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3RD GENERATION
PARTNERSHIP
PROJECT 2
"3GPP2"

Converged Access Network Accounting Specification

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REVISION HISTORY

Revision	Date	Remarks
0	December 2007	Initial Release

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FOREWORD

(This foreword is not part of this Standard.)

This document was prepared by 3GPP2 TSG-X.

This document is a new specification.

This document is part of a multi-part document consisting of multiple parts that together describes Converged Access Network.

This document is subject to change following formal approval. Should this document be modified, it will be re-released with a change of release date and an identifying change in version number as follows:

X.S0054-400-X version n.0

where:

- X an uppercase numerical or alphabetic character [0, A, B, C, ...] that represents the revision level.
- n a numeric string [1, 2, 3, ...] that indicates an point release level.

This document uses the following conventions:

- “Shall” and “shall not” identify requirements to be followed strictly to conform to this document and from which no deviation is permitted.
- “Should” and “should not” indicate that one of several possibilities is recommended as particularly suitable, without mentioning or excluding others, that a certain course of action is preferred but not necessarily required, or that (in the negative form) a certain possibility or course of action is discouraged but not prohibited.
- “May” and “need not” indicate a course of action permissible within the limits of the document.
- “Can” and “cannot” are used for statements of possibility and capability, whether material, physical or causal.

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1 Introduction

This document defines offline accounting functionality in the CAN. It describes the functional responsibilities of the network elements including the accounting data to be collected by certain elements in the CAN architecture. It describes the protocol messages and message contents that are exchanged between eBSs in an AT's Route Set and the AGW, and between the AGW and the accounting server.

Only RADIUS based accounting is specified in this release.

1.1 Scope

This part specifies the requirements for the offline accounting functionality in a CAN system.

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2 References

2.1 Normative References

This section provides references to other specifications and standards that are necessary to implement this document.

- [1] IETF: RFC 2866, Rigney. C, "RADIUS Accounting", June 2000.
- [2] 3GPP2: X.S0054-000-0 v1.0, "CAN Wireless IP Network Overview and List of Parts", December 2007.
- [3] 3GPP2: X.S0054-100-0 v1.0, "Basic IP Services for Converged Access Network Specification", December 2007.
- [4] 3GPP2 X.S0054-910-0 v1.0, "CAN Data Dictionary", December 2007.
- [5] 3GPP2 A.S0020-0 v1.0, "Interoperability Specification (IOS) for Ultra Mobile Broadband (UMB) Radio Access Network Interfaces", November 2007.
- [6] 3GPP2 C.S0084-0 v2.0, "Ultra Mobile Broadband (UMB) Air Interface Specification", September 2007.
- [7] 3GPP2 X.S0011-D v2.0, "Wireless IP Network Specifications", December 2007.
- [8] IETF: RFC2794, Calhoun, et.al., "Mobile IP Network Access Identifier Extension for IPv4", March 2000

2.2 Informative References

This section provides references to other documents that may be useful for the reader of this document.

- <1> 3GPP2: X.S0054-102-0 v1.0, "Multiple-Authentication and Legacy Authentication Support for Converged Access Network", December 2007.
- <2> 3GPP2: X.S0054-110 v1.0, "MIP4 Specification in Converged Access Network Specification", December 2007.
- <3> 3GPP2: X.S0054-210-0 v1.0, "CMIP based Inter-AGW Handoff", December 2007.
- <4> 3GPP2: X.S0054-220-0 v1.0, "Network PMIP Support", December 2007.
- <5> 3GPP2: X.S0054-300-0 v1.0, "QoS Support for Converged Access Network Specification", December 2007.

3 Definitions and Abbreviations

3.1 Definitions

Connection Time: Connection Time is the duration of time in seconds that the AT is associated with the traffic channel.

IP-session based accounting: IP-session based accounting is accounting for each AT's IP address.

Reservation/IP-session based accounting: Reservation/IP-session based accounting is accounting for each separate reservation/IP-session where a single reservation is identified by the reservation label and direction indicator associated with AT's IP address.

4 Accounting

Accounting in a CAN system is accomplished through functionality shared across the eBSs, the AGW and the accounting server. The three major functions are:

1. Measuring/counting of the quantity of data sent and received by an eBS on behalf of an AT or the amount of connected radio air time that an AT uses for a reservation.
2. Creation and management of accounting records that are sent to an AAA accounting server and used for billing purposes.
3. Assimilation of policy and charging control rules into the accounting process. Note: Dynamic policy and accounting interactions are not part of the first release of this document.

4.1 Overview

Figure 1 provides a pictorial overview of the offline accounting architecture in a CAN system.

