



Rf/Ro Interface Specification

Release 23.0

Document Version 1

BroadWorks® Guide

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1 Summary of Interface Changes

This section describes the interface changes to the Rf/Ro interface specification.

1.1 Changes for Release 23.0, Document Version 1

The following changes were made to this version of the document:

- Added new Attribute Value Pairs (AVPs) for Credit Control Answer (CCA): Announcement-Information and its children AVPs.
- Added GETS support in AS mode, initially implemented for XS mode.
- Updated sections [4.8 ACR Content](#) and [4.10 CCR Content](#). In XS mode, it is now possible to purposely inhibit AVPs for a given Diameter interface.
- Added new AVP for Credit Control Request (CCR): Multiple-Service-Indicator.
- Modified AVP for CCR: Destination-Host.

1.2 Changes for Release 22.0, Document Version 1

The following changes were made to this version of the document:

- Added support for *RFC 7315* [\[6\]](#) format for both Rf and Ro interfaces.
- Added a new CCR [Update] trigger point for “scc” service extension changes.
- Added a new ACR [Interim] trigger point for “scc” service extension changes.
- GETS/eMPS call session termination is now configurable on the Execution Server (XS) (per sections [4.13 Ro Interface – Abort Session](#) and [4.14.30 Final-Unit-Action](#)).
- Added description of *GETSNTInhibitedAVPCodeList* Diameter accounting system parameter in sections [4.8 ACR Content](#) and [4.10 CCR Content](#).

1.3 Changes for Release 21.sp2, Document Version 2

The following changes were made to this version of the document:

- Added Reauthorization/Re-Authentication Request (RAR) and Answer (RAA) support for XS Mode Ro Interface Updated the definition of CC-Request-Number (section [4.14.10 CC-Request-Number](#)), CC-Session-Failover (section [4.14.92 CC-Session-Failover](#)), and the content of [Table 10 CCR Update Failure Handling](#) for PR 48410.

1.4 Changes for Release 21.sp2, Document Version 1

The following changes were made to this version of the document:

- Added Reauthorization/Re-Authentication Request (RAR) and Answer (RAA) support for XS Mode Ro Interface.
- Added Abort Session Request (ASR) and Answer (ASA) support for XS Mode Ro Interface.
- Added new CCR [Event] and CCR [Update] trigger points.
- Added new AVPs for CCR: Redirect-Server (and its children AVPs), Rating-Group.
- Modified AVPs CCR: SIP-Method, Trigger-Type, Termination-Cause, and Subscription-Id.
- Added new ACR [Interim] trigger point for location changes and repeated limit violations.

- Noted that ACR [Event] generation is now optional.
- Added new AVPs for ACR: Reason-Header, AoC-Information, and AoC-Cost-Information and its children.
- Modified AVP for ACR: Destination-Host.
- Added new AVPs for both ACR and CCR: Outgoing-Session-Id, Requested-Party-Address, SIP-Request-Timestamp-Fraction, SIP-Response-Timestamp-Fraction, SDP-Type, PS-Information, 3GPP-MS-Timezone, and User-Equipment-Info (and its children).
- Modified AVPs for both ACR and CCR: User-Name, User-Session-Id, and Service-Context-Id.

1.5 Changes for Release 21.0, Document Version 1

The following changes were made to this version of the document:

- Added support for the routing number in the Calling-Party-Address AVP on the Execution Server.
- Added support for called party address strict compliance on the Application Server.
- Added support for Advice of Charge Tariff Information (Application Server only).

1.6 Changes for Release 20.0, Document Version 3

The following change was made to this version of the document:

- Added GETS support in XS mode, which adds the Session Priority AVP to GETS calls in CCR messages on the Ro interface.

1.7 Changes for Release 20.0, Document Version 2

There were no Rf/Ro interface changes however; the following changes were made to this version of the document:

- Updated document to refer to 3GPP Release 12 specifications.

1.8 Changes for Release 20.0, Document Version 1

The following changes were made to this version of the document:

- Added calling party address strict compliance to section [4.14.53 Calling Party Address](#).
- Added individual AVP control to sections [4.8 ACR Content](#) and [4.10 CCR Content](#).

1.9 Changes for Release 19.0, Document Version 1

The following change was made to this version of the document:

- Polling period for file queuing is now configurable on the Application Server (AS) (per section [4.15.2.1 Queue to Disk](#)).

1.10 Changes for Release 18.0, Document Version 1

The following change was made to this version of the document:

- Support for IPv6 is added to section [4.2 Architecture](#).

1.11 Changes for Release 17.0, Document Version 3

The following change was made to this version of the document:

- The description of *Calling-Party-Address* in section [4.14.53 Calling Party Address](#) was updated for EV 124131.

1.12 Changes for Release 17.0, Document Version 2

The following change was made to this version of the document:

- The description of *useRealmFromCapabilitiesExchange* accounting system parameter was added in section [4.14.4 Destination Domain \(Destination-Realm\)](#).

1.13 Changes for Release 17.0, Document Version 1

This version of the document reflects the fact that BroadWorks is now using its own Diameter stack instead of Condor's stack.

1.14 Changes for Release 16.0, Document Version 1

In this version of the document, the Ro interface for credit control and service price enquiry was added.

1.15 Changes for Release 15.0, Document Version 1

This document was created for Release 15.0.

2 Purpose

This document describes the interfaces used by BroadWorks to communicate with billing servers over the Diameter protocol for offline and online charging. BroadWorks records accounting information about calls in progress and can transmit this information in real-time using a diameter connection.

Diameter-based accounting is primarily used in IP Multimedia Subsystem (IMS) mode. In IMS mode, this interface is named the Rf interface for offline billing and the Ro interface for online billing. Offline and online diameter-based accounting can also be used in non-IMS deployments. The Ro interface is also used for service price enquiries for the Advice of Charge feature (AoC).

This document describes how BroadWorks employs the Diameter protocol for offline and online charging and defines the content of the various messages.

3 Specifications

BroadWorks complies with the following specifications for the offline and online diameter accounting interfaces:

- *RFC 3588: Diameter Base Protocol, September 2003*
- *RFC 4006: Diameter Credit-Control Application, August 2005*
- *3GPP TS 32.260 v12.1.0 IP Multimedia Subsystem (IMS) Charging*
- *3GPP TS 32.299 v12.2.0 Diameter Charging Applications*

4 Functional Description

4.1 Definitions and Acronyms

The following acronyms and definitions are used in the text.

Acronyms	Definitions
ACA	Accounting Answer: Sent from the Charging Data Function (CDF) to BroadWorks.
ACR	Accounting Request: Sent from BroadWorks to the CDF.
AVP	Attribute Value Pair: Fields of the accounting and credit control requests.
CCA	Credit Control Answer: Sent from the Online Charging System (OCS) to BroadWorks.
CCR	Credit Control Request: Sent from BroadWorks to the OCS.
CDF	Charging Data Function: The billing server that receives accounting information (offline billing) from BroadWorks.
OCS	Online Charging System: The billing server that processes credit control requests (online billing) from BroadWorks.

Table 1 Acronyms and Definitions

4.2 Architecture

The BroadWorks Application Server supports offline (Rf) and online (Ro) diameter-based accounting and service price enquiry over Transmission Control Protocol/Internet Protocol (TCP/IP) using IPv4 or IPv6 (for more information, see the *BroadWorks Diameter, Rf, Ro, and Sh Interface Configuration Guide* [8]). Each Application Server node in a redundant pair is a diameter peer, with its own diameter identity. At startup, each Application Server node in the redundant pair connects to all configured billing servers (each billing server appears as a separate diameter peer) and performs a capabilities exchange with each. After a successful exchange, the Application Server is ready for diameter-based accounting. *Figure 1* shows the network architecture. The BroadWorks Application Server connects to a number of billing servers arranged as redundant pairs or stand-alone servers.

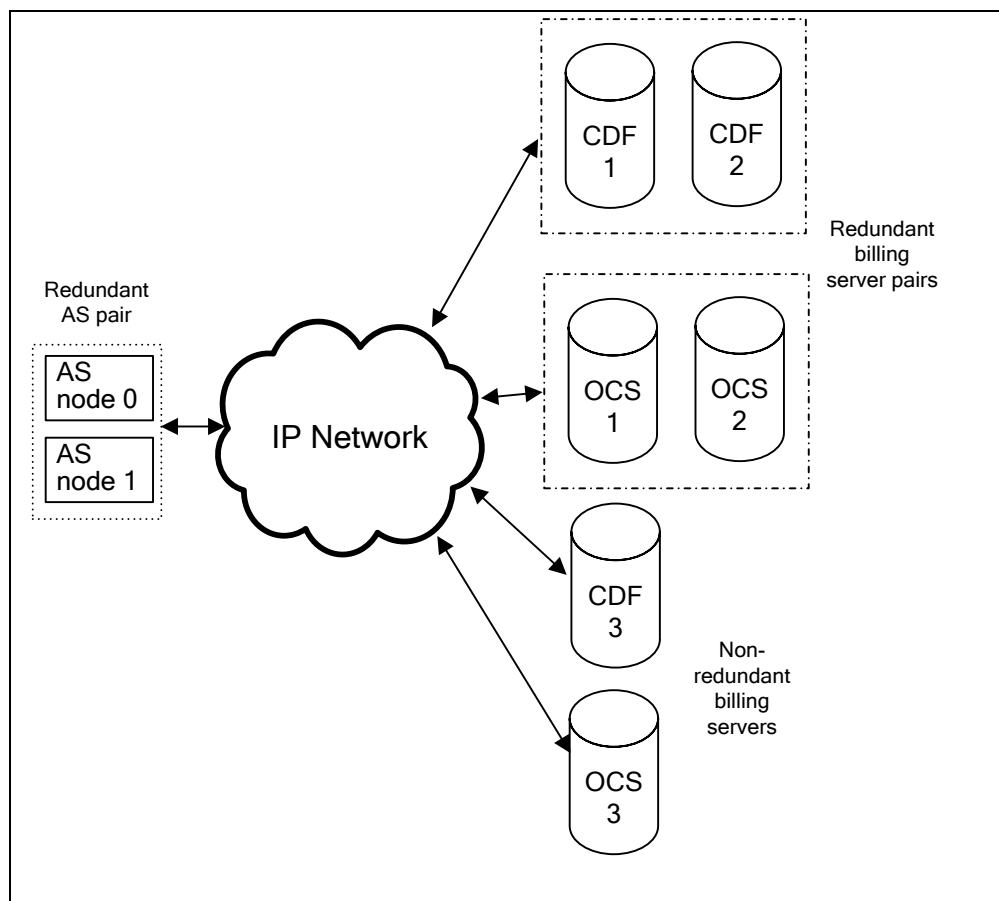


Figure 1 Network Architecture

Offline billing information sent to the CDF over the Rf interface is divided in accounting sessions for answered calls and accounting events (accounting request [ACR] events) for unanswered calls. Accounting sessions are composed of one ACR Start, zero or more ACR Interims, and one ACR Stop. Each accounting event and accounting session corresponds to one BroadWorks call detail record (CDR). Both the content and the moment the ACR is sent are aligned with BroadWorks CDRs.

Online billing (and service price enquiry) over the Ro interface is performed with BroadWorks sending a request to the OCS at call setup time, and waiting for a response before proceeding with the call, assuming enough credits could be granted. Credit control sessions are composed of one CCR Initial, zero or more CCR Update, and one CCR Termination. The content of the CCR is aligned with BroadWorks CDRs, but not the timing.

The CDF and OCS are selected based on the content of the *chargingFunctionAddresses* CDR field. The *chargingFunctionAddresses* is typically obtained from the SIP signaling; however, it can be a default value configured on the Application Server if it is not received from the Session Initiation Protocol (SIP) signaling.

The basic steps performed by BroadWorks during offline diameter accounting are as follows:

- 1) BroadWorks detects a condition that triggers an ACR generation (for example a call answered).
- 2) BroadWorks selects the destination server(s), typically from the content of the received *P-Charging-Function-Addresses* SIP header received in the initial SIP INVITE message.
- 3) BroadWorks builds the ACR message.
- 4) BroadWorks sends the ACR message to the selected server(s).

BroadWorks accomplishes the following steps to ensure delivery of the ACR:

- 1) When unable to send the ACR to the selected server, BroadWorks attempts to reach backup servers if some are specified.
- 2) If still unable to send the ACR to the selected server, BroadWorks saves the ACR to disk (if file queuing is enabled).
- 3) BroadWorks periodically retries to send the ACR from disk.

For online billing, the basic steps are as follows:

- 1) BroadWorks interrupts call setup when the call involves a subscriber subject to credit control.
- 2) BroadWorks selects the destination server(s), typically from the content of the received *P-Charging-Function-Addresses* SIP header received in the initial SIP INVITE message.
- 3) BroadWorks builds the CCR message and sends it to the selected server(s).
- 4) When a positive response with granted credits is received from the OCS, call setup continues as usual.

4.3 Triggers for Offline Accounting Requests

The offline charging diameter interface generates four types of requests, as defined in *RFC 3588*. The following table details what triggers each type of request.

Start:	The Start Accounting Request (ACR [Start]) is sent when a call leg is answered. There is at most one ACR [Start] per call leg.
Interim:	<p>The Interim Accounting Request (ACR [Interim]) is sent mid-call to the CDF. The following triggers are defined:</p> <ul style="list-style-type: none"> ▪ A codec renegotiation after answer occurs (if enabled). ▪ The long duration CDR timer expires (if enabled). ▪ Participants are added or dropped from a conference (if enabled). ▪ For XS Mode only, user device location changes (if enabled). ▪ For XS Mode only, repeated AVP limit is exceeded (if enabled). ▪ For XS Mode only, "scc" service extension changes (if enabled).
Stop:	<p>The Stop Accounting Request (ACR [Stop]) is sent when a call leg is released after answer. There is at most one ACR [Stop] per call leg.</p> <p>If the Application Server is shut down gracefully, an ACR [Stop] is generated for each answered call.</p>
Event:	<p>The Event Accounting Request (ACR [Event]) is sent when a call leg is released before answer.</p> <p>If the Application Server is shut down gracefully, an ACR [Event] is generated for each unanswered call.</p> <p>Failover CDRs (if enabled) are sent as ACR [Event] messages.</p>

Table 2 Operation Type

For the XS Mode only, the reporting of ACR [Event] is optional and can be turned off with the *enableACREvent* configuration.

ACR [Interim] for long duration calls are optional. They can be disabled or enabled with a frequency configured on the Application Server. It is also possible to have the long duration ACR [Interim] controlled by the CDF. In this mode of operation, the Application Server sends ACR [Interim] for long duration at the frequency specified by the Acct-Interim-Interval AVP if present in the ACA [Start] response.

This behavior is summarized in the *Table 3*.

enableCDRLong Duration	longCallDuration TimerMinutes	Acct-Interim-Interval AVP (Answer to real- time ACR [Start])	Comment
disabled	Any	Any	No long duration CDR is sent.
enabled	X	Any	Long duration CDRs are produced every X minutes after answer.
controlledBy DiameterServer	Any	0 or not present	No long duration CDR is sent.
controlledBy DiameterServer	Any	X	Long duration CDRs are produced every X minutes after answer.

Table 3 Generation of Long Duration ACR

BroadWorks does not send any ACR when it receives or sends the following SIP requests: INFO, NOTIFY, MESSAGE, REGISTER, SUBSCRIBE, PUBLISH, or REFER.

4.4 Sequence of Events for Online Billing

4.4.1 Call Setup (CCR Initial)

Before an origination or termination can complete, the invitation is interrupted (except for emergency calls) on BroadWorks so that a Credit Control Request (CCR) Initial event can be sent to the OCS and a Credit Control Answer (CCA) response with granted credits can be received. Call setup resumes once BroadWorks processes the CCA (assuming there are granted credits).

CCR Initial events are also sent when calls are initiated on behalf of the subscriber subject to credit control, for example, when the user forwards or transfers the call, has the Simultaneous Ringing feature, and so on. These features are also interrupted until credits are granted by the OCS.

Emergency calls are never blocked however, on call setup or later by running out of credits. They are nevertheless reported to the OCS, which can debit the user's account if necessary.

Note that for terminations, the OCS is only queried if the *enableTerminatingCDR* accounting parameter is enabled. If the parameter is disabled, the call is considered free of charge.

Similarly, the OCS is only queried for intra-group calls if the *enableIntraGroupCDR* parameter is enabled. Otherwise, intra-group calls are considered free of charge.

Finally, if the main *enabled* accounting configuration parameter (under *AS_CLI/Interface/Accounting/BroadWorksCDRInterface*) is disabled, the OCS is never queried, and all calls are considered free of charge.

4.4.2 CCR Update

During a credit control session, CCR Update messages are used to reauthorize an existing session and report used credits. The following reasons can trigger a CCR Update:

- The granted credits are nearly exhausted or expired (the exact time is determined by the configured *defaultTimeQuotaThresholdSeconds* value, and this default value can be overridden by the Time-Quota-Threshold AVP [AVP code 868] sent in a CCA).
- The media (Session Description Protocol [SDP]) has changed or it has been received for the first time, typically upon answer.

An SDP change typically occurs (apart from on answer) when parties are reconnected (re-INVITE) due to some service execution. The reconnection is not interrupted (as it is for call setup) and the CCR Update is sent to the OCS in parallel to usual call processing. Not every re-INVITE triggers a CCR Update, only those that result in negotiated media change.

CCR Update due to SDP change (including answer) are only sent in two cases:

- If a *CHANGE_IN_MEDIA_COMPOSITION* Trigger-Type (AVP 870) has been received (as part of the Trigger AVP).
- or–
- If no Trigger AVP has been received and the *enableCDRCodecChanges* accounting configuration parameter is set to “True”.
- For XS Mode only, when receiving a location change notification from the S-CSCF, the Execution Server sends a CCR [Update] message to the Online Charging Server. There are only two cases in which CCR [Update] messages due to location change (including answer) are sent:
 - If a *CHANGE_IN_LOCATION* Trigger-Type (AVP 870) has been received (as part of the Trigger AVP)
 - or–
 - If no Trigger AVP has been received and the *enableAccessNetworkChanges* accounting configuration parameter is set to “true”.
- For XS Mode only, when the “scc” service extension changes, the Execution Server sends a CCR [Update] message to the Online Charging Server. There are only two cases in which CCR [Update] messages due to “scc” service extension change are sent:
 - If a *CHANGE_IN_LOCATION* Trigger-Type (AVP 870) has been received (as part of the Trigger AVP)
 - or–
 - If no Trigger AVP has been received and the *enableCentralizationContinuityChanges* accounting configuration parameter is set to “true”.

Note that the *longCallDurationRecordControl* configuration parameter does not affect the online billing interface. If enabled, it does not trigger a CCR Update when the long duration timer expires. Conversely, disabling the parameter does not prevent CCR Update from being sent as described above.

4.4.3 CCR Termination

Whenever one of the parties releases the call, BroadWorks sends a CCR Termination event to the OCS to indicate the end of the call and report the last used credits.

As with the CCR Update, call processing is not interrupted when a CCR Termination is sent to the OCS.

4.4.4 Answer Time Considerations

The operator may wish to charge the call only after answer, yet if the *enableCDRCodecChanges* accounting configuration parameter is disabled (or the corresponding Trigger AVP has disabled it) or if the SDP is not changed on answer, a CCR Update may not be sent to the OCS at answer time. The OCS can still use the subsequent CCR's answer time to adjust the used credits accordingly, using the SIP-Response-Timestamp (3GPP AVP 835) or the BWAS-Answer-Time (BroadSoft AVP 13).

4.4.5 CCR Event

A CCR Event can be sent in the following situations:

- For failover CDRs.
- For service price enquiry.
- In XS Mode, the XS server receives notification for a subscriber starting or ending an emergency call.

When a BroadWorks Application Server receives a BYE SIP request for an unknown call, it assumes the call was started on the peer Application Server or that the server was restarted since the call was initiated. It generates a failover CDR and sends it in a CCR Event if the *enableFailoverInfo* accounting parameter is enabled. It is the only instance of a CCR Event for Ro accounting. Note that the Requested-Action (AVP 436) is set to "DIRECT_DEBITING" in this case.

Failover CDRs can be enabled and disabled at the command line interface (CLI) (using the aforementioned *enableFailoverInfo* parameter). They can be correlated with the usual CDRs using the *failoverCorrelationId* field, as described in the *BroadWorks Accounting Call Detail Record Interface Specification* [7].

When service price enquiry is made for the Advice of Charge (AoC) feature, a CCR Event is sent with the PRICE_ENQUIRY Requested-Action AVP.

The use of the *P-Charging-Function-Addresses* header or fallback to the default *P-Charging-Function-Addresses* is similar to other scenarios when sending a CCR Event. Because this event is not tied to a credit control session, backup OCSs, when they are available, are always contacted if the primary fails to respond. If the backup OCSs are also unavailable and the event discarded, it is not queued.

In XS Mode, when receiving an emergency call notification from the S-CSCF, the Execution Server sends a CCR [Event] message to the Online Charging Server. The emergency call notification is only sent on the Ro interface and does not generate any call detail records (CDRs). The BroadWorks-specific AVPs are not present in the CCR [Event] triggered by an emergency call notification.

4.5 Offline Call Flows

The following figures show the relations between the SIP signaling and the corresponding offline diameter accounting for a few typical call scenarios.

The typical flow of events for an answered call is shown in *Figure 2*. In this figure, party A calls party B. The figure is valid for both the originating and the terminating party Application Server.

