 Interworking function (ePDIF) to connect the 3GPP2 operator's network to  
19 access that network.  
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##### 22 **2.2.2.4.2 Non-3GPP2 Trusted Access Network**

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24 If the access network is trusted, then the access network connects directly to the  
25 AGW (i.e. without using the ePDIF).  
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27

#### 28 **2.2.3 Authentication, Authorization and Accounting (AAA)**

29 This functional entity provides authentication, authorization, and accounting  
30 functions with respect to the AT's use of the network resources.  
31

32 Additional information regarding the AAA is contained in [3].  
33

34 A visited AAA is the AAA in the network that is serving the call.  
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#### 36 **2.2.4 Application Server**

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38 The NAM for the Application Server is contained in [3].  
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#### 41 **2.2.5 BCMCS Controller**

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43 The NAM for the BCMCS Controller is contained in [3].  
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#### 46 **2.2.6 Border Router (BR)**

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48 The NAM for the BR is contained in [3].  
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#### 51 **2.2.7 Breakout Gateway Control Function (BGCF)**

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53 The NAM for the BGCF is contained in [3].  
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#### 56 **2.2.8 Call Session Control Function (CSCF)**

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58 The NAM for the CSCF is contained in [3].  
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### **2.2.9 Databases (DB)**

The NAM for the DB is contained in [3]. The DB contains the Equipment Identity Register (EIR), Dynamic Subscriber Information, Network Policy Rules, Subscriber Profile, and other information.

### **2.2.10 Evolved Packet Data Interworking Function (ePDIF)**

The evolved ePDIF provides connectivity from the Home Agent to an un-trusted non-3GPP2 network.

### **2.2.11 Home Subscriber Server**

The NAM for the Home Subscriber Server (HSS) is contained in [3].

### **2.2.12 IP Multimedia Client**

The NAM for the IP Multimedia Client is contained in [3].

### **2.2.13 IP Network**

The NAM for the IP Network is contained in [3].

### **2.2.14 IP Services**

IP Services comprise any IP based services provided by the operator or 3rd party. This may be part of the Internet or a closed network. The IP service network may include IP Multimedia Subsystem (IMS), Multimedia Domain (MMD), and other network entities in Figure 2.1-1.

### **2.2.15 Legacy MS Domain Support (LMSDS)**

The NAM for LMSDS is contained in [3]. The LMSDS contains the Home Location Register emulation (HLRe), Mobile Switching Center emulation (MSCe), and Service Control Point emulation (SCPe).

### **2.2.16 Local Mobility Anchor (LMA)**

Local Mobility Anchor is the home agent for the mobile node in the Proxy Mobile IPv6 domain per RFC5213 [5]. It is the topological anchor point for the mobile node's home prefix and is the entity that manages the mobile node's reachability state.

### **2.2.17 Media Gateway (MGW)**

The NAM for the MGW is contained in [3].

### **2.2.18 Media Gateway Control Function (MGCF)**

The NAM for the MGCF is contained in [3].

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### **2.2.19 Media Resource Function Controller (MRFC)**

The NAM for the MRFC is contained in [3].

### **2.2.20 Media Resource Function Processor (MRFP)**

The NAM for the MGFP is contained in [3].

### **2.2.21 Mobile IP Home Agent (HA)**

The Home Agent is like the home agent that exists in today's networks. It is used to provide a mobility solution to the AT in a 3GPP2 packet data network.

However, in an evolved network, the home agent may also be used for inter-technology mobility.

Additional NAM information for the HA is contained in [3].

### **2.2.22 Mobile Station (MS)**

The NAM for the MS is contained in [3].

### **2.2.23 Operations Systems Function (OSF)**

The NAM for the OSF is contained in [3]. The OSF contains the Element Management Layer (OSF-EML), Network Management Layer/Operations Support System (OSF-NML/OSS), and Managed Network Entity (M-NE).

In addition to the managed network entities defined in [3], the following network entities may be managed: eBS, SRNC, LMA, ePDIF, HRPD-AN.

### **2.2.24 Packet Data Serving Node (PDSN)**

The PDSN is the node that provides the user's point of IP connectivity in the legacy packet data network.

### **2.2.25 Policy and Charging Rules Function (PCRF)**

This term refers to the rules provided by the PCRF to the AGW. The purpose of the Policy and Charging Control (PCC) rule is to:

- a. - Detect a packet belonging to a service data flow,
- b. - Provide policy control for a service data flow, and to
- c. - Provide applicable charging parameters for a service data flow.

Additional NAM information for the PCRF is contained in [3].

### **2.2.26 Position Determining Entity (PDE)**

The NAM for the PDE is contained in [3].

### **2.2.27 Position Server**

The NAM for the position server is contained in [3].

### **2.2.28 Public Switched Telephone Network (PSTN)**

The NAM for the PSTN is contained in [3].

### **2.2.29 Signaling Gateway (SGW)**

The NAM for the SGW is contained in [3].

### **2.2.30 Short Message Service Gateway (SMS-GW)**

The NAM for the SMS-GW is contained in [3].

### **2.2.31 Voice Call Continuity Application Server (VCC AS)**

The NAM for the VCC AS is contained in [3].

## **2.3 Reference Points**

### **2.3.1 A10/A11 PDSN – HRPD-AN**

The A10/A11 reference point carries control (A11) and bearer (A10) information between the PDSN and HRPD-AN.

### **2.3.2 Tx PCRF -- Application Function**

The Tx reference point carries control information between the PCRF and the Application Function in the IP Services network. Additional information for the Tx reference point is contained in [3].

### **2.3.3 UMB-AI AT -- eBS**

The UMB air interface carries control and bearer information between the AT and the eBS.