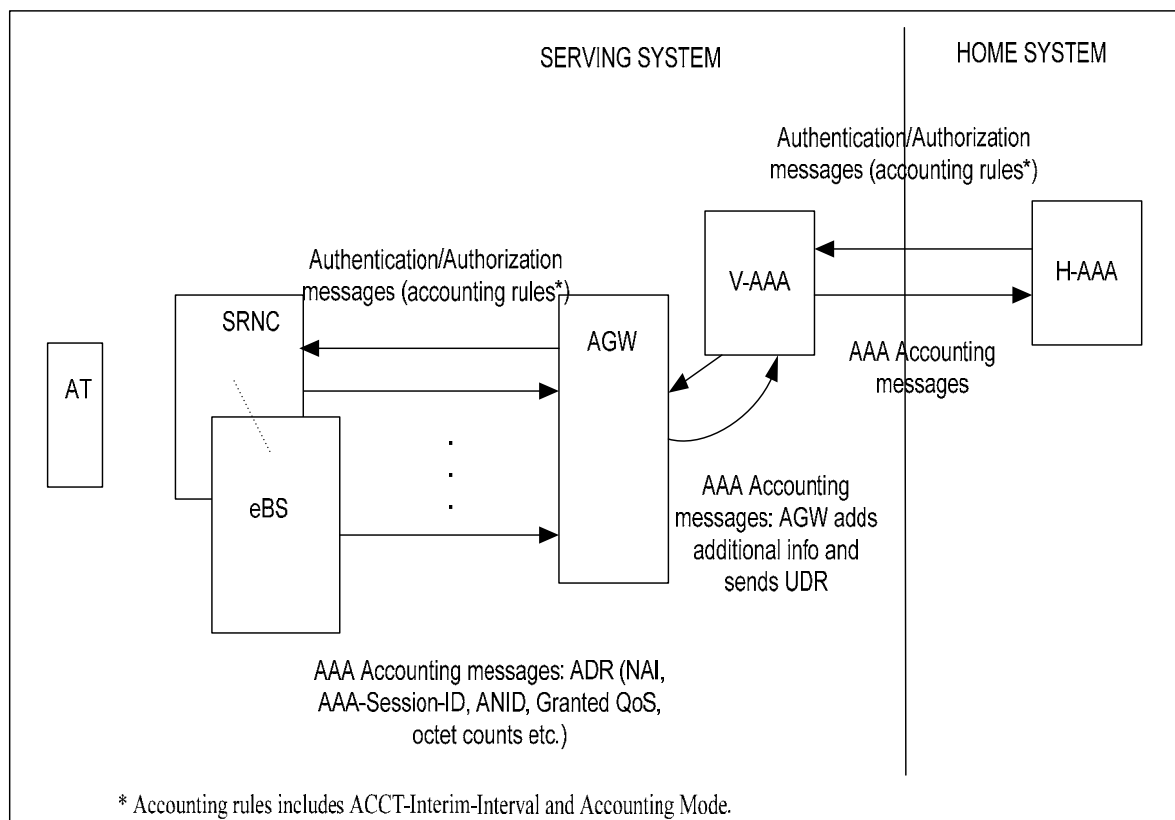


Figure 1 Basic Accounting Architecture

Each eBS that is a member of the Route Set for an AT is responsible for reporting usage data for the AT that utilizes the resources in the eBS to the AGW. Radio specific information is collected by the eBSs and delivered to the AGW in RADIUS VSAs. Accounting information is sent from the reporting eBSs of the Route Set to the AGW in Airlink Data Records (ADRs). Triggers to start and stop collecting usage information in the eBS, triggers for the delivery of

1 information in ADRs to the AGW, and triggers for sending accounting information from the
 2 AGW to the Accounting Server (HAAA) are covered in subsequent sections.

3
 4 Accounting can be performed per Reservation and per IP-session– Reservation/IP-session
 5 based accounting, or per IP session – IP-session based accounting,. Reservation/IP-session
 6 based accounting is performed by both eBS and AGW. IP-session based accounting is
 7 preformed only by the AGW.
 8

9
 10 In reservation/IP-session based accounting, the eBS reports the usage for each reservation/IP-
 11 session, where a reservation/IP-session is identified by the reservation label and direction
 12 indicator associated with AT's IP address. A reservation consists of one or more packet filters
 13 describing the IP flows associated with the reservation, and the QoS requested for the packets
 14 that pass the packet filters. The AGW combines information reported from the individual
 15 eBSs for the reservation associated with AT's IP address into one UDR. The AGW reports the
 16 UDR to the HAAA. In IP-Session based accounting the usage for all the flows associated with
 17 the AT's IP-Session are counted and reported by the AGW. Reservation/IP-session based
 18 accounting session and IP-session based accounting session reported from the AGW to
 19 HAAA are different accounting sessions.
 20

21
 22 The basis for accounting at the AGW and eBS, (e.g., whether accounting is performed
 23 Reservation/IP-session, or IP-session) is established by the policies of the home network
 24 specified in the Accounting-Mode VSA [4] received by the AGW/SRNC from the HAAA
 25 during the EAP authentication and authorization procedures [3] and the serving network (if
 26 Accounting-Mode VSA is not received from HAAA).
 27

28 **4.2 General Accounting Rules**

29 **4.2.1 Reservation/IP-session Based Accounting**

30
 31 If the Accounting-Mode VSA (received from the HAAA during the EAP Access
 32 Authentication and Authorization procedures) or the local network policy (if the Accounting-
 33 Mode VSA is not received from the HAAA) indicates that Reservation/IP-session based
 34 accounting shall be performed for the session, the accounting rules specified in this session
 35 shall be applied. Reservation/IP-session based accounting involves the eBSs, AGW, and
 36 HAAA.
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38 **4.2.1.1 Accounting Rules between eBS and AGW**

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 40 Following are general accounting rules that apply for reservation/IP-session based accounting
 41 between eBSs and AGW.
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- Every eBS in an AT's Route Set is capable of performing Reservation/IP-session accounting for each reservation associated with AT's IP address.
- From each eBS in Route Set for the AT, Accounting Start is triggered when the first reservation is able to send IP packets. The Accounting Stop is triggered after Accounting Start has been sent and no remaining reservations are able to send IP packets.
- The eBS that forms RLP packets counts forward IP packets and octets for each forward reservation/IP-session when the reservation is open. The eBS that assembles IP packets (from RLP packet) counts reverse IP packets and octets for each reverse reservation/IP-session when the reservation is open. The eBS shall count uncompressed IP packets and octets for both forward and reverse directions.
- Based on local and home network policy, the AGW may send ACCT-Interim-Interval attribute and Accounting-Mode VSA (see [4]) to the SRNC through EAP Access Authentication and Authorization (see [3]). Table 1 shows the additional RADIUS attributes exchanged between the AGW and SRNC during EAP Access Authentication and Authorization for accounting support. Table 2 shows the additional Diameter AVPs exchanged between the AGW and SRNC during EAP Access Authentication and Authorization for accounting support
- An eBS in AT's Route Set sends an AAA-Accounting-Request message for Interim-Update to the AGW to report accounting information on a periodic basis.