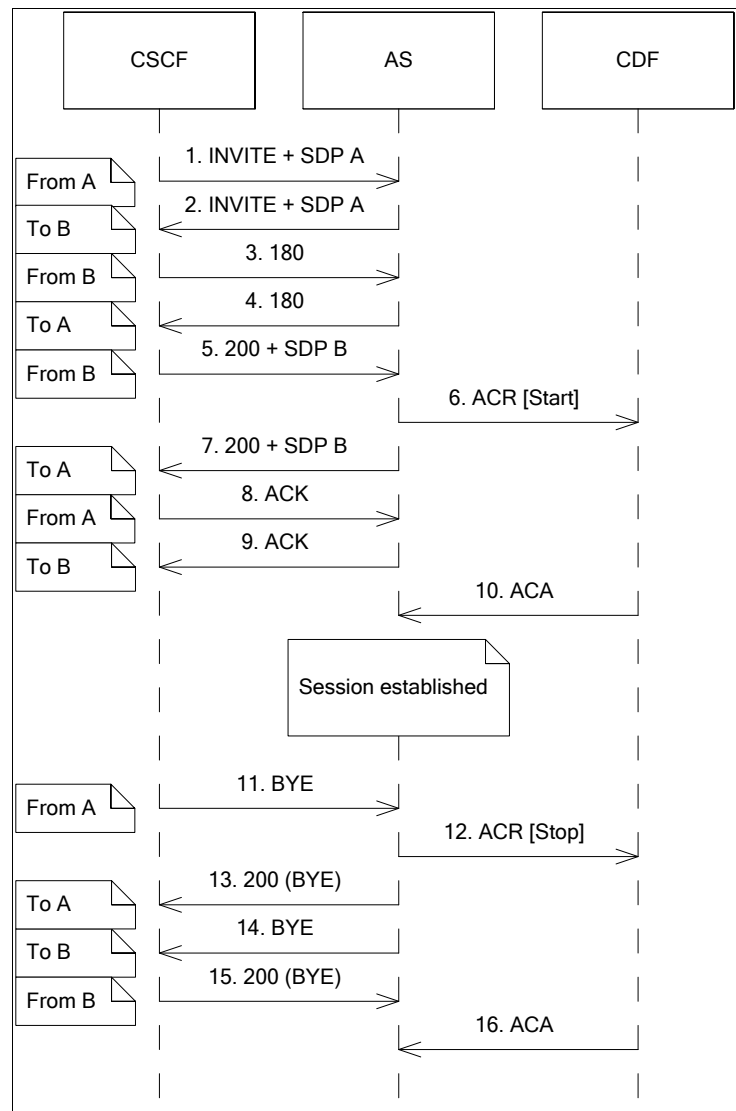


Figure 2 Basic Call

Figure 3 shows the accounting events if codec renegotiation occurs after answer. In this figure, party A calls party B. This assumes that the *enableCDRCodecChanges* = *true* option is selected.

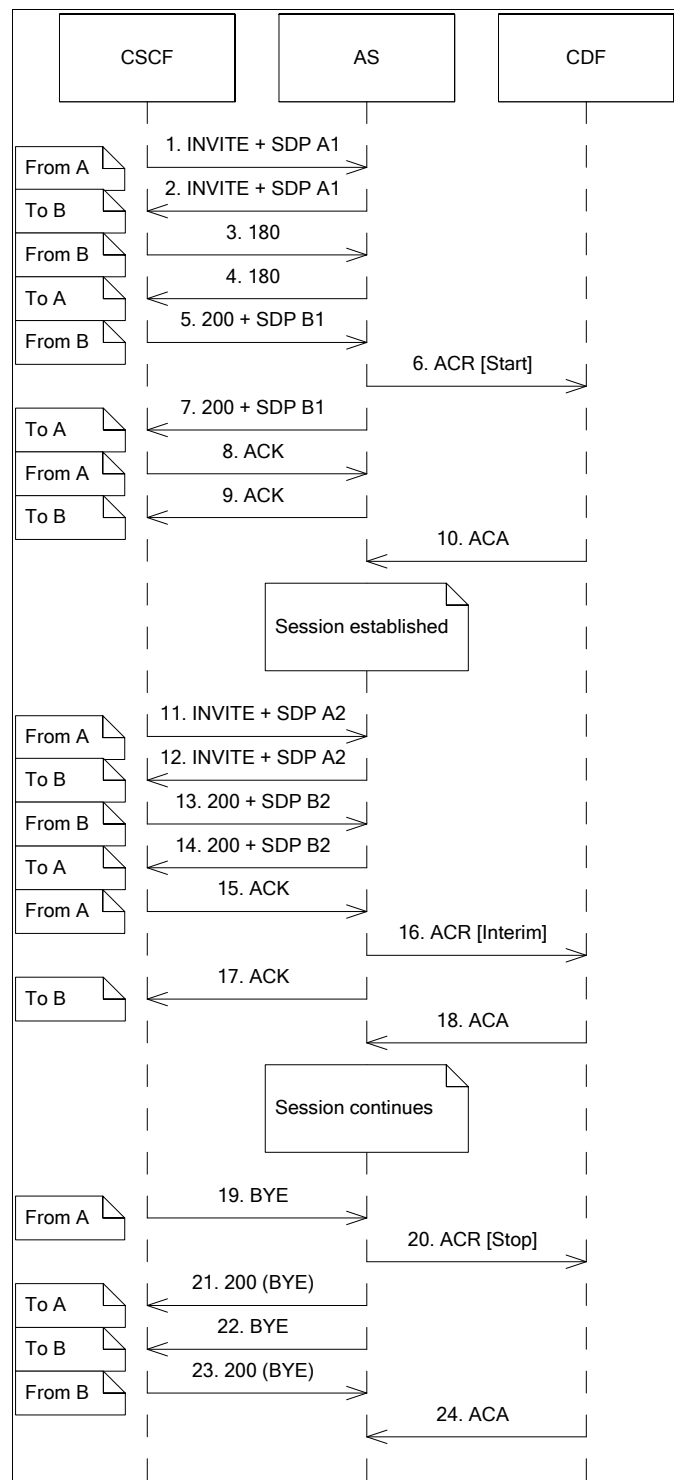


Figure 3 Codec Renegotiation

For an unanswered call, the typical flow of events is shown in *Figure 4*. In this figure, party A calls party B, but hangs up before answer.

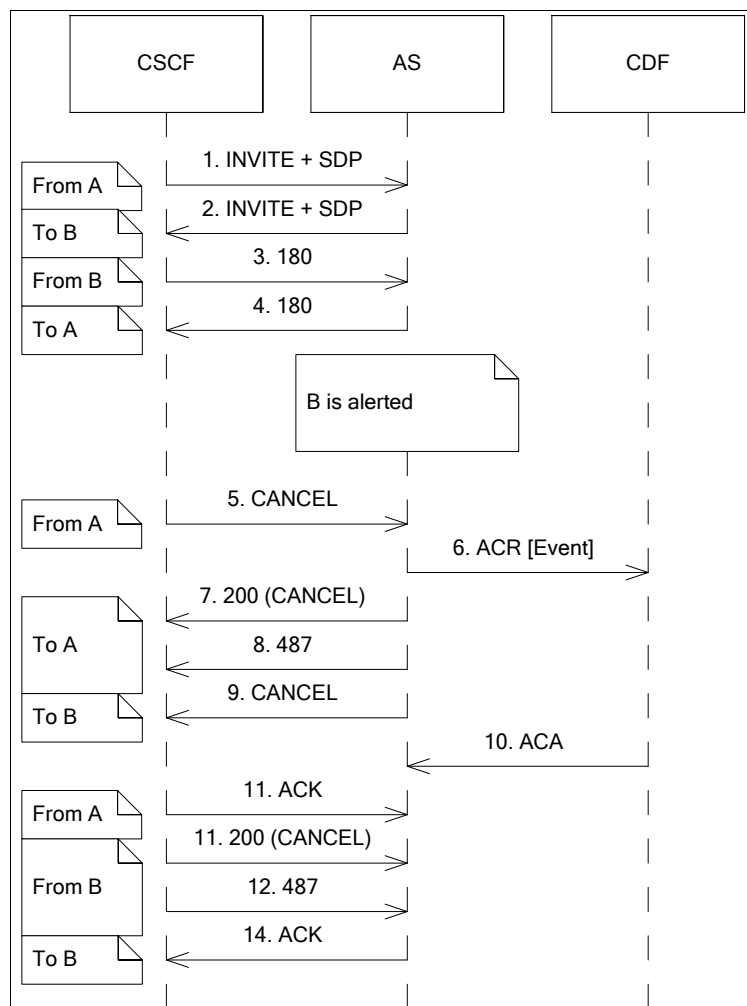


Figure 4 Release Before Answer

Figure 5 shows the typical flow of events if the terminating user is busy and no service is triggered.

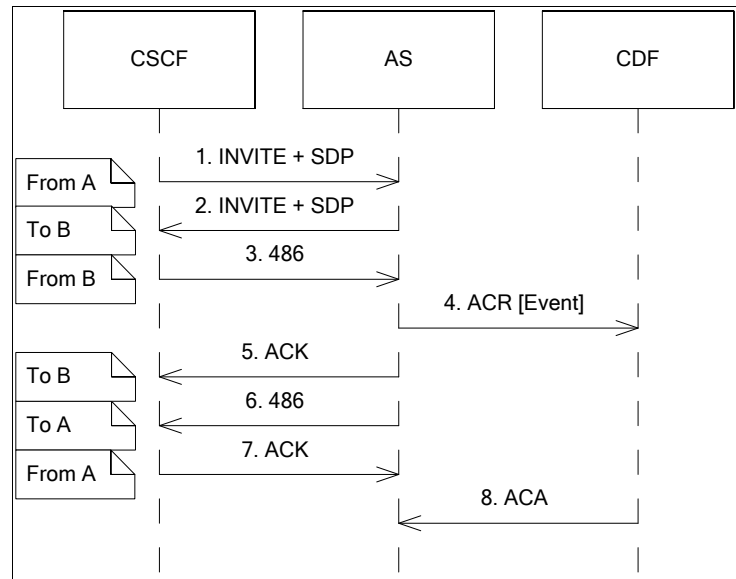


Figure 5 Busy Terminator

4.6 Online Call Flows

This section shows a number of simple call flows and the interactions with the OCS. The *enableTerminatingCDR* and *enableCDRCodecChanges* configuration parameters are assumed to be enabled.

Figure 6 shows the sequence of events occurring in the simplest origination or termination scenario. In step 2, the CCR Initial blocks the call until authorization is obtained from the OCS in step 3. Reauthorization following media change is requested at step 10; however, reauthorization does not block call progression. The same behavior applies to Call Release at step 15.

Note that the CCR Initial does not contain an SDP, since the Answer SDP is not yet known (and an offer SDP is never sent).

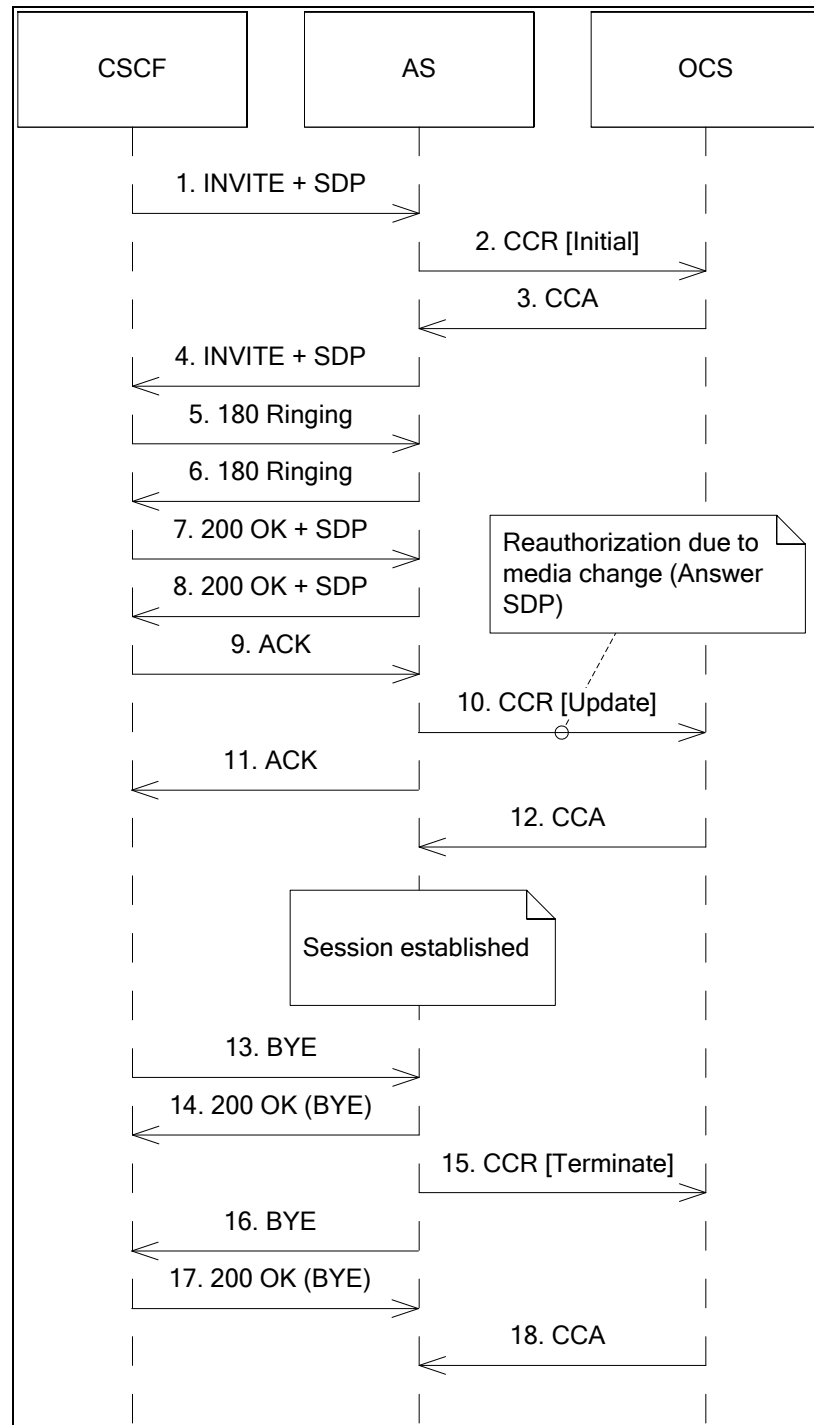


Figure 6 Call Origination or Termination

The following scenario can lead to credit fragmentation. This is because the same user has both a terminating and an originating call. As far as BroadWorks is concerned, the two call legs are separate and handled by two different credit control sessions. The OCS is responsible for credit fragmentation handling (by distributing credits evenly, making one of the legs non-chargeable, or any other strategy it deems appropriate) if it wants to prevent one of the legs from running out of credits before the other. This results in the call ending sooner than expected.

The scenario is as follows:

- 1) User A calls B.
- 2) User B is configured to forward all calls to user C.
- 3) User C rings and answers the call.
- 4) User A hangs up.

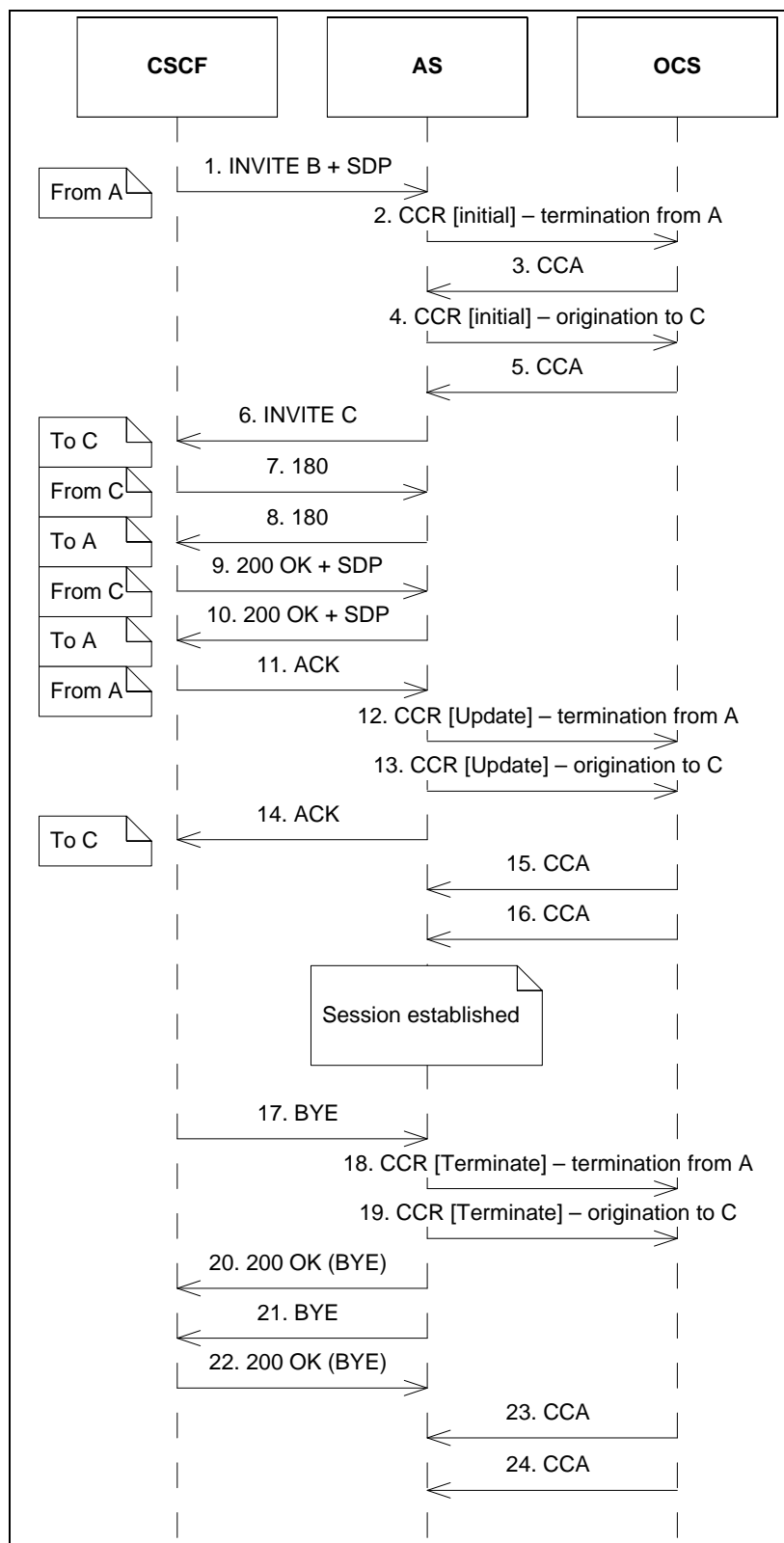


Figure 7 Call Forwarding Always – Redirecting Party

Figure 8 shows BroadWorks behavior when final credits are exhausted. A treatment is played to the local party. Note that the CCR Termination message is sent after the end of the treatment; however, the release time and amount of used credits reflect the exhaustion trigger time. Note that the low credits warning tone played to the subscriber is not shown in this figure.

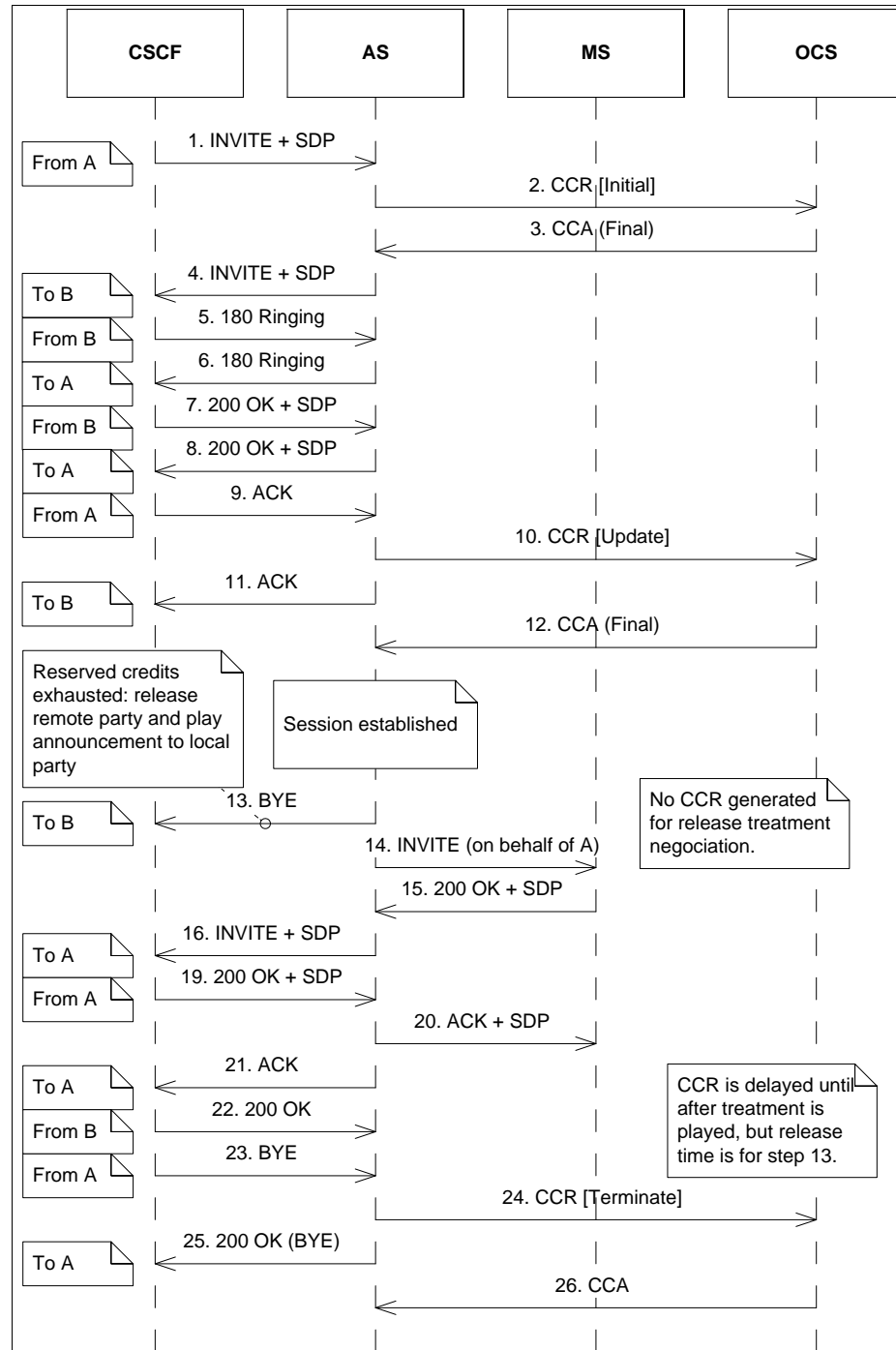


Figure 8 Credit Exhaustion

4.7 Request Forwarding and Routing

The Diameter stack supports both general Request Forwarding and Realm Routing procedures as defined in *RFC 3588* [3] section 6; however, the exact failover behavior, defined in following subsections, is application-specific.