### **2.3.4 U1 eBS -- AGW**

The U1 reference point carries control and bearer information between the enhanced Base Station (eBS) and the Access GateWay (AGW). The U1 reference point includes interfaces for bearer transport (user data and signaling), Quality of Service (QoS), and accounting.

### **2.3.5 U2 eBS -- SRNC**

The U2 reference point provides interfaces for carrying control information between the eBS and the SRNC.

### **2.3.6 U3 eBS -- eBS**

The U3 reference point carries control and bearer information between eBSs. The U3 control interface includes tunnel management and active set management for the UMB air interface.

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### 2.3.7 U4 SRNC -- SRNC

The U4 reference point carries control information between SRNCs. The U4 control interface includes inter-SRNC paging and session transfer.

### 2.3.8 U6 AGW -- SRNC

The U6 reference point carries control information for authentication, idle state management and paging between the SRNC and the AGW. Components of this interface are currently under study.

### 2.3.9 U14 AGW -- AAA

The U14 reference point carries control information between the anc-AGW and the AAA infrastructure via the Visited AAA server (VAAA). This reference point implements a signaling protocol to support user authentication, authorization and accounting.

### 2.3.10 U15 srv-AGW – srv-AGW

The U15 reference point carries carry control and bearer information between two Serving AGWs (srv-AGWs) to support inter-AGW mobility.

### 2.3.11 U15' srv-AGW – anc-AGW

The U15' reference point carries control and bearer information between the srv-AGW) and the Anchor (anc-AGW). The U15' reference point is not exposed if the srv-AGW and the anc-AGW are collocated.

### 2.3.12 U16 AGW -- HA

The U16 reference point carries control and bearer information between the AGW and the Home Agent (HA) for a split AGW configuration, and supports bearer transport and signaling for mobility as well.

### 2.3.13 U17 3GPP2 Network -- non-3GPP2 Network

The U17a reference point provides control and bearer connectivity between the 3GPP2 network and a trusted non-3GPP2 network (e.g., 3GPP System Architecture Evolution (SAE)/Long Term Evolution (LTE) or WiMAX<sup>TM</sup><sup>3</sup>) or between an HA and a non-3GPP2 Trusted AN. The U17b reference point provides control and bearer connectivity between the 3GPP2 network and an untrusted non-3GPP2 network via the ePDIF (e.g., a WiFi network) or between a HA and an ePDIF.

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<sup>3</sup> “WiMAX Forum®” is a registered trademark of the WiMAX Forum. “WiMAX<sup>TM</sup>” is a trademark of the WiMAX Forum.

### 2.3.14 U18 PCRF -- PCRF

The U18 reference point carries control information between a visited PCRF and home PCRF in order to transfer policy and charging rules between domains. The U18 reference point is the same as the Ty reference point.

### 2.3.15 U19 AGW – Specific Other Networks

The U19 reference point carries control and bearer information between an anc-AGW and the PDSN for split AGW configurations. The U19a reference point connects between an AGW and a Non-3GPP2 Trusted AN. The U19b reference point connects control and bearer between an AGW and an ePDIF. The U19c reference point control and bearer connects between an AGW and a PDSN.

### 2.3.16 U21 ePDIF – un-trusted non-3GPP2 access network

The U21 reference point carries control and bearer information between the ePDIF and an un-trusted non-3GPP2 access network.

### 2.3.17 U22 PDSN -- non-3GPP2 Network

The U22 reference point provides two separate interfaces: U22a and U22b. The U22a reference point carries control and bearer information between the PDSN and a trusted non-3GPP2 network. For this connection the ePDIF is not required to be on the data path. The U22b reference point, however, carries control and bearer information between the PDSN and an untrusted non-3GPP2 network. For this connection the ePDIF is required to be on the data path.

### 2.3.18 U23 PCRF -- AGW

The U23 interface carries control information from the (QoS) Policy and Charging Rules Function (PCRF) to the anc-AGW. The U23 reference point is the same as the Ty reference point.

### 2.3.19 U24 LMA -- Specific Other Network

The U24 reference point carries control and bearer information with Proxy Mobile Internet Protocol (PMIP) between the Local Mobility Anchor (LMA) and the trusted non-3GPP2 (U24a), and between the LMA and the ePDIF (U24b), and between the LMA and the PDSN (U24c), and supports handoff between a Converged Access Network (CAN) and another system.

### 2.3.20 U25 HA -- Specific Other Network

The U25 reference point carries control and bearer information with Client Mobile Internet Protocol (CMIP) between the HA and the trusted non-3GPP2 (U25a), and between the HA and the ePDIF (U25b), and supports handoff between a CAN and another system.

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### **2.3.21 U26 LMA -- AGW**

The U26 reference point carries control and bearer information with PMIP between the LMA and the AGW and supports handoff between AGWs.

### **2.3.22 U27 HA -- AGW**

The U27 reference point carries control and bearer information with CMIP between the HA and the AGW for single (i.e. non-split) AGW configurations and supports handoff between AGWs.

### **2.3.23 U28 AGW -- AGW**

The U28 reference point carries control and bearer (optional) information between the AGWs for single (i.e. non-split) AGW configurations and supports fast inter-AGW handoff.

### **2.3.24 U29 HA -- PDSN**

The U29 reference point carries control and bearer information between the HA and the PDSN.

### **2.3.25 U30 AGW – IP Services**

The U30 reference point carries IP traffic between the AGW and the IP Services network.

### **2.3.26 U31 HA – IP Services**

The U31 reference point carries IP traffic between the HA and the IP Services network.

### **2.3.27 U32 LMA – IP Services**

The U32 reference point carries IP traffic between the LMA and the IP Services network.

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