Table 1 Additional RADIUS Attributes between AGW and SRNC during EAP Access Authentication and Authorization for Accounting Support

Attribute/VSA	Type	Access-Request	Access-Accept	Interface(s)
ACCT-Interim-Interval	85	0	0-1	SRNC<-AGW
Accounting-Mode	26/198	0	0-1	SRNC<-AGW

Table 2 Additional Diameter AVPs between AGW and SRNC during EAP Access Authentication and Authorization for Accounting Support

AVP	AVP Code	Diameter-EAP-Request	Diameter-EAP-Answer	Interface(s)
ACCT-Interim-Interval	85	0	0-1	SRNC<-AGW
Accounting-Mode	5535/31	0	0-1	SRNC<-AGW

4.2.1.2 Accounting Rules between AGW and HAAA

Following are general accounting rules that apply for reservation/IP-session based accounting between AGW and HAAA.

- The AGW shall support the RADIUS protocol and 3GPP2 vendor specific attributes for accounting with the HAAA.

4.2.2.1 Accounting Rules between AGW and HAAA

Following are general accounting rules that apply for IP-session based accounting between AGW and HAAA.

- The AGW shall support the RADIUS protocol and 3GPP2 vendor specific attributes for accounting with the HAAA.
- The AGW shall identify an IP session for a particular AT by the user's NAI, AAA-Session-ID, and the AT's IP address.
- When an IP address is assigned to the AT, the AGW shall send an AAA message indicating accounting start to the HAAA with user's NAI, AAA-Session-ID, and AT's IP address included to. Accounting message indicating accounting start shall be sent for each IP-session.
- The AGW shall count all AT's IP packets. The AGW shall perform the IP packet count per AT's IP address and collect them in the UDR.
- When an IP address assigned to the AT is released, the AGW shall send an AAA message indicating accounting stop to the HAAA with user's NAI, AAA-Session-ID, and AT's IP address included. Accounting message indicating accounting stop shall be sent for each released IP session.
- If the primary PMIP tunnel is released before IP address is released, the AGW shall send an AAA message indicating accounting stop to the HAAA with user's NAI, AAA-Session-ID, and AT's IP address included for each AT's IP session.

4.3 Reservation/IP-session Based Accounting

The eBS and AGW perform Reservation/IP-session based accounting as specified in this section if the Accounting-Mode received from the HAAA through EAP Access Authentication and Authorization procedure is set to "Per Reservation/IP-session Accounting-Mode" (see [4]), or based on local policy if Accounting-Mode is not received from the HAAA.

4.3.1 ADR Definition for Reservation/IP-Session Based Accounting

This section defines the ADR sent from eBSs in an AT's Route Set to the serving AGW. The information from the ADR is formatted in Vendor Specific RADIUS VSA (see [4]), and delivered to the serving AGW via the RADIUS Accounting messages.

Table 5 provides the format of the ADR. Based on Acct-Status-Type attribute, the AGW can determine if more records for this AT's reservation/IP-session should be expected from this or other eBSs. The Acct-Multi-Session-Id attribute is used to identify a particular AT's connection across multiple eBSs. The Acct-Multi-Session-Id attribute is populated with ASCII hexadecimal representation of the Access Counter value (see [5]).

Table 5 ADR Format for Reservation/IP-session Based Accounting

Attribute/VSA	Max Payload Length(octets) (including type and length)	Format	Type	Occurrence
NAI	Variable	String	1	1
Acct-Status-Type	6	Integer	40	1
Acct-Session-Id	Variable	String	44	1
Acct-Multi-Session-Id	Variable	String	50	1
Event-Timestamp	6	time	55	1
MEID ¹	16	String	26/116	0-1
AAA-Session-ID	Variable	String	26/180	1
Reservation-Based-Usage	Variable	See format of Subtype	26/200	1+
ANID	18	IPv6 address	26/201	1

Table 6 Reservation-Based-Usage VSA includes the following sub-types

Subtype	Max Payload Length(octets)	Format	Occurrence
AN Type ID	Variable	String	0-1
Reservation Parameter	4	Integer	1
AT's IPv4 Address	6	Ip-addr	0-1 (Note 1)
AT's IPv6 Prefix	10	Ipv6-prefix	0-1 (Note 1)
Packet Filters	Variable	String	0-1
Data-Octet-Count	10	Integer	1
IP-Packet-Count	6	Integer	1
Granted FlowProfileID	4	Integer	0-1
Granted Verbose QoS	Variable	String	0-1
Reservation Start Time	4	Integer	1
Reservation End Time	4	Integer	1

Note 1: Either AT's IPv4 Address or AT's IPv6 Prefix shall be present. On forward link reservation, this is the destination IPv4 address or the destination IPv6 prefix. On reverse link reservation, this is the source IPv4 address or the source IPv6 prefix. For unknown IPv4 address or unknown IPv6 Prefix, this field shall be set to all zeros.