4.7.1 General Realm Routing Procedures

Realm Routing is only used when a request is destined to a peer for which the Diameter stack does not have a direct connection, or when the request does not need to reach a specific destination server. For Rf and Ro, the use of Realm Routing is optional and configurable through Rf *routingMode* and Ro *routingMode* system parameters (for Sh, Realm Routing is always applied).

The Realm Routing Table is used to find a list of next hop Diameter peers to which the request is forwarded. The lookup is done in the following order:

- 1) A lookup is done against the requested Destination-Realm and relevant application ID.
- 2) If there is no match, a lookup is done for a default entry for the relevant application ID.
- 3) If there is no match, DNS NAPTR/SRV procedures as defined by *RFC 3588* [3] section 5.2 are applied, using the input realm (based on User-Name AVP for Rf/Ro). If lookups are successful, dynamic entries are added in the Realm Routing Table and Peer Table.
- 4) If DNS procedures failed, the request is not sent. The application may attempt to re-send the request to an alternate destination (that is, the next CDF for Rf).

When an outgoing request is sent using Realm Routing, the server list from the Realm Routing Table entry is sorted using the server's priority; servers with the same priority are randomized using the weight field (that is, servers with higher weights have more chance of being selected before those with lower weights).

4.7.2 Rf Request Forwarding/Routing

The Diameter stack tries to send ACRs to CDFs taken from *ccf* parameters specified in the *SIP P-Charging-Function-Addresses* (P-CFA) header (or through configuration if P-CFA is unavailable) of the incoming SIP INVITE message. CDFs are always "tried" following these rules:

- If *RFC 7315* [6] is supported:

The first *ccf* parameter received in the *P-CFA* header is the first CDF. If the *ccf-2* parameter is present, the first *ccf-2* parameter is the single alternative CDF. Additional *ccf* and *ccf-2* parameters are unexpected and are not processed as additional alternatives. If the *ccf-2* parameter is not present while additional *ccf* parameters are present (reflects *RFC 3455* format), the additional *ccf* parameters are on the ordered list of alternative CDFs.
- If only *RFC 3455* [5] is supported:

The first *ccf* parameter received in the *P-CFA* header is the first CDF. The additional *ccf* parameters are on the ordered list of alternative CDFs.

By default, the Execution Server requires direct Diameter connections to the CDFs, but Realm Routing can be used if the Rf *routingMode* system parameter is set to "realm".

Rf request *forwarding* or *routing* is driven by the *Rf routingMode* system parameter:

- “direct”: This indicates that the Execution Server shall have a direct connection to the CDFs specified in the *P-CFA* header. For a given Rf accounting session, the CDFs are tried in the order received in the *P-CFA*; if no Diameter connection exists for a given CDF, the next CDF from the *P-CFA* is tried.
- “dynamic”: This is similar to “direct”, except that if no direct connection exists to a given CDF, the Execution Server tries to dynamically establish a diameter connection to the CDF using the information available in the *P-CFA*. This results in a dynamic entry to be created in the Peer Table (this does not impact the Realm Routing Table). Note that the entry is added even if the connection fails.
- “realm”: This indicates that Realm Routing procedures are applied in case the Execution Server does not have direct connections to the CDF. The realm is extracted from the User-Name AVP present in the ACR. Note that using Realm Routing for Rf implies that the Destination-Host AVP is present in the ACRs, which is not compliant with the ACR Augmented Backus-Naur Format (ABNF) as defined in 3GPP TS 32.299 [2]. The Destination-Host **must** be inserted in Realm-based Routing for a request to reach a specific server, in this case, a given CCF.

Furthermore, in XS Mode, when the Execution Server configuration parameter *useACAOriginHostForACRDestinationHost* is set to “true”, the Destination-Host is still set in an ACR [Start] as previously described for realm routing without a direct connection to the CDF (remains set to “P-Charging-Function-Addresses”). However, ACR [Interim] and ACR [Stop] have the Destination-Host AVP set to the value of the Origin-Host AVP of the last received ACA for the current call. When the *useACAOriginHostForACRDestinationHost* parameter is set to “false”, the above behavior remains.

No matter which selected routing mode is used, the Diameter stack tries to route ACRs using direct connections to a CDF if one is readily available. For this, the Diameter stack tries to match CDF entries from the *P-CFA* header to an entry in the Peer Table, using either the peer’s identity or IP address and optionally the port, depending on the actual content of the *ccf* parameter of the *P-CFA* header.

Realm Routing cannot be performed when CDFs are specified using IP addresses. There would be no way to infer a valid Destination-Host AVP to insert in ACRs (and sending out an ACR without Destination-Host AVP through Realm Routing implies that the ACR would probably not reach the intended CDF received through *P-CFA*).

Example:

The *P-CFA* contains two CDFs: *cdf1* and *cdf2*.

The Diameter stack is configured with a direct connection to *cdf2* and the Realm Routing Table contains a default entry for Rf, with servers *cdfagent1* and *cdfagent2*, (with respective priorities of 1 and 2). *Rf routingMode* is set to “realm”.

The list of servers is then tried in the following order:

- 1) *cdfagent1* (ACR contains a Destination-Host AVP set to “*cdf1*”)
- 2) *cdfagent2* (ACR contains a Destination-Host AVP set to “*cdf1*”)
- 3) *cdf2* (no Destination-Host AVP in the ACR)

4.7.3 Ro Request Forwarding/Routing

Ro request Forwarding/Routing follows the same rules used for Rf, with the following differences:

- The Destination-Host is always populated whether or not Request Forwarding or Routing was used. This is similar to Rf, but the resulting CCR is still compliant with the CCR ABNF defined in *3GPP TS 32.299* [2].
- Ro routing is independently configured using the Ro *routingMode*.
- The P-CFA *ecf* parameters are used to select destination OCS as opposed to *ccf* parameters for Rf.
- For service price enquiry, the *P-Charging-Function-Addresses* header is never used. Instead, the *costInformationSource* configuration value associated with the Advice of Charge (AoC) service is used to identify the server to which the request is sent.

4.8 ACR Content

The ACR requests sent by BroadWorks for offline billing are constructed according to *RFC 3588*. *Table 4* lists all AVPs supported by BroadWorks. It contains the following information:

- ACR Field: The name of the AVP as defined in the 3GPP specifications. When different, the *RFC 3588* name is provided between parentheses. When an AVP is part of a group AVP, it is indented relative to the enclosing group AVP.
- Flags: The flags set by BroadWorks for this AVP. M stands for mandatory; V stands for vendor-specific.
- Vendor ID: For AVPs with the V flag, this column indicates the corresponding vendor ID number.
 - 10415 is the vendor ID for 3GPP.
 - 6431 is the vendor ID for BroadSoft.
- Type: The type of this AVP.
- Controlling Configuration: Defines which CLI configuration parameter controls whether or not this AVP is included. Possible values are:
 - N/A: Mandatory AVPs are identified in *3GPP TS 32.299 v12.2.0 Diameter Charging Applications* [2] and are always included.
 - send3GPPInfo: These AVPs are included when *send3GPPInfo* is set to “true” as per the *BroadWorks Diameter, Rf, Ro, and Sh Interface Configuration Guide* [8]. Some of these AVPs apply only to some call scenarios and are omitted when they are not applicable.
 - sendBroadWorksInfo: These AVPs are included when *sendBroadWorksInfo* is set to “true” as per the *BroadWorks Diameter, Rf, Ro, and Sh Interface Configuration Guide* [8]. Some of these AVPs apply only to some call scenarios, and they are omitted when not applicable. Furthermore, BroadWorks fields are controlled with a finer granularity by enabling or disabling modules as per the *BroadWorks Accounting Call Detail Record Interface Specification* [7].
 - routingMode: This AVP (which only applies to the Destination-Host AVP) is included if Realm Routing is configured and actually used for the given request (that is, Realm Routing may be enabled, but if a direct connection to the CDF is used instead of Realm Routing, then the AVP is not included).

- **Data Source:** This column indicates the origin of the data used to populate this AVP. Possible values are:
 - **Diameter transport:** These are AVPs that do not carry accounting information, but they are used by the Diameter protocol.
 - **Grouped:** These AVPs are grouped AVPs. They simply wrap around other AVPs.
 - **Constant:** These AVPs are always populated with the same constant value.
 - **BasicModule, CentrexModule, IPModule, and 3GPPModule:** One or more of these values may be listed to indicate that this AVP is constructed from data, from one or more BroadWorks CDR modules.

ACR Field	Flags	Code	Vendor ID	Type	Controlling Configuration	Data Source
Session Identifier (Session-Id)	M	263	N/A	UTF8String	N/A	Diameter transport
Originator Host (Origin-Host)	M	264	N/A	Diameter identity	N/A	Diameter transport
Originator Domain (Origin-Realm)	M	296	N/A	Diameter identity	N/A	Diameter transport
Destination Domain (Destination-Realm)	M	283	N/A	Diameter identity	N/A	Diameter transport
Destination-Host	M	293	N/A	Diameter identity	routingMode	Diameter transport
Operation Type (Accounting-Record-Type)	M	480	N/A	Enumerated	N/A	Diameter transport
Operation Number (Accounting-Record-Number)	M	485	N/A	Unsigned32	N/A	Diameter transport
Operation Identifier (Acct-Application-Id)	M	259	N/A	Unsigned32	send3GPPIInfo	Constant
User Name (User-Name)	M	1	N/A	UTF8String	send3GPPIInfo	3GPPModule
Accounting Interim Interval (Acct-Interim-Interval)	M	85	N/A	Unsigned32	send3GPPIInfo	Constant
Origination State (Origin-State-Id)	M	278	N/A	Unsigned32	send3GPPIInfo	Diameter transport
Origination Time Stamp (Event-Timestamp)	M	55	N/A	Time	send3GPPIInfo	BasicModule
Operation Token (Service-Context-Id)	M	461	N/A	UTF8String	send3GPPIInfo	Constant
Service Information	V, M	873	10415	Grouped	send3GPPIInfo	Grouped
Subscriber Identifier (Subscription-Id)	M	443	N/A	Grouped	send3GPPIInfo	Grouped
Subscription-Id-Type	M	450	N/A	Enumerated	send3GPPIInfo	Constant
Subscription-Id-Data	M	444	N/A	UTF8String	send3GPPIInfo	3GPPModule

ACR Field	Flags	Code	Vendor ID	Type	Controlling Configuration	Data Source
IMS Information	V, M	876	10415	Grouped	send3GPPInfo	Grouped
Event Type	V, M	823	10415	Grouped	send3GPPInfo	Grouped
Sip-Method	V, M	824	10415	UTF8String	send3GPPInfo	Constant
Node Functionality	V, M	862	10415	Enumerated	send3GPPInfo	Constant
Role of Node	V, M	829	10415	Enumerated	send3GPPInfo	BasicModule
User Session ID	V, M	830	10415	UTF8String	send3GPPInfo	IPModule
Outgoing-Session-Id	V, M	2320	10415	UTF8String	send3GPPInfo	IPModule
Calling Party Address	V, M	831	10415	UTF8String	send3GPPInfo	BasicModule
Called Party Address	V, M	832	10415	UTF8String	send3GPPInfo	BasicModule
Called Asserted Identity	V, M	1250	10415	UTF8String	send3GPPInfo	3GPPModule
Requested-Party-Address	V, M	1251	10415	UTF8String	send3GPPInfo	3GPPModule
Time Stamps	V, M	833	10415	Grouped	send3GPPInfo	Grouped
SIP-Request-Timestamp	V, M	834	10415	Time	send3GPPInfo	BasicModule
SIP-Response-Timestamp	V, M	835	10415	Time	send3GPPInfo	BasicModule
SIP-Request-Timestamp-Fraction	V, M	2301	10415	Unsigned32	send3GPPInfo	BasicModule
SIP-Response-Timestamp-Fraction	V, M	2302	10415	Unsigned32	send3GPPInfo	BasicModule
Inter Operator Identifier	V, M	838	10415	Grouped	send3GPPInfo	Grouped
Originating-IOI	V, M	839	10415	UTF8String	send3GPPInfo	IPModule
Terminating-IOI	V, M	840	10415	UTF8String	send3GPPInfo	IPModule
IMS Charging Identifier (ICID)	V, M	841	10415	UTF8String	send3GPPInfo	IPModule
Early Media Description	V, M	1272	10415	Grouped	send3GPPInfo	Grouped
SDP-Timestamps	V, M	1273	10415	Grouped	send3GPPInfo	Grouped
SDP-Offer-Timestamp	V, M	1274	10415	Time	send3GPPInfo	3GPPModule
SDP-Answer-Timestamp	V, M	1275	10415	Time	send3GPPInfo	3GPPModule
SDP-Media-Component	V, M	843	10415	Grouped	send3GPPInfo	Grouped
SDP-Media-Name	V, M	844	10415	UTF8String	send3GPPInfo	3GPPModule
SDP-Media-Description	V, M	845	10415	UTF8String	send3GPPInfo	3GPPModule
Media-Initiator-Flag	V, M	882	10415	Enumerated	send3GPPInfo	3GPPModule
SDP-Type	V, M	2036	10415	Enumerated	send3GPPInfo	3GPPModule
SDP-Session-Description	V, M	842	10415	UTF8String	send3GPPInfo	3GPPModule
SDP Session Description	V, M	842	10415	UTF8String	send3GPPInfo	3GPPModule
SDP Media Component	V, M	843	10415	Grouped	send3GPPInfo	Grouped
SDP-Media-Name	V, M	844	10415	UTF8String	send3GPPInfo	3GPPModule

ACR Field	Flags	Code	Vendor ID	Type	Controlling Configuration	Data Source
SDP-Media-Description	V, M	845	10415	UTF8String	send3GPPInfo	3GPPModule
Media-Initiator-Flag	V, M	882	10415	Enumerated	send3GPPInfo	3GPPModule
SDP-Type	V, M	2036	10415	Enumerated	send3GPPInfo	3GPPModule
Message Bodies	V, M	889	10415	Grouped	send3GPPInfo	Grouped
Content-Type	V, M	826	10415	UTF8String	send3GPPInfo	3GPPModule
Content-Length	V, M	827	10415	Unsigned32	send3GPPInfo	3GPPModule
Content-Disposition	V, M	828	10415	UTF8String	send3GPPInfo	3GPPModule
Originator	V, M	864	10415	Enumerated	send3GPPInfo	3GPPModule
Access Network Information	V, M	1263	10415	OctetString	send3GPPInfo	IPModule
Cause Code	V, M	861	10415	Integer32	send3GPPInfo	BasicModule, 3GPPModule
Reason-Header	V, M	3401	10415	UTF8String	send3GPPInfo	3GPPModule
PS Information	V, M	874	10415	Grouped	send3GPPInfo	Grouped
3GPP-MS-Timezone	V, M	23	10415	OctetString	send3GPPInfo	BasicModule, 3GPPModule
User-Equipment-Info	V, M	458	10415	Grouped	send3GPPInfo	3GPPModule
User-Equipment-Info-Type	V, M	459	10415	Enumerated	send3GPPInfo	3GPPModule
User-Equipment-Info-Value	V, M	460	10415	OctetString	send3GPPInfo	3GPPModule
AoC-Information	V, M	2054	10415	Grouped	send3GPPInfo	Grouped
AoC-Cost-Information	V, M	2053	10415	Grouped	send3GPPInfo	Grouped
Accumulated-Cost	V, M	2052	10415	Grouped	send3GPPInfo	Grouped
Value-Digits	M	447	N/A	Integer64	send3GPPInfo	CentrexModule
Exponent	M	429	N/A	Integer32	send3GPPInfo	CentrexModule
Incremental-Cost	V, M	2062	10415	Grouped	send3GPPInfo	Grouped
Value-Digits	M	447	N/A	Integer64	send3GPPInfo	CentrexModule
Exponent	M	429	N/A	Integer32	send3GPPInfo	CentrexModule
Currency-Cost	M	425	N/A	Unsigne32	send3GPPInfo	CentrexModule
Custom AVPs (the list of individual BroadSoft vendor-specific AVPs is provided in the <i>BroadWorks Accounting Call Detail Record Interface Specification</i> [7])	V		6431	UTF8String	send BroadWorks Info	BasicModule, CentrexModule, IPModule, 3GPPModule

Table 4 ACR Content

Figure 9 shows graphically the different AVP categories and modules as well as the controlling configuration.

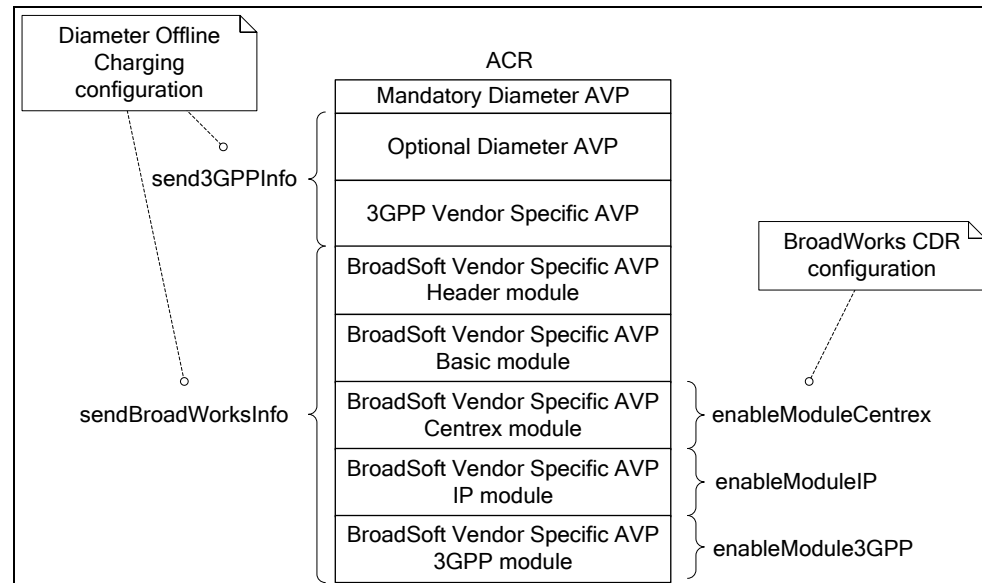


Figure 9 Configuration of Optional AVPs

The following configuration can be used to control the content of the ACR:

- **send3GPPInfo:** When enabled, all 3GPP optional AVPs are included in the ACR if relevant to the call scenario. When disabled, these AVPs are not included.
- **sendBroadworksInfo:** When enabled, BroadWorks information AVPs are included in the ACR. At a minimum, the header and basic modules are included. Centrex, IP, and 3GPP modules depend on further configuration. When disabled, these AVPs are not included.
- **enableModuleCentrex:** When enabled, the BroadWorks Centrex module is included in the ACR provided that the *sendBroadWorksInfo* is enabled. When disabled, the Centrex module is not included. For more information on the Centrex module, see the *BroadWorks Accounting Call Detail Record Interface Specification* [7].
- **enableModuleIP:** When enabled, the BroadWorks IP module is included in the ACR provided that the *sendBroadWorksInfo* is enabled. When disabled, the IP module is not included. For more information on the IP module, see the *BroadWorks Accounting Call Detail Record Interface Specification* [7].
- **enableModule3GPP:** When enabled, the BroadWorks 3GPP module is included in the ACR provided that the *sendBroadWorksInfo* is enabled. When disabled, the 3GPP module is not included. For more information on the 3GPP module, see the *BroadWorks Accounting Call Detail Record Interface Specification* [7].
- **InhibitedAVPCodeList:** When an AVP is configured in this list at the Application Server CLI or when an AVP is configured in this list with the diameter interface set to "Rf" or "Both" at the Execution Server CLI, it is not included in the outgoing ACR messages. This provides individual control on the AVP generation. For more information, see the *BroadWorks 3GPP Standard AVP Control Feature Description* [12] and the *Separate Inhibited AVP List for Ro and Rf Feature Description* [14].

- **GETSNTInhibitedAVPCodeList:** When a GETS-NT or GETS-FC + GETS-NT originating session is created, all AVPs present in this table are removed from any outgoing billing ACR Diameter messages associated with this GETS call. For more information, see the *eMPS/GETS Enhancements Feature Description* [13].

NOTE 1: The 3GPP module contains information that is also found in the *Optional 3GPP AVP*. This is because the other CDR output formats (CSV, XML, and Radius) contain only BroadSoft vendor-specific fields. By including the values from the *Optional 3GPP AVP*, which are not found elsewhere in the 3GPP module, all output formats contain the same information.

NOTE 2: All AVPs controlled by *send3GPPInfo* are either constant or constructed from BroadWorks vendor-specific AVPs. Therefore, if both *send3GPPInfo* and *sendBroadWorksInfo* are enabled, there is duplicate information in the ACR because there is an overlap between the 3GPP vendor-id AVPs and the BroadSoft vendor-id AVPs. To minimize duplication, the following typical configurations are suggested:

- 1) Enable *send3GPPInfo* and disable *sendBroadWorksInfo*. This provides only the standard AVPs and eliminates all duplications. However, 3GPP AVPs are missing much service-related information only present in BroadSoft vendor-specific AVPs.
- 2) Disable *send3GPPInfo* and enable *sendBroadWorksInfo*. This provides only the BroadSoft vendor-specific AVPs and eliminates all duplications.
- 3) Enable both *send3GPPInfo* and *sendBroadWorksInfo* but turn off the *3GPPModule* in the BroadSoft vendor-specific AVPs (*enableModule3GPP* = false; for more information, see the *BroadWorks Accounting Call Detail Record Interface Specification* [7]). This provides the 3GPP's AVP as well as the additional service-specific AVPs found only in BroadSoft vendor-specific AVPs. Turning off the 3GPP module minimizes the duplication because the information found in the 3GPP module is fully redundant with 3GPP AVPs.

4.9 ACA Content

After having received the ACR, the server must answer it with an Accounting Answer (ACA). The ACA must be constructed according to *RFC 3588* [3].

ACA Field	Flags	Code	Vendor ID	Type	Category
Session Identifier (Session-Id)	M	263	N/A	UTF8String	Mandatory
Result-Code	M	268	N/A	Unsigned32	Mandatory
Originator Host (Origin-Host)	M	264	N/A	Diameter identity	Mandatory
Originator Domain (Origin-Realm)	M	296	N/A	Diameter identity	Mandatory
Operation Type (Accounting-Record-Type)	M	480	N/A	Enumerated	Mandatory
Operation Number (Accounting-Record-Number)	M	485	N/A	Unsigned32	Mandatory
Operation Identifier (Acct-Application-Id)	M	259	N/A	Unsigned32	Mandatory

ACA Field	Flags	Code	Vendor ID	Type	Category
Acct-Interim-Interval	M	85	N/A	Unsigned32	Optional

Table 5 ACA Content

For more information on the usage of the Acct-Interim-Interval AVP, see section [4.3 Triggers for Offline Accounting Requests](#).

4.10 CCR Content

BroadWorks generates three types of CCRs:

- 1) Online billing requests associated with prepaid calls.
- 2) Advice of Charge requests using the service price enquiry.
- 3) Advice of Charge requests using the AoC Tariff Information (Application Server only, not application to the Execution Server).

The CCRs sent by BroadWorks are constructed according to *RFC 4006*. Table 6 lists all AVPs supported by BroadWorks for online billing or Advice of Charge. It contains the following information:

- **CCR Field:** The name of the AVP as defined in the 3GPP specifications. When different, the *RFC 4006* name is provided between parentheses. When an AVP is part of a group AVP, it is indented relative to the enclosing group AVP. In a few rare cases (for example, CC-Time), an entry is present twice, because it can be part of more than one group.
- **Flags:** The flags set by BroadWorks for this AVP. M stands for mandatory¹; V stands for vendor-specific.
- **Vendor ID:** For AVPs with the V flag, this column indicates the corresponding vendor ID number.
 - 10415 is the vendor ID for 3GPP.
 - 6431 is the vendor ID for BroadSoft.
- **Type:** The type of this AVP.
- **Data Source:** This column indicates the origin of the data used to populate this AVP. Possible values are:
 - Diameter transport: These are AVPs that do not carry accounting information but are used by the Diameter protocol.
 - Grouped: These AVPs are grouped AVPs. They simply wrap around other AVPs.
 - Constant: These AVPs are always populated with the same constant value.
 - BasicModule, CentrexModule, IPModule, and 3GPPModule: One or more of these values may be listed to indicate that this AVP is constructed from data, from one or more BroadWorks CDR modules.

CCR Field	Flags	Code	Vendor ID	Type	Data Source
Session Identifier (Session-Id)	M	263	N/A	UTF8String	Diameter transport

¹ Mandatory in this context means that the receiving Diameter Node must understand this AVP if present, or reject the request if it does not. It does not mean that the AVP is always present.

CCR Field	Flags	Code	Vendor ID	Type	Data Source
Originator Host (Origin-Host)	M	264	N/A	Diameter identity	Diameter transport
Originator Domain (Origin-Realm)	M	296	N/A	Diameter identity	Diameter transport
Destination Domain (Destination-Realm)	M	283	N/A	Diameter identity	Diameter transport
Destination-Host	M	293	N/A	Diameter identity	Diameter transport
CC-Request-Type	M	416	N/A	Enumerated	Diameter transport
CC-Request-Number	M	415	N/A	Unsigned32	Diameter transport
Auth-Application-Id	M	258	N/A	Unsigned32	Constant
User Name (User-Name)	M	1	N/A	UTF8String	3GPPModule
Origination State (Origin-State-Id)	M	278	N/A	Unsigned32	Diameter transport
Event-Timestamp	M	55	N/A	Time	Diameter transport or BasicModule
Operation Token (Service-Context-Id)	M	461	N/A	UTF8String	Constant
Subscriber Identifier (Subscription-Id)	M	443	N/A	Grouped	Grouped
Subscription-Id-Type	M	450	N/A	Enumerated	Constant
Subscription-Id-Data	M	444	N/A	UTF8String	3GPPModule
Termination-Cause	M	295	N/A	Enumerated	Diameter transport
Requested-Action	M	436	N/A	Enumerated	Diameter transport
Multiple-Services-Indicator	M	455	N/A	Enumerated	Constant
Multiple-Services-Credit-Control	M	456	N/A	Grouped	Grouped
Requested-Service-Unit	M	437	N/A	Grouped	Grouped
CC-Time	M	420	N/A	Unsigned32	Diameter transport
Used-Service-Unit	M	446	N/A	Grouped	Grouped
Reporting-Reason	V, M	872	10415	Enumerated	Diameter transport
CC-Time	M	420	N/A	Unsigned32	Diameter transport
Reporting-Reason	V, M	872	10415	Enumerated	Diameter transport

CCR Field	Flags	Code	Vendor ID	Type	Data Source
Trigger	V, M	1264	10415	Grouped	Grouped
Trigger-Type	V, M	870	10415	Enumerated	Diameter transport
Rating-Group	M	432	N/A	Unsigned32	Constant
Service Information	V, M	873	10415	Grouped	Grouped
IMS Information	V, M	876	10415	Grouped	Grouped
Event Type	V, M	823	10415	Grouped	Grouped
Sip-Method	V, M	824	10415	UTF8String	Diameter transport
Node Functionality	V, M	862	10415	Enumerated	Constant
Role of Node	V, M	829	10415	Enumerated	BasicModule
User Session ID	V, M	830	10415	UTF8String	IPModule
Outgoing-Session-Id	V, M	2320	10415	UTF8String	IPModule
Session Priority	V, M	650	10415	UTF8String	3GPPModule
Calling Party Address	V, M	831	10415	UTF8String	BasicModule
Called Party Address	V, M	832	10415	UTF8String	BasicModule
Called Asserted Identity	V, M	1250	10415	UTF8String	3GPPModule
Requested-Party-Address	V, M	1251	10415	UTF8String	3GPPModule
Time Stamps	V, M	833	10415	Grouped	Grouped
SIP-Request-Timestamp	V, M	834	10415	Time	BasicModule
SIP-Response-Timestamp	V, M	835	10415	Time	BasicModule
SIP-Request-Timestamp-Fraction	V, M	2301	10415	Unsigned32	BasicModule
SIP-Response-Timestamp-Fraction	V, M	2302	10415	Unsigned32	BasicModule
Inter Operator Identifier	V, M	838	10415	Grouped	Grouped
Originating-IOI	V, M	839	10415	UTF8String	IPModule
Terminating-IOI	V, M	840	10415	UTF8String	IPModule
IMS Charging Identifier (ICID)	V, M	841	10415	UTF8String	IPModule
Early Media Description	V, M	1272	10415	Grouped	Grouped
SDP-Timestamps	V, M	1273	10415	Grouped	Grouped
SDP-Offer-Timestamp	V, M	1274	10415	Time	3GPPModule
SDP-Answer-Timestamp	V, M	1275	10415	Time	3GPPModule
SDP-Media-Component	V, M	843	10415	Grouped	Grouped
SDP-Media-Name	V, M	844	10415	UTF8String	3GPPModule
SDP-Media-Description	V, M	845	10415	UTF8String	3GPPModule

CCR Field	Flags	Code	Vendor ID	Type	Data Source
Media-Initiator-Flag	V, M	882	10415	Enumerated	3GPPModule
SDP-Type	V, M	2036	10415	Enumerated	3GPPModule
SDP-Session-Description	V, M	842	10415	UTF8String	3GPPModule
SDP Session Description	V, M	842	10415	UTF8String	3GPPModule
SDP Media Component	V, M	843	10415	Grouped	Grouped
SDP-Media-Name	V, M	844	10415	UTF8String	3GPPModule
SDP-Media-Description	V, M	845	10415	UTF8String	3GPPModule
Media-Initiator-Flag	V, M	882	10415	Enumerated	3GPPModule
SDP-Type	V, M	2036	10415	Enumerated	3GPPModule
Message Bodies	V, M	889	10415	Grouped	Grouped
Content-Type	V, M	826	10415	UTF8String	3GPPModule
Content-Length	V, M	827	10415	Unsigned32	3GPPModule
Content-Disposition	V, M	828	10415	UTF8String	3GPPModule
Originator	V, M	864	10415	Enumerated	3GPPModule
Access Network Information	V, M	1263	10415	OctetString	IPModule
Cause Code	V, M	861	10415	Integer32	BasicModule, 3GPPModule
Reason-Header	V, M	3401	10415	UTF8String	3GPPModule
PS Information	V, M	874	10415	Grouped	Grouped
3GPP-MS-Timezone	V, M	23	10415	OctetString	BasicModule, 3GPPModule
AoC-Request-Type	V, M	2055	10415	Enumerated	Constant
User-Equipment-Info	V, M	458	10415	Grouped	Grouped
User-Equipment-Info-Type	V, M	459	10415	Enumerated	3GPPModule
User-Equipment-Info-Value	V, M	460	10415	OctetString	3GPPModule
Custom AVPs (the list of individual BroadSoft vendor-specific AVPs is provided in the <i>BroadWorks Accounting Call Detail Record Interface Specification</i> [7])	V		6431	UTF8String	BasicModule, CentrexModule, IPModule, 3GPPModule

Table 6 CCR Content

Note that none of the above AVPs' presence depends on configuration, except the BroadSoft AVPs with *sendBroadWorksInfo*, the use of the *InhibitedAVPCodeList*, or the use of *GETSNTInhibitedAVPCodeList*. Contrary to offline accounting's ACRs, there is no *send3GPPInfo* configuration for online billing since the 3GPP fields are required for proper credit control.

When an AVP is configured in the *InhibitedAVPCodeList* at the Application Server CLI or in the *InhibitedAVPCodeList* with the diameter interface set to “Ro” or “Both” at the Execution Server CLI, it is not included in the outgoing CCR messages. This provides individual control on the AVP generation. For more information, see the *BroadWorks 3GPP Standard AVP Control Feature Description* [12] and the *Separate Inhibited AVP List for Ro and Rf Feature Description* [14].

When a GETS-NT or GETS-FC + GETS-NT originating session is created, all AVPs present in the *GETSNTInhibitedAVPCodeList* are removed from any outgoing billing CCR Diameter messages associated with this GETS call. For more information, see the *eMPS/GETS Enhancements Feature Description* [13].

4.11 CCA Content

After having received the CCR, the server must answer it with a CCA. The CCA must be constructed according to *RFC 4006* [4].

CCA Field	Flags	Code	Vendor ID	Type	Category
Session Identifier (Session-Id)	M	263	N/A	UTF8String	Mandatory
Result-Code	M	268	N/A	Unsigned32	Mandatory
Originator Host (Origin-Host)	M	264	N/A	Diameter identity	Mandatory
Originator Domain (Origin-Realm)	M	296	N/A	Diameter identity	Mandatory
CC-Request-Type	M	416	N/A	Enumerated	Mandatory
CC-Request-Number	M	415	N/A	Unsigned32	Mandatory
Auth-Application-Id	M	258	N/A	Unsigned32	Mandatory
CC-Session-Failover	M	418	N/A	Enumerated	Optional
Multiple-Services-Credit-Control	M	456	N/A	Grouped	Optional
Granted-Service-Unit	M	431	N/A	Grouped	Optional
CC-Time	M	420	N/A	Unsigned32	Optional
Validity-Time	M	448	N/A	Unsigned32	Optional
Final-Unit-Indication	M	430	N/A	Grouped	Optional
Final-Unit-Action	M	449	N/A	Enumerated	Optional
Redirect-Server	M	434	N/A	Grouped	Optional
Redirect-Address-Type	M	433	N/A	Enumerated	Optional
Redirect-Server-Address	M	435	N/A	UTF8String	Optional
Time-Quota-Threshold	V, M	868	10415	Unsigned32	Optional
Trigger	V, M	1264	10415	Grouped	Optional
Trigger-Type	V, M	870	10415	Enumerated	Optional
Announcement-Information	V, M	3904	10415	Grouped	Optional
Announcement-Identifier	V, M	3905	10415	Unsigned32	Mandatory
Time-Indicator	V, M	3911	10415	Unsigned32	Optional

CCA Field	Flags	Code	Vendor ID	Type	Category
Quota-Indicator	V, M	3912	10415	Enumerated	Optional
Announcement-Order	V, M	3906	10415	Unsigned32	Optional
Play-Alternative	V, M	3913	10415	Enumerated	Optional
Credit-Control-Failure-Handling	M	427	N/A	Enumerated	Optional
Failed-AVP	M	279	N/A	Grouped	Optional
Cost-Information	M	423	N/A	Grouped	Optional
Unit-Value	M	445	N/A	Grouped	Optional
Value-Digits	M	447	N/A	Integer64	Optional
Exponent	M	429	N/A	Integer32	Optional
Currency-Code	M	425	N/A	Unsigned32	Optional
Cost-Unit	M	424	N/A	UTF8String	Optional
Service-Information	V, M	873	10415	Grouped	Optional
AoC-Information	V, M	2054	10415	Grouped	Optional
Tariff-Information	V, M	2060	10415	Grouped	Optional
Current-Tariff	V, M	2056	10415	Grouped	Optional
Currency-Code	M	425	N/A	Unsigned32	Optional
Scale-Factor	V, M	2059	10415	Grouped	Optional
Value-Digits	M	447	N/A	Integer64	Optional
Exponent	M	429	N/A	Integer32	Optional
Rate-Element	V, M	2058	10415	Grouped	Optional
CC-Unit-Type	M	454	N/A	Enumerated	Optional
Charge- Reason-Code	V, M	2118	10415	Enumerated	Optional
Unit-Value	M	445	N/A	Grouped	Optional
Value-Digits	M	447	N/A	Integer64	Optional
Exponent	M	429	N/A	Integer32	Optional
Unit-Cost	V, M	2061	10415	Grouped	Optional
Value-Digits	M	447	N/A	Integer64	Optional
Exponent	M	429	N/A	Integer32	Optional
Unit-Quota-Threshold	V, M	1226	10415	Unsigned32	Optional
Tariff-Time-Change	V, M	451	10415	Time	Optional
Next-Tariff	V, M	2057	10415	Grouped	Optional
Currency-Code	M	425	N/A	Unsigned32	Optional
Scale-Factor	V, M	2059	10415	Grouped	Optional
Value-Digits	M	447	N/A	Integer64	Optional
Exponent	M	429	N/A	Integer32	Optional
Rate-Element	V, M	2058	10415	Grouped	Optional

CCA Field	Flags	Code	Vendor ID	Type	Category
CC-Unit-Type	M	454	N/A	Enumerated	Optional
Charge-Reason-Code	V, M	2118	10415	Enumerated	Optional
Unit-Value	M	445	N/A	Grouped	Optional
Value-Digits	M	447	N/A	Integer64	Optional
Exponent	M	429	N/A	Integer32	Optional
Unit-Cost	V, M	2061	10415	Grouped	Optional
Value-Digits	M	447	N/A	Integer64	Optional
Exponent	M	429	N/A	Integer32	Optional
Unit-Quota-Threshold	V, M	1226	10415	Unsigned32	Optional

Table 7 CCA Content

NOTE: *Multiple-Services-Credit-Control* applies to online billing answers. *Cost-Information* applies to service price enquiry answers. *Service-Information* applies to AoC tariff information answers.

4.12 Ro Interface – Re-authorization/Re-authentication

The Online Charging Server (or System) may initiate a re-authentication and/or credit re-authorization for a particular session by issuing a RAR message to the Execution Server. The Execution Server responds with a RAA acknowledging the RAR sent by the Online Charging Server for the session that needs to be reauthorized. The Execution Server then takes necessary actions to identify the corresponding session ID for the subscriber. A successful RAA transaction is followed by a Credit-Control-Request-Update (CCR-U) indicating the current status and used units for the session. The CCR [Update] following a RAR message contains the Reporting-Reason AVP (AVP code 872) with the value of "FORCED_REAUTHORISATION (7)" to indicate that the Online Charging Server initiates a reauthorization procedure.

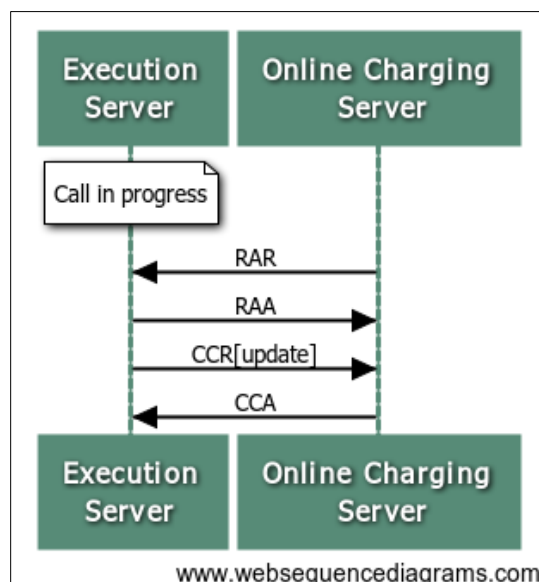


Figure 10 Ro Interface – Re-authorization/Re-authentication

4.12.1 RAR Content

The Online Charging Server (or System) may initiate a re-authentication and/or credit re-authorization for a particular session by issuing a RAR message to the Execution Server. The following table contains the AVPs supported by BroadWorks when received as part of a RAR message.

RAR Field	Flags	Code	Vendor ID	Type	Category
Session Identifier (Session-Id)	M	263	N/A	UTF8String	Mandatory
Originator Host (Origin-Host)	M	264	N/A	Diameter identity	Mandatory
Originator Domain (Origin-Realm)	M	296	N/A	Diameter identity	Mandatory
Destination Domain (Destination-Realm)	M	283	N/A	Diameter identity	Mandatory
Destination-Host	M	293	N/A	Diameter identity	Mandatory
Auth-Application-Id	M	258	N/A	Unsigned32	Mandatory
Re-Auth-Request-Type	M	285	N/A	Enumerated	Mandatory
User Name (User-Name)	M	1	N/A	UTF8String	Optional
Origination State (Origin-State-Id)	M	278	N/A	Unsigned32	Optional
Proxy-Info	M	284	N/A	Grouped	Optional
Proxy-Host	M	280	N/A	Diameter Identity	Optional
Proxy-State	M	33	N/A	OctetString	Optional

4.12.2 RAA Content

After having received the RAR, the Execution Server responds with a RAA as defined in the following table.

RAR Field	Flags	Code	Vendor ID	Type	Category
Session Identifier (Session-Id)	M	263	N/A	UTF8String	Mandatory
Result-Code	M	268	N/A	Unsigned32	Mandatory
Originator Host (Origin-Host)	M	264	N/A	Diameter identity	Mandatory
Originator Domain (Origin-Realm)	M	296	N/A	Diameter identity	Mandatory
User Name (User-Name)	M	1	N/A	UTF8String	Optional
Origination State (Origin-State-Id)	M	278	N/A	Unsigned32	Optional
Proxy-Info	M	284	N/A	Grouped	Optional
Proxy-Host	M	280	N/A	Diameter Identity	Optional
Proxy-State	M	33	N/A	OctetString	Optional
Failed-AVP	M	279	N/A	Grouped	Optional

4.13 Ro Interface – Abort Session

The Online Charging Server may initiate an abort session procedure to force the active session to be terminated for a subscriber due to changes in their price plan and/or usage preferences. The Online Charging Server requests session termination by issuing an ASR message to the Execution Server. The Execution Server responds with an ASA acknowledging the ASR sent by the Online Charging Server for the session that needs to be aborted. The Execution Server then takes necessary actions to identify the corresponding call for the subscriber.

- If the call is *active*, a successful ASR transaction must be followed by releasing the call and playing a treatment to the subscriber to the effect that the subscriber's account does not contain sufficient credits (the *insufficient credits* treatment). The remote party is immediately disconnected.
- If the call is *alerting*, a successful ASR transaction must be followed by releasing the call with a *temporarily unavailable* treatment.

Note that if the *bypassRoRelease* Diameter system accounting parameter is set to "true", then the Execution Server ignores any ASRs for GETS/eMPS call sessions. This prevents the session to be terminated.

The CCR [Terminate] following the reception of the ASR message contains the Termination-Cause AVP (AVP code 295) set to "DIAMETER_ADMINISTRATIVE (4)". The Execution Server uses this value to indicate to the Online Charging Server that the call has been released following the reception of the ASR message.

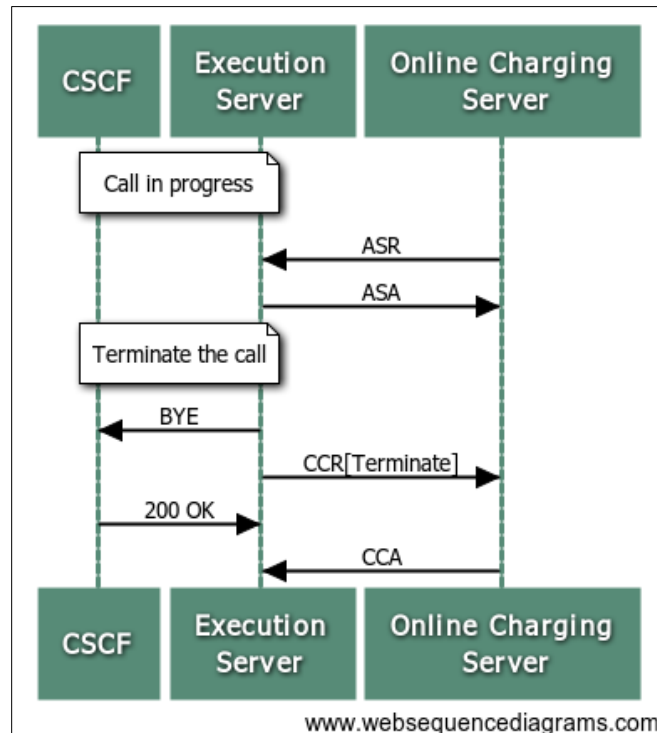


Figure 11 Ro Interface – Abort Session

4.13.1 ASR Content

The Online Charging Server may initiate an abort session procedure to force the active session to be terminated for a subscriber due to changes in their price plan and/or usage preferences. The Online Charging Server requests session termination by issuing an ASR message to the Execution Server. The following table contains the core AVPs supported by BroadWorks when received as part of ASR message.

ASR Field	Flags	Code	Vendor ID	Type	Category
Session Identifier (Session-Id)	M	263	N/A	UTF8String	Mandatory
Originator Host (Origin-Host)	M	264	N/A	Diameter identity	Mandatory
Originator Domain (Origin-Realm)	M	296	N/A	Diameter identity	Mandatory
Destination Domain (Destination-Realm)	M	283	N/A	Diameter identity	Mandatory
Destination-Host	M	293	N/A	Diameter identity	Mandatory
Auth-Application-Id	M	258	N/A	Unsigned32	Mandatory
User Name (User-Name)	M	1	N/A	UTF8String	Optional
Origination State (Origin-State-Id)	M	278	N/A	Unsigned32	Optional
Proxy-Info	M	284	N/A	Grouped	Optional

ASR Field	Flags	Code	Vendor ID	Type	Category
Proxy-Host	M	280	N/A	Diameter Identity	Optional
Proxy-State	M	33	N/A	OctetString	Optional

4.13.2 ASA Content

After having received the ASR, the Execution Server responds with an ASA as defined in the following table.

ASA Field	Flags	Code	Vendor ID	Type	Category
Session Identifier (Session-Id)	M	263	N/A	UTF8String	Mandatory
Result-Code	M	268	N/A	Unsigned32	Mandatory
Originator Host (Origin-Host)	M	264	N/A	Diameter identity	Mandatory
Originator Domain (Origin-Realm)	M	296	N/A	Diameter identity	Mandatory
User Name (User-Name)	M	1	N/A	UTF8String	Optional
Origination State (Origin-State-Id)	M	278	N/A	Unsigned32	Optional
Proxy-Info	M	284	N/A	Grouped	Optional
Proxy-Host	M	280	N/A	Diameter Identity	Optional
Proxy-State	M	33	N/A	OctetString	Optional
Failed-AVP	M	279	N/A	Grouped	Optional

4.14 Detailed AVP Description

This section details how BroadWorks populates each AVP. Many AVPs are defined in terms of the function of the BroadWorks CDR fields. The BroadWorks CDR field definition can be found in the *BroadWorks Accounting Call Detail Record Interface Specification* [7] and is not repeated here.

4.14.1 Session Identifier (Session-Id)

This value is composed of the origin host configured value, followed by a string so that the entire value of the session identifier is guaranteed to be globally and eternally unique. The following is an example.

```
as1.broadsoft.com;1256933663;1;002219FF81DD;3
```

4.14.2 Originator Host (Origin-Host)

The content of the Origin-Host AVP is configured through the Diameter interface base system data, as described in the *BroadWorks Diameter, Rf, Ro, and Sh Interface Configuration Guide* [8]. The following is an example.


```
asl.broadsoft.com
```

4.14.3 Originator Domain (Origin-Realm)

The content of the Origin-Realm AVP is configured through the Diameter interface base system data, as described in the *BroadWorks Diameter, Rf, Ro, and Sh Interface Configuration Guide* [8]. The following is an example.

```
broadsoft.com
```

4.14.4 Destination Domain (Destination-Realm)

The Destination-Realm AVP is populated using the following rules:

- If the *useRealmFromCapabilitiesExchange* Diameter system accounting parameter is set to “true” AND *routingMode* is set to either “direct” or “dynamic”, then the Destination-Realm is set to the Origin-Realm received by the Diameter peer during Capabilities-Exchange.
- If the *useRealmFromCapabilitiesExchange* Diameter system accounting parameter is set to “false” OR *routingMode* is set to “realm”, the Destination-Realm is set to the domain part of the User-Name AVP, as specified by relevant Internet Engineering Task Force (IETF) and 3rd Generation Partnership Project (3GPP) specifications. In case of failover CDRs, the User-Name AVP is not specified and the Destination-Realm is populated with the *defaultDestinationRealm* Diameter system accounting parameter.

Following is an example.

```
systemprovider.com
```

4.14.5 Destination-Host

With the introduction of Realm Routing support for Rf, the Destination-Host AVP is inserted in ACRs ONLY when the ACR is sent using Realm Routing (as opposed to when the request is sent to a directly connected CDF, even in the case where Rf *routingMode* is set to “realm”).

For the online billing interface (Ro):

- On the Application Server, this AVP is always sent. It is set to the address of the OCS that the CCR is sent to.
- On the Execution Server, the *useCCAOriginHostForCCRDestinationHost* parameter controls whether the Destination-Host AVP sent in CCR of types CCR[Update] and CCR[Termination] is present and populated with the content of the Origin-Host AVP of the previous CCA. Also, if this parameter is set to “true”, then the Destination-Host AVP is not included in the CCR[Initial]. For more information, see the *BroadWorks XS Mode Diameter, Sh/Dh, and Rf/Ro Interfaces Configuration Guide* [15].

4.14.6 Operation Type (Accounting-Record-Type)

This field indicates the type of operation described in *Table 2*. The value is encoded as follows:

- EVENT_RECORD = 1
- START_RECORD = 2
- INTERIM_RECORD = 3

- STOP_RECORD = 4

For a complete description, see *Table 2*.

4.14.7 Operation Number (Accounting-Record-Number)

This field contains a number of messages in sequence, in an accounting session. It starts at zero and is incremented by one for each subsequent message.

4.14.8 Operation Identifier (Acct-Application-Id)

This field is always set to the value “3” for offline billing.

4.14.9 CC-Request-Type

Set to “1” for an INITIAL_REQUEST, “2” for an UPDATE_REQUEST, and “3” for a TERMINATION_REQUEST. Value “4” (EVENT_REQUEST) is only used by BroadWorks when sending a failover CDR.

4.14.10 CC-Request-Number

This field increases from “0” in the CCR Initial, “1” in the subsequent CCR Update, and so on, within a call. It is always set to “0” for a CCR Event.

4.14.11 Auth-Application-Id

This field is always set to the value “4” for online billing.

4.14.12 User Name (User-Name)

For the Application Server, this field is set to the value of the *primaryDeviceLinePort* CDR field as defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]. If the value does not exist, the field is not included.

For the Execution Server, the value set for this field is based on the configured *userNameIdentity* parameter.

- When set to “public” to use the primary Public User Identity, it is set to the value of the *primaryDeviceLinePort* CDR field as defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7].
- When set to “private” to use the Private User Identity, the AVP is set to the contents of the *privateUserIdentity* CDR field as defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]. It is not populated if the *privateUserIdentity* CDR field is omitted.

4.14.13 Accounting Interim Interval (Acct-Interim-Interval)

For the Execution Server only, this field is set for ACRs when the accounting interface configuration *longCallDurationRecordControl* value is set to “enabled” or “disabled”. If the value is set to “controlledByDiameterServer”, then this field is not included.

4.14.14 Origination State (Origin-State-Id)

BroadWorks includes the time stamp of the initialization time of the Rf/Ro accounting interface. The value is reset each time the Rf and Ro accounting interfaces are turned on (“off” then “on”). This value is generated independently for each Application Server in a cluster, and independently for Rf and Ro.

4.14.15 Origination Time Stamp (Event-Timestamp)

For offline billing, BroadWorks sets this field as follows:

- If the call is released (ACR Stop or ACR Event), this field is set to the value of the *releaseTime* CDR field defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7], in seconds since January 1, 1900 00:00 UTC.
- If the message is a Start message, this field is set to the value of the *answerTime* CDR field defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7].
- If neither one of these occur, then the time that the message was sent is used.

For online billing, BroadWorks sets this field as follows:

- If the call is released (CCR Termination), this field is set to the value of the *releaseTime* CDR field defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7] if one is available.
- In all other cases, the time that the message is sent is used.

4.14.16 Operation Token (Service-Context-Id)

This represents the value configured in BroadWorks for each interface.

For the Rf interface, this field is set to the configured *serviceContextID* value for the Rf interface. The value is defaulted to:

32260@3gpp.org

For the Ro interface, the Execution Server sets this field to the configured *serviceContextID* value for the Ro interface. The value is defaulted to:

8.32260@3gpp.org

For Advice or Charge requests on the Application Server, the value is set to the Ro interface *serviceContextID*AoC. The value is defaulted to:

11.32280@3gpp.org

The values are configurable on the Application Server and the Execution Server.

4.14.17 Termination-Cause

This AVP is only sent in a few Ro error scenarios as part of a CCR Termination. Normally, the Cause-Code (AVP 861) indicates the release reason, along with the BWA- Termination-Cause (BroadSoft AVP 15). The Termination-Cause is sent with a DIAMETER_BAD_ANSWER (value “3”) when a Tariff-Time-Change AVP is received in a CCA or when a Granted-Service-Unit AVP is received for a unit type other than CC-Time.

The CCR [Terminate] following the reception of the ASR message contains the Termination-Cause AVP (AVP code 295) set to “DIAMETER_ADMINISTRATIVE (4)”. The Execution Server uses this value to indicate to the Online Charging Server that the call has been released following the reception of the ASR message.

The Execution Server also sets this field to “DIAMETER_SERVICE_NOT_PROVIDED (2)” when the user releases the call after it has sent the CCR Initial but the corresponding CCA response was not received.

4.14.18 Requested-Action

This AVP is sent for the Ro interface in the case of CCR Event only. When a CCR Event is sent for a failover CDR, this field's value is set to DIRECT_DEBITING (value "0"). When a CCR Event is sent for a price enquiry, the value is set to PRICE_ENQUIRY (value "3").

4.14.19 Multiple-Services-Indicator

This AVP indicates whether the Diameter credit-control client is capable of handling multiple services independently within a (sub-) session. The value is encoded as follows:

- MULTIPLE_SERVICES_SUPPORTED
- MULTIPLE_SERVICES_NOT_SUPPORTED

For the Ro interface, the Execution Server sets this field to the configured *multipleServicesIndicatorValue*. For more information, see the *BroadWorks XS Mode Diameter, Sh/Dh, and Rf/Ro Interfaces Configuration Guide* [15].

4.14.20 Multiple-Services-Credit-Control

This group AVP contains the Requested-Service-Unit and/or the Used-Service-Unit AVPs for a CCR (online billing requests). If none of the above is sent, this field is omitted. This is also used as part of an online billing answer to report the granted credits and the final unit indication when applicable.

4.14.21 Requested-Service-Unit

This group AVP indicates the number of requested seconds, as configured on BroadWorks, in a CCR Initial or CCR Update. The field can be omitted for centralized unit determination. This is not used in CCR Termination or CCR Event. This field always contains a CC-Time AVP.

4.14.22 CC-Time

This field is used inside the Requested-Service-Unit and Used-Service-Unit group AVPs (for credit control requests). It represents the number of requested or used seconds. It is also present, for answers, in the Granted-Service-Unit AVP.

4.14.23 Used-Service-Units

This group AVP indicates the number of used seconds since the last CCR in a CCR Update or CCR Termination. This is not used in CCR Initial or CCR Event. It contains a CC-Time AVP in all cases and may contain a Reporting-Reason AVP, for CCR Update.

4.14.24 Reporting-Reason

This field is present in CCR Update and CCR Termination, and indicates the reason for usage reporting.

- THRESHOLD (value "0") is used in a CCR Update when requesting additional credits at the time quota threshold.
- FINAL (value "2") is used in CCR Termination when the call has ended normally (for example, a user hung up) or for other reasons not related to credit control (for example, graceful server shutdown).
- QUOTA_EXHAUSTED (value "3") is used in a CCR Termination after the call has run out of credits.
- VALIDITY_TIME (value "4") is used if the validity time expired before the quota was exhausted.

- **RATING_CONDITION_CHANGE** (value “6”) is used if the SDP was modified. In this case, the Trigger group AVP (and the Trigger-Type AVP) is also present and indicates the type of rating condition change.

The other possible values are not used by BroadWorks.

Note that this AVP is sometimes included inside the Used-Service-Units group AVP (when value is **THRESHOLD** or **QUOTA_EXHAUSTED**), and sometimes directly under the Multiple-Services-Credit-Control group AVP (in the other cases).

4.14.25 Trigger

4.14.25.1 Request

For CCR, this group AVP contains the Trigger-Type AVP used in CCR Update when the Reporting-Reason is set to “**RATING_CONDITION_CHANGE**”.

4.14.25.2 Response

In a CCA, an empty Trigger AVP means that all trigger types should be disabled. In this case, the Application Server disables codec change CCR Update messages for the current credit control session (this is the only supported trigger type). If the CCA is not empty, then the Trigger-Type AVPs indicate which types of triggers should be activated, and any Trigger-Type that is not included is assumed to be deactivated.

4.14.26 Trigger-Type

4.14.26.1 Request

This AVP part of the Trigger group AVP is used in CCR Update when the Reporting-Reason is set to “**RATING_CONDITION_CHANGE**”.

CHANGE_IN_MEDIA_COMPOSITION (value “40”) is used when the CCR Update is due to a codec change. This only occurs if a previously received Trigger AVP allows it for the current credit control session, if such an AVP has been received, or if the *enableCDRCodecChanges* accounting configuration parameter is “true” (if the Trigger AVP has not been received).

Although this field is set by both the Application Server and the Execution Server, only the Execution Server populates the Trigger-Type AVP with the value “**CHANGE_IN_LOCATION (3)**” when it receives a location change notification or a new SCC invocation. This value indicates to the Online Charging Server that a change in location should cause the credit control client to ask for a re-authorization of the associated quota. None of the other possible values is used by BroadWorks.

4.14.26.2 Response

The only value currently supported is **CHANGE_IN_MEDIA_COMPOSITION** (value “40”). This overrides the configured value for *enableCDRCodecChanges* and determines whether a CCR Update is sent whenever an answer SDP is received.

4.14.27 Granted-Service-Unit

This grouped AVP, which can be received as part of a CCA, contains the CC-Time AVP indicating how many seconds have been granted for this slice of the call.

This field may or may not be part of the Multiple-Services-Credit-Control AVP. BroadWorks supports both formats for purposes of robustness, even though TS 32.299 [2] only specifies one format.

4.14.28 Validity-Time

This field, which can be received as part of a CCA, indicates the expiration time of the granted units. BroadWorks reauthorizes the service by sending a CCR Update when the credits are exhausted or the validity time is reached, whichever comes first.

4.14.29 Final-Unit-Indication

This group AVP is used by the OCS to inform BroadWorks that no more units are available for this subscriber. BroadWorks does not attempt to request additional credits after receiving this AVP, and the call is terminated when units run out.

This field may or may not be part of the Multiple-Services-Credit-Control AVP. BroadWorks supports both formats for purposes of robustness, even though TS 32.299 [2] only specifies one format.

4.14.30 Final-Unit-Action

This is part of the Final-Unit-Indication group AVP. It can be set to TERMINATE ("0"), REDIRECT ("1"), and RESTRICT_ACCESS ("2"). BroadWorks only supports TERMINATE in this release and the call is terminated no matter what value was received when units ran out.

Note that if the *bypassRoRelease* Diameter system accounting parameter is set to "true", then incoming CCA messages that have a Final-Unit-Indication AVP and a Final-Unit-Action AVP set to "TERMINATE" or to "REDIRECT" are processed but do not result in the termination of the call session for eMPS/GETS sessions.

4.14.31 Rating-Group

This field is populated by the Execution Server Ro interface and is set to the value of the system parameter, *ratingGroup*. If this system parameter is not configured, the Rating-Group AVP is not sent by the Execution Server.

4.14.32 Redirect-Server

This field can be received by the Execution Server as part of a CCA, and it groups the address information of the redirect server (such as HTTP redirect server or SIP server) with which the end user is to be connected when the account cannot cover the service cost. It must be present when the Final-Unit-Action AVP is set to "REDIRECT". If it is not present, then the Execution Server behaves as if the Final-Unit-Action AVP had been set to "TERMINATE".

4.14.33 Redirect-Address-Type

This field is grouped by the Redirect-Server AVP and defines the address type for the server. BroadWorks supports all four *Redirect-Address-Type* values:

- IPv4 ADDRESS (0)
- IPv6 ADDRESS (1)
- URL (2)
- SIP URI (3)

4.14.34 Redirect-Server-Address

This field is grouped by the Redirect-Server AVP and defines the address for the server. When received, BroadWorks populates the outgoing SIP INVITE's *Request-URI* and *To* headers with the content of the Redirect-Server-Address AVP, and sends the event to the S-CSCF.

4.14.35 Time-Quota-Threshold

This field can be received as part of a CCA, for online billing. The value received in this AVP overrides the configured *defaultTimeQuotaThresholdSeconds*. This is used by BroadWorks when requesting additional credits. When the granted units fall below this threshold, a CCR Update is sent.

4.14.36 Unit-Value

This field can be received as part of a CCA, for service price enquiry responses. It contains the cost estimate of the service. $\text{Unit-Value} = \text{Value-Digits AVP} * 10^{\text{Exponent AVP}}$. This grouped AVP is part of the Cost-Information AVP.

4.14.37 Value-Digits

This field can be received as part of a CCA, for service price enquiry responses. It contains the significant digits of the number contained in the Unit-Value, Unit Cost, or Scale-Factor grouped AVP.

This field can be sent as part of an ACR in order to report Advice of Charge charges. It contains the significant digits of the number contained in the Accumulated-Cost or Incremental-Cost grouped AVP.

4.14.38 Exponent

This field can be received as part of a CCA for service price enquiry responses. It contains the exponent value to be applied to the Value-Digit AVP within the Unit-Value, Unit-Cost, or Scale-Factor AVP.

This field can be sent as part of an ACR, in order to report Advice of Charge charges. It contains the exponent value to be applied to the Value-Digit AVP within the Accumulated-Cost or Incremental-Cost grouped AVP.

4.14.39 Currency-Code

This field can be received as part of a CCA for service price enquiry responses and it can be part of an ACR for reporting of Advice of Charge charges. It specifies in which currency the values of AVPs containing monetary units were given. This AVP is part of the Cost-Information grouped AVP. The numerical values refer to the ones defined in the ISO 4217 standard. Code 999 is interpreted as using generic "units" instead of currency.

4.14.40 Cost-Unit

This field can be received as part of a CCA, for service price enquiry responses. It specifies the applicable unit to the Cost-Information when the service cost is a cost per unit (for example, cost of the service is \$1 per minute). Accepted values are "millisecond(s)", "second(s)", "minute(s)", and "hour(s)". Any other value is rejected by BroadWorks. This AVP is part of the Cost-Information grouped AVP.

4.14.41 Subscription-Id

This field is a grouped AVP containing Subscription-Id-Type and Subscription-Id-Data.

4.14.42 Subscription-Id-Type

BroadWorks sets this field to the value “2” (END_USER_SIP_URI) if the Subscription-Id-Data is present.

For the Execution Server:

- When the *subscriptionIdType* system parameter is set to “sipUri”, BroadWorks sets this field to the value “2” (END_USER_SIP_URI).
- When the *subscriptionIdType* system parameter is set to “e164”, BroadWorks sets the Subscription-ID-Type (AVP code 450) to “END_USER_E164 (0)” and the Subscription-ID-Data with the user’s primary DN in the E.164 format. If the user’s E.164 is not available (for example, a user with only an extension and no DN), the group Calling Line ID (CLID) is used in the E.164 format. If no E.164 number is available, no Subscription-ID group AVP is provided.
- When the *subscriptionIdType* system parameter is set to “sipUriAndE164”, two Subscription-ID groups (AVP code 443) are provided by BroadWorks. BroadWorks provides the user’s primary DN in the E.164 format in the first Subscription-ID group and the user’s primary device SIP URI in the second Subscription-ID group. If no E.164 number is available, only the SIP URI is provided.

4.14.43 Subscription-Id-Data

This field is set to the value of the *primaryDeviceLinePort* CDR field defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]. The value is prefixed by “sip:”. If the value does not exist, then the field is not included.

4.14.44 Service-Information

This field is a grouped AVP containing Subscription-Id, IMS-Information, PS-Information, and/or AoC-Information (Application Server only).

4.14.45 IMS-Information

This field is a grouped AVP containing Event-Type, Role-Of-Node, Node-Functionality, User-Session-Id, Session-Priority, Calling-Party-Address, Called-Party-Address, Called-Asserted-Identity, Time-Stamps, Inter-Operator-Identifier, IMS-Charging-Identifier, Early-Media-Description, SDP-Session-Description, SDP-Media-Component, Message-Body, Access-Network-Information, and Cause-Code.

4.14.46 Event-Type

This field is a grouped AVP containing Sip-Method.

4.14.47 Sip-Method

BroadWorks sets this field to the following value:

INVITE

... except for the Ro interface, in CCR Event for the failover scenario. In this case, the value is:

BYE

Also, for the Execution Server Ro interface in CCR Event for emergency notification and CCR Update for location changes and “scc” service extension changes, the value is:

NOTIFY

4.14.48 Node Functionality

BroadWorks sets this field to the value “6” (Application Server).

4.14.49 Role of Node

BroadWorks sets this based on the value of the *direction* CDR field defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7].

- If the *direction* is *Originating*, the role of the node is set to “0” (ORIGINATING_ROLE)
- If the *direction* is *Terminating*, the role of the node is set to “1” (TERMINATING_ROLE)

For cases in which the direction is not specified (for example failover CDR), this field is not set.

4.14.50 User Session ID

BroadWorks sets this field to the value of the *accessCallId* CDR field defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7], if not null. Otherwise, the field is not present.

For the Execution Server, the configuration parameter *userSessionIdSource* controls the contents of this field. When the value is set to “access”, BroadWorks populates the User-Session-Id AVP with the access-side SIP call ID from the incoming SIP INVITE for originating calls and from the outgoing INVITE for terminating calls. When the value is set to “incoming”, the AVP is set to the call ID of the incoming SIP INVITE request.

4.14.51 Outgoing Session Id

For the Execution Server, BroadWorks sets this field for both Ro and Rf based on the values of the *direction*, *networkCallId*, and *accessCallId* CDR fields. For originating calls, this field corresponds to the *networkCallId* CDR field and for terminating calls, this corresponds to the *accessCallId* CDR field.

If corresponding CDR fields are not present, this AVP is not set. The *direction*, *networkCallId*, and *accessCallId* fields are defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7].

4.14.52 Session Priority

This field is present only for GETS calls. It contains the priority value for GETS calls, as configured at the CLI. It may appear in CCR (Ro interface) but not in ACR (Rf interface).

4.14.53 Calling Party Address

The value of this field depends on the *callingPartyAddressStrictCompliance* configuration at the Application Server CLI. When set to false, this field is populated as follows:

This field is constructed by prepending “tel:” or “sip:” to the value of the *callingNumber* CDR field defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]. If non-null and not set to “Unavailable” (set when *callingPresentationIndicator* CDR field is set to “Unavailable”), the *callingNumberContext* is added, prefixed by “;phone-context”. BroadWorks only includes one instance of this AVP. The following are some examples.

```
sip:user@domain.com
tel:3335550100;phone-context=+1
tel:+13335550100
```

If the *callingNumber* is null, this field is not set.

On the Execution Server, if the *includeRoutingNumberInCallingPartyAddress* configuration is set to “true”, then the received routing number is added to the Calling-Party-Address AVP (for example, +15146999502;rn=+1-514-000-0000). When set to “false”, it is not added.

If *callingPartyAddressStrictCompliance* is set to “true”, this field is set according to the BroadWorks CDR field *callingPartyAddress* in the 3GPP module.

4.14.54 Called Party Address

This field is constructed as follows:

- On the Application Server, if the *calledPartyAddressStrictCompliance* configuration is set to “true” and the *calledPartyAddress* BroadWorks CDR field is not empty, then the Called-Party-Address AVP contains the value taken from *calledPartyAddress*.

Otherwise:

- If the network translated number is available, this field contains the value of the *networkTranslatedNumber* CDR field (defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]) prepended with “sip:” or “tel:” as appropriate. If non-null, the *networkTranslatedNumberContext* (defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]) is added, prefixed by “;phone-context”.
- If the called number is available but the network translated number is not available, this field contains the value of the *calledNumber* CDR field (defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]) prepended with “sip:” or “tel:” as appropriate. If non-null, the *calledNumberContext* field (defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]) is added, prefixed by “;phone-context”.

Examples:

```
sip:username@domain.net  
tel:3335550199;phone-context=+1  
tel:+13335550199;phone-context=+1
```

If both the *networkTranslatedNumber* and *calledNumber* are null, this field is not set.

4.14.55 Called Asserted Identity

This field is set to the value of the *calledAssertedIdentity* CDR field defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7].

4.14.56 Requested Party Address

For the Execution Server, this field is added for both the Rf and Ro interfaces. It contains the contents of the *requestedPartyAddress* CDR field as defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]. This AVP is only present if different from the Called-Party-Address AVP. It is not present for Out-of-the-Blue (OOTB) originations.

4.14.57 Time-Stamps

This field is a grouped AVP containing SIP-Request-Timestamp and SIP-Response-Timestamp.

4.14.58 SIP-Request-Timestamp

BroadWorks sets this field to the value of the *startTime* CDR field defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]. If *startTime* is null (for example for failover CDR), this field is not set. The value is in seconds since January 1, 1900 00:00 UTC.

4.14.59 SIP-Response-Timestamp

BroadWorks sets this field to the value of the *answerTime* CDR field defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]. If *answerTime* is null, this field is not set. The value is in seconds since January 1, 1900 00:00 UTC.

4.14.60 SIP-Request-Timestamp-Fraction

For the Execution Server, BroadWorks sets this field to the millisecond portion for the corresponding Timestamp. The milliseconds value is derived from the *startTime* CDR field defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]. If *startTime* is null, this field is not set.

4.14.61 SIP-Response-Timestamp-Fraction

For the Execution Server, BroadWorks sets this field to the millisecond portion for the corresponding Timestamp. The milliseconds value is derived from the *answerTime* CDR field defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]. If *answerTime* is null, this field is not set.

4.14.62 Inter-Operator-Identifier

This field is a grouped AVP containing Originating-IOI and Terminating-IOI.

4.14.63 Originating-IOI

BroadWorks sets this field to the value of the *originatorNetwork* CDR field defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]. If *originatorNetwork* is null, this field is not set.

4.14.64 Terminating-IOI

BroadWorks sets this field to the value of the *terminatorNetwork* CDR field defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]. If *terminatorNetwork* is null, this field is not set.

4.14.65 IMS Charging Identifier (ICID)

BroadWorks sets this field to the value of the *key* CDR field defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]. If *key* is null, this field is not set.

4.14.66 Early-Media-Description

This field is a grouped AVP containing SDP-Timestamps, SDP-Media-Component, and SDP-Session-Description.

4.14.67 SDP-Timestamps

This field is a grouped AVP containing SDP-Offer-Timestamp and SDP-Answer-Timestamp.

4.14.68 SDP-Offer-Timestamp

BroadWorks sets this field to the value of one of the subfields of the *sdpOfferTimestamp* CDR field, defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]. If the *sdpOfferTimestamp* is null, this field is not set. The value is in seconds since January 1, 1900 00:00 UTC.

4.14.69 SDP-Answer-Timestamp

BroadWorks sets this field to the value of one of the subfields of the *sdpAnswerTimestamp* CDR field, defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]. If the *sdpAnswerTimestamp* is null, this field is not set. The value is in seconds since January 1, 1900 00:00 UTC.

4.14.70 SDP-Media-Component

This field is a grouped AVP containing SDP-Media-Name, SDP-Media-Description, and Media-Initiator-Flag.

4.14.71 SDP-Media-Name

BroadWorks includes as many *SDP-Media-Name* AVPs as there are m= lines in the corresponding SDP.

- For early media, the SDP is taken from the *earlyMediaSdp* CDR field.
- For answered calls, the SDP is taken from the *sdp* CDR field.

Both are defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7].

4.14.72 SDP-Media-Description

BroadWorks includes as many *SDP-Media-Description* AVPs as there are “attribute-lines” (i=, c=, b=, k=, a=, and so on) associated with the corresponding media line from the SDP.

- For early media, the SDP is taken from the *earlyMediaSdp* CDR field.
- For answered calls, the SDP is taken from the *sdp* CDR field.

Both are defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7].

4.14.73 Media-Initiator-Flag

BroadWorks sets this field to the value of one of the subfields of the *earlyMediaInitiatorFlag* CDR field or *mediaInitiatorFlag* CDR field. Both are defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7].

- The value *earlyMediaInitiatorFlag* is used when reporting early media. It can contain multiple subfields if there was a multiple early media SDP.
- The value *mediaInitiatorFlag* is used for the regular session media.
- If the CDR value is “none”, then the AVP is not included.

Note that there is one value per SDP in the CDR fields, while there is one *Media-Initiator-Flag* per media line in the SDP. BroadWorks repeats the value for the different media lines when necessary.

4.14.74 SDP-Type

For the Execution Server, BroadWorks only reports the answer SDP. Therefore, the SDP-Type enumerated AVP is added to the SDP-Media-Component group AVP but it is always set to “SDP Answer (1)”.

4.14.75 SDP-Session-Description

BroadWorks includes as many *SDP-Session-Description* AVPs as there are “attribute-lines” (i=, c=, b=, k=, a=, and so on) in the corresponding SDP.

- For early media, the SDP is taken from the *earlyMediaSdp* CDR field.
- For answered calls, the SDP is taken from the *sdp* CDR field.

Both are defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7].

4.14.76 Message-Bodies

This field is a grouped AVP containing Content-Type, Content-Length, Content-Disposition, and Originator.

4.14.77 Content-Type

BroadWorks includes as many *Content-Type* AVPs as there are subfields in the *bodyContentType* CDR field, as defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7].

4.14.78 Content-Length

BroadWorks includes as many *Content-Length* AVPs as there are subfields in the *bodyContentLength* CDR field, as defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7].

4.14.79 Content-Disposition

BroadWorks includes as many *Content-Disposition* AVPs as there are subfields in the *bodyContentDisposition* CDR field, as defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]. Null values are not set.

4.14.80 Originator

BroadWorks includes as many *Originator* AVPs as there are subfields in the *bodyOriginator* CDR field, as defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]. If the CDR value is “none”, then the AVP is not included.

4.14.81 Access Network Information

BroadWorks sets this field to the value of the *accessNetworkInfo* CDR field, as defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]. If *accessNetworkInfo* is null, this field is not set.

For the Execution Server, when the *use3rdPartyRegistrationForLocation* system parameter is enabled, this field is set to the value of the *accessNetworkInfoFromRegister* CDR field as defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7].

4.14.82 Cause Code

BroadWorks sets this field as follows:

- If the call is not released, this value is not present.
- If the BroadWorks termination cause (defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]) is 016 (normal), the Cause-Code is "0".
- If the call is released due to a SIP error code (taken from the *sipErrorCode* defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]), this value is reported as a 4xx, 5xx, 6xx value.
- If the BroadWorks termination cause is 111 (protocol error), the Cause-Code is "2".
- If none of the above is true, the value is set to "1".

4.14.83 Reason Code

For the Execution Server, BroadWorks sets this field to the reason headers contained in the *incomingReason* and *outgoingReason* CDR fields. As defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7], multiple *Reason* headers can be captured in these CDR fields. Each individual reason is represented in a repeated Reason-Code AVP and is added for both the Rf and Ro interfaces. If the *incomingReason* and *outgoingReason* CDR fields are null, this field is not set.

4.14.84 PS Information

For the Execution Server, this field is a grouped AVP containing 3GPP-MS-Timezone AVPs and User-Equipment-Info AVPs. The User-Equipment-Info AVP is supplied for the Rf interface only.

4.14.85 3GPP-MS-Timezone

For the Execution Server, the 3GPP-MS-TimeZone AVP is populated using the *receivedTimeZone* CDR field, if available. When the *receivedTimeZone* CDR field is not defined or it is not a valid 3GPP time zone, then the 3GPP-MS-TimeZone AVP is populated using the *userTimeZone* CDR field. The contents of the *receivedTimeZone* and *userTimeZone* CDR fields are defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]. In both cases, the CDR field is subject to the manipulation described in the next paragraphs to respect the specification's format.

The AVP's first octet contains the actual time zone in semi-octet representation, with the fourth bit being a sign bit, and the value representing the difference expressed in quarters of an hour, between the user's time zone and Greenwich Mean Time (GMT). In this representation, the four least significant bits are the first digit of the represented value (including the sign bit), and the four most significant bits represent the second digit of the represented value. For example, 0x40 = 01000000 means GMT+1 and 0x4A = 01001010 means GMT-6. The Daylight Saving Time (DST) adjustment is included in (that is, added to) the time zone.

The second octet contains the DST adjustment that was included in the above-mentioned time zone, and can take one of the following three possible values:

- 0x00 means no DST adjustment
- 0x01 means a +1 hour DST adjustment
- 0x02 means a +2 hours DST adjustment

4.14.86 User-Equipment-Info

For the Execution Server, this field is a grouped AVP containing User-Equipment-Info-Type and User-Equipment-Info-Value AVPs.

4.14.87 User-Equipment-Info-Type

For the Execution Server, BroadWorks sets this field is derived from the *userEquipmentInfo* CDR field defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]. From the *userEquipmentInfo*, the value header's *uei-type* parameter is used to populate the User-Equipment-Info-Type AVP. The possible values for the User-Equipment-Info-Type AVP are as follows:

- 0: IMEISV
- 1: MAC
- 2: EUI64
- 3: MODIFIED_EUI64

4.14.88 User-Equipment-Info-Value

For the Execution Server, BroadWorks sets this field as derived from the *userEquipmentInfo* CDR field defined in the *BroadWorks Accounting Call Detail Record Interface Specification* [7]. From the *userEquipmentInfo*, the value header's *uei-value* parameter is used to populate the User-Equipment-Info-Value AVP (stripping out the quotes).

4.14.89 Custom AVPs

BroadWorks optionally adds BroadSoft vendor-specific AVPs with the content of BroadWorks CDR (see the *BroadWorks Accounting Call Detail Record Interface Specification* [7]). Each custom AVP represents one non-null CDR field or subfield, and is constructed as follows:

- The AVP is configured as a vendor-specific AVP.
- The vendor ID is 6431 (BroadSoft vendor ID).
- The code is the value of the field ID.
- The value is always UTF8String.
- Subfields in a CDR field are each encoded in its own AVP.

4.14.90 AoC-Request-Type

This field denotes whether AoC-Information is requested and what type of information is needed. For Service Price Enquiry, this is set to "0" (AoC not requested) and for AoC Tariff Information, this is set to "3" (AoC_Tariff_Only). This field is present for online requests only.

4.14.91 Result-Code

In answers, this AVP contains the status of the operation.

4.14.92 CC-Session-Failover

In online billing answers, this AVP contains information as to whether moving the credit-control message stream to a backup server during an ongoing credit-control session is supported.

If not received, the value is assumed to be FAILOVER NOT SUPPORTED.

4.14.93 Granted-Service-Unit

In online billing answers, this grouped AVP contains Granted-Service-Unit, Validity-Time, Final-Unit-Indication, Time-Quota-Threshold, and Trigger.

4.14.94 Credit-Control-Failure-Handling

In online billing answers, this AVP controls the behavior if sending credit-control messages to the credit-control server has been, for instance, temporarily prevented due to a network problem.

4.14.95 Cost-Information

In Advice of Charge Price Enquiry answers, this grouped AVP contains Unit-Value, Currency-Code, and Cost-Unit.

4.14.96 AoC-Information

For the Ro interface Advice of Charge Tariff Information answers, this grouped AVP contains the Tariff-Information.

For the Rf interface, this grouped AVP contains the AoC-Cost-Information for the Advice of Charge information sent to the access device.

This AVP applies only to the Application Server and the Advice of Charge Tariff Information is not available on the Execution Server.

4.14.97 Tariff-Information

This field is a grouped AVP containing Current-Tariff, Tariff-Time-Change, and Next-Tariff.

4.14.98 Current-Tariff

This field is a grouped AVP containing Currency-Code, Scale-Factor, and Rate-Element. It is the tariff definition for the current time period.

4.14.99 Scale-Factor

This field is a grouped AVP containing Value-Digits and Exponent.

4.14.100 Rate-Element

This field is a grouped AVP containing CC-Unit-Type, Charge-Reason-Code, Unit-Value, and Unit-Cost.

4.14.101 CC-Unit-Type

This grouped AVP is part of the Rate-Element AVP. It contains the measuring unit type/description:

- *TIME – 0*
- *MONEY – 1*
- *TOTAL-OCTETS – 2* – Not supported by BroadWorks
- *INPUT-OCTETS – 3* – Not supported by BroadWorks
- *OUTPUT-OCTETS – 4* – Not supported by BroadWorks
- *SERVICE-SPECIFIC-UNITS – 5*

4.14.102 Charge-Reason-Code

This grouped AVP is part of the Rate-Element AVP. It contains a specific charge type code/description. Valid values are:

- *UNKNOWN – 0*
- *USAGE – 1*
- *COMMUNICATION-ATTEMPT-CHARGE – 2*
- *SETUP-CHARGE – 3*
- *ADD-ON-CHARGE – 4*

4.14.103 Unit-Cost

This field is a grouped AVP containing Value-Digits and Exponent. It contains the amount charged since the beginning of the call/session. $\text{Unit-Cost} = \text{Value-Digits AVP} * 10^{\text{Exponent AVP}}$.

4.14.104 Tariff-Time-Change

This AVP contains the tariff switch time required to activate the Next-Tariff (when defined).

4.14.105 Next-Tariff

This field is a grouped AVP containing Currency-Code, Scale-Factor, and Rate-Element. It is the tariff of the next time period starting at Tariff-Time-Change time. It is mandatory when Tariff-Time-Change is defined.

4.14.106 AoC-Cost-Information

This field is a grouped AVP containing Accumulated-Cost, Incremental-Cost, and Currency-Code AVPs. It is used by the Rf interface to report Advice of Charge charges.

4.14.107 Accumulated-Cost

This field is a grouped AVP containing Value-Digits and Exponent AVPs. It is used by the Rf interface to report Advice of Charge charges. It contains the amount charged since the beginning of the call/session. $\text{Accumulated-Cost} = \text{Value-Digits AVP} * 10^{\text{Exponent AVP}}$.

4.14.108 Incremental-Cost

This field is a grouped AVP containing Value-Digits and Exponent AVPs. It is used by the Rf interface to report Advice of Charge charges. It contains the incremental amount charged to the access device since last reported. $\text{Incremental-Cost} = \text{Value-Digits AVP} * 10^{\text{Exponent AVP}}$.

4.14.109 Re-Auth-Request-Type

This field is sent by the OCS in a RAR message to the Execution Server. The Re-Auth-Request-Type AVP is ignored by the Execution Server. The Execution Server has the same behavior no matter the value of the Re-Auth-Request-Type AVP.

4.14.110 Proxy-Info

This field is used by the RAR, RAA, ASR, and ASA supported by the Execution Server. This is a group AVP that contains the Proxy-Host and Proxy-State AVPs. BroadWorks receives this AVP (and its children AVPs) from the RAR or ASR and echoes them back in the corresponding RAA or ASA.

4.14.111 Proxy-State

This field is mandatory when the Proxy-Info group AVP is present. This AVP contains the proxy server's identity and is only echoed back in the corresponding RAA/ASA message. Only the Execution Server validates its presence in the Proxy-Info group AVP.

4.14.112 Proxy-Host

This field is mandatory when the Proxy-Info group AVP is present. This AVP contains the proxy server's state local information and is only echoed back in the corresponding RAA/ASA message. Only the Execution Server validates its presence in the Proxy-Info group AVP.

4.14.113 Failed-AVP

For Execution Server logging purposes, this field groups a list of AVPs that caused the corresponding RAR or ASR message to fail (if any).

4.14.114 Announcement-Information AVP

This field is a grouped AVP containing the Announcement-Identifier, Time-Indicator, Quota-Indicator, Announcement-Order, and Play-Alternative AVPs. It is used by the OCS to specify an announcement to be played to a prepaid user by the Execution Server.

4.14.115 Announcement-Identifier AVP

This is part of the Announcement-Information AVP. This AVP is mandatory and contains the announcement number to be played to the prepaid subscriber. The Execution Server uses the AVP to build the announcement file name as shown.

```
"prepaid/Announcement_" + Announcement-Identifier + ".wav"
```

4.14.116 Time-Indicator AVP

This is part of the Announcement-Information AVP. This AVP is optional and indicates at which time relative to the exhaustion of quotas the announcement should be played.

- A value higher than the granted quota or the absence of AVP causes the announcement to be played upon reception of the CCA message.
- A value lower than the granted quotas but higher than 0 causes the announcement to be played when this value of quotas is remaining.
- A value of "0" causes the announcement to be played upon quota exhaustion.

4.14.117 Quota-Indicator AVP

This is part of the Announcement-Information AVP. This AVP is optional and controls the consumption of quota service units during the playback of announcements.

- A value of "0" (QUOTA_IS_NOT_USED_DURING_PLAYBACK) indicates that quota is not consumed during announcement playback.
- A value of "1" (QUOTA_IS_USED_DURING_PLAYBACK) or the absence of AVP indicates that quota is consumed during announcement playback. If the quota is exhausted during announcement playback, the prepaid user is disconnected from the Media Server and the call is released.

4.14.118 Announcement-Order AVP

This is part of the Announcement-Information AVP. This AVP is optional and indicates the order in which announcements should be played when multiple Announcement-Information AVPs are received in the same CCA.

- A value of “0” indicates that this announcement is played first.
- The absence of a value indicates that this announcement is played last.

4.14.119 Play-Alternative AVP

This is part of the Announcement-Information AVP. This AVP is optional and indicates the party to which the announcement should be played. It is only supported for failed termination attempts, or in other words, in a CCA[Final] received in response to a CCR[Initial] for a terminating prepaid user.

- A value of “0” (SERVED_PARTY) or the absence of AVP indicates that the announcement should be played to the local served party.
- A value of “1” (REMOTE_PARTY) indicates that the announcement should be played to the remote party.

4.15 Failure Handling

4.15.1 General Failover/Failback Procedures

The Diameter stack maintains a list of outstanding outgoing transactions for each Diameter connection. When a problem is detected on a connection, all outstanding requests *may* be retransmitted to an alternate peer (next CDF, next Realm Routing peer, and so on). Request retransmission is both application-dependent and configuration-dependent.

Additionally, Diameter applications perform failover when receiving specific values for Result-Code AVPs from peer. One typical scenario is when a request is sent across a chain of Diameter agents (presumably using Realm Routing), and one agent in the path becomes unreachable. In such a case, the Diameter stack is expected to receive a DIAMETER_UNABLE_TO_DELIVER (3002) Result-Code AVP from the preceding agent. Another typical scenario is when the Diameter stack receives a DIAMETER_TOO_BUSY (3004) Result-Code AVP.

Failover procedures are also invoked when a specific request has not been answered in a timely manner; however, the failover scope is request-only (or session-only for session-based applications such as Rf/Ro), and other requests are still forwarded to the peer.

When retransmission occurs, the request’s “T” bit is always set and the same end-to-end ID is kept but a new hop-by-hop ID is generated.

4.15.2 Rf Failover/Failback

Rf failover occurs when the Diameter stack detects a problem on a Diameter connection for which there are outstanding Rf transactions. Failover is also applied when receiving the following Result-Code AVPs:

- DIAMETER_UNABLE_TO_DELIVER (3002)
- DIAMETER_TOO_BUSY (3004)
- DIAMETER_OUT_OF_SPACE (4002)

The list of destination CDFs (or next hops if Realm Routing is used, or a combination of both) is determined when the Rf session is started. This is done so all ACRs that belong to the same Rf session are sent to the same destination CDF (or next hop). Note that the list is evaluated once at the beginning of the Rf session; it is not re-evaluated upon peer configuration changes after the Rf session was started.

- If the *Rf routingMode* system parameter is set to “direct”, “dynamic”, or “realm” (and the CDF was directly connected to the Application Server), failover procedures consist of selecting the next CDF from the *P-CFA* header. The outstanding ACR (and all subsequent ACRs for the same Rf session) are sent to the newly selected CDF.
- If the *Rf routingMode* is set to “dynamic” and there is currently no connection to the CDF, the Application Server tries first to establish a Diameter connection to the CDF.
- If the *Rf routingMode* system parameter is set to “realm” and Realm Routing was used to send the ACR (that is, the CDF is NOT directly connected to the Application Server), the next destination is selected.

There is no fallback for a given Rf session. Fallback is performed for subsequent Rf sessions that need to access a CDF that returned to health.

4.15.2.1 Queue to Disk

BroadWorks saves on disk accounting requests for which it is unable to obtain a successful answer under any of the following conditions.

Error
All selected CDFs for this request are down or unreachable.
There is timeout waiting for the answer.
An accounting answer with an error code 3004 (DIAMETER_TOO_BUSY) is received.
An accounting answer with any error code 4XXX (transient failures) is received.

Table 8 Errors Causing File Queuing

File queuing is performed if all CDFs fail with one of the above conditions. All subsequent requests for the same accounting session are also queued to disk to preserve the sequence.

A separate file is used for each different P-CFA first *ccf* parameter selected (that is, only the first *ccf* is used). Active files are closed after five minutes, and a new file is opened. Files are named:

<P-CFA first *ccf* parameter><date><time>.xml²

... where *date* is written as YYYYMMDD (YYYY is the year, MM is the month, and DD is the day of the month). The time is written as *hhmmss* (*hh* is the hour in 24-hour format, *mm* is the minutes, and *ss* is the seconds).

Files are written in the directory `/var/broadworks/billing/rf/<P-CFA first ccf parameter>/writing`.

Example:

`/var/broadworks/billing/rf/first.ccf/writing/first.ccf_20090131114530.xml`

The file being written to is automatically closed after five minutes. Then it is moved to the following directory:

`/var/broadworks/billing/rf/<P-CFA first ccf parameter>/ready`

² CDF Internal ID: Unique ID generated by BroadWorks

Files are preserved for a maximum configurable time that is between one hour and one week. The maximum number of files per CDF is:

12 files/hour * 168 hours/week = 2,016 files, assuming a one-week retention period

Periodically, a check is made for the presence of one or more files in the `/var/broadworks/billing/rf/<P-CFA first ccf parameter>/ready` directories. On the AS, the period is configurable at the CLI (`AS_CLI/Interface/Accounting/BroadWorksCDRInterface/Diameter/Offline> set pollingIntervalSeconds`), with a default of 30 minutes. On the XS, the period is set to 30 minutes and is not configurable.

If any file is found:

- All files older than the configured value are deleted. An alarm is raised for each file deleted.
- The remaining files are processed from the oldest to the newest. Files from different directories (different CDFs) are processed in parallel.
- The first ACR from the file is read. A first attempt is made to send the request to the selected CDF.
- If BroadWorks receives a positive answer, it moves to the next entry in the file; otherwise, it pauses and retries the same request again.
- If an unrecoverable error condition is encountered, (any failure except those listed in *Table 8*), then the request is dropped and the appropriate alarm is raised.
- BroadWorks resumes retransmission of queued ACRs after a restart.

File queuing can generate a large quantity of data on disk if the call rate is high, the retention period is long, and the outage is extended. If the disk partition used to store queued diameter requests fills up, file queuing is automatically disabled to protect system integrity. The conditions for stopping file queuing are:

- The disk partition, where the queued requests are saved, is over occupied when it exceeds a certain ratio (default 90%).
- The space occupied by file queuing exceeds a certain ratio (default 5%).

When these conditions are met, the following occurs:

- An alarm is raised indicating the condition.
- File queuing is disabled; this stops the queuing of new requests to disk on both the primary and secondary Application Servers, regardless of which Application Server has a full disk.

NOTE: When the "disk full" condition clears, file queuing must be re-enabled manually.

4.15.3 Ro Failover/Failback

Ro failover basically follows the same procedures as Rf; however, failover is further controlled by the *defaultCreditControlFailureHandling* system parameter and received values for Credit-Control-Failure-Handling and CC-Session-Failover AVPs.

Since Ro interface is invoked during call setup, it uses the *roTxTimerSeconds* system parameter (which effectively implements the *RFC 4006* Tx timer) instead of the general *requestTimerSeconds* system parameter. The Tx timer is started when sending a CCR initial and when sending a CCR update, if the applicable Credit-Control-Failure-Handling (as received in the AVP, or else it is the default value) is TERMINATE.

Similar to Rf, failback is performed for any new Ro session containing the previously failed server (having returned to health, that is, its connection control status returned to OKAY) in priority in the *P-CFA* header. Failback does not occur in the scope of a given Ro session.

4.15.3.1 Initial Request

When the communication with the primary OCS fails during a CCR Initial, (no response is received within the Tx timer, BroadWorks behavior is controlled by the system configuration *defaultCreditControlFailureHandling*.

defaultCreditControlFailureHandling	Behavior
CONTINUE	Call setup resumes. The Application Server may tear down the call afterward if it receives an answer from an OCS with insufficient credit indication (or other conditions upon which the call should be denied), given such an answer is received within <i>requestTimerSeconds</i> system parameter. Other servers are attempted.
TERMINATE	The call is released immediately (that is, after the Tx timer). No attempt is made to communicate with another OCS.
RETRY_AND_TERMINATE	Call setup is temporarily resumed. If a positive response is received within <i>requestTimerSeconds</i> , the call continues. Other servers are attempted. When the <i>requestTimerSeconds</i> expires (or if other "negative" conditions occur) for each attempted OCS, the call is released.

Table 9 defaultCreditControlFailureHandling for Initial Request

This also applies when the system is not configured properly and no OCS can be contacted.

4.15.3.2 Update Request

When the communication with the OCS fails during a CCR Update, BroadWorks may attempt communication with another OCS. The behavior depends on the received value of Credit-Control-Failure-Handling AVP, CC-Session-Failover AVP, and the system configuration *defaultCreditControlFailureHandling*, as shown in the following table.

CC-Session-Failover	Credit-Control-Failure-Handling	defaultCreditControlFailureHandling	Behavior
FAILOVER SUPPORTED	CONTINUE	any	Call continues. Other servers are attempted. The Application Server may tear down the call afterward if it receives an answer from the OCS with insufficient credit indication (or other conditions upon which the call should be denied), given such an answer is received within <i>requestTimerSeconds</i> system parameter.
	none	CONTINUE	
any	TERMINATE	any	The call is released when the TX timer expires. Other servers are not contacted.
	none	TERMINATE	

CC-Session-Failover	Credit-Control-Failure-Handling	defaultCreditControlFailureHandling	Behavior
FAILOVER NOT SUPPORTED	RETRY AND TERMINATE	any	The call is released when the <i>requestTimerSeconds</i> expires (or if another "negative" condition occurs). Other servers are not contacted.
	none	RETRY AND TERMINATE	
FAILOVER NOT SUPPORTED	CONTINUE	any	Call continues. Other servers are not contacted.
	none	CONTINUE	
FAILOVER SUPPORTED	RETRY AND TERMINATE	Any	Other OCSs are contacted. If successful, the call continues. Otherwise, when the <i>requestTimerSeconds</i> expires (or if other "negative" conditions occur) for all servers, the call is released.
	none	RETRY AND TERMINATE	

Table 10 CCR Update Failure Handling

For CCR update, the Tx timer is only started if the applicable Credit-Control-Failure-Handling is TERMINATE.

4.15.3.3 Termination Request

When the communication with the OCS fails during a CCR Termination, the Application Server may attempt communication with another OCS. The behavior depends on the received value of Credit-Control-Failure-Handling AVP, CC-Session-Failover AVP, and the system configuration *defaultCreditControlFailureHandling*, as shown in the following table.

CC-Session-Failover	Credit-Control-Failure-Handling	defaultCreditControlFailureHandling	Behavior
any	TERMINATE	any	The call is released normally. The other servers are not contacted.
	none	TERMINATE	
FAILOVER NOT SUPPORTED	any	any	
FAILOVER SUPPORTED	CONTINUE or RETRY AND TERMINATE	any	The call is released normally. The other OCSs are contacted.
	none	CONTINUE or RETRY AND TERMINATE	

Table 11 CCR Termination Failure Handling

For CCR Termination, the Tx timer is never started.

4.15.3.4 Event Request

For CCR Event, BroadWorks attempts to communicate with a secondary OCS if one is available. Events are not queued if none of the servers responds, and the Tx timer is never started.

Appendix A: Diameter Wireshark Dictionary for Rf and Ro Applications

The following file, available from BroadSoft upon request (usually found in the same directory as this document), contains the information required to configure Wireshark to properly decode the BroadSoft AVPs:

`wireshark_diameter_dictionary-R23.0.txt`

Appendix B: Diameter Dictionary Document Type Definition

The following is the diameter dictionary document type definition taken from *draft-frascone-xml-dictionary-00*.

```
<?xml version="1.0" encoding="UTF-8"?>
<!ELEMENT dictionary (vendor*, base, application*)>

<!ELEMENT vendor EMPTY>
<!ATTLIST vendor
    id CDATA #REQUIRED
    name CDATA #REQUIRED
>

<!ELEMENT base (command*, typedefn+, avp+)>
<!ATTLIST base
    uri CDATA #IMPLIED
>

<!ELEMENT application (command*, typedefn*, avp*)>
<!ATTLIST application
    id CDATA #REQUIRED
    name CDATA #IMPLIED
    uri CDATA #IMPLIED
>

<!ELEMENT command (requestrules*, answeerrules*)>
<!ATTLIST command
    name CDATA #REQUIRED
    code CDATA #REQUIRED
    vendor-id CDATA #IMPLIED
    pbit (0 | 1) "1"
>

<!ELEMENT typedefn EMPTY>
<!ATTLIST typedefn
    type-name ID #REQUIRED
    type-parent IDREF #IMPLIED
    description CDATA #IMPLIED
>

<!ELEMENT avp ((type | grouped), (enum*))>
<!ATTLIST avp
    name ID #REQUIRED
    description CDATA #IMPLIED
    code CDATA #REQUIRED
    may-encrypt (yes | no) "yes"
    mandatory (must | may | mustnot | shouldnot) "may"
    protected (must | may | mustnot | shouldnot) "may"
    vendor-id CDATA #IMPLIED
>

<!ELEMENT type EMPTY>
<!ATTLIST type
    type-name IDREF #REQUIRED
>

<!ELEMENT grouped (gavp+)>
<!ELEMENT gavp EMPTY>
<!ATTLIST gavp
    name IDREF #REQUIRED
    vendor-id CDATA #IMPLIED
>

<!ELEMENT enum EMPTY>
<!ATTLIST enum
    name CDATA #REQUIRED
```

```
        code CDATA #REQUIRED
    >

    <!--ELEMENT requestrules (avprule+)-->
    <!--ELEMENT answerrules (avprule+)-->

    <!--ELEMENT avprule EMPTY-->
    <!--ATTLIST avprule
        name IDREF #REQUIRED
        position (first | last | unspecified) "unspecified"
        maximum CDATA "none"
        minimum CDATA "0"
    >
```

Appendix C: Example Messages

The following is an example of ACR [Start].

```
Message header:
  flags=RP
  commandCode=271 (ACR)
  applicationId=3
  hopByHopId=146837697
  endToEndId=-1846542331
AVPs:
  Session-Id: code=263, flags=M, UTF8String,
value=as.client.mtl.broadsoft.com;1256933663;1;002219FF81DD;3
  Origin-Host: code=264, flags=M, DiameterIdentity,
value=as.client.mtl.broadsoft.com
  Origin-Realm: code=296, flags=M, DiameterIdentity, value=TestRealm
  Origin-State-Id: code=278, flags=M, Unsigned32, value=1256933663
  Destination-Realm: code=283, flags=M, DiameterIdentity, value=mtlasdev81.net
  Accounting-Record-Type: code=480, flags=M, Enumerated, value=Start Record
  Accounting-Record-Number: code=485, flags=M, Unsigned32, value=0
  Acct-Application-Id: code=259, flags=M, Unsigned32, value=3
  User-Name: code=1, flags=M, UTF8String, value=5146981603@mtlasdev81.net
  Event-Timestamp: code=55, flags=M, Time, value=Fri Oct 30 16:24:08 EDT 2009
  Service-Context-Id: code=461, flags=M, UTF8String, value=32260@3gpp.org
  Service-Information: code=873, vendorId=10415, flags=VM, Grouped, value=
    Subscription-Id: code=443, flags=M, Grouped, value=
      Subscription-Id-Type: code=450, flags=M, Integer32, value=2
      Subscription-Id-Data: code=444, flags=M, UTF8String,
value=sip:5146981603@mtlasdev81.net
    IMS-Information: code=876, vendorId=10415, flags=VM, Grouped, value=
      Event-Type: code=823, vendorId=10415, flags=VM, Grouped, value=
        Sip-Method: code=824, vendorId=10415, flags=VM, UTF8String, value=INVITE
        Node-Functionality: code=862, vendorId=10415, flags=VM, Enumerated,
value=AS
      Role-of-Node: code=829, vendorId=10415, flags=VM, Enumerated,
value=TERMINATING-ROLE
      User-Session-Id: code=830, vendorId=10415, flags=VM, UTF8String,
value=BW162407624301009-1410000101@192.168.8.207
      Calling-Party-Address: code=831, vendorId=10415, flags=VM, UTF8String,
value=tel:+15146981604
      Called-Party-Address: code=832, vendorId=10415, flags=VM, UTF8String,
value=tel:+15146981603
      Time-Stamps: code=833, vendorId=10415, flags=VM, Grouped, value=
        SIP-Request-Timestamp: code=834, vendorId=10415, flags=VM, Time,
value=Fri Oct 30 16:24:07 EDT 2009
        SIP-Response-Timestamp: code=835, vendorId=10415, flags=VM, Time,
value=Fri Oct 30 16:24:08 EDT 2009
      SDP-Session-Description: code=842, vendorId=10415, flags=VM, UTF8String,
value=v=0
      SDP-Session-Description: code=842, vendorId=10415, flags=VM, UTF8String,
value=o=BroadWorks 12 1 IN IP4 192.168.8.20
      SDP-Session-Description: code=842, vendorId=10415, flags=VM, UTF8String,
value=s=-
      SDP-Session-Description: code=842, vendorId=10415, flags=VM, UTF8String,
value=c=IN IP4 192.168.8.20
      SDP-Session-Description: code=842, vendorId=10415, flags=VM, UTF8String,
value=t=0 0
      SDP-Media-Component: code=843, vendorId=10415, flags=VM, Grouped, value=
        SDP-Media-Name: code=844, vendorId=10415, flags=VM, UTF8String,
value=m=audio 16384 RTP/AVP 0 101
        SDP-Media-Description: code=845, vendorId=10415, flags=VM, UTF8String,
value=a=rtpmap:0 PCMU/8000/1
        SDP-Media-Description: code=845, vendorId=10415, flags=VM, UTF8String,
value=a=rtpmap:101 telephone-event/8000
        SDP-Media-Description: code=845, vendorId=10415, flags=VM, UTF8String,
value=a=fmtp:101 0-15
      Media-Initiator-Flag: code=882, vendorId=10415, flags=VM, Enumerated,
value=calling party
```

```

    BWAS-Radius-Encoding-Version: code=0, vendorId=6431, flags=V, UTF8String,
value=17.0
    BWAS-Record-id: code=1, vendorId=6431, flags=V, UTF8String,
value=0000000002DEFAULT20091030202407.2291-040000
    BWAS-Service-provider: code=2, vendorId=6431, flags=V, UTF8String,
value=MtIASDev
    BWAS-Type: code=3, vendorId=6431, flags=V, UTF8String, value=Normal
    BWAS-User-Number: code=4, vendorId=6431, flags=V, UTF8String,
value=+15146981603
    BWAS-Direction: code=6, vendorId=6431, flags=V, UTF8String, value=Terminating
    BWAS-Calling-Number: code=7, vendorId=6431, flags=V, UTF8String,
value=+15146981604
    BWAS-Calling-Presentation-Indic: code=8, vendorId=6431, flags=V, UTF8String,
value=Public
    BWAS-Called-Number: code=9, vendorId=6431, flags=V, UTF8String,
value=+15146981603
    BWAS-Start-Time: code=10, vendorId=6431, flags=V, UTF8String,
value=20091030202407.229
    BWAS-User-Timezone: code=11, vendorId=6431, flags=V, UTF8String, value=1-040000
    BWAS-Answer-Indic: code=12, vendorId=6431, flags=V, UTF8String, value=Yes
    BWAS-Answer-Time: code=13, vendorId=6431, flags=V, UTF8String,
value=20091030202408.791
    BWAS-Network-Type: code=16, vendorId=6431, flags=V, UTF8String, value=VoIP
    BWAS-Route: code=24, vendorId=6431, flags=V, UTF8String, value=Group
    BWAS-Codec: code=26, vendorId=6431, flags=V, UTF8String, value=PCMU/8000/1
    BWAS-Access-Device-Address: code=27, vendorId=6431, flags=V, UTF8String,
value=192.168.8.20
    BWAS-Access-Callid: code=28, vendorId=6431, flags=V, UTF8String,
value=BW162407624301009-1410000101@192.168.8.207
    BWAS-Group: code=32, vendorId=6431, flags=V, UTF8String, value=South_as81
    BWAS-Charge-Indic: code=42, vendorId=6431, flags=V, UTF8String, value=n
    BWAS-Local-Callid: code=45, vendorId=6431, flags=V, UTF8String, value=72:0
    BWAS-Remote-Callid: code=46, vendorId=6431, flags=V, UTF8String, value=70:0
    BWAS-UserId: code=121, vendorId=6431, flags=V, UTF8String,
value=south03@mtlasdev81.net
    BWAS-Other-Party-Name: code=122, vendorId=6431, flags=V, UTF8String,
value=john4 south
    BWAS-Other-Party-Name-Pres-Indic: code=123, vendorId=6431, flags=V, UTF8String,
value=Public
    BWAS-CLID-Permitted: code=141, vendorId=6431, flags=V, UTF8String, value=Yes
    BWAS-Primary-Device-Line-Port: code=207, vendorId=6431, flags=V, UTF8String,
value=5146981603@mtlasdev81.net
    BWAS-SDP: code=210, vendorId=6431, flags=V, UTF8String, value=Content-
Type:application/sdp
Content-Length:203

v=0
o=BroadWorks 12 1 IN IP4 192.168.8.20
s=-
c=IN IP4 192.168.8.20
t=0 0
m=audio 16384 RTP/AVP 0 101
a=rtpmap:0 PCMU/8000/1
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15

    BWAS-Media-Initiator-Flag: code=211, vendorId=6431, flags=V, UTF8String,
value=1
    BWAS-AS-Call-Type: code=231, vendorId=6431, flags=V, UTF8String, value=Group
    BWAS-NAME-Permitted: code=272, vendorId=6431, flags=M, UTF8String, value=Yes

```

The following is an example of ACR [Stop].

```
Message header:
  flags=RP
  commandCode=271 (ACR)
  applicationId=3
  hopByHopId=146837704
  endToEndId=-1846542324
AVPs:
  Session-Id: code=263, flags=M, UTF8String,
value=as.client.mtl.broadsoft.com;1256933663;4;002219FF81DD;3
  Origin-Host: code=264, flags=M, DiameterIdentity,
value=as.client.mtl.broadsoft.com
  Origin-Realm: code=296, flags=M, DiameterIdentity, value=TestRealm
  Origin-State-Id: code=278, flags=M, Unsigned32, value=1256933663
  Destination-Realm: code=283, flags=M, DiameterIdentity, value=mtlasdev81.net
  Accounting-Record-Type: code=480, flags=M, Enumerated, value=Stop Record
  Accounting-Record-Number: code=485, flags=M, Unsigned32, value=1
  Acct-Application-Id: code=259, flags=M, Unsigned32, value=3
  User-Name: code=1, flags=M, UTF8String, value=5146981604@mtlasdev81.net
  Event-Timestamp: code=55, flags=M, Time, value=Fri Oct 30 16:24:42 EDT 2009
  Service-Context-Id: code=461, flags=M, UTF8String, value=32260@3gpp.org
  Service-Information: code=873, vendorId=10415, flags=VM, Grouped, value=
    Subscription-Id: code=443, flags=M, Grouped, value=
      Subscription-Id-Type: code=450, flags=M, Integer32, value=2
      Subscription-Id-Data: code=444, flags=M, UTF8String,
value=sip:5146981604@mtlasdev81.net
    IMS-Information: code=876, vendorId=10415, flags=VM, Grouped, value=
      Event-Type: code=823, vendorId=10415, flags=VM, Grouped, value=
        Sip-Method: code=824, vendorId=10415, flags=VM, UTF8String, value=INVITE
        Node-Functionality: code=862, vendorId=10415, flags=VM, Enumerated,
value=AS
      Role-of-Node: code=829, vendorId=10415, flags=VM, Enumerated,
value=ORIGINATING-ROLE
      User-Session-Id: code=830, vendorId=10415, flags=VM, UTF8String,
value=1900509628@192.168.8.20
      Calling-Party-Address: code=831, vendorId=10415, flags=VM, UTF8String,
value=tel:+15146981604
      Called-Party-Address: code=832, vendorId=10415, flags=VM, UTF8String,
value=tel:+15146981603
      Called-Asserted-Identity: code=1250, vendorId=10415, flags=VM, UTF8String,
value=sip:+15146981603@192.168.8.207
      Time-Stamp: code=833, vendorId=10415, flags=VM, Grouped, value=
        SIP-Request-Timestamp: code=834, vendorId=10415, flags=VM, Time,
value=Fri Oct 30 16:24:23 EDT 2009
        SIP-Response-Timestamp: code=835, vendorId=10415, flags=VM, Time,
value=Fri Oct 30 16:24:23 EDT 2009
      SDP-Session-Description: code=842, vendorId=10415, flags=VM, UTF8String,
value=v=0
        SDP-Session-Description: code=842, vendorId=10415, flags=VM, UTF8String,
value=o=BroadWorks 14 1 IN IP4 192.168.8.20
        SDP-Session-Description: code=842, vendorId=10415, flags=VM, UTF8String,
value=s=-
          SDP-Session-Description: code=842, vendorId=10415, flags=VM, UTF8String,
value=c=IN IP4 192.168.8.20
          SDP-Session-Description: code=842, vendorId=10415, flags=VM, UTF8String,
value=t=0 0
            SDP-Media-Component: code=843, vendorId=10415, flags=VM, Grouped, value=
              SDP-Media-Name: code=844, vendorId=10415, flags=VM, UTF8String,
value=m=audio 16384 RTP/AVP 0 101
              SDP-Media-Description: code=845, vendorId=10415, flags=VM, UTF8String,
value=a=rtpmap:0 PCMU/8000/1
              SDP-Media-Description: code=845, vendorId=10415, flags=VM, UTF8String,
value=a=rtpmap:101 telephone-event/8000
              SDP-Media-Description: code=845, vendorId=10415, flags=VM, UTF8String,
value=a=fmtp:101 0-15
              Media-Initiator-Flag: code=882, vendorId=10415, flags=VM, Enumerated,
value=calling party
            Cause-Code: code=861, vendorId=10415, flags=VM, Integer32, value=0
            BWAS-Radius-Encoding-Version: code=0, vendorId=6431, flags=V, UTF8String,
value=17.0
```

```
BWAS-Record-id: code=1, vendorId=6431, flags=V, UTF8String,
value=0000000006DEFAULT20091030202423.0631-040000
BWAS-Service-provider: code=2, vendorId=6431, flags=V, UTF8String,
value=MtlASDev
BWAS-Type: code=3, vendorId=6431, flags=V, UTF8String, value=Normal
BWAS-User-Number: code=4, vendorId=6431, flags=V, UTF8String,
value=+15146981604
BWAS-Direction: code=6, vendorId=6431, flags=V, UTF8String, value=Originating
BWAS-Calling-Number: code=7, vendorId=6431, flags=V, UTF8String,
value=+15146981604
BWAS-Calling-Presentation-Indic: code=8, vendorId=6431, flags=V, UTF8String,
value=Public
BWAS-Called-Number: code=9, vendorId=6431, flags=V, UTF8String,
value=+15146981603
BWAS-Start-Time: code=10, vendorId=6431, flags=V, UTF8String,
value=20091030202423.063
BWAS-User-Timezone: code=11, vendorId=6431, flags=V, UTF8String, value=1-040000
BWAS-Answer-Indic: code=12, vendorId=6431, flags=V, UTF8String, value=Yes
BWAS-Answer-Time: code=13, vendorId=6431, flags=V, UTF8String,
value=20091030202423.640
BWAS-Release-Time: code=14, vendorId=6431, flags=V, UTF8String,
value=20091030202442.136
BWAS-Termination-Cause: code=15, vendorId=6431, flags=V, UTF8String, value=016
BWAS-Network-Type: code=16, vendorId=6431, flags=V, UTF8String, value=VoIP
BWAS-Dialed-Digits: code=18, vendorId=6431, flags=V, UTF8String, value=603
BWAS-Call-Category: code=19, vendorId=6431, flags=V, UTF8String, value=private
BWAS-Releasing-Party: code=23, vendorId=6431, flags=V, UTF8String, value=local
BWAS-Route: code=24, vendorId=6431, flags=V, UTF8String, value=Group
BWAS-Codec: code=26, vendorId=6431, flags=V, UTF8String, value=PCMU/8000/1
BWAS-Access-Device-Address: code=27, vendorId=6431, flags=V, UTF8String,
value=192.168.8.20
BWAS-Access-Callid: code=28, vendorId=6431, flags=V, UTF8String,
value=1900509628@192.168.8.20
BWAS-Group: code=32, vendorId=6431, flags=V, UTF8String, value=South_as81
BWAS-Charge-Indic: code=42, vendorId=6431, flags=V, UTF8String, value=n
BWAS-Local-Callid: code=45, vendorId=6431, flags=V, UTF8String, value=74:0
BWAS-Remote-Callid: code=46, vendorId=6431, flags=V, UTF8String, value=76:0
BWAS-UserId: code=121, vendorId=6431, flags=V, UTF8String,
value=south04@mtlasdev81.net
BWAS-Other-Party-Name: code=122, vendorId=6431, flags=V, UTF8String,
value=john3 south
BWAS-Other-Party-Name-Pres-Indic: code=123, vendorId=6431, flags=V, UTF8String,
value=Public
BWAS-Codec-Usage: code=157, vendorId=6431, flags=V, UTF8String, value=18.491
BWAS-Primary-Device-Line-Port: code=207, vendorId=6431, flags=V, UTF8String,
value=5146981604@mtlasdev81.net
BWAS-Called-Asserted-Identity: code=208, vendorId=6431, flags=V, UTF8String,
value=sip:+15146981603@192.168.8.207
BWAS-Called-Asserted-Pres-Indicator: code=209, vendorId=6431, flags=V,
UTF8String, value=Public
BWAS-SDP: code=210, vendorId=6431, flags=V, UTF8String, value=Content-
Type:application/sdp
Content-Length:203

v=0
o=BroadWorks 14 1 IN IP4 192.168.8.20
s=-
c=IN IP4 192.168.8.20
t=0 0
m=audio 16384 RTP/AVP 0 101
a=rtpmap:0 PCMU/8000/1
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15

BWAS-Media-Initiator-Flag: code=211, vendorId=6431, flags=V, UTF8String,
value=1
BWAS-AS-Call-Type: code=231, vendorId=6431, flags=V, UTF8String, value=Group
BWAS-Prepaid-Status: code=246, vendorId=6431, flags=V, UTF8String,
value=charged
```

The following is an example of CCR Termination.

```
Message header:
  flags=RP
  commandCode=272 (CCR)
  applicationId=4
  hopByHopId=146837699
  endToEndId=-1846542329
AVPs:
  Session-Id: code=263, flags=M, UTF8String,
value=as.client.mtl.broadsoft.com;1256933663;0;002219FF81DD;4
  Origin-Host: code=264, flags=M, DiameterIdentity,
value=as.client.mtl.broadsoft.com
  Origin-Realm: code=296, flags=M, DiameterIdentity, value=TestRealm
  Destination-Realm: code=283, flags=M, DiameterIdentity, value=mtlasdev81.net
  Destination-Host: code=293, flags=M, DiameterIdentity,
value=ro.server.mtl.broadsoft.com
  CC-Request-Type: code=416, flags=M, Enumerated, value=TERMINATION_REQUEST
  CC-Request-Number: code=415, flags=M, Unsigned32, value=1
  Auth-Application-Id: code=258, flags=M, Unsigned32, value=4
  Origin-State-Id: code=278, flags=M, Unsigned32, value=1256933663
  User-Name: code=1, flags=M, UTF8String, value=5146981604@mtlasdev81.net
  Event-Timestamp: code=55, flags=M, Time, value=Fri Oct 30 16:24:17 EDT 2009
  Service-Context-Id: code=461, flags=M, UTF8String, value=8.32260@3gpp.org
  Subscription-Id: code=443, flags=M, Grouped, value=
  Subscription-Id-Type: code=450, flags=M, Integer32, value=2
  Subscription-Id-Data: code=444, flags=M, UTF8String,
value=sip:5146981604@mtlasdev81.net
  Multiple-Services-Credit-Control: code=456, flags=M, Grouped, value=
  Used-Service-Unit: code=446, flags=M, Grouped, value=
  CC-Time: code=420, flags=M, Unsigned32, value=10
  Reporting-Reason: code=872, vendorId=10415, flags=VM, Enumerated, value=FINAL
  Service-Information: code=873, vendorId=10415, flags=VM, Grouped, value=
  IMS-Information: code=876, vendorId=10415, flags=VM, Grouped, value=
  Event-Type: code=823, vendorId=10415, flags=VM, Grouped, value=
  Sip-Method: code=824, vendorId=10415, flags=VM, UTF8String, value=INVITE
  Node-Functionality: code=862, vendorId=10415, flags=VM, Enumerated,
value=AS
  Role-of-Node: code=829, vendorId=10415, flags=VM, Enumerated,
value=ORIGINATING-ROLE
  User-Session-Id: code=830, vendorId=10415, flags=VM, UTF8String,
value=356612692@192.168.8.20
  Calling-Party-Address: code=831, vendorId=10415, flags=VM, UTF8String,
value=tel:+15146981604
  Called-Party-Address: code=832, vendorId=10415, flags=VM, UTF8String,
value=tel:+15146981603
  Called-Asserted-Identity: code=1250, vendorId=10415, flags=VM, UTF8String,
value=sip:+15146981603@192.168.8.207
  Time-Stamps: code=833, vendorId=10415, flags=VM, Grouped, value=
  SIP-Request-Timestamp: code=834, vendorId=10415, flags=VM, Time,
value=Fri Oct 30 16:24:07 EDT 2009
  SIP-Response-Timestamp: code=835, vendorId=10415, flags=VM, Time,
value=Fri Oct 30 16:24:08 EDT 2009
  SDP-Session-Description: code=842, vendorId=10415, flags=VM, UTF8String,
value=v=0
  SDP-Session-Description: code=842, vendorId=10415, flags=VM, UTF8String,
value=o=BroadWorks 12 1 IN IP4 192.168.8.20
  SDP-Session-Description: code=842, vendorId=10415, flags=VM, UTF8String,
value=s=-
  SDP-Session-Description: code=842, vendorId=10415, flags=VM, UTF8String,
value=c=IN IP4 192.168.8.20
  SDP-Session-Description: code=842, vendorId=10415, flags=VM, UTF8String,
value=t=0 0
  SDP-Media-Component: code=843, vendorId=10415, flags=VM, Grouped, value=
  SDP-Media-Name: code=844, vendorId=10415, flags=VM, UTF8String,
value=m=audio 16384 RTP/AVP 0 101
  SDP-Media-Description: code=845, vendorId=10415, flags=VM, UTF8String,
value=a=rtpmap:0 PCMU/8000/1
  SDP-Media-Description: code=845, vendorId=10415, flags=VM, UTF8String,
value=a=rtpmap:101 telephone-event/8000
```



```

SDP-Media-Description: code=845, vendorId=10415, flags=VM, UTF8String,
value=a=fmtp:101 0-15
Media-Initiator-Flag: code=882, vendorId=10415, flags=VM, Enumerated,
value=calling party
Cause-Code: code=861, vendorId=10415, flags=VM, Integer32, value=0
BWAS-Radius-Encoding-Version: code=0, vendorId=6431, flags=V, UTF8String,
value=17.0
BWAS-Record-id: code=1, vendorId=6431, flags=V, UTF8String,
value=0000000002DEFAULT20091030202407.2291-040000
BWAS-Service-provider: code=2, vendorId=6431, flags=V, UTF8String,
value=MtIASDev
BWAS-Type: code=3, vendorId=6431, flags=V, UTF8String, value=Normal
BWAS-User-Number: code=4, vendorId=6431, flags=V, UTF8String,
value=+15146981604
BWAS-Direction: code=6, vendorId=6431, flags=V, UTF8String, value=Originating
BWAS-Calling-Number: code=7, vendorId=6431, flags=V, UTF8String,
value=+15146981604
BWAS-Calling-Presentation-Indic: code=8, vendorId=6431, flags=V, UTF8String,
value=Public
BWAS-Called-Number: code=9, vendorId=6431, flags=V, UTF8String,
value=+15146981603
BWAS-Start-Time: code=10, vendorId=6431, flags=V, UTF8String,
value=20091030202407.229
BWAS-User-Timezone: code=11, vendorId=6431, flags=V, UTF8String, value=1-040000
BWAS-Answer-Indic: code=12, vendorId=6431, flags=V, UTF8String, value=Yes
BWAS-Answer-Time: code=13, vendorId=6431, flags=V, UTF8String,
value=20091030202408.791
BWAS-Release-Time: code=14, vendorId=6431, flags=V, UTF8String,
value=20091030202417.800
BWAS-Termination-Cause: code=15, vendorId=6431, flags=V, UTF8String, value=016
BWAS-Network-Type: code=16, vendorId=6431, flags=V, UTF8String, value=VoIP
BWAS-Dialed-Digits: code=18, vendorId=6431, flags=V, UTF8String, value=603
BWAS-Call-Category: code=19, vendorId=6431, flags=V, UTF8String, value=private
BWAS-Releasing-Party: code=23, vendorId=6431, flags=V, UTF8String, value=local
BWAS-Route: code=24, vendorId=6431, flags=V, UTF8String, value=Group
BWAS-Codec: code=26, vendorId=6431, flags=V, UTF8String, value=PCMU/8000/1
BWAS-Access-Device-Address: code=27, vendorId=6431, flags=V, UTF8String,
value=192.168.8.20
BWAS-Access-Callid: code=28, vendorId=6431, flags=V, UTF8String,
value=356612692@192.168.8.20
BWAS-Group: code=32, vendorId=6431, flags=V, UTF8String, value=South_as81
BWAS-Charge-Indic: code=42, vendorId=6431, flags=V, UTF8String, value=n
BWAS-Local-Callid: code=45, vendorId=6431, flags=V, UTF8String, value=70:0
BWAS-Remote-Callid: code=46, vendorId=6431, flags=V, UTF8String, value=72:0
BWAS-UserId: code=121, vendorId=6431, flags=V, UTF8String,
value=south04@mtlasdev81.net
BWAS-Other-Party-Name: code=122, vendorId=6431, flags=V, UTF8String,
value=john3 south
BWAS-Other-Party-Name-Pres-Indic: code=123, vendorId=6431, flags=V, UTF8String,
value=Public
BWAS-Codec-Usage: code=157, vendorId=6431, flags=V, UTF8String, value=8.950
BWAS-Primary-Device-Line-Port: code=207, vendorId=6431, flags=V, UTF8String,
value=5146981604@mtlasdev81.net
BWAS-Called-Asserted-Identity: code=208, vendorId=6431, flags=V, UTF8String,
value=sip:+15146981603@192.168.8.207
BWAS-Called-Asserted-Pres-Indicator: code=209, vendorId=6431, flags=V,
UTF8String, value=Public
BWAS-SDP: code=210, vendorId=6431, flags=V, UTF8String, value=Content-
Type:application/sdp
Content-Length:203

v=0
o=BroadWorks 12 1 IN IP4 192.168.8.20
s=-
c=IN IP4 192.168.8.20
t=0 0
m=audio 16384 RTP/AVP 0 101
a=rtpmap:0 PCMU/8000/1
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15

```



```
BWAS-Media-Initiator-Flag: code=211, vendorId=6431, flags=V, UTF8String,  
value=1  
  BWAS-AS-Call-Type: code=231, vendorId=6431, flags=V, UTF8String, value=Group  
  BWAS-Prepaid-Status: code=246, vendorId=6431, flags=V, UTF8String,  
value=charged
```

Appendix D: AVP Length

The following table provides an indication of the maximum length of standard and 3GPP vendor-specific AVPs. Fixed-length AVPs (Unsigned32, Enumerated, Time, and so on) have a maximum length implicit to their type. Variable length AVPs (OctetString, UTF8String) have a maximum length determined from the information they carry. Grouped AVPs are not specified since their length is simply the sum of the AVPs they group together. Length information for BroadSoft vendor-specific AVPs is found in the *BroadWorks Accounting Call Detail Record Interface Specification* [7].

NOTE: Many fields report data that is unbounded in nature. The Offline Charging Diameter interface always reports the full values. For this reason, billing mediation systems must either be flexible enough to accept longer values than indicated in the following table or they must truncate the fields to the lengths indicated in the following table, while accepting that occasionally information might be lost.

AVP	Maximum Length
Session Identifier (Session-Id)	112
Originator Host (Origin-Host)	80
Originator Domain (Origin-Realm)	80
Destination Domain (Destination-Realm)	80
Destination-Host	80
Operation Type (Accounting-Record-Type)	4
Operation Number (Accounting-Record-Number)	4
Operation Identifier (Acct-Application-Id)	4
User Name (User-Name)	161
Origination State (Origin-State-Id)	4
Origination Time Stamp (Event-Timestamp)	4
Operation Token (Service-Context-Id)	17
Subscription-Id-Type	4
Subscription-Id-Data	165
Sip-Method	6
Node Functionality	4
Role of Node	4
User Session ID	161
Calling Party Address	341
Called Party Address	341
Called Asserted Identity	161
SIP-Request-Timestamp	4
SIP-Response-Timestamp	4

AVP	Maximum Length
Originating-IOI	80
Terminating-IOI	80
IMS Charging Identifier (ICID)	161
SDP-Offer-Timestamp	4
SDP-Answer-Timestamp	4
SDP-Media-Name	255
SDP-Media-Description	255
Media-Initiator-Flag	4
SDP Session Description	255
Content-Type	255
Content-Length	4
Content-Disposition	255
Originator	4
Access Network Information	1024
Cause Code	4
Cost-Unit	12
CC-Request-Type	4
CC-Request-Number	4
Auth-Application-Id	4
Termination-Cause	4
Requested-Action	4
CC_time	4
Reporting-Reason	4
Trigger-Type	4

Table 12 Maximum AVP Length

Acronyms and Abbreviations

ABNF	Augmented Backus-Naur Format
ACA	Accounting Answer
ACR	Accounting Request
AoC	Advice of Charge
AS	Application Server
ASA	Abort Session Answer
ASR	Abort Session Request
AVP	Attribute Value Pair
CCA	Credit Control Answer
CCR	Credit Control Request
CDF	Charging Data Function
CDR	Call Detail Record
CLI	Command Line Interface
DN	Directory Number
DNS	Domain Name System
DST	Daylight Saving Time
GETS	Government Emergency Telecommunications Service
GMT	Greenwich Mean Time
IETF	Internet Engineering Task Force
IMS	IP Multimedia Subsystem
IP	Internet Protocol
OCS	Online Charging System
OOTB	Out-of-the-Blue
RAA	Re-Auth-Answer
RAR	Re-Authentication Request
SCC	Service Centralization and Continuity
SDP	Session Description Protocol
SIP	Session Initiation Protocol
XS	Execution Server

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