

# Oracle® Communications Convergent Charging Controller Diameter Control Agent Technical Guide



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The Oracle logo, consisting of the word "ORACLE" in white, uppercase, sans-serif font, centered within a solid red square.

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# Contents

About This Document .....	v
Document Conventions .....	vi
<b>Chapter 1</b>	
<b>System Overview .....</b>	<b>1</b>
Overview .....	1
What is Diameter Control Agent? .....	1
<b>Chapter 2</b>	
<b>Configuration.....</b>	<b>5</b>
Overview .....	5
Configuration Overview .....	5
eserv.config Configuration .....	6
SLEE.cfg Configuration .....	7
RAR Configuration.....	8
acs.conf Configuration .....	9
Prepaid Charging Configuration .....	10
Feature Node Configuration .....	12
INAP Extensions.....	14
Parameter Mappings .....	15
Business Scenarios .....	19
<b>Chapter 3</b>	
<b>Background Processes .....</b>	<b>27</b>
Overview .....	27
dcaResPlugin .....	27
diameterControlAgent Process .....	28
xmlSleeDcaInterface .....	30
DCADefaults Configuration Section .....	31
DCAInstances Configuration Section .....	41
Services Configuration .....	66
PeerSchemes Configuration Section .....	83
Statistics Logged by diameterControlAgent .....	88
<b>Chapter 4</b>	
<b>Service Specific AVP Mappings.....</b>	<b>91</b>
Overview .....	91
Introduction .....	91
Basic Array .....	93
Key Array.....	96
Array with Conditions.....	99
Array with Context .....	109
Conditional AVP .....	115
Prefix Tree .....	123
Timestamp.....	125

## Chapter 5

### Control Plans ..... 131

Overview.....	131
Check Balance .....	131
Direct Debiting .....	132
Price Enquiry .....	134
Refund Account .....	134
Session No Redirect.....	136
Session Redirect .....	137
Screening .....	138

## Chapter 6

### About Installation and Removal ..... 141

Overview.....	141
Installation and Removal Overview .....	141
Checking the Installation .....	141

## Chapter 7

### Diameter Charging Agent Call Flows ..... 143

Call Flow Overview.....	143
Initial Request Success .....	143
Initial Request Release Call .....	144
Initial Request Multiple Requested Service Units .....	144
AVP Pass-Through DCA to DCD .....	146
Screening Successful .....	148
Screening Call Disallowed.....	148
Screening Failure .....	149
Update Request.....	149
Terminate Request .....	150

# About This Document

## Scope

The scope of this document includes all the information required to install, configure and administer the Diameter Control Agent application.

## Audience

This guide was written primarily for system administrators and persons installing, configuring and administering the Diameter Control Agent application. However, sections of the document may be useful to anyone requiring an introduction to the application.

## Prerequisites

A solid understanding of UNIX and a familiarity with IN concepts are an essential prerequisite for safely using the information contained in this technical guide. Attempting to install, remove, configure or otherwise alter the described system without the appropriate background skills, could cause damage to the system; including temporary or permanent incorrect operation, loss of service, and may render your system beyond recovery.

A familiarity with the Diameter protocol is also required. Refer to the following:

- Internet Engineering Task Force (IETF) specifications:
  - RFC 3588 – Diameter Base Protocol
  - RFC 4006 – Diameter Credit-Control Application
  - RFC 4005 – Diameter Network Access Server Application
- 3GPP TS 32.299 V11.3.0 (2012-03) – 3rd Generation Partnership Project; Technical Specification Group Service and System Aspects; Telecommunication management; Charging management; Diameter charging applications (Release 11)

Although it is not a prerequisite to using this guide, familiarity with the target platform would be an advantage.

This manual describes system tasks that should only be carried out by suitably trained operators.

## Related Documents

The following documents are related to this document:

- *Advanced Control Services Technical Guide*
- *Charging Control Services Technical Guide*
- *Charging Control Services User's Guide*
- *Service Management System Technical Guide*
- *Service Management System User's Guide*
- *Service Logic Execution Environment Technical Guide*

# Document Conventions

## Typographical Conventions

The following terms and typographical conventions are used in the Oracle Communications Convergent Charging Controller documentation.

Formatting Convention	Type of Information
<b>Special Bold</b>	Items you must select, such as names of tabs. Names of database tables and fields.
<i>Italics</i>	Name of a document, chapter, topic or other publication. Emphasis within text.
<b>Button</b>	The name of a button to click or a key to press. <b>Example:</b> To close the window, either click <b>Close</b> , or press <b>Esc</b> .
<b>Key+Key</b>	Key combinations for which the user must press and hold down one key and then press another. Example: <b>Ctrl+P</b> or <b>Alt+F4</b> .
Monospace	Examples of code or standard output.
<b>Monospace Bold</b>	Text that you must enter.
<i>variable</i>	Used to indicate variables or text that should be replaced with an actual value.
menu option > menu option >	Used to indicate the cascading menu option to be selected. Example: <b>Operator Functions &gt; Report Functions</b>
<a href="#">hypertext link</a>	Used to indicate a hypertext link.

# System Overview

## Overview

### Introduction

This chapter provides a high-level overview of the application. It explains the basic functionality of the system and lists the main components.

It is not intended to advise on any specific Oracle Communications Convergent Charging Controller network or service implications of the product.

### In this Chapter

---

This chapter contains the following topics.

What is Diameter Control Agent? ..... 1

## What is Diameter Control Agent?

### Introduction

The Diameter Control Agent (DCA) is a SLEE interface used to translate between Diameter messages and CAP 3 INAP.

Diameter is a protocol which has been designed to supersede RADIUS, and which facilitates AAA (Authentication, Authorization and Accounting), and Credit-Control. This protocol forms the basis of a Credit-Control solution for Oracle IMS (IP Multimedia Subsystem) products.

The DCA acts as a Diameter based credit control server. In doing so, it provides an interface to the Prepaid Charging product (CCS component), to facilitate the use of the billing functionality provided there.

### Features

The DCA provides the following features:

- Provides support for AVPs specified in TS 32.299.
  - Allows an AVP to be mapped to any INAP operation argument; for example, InitialDP.calledPartyNumber
  - Allows AVPs from any CCR to be mapped to ACS profile fields
  - Allows ACS Profile fields to be mapped to any CCA response sent to a CC-Client
  - Allows specification of complex mappings between AVPs and ACS Profile fields (including type ARRAY)
- Supports call-screening without the need to start a billing session.
- Provides free call support (the ability to send DIAMETER\_CREDIT\_CONTROL\_NOT\_APPLICABLE as a response).
- Support for Mobile Network operators (MNO) who provide their own variations on 3GPP and IETF Diameter standards for Credit Control, including:
  - Service triggering

- Extensions to standards based enumerated values
- Default units may be assumed by operators, but be specified explicitly later in the call flows
- Ability to track elapsed-time at the interface and report back to the client
- Allows result-codes set by the interface to be mapped
- Supports the use of non-standard capabilities negotiation

### **Per-Message Type AVP Mapping**

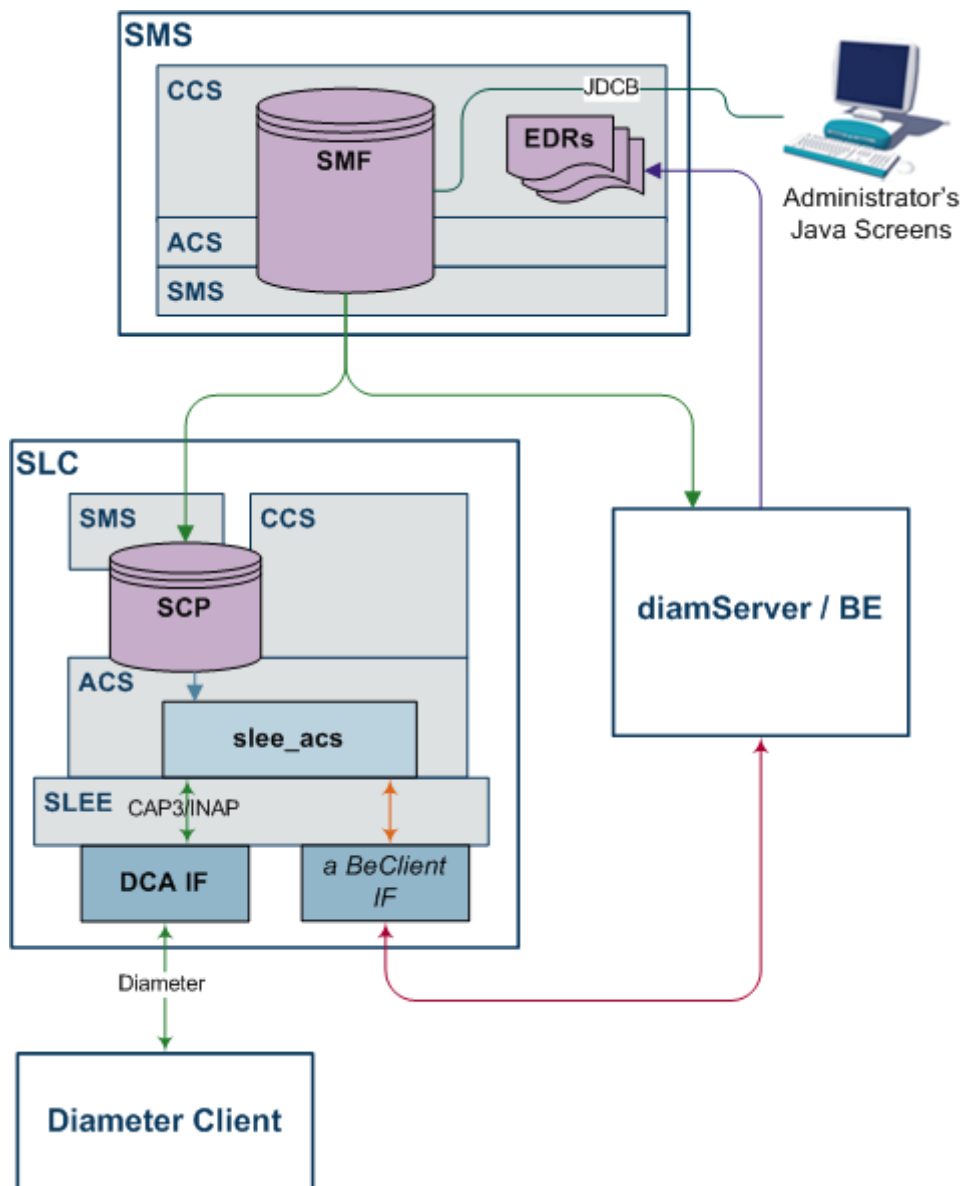
The AVP mapping rules configurable in DCA are:

- CCR INITIAL\_REQUEST
- CCR EVENT\_REQUEST
- CCA INITIAL\_REQUEST
- CCA EVENT\_REQUEST
- CCR UPDATE\_REQUEST (one or more existing services) + CCA UPDATE\_REQUEST
- CCR TERMINATION\_REQUEST + CCA TERMINATION\_REQUEST



## Diagram

Here is a high level diagram showing Diameter Control Agent in the context of Convergent Charging Controller components.



### DCA Components

In this diagram, the components that are specific to DCA are:

- Diameter Client
- Diameter messages
- DCA interface
- CAP3/INAP within the SLEE

## Screening

DCA screening provides the ability to configure one or more service entries in the **eserv.config** file that do not specify a Service-Identifier or a Rating-Group. Additionally, these services contain a flag indicating that they are for screening. Screening is only available if no default Rating-Group has been specified in the config file.

When a Diameter Initial CCR is received by DCA with no Service-Identifier or Rating-Group, DCA will check the configured services for a service that matches the remaining AVPs. If such a service is found, then the corresponding control plan will be triggered.

The control plans used for screening can perform logic, and will return the result of screening by returning either a continue for success, or a release for failure. In both cases, extra information can be passed between the CCR/CCA and ACS using the inbound and outbound AVP mapping features listed in *Per-Message Type AVP Mapping* (on page 2).

On receipt of the continue or release from ACS, DCA will shut down the dialog to ACS, and return the relevant response to Diameter.

Refer to the following:

- Configuration file parameter *screeningService* (on page 71) in the Services section
- ACS Control Plan for *Screening* (on page 138)

# Configuration

## Overview

### Introduction

This chapter explains how to configure the Oracle Communications Convergent Charging Controller application.

### In this chapter

---

This chapter contains the following topics.

Configuration Overview .....	5
eserv.config Configuration .....	6
SLEE.cfg Configuration .....	7
DCA SLEE Configuration .....	7
RAR Configuration.....	8
acs.conf Configuration .....	9
Prepaid Charging Configuration .....	10
Feature Node Configuration .....	12
INAP Extensions.....	14
Parameter Mappings .....	15
Business Scenarios .....	19

## Configuration Overview

### Introduction

This topic provides a high level overview of how the Diameter Control Agent (DCA) interface is configured.

There are configuration options which are added to the configuration files that are not explained in this chapter. These configuration options are required by the application and should not be changed.

### Configuration Components

The Diameter Control Agent is configured by the following components:

Component	Locations	Description	Further Information
<b>eserv.config</b>	All SLC machines	DCA is configured by the <code>DIAMETER</code> section of <b>eserv.config</b> .	<i>eserv.config Configuration</i> (on page 6).
<b>eserv.config</b>	All SLC machines	DCA services mappings are configured in the <code>ccsServiceLibrary</code> section of <b>eserv.config</b> .	<i>CCS Service Library configuration</i> (on page 10).

Component	Locations	Description	Further Information
<b>SLEE.cfg</b>	All SLC machines	The SLEE interface is configured to include the DCA service.	<i>SLEE.cfg Configuration</i> (on page 7) and <i>SLEE Technical Guide</i> .
<b>acs.conf</b>	All SLC machines	Configures the cc extension Digits/INAP extension mappings	<i>acs.conf Configuration</i> (on page 9)

## eserv.config Configuration

### Introduction

The **eserv.config** file is a shared configuration file, from which many Oracle Communications Convergent Charging Controller applications read their configuration. Each Convergent Charging Controller machine (SMS, SLC, and VWS) has its own version of this configuration file, containing configuration relevant to that machine. The **eserv.config** file contains different sections; each application reads the sections of the file that contains data relevant to it.

The **eserv.config** file is located in the `/IN/service_packages/` directory.

The **eserv.config** file format uses hierarchical groupings, and most applications make use of this to divide the options into logical groupings.

### Configuration File Format

To organize the configuration data within the **eserv.config** file, some sections are nested within other sections. Configuration details are opened and closed using either `{ }` or `[ ]`.

- Groups of parameters are enclosed with curly brackets – `{ }`
- An array of parameters is enclosed in square brackets – `[ ]`
- Comments are prefaced with a `#` at the beginning of the line

To list things within a group or an array, elements must be separated by at least one comma or at least one line break. Any of the following formats can be used, as in this example:

```
{ name="route6", id = 3, prefixes = [ "00000148", "0000473" ] }
{ name="route7", id = 4, prefixes = [ "000001049" ] }
```

or

```
{ name="route6"
  id = 3
  prefixes = [
    "00000148"
    "0000473"
  ]
}
{ name="route7"
  id = 4
  prefixes = [
    "000001049"
  ]
}
```

or

```
{ name="route6"
  id = 3
  prefixes = [ "00000148", "0000473" ]
}
{ name="route7", id = 4
```

```

    prefixes = [ "000001049" ]
}

```

## eserv.config Files Delivered

Most applications come with an example **eserv.config** configuration in a file called **eserv.config.example** in the root of the application directory. The example file for DCA is:

**/IN/service\_packages/eserv.config.dca.example**

**Warning:** This file is not intended to be changed by the User. Please contact the Oracle support with your queries.

## Editing the File

Open the configuration file on your system using a standard text editor. Do not use text editors, such as Microsoft Word, that attach control characters. These can be, for example, Microsoft DOS or Windows line termination characters (for example, ^M), which are not visible to the user, at the end of each row. This causes file errors when the application tries to read the configuration file.

Always keep a backup of your file before making any changes to it. This ensures you have a working copy to which you can return.

## Loading eserv.config Changes

If you change the configuration file, you must restart the appropriate parts of the service to enable the new options to take effect.

## Diameter eserv.config Configuration

The **eserv.config** file must be configured to enable the DCA to work. All necessary DCA configuration in **eserv.config** is done at installation time by the configuration script. However, you must manually map the service handles for services to the libdcaCcsSvcExtra.so library in the ccsPluginExtend section of ccsServiceLibrary. Refer to *CCS Service Library configuration* (on page 10).

**Note:** The DCA configuration options in **eserv.config** are explained in the section on the *diameterControlAgent background process* (on page 28).