Table 6 specifies the subtypes included in the Reservation-Based-Usage VSA. Reservation-Based-Usage VSA contains accounting information associated with a reservation and IP address. The AN Type ID is configured by the operator. In this release, the AN Type ID shall be set to the same value for all eBSs under the same operator. Reservation Parameter includes Reservation Label, Reservation Direction Indicator, and Reservation Stop indicator (see [4]). For QoS Reservation Packet Filters subtype is included in the Reservation-Based-Usage VSA. Details for Packet Filters rules can be found in [6]. For a particular AT's reservation, it is assumed that Granted FlowProfileID and Granted Verbose QoS are the same for all eBSs. This implies that the AT requests the QoS granted by the first eBS from all other eBSs that are subsequently added in the AT's Route Set. Reservation Start Time indicates the time when the reservation is first able to send IP packets in the eBS. Reservation End Time with Reservation Stop Indicator set to 1 indicates the time when the reservation is first unable to

¹ MEID may be provided by the AT and is not authenticated by the network.

send IP packets in the eBS. Reservation End Time with Reservation Stop Indicator set to 0 indicates the time when interim report is sent from the eBS for the reservation that remains open.

The AGW consolidates the reservation/IP-session based usage from eBSs in Route Set based on AN Type ID, Reservation Parameter, and AT's IP address.

4.3.1.1 eBS Triggers for ADR

Specific events trigger eBS members of an AT's Route Set to send an ADR to the serving AGW RADIUS accounting messages. The following events triggers an eBS in an AT's Route Set to send an ADR for a specific reservation or for all reservations associated with the AT.

Accounting Start: The eBS sends Accounting Start when the first reservation is able to send IP packets for the AT (see A.S0020).

Accounting Stop: The eBS sends Accounting Stop when the no Reservation(s) is able to send IP packets for the AT (see A.S0020).

Interim Report: All eBS in the Route Set may send interim ADRs (Acct-Status-Type = Interim-Update) to the AGW to report accounting information on a time related basis. The frequency of interim reports is based on local policy, or interim interval information received from the AGW.

See [A.S0020] for the detail requirements.

4.3.2 CAN Usage Data Record (UDR)

Accounting information is collected and coordinated by the serving AGW based on ADRs sent from the eBSs in an AT's Route Set. This information is used by an operator's billing system to charge the user for service and for other purposes such as auditing and payment consolidation between roaming partners. The following rules shall apply to the data contained in a UDR and the associated AAA data elements (VSAs).

- A UDR consists of sections 1 through 7 defined in Table 7., Sections 1 through 6 appear once in the UDR and a sub-record corresponding to section 7 can appear one or more times.
- A UDR can contain accounting information for multiple reservations/IP-sessions that belongs to a single CAN session (User-Name (NAI), AAA-Session-ID).
- The Reservation-Based-Usage VSA in UDR shall be consolidated by the AGW from eBSs in Route Set based on AN Type ID, Reservation Parameter, and AT's IP address. If AN Type ID, Reservation Label/Direction, or AT's IP address/Prefix is different, the AGW shall keep different Reservation-Based-Usage VSAs in the UDR.

Table 7 UDR Format for Reservation/IP-session Based Accounting

Item	Parameter	Description	VSA Type/ VSA Defined
1. AT Identifiers			
A1	MSID	IMSI	31 /[7]

Item	Parameter	Description	VSA Type/ VSA Defined
A3	MEID	MEID is used for AT ID	26/116 /[7]
2. User Identifiers			
B2	Network Access Identifier (NAI)	user@domain construct which identifies the user and home network of the AT.	1 /[7]
3. Session Identifiers			
C7	AAA-Session-ID	The AAA-Session-ID is a unique ID created by the Home AAA for a CAN session. All UDRs delivered in AAA accounting message for a CAN session shall contain the same AAA-Session-ID.	26/180 /[4]
C1	Accounting Session ID	The Account Session ID is a unique accounting ID created by the Serving AGW that allows start and stop RADIUS records to be matched.	44 /[7]
C3	Session Continue	This attribute when set to 'true' means it is not the end of a Session and an Accounting Stop is immediately followed by an Account Start Record. 'False' means the end of a session.	26/48 /[7]]
4. Infrastructure Identifiers			
D1	Home Agent	The IPv4 address of the HA.	26/7 /[7]
D2	AGW Address	The IPv4 address of the AGW.	4 /[7]
D5	IPv6 AGW Address	The IPv6 address of the AGW.	95 /[7]
D6	Foreign Agent Address	The IPv4 address of the FA-CoA.	26/79 /[7]
D8	Carrier-ID	A string that uniquely identifies the carrier that generated this UDR.	26/142 /[7]
5. Zone Identifiers			
E2	GMT-Time-Zone- Offset	A four octet string interpreted as a signed integer that indicates the offset in seconds from GMT time.	26/143 /[7]
6. Session Activity			
G4	Event Time	This is an event timestamp which indicates one of the following: The start of an accounting session if it is part of a RADIUS Accounting Request (Start) message; The end of an accounting session if it is part of a RADIUS Accounting Request (Stop) message; An Interim-Update accounting event if it is part of a RADIUS Accounting Request (Interim-Update) message.	55 /[7]
7. Reservation Activity (The following VSA can occur multiple times in UDR)			
H1	Connection-Time	The total active connection time on traffic channel in seconds. This VSA also includes the time stamp of the connection start time.	26/199 /[4]
H2	Reservation-Based-Usage	Reservation Usage information	26/200 /[4]
Reservation Based Usage VSA includes the following subtypes:			
	AN Type ID	A string that uniquely identifies the AN type that generates this Reservation/IP-session.	[4]
	Reservation Parameter	This attribute includes a reservation label, direction indicator, and Reservation Stop Indicator.	[4]
	AT's IPv4 Address	This parameter identifies the destination IPv4 address on forward link reservation and identifies the source IPv4 address on reverse link reservation.	[4]
	AT's IPv6 Prefix	This parameter identifies the destination IPv6 prefix on forward link reservation and identifies the source IPv6 prefix on reverse link reservation.	[4]

Item	Parameter	Description	VSA Type/ VSA Defined
	Packet Filters	Packet filters associated with the reservation.	[4]
	Data-Octet-Count	The total number of octets in IP packets sent to or by the user based on Reservation Direction.	[4]
	IP-Packet-Count	The numbers of IP packets sent to the user or by the user based on Reservation Direction.	[4]
	Granted Flow ProfileID	The granted QoS FlowProfileID for the reservation.	[4]
	Granted Verbose QoS	The granted verbose QoS for the reservation.	[4]
	Reservation Start Time	Time when the reservation is first able to send IP packets.	[4]
	Reservation End Time	The time when no further IP packets could be sent for this reservation.	[4]

Note 1: ANIDs identifying eBSs that report flow data in ADRs to the AGW, are not part of the UDR sent to the HAAA.

Note 2: Acct-Multi-Session-Id is only needed between eBSs and AGW to correlate the reports from different eBSs contained in ADRs for a particular AT's connection. It is not needed for the UDR sent from the AGW to the HAAA.

4.3.3 AGW Accounting Triggers

Events that trigger the AGW to take accounting related actions are specified as follows.

- When the RAN Primary PMIP tunnel is successfully established between an eBS and AGW, the AGW shall create UDR and send an Accounting Start to the HAAA Accounting Server to indicate the AAA session is started. The AGW shall set the AAA-Session-ID to the value of the AAA-Session-ID received from the HAAA upon successful EAP Access Authentication and Authorization procedures.
- When the AGW receives the first Accounting Start from an eBS for the AT, the AGW shall modify a UDR or UDR Sub-record for the AT.
- When the AGW receives an ADR for a reservation associated with a User NAI and AAA-Session-ID for which the first Accounting Start for the AT has been received and for which the last Accounting Stop has not been received, and a Reservation Parameter for which no Granted FLOWProfileID has been created, the AGW shall create a new reservation Sub-Record for the reservation.
- When the RAN Primary PMIP tunnel is released between an eBS and AGW, the AGW should wait to receive the accounting messages indicating accounting stop from all eBSs from which an Accounting Start for a particular AT has been received. The AGW shall send an Accounting Stop to the HAAA. The AGW shall set the AAA-Session-ID to the value of the AAA-Session-ID received from the HAAA upon successful EAP Access Authentication and Authorization procedures.
- The AGW may send the interim report accounting information on a time related basis to the HAAA. The frequency of interim reports is based on local policy, or interim interval information received from the HAAA during EAP Access Authentication and Authorization procedures.

4.4 IP-Session Based Accounting

The AGW shall perform IP-session based accounting as specified in this section if the Accounting-Mode received from the HAAA through EAP Access Authentication and Authorization procedures is set to “Per IP-session Accounting-Mode” (see [4]), or based on local policy if Accounting-Mode is not received from the HAAA.

4.4.1 UMB Usage Data Record (UDR)

The accounting information is used by an operator’s billing system to charge the user for service and for other purposes such as auditing and payment consolidation between roaming partners. The following rules shall apply to the data contained in a UDR and the associated AAA data elements (VSAs).

- A UDR is created per IP address per NAI.
- A UDR consists of sections 1 through 6 of Table 8. All sections appear once in the UDR.
- A UDR can contain accounting information for multiple IP flows from the same CAN session identified by user-Name (NAI), AAA-Session-ID, and AT’s IP address.

Table 8 UDR Format for IP-Session Based Accounting

Item	Parameter	Description	VSA Type/ VSA Defined
1. AT Identifiers			
A1	MSID	IMSI	31 /[7]
A3	MEID	MEID is used for AT ID	26/116 /[7]
2. User Identifiers			
B1	Source IP Address	IPv4 address of the AT.	8 /[7]
B2	Network Access Identifier (NAI)	user@domain construct which identifies the user and home network of the AT.	1 /[7]
B3	Framed-IPv6-Prefix	AT IPv6 prefix.	97 /[7]
B4	IPv6 Interface ID	AT IPv6 interface identifier.	96 /[7]
3. Session Identifiers			
C7	AAA-Session-ID	The AAA-Session-ID is a unique ID created by the Home AAA for a CAN session. All UDRs delivered in AAA accounting message for a CAN session shall contain the same AAA-Session-ID.	26/180 /[7]
C1	Accounting Session ID	The Account Session ID is a unique accounting ID created by the Serving AGW that allows start and stop RADIUS records to be matched.	44 /[7]
C3	Session Continue	This attribute when set to ‘true’ means it is not the end of a Session and an Accounting Stop is immediately followed by an Account Start Record. ‘False’ means end of a session.	26/48 /[7]
4. Infrastructure Identifiers			
D1	Home Agent	The IPv4 address of the HA.	26/7 /[7]
D2	AGW Address	The IPv4 address of the AGW.	4 /[7]

Item	Parameter	Description	VSA Type/ VSA Defined
D5	IPv6 AGW Address	The IPv6 address of the AGW.	95 /[7]
D6	Foreign Agent Address	The IPv4 address of the FA-CoA.	26/79 /[7]
D8	Carrier-ID	A string that uniquely identifies the carrier that generated this UDR.	26/142 /[7]
5. Zone Identifiers			
E2	GMT-Time-Zone- Offset	A four octet string interpreted as a signed integer that indicates the offset in seconds from GMT time.	26/143 /[7]
6. Session Activity			
G1	Data Octet Count (Terminating)	The total number of octets in IP packets sent to the user, as received at the AGW from the IP network (i.e. prior to any compression and/or fragmentation).	43 /[7]
G2	Data Octet Count (Originating)	The total number of octets in IP packets sent by the user.	42 /[7]
G4	Event Time	This is an event timestamp which indicates one of the following: The start of an accounting session if it is part of a RADIUS Accounting Request (Start) message; The end of an accounting session if it is part of a RADIUS Accounting Request (Stop)message; An Interim-Update accounting event if it is part of a RADIUS Accounting Request (Interim-Update) message.	55 /[7]
G15	Inbound MIP Signaling Octet Count	This is the total number of octets in registration requests and solicitations sent by the MS.	26/46 /[7]
G16	Outbound MIP Signaling Octet Count	This is the total number of octets in registration replies and agent advertisements, sent to the MS.	26/47 /[7]
G26	IP-Packet-Count (Terminating)	The number of IP packets sent to the user	48 /[4]
G27	IP-Packet-Count (Originating)	The number of IP packets sent by the user	47 /[4]

4.4.2 AGW Accounting Triggers

Events that trigger the AGW to take accounting related actions are as follows.

- When the AGW determines that an IP address is assigned to the AT, the AGW shall create a UDR for the IP-Session. The AGW shall send an Accounting Start RADIUS message containing the UDR to the HAAA Accounting Server. The AGW shall set the AAA-Session-ID to the value of the AAA-Session-ID received from the HAAA upon successful EAP Access Authentication and Authorization procedures.
- When the IP address assigned to the AT is released, the AGW shall send an Accounting Stop RADIUS message containing the UDR to the HAAA Accounting Server with the user's NAI, AAA-Session-ID, and AT's released IP address included.
- If the primary PMIP tunnel is released before IP address(s) is released, the AGW shall send an AAA message indicating accounting stop with user's NAI, AAA-Session-ID, and AT's IP address included to the HAAA for each IP session.
- The AGW may send the interim accounting information to the HAAA on a time related basis. The frequency of interim reports is based on local policy, or interim

interval information received from the HAAA during EAP Access Authentication and Authorization procedures.

4.5 Accounting Call flows

4.5.1 Reservation/IP-Session Based Accounting Call Flow

Figure 2 shows an example accounting call flow for Reservation/IP-session Based Accounting.

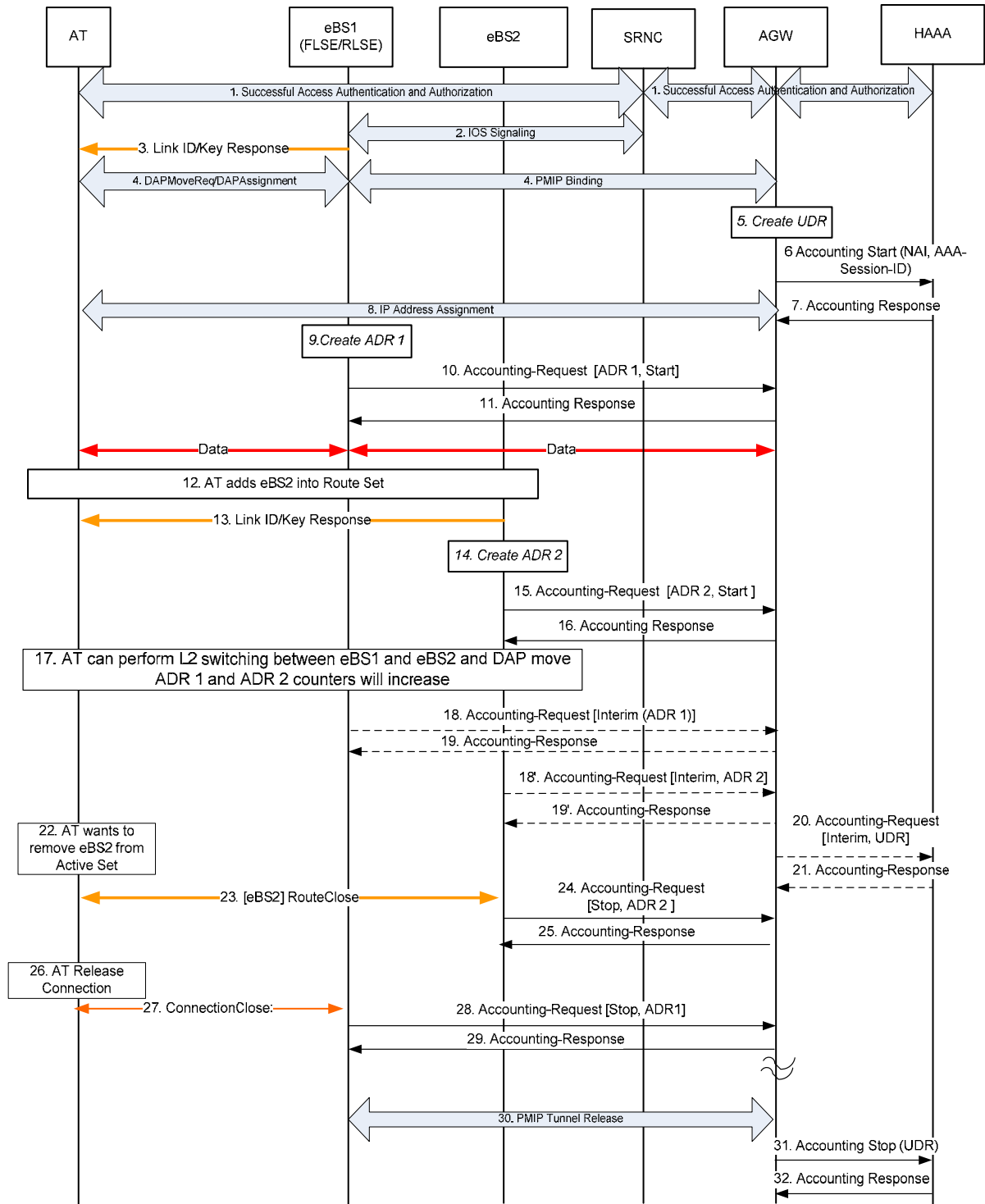


Figure 2 Accounting with Two eBS in Route Set for Reservation/IP-session Based Accounting

The steps in Figure 2 are described below.

1. The AT performs successful EAP Access Authentication and Authorization.

- 1 2. The AT adds eBS1 in the Route Set and it triggers IOS signaling exchanged between
2 eBS1 and the SRNC. The SRNC sends session information to eBS1.
- 3 3. eBS1 sends Link ID to the AT. At this time, eBS1 serves as both FLSE (Forward Link
4 Serving eBS) and RLSE (Reverse Link Serving eBS).
- 5 4. The AT requests eBS1 to be the DAP (Data Attachment Point) or the network decides
6 that eBS1 should be DAP. eBS1 triggers the primary PMIP tunnel establishment between
7 eBS1 and AGW.
- 8 5. After RAN Primary PMIP tunnel is established, the AGW creates User Data Record
9 (UDR) for the AT.
- 10 6. The AGW sends The Accounting Start including NAI and AAA-Session-ID to the
11 HAAA to indicate that the accounting has started.
- 12 7. The HAAA sends the Accounting Response to the AGW.
- 13 8. The AT and AGW perform IP address assignment.
- 14 9. eBS1 creates Airlink Data Record (ADR1) for the AT.
- 15 10. eBS1 sends Accounting-Request (Start) to the AGW when the first AT's reservation is
16 able to send IP packets.
- 17 11. The AGW sends Accounting-Response to eBS1.
- 18 12. The AT adds eBS2 into the Route Set. eBS2 gets session info from the SRNC, via IOS
19 signaling.
- 20 13. eBS2 sends Link ID to the AT.
- 21 14. eBS2 creates Airlink Data Record (ADR2) for the AT.
- 22 15. eBS2 sends Accounting-Request (Start) to the AGW when the first AT's reservation is
23 able to send IP packets.
- 24 16. The AGW sends Accounting-Response to eBS2.
- 25 17. The AT performs L2 switching and DAP move between eBS1 and eBS2. The counters in
26 both Airlink Record 1 and Airlink Record 2 increase when the eBS forms RLP packet on
27 the forward link or the eBS assembles IP packets (from RLP packet) on the reverse link.
28 There is no accounting report triggered from the eBSs to the AGW.
- 29 18. Meanwhile, eBS1 and eBS2 can send interim accounting reports to the AGW
30 periodically. The interim accounting period is based on interim interval parameter
31 received from the SRNC. The SRNC sets the accounting period based on interval
32 received from the AGW via EAP Access Authentication and Authorization procedures or
33 is based on local policy if the interval parameter is not received.
- 34 19. The AGW sends Accounting-Response to eBS1 and eBS2.
- 35 20. Meanwhile, the AGW can send interim accounting report to the HAAA periodically. The
36 accounting period is based on the interim interval parameter received from HAAA via
37 EAP Access Authentication and Authorization procedures or is based on local policy if
38 interim interval parameter is not received from HAAA.
- 39 21. The HAAA sends Accounting-Response to the AGW.
- 40 22. Sometime later, the AT wants to remove eBS2 from the Route Set.
- 41 23. The AT and eBS2 perform Route Close procedures.

24. Since eBS2 is removed from AT's Route Set, eBS2 sends Accounting-Request (Stop) to the AGW including ADR 2.
25. The AGW sends Accounting-Response to eBS2.
26. Sometime later, the AT releases the connection.
27. The AT and eBS1 perform connection close procedures.
28. eBS1 sends Accounting-Request (Stop) to the AGW including ADR 1.
29. The AGW sends Accounting-Response to eBS1.
30. Sometime later, the Primary PMIP tunnel is released or the lifetime timer expires.
31. The AGW sends the Accounting Stop with UDR included to the HAAA to indicate that accounting is terminated.
32. The HAAA sends the Accounting Response to the AGW.

4.5.2 IP-Session Based Accounting Call Flow

Figure 3 shows an example accounting call flow for IP-session based accounting.

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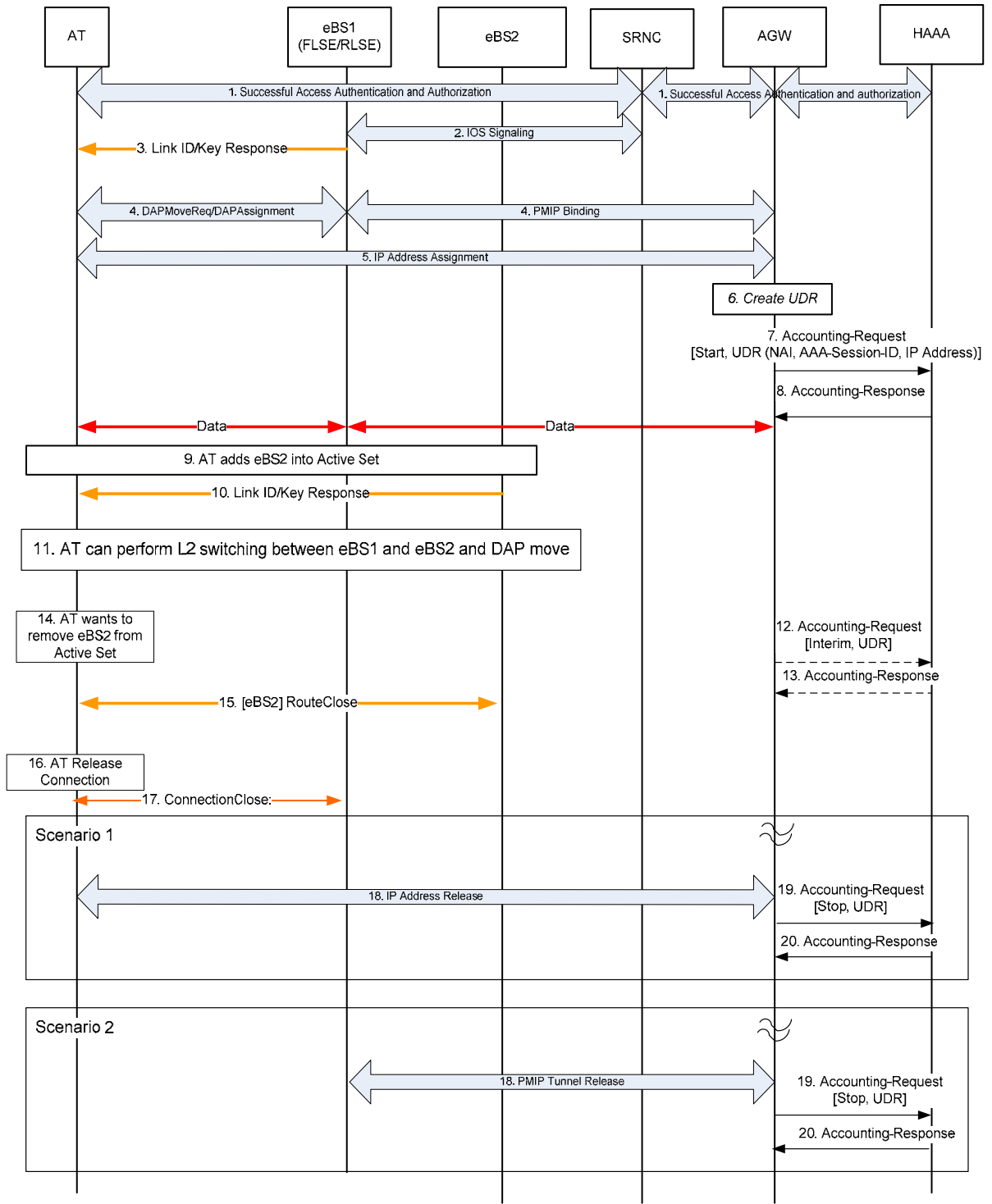


Figure 3 IP-Session Based Accounting

The steps in Figure 3 are described below.

1. The AT performs successful EAP Access Authentication and Authorization.

2. The AT adds eBS1 in the Soute Set and triggers IOS signaling exchanged between eBS1 and the SRNC. The SRNC sends session information to eBS1. 1
 3. eBS1 sends Link ID to the AT. At this time, eBS1 serves as both FLSE (Forward Link Serving eBS) and RLSE (Reverse Link Serving eBS). 2
 4. The AT requests eBS1 to be the DAP (Data Attachment Point) or the network decides that eBS1 should be DAP. eBS1 triggers the primary PMIP tunnel establishment between eBS1 and AGW. 3
 5. The AT and AGW perform IP address assignment. 4
 6. The AGW creates UDR for AT's IP address. 5
 7. The AGW sends Accounting-Request (Start) including the created UDR to the HAAA. 6
 8. The HAAA sends Accounting-Response to the AGW. Data can flow between AT and eBS1 and AGW. 7
 9. The AT adds eBS2 into the Route Set. eBS2 gets session info from the SRNC through IOS signaling. 8
 10. eBS2 sends Link ID to the AT. 9
 11. The AT performs L2 switching and DAP move between eBS1 and eBS2. 10
 12. Meanwhile, the AGW can send interim accounting report to the HAAA periodically. The interim accounting period is based on the interim interval parameter received from HAAA via EAP Access Authentication and Authorization procedures or is based on local policy if interim-interval parameter is not received from HAAA. 11
 13. The HAAA sends Accounting-Response to the AGW. 12
 14. Sometime later, the AT wants to remove eBS2 from the Route Set. 13
 15. The AT and eBS2 perform Route Close procedures. 14
 16. Sometime later, the AT releases the connection. 15
 17. The AT and eBS1 perform connection close procedures. 16
- Two scenarios can occur: Scenario 1 occurs when the IP address is released before the Primary PMIP Tunnel is released: 17
18. Sometime later, the AT's IP address is released. 18
 19. The AGW sends Accounting-Request (Stop) to HAAA. 19
 20. The HAAA sends back Accounting-Response to the AGW. 20
- Scenario 2 occurs when the Primary PMIP Tunnel is released before IP address is released: 21
18. Sometimes later, the Primary PMIP tunnel is released or the lifetime expires. 22
 19. The AGW sends the Accounting Stop to the HAAA for each IP session accounting. 23
 20. The HAAA sends the Accounting Response to the AGW. 24