## SLEE.cfg Configuration

### Introduction

The **SLEE.cfg** file must be configured to enable the DCA to work. All necessary SLEE configuration is done at installation time by the configuration script, this section is for information only.

The SLEE configuration file is located at **/IN/service\_packages/SLEE/etc/SLEE.cfg**.

For more information on SLEE configuration, see *SLEE Technical Guide*.

### DCA SLEE Configuration

On installation, the following lines are added to the **SLEE.cfg** configuration file.

```

INTERFACE=dcaIf dca.sh /IN/service_packages/DCA/bin EVENT
SERVICEKEY=INTEGER 1230 Dca_Session
SERVICEKEY=INTEGER 1231 Dca_DD
SERVICEKEY=INTEGER 1232 Dca_RA
SERVICEKEY=INTEGER 1233 Dca_CB
SERVICEKEY=INTEGER 1234 Dca_PE

```

```
SERVICE=Dca_Session 1 slee_acs Dca_Session
SERVICE=Dca_DD 1 slee_acs Dca_DD
SERVICE=Dca_RA 1 slee_acs Dca_RA
SERVICE=Dca_CB 1 slee_acs Dca_CB
SERVICE=Dca_PE 1 slee_acs Dca_PE
```

**Note:** It is essential for the correct operation of this application that the SLEE Interface type is always set to EVENT.

### SERVICEKEY

The SERVICEKEY entries specify the SLEE service keys for the Diameter service.

During dcaScp installation the value of the service keys can be specified, or modified manually after installation, if necessary.

## RAR Configuration

Diameter Charging Driver (DCD) can forward re-authorization requests (RARs) to DCA for forwarding on to network elements such as the Online Charging Server (OCS). You enable DCA to process RARs by setting the following parameter:

```
rarHandlingEnabled = true
```

When RAR processing is enabled in DCA, DCA informs DCD that it can process RAR messages, and DCD uses this information to pass on any RARs it receives from the OCS. DCA then forwards the re-authorization response that it receives back from the network to DCD, for DCD to forward on to the OCS. If DCD is not informed by DCA, then DCD will respond to a RAR with a re-authorization acknowledgement (RAA) containing the corresponding result code set in the `rarResultCode` parameter.

Add the following parameters to the DIAMETER configuration section in the **eserv.config** file to enable DCA to process RARs:

```
DIAMETER = {
  DCAInstances = {

    rarHandlingEnabled = true
    rarClientTimeout = int
    rarMaxRetry = int

  }
}
```

See *DCAInstances Parameters* (on page 43) for more information.

You must also add service library entries to the CCS section of the **eserv.config** file using the following syntax:

```
CCS = {
  ccsServiceLibrary = {

    ccsPluginExtend = {
      library="libdcdCcsSvcExtra.so"
      handleName="Dca_Session"
    }
  }
}
```

where `Dca_Session` is the name of the DCA session service.

Ensure the corresponding SERVICEKEY and SERVICE entries in the SLEE configuration file (**SLEE.cfg**) are present for the DCA session service. For example:

```
SERVICEKEY=INTEGER 1230 Dca_Session
SERVICE=Dca_Session 1 slee_acs Dca_Session
```

Add the following parameters to the CCS configuration section in the `eserv.config` file on VWS to enable DAP IF to handle out-of-band balance update notification events, such as VWS balance top-ups or depletions, which are likely to affect obtainable reservation durations. In these scenarios, the client (by means of a server-initiated RAR message) is prompted to resubmit a new CCR-UPDATE:

```
CCS = {
  # dcaResPlugin.so config
  dcaResPlugin = {
    # Operation set for RAR notifications
    dapOperationSet = "RAR"
  }
}
BE = {
  plugins = [
    # Final plugin:
    "dcaResPlugin.so"
  ]
}
```

**Note:** Whenever an RAA is received with AVP parsing error, further RARs to the same GGSN will get blocked.

For more information on RAR processing in DCD, see the RAR configuration section in *Diameter Charging Driver Technical Guide*.

## acs.conf Configuration

### Introduction

The `acs.conf` file must be configured to enable the application to work. All necessary configuration is done at installation time by the configuration script; this section is for information only.

The ACS configuration file is located at `/IN/service_packages/ACS/etc/acs.conf`.

Refer to *ACS Technical Guide* for details on ACS configuration.

### INAP Extension

The following values for cc extension Digits and INAP extension mappings and format are set in `acs.conf` on installation. You can change these, if required.

```
extensionNumber 3 506 asn1Integer value
extensionNumber 4 507 asn1Integer value
extensionNumber 5 501 asn1Integer value
extensionNumber 6 502 asn1Integer value
extensionNumber 7 503 asn1Integer value
extensionNumber 8 504 asn1Integer value
extensionNumber 9 505 octets value
```

**Note:** The `extensionNumber n` is displayed as CC Extension Digits *n* in the drop-down fields (for example, **Number of Events**) in the macro node configuration screens. See *Control Plans* (on page 131) for examples.

## Prepaid Charging Configuration

### CCS Service Library configuration

In order for the PRICE\_ENQUIRY, DIRECT\_DEBITING and REFUND\_ACCOUNT services to work properly, you must manually map the service handles for these services to the libdcaCcsSvcExtra.so library in the `CCS.ccsServiceLibrary.ccsPluginExtend` section of the `/IN/service_packages/eserv.config` file. For example:

```
CCS = {
    ...
    ccsServiceLibrary = {
        ...
        ccsPluginExtend = [
            {
                library="libdcaCcsSvcExtra.so"
                handleName="Dca_PE"
            }
            {
                library="libdcaCcsSvcExtra.so"
                handleName="Dca_DD"
            }
            {
                library="libdcaCcsSvcExtra.so"
                handleName="Dca_RA"
            }
        ]
        ...
    }
}
```

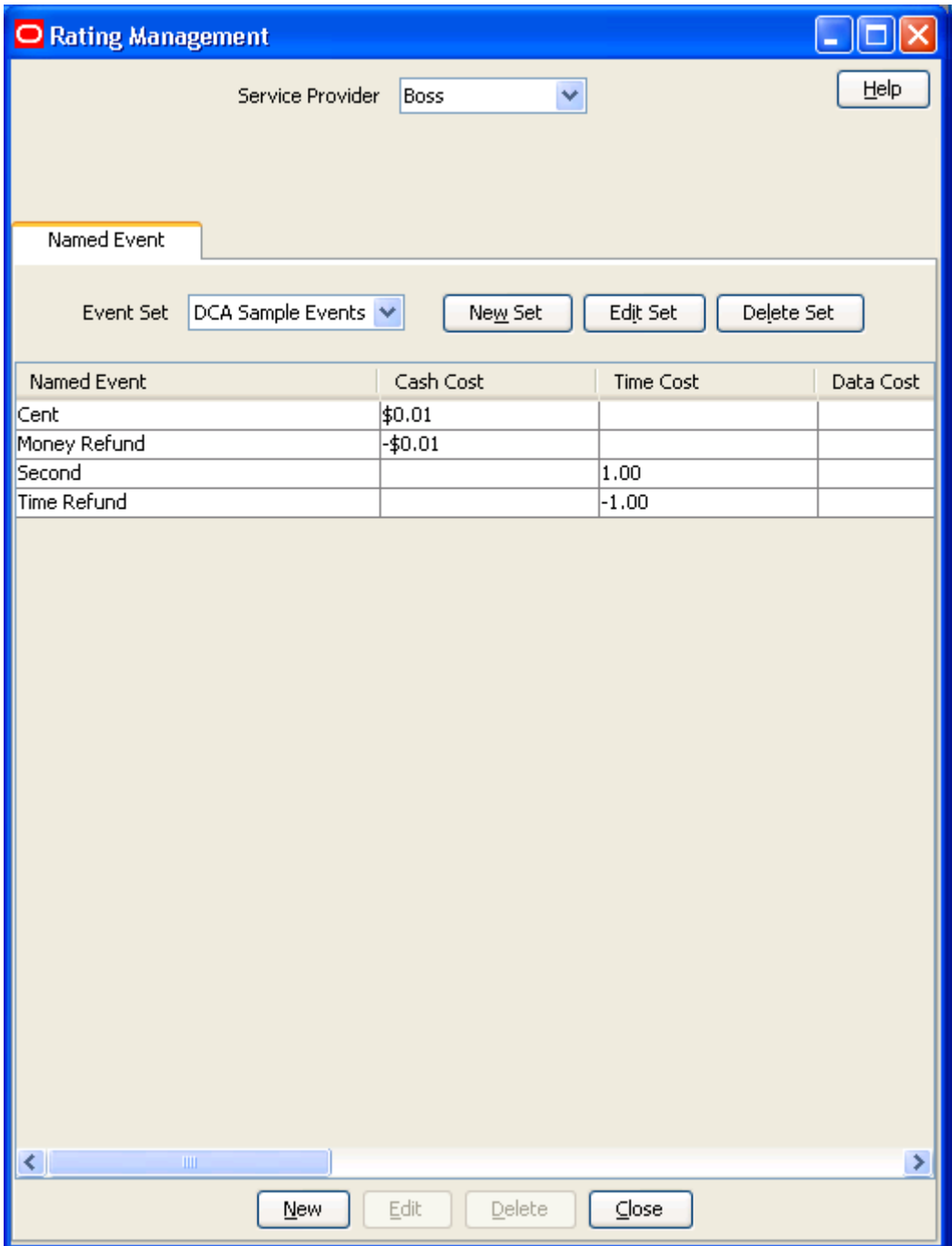
### Enabling Named Events

The DCA installation does as much as possible to be usable as soon as it is installed. However, you need to perform one manual procedure in Prepaid Charging before you try to use it first-off. You need to allow the use of the named events that are installed to whatever product types that you employ.

Here is an example of the procedure to follow to allocate product types to a DCA event set.

Step	Action
1	In the SMS main screen, open <b>Services &gt; Prepaid Charging &gt; Rating Management</b> . <b>Result:</b> The Rating Management screen will display.
2	Select the <b>Named Event</b> tab.
3	From the <b>Event Set</b> drop-down box, select <code>DCA Sample Events</code> .



Step	Action																				
	 <p>The screenshot shows the 'Rating Management' window. At the top, there's a 'Service Provider' dropdown menu set to 'Boss' and a 'Help' button. Below this is a tabbed interface with the 'Named Event' tab selected. Under the tab, there's an 'Event Set' dropdown menu set to 'DCA Sample Events', and three buttons: 'New Set', 'Edit Set', and 'Delete Set'. The main area contains a table with four columns: 'Named Event', 'Cash Cost', 'Time Cost', and 'Data Cost'. The table has four rows: 'Cent' with a cash cost of \$0.01, 'Money Refund' with a cash cost of -\$0.01, 'Second' with a time cost of 1.00, and 'Time Refund' with a time cost of -1.00. At the bottom of the window, there are four buttons: 'New', 'Edit', 'Delete', and 'Close'.</p> <table border="1"><thead><tr><th>Named Event</th><th>Cash Cost</th><th>Time Cost</th><th>Data Cost</th></tr></thead><tbody><tr><td>Cent</td><td>\$0.01</td><td></td><td></td></tr><tr><td>Money Refund</td><td>-\$0.01</td><td></td><td></td></tr><tr><td>Second</td><td></td><td>1.00</td><td></td></tr><tr><td>Time Refund</td><td></td><td>-1.00</td><td></td></tr></tbody></table>	Named Event	Cash Cost	Time Cost	Data Cost	Cent	\$0.01			Money Refund	-\$0.01			Second		1.00		Time Refund		-1.00	
Named Event	Cash Cost	Time Cost	Data Cost																		
Cent	\$0.01																				
Money Refund	-\$0.01																				
Second		1.00																			
Time Refund		-1.00																			

- 4 From the Named Event grid, select **Cent** and click **Edit**.  
**Result:** The Edit Named Event screen appears.

Step	Action

- 5 From the **Available Named Event Catalogues** field, select the named event catalogues for this event that will use DCA billing and click **>> Add >>**.
- 6 Click **Save**.
- 7 Repeat steps 4 through 6 for the *Second* named event.

Refer to *CCS User's Guide, Named Event* topic for details.

## Feature Node Configuration

### Named Event Node

The Named Event node must be configured as shown for the following fields:

- Event Class – A Diameter (DCA) event class
- Number of Events Location – Incoming Session Data

- Number of Events Field – CC Extension Digits 5

**Configure Named Event** [X]

Node name:

---

Event Class:  ▼

Named Event:  ▼

---

**Number of Events**

☐ Node dialog ☒ Profile

Number of Events:

Number of Events Data Type:  ▼

Number of Events Location:  ▼

Number of Events Field:  ▼

---

**Discount Percentage**

Discount:

---

**Allow Negative Balance**

Allow ☐

---

**Named Event Feature Selection**

☒ Direct Event ☐ Reserve Event ☐ Confirm Event ☐ Revoke Event ☐ Cost of Event

---

**Store Cost**

Store Cost ☐

---

**Charge Cost**

ChargeCost Data Type:  ▼

ChargeCost Location:  ▼

ChargeCost Field:  ▼

---

**Exit Branches**

1	Success	2	No Credit
3	Billing Fault	4	Unsupported

---

# INAP Extensions

## Introduction

As INAP is not designed to contain Diameter AVPs, these will be carried, where necessary, in INAP extensions in the InitialDP or the Connect. The following pre-defined INAP extension types are used, where appropriate.

The IDP extensions are used by the service loader plug-in to modify the CCS/ACS call context. Also, the control plans may access these extensions by means of suitable **acs.conf** configuration and by use of the ExtensionDigits[0-9] call context fields. See *Control Plans* (on page 131) for examples of control plans using these extensions.

In addition, inbound extension profiles may be set using the `encodedExtension` and `extensionFormat` parameters. This enables inbound AVPs within INITIAL or EVENT based Credit-Control-Request messages to be identified for mapping into the IDP passed to ACS. Multiple AVPs can be identified and passed to the target profile tags available within the inbound extensions block.

**Note:** While you can have multiple AVP mappings, you can have only *three* extension mappings from DCA to `slee_acs`. You can create extension mappings either by specifying an encoded extension value, for example `extensionType = 508`, or by encoding as an extension profile block, which is extension type 701. Note that all profile tags go into one profile block and therefore use only one extension.

Therefore, if you define a profile encoded AVP, you have only 2 more user-defined extensions available. For example, you can have either three AVPs mapped directly to INAP extensions or two AVPs mapped directly to INAP extensions and multiple AVPs that are encoded in one profile block that is mapped to extension type 701.

## IDP

The following standard INAP extensions are used in the IDP. This table also lists the mapping of the INAP extensions to the Call Content extension Digits profile buffers.

Extension	Description	Type	cc extension Digits
501	Requested-Service-Units	Asn1Integer	5
502	Requested service unit type: <ul style="list-style-type: none"> <li>1 = CC-Time</li> <li>2 = CC-Money</li> <li>3 = CC-Total-Octets</li> <li>4 = CC-Input-Octets</li> <li>5 = CC-Output-Octets</li> <li>6 = CC-Service-Specific-Units</li> </ul>	Asn1Integer	6
503	Requested-action: <ul style="list-style-type: none"> <li>0 = DIRECT_DEBITING</li> <li>1 = REFUND_ACCOUNT</li> <li>2 = CHECK_BALANCE</li> <li>3 = PRICE_ENQUIRY</li> </ul>	Asn1Integer	7
504	Event-Timestamp	Asn1Integer	8
505	Subscription ID	Asn1OctetString	9
506	Currency	Asn1Integer. Value from ISO 4217, for example, 978 = Euro	3

Extension	Description	Type	cc extension Digits
507	Exponent	Asn1Integer. Currency exponent + 0x20. for example, 1E for -2	4
701	Multiple encoded AVPs	Inbound extension profile block	

**Note:** The cc extension Digits-INAP extension mappings are set in **acs.conf** on installation and can be changed, if required. See *acs.conf Configuration* (on page 9).

## Connection

The following INAP extensions are used in the Connect operation.

Extension	Description	Type
601	Granted service units	Asn1Integer
602	Granted service unit type: <ul style="list-style-type: none"> <li>• 1 = CC-Time</li> <li>• 2 = CC-Money</li> <li>• 3 = CC-Total-Octets</li> <li>• 4 = CC-Input-Octets</li> <li>• 5 = CC-Output-Octets</li> <li>• 6 = CC-Service-Specific-Units</li> </ul>	Asn1Integer
603	Cost information (in system currency)	Asn1OctetString

## Parameter Mappings

### Introduction

This topic describes the mappings between INAP parameters and Diameter AVPs.

### CCR

This table describes the mappings for Credit-Control-Request AVPs.

AVP	Action
Session-Id	Used to look up the correct StateMachine in <b>sessionIdToStateMachine</b> .
Origin-Host	The stack code in the DIAMETER module handles this.
Origin-Realm	The stack code in the DIAMETER module handles this.
Destination-Realm	The stack code in the DIAMETER module handles this.
Auth-Application-Id	Throw it out if not 4
Service-Context-Id	Used as part of the key to look up the service.
CC-Request-Type	Used as part of the key to look up the service.

AVP	Action
	Also used to determine the next state in the state machine.
CC-Request-Number	Used in duplicate detection.
Destination-Host	The stack code in the DIAMETER module handles this.
User-Name	Ignored unless mapped to an IDP extension by the AVP mappings in <b>eserv.config</b> .
CC-Sub-Session-Id	Ignored after copying from the request to the answer message. We do not support multiple session IDs but some clients may set this anyway so we just ignore it.
Acct-Multi-Session-Id	Ignored after copying from the request to the answer message. We do not support multiple session IDs but some clients may set this anyway so we just ignore it.
Origin-State-Id	Used to detect a client re-booting and wipe sessions for the host if it has rebooted.
Event-Timestamp	For EVENT_REQUEST messages, this gets copied into IDP extension type 504.
Subscription-Id	<p>One or more Subscription-Id AVPs may be supplied. The first SIP or E164 type Subscription-Id is copied to:</p> <ul style="list-style-type: none"> <li>• CallingPartyNumber after applying the configured normalization rules and</li> <li>• IDP extension type 505.</li> </ul> <p>The first IMSI type Subscription-Id is copied to IMSI.</p> <p><b>Note:</b> There must be an E164 or SIP type Subscription -Id present. Otherwise the message will be rejected.</p>
Service-Identifier	Used as part of the key to look up the service.
Termination-Cause	Use <b>cmnDebug()</b> to trace this if this transaction is being traced. Otherwise, ignore.
Requested-Service-Unit	<p>The type of the service unit (derived from which sub-AVP is contained within this one) is placed in IDP extension type 502. The value of the sub-AVP is placed in IDP extension type 501.</p> <p>Multiple unit types are supported. You can perform Basic and MSCC services, with the following provisos:</p> <ul style="list-style-type: none"> <li>• The units in Initial request are the units for the whole session, that is, you cannot add another unit mid-session.</li> <li>• If one unit fails to be granted, the entire service is denied.</li> <li>• Multiple units are not suitable for use in event based credit control, because the call or dialog with ACS is a one-shot for each type (likely through a Named Event node). If multiple calls are opened to ACS and one of them happens to fail, it is too late for DCA to go back and revoke the successful cases.</li> </ul>
Requested-Action	<p>Used as part of the key to look up the service.</p> <p>Also used to determine the next state in the state machine.</p>
Used-Service-Unit	The cumulative total of all the Used-Service-Unit AVPs is copied to ApplyChargingReport.timeNoTariffSwitch (multiplied by 10 to be in deciseconds if the unit type is Time). The variable <b>dca::StateMachine::totalUsedUnits</b> is used for storing this information.

AVP	Action
Multiple-Services-Indicator	<p>If this is set to MULTIPLE_SERVICES_SUPPORTED then DCA will accept the incoming message and subsequent Multiple-Services-Credit-Control AVPs received in CCR/CCA update and final request messages.</p> <p><b>Note:</b> This parameter will not be mapped to the InitialDP.</p>
Multiple-Services-Credit-Control	<p>This is a grouped AVP that can contain these AVPs:</p> <ul style="list-style-type: none"> <li>• Requested-Service-Unit</li> <li>• Used Service-Unit</li> <li>• Service-Identifier</li> <li>• Rating Group</li> </ul> <p>Requires that Multiple-Services-Indicator AVP has been received with value set to MULTIPLE_SERVICES_SUPPORTED.</p> <p>For multiple services credit control, a single session typically comprises multiple services. Each service is identified by either the Service-identifier or Rating-Group (where no Service-identifier). Requests received are handled as follows:</p> <ul style="list-style-type: none"> <li>• INITIAL-REQUEST – One IDP is sent for each service. The Diameter session will have multiple INAP dialogs with <code>slee_acs</code>.</li> <li>• UPDATE-REQUEST for a new Service-identifier/Rating-Group – Starts a new service within the session and causes DCA to send another IDP.</li> <li>• UPDATE-REQUEST with no requested-service-unit AVP – Ends a service within the session.</li> <li>• TERMINATION-REQUEST – Ends the whole session.</li> </ul> <p><b>Note:</b></p> <ul style="list-style-type: none"> <li>• If more than one unit type is received within this AVP, DCA will recognize the used-service-unit AVP in update and termination request messages and will extract the relevant unit used. Typically this will be the unit previously specified in the granted service unit.</li> <li>• If no relevant unit is found then DCA returns CCA (Multiple-Services-Credit-Control( result-Code = DIAMETER_INVALID_AVP_VALUE )).</li> </ul>
Service-Parameter-Info	Ignored unless mapped to an IDP extension by the AVP mappings in <b>eserv.config</b> .
CC-Correlation-Id	Ignored unless mapped to an IDP extension by the AVP mappings in <b>eserv.config</b> .
User-Equipment-Info	Ignored unless mapped to an IDP extension by the AVP mappings in <b>eserv.config</b> .
Proxy-Info	The stack code in the DIAMETER module handles this.
Route-Record	Ignored at present.

## CCA

This table describes the mappings for Credit-Control-Answer AVPs.

AVP	Set from
Session-Id	The Session-Id AVP of the first message in this transaction. (stored in <b>dca::StateMachine:: sessionId</b> )

AVP	Set from
Result-Code	Set to DIAMETER_SUCCESS unless otherwise stated.
Origin-Host	The stack code in the DIAMETER module sets this.
Origin-Realm	The stack code in the DIAMETER module sets this.
Auth-Application-Id	Set to 4
CC-Request-Type	Leave as the stack default, that is, the value of CC-Request-Type from the corresponding request.
CC-Request-Number	Leave as the stack default, that is, the value of CC-Request-Number from the corresponding request.
User-Name	Not set
CC-Session-Failover	Not set (will default to FAILOVER-NOT-SUPPORTED according to <i>RFC 4006</i> )
CC-Sub-Session-Id	Set to the value from the corresponding request message, of present.
Acct-Multi-Session-Id	Set to the value from the corresponding request message, of present.
Origin-State-Id	Set to <code>dca::ControlAgent::originStateId</code> .
Event-Timestamp	Set to the value of the Event-Timestamp AVP from the corresponding request.
Granted-Service-Unit	<p>For session based services, this is <code>ApplyCharging.maxDuration</code> (divided by 10 if the unit type is Time). The unit type is obtained from the "DCA Unit Type" profile tag, if it is available in the <code>ApplyCharging</code> extension profile block.</p> <p>For Requested-Action type <code>DIRECT_DEBIT</code>, in the success case, this is the same as the <code>Requested-Service-Unit</code> AVP in the corresponding request. Otherwise, not present.</p>
Multiple-Services-Credit-Control	<p>DCA will populate the MSCC AVPs in CCA messages with the following sub-AVPs where applicable:</p> <ul style="list-style-type: none"> <li>Granted-Units</li> <li>Rating-Group or Service-Identifier</li> <li>Result-Code</li> <li>Time-Quota-Threshold (AVP code 868)</li> <li>Volume-Quota-Threshold (AVP code 869)</li> <li>Validity-Time (if applicable)</li> <li>Final-Unit-Indication (if applicable)</li> </ul> <p><b>Note:</b> Both Time-Quota-Threshold AVP and Volume-Quota-Threshold AVP will be sent with:</p> <ul style="list-style-type: none"> <li>Vendor_ID 10415</li> <li>Quota-Threshold value 0</li> </ul>
Cost-Information	For Request-Action type <code>PRICE_ENQUIRY</code> , success case, this comes from the value of extension 603 in the INAP Connect. Otherwise, not set.
Final-Unit-Indication	Final-Unit-Action is set to <code>REDIRECT</code> or <code>TERMINATE</code> depending on the INAP operations received. Redirect-Server is set to the number matched in the <code>redirectNumbers</code> config list or <code>TEL:&lt;Connect destinationRoutingAddress&gt;@&lt;Configured SIP host&gt;</code> .
Check-Balance-Result	This is derived from the type of INAP operation received as described in the <i>Check balance, with a result of enough credit</i> (on page 21) scenario.



AVP	Set from
Credit-Control-Failure-Handling	Set to TERMINATE.
Direct-Debiting-Failure-Handling	Not set. (According to <i>RFC 4006</i> , it will default to TERMINATE_OR_BUFFER).
Validity-Time	Set to the configured validity-time for the service in the graceful termination scenarios only. See the <i>Funds expiry, redirect, top-up and reconnect</i> (on page 23) scenario.
Redirect-Host	Not set.
Redirect-Host-Usage	Not set.
Redirect-Max-Cache-Time	Not set.
Proxy-Info	The stack code in the DIAMETER module sets this.
Route-Record	Not set at the moment. If we set this in the future, the stack code in the DIAMETER module will set this.
Failed-AVP	Set in some cases when Result-Code != success.

## Business Scenarios

### Introduction

This topic explains how the flow through the software achieves Diameter server services and also gives more details on the mapping between INAP operations/parameters and Diameter messages/AVPs.

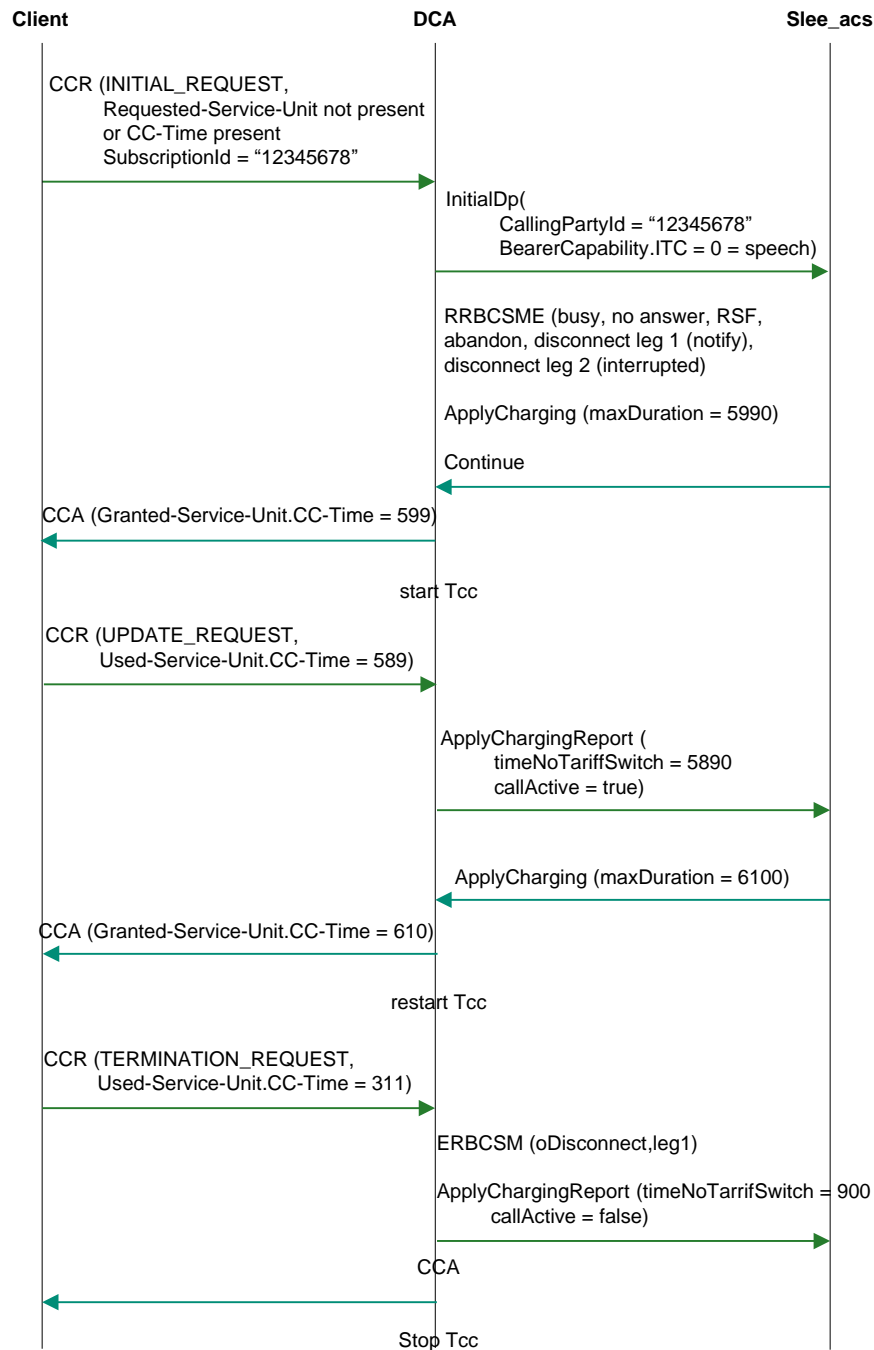
The following scenarios are based on (and named after) the relevant appendixes in *RFC 4006*.

For each business scenario, a message sequence chart is given.

For sample message flows, refer also to the *DCA Messages Flows* chapter in *Sample Message Flows Reference Guide*.

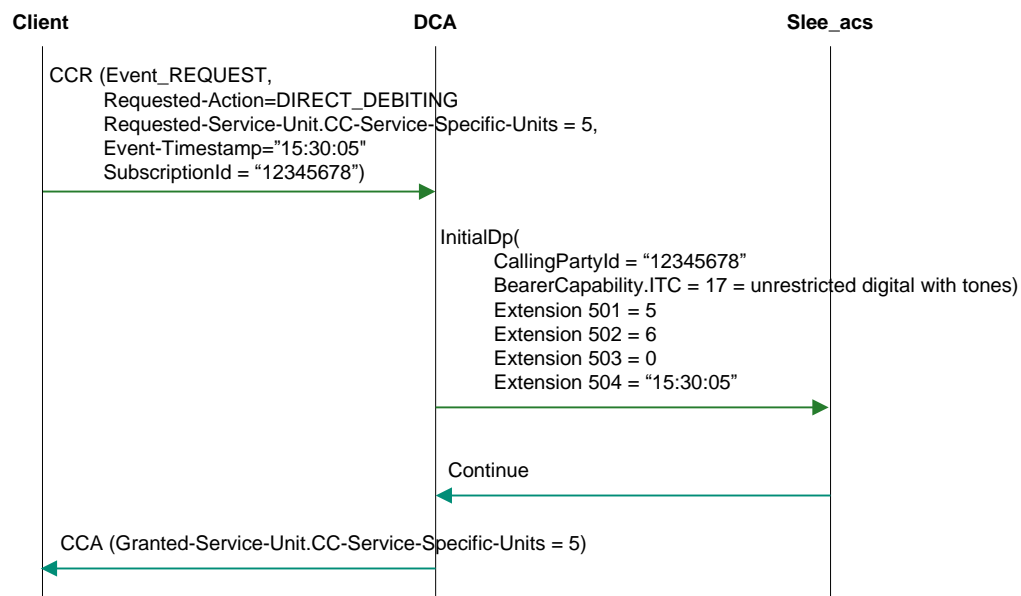
## Successful session-based charging, client terminates session

Here is an example successful session-based charging, client terminates session.



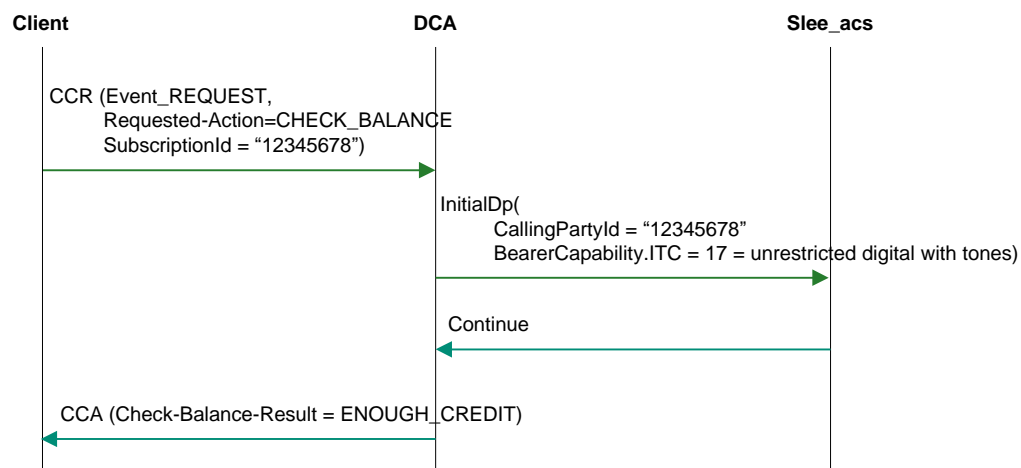
## Multimedia messaging direct debit scenario

Here is an example multimedia messaging direct debit scenario.



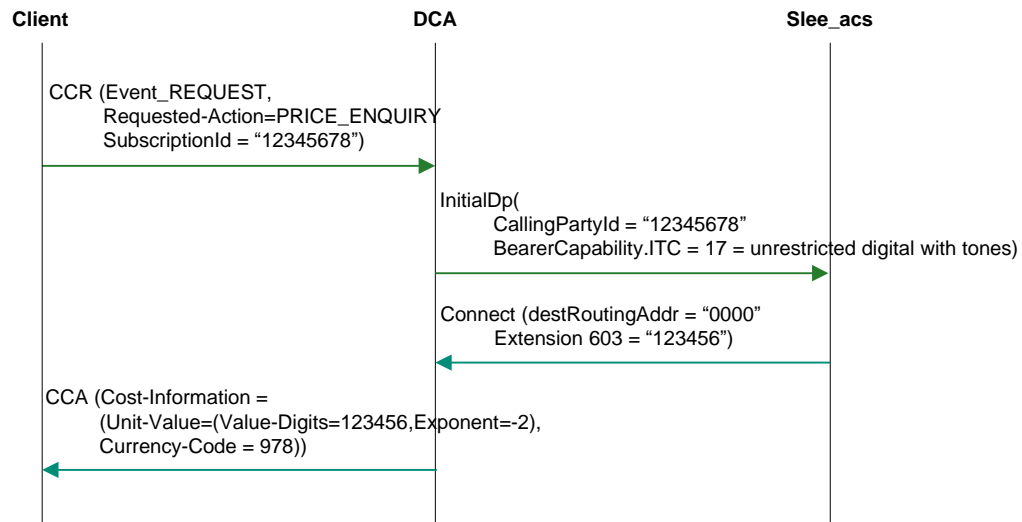
## Check balance, with a result of enough credit

Here is an example check balance, with a result of enough credit.



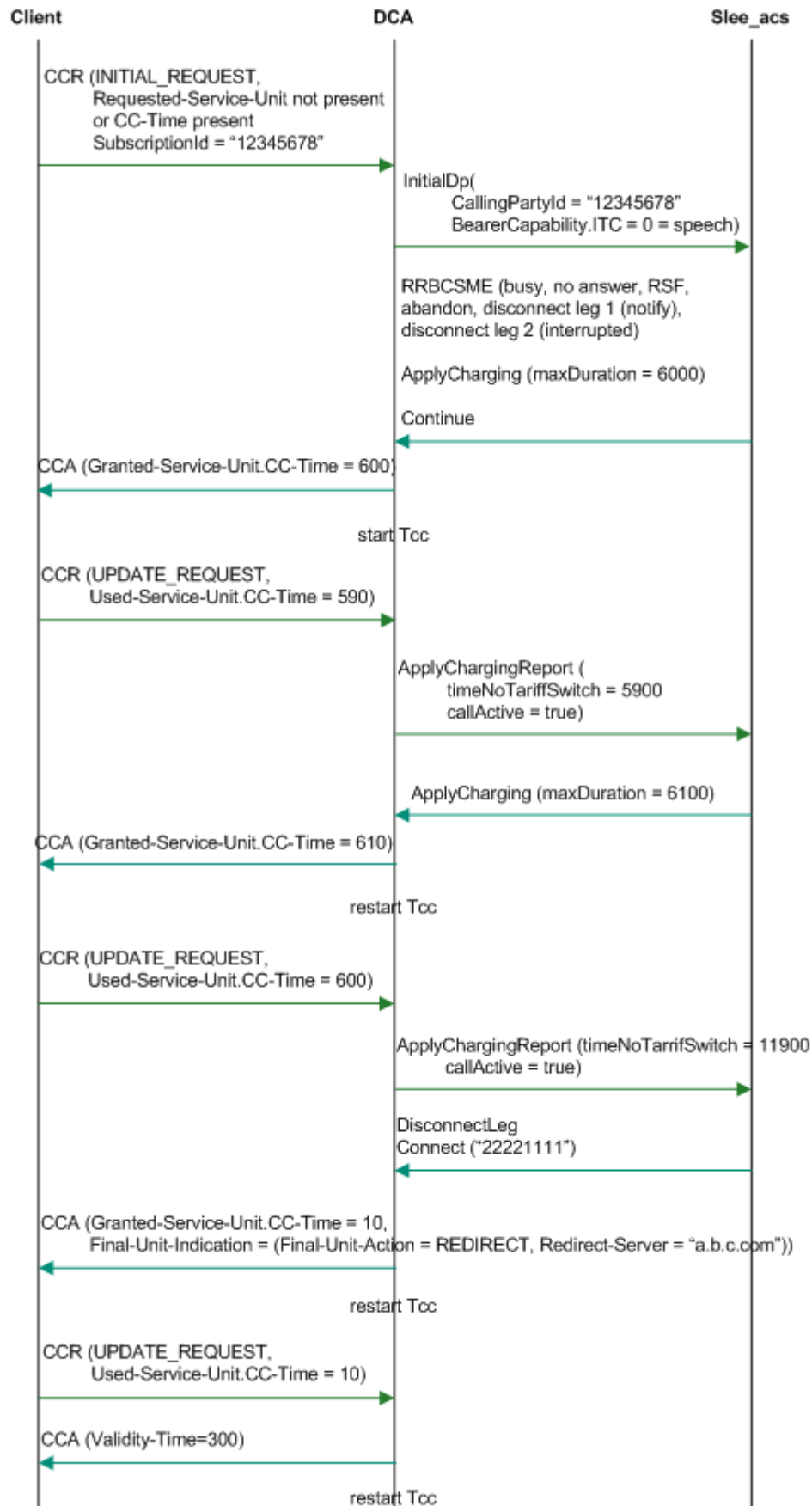
## Price enquiry

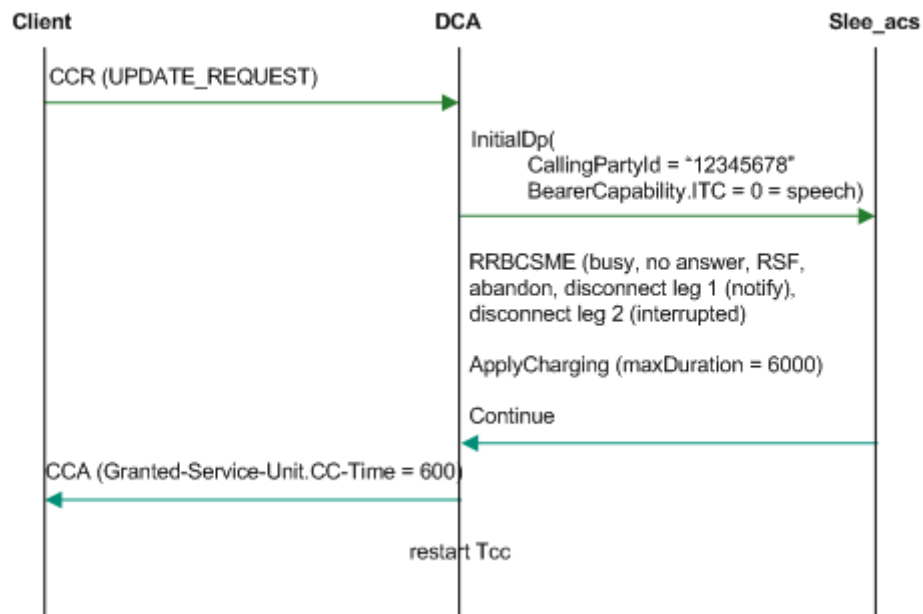
Here is an example price enquiry.



### **Funds expiry, redirect, top-up and reconnect**

Here is an example funds expiry, redirect, top-up and reconnect.





## Multiple services credit control scenario

Here is an example multiple services credit control scenario.





# Background Processes

## Overview

### Introduction

This chapter explains the process which runs automatically as part of the Oracle Communications Convergent Charging Controller application. This process is started automatically by the SLEE.

### In this chapter

---

This chapter contains the following topics.

dcaResPlugin .....	27
diameterControlAgent Process .....	28
xmlSleeDcaInterface .....	30
DCADefaults Configuration Section .....	31
DCAInstances Configuration Section .....	41
Services Configuration .....	66
PeerSchemes Configuration Section .....	83
Statistics Logged by diameterControlAgent .....	88

## dcaResPlugin

This plugin runs on the VWS and triggers DAP events to trigger HTTP RAR requests to the SLC

### Purpose

Sends DAP2 RAR requests to xmlSleeDcaInterface.

dcaResPlugin supplies the callback implementation for reservationAdded. Upon triggering, dcaResPlugin checks the supplied reservation context EDR fields for any DIAMETER call details. If the call is determined to be a DIAMETER call, dcaResPlugin stores in a map (keyed by walletId) the DIAMETER reservations against that wallet (given by clientId and clientMsgId) and the DCA details (DCA\_INSTANCE, DCA\_SCP, DCA\_SESSION, DCA\_ORIGIN\_HOST), in the following format:

WALT -> [CLID,CMID] [DCA\_SCP] [DCA\_INSTANCE] [DCA\_ORIGIN\_HOST] [DCA\_SESSION]

For example:

1 -> [1, 1] [slc1.example.com] [dca1f1] [MIPT-TEST] [MIPT-TEST;1500000000;1]

2 -> [1, 2] [slc1.example.com] [dca1f1] [MIPT-TEST] [MIPT-TEST;1500000001;1]

3 -> [2, 3] [slc2.example.com] [dca1f2] [MIPT-TEST] [MIPT-TEST;1500000004;1]

During the call, an out-of-band balance update event (for example, account top-up) may be triggered by the subscriber. The plugin (in addition to the new reservation callbacks) supplies methods for existing wallet/balance/bucket callbacks.

For example, if the balance update callback is triggered on a wallet previously determined as subject to an open DIAMETER reservation, the plugin logic creates a DAP2 notification event to be populated with relevant DCA session data (DCA\_INSTANCE, DCA\_SCP, DCA\_SESSION, DCA\_ORIGIN\_HOST) obtainable via reservation map lookup.

### Startup

This process is started automatically by the SLEE. For more information see *SLEE.cfg Configuration* (on page 7).

### Default Configuration

```
CCS = {
  # dcaResPlugin.so config
  dcaResPlugin = {
    # Operation set for RAR notifications
    dapOperationSet = "RAR"
  }
}

BE = {
  plugins = [
    # other plugins
    "dcaResPlugin.so"
  ]
}
```

### Alarms

The following alarms can be raised by dcaVWARSPPlugin:

- ERROR [960601] Failed to read plugin config: <string>
- NOTICE [960602] Loaded plugin config.
- ERROR [960601] Failed to read plugin config: <string>
- ERROR [960603] Cannot read Tariff Handler data.
- ERROR [960604] Cannot read cascadeBalances in Tariff Handler data.
- ERROR [960605] Cannot read cascadeXBalances in Tariff Handler data.
- NOTICE [960606] Cannot read CDR tags in Tariff Handler data.
- WARNING [960607] Incomplete RAR tags in Tariff Handler CDR data.

## diameterControlAgent Process

### Purpose

The diameterControlAgent executable is a SLEE interface which converts between Diameter messages and CAP3 operations to enable a Diameter client to communicate with a CAP3 SCF.

### Startup

This process is started automatically by the SLEE. For more information see *SLEE.cfg Configuration* (on page 7).

### DIAMETER Configuration Structure

Here is the high-level structure of the `DIAMETER` configuration section of the `eserv.config` file.

```

DIAMETER = {
    DCADefaults = {
        DCADefaults_parameters
    }

    DCAInstances = [
    # First Instance
    {
    NumberRules = [
        NumberRules_parameters
    ]
        DCAInstances_parameters
    ]

    RedirectNumberMappings = [
    {
        RedirectNumberMappings_parameters
    }
    ]

    Tracing = {
        Tracing_parameters
    }

    Services = [
    {
        Services_parameters
    }
    ]

    DiameterServer = {
        DiameterServer_parameters
    }

    } # end of First Instance
    ] # end of DCAInstances section

PeerSchemes = [
# First Scheme
{
    schemeName = "SchemeA"

    Peers = [

        {
            peerhost1_parameters
        }
        {
            peerhost2_parameters
        }

    ]

    {
        schemeName = "SchemeB"
        SchemeB_parameters
    }

    ] # End of PeerSchemes section

```

## TTC Based Rating and Charging

When **Continuous-Time Rating** is disabled, TTC based rating/charging is performed.

During TTC based charging, in CCR-Update/CCR-Terminate messages, rating engine expects before and after usage. They are stored in the following profile tags:

a. DCA Unit Before Tariff Change

profileTag = 6291472

profileFormat = "INTEGER"

b. DCA Unit After Tariff Change

profileTag = 6291473

profileFormat = "INTEGER"

In SLC node's **eserv.config** file, the incoming Tariff-Change-Usage AVPs for before and after usage should be mapped to those profile tags for TerminateRequest and UpdateRequest.

Entries should be added in the following section of **eserv.config**:

DIAMETER > DCAInstances > Services > AvpMappings

Example entry for TTC is provided in SLC node.

/IN/service\_packages/DCA/etc/eserv.config.RAR.example.TTC

## Failure

If the diameterControlAgent fails, no Diameter messages will be processed.

## xmlSleeDcaInterface

### Purpose

Converts DAP2 RAR requests to SLEE RAR Events and forwards to diameterControlAgent.

Accepts dcaRarReq messages and uses the data contained therein to construct a diameterSleeEvent message.

### Startup

This process is started automatically by the SLEE. For more information see *SLEE.cfg Configuration* (on page 7).

### Default Configuration

```
DIAMETER = {
  #xmlSleeDcaIF
  DCA = {
    # xmlSleeDcaIF listens for HTTP connections
    listenPort = 3088

    # Incoming connection detection polling timer
    # (microseconds)
    pollTime = 100000

    # Automatic periodic config reload time?
    # (seconds)
```

```

        # 0 = disabled
        reloadInterval = 0
    }
}

```

## Alarms

The following alarms can be raised by `xmlSleeDcaInterface`:

- WARNING [960501] Terminated with INTERFACE\_END.
- WARNING [960502] Terminated with INTERFACE\_KILL.
- NOTICE [960503] Reread config management event.
- ERROR [960504] accept() failed. duplicate fd: %d
- CRITICAL [960505] Failed to get management event type from SLEE.
- NOTICE [960506] Received unknown EventType from SLEE: <String>.
- CRITICAL [960507] Failed to get SLEE API handle: <String>.
- CRITICAL [960508] Failed to initialise Xerces parser..
- ERROR [960509] sigaction() failed: <String>.
- CRITICAL [960510] Failed to read config: <String>.
- NOTICE [960511] xmlSleeDcaIF is now running.
- ERROR [960512] Failed to reread config: <String>.
- WARNING [960521] Outstanding request on fd: <Int>.
- NOTICE [960522] Connection closed by foreign host (fd: <int>).
- WARNING [960523] read() error (fd: <Int>) : <String>.
- WARNING [960524] Received invalid HTTP request.
- ERROR [960525] XMLException: <String>.
- ERROR [960526] SAXParseException: <String>.
- ERROR [960527] UnknownException: <String>.
- ERROR [960528] 503 Service Unavailable: Unable to send RAR event.
- ERROR [960529] 503 Service Unavailable: Could not create RAR event.
- NOTICE [960531] No existing entry found in cache for this interface.
- WARNING [960532] Unable to get SLEE handle for DCA interface.
- ERROR [960533] SLEE error: Could not sendEvent() to DCA.
- ERROR [960534] Unable to create a DiameterSleeEvent.

## DCADefaults Configuration Section

### Example DCADefaults Configuration in `eserv.config` File

Here is an example `DCADefaults` section of the `DIAMETER` configuration in the `eserv.config` file.

```

DCADefaults = {
    sleeServiceKey = 1234
    inapServiceKey = 1234
    maxSessionLengthAfterFinalUnitIndicationsSeconds = 14340
    tcc = 3600
    gracefulTerminationValidityTime = 300
    validityTime = 30
    systemErrorResultCode = 5012
    invalidMessageSequenceResultCode = 5012
}

```

```

    itc = "udi"

    AvpMappings = [
    {
        AvpCodes = [
        {
            avpCode = 1234
            mandatory = true
            vendorId = "16747"
        }
        ]

        avpFormat = "OctetString"
        sipScheme = "sip"
        extensionType = 1234
        extensionFormat = "inapnumber"

        conversion = [
            { internal = 1, external = 5030 }
            { internal = 16, external = 2001 }
            { internal = 17, external = 3004 }
            { internal = 42, external = 5006 }
            { internal = 111, external = 3001 }
        ]
        mappingTypes = ["InitialRequest", "InitialResponse", "EventRequest",
            "EventResponse"]
    }
    ]
}

```

## DCADefaults Parameters

The following parameters are used as defaults if not specified in a Service. They are found within the `DCADefaults = { }` statement.

### avpMappings

**Syntax:** `avpMappings = [mappings_parameters]`  
**Description:** The default service AVP mappings.  
**Optionality:** Mandatory  
**Notes:** See *AvpMappings Parameters* (on page 35).

### gracefulTerminationValidityTime

**Syntax:** `gracefulTerminationValidityTime = seconds`  
**Description:** The number of seconds granted for the user to top up the account during graceful termination. Refer to *RFC 4006 A.7*.  
**Type:** Integer  
**Optionality:** Optional  
**Allowed:** in seconds  
**Default:**  
**Notes:** Not present means no graceful termination.  
**Example:** `gracefulTerminationValidityTime = 300`

`inapServiceKey`

**Syntax:** `inapServiceKey = value`  
**Description:** The INAP Key value  
**Type:** Integer  
**Optionality:** Mandatory  
**Allowed:** Any 32 bit integer  
**Example:** `inapServiceKey = 1234`

`invalidMessageSequenceResultCode`

**Syntax:** `invalidMessageSequenceResultCode = code`  
**Description:** The error code for an invalid message sequence result, for example, if TERMINATION\_REQUEST is the first message.  
**Type:** Integer  
**Optionality:** Mandatory  
**Allowed:**  
**Default:** 5012 [Diameter unable to comply]  
**Notes:** See Part 7.1 of *RFC 3588* and Part 9 of *RFC 4006* for a list valid codes.  
**Example:** `invalidMessageSequenceResultCode = 5012`

`itc`

**Syntax:** `itc = infoTransferCapability`  
**Description:** The Bearer Capability Information Element (Q.931 section 4.5.5) contains an Information Transfer Capability (ITC) field that is set automatically by DCA when DCA triggers ACS.  
This parameter overrides the ITC value within the Bearer Capability Information Element.  
For more details, please see `itc` (on page 70) parameter under the Services section.  
**Type:** Integer, or string  
**Optionality:** Optional  
**Allowed:**  
**Default:**  
**Notes:** If automatic setting of ITC is required, then this parameter should be absent.  
**Example:** `itc = 16`  
or  
`itc = "3.1kHzAudio"`  
or  
`itc = 0x10`

`mappingTypes`

**Syntax:** `mappingTypes = ["mapping_types"]`  
**Description:** Specifies the cases that the mapping applies to.  
**Type:** String Array  
**Optionality:** Optional  
**Allowed:**

**Default:**

**Notes:** For more details, please see the `mappingTypes` (on page 79) parameter under the **Services** section.

**Example:** `mappingTypes = ["InitialRequest", "UpdateRequest", "EventRequest", "TerminateRequest"]`

### `maxSessionLengthAfterFinalUnitIndicationsSeconds`

**Syntax:** `maxSessionLengthAfterFinalUnitIndicationsSeconds = secs`

**Description:** The maximum number of seconds that a session can last after the Final-Unit-Indication AVP has been sent to the client.

**Type:** Integer

**Optionality:** Optional (default used if not set).

**Allowed:** A valid integer.

**Default:** 14340

**Example:** `maxSessionLengthAfterFinalUnitIndicationsSeconds = 14340`

### `sleeServiceKey`

**Syntax** `sleeServiceKey = value`

**Description:** The Service Key value

**Type:** Integer

**Optionality:** Mandatory

**Allowed:** *Refer to SLEE Technical Guide*

**Default:** N/A

**Example:** `sleeServiceKey = 1234`

### `systemErrorResultCode`

**Syntax:** `systemErrorResultCode = code`

**Description:** The error code for a system error

**Type:** Integer

**Optionality:** Mandatory

**Allowed:**

**Default:** 5012 [Diameter unable to comply]

**Notes:** See Part 7.1 of *RFC 3588* and Part 9 of *RFC 4006* for a list valid codes

**Example:** `systemErrorResultCode = 5012`

### `tcc`

**Syntax:** `tcc = value`

**Description:** The Session supervision timer timeout

**Type:** Integer

**Optionality:** Mandatory

**Allowed:** number of seconds

**Default:** 3600

**Notes:** Refer to *RFC 4006*.

**Example:** `tcc = 3600`



validityTime

<b>Syntax:</b>	<code>validityTime = seconds</code>
<b>Description:</b>	The validity time in seconds of granted units. Results in Validity-Time AVP being placed in CCA.
<b>Type:</b>	Integer
<b>Optionality:</b>	Optional (default used if not set).
<b>Allowed:</b>	
<b>Default:</b>	-1 (Not included)
<b>Notes:</b>	
<b>Example:</b>	<code>validityTime = 30</code>

## AvpMappings Parameters

The following parameters are used for AVP mappings. They are all found within an `AvpMappings = [ ]` array.

You can set up as many AVP mappings as required.

Within this section you can specify AVP codes for mapping. They are all found within an `AvpCodes = [ ]` array.

There MUST be one specified for the base AVP, plus list all extras for grouped AVPs.

## AVP Format to Extension Type

This table shows the allowable conversion of AVP format to the Extension type.

AVP Format	Extension Type	Notes
OctetString	INAP Number	Not allowed
Time	INAP Number	Not allowed
String/OctetString	Integer	<ul style="list-style-type: none"> <li>Must be ASCII digits</li> <li>Converts to Integer</li> </ul>
String	INAP Number	Must be Hex digits
Integer	String/Octets	Converts to string
Time	Integer	Number of seconds since 1 January 1970
Time	String/Octets	In format <code>YYYYMMDDHH24mmss</code>

## AVP Casting

Casting between the AVP format and the encoded extension format is supported only for encoded extension formats with variable sizes. All other encoded extension formats are fixed in size and cannot be casted. In the `eserv.config` file, encoded extension formats are defined by the `profileFormat` parameter. See *profileFormat* (on page 78) for more information.

This table shows the `profileFormat` values that have variable sizes (which can be casted) versus fixed sizes (which cannot be casted).

Size Type	profileFormat Value
Variable size	LNSTRING, STRING, NSTRING, and RAW_DATA
Fixed size	INTEGER, INTEGER64, UIINTEGER, UIINTEGER64, TIME, BOOLEAN, and ARRAY

For example, the following configuration casts an OctetString AVP format (1 byte) as a STRING encoded extension format (1 byte), which is supported:

```
{
  AvpCodes = [
    {
      avpCode = 21 # RAT-Type
      mandatory = true
      vendorId = 10415
    }
  ]
  avpFormat = "OctetString"
  encodedExtension = {
    profileTag = 6760105
    profileFormat = "STRING"
  }
}
```

In contrast, the following configuration attempts to cast an OctetString AVP format (1 byte) as an INTEGER encoded extension format (4 bytes), which is not supported:

```
{
  AvpCodes = [
    {
      avpCode = 21 # RAT-Type
      mandatory = true
      vendorId = 10415
    }
  ]
  avpFormat = "OctetString"
  encodedExtension = {
    profileTag = 6760105
    profileFormat = "INTEGER"
  }
}
```

#### avpCode

**Syntax:** `avpCode = code`  
**Description:** The AVP code for this AVP.  
**Type:** Integer  
**Optionality:** Mandatory  
**Notes:** This parameter is an element of the `AvpCodes` parameter array.  
**Example:** `avpCode = 1234`

#### AvpCodes

**Syntax:** `AvpCodes = [avpcodes]`  
**Description:** The AVP code[s] specifying the AVP.  
**Type:** Array  
**Optionality:** Optional  
**Allowed:**  
**Default:**  
**Notes:** FULLY-QUALIFIED AVP CODE:  
 If more than 1 element is specified in this array, the `AvpCodes` refer to a Fully-Qualified "path" into the AVP hierarchy.  
 RELATIVE AVP CODE:  
 If only a single entry is specified and if this "`AvpCodes`" is used within the "AVPs" Array Section, each element in "`AvpCodes`" is relative and all the nested AVPs collectively form the complete "path" to specifying the AVP within the hierarchy.

**Example:**

```
AvpCodes = [
{
  avpCode = 1234
  mandatory = true
  vendorId = "16747"
}
]
```

#### avpFormat

**Syntax:** `avpFormat = "format"`

**Description:** The format of the AVP.

**Type:** String

**Optionality:** Mandatory

**Allowed:** Allowed values are:

- "OctetString"
- "Integer32"
- "Integer64"
- "Unsigned32"
- "Unsigned64"
- "Address"
- "Time"
- "UTF8String"
- "DiameterIdentity"
- "DiameterURI"
- "Enumerated"
- "Grouped" – Only valid if used in *Service Specific AVP Mappings* (on page 91)

**Example:** `avpFormat = "OctetString"`

#### conversion

**Syntax:** `conversion = [mappings]`

**Description:** For Integer type formats, you can use this parameter to define a conversion table (for outbound mapping) for further mapping of internal (typically INAP cause, or acsProfile values) to external (that is, Diameter AVP) values.

**Type:** Parameter array

**Optionality:** Optional

**Allowed:**

**Default:**

**Notes:**

**Example:** This example is mapping from internal INAP Cause codes to its Diameter Result-Code.

```
conversion = [
{ internal = 1, external = 5030 }
{ internal = 16, external = 2001 }
{ internal = 17, external = 3004 }
{ internal = 42, external = 5006 }
{ internal = 111, external = 3001 }
]
```

### extensionFormat

<b>Syntax:</b>	<code>extensionFormat = "format"</code>
<b>Description:</b>	The format of the extension in ACS.
<b>Type:</b>	String
<b>Optionality:</b>	Optional
<b>Allowed:</b>	<ul style="list-style-type: none"><li>• "inapnumber"</li><li>• "asn1integer"</li><li>• "octets"</li><li>• "encoded" – Only valid if used in Service Specific AVP Mappings. See <i>encodedExtension</i> (on page 76).</li></ul>
<b>Notes:</b>	
<b>Example:</b>	<code>extensionFormat = "inapnumber"</code>

### extensionType

<b>Syntax:</b>	<code>extensionType = type</code>
<b>Description:</b>	The InitialDP extension type
<b>Type:</b>	Integer
<b>Optionality:</b>	Mandatory
<b>Notes:</b>	Cannot be a pre-defined INAP extension nonProfile Encoded Extensions should be considered deprecated
<b>Example:</b>	<code>extensionType = 1234</code>

### external

<b>Syntax:</b>	<code>external = value</code>
<b>Description:</b>	The external value to be put into the AVP to be sent.
<b>Type:</b>	Integer
<b>Optionality:</b>	Optional
<b>Allowed:</b>	
<b>Default:</b>	
<b>Notes:</b>	Member of the <code>conversion</code> section.
<b>Example:</b>	<code>external = 5030</code>

### internal

<b>Syntax:</b>	<code>internal = value</code>
<b>Description:</b>	The internal value (typically INAP cause or acsProfile values) from ACS.
<b>Type:</b>	Integer
<b>Optionality:</b>	Optional
<b>Allowed:</b>	
<b>Default:</b>	
<b>Notes:</b>	Member of the <code>conversion</code> section.
<b>Example:</b>	<code>internal = 1</code>

**mandatory**

<b>Syntax</b>	<code>mandatory = true false</code>
<b>Description:</b>	Whether the AVP code is mandatory
<b>Type:</b>	Boolean
<b>Optionality:</b>	Optional
<b>Allowed:</b>	true, false
<b>Default:</b>	false
<b>Notes:</b>	This parameter is an element of the <code>AvpCodes</code> parameter array.
<b>Example :</b>	<code>mandatory = true</code>

**noa**

<b>Syntax:</b>	<code>noa = value</code>
<b>Description:</b>	The Nature of Address (NOA) for the INAP number. If a SIP Address AVP telephone number is not international, the NOA of a mapped INAP Number will be set to the value specified in this parameter.
<b>Type:</b>	Integer
<b>Optionality:</b>	Optional (default used if not set).
<b>Allowed:</b>	<ul style="list-style-type: none"> <li>• 1 – Subscriber</li> <li>• 2 – Unknown</li> <li>• 3 – National</li> <li>• 4 – International</li> </ul>
<b>Default:</b>	4
<b>Notes:</b>	The NoA field of an INAP Number will be set to International (4) if the mapped SIP address AVP telephone number begins with '+'. The NoA field of an INAP Number will be set to International (4) if the mapped SIP address AVP telephone number begins with '+'.
<b>Example:</b>	<code>noa = 2</code>

**sipScheme**

<b>Syntax:</b>	<code>sipScheme = "sip_scheme"</code>
<b>Description:</b>	Indicates that the AVP contains a SIP address conforming to the URL scheme configured.
<b>Type:</b>	String
<b>Optionality:</b>	Optional (default used if not present).
<b>Allowed:</b>	Allowed values: <ul style="list-style-type: none"> <li>• "sip"</li> <li>• "tel"</li> <li>• "both"</li> </ul>
<b>Default:</b>	<i>parameter not present.</i> No mapping done.

**Notes:** If specified, the SIP address (if found in the AVP) will be extracted and used in the mapped field sent to ACS. See *sipScheme example configurations* (on page 40).

The following parameter must be set:

- `avpFormat = "UTF8String"` - if not set, AVP mapping will be ignored.

If a `sipScheme` is used, the destination is restricted. It can only be mapped to one of the following:

- `inapField`
- `extensionFormat` (of `"inapnumber"`, or `"octets"`)

If not specified, this indicates that the AVP does not contain a SIP address, so no address information will be extracted from the AVP.

If the value set is `"both"`, then it supports both tel and sip format for a single AVP.

**Example:** `sipScheme = "sip"`

### sipScheme example configurations

The following examples illustrate the use of the `sipScheme` parameter in the `AvpMappings` configuration, and the resulting mappings.

#### Example 1

Map AVP 1000 to the `calledPartyNumber` field in IDP. For example, with `"sip:+12125551212@phone2net.com;tag=887s"`, the digits `+12125551212` are mapped to `calledPartyNumber`.

```
{
  AvpCodes = [
    {
      avpCode = 1001
    }
  ]
  avpFormat = "UTF8String"
  sipScheme = "sip"
  inapField = ["calledPartyNumber"]
  mappingTypes = ["InitialRequest"]
}
```

#### Example 2

Map AVP 2000 to extension 7890 of type `InapNumber`. For example, with `"tel:+358-555-1234567"`, the digits `+358-555-1234567` are mapped to extension 7890.

```
{
  AvpCodes = [
    {
      avpCode = 2000
    }
  ]
  avpFormat = "UTF8String"
  sipScheme = "tel"
  extensionFormat = "inapnumber"
  extensionType = 7890
  mappingTypes = ["InitialRequest"]
}
```

#### Example 3

Map AVP 2000 to extension 8000 of type `InapNumber`. For example, with `"tel:555-1234567"`, the digits `555-1234567` are mapped to extension 8000. Because the number is not internationalized (no leading '+'), you must set the Nature of Address (`noa` parameter) to the configured value of 2.

```

{
    AvpCodes = [
        {
            avpCode = 2000
        }
    ]
    avpFormat = "UTF8String"
    sipScheme = "tel"
    noa = 2
    extensionFormat = "inapnumber"
    extensionType = 8000
    mappingTypes = ["InitialRequest"]
}

```

vendorId

**Syntax:** vendorId = "id"

**Description:** The vendor specific AVP, if present.

**Type:** String

**Optionality:** Optional

**Notes:** This parameter is an element of the AvpCodes parameter array.

**Example:** vendorId = "16747"

## DCAInstances Configuration Section

### Introduction

Due to the size and complexity of the `DCAInstances` configuration, the description is broken down into the following topics:

- *DCAInstances Parameters* (on page 43)
- *NumberRules Parameters* (on page 50)
- *RedirectNumberMappings Parameters* (on page 52)
- *Tracing Parameters* (on page 53)
- *DiameterServer parameters* (on page 55)
- *Services Configuration* (on page 66)
- *Service Specific AVP Mappings* (on page 91)

### DCAInstances configuration structure

Here is the high level structure of the configuration of an instance in the `DCAInstances` section of the `DIAMETER` configuration in the `eserv.config` file.

```

DCAInstances = [

    # First Instance
    {
        NumberRules = [
            NumberRules_parameters
        ]

        dummyDestination = "0000"
        systemCurrencyCode = 978
        systemCurrencyExponent = -2
    }
]

```

```

multipleServicesRatingGroup = 0

allowDefaultRatingGroup = false

customDefaultUnits = false

dontDiscardRatingGroupInResponse = true

SIPDomain = "SIP_Domain"
SIPPrefix = "SIP_prefix"

ignoreRSU = true
}
rarHandlingEnabled = false
rarClientTimeout = 30
rarMaxRetry = None

RedirectNumberMappings = [
{
    RedirectNumberMappings_parameters
}
]

Tracing = {
    Tracing_parameters.
}

instanceName = "dcaIf"
scheme = "SchemeA"
systemErrorResultCode = 5012
invalidMessageSequenceResultCode = 5012
sessionBasedDuplicateDetection = true
returnServiceResultCodeInRoot = false
ggsnSupportsFinalUnitIndication = true
ccDuplicateStoreSize = 20
maxAnswerReorder = 2
roundingThreshold = "0.5"
roundingDetail = "ceil"
SubscriptionIdTypes = [
    0,
    2,
    1
]

Services = [
{
    Services_parameters.
}
]

DiameterServer = {
    DiameterServer_parameters
}

} # end of First Instance

] # end of Instances section

```

**Note:** Default settings are specified at installation time.



## DCAInstances Parameters

Here are the parameters for the `DCAInstances` section.

### `allowDefaultRatingGroup`

<b>Syntax:</b>	<code>allowDefaultRatingGroup = true false</code>
<b>Description:</b>	Whether or not to use the default Rating Group.
<b>Type:</b>	Boolean
<b>Optionality:</b>	Optional (default used if not set).
<b>Allowed:</b>	If set to: <ul style="list-style-type: none"> <li><code>true</code> and if no Service-Identifier AVP or Rating-Group AVP is received in the initial request CCR, DCA will use the Default Rating Group defined in <code>multipleServicesRatingGroup</code>.</li> <li><code>false</code> DCA will not use the default Rating Group but instead will wait for the Service-Identifier AVP or Rating-Group AVP in the subsequent request.</li> </ul>
<b>Default:</b>	<code>false</code>
<b>Notes:</b>	
<b>Example:</b>	<code>allowDefaultRatingGroup = false</code>

### `ccDuplicateStoreSize`

<b>Syntax:</b>	<code>ccDuplicateStoreSize = value</code>
<b>Description:</b>	The number of credit-control messages to maintain, when checking for duplicates.
<b>Type:</b>	Integer
<b>Optionality:</b>	Optional (default used if not set).
<b>Allowed:</b>	
<b>Default:</b>	<code>20</code>
<b>Notes:</b>	Requires <code>sessionBasedDuplicateDetection</code> to be set to <code>true</code> .
<b>Example:</b>	<code>ccDuplicateStoreSize = 10</code>

### `customDefaultUnits`

<b>Syntax:</b>	<code>customDefaultUnits = true false</code>
<b>Description:</b>	<p>Applies only when multiple service credit control (MSCC) is in use. Try to accommodate operator-specific ways of handling default units in the following circumstances:</p> <p>An initial request with an MSCC having:</p> <ul style="list-style-type: none"> <li>• A Used-Service-Unit AVP containing CC-Time = 0</li> <li>• No Requested-Service-Unit AVP</li> </ul> <p>An update request with an MSCC having:</p> <ul style="list-style-type: none"> <li>• An Used-Service-Unit AVP containing CC-Time = &lt;actual used&gt;</li> <li>• No Requested-Service-Unit AVP</li> </ul>
<b>Type:</b>	Boolean
<b>Optionality:</b>	Optional (default used if not set)

- Allowed:**
- true – DCA behaves as if the RSU had been specified with the unit type of CC-Time.
  - false – DCA behaves as it normally does if no RSU has been specified.

**Default:** false

**Notes:**

**Example:** `customDefaultUnits = true`

### `dummyDestination`

**Syntax:** `dummyDestination = "num"`

**Description:** Used as the Called Party Number in the InitialDP.

**Type:** Number string

**Optionality:** Mandatory

**Allowed:** Digits

**Default:** 0000

**Notes:** DCA requires a destination; however we do not use it.

**Example:** `dummyDestination = "0000"`

### `dontDiscardRatingGroupInResponse`

**Syntax:** `dontDiscardRatingGroupInResponse = true|false`

**Description:** If set to true, and a Service-Identifier AVP, and a Rating-Group AVP are both received in the request AVP (for MSCC), then the Rating-Group AVP is returned in the CCA response. Otherwise the Rating-Group AVP is not returned.

**Type:** Boolean

**Optionality:** Optional (default used if not set).

**Default:** false

**Example:** `dontDiscardRatingGroupInResponse = false`

### `ggsnSupportsFinalUnitIndication`

**Syntax:** `ggsnSupportsFinalUnitIndication = true|false`

**Description:** Whether or not the GGSN supports final unit indication AVPs.

**Type:** Boolean

**Optionality:** Optional (default used if not set).

**Allowed:** true, false

**Default:** true

**Notes:** A false value implies a non-compliant GGSN.

**Example:** `ggsnSupportsFinalUnitIndication = true`

### `ignoreRSU`

**Syntax:** `ignoreRSU = true|false`

**Description:** Specifies whether DCA ignores any unit types in Requested-Service-Unit AVPs that are included in a request. This parameter applies to session request types only.

**Type:** Boolean

**Optionality:** Optional (default used if not set)

- Allowed:**
- true – DCA ignores any unit types in Requested-Service-Unit AVPs that are included in a request by treating them like empty RSUs.
  - false – DCA recognizes all Requested-Service-Unit AVPs in requests.

**Default:** false

**Notes:**

**Example:** ignoreRSU = true

#### instanceName

**Syntax:** instanceName = "name"

**Description:** The unique identifying name for this instance.

**Type:** String

**Optionality:** Mandatory

**Allowed:** This must match the interface name in SLEE.cfg. See *SLEE.cfg Configuration* (on page 7).

**Default:** no default

**Notes:**

**Example:** instanceName = "dcaIf"

#### invalidMessageSequenceResultCode

**Syntax:** invalidMessageSequenceResultCode = code

**Description:** The error code for an invalid message sequence result, for example, if TERMINATION\_REQUEST is the first message.

**Type:** Integer

**Optionality:** Mandatory

**Allowed:**

**Default:** 5012 [Diameter unable to comply]

**Notes:** See Part 7.1 of *RFC 3588* and Part 9 of *RFC 4006* for a list valid codes.

**Example:** invalidMessageSequenceResultCode = 5012

#### maxAnswerReorder

**Syntax:** maxAnswerReorder = number

**Description:** The maximum number of answers to consider for reordering, before giving up, and answering.

**Type:** Integer

**Optionality:** Optional (default used if not set).

**Allowed:**

**Default:** 10

**Notes:**

**Example:** maxAnswerReorder = 2

#### multipleServicesRatingGroup

**Syntax:** multipleServicesRatingGroup = value

**Description:** Rating Group value used to populate Rating Group AVPs in Multiple Services Credit Control AVPs.

**Type:** Integer

**Optionality:** Optional (default used if not set).  
**Allowed:**  
**Default:** 0  
**Notes:**  
**Example:** `multipleServicesRatingGroup = 3`

### `originHostMustBeFQDN`

**Syntax:** `originHostMustBeFQDN = true`  
**Description:** Sets whether the Origin-Host needs to be a fully qualified domain name.  
**Type:** Boolean  
**Optionality:** Optional (default used if not set)  
**Allowed:** `true` = DCA will reject messages  
`false` = DCA will accept messages  
**Default:** `true`  
**Notes:** With this parameter set to `true`, DCA will reject messages from an Origin-Host which is not a fully qualified domain name. If this parameter is set to `false`, DCA will accept messages regardless of the Origin-Host parameter.  
**Example:** `originHostMustBeFQDN = true`

### `rarClientTimeout`

**Syntax:** `rarClientTimeout = int`  
**Description:** Specifies the time, in seconds, that the DCA will wait for an RAA response from the Diameter client  
**Type:** Integer  
**Allowed:** `>=0`  
**Default:** 30  
**Notes:** Set `rarClientTimeout` to 0 (zero) to disable timeouts.  
**Example:** `rarClientTimeout=30`

### `rarHandlingEnabled`

**Syntax:** `rarHandlingEnabled = true|false`  
**Description:** Determines whether RAR Handling is enabled in DCD  
**Type:** Boolean  
**Optionality:** Optional (default used if not set)  
**Allowed:** `true, false`  
**Default:** `false`  
**Notes:** When `rarHandlingEnabled` is set to `false`, the DCD responds to an RAR with an RAA containing the corresponding result code set in the `rarResultCode` parameter  
**Example:** `rarHandlingEnabled = false`

### `rarMaxRetry`

**Syntax:** `rarMaxRetry = int`  
**Description:** Specifies the maximum number of times that the DCA will attempt to re-transmit an RAR to the Diameter client  
**Type:** Integer  
**Allowed:** `>=1`

**Default:** None  
**Notes:** A single re-transmit is allowed per timeout.

#### `returnServiceResultCodeInRoot`

**Syntax:** `returnServiceResultCodeInRoot = true|false`  
**Description:** Whether or not service result codes should always be returned in the root level (against the dictates of RFC 4006).  
**Type:** Boolean  
**Optionality:** Optional (default used if not set).  
**Allowed:** true, false  
**Default:** false  
**Notes:** A true value implies a non-compliant GGSN.  
**Important:** This can only apply (work sensibly) where there is a single service.  
**Example:** `returnServiceResultCodeInRoot = false`

#### `gracefulTerminationFlag`

**Syntax:** `gracefulTerminationFlag = true|false`  
**Description:** Whether or not to allow graceful termination of the call for failed session, if the session fails with result code 5012.  
**Type:** Boolean  
**Optionality:** Optional (default used if not set).  
**Allowed:** true, false  
**Default:** false  
**Notes:** True value allows the graceful termination of failed session if the session failed with result code 5012. This flag is used only in session based call.  
**Important:** This flag handles the graceful termination only when the termination response result code is 5012 and when this flag and `returnServiceResultCodeInRoot` flag is set to true.  
**Example:** `gracefulTerminationFlag = false`

#### `roundingThreshold`

**Syntax:** `roundingThreshold = "fraction"`  
**Description:** The threshold for rounding fractional unit values to integers.  
 Fractional parts less than this amount are rounded down, fractional parts greater than this amount are rounded up.  
**Type:** String containing a float  
**Optionality:** Optional (default used if not set).  
**Allowed:** Between 0.0 and 1.0  
**Default:** "0.5"  
**Notes:** If you want to truncate, set this to "1".  
 If you want to round all non-integers upwards, then set this to "0" and use "floor" for `roundingDetail` parameter).  
**Example:** `roundingThreshold = "0.5"`

### roundingDetail

<b>Syntax:</b>	<code>roundingDetail = "rounding"</code>
<b>Description:</b>	The direction to round the number when the fractional part equals the <code>roundingThreshold</code> .
<b>Type:</b>	String
<b>Optionality:</b>	Optional (default used if not set)
<b>Allowed:</b>	Allowed values are: <ul style="list-style-type: none"><li>• "ceil" means upwards</li><li>• "floor" means downwards</li></ul>
<b>Default:</b>	"ceil"
<b>Notes:</b>	
<b>Example:</b>	<code>roundingDetail = "ceil"</code>

### scheme

<b>Syntax:</b>	<code>scheme = "name"</code>
<b>Description:</b>	The name of which scheme configuration this instance uses.
<b>Type:</b>	String
<b>Optionality:</b>	Mandatory
<b>Allowed:</b>	This must be a <code>SchemeName</code> from the <code>PeerSchemes</code> section.
<b>Default:</b>	no default
<b>Notes:</b>	
<b>Example:</b>	<code>scheme = "SchemeA"</code>

### sessionBasedDuplicateDetection

<b>Syntax:</b>	<code>sessionBasedDuplicateDetection = true false</code>
<b>Description:</b>	Whether to use CC-Request-Number and Session-Id for duplicate detection for session based services, as specified in <i>RFC 4006</i> . Otherwise the algorithm from <i>RFC 3588</i> is used.
<b>Type:</b>	Boolean
<b>Optionality:</b>	Mandatory
<b>Allowed:</b>	true, false
<b>Default:</b>	true
<b>Notes:</b>	Set to false if the clients do not implement this mechanism from <i>RFC 4006</i> .
<b>Example:</b>	<code>sessionBasedDuplicateDetection = true</code>

### SIPDomain

<b>Syntax:</b>	<code>SIPDomain= "domain"</code>
<b>Description:</b>	The SIP domain for telephone redirections.
<b>Type:</b>	String
<b>Optionality:</b>	Mandatory
<b>Allowed:</b>	
<b>Default:</b>	no default
<b>Notes:</b>	Used when no <code>redirectNumberMapping</code> exists for the given value.
<b>Example:</b>	<code>SIPDomain = "oracle.com"</code>

`SIPPrefix`

<b>Syntax:</b>	<code>SIPPrefix= "prefix"</code>
<b>Description:</b>	The SIP prefix for telephone redirections.
<b>Type:</b>	String
<b>Optionality:</b>	Mandatory
<b>Allowed:</b>	
<b>Default:</b>	"tel+"
<b>Notes:</b>	Used in redirect-server-address when connect received from SLEE_acs. Used when no <code>RedirectNumberMapping</code> exists for the given value.
<b>Example:</b>	<code>SIPDomain = "tel+"</code>

`SubscriptionIdTypes`

<b>Syntax:</b>	<code>SubscriptionIdTypes = [Ids]</code>
<b>Description:</b>	If there is more than one Diameter Subscription-ID in the request, the Subscription-ID with a Subscription-ID-Type nearest the top of this list is used.
<b>Type:</b>	Integer array
<b>Optionality:</b>	Optional (default used if not set).
<b>Allowed:</b>	Subscription-ID-Types defined in <i>RFC 3588</i> are: <ul style="list-style-type: none"> <li>0    <code>END_USER_E164</code> The identifier is in international E.164 format (for example, MSISDN), according to the ITU-T E.164 numbering plan defined in [E164] and [CE164].</li> <li>1    <code>END_USER_IMSI</code> The identifier is in international IMSI format, according to the ITU-T E.212 numbering plan as defined in [E212] and [CE212].</li> <li>2    <code>END_USER_SIP_URI</code> The identifier is in the form of a SIP URI, as defined in [SIP].</li> <li>3    <code>END_USER_NAI</code> The identifier is in the form of a Network Access Identifier, as defined in [NAI].</li> <li>4    <code>END_USER_PRIVATE</code> The Identifier is a credit-control server private identifier.</li> </ul>
<b>Default:</b>	0, 2, 1
<b>Notes:</b>	If an entry in the list is not matched, then a Diameter error is returned.
<b>Example:</b>	<code>SubscriptionIdTypes = [</code> <div style="margin-left: 40px;">0,</div> <div style="margin-left: 40px;">2,</div> <div style="margin-left: 40px;">1</div> <div style="margin-left: 40px;">] </div>

`systemCurrencyCode`

<b>Syntax:</b>	<code>systemCurrencyCode = code</code>
<b>Description:</b>	The ISO 4217 code of the currency.
<b>Type:</b>	Integer
<b>Optionality:</b>	Mandatory

**Allowed:** ISO 4217 code of the currency.  
**Default:** 978 (Euro)  
**Notes:**  
**Example:** `systemCurrencyCode = 978`

#### `systemCurrencyExponent`

**Syntax:** `systemCurrencyExponent = code`  
**Description:** The exponent value of small units for a big unit in the currency.  
**Type:** Integer  
**Optionality:** Mandatory  
**Allowed:**  
**Default:** -2 (100 small units for every big unit.)  
**Notes:**  
**Example:** `systemCurrencyExponent = -2`

#### `systemErrorResultCode`

**Syntax:** `systemErrorResultCode = code`  
**Description:** The error code for a system error  
**Type:** Integer  
**Optionality:** Mandatory  
**Allowed:**  
**Default:** 5012 [Diameter unable to comply]  
**Notes:** See Part 7.1 of *RFC 3588* and Part 9 of *RFC 4006* for a list valid codes  
**Example:** `systemErrorResultCode = 5012`

## NumberRules Parameters

The following parameters define the number normalization rules for DCA. They are found within `NumberRules = [ ]`.

This section is optional.

### Example NumberRules configuration

Here is an example `NumberRules` section of the `DCAInstances` configuration.

```
NumberRules = [
  { prefix="25", fromNoa=3, min=8, max=9, remove=0, prepend="0" }
  { fromNoa=4, remove=0, prepend="00" }
  { prefix="027", min=9, remove=1, resultNoa=3 }
  { prefix="00", min=5, remove=2, prepend="", resultNoa=4 }
]
```

#### `fromNoa`

**Syntax:** `fromNoa = int`  
**Description:** Used when attempting to match the nature of address (NoA) number contained in a message. If there is a match, the `fromNoa` part of the number rule is evaluated.  
**Type:** Integer  
**Optionality:** Required



- Allowed:**
- 2 – For unknown NoAs
  - 3 – For national NoAs
  - 4 – For international NoAs

**Notes:** If you omit `fromNoa` from the `NumberRules` parameter section, then no matching rule will be found.

**Example:** `fromNoa = 3`

`max`

**Syntax:** `max = num`

**Description:** Specifies the maximum number of digits a number may contain. To meet the `max` part of the number rule, the number of digits in the number must be equal to or less than the value of `max`.

**Type:** Integer

**Optionality:** Optional (default used if not set)

**Default:** 999

**Example:** `max = 9`

`min`

**Syntax:** `min = num`

**Description:** Specifies the minimum number of digits a number may contain. To meet the `min` part of the number rule, the number of digits in the number must be equal to or greater than the value of `min`.

**Type:** Integer

**Optionality:** Optional (default used if not set)

**Default:** 0

**Notes:** The value of the `min` parameter must be greater than or equal to the value of the `remove` (on page 52) parameter.

**Example:** `min = 5`

`prefix`

**Syntax:** `prefix = "pref"`

**Description:** Contains a digit or digits. Used to attempt to match the first digit or digits of a prefix number with the specified value. If the digit or digits match, the prefix part of the number rule is met.

**Type:** String

**Optionality:** Optional

**Allowed:** One or more decimal digits

**Notes:** This parameter is an element of the `NumberRules` parameter array.

**Example:** `prefix = "25"`

`prepend`

**Syntax:** `prepend = "digits"`

**Description:** Defines digits added to the beginning of a number.

**Type:** String

**Optionality:** Optional

<b>Allowed:</b>	Any combination of decimal digits, or a null string ("")
<b>Notes:</b>	<ul style="list-style-type: none"> <li>• If the <code>remove</code> and <code>prepend</code> parameters are both used in the same number rule, "<i>prepend</i>" is added to the beginning of the number after the number has been modified by the <code>remove</code> parameter.</li> <li>• The <code>prepend</code> parameter is an element of the <code>NumberRules</code> parameter array.</li> </ul>
<b>Example:</b>	<code>prepend = "0"</code>

`remove`

<b>Syntax:</b>	<code>remove = num</code>
<b>Description:</b>	The number of digits stripped from the beginning of a number.
<b>Type:</b>	Integer
<b>Optionality:</b>	Required
<b>Notes:</b>	The value of the <code>remove</code> parameter must be less than or equal to the value of the <i>min</i> (on page 51) parameter.
<b>Example:</b>	<code>remove = 2</code>

`resultNoa`

<b>Syntax:</b>	<code>resultNoa = noa</code>
<b>Description:</b>	A nature of address (NOA) sent to the network.
<b>Type:</b>	Integer
<b>Optionality:</b>	Optional
<b>Notes:</b>	<ul style="list-style-type: none"> <li>• A value is typically specified in demoralization rules</li> <li>• This parameter is an element of the <code>NumberRules</code> parameter array</li> </ul>
<b>Example:</b>	<code>resultNoa = 4</code>

## RedirectNumberMappings Parameters

The following parameters are used to map the redirect number. They are found within `RedirectNumberMappings = [ ]`.

This section is optional.

### Example RedirectNumberMappings configuration

Here is an example `RedirectNumberMappings` section of the `DCAInstances` configuration.

```
RedirectNumberMappings = [
{
    prefix = "641234"
    destination = "oracle.com"
    type = "SIP_URI"
}
]
```

`destination`

<b>Syntax:</b>	<code>destination = "address"</code>
<b>Description:</b>	The destination address string.
<b>Type:</b>	String
<b>Optionality:</b>	Mandatory if the <code>RedirectNumberMappings</code> section is included.
<b>Allowed:</b>	See <i>RFC 4006</i>

**Default:** N/A  
**Example:** `destination = oracle.com`

#### `prefix`

**Syntax:** `prefix = pref`  
**Description:** A prefix of the destination Routing Address in the connect.  
**Type:** Number string  
**Optionality:** Mandatory if the `RedirectNumberMappings` section is included.  
**Allowed:** Digits  
**Default:** N/A  
**Example:** `prefix = 641234`

#### `type`

**Syntax:** `type = "type"`  
**Description:** The destination's type.  
**Type:** String  
**Optionality:** Required if the `RedirectNumberMappings` section is included.  
**Allowed:**

- IPv4
- IPv6
- URL
- SIP\_URI

**Default:** N/A  
**Example:** `type = "SIP_URI"`

## Tracing Parameters

The following parameters are used for tracing activities. They are all found within the `Tracing = { }` statement.

### Example Tracing configuration

Here is an example `Tracing` section of the `DCAInstances` configuration.

```
Tracing = {
    enabled = true

    OrigAddress = [
        "a.b.c.com.0064212",
        "a.b.c.com.0064213",
        "a.b.c.com.0064214"
    ]

    destinationAddressAvp = 1234

    DestAddress = [
        "a.b.c.com.0064213",
        "a.b.c.com.0064214"
    ]

    traceDebugLevel = "all"
}
```

### destAddress

<b>Syntax:</b>	<code>destAddress = ["addr", "addr"]</code>
<b>Description:</b>	List of destination addresses that are to be traced.
<b>Type:</b>	String array
<b>Optionality:</b>	Optional
<b>Allowed:</b>	<ul style="list-style-type: none"><li>Any valid addresses</li><li>""</li></ul>
<b>Default:</b>	""
<b>Notes:</b>	"" = trace all known destination addresses. destAddress is set to <i>Dest-Realm.Subscription-Id</i> .
<b>Example values:</b>	<pre>destAddress = [   "a.b.c.com.0064213",   "a.b.c.com.0064214" ]</pre>

### destinationAddressAvp

<b>Syntax:</b>	<code>destinationAddressAvp = avp</code>
<b>Description:</b>	The AVP to use in destination address as <i>RFC 4006</i> does not specify this.
<b>Type:</b>	Integer
<b>Optionality:</b>	Optional
<b>Notes:</b>	If not specified, <code>destinationAddress</code> is hard-coded to 0000
<b>Example:</b>	<code>destinationAddressAvp = 1234</code>

### enabled

<b>Syntax:</b>	<code>enabled = true false</code>
<b>Description:</b>	Switches tracing on or off.
<b>Type:</b>	Boolean
<b>Optionality:</b>	Optional
<b>Allowed:</b>	true, false
<b>Default:</b>	false
<b>Notes:</b>	If false, then the parameters in the Tracing section are ignored.
<b>Example:</b>	<code>enabled = false</code>

### origAddress

<b>Syntax:</b>	<code>origAddress = ["addr", "addr"]</code>
<b>Description:</b>	List of originating addresses that are to be traced.
<b>Type:</b>	String array
<b>Optionality:</b>	Optional
<b>Allowed:</b>	<ul style="list-style-type: none"><li>Any valid addresses</li><li>""</li></ul>
<b>Default:</b>	""
<b>Notes:</b>	"" = trace all known originating addresses. origAddress is set to <Origin-Realm>.<Subscription-Id>

**Example values:**

```
origAddress = [
    "a.b.c.com.0064212",
    "a.b.c.com.0064213",
    "a.b.c.com.0064214"
]
```

traceDebugLevel

**Syntax:** traceDebugLevel = "level"

**Description:** The debug level the tracing be at should.

**Type:** String

**Optionality:** Mandatory

**Notes:** This is a string, with comma separation in it. See traceDebugLevel in *ACS Technical Guide*.  
Useful flags are cdaconfig, diameterControlAgent, cdaObjectCounts

**Example:** traceDebugLevel = "all"

## DiameterServer Parameters

The following parameters are used for a Diameter Server. They are all found within `DiameterServer` = { }.

### Example DiameterServer Configuration

Here is an example `DiameterServer` section in the `DCAInstances` configuration.

```
DiameterServer = {
    protocol = "both"
    sctpListenPort = "3868"
    tcpListenPort = "3868"
    tcpBindAddress = "192.168.1.1"
    sctpBindAddress = "192.168.1.2"
    Auth-Application-Id = [ 4, 34, 42 ]
    Acct-Application-Id = 21
    Vendor-Specific-Application-Identifier = [
        {
            Vendor-Id = 111
            Auth-Application-Id = 1234
        }
        {
            Vendor-Id = 111
            Acct-Application-Id = 4321
        }
    ]
    localOriginHost = "creditcontrol.realm3.oracle.com"
    localOriginRealm = "realm3.oracle.com"
    productName = "oracle-dca"
    vendorId = 16247
    Supported-Vendor-Id = [ 16247, 10415 ]
    duplicateTime = 240
    duplicateBytes = 31457280
    connectionTimeout = 30
    watchdogPeriod = 30
    inBufferSize = 16384
    outBufferSize = 16384
    sendOriginStateId = false
    sendQuotaThreshold = true
    thirtyTwoBitQuotaThresholds = true
}
```

```

percentTimeQuotaThreshold = 80
percentVolumeQuotaThreshold = 80
commitGrantedOnTerminate = false
allowMultiServiceIdentifier = false
finalGrantUnused = false
sessionLimit = 0
throttleLimitError = 3004
overLimitError = 3004
counterLogInterval = 0
throttleThreshold = 100
throttleInterval = 100
sendCreditLimitReachedOnSessionEnd = false
chargeOnSessionTimeout = true
sendAbortOnSessionTimeout = true
commitGrantedOnSessionTimeout = true
sessionFallbackTcc = 3600
noMSCSessionValidityTime = 0
} # End of DiameterServer section

```

### Acct-Application-Id

**syntax:** Acct-Application-Id = [IDs]

**Description:** The Acct-Application-Id AVP values to include in the Capabilities Exchange message.

**Type:** Integer – Single value, or array

**Optionality:** Optional

**Notes:** This array may have one or more values, or no value.  
If there is only one value, brackets are not required.  
If neither Auth-Application-Id, nor Acct-Application-Id is specified, then Auth-Application-Id = 4.

**Examples:** Acct-Application-Id = 21

### allowMultiServiceIdentifier

**Syntax:** allowMultiServiceIdentifier = true|false

**Description:** Whether or not more than one Service-Identifier is supported for MSSC with a single multiple service credit control AVP.

**Type:** Boolean

**Optionality:** Optional (default used if not set).

**Allowed:**

- true – More than one allowed. Triggers a service per Service-Identifier
- false – More than one not permitted. Only use the first Service\_Identifier

**Default:** false

**Notes:**

**Example:** allowMultiServiceIdentifier = true

### Auth-Application-Id

**syntax:** Auth-Application-Id = [IDs]

**Description:** The Auth-Application-Id AVP values to include in the Capabilities Exchange message.

**Type:** Integer – Single value, or array

**Optionality:** Optional (default used if not set)

**Notes:** For Credit control this is 4.

This array may have one or more values, or no value.

If there is only one value, brackets are not required.

The first Auth-Application-Id (or 4 if none) is placed in that AVP in the CCR messages also.

If neither Auth-Application-Id, nor Acct-Application-Id is specified, then Auth-Application-Id = 4.

**Default:** 4

**Examples:** Auth-Application-Id = [ 4, 34, 42 ]  
or  
Auth-Application-Id = 4

#### chargeOnSessionTimeout

**Syntax:** chargeOnSessionTimeout = true|false

**Description:** Indicates how DCA should manage a timeout with an access device (for example, GGSN).

**Type:** Boolean

**Optionality:** Optional (default used if not set).

**Allowed:** If set to true, DCA will attempt to finalize any sessions with ACS that are associated with the timed-out session - and..

<p>there is an outstanding Apply Charging</p> <p>a service's charging is via SMCB (armed to report oAnswer; no outstanding ACh)</p>	<p>DCA will respond with an Apply Charging Report with either the Total Granted Units or Total Used Units depending on configuration.</p> <p>we send ERBCSM(oAnswer) to ACS.</p>
---	--

**Default:** false

**Notes:**

**Example:** chargeOnSessionTimeout = true

#### commitGrantedOnSessionTimeout

**Syntax:** commitGrantedOnSessionTimeout = true|false

**Description:** Indicates whether DCA should request that the Total Granted Units or the Total Used Units should be committed.

**Type:** Boolean

**Optionality:** Optional (default used if not set).

**Allowed:**

**Default:** false

**Notes:**

**Example:** commitGrantedOnSessionTimeout = false

### commitGrantedOnTerminate

<b>Syntax:</b>	<code>commitGrantedOnTerminate = true false</code>
<b>Description:</b>	Whether or not to commit granted funds on session terminate where the used units are not specified.
<b>Type:</b>	Boolean
<b>Optionality:</b>	Optional (default used if not set).
<b>Allowed:</b>	<ul style="list-style-type: none"><li>• true – Commit granted (that is, charges for granted units)</li><li>• false – Only commit reported used units (that is, does not charge)</li></ul>
<b>Default:</b>	false
<b>Notes:</b>	
<b>Example:</b>	<code>commitGrantedOnTerminate = true</code>

### connectionTimeout

<b>Syntax:</b>	<code>connectionTimeout = seconds</code>
<b>Description:</b>	How long to wait for a reply before considering there is a transport level problem
<b>Type:</b>	Integer
<b>Optionality:</b>	Mandatory
<b>Allowed:</b>	Seconds
<b>Default:</b>	30
<b>Example:</b>	<code>connectionTimeout = 30</code>

### counterLogInterval

<b>Syntax:</b>	<code>counterLogInterval = secs</code>
<b>Description:</b>	The interval in seconds between sending request counts to the syslog file. Set to 0 (zero) if you do not want to log requests.
<b>Type:</b>	Integer
<b>Optionality:</b>	Optional (default used if not set).
<b>Allowed:</b>	
<b>Default:</b>	600
<b>Notes:</b>	This parameter is also used to control the frequency of notice messages that log the number of requests received, and the frequency of warning messages that log the number of throttled requests.
<b>Example:</b>	<code>counterLogInterval = 0</code>

### duplicateBytes

<b>Syntax:</b>	<code>duplicateBytes = bytes</code>
<b>Description:</b>	How many bytes to allocate to the duplicate detection buffer
<b>Type:</b>	Integer
<b>Optionality:</b>	Mandatory
<b>Default:</b>	31457280 (30 MB)
<b>Example:</b>	<code>duplicateBytes = 31457280</code>

### duplicateTime

<b>Syntax:</b>	<code>duplicateTime = seconds</code>
<b>Description:</b>	How long to hold End-to-End Identifiers, when considering them for potential duplicates.



**Type:** Integer  
**Optionality:** Mandatory  
**Allowed:** Seconds  
**Default:** 240  
**Example:** `duplicateTime = 240`

#### `finalGrantUnused`

**Syntax:** `finalGrantUnused = true|false`  
**Description:** Whether or not to allow re-granting of unused units after a final unit indication is sent.  
**Type:** Boolean  
**Optionality:** Optional (default used if not set).  
**Allowed:** true, false  
**Default:** false  
**Notes:**  
**Example:** `finalGrantUnused = true`

#### `inBufferSize`

**Syntax:** `inBufferSize = size`  
**Description:** The size, in bytes, of inbound transport buffer.  
**Type:** Integer  
**Optionality:** Mandatory  
**Allowed:**  
**Default:** 0 (kernel default)  
**Example:** `inBufferSize = 16384`

#### `throttleLimitError`

**Syntax:** `throttleLimitError = Int`  
**Description:** The error code generated when a throttle limit is breached.  
**Type:** Integer  
**Optionality:** Optional (default used if not set)  
**Allowed:**  
**Default:** 3004 – Diameter too busy  
**Notes:**  
**Example:** `throttleLimitError = 5006`

#### `overLimitError`

**Syntax:** `overLimitError = int`  
**Description:** Sets the error code to use in a throttle-generated CCA, and when rejecting a session because the memory or session limit has been exceeded.  
**Type:** Integer  
**Optionality:** Optional (default used if not set).  
**Allowed:**  
**Default:** 3004 – Diameter too busy

**Notes:**

**Example:** `overLimitError = 3004`

### `protocol`

**Syntax:** `protocol = "protocol"`

**Description:** The protocol for this server.

**Type:** String

**Optionality:** Mandatory

**Allowed:**

- "sctp"
- "tcp"
- "both"

**Default:** "tcp"

**Example:** `protocol = "tcp"`

### `sctpBindAddress`

**Syntax:** `sctpBindAddress = "addr"`

**Description:** The SCTP port to listen on for this instance.

**Type:** String

**Optionality:** Mandatory

**Default:** 0 (that is, INADDR\_ANY)

**Example:** `sctpBindAddress = "192.168.1.2"`

### `sctpListenPort`

**Syntax:** `sctpListenPort = "port"`

**Description:** The SCTP port to listen on

**Type:** String

**Optionality:** Mandatory

**Default:** "3868"

**Example:** `sctpListenPort = "3868"`

### `sessionLimit`

**Syntax:** `sessionLimit = int`

**Description:** Limits the number of credit control sessions that may be created to the specified value.

**Type:** Integer

**Optionality:** Optional (default used if not set).

**Allowed:** A positive value.

**Default:** 0 – Do not apply a limit.

**Notes:**

**Example:** `sessionLimit = 0`

### `tcpBindAddress`

**Syntax:** `tcpBindAddress = "addr"`

**Description:** The TCP port to listen on for this instance.

**Type:** String

**Optionality:** Mandatory  
**Default:** 0 (that is, INADDR\_ANY)  
**Example:** `tcpBindAddress = "192.168.1.1"`

#### `tcpListenPort`

**Syntax:** `tcpListenPort = "port"`  
**Description:** The TCP port to listen on  
**Type:** String  
**Optionality:** Mandatory  
**Default:** 3868  
**Example:** `tcpListenPort = "3868"`

#### `throttleThreshold`

**Syntax:** `throttleThreshold = int`  
**Description:** The number of initial or event requests to allow in a single interval. You set the length of the interval by using the `throttleInterval` parameter. The control agent counts the number of initial reservations or events received in the current interval and rejects new requests once the count has gone above the threshold.  
**Type:** Integer  
**Optionality:** Optional (default used if not set)  
**Allowed:**  
**Default:** 0 – Allow all requests  
**Notes:**  
**Example:** `throttleThreshold = 50`

#### `throttleInterval`

**Syntax:** `throttleInterval = int`  
**Description:** The length, in milli-seconds, of each interval for which new requests will be counted and checked against the threshold specified in `throttleThreshold`.  
**Type:** Integer  
**Optionality:** Optional (default used if not set)  
**Allowed:** None  
**Default:** 100  
**Notes:** If the value of the `throttleInterval` is set to any value other than 0 (zero), DCA rejects new requests and reports an error until the time set by the `throttleInterval`.  
**Example:** `throttleInterval = 100`

#### `localOriginHost`

**Syntax:** `localOriginHost = "hostname"`  
**Description:** The Origin-Host for messages sent out  
**Type:** String  
**Optionality:** Optional  
**Default:** "hostname"

**Notes:** Recommended to keep the default value as the hostname of the target node, for example the SLC.

**Example:** `localOriginHost = "creditcontrol.realm3.oracle.com"`

### `localOriginRealm`

**Syntax:** `localOriginRealm = "realmname"`

**Description:** The Origin-Realm for messages sent out

**Type:** String

**Optionality:** Mandatory

**Notes:** Each realm may contain at most one SLC

**Example:** `localOriginRealm = "realm3.oracle.com"`

### `outBufferSize`

**Syntax:** `outBufferSize = size`

**Description:** The size, in bytes, of inbound transport buffer.

**Type:** Integer

**Optionality:** Mandatory

**Allowed:** Bytes

**Default:** 0 (kernel default)

**Example:** `outBufferSize = 16384`

### `percentTimeQuotaThreshold`

**Syntax:** `percentTimeQuotaThreshold = percent`

**Description:** The percentage of granted service units of the time quota threshold.

**Type:** Integer

**Optionality:** Optional (default used if not set).

**Allowed:** 0 to 100 per cent

**Default:** 0

**Notes:**

**Example:** `percentTimeQuotaThreshold = 80`

### `percentVolumeQuotaThreshold`

**Syntax:** `percentVolumeQuotaThreshold = percent`

**Description:** The percentage of granted service units of the volume quota threshold.

**Type:** Integer

**Optionality:** Optional (default used if not set).

**Allowed:** 0 to 100 percent

**Default:** 0

**Notes:**

**Example:** `percentVolumeQuotaThreshold = 80`

### `productName`

**Syntax:** `productName = "name"`

**Description:** The product name used in Capabilities-Exchange-Answer

**Type:** String

**Optionality:** Mandatory  
**Allowed:**  
**Default:** "esg-dca" (that is, Diameter Control Agent)  
**Notes:**  
**Example:** `productName = "esg-dca"`

#### `sendAbortOnSessionTimeout`

**Syntax:** `sendAbortOnSessionTimeout = true|false`  
**Description:** Indicates whether DCA will send an abort session request to the access device when the session with that device times out.  
**Type:** Boolean  
**Optionality:** Optional (default used if not set).  
**Allowed:**  
**Default:** `false`  
**Notes:**  
**Example:** `sendAbortOnSessionTimeout = false`

#### `sendCreditLimitReachedOnSessionEnd`

**Syntax:** `sendCreditLimitReachedOnSessionEnd = true|false`  
**Description:** Indicates if we should reply to the final update request for a service (which DCA sometimes referred to as a sub-session) with a result code of `DIAMETER_CREDIT_LIMIT_REACHED` (4012), rather than `DIAMETER_SUCCESS` (2001).  
**Type:** Boolean  
**Optionality:** Optional (default used if not set).  
**Allowed:**  
**Default:**  
**Notes:** For the record, the last update request for a service contains an MSCC with used service units but no requested-service-units AVP.  
**Example:** `sendCreditLimitReachedOnSessionEnd = false`

#### `sendOriginStateId`

**Syntax:** `sendOriginStateId = true|false`  
**Description:** To send or not send the origin state id flag.  
**Type:** Boolean  
**Optionality:** Optional (default used if not set).  
**Allowed:** `true, false`  
**Default:** `true`  
**Notes:** Must be set to `false` if you do not want to send  
**Example:** `sendOriginStateId = false`

#### `sendQuotaThreshold`

**Syntax:** `sendQuotaThreshold = true|false`  
**Description:** Whether or not to send volume and quota threshold for MSCC.  
**Type:** Boolean

**Optionality:** Optional (default used if not set).  
**Allowed:** true, false  
**Default:** true  
**Notes:** Must be set to *false* if you do not want to send volume and quota threshold.  
**Example:** `sendQuotaThreshold = false`

### `sessionFallbackTcc`

**Syntax:** `sessionFallbackTcc = seconds`  
**Description:** The session fallback tcc timer (in seconds).  
**Type:** Integer  
**Optionality:** Optional (default used if not set).  
**Allowed:**  
**Default:** 3600  
**Notes:** This value is used as the tcc timer for sessions that do not have an associated service.  
**Example:** `sessionFallbackTcc = 3600`

### `noMSCCsessionValidityTime`

**Syntax:** `noMSCCsessionValidityTime = seconds`  
**Description:** Returns this validity time outside MSCC.  
**Type:** Integer  
**Optionality:** Optional (default used if not set).  
**Allowed:**  
**Default:** 0  
**Notes:** This value is used to show validity time in root level (outside MSCC) when no RSU is set.  
**Example:** `noMSCCsessionValidityTime = 1500`

### `Supported-Vendor-Id`

**Syntax:** `Supported-Vendor-Id = [ values ]`  
**Description:** The Supported-Vendor-Id AVP values to include in the Capabilities Exchange message.  
**Type:** Integer – Single value, or array  
**Optionality:** Optional  
**Allowed:**  
**Default:**  
**Notes:** This field may be specified as an array with either one or more values, or no value.  
If there is only one value, brackets are not required.  
**Example:** `Supported-Vendor-Id = [ 16247, 10415 ]`

### `thirtyTwoBitQuotaThresholds`

**Syntax:** `thirtyTwoBitQuotaThresholds = true|false`  
**Description:** Whether to send the Time-Quota-Threshold and Volume-Quota-Threshold AVPs as 32-bit integers (as supported by a Cisco Release 9 GGSN).  
**Type:** Boolean

**Optionality:** Optional (default used if not set).  
**Allowed:** true, false  
**Default:** true  
**Notes:** If this is *false* it is sent as a 64-bit integer(as supported by a Cisco Release 7 GGSN).  
**Example:** `thirtyTwoBitQuotaThresholds = true`

#### Vendor-Specific-Application-Identifier

**Syntax:** `Vendor-Specific-Application-Identifier = [values]`  
**Description:** The Vendor-Specific-Application-Id AVP values  
**Type:** Array  
**Optionality:** Optional  
**Allowed:**  
**Default:**  
**Notes:**  
**Example:**

```
Vendor-Specific-Application-Identifier = [
{
  Vendor-Id = 111
  Auth-Application-Id = 1234
}
{
  Vendor-Id = 111
  Auth-Application-Id = 4321
}]
```

#### vendorId

**Syntax:** `vendorId = id`  
**Description:** The Vendor ID to be supplied in the Capabilities-Exchange-Answer.  
**Type:** Integer  
**Optionality:** Mandatory  
**Allowed:** A valid ID  
**Default:** 0  
**Notes:**  
**Example:** `vendorId = 16247`

#### watchdogPeriod

**Syntax:** `watchdogPeriod = seconds`  
**Description:** The period between sending out Device Watchdog messages to next-hop peer.  
**Type:** Integer  
**Optionality:** Mandatory  
**Allowed:** Seconds  
**Default:** 30  
**Example:** `watchdogPeriod =30`

# Services Configuration

## Introduction

The `Services` section of the `DCAInstances` configuration allows you to select a specified service based upon one of the following:

- Service Context ID, Service Identifier, Rating Group, UnitType
- Configurable list of AVP values matched against the inbound message

If the `SelectionAVPs` is specified, then the `serviceContextId`, `serviceIdentifier`, `ratingGroup`, and `unitType` parameters cannot be specified.

**Note:** The service selection rules are tried in order. If you want the service configured by configurable AVPs to be used first, then put the parameters first in the `Services` section of the `eserv.config` file.

## Services configuration structure

Here is the high-level structure of `Services` configuration section of the `DIAMETER` configuration in the `eserv.config` file.

```
Services = [
{
    serviceName = "<Service name>"

    serviceContextId = "<Service-Context-Id>"

    serviceIdentifier = "<Service-Identifier>"

    ratingGroup = "<Rating-Group>"

    screeningService = false

    unitType = "Time"

    selectionAVPsIsChargingKey = false

    conversionFactor = 1.0

    requestedAction="DIRECT_DEBITING"

    sleeServiceKey = 1231
    inapServiceKey = 1231
    tcc = 3600
    gracefulTerminationValidityTime= 300
    itc = "udi"
    validityTime = 30
    sleeTimeout = 10
    validateDestinationNumber = true

    SelectionAVPs = [
        {
            AvpCodes = [ { avpCode=5, vendorId=16247 },
                        { avpCode=7, vendorId=16247 } ],
            avpType = "Unsigned64"
            avpValue = 123
            avpValue = "-0x5000000000"
            avpValue = "This Really Is A String"
            isChargingKey = false
        }
    ]

    AVPMappings = [
```



```

    {
        base_avpmappings
    }

    {
        basic_arrayavpmappings
    }

    {
        key_array_avpmappings
    }

    {
        array_with_conditions_avpmappings
    }

    {
        array_with_context_avpmappings
    }

    {
        conditional_avp_avpmappings
    }

    {
        prefix_tree_avpmappings
    }

    {
        timestamp_avpmappings
    }
}

```

See *Service Specific AVP Mappings* (on page 91) for a description of the `AVPMappings` configuration and examples of specific configuration and mappings.

## Services parameters

The following parameters are used for a service. They are all located within the `Services` array.

As many services as required can be set up.

`AvpCodes`

<b>Syntax:</b>	<code>AvpCodes = [avp_codes]</code>
<b>Description:</b>	For a description of the <code>AVPCodes</code> parameters, see <code>AvpCodes</code> in the <code>DCADefaults</code> section.
<b>Type:</b>	Array
<b>Optionality:</b>	Optional
<b>Allowed:</b>	
<b>Default:</b>	
<b>Notes:</b>	<p><code>AvpCodes</code> may be included as a member of the following:</p> <ul style="list-style-type: none"> <li>• <code>DCADefaults</code></li> <li>• <i>SelectionAVPs</i> (on page 71)</li> <li>• <i>typeCriteria</i> (on page 82)</li> <li>• the base <i>Service Specific AVP Mappings</i> (on page 91)</li> <li>• within AVP mappings of each level of a nested array</li> </ul>

**Example:**

```
AvpCodes = [
{
  avpCode = 1234
  mandatory = true
  vendorId = "16747"
}
]
```

### avpMappings

**Syntax:** `avpMappings = [avpMappings_parameters]`  
**Description:** The service-specific AVP mappings.  
**Optionality:** Optional  
**Default:** If not present, will use the `avpMappings` in the `DCADefaults` section.  
**Notes:** See *Service Specific AVP Mappings* (on page 91).

### avpType

**Syntax:** `avpType = "type"`  
**Description:** The AVP datatype to match.  
**Type:** String  
**Optionality:** Optional  
**Allowed:** Allowed values are:

- Integer32
- Integer64
- Unsigned32
- Unsigned64
- UTF8String
- Enumerated

**Default:**  
**Notes:** This is a member of the `SelectionAVPs` array.  
**Example:** `parameter = "Integer32"`

### avpValue

**Syntax:** `avpValue = "value"`  
**Description:** The value to match.  
**Type:** It may be specified either as a number or a quoted string.  
**Optionality:** Optional  
**Allowed:**  
**Default:**  
**Notes:** The config file supports only the signed 32-bit range for numbers. For numbers outside of that range, put it in quotes.  
This is a member of the `SelectionAVPs` array.  
**Example:**

```
avpValue = 123
avpValue = "-0x50000000000"
avpValue = "This Really Is A String"
```

`conversionFactor`

<b>Syntax:</b>	<code>conversionFactor = unit</code>
<b>Description:</b>	The conversion factor to use when communicating with ACS. <ul style="list-style-type: none"> <li>• Multiplies the value received from ACS by this factor to calculate the Granted-Service-Unit AVP.</li> <li>• Divides the Used-Service-Unit AVP by this value before sending it to ACS.</li> </ul>
<b>Type:</b>	Float
<b>Optionality:</b>	Mandatory
<b>Allowed:</b>	
<b>Default:</b>	Defaults to: <ul style="list-style-type: none"> <li>• 0.1 for time</li> <li>• 1048576 for octets</li> <li>• 1.0 for everything else</li> </ul>
<b>Notes:</b>	Ignored for CC-Time AVPs (always uses the default of 0.1)
<b>Example:</b>	<code>conversionFactor = 1.0</code>

`gracefulTerminationValidityTime`

<b>Syntax:</b>	<code>gracefulTerminationValidityTime = seconds</code>
<b>Description:</b>	The number of seconds granted for the user to top up the account during graceful termination. Refer to <i>RFC 4006 A.7</i> .
<b>Type:</b>	Integer
<b>Optionality:</b>	Optional
<b>Allowed:</b>	in seconds
<b>Default:</b>	
<b>Notes:</b>	Not present means no graceful termination.
<b>Example:</b>	<code>gracefulTerminationValidityTime = 300</code>

`inapServiceKey`

<b>Syntax:</b>	<code>inapServiceKey = value</code>
<b>Description:</b>	The INAP Key value
<b>Type:</b>	Integer
<b>Optionality:</b>	Optional
<b>Allowed:</b>	Any 32 bit integer
<b>Example:</b>	<code>inapServiceKey = 1234</code>

`isChargingKey`

<b>Syntax:</b>	<code>isChargingKey = true false</code>
<b>Description:</b>	
<b>Type:</b>	Boolean
<b>Optionality:</b>	Optional (default used if not set).
<b>Allowed:</b>	true, false
<b>Default:</b>	

**Notes:** If true, then we may match a Diameter CCR INITIAL\_REQUEST, or UPDATE\_REQUEST.  
 If false, then we may only match the INITIAL\_REQUEST (or if that is empty, then the first UPDATE\_REQUEST).

This is a member of the `SelectionAVPs` array.

**Example:** `isChargingKey = false`

`itc`

**Syntax:** `itc = infoTransferCapability`

**Description:** The Bearer Capability Information Element (Q.931 section 4.5.5) contains an Information Transfer Capability (ITC) field that is set automatically by DCA when DCA triggers ACS.

This parameter overrides the ITC value within the Bearer Capability Information Element.

**Type:** Integer or string

**Optionality:** Optional

**Allowed:** Allowed values are:

String	Integer	Hex	Description
"speech"	0	0x00	Speech
"udi"	8	0x08	Unrestricted Digital Information
"rdi"	9	0x09	Restricted Digital Information
"3.1kHzAudio"	16	0x10	3.1 kHz audio
"udiTA" or "7kHzAudio"	17	0x11	Unrestricted Digital Information with tones/announcements
"video"	24	0x18	Video

**Default:** Defaults to one of the following:

- "speech" (0x00), if the Requested-Service-Unit AVP is set to CC-Time.
- "udi" (0x08), if otherwise.

**Notes:** If automatic setting of ITC is required, then this parameter should be absent.

**Example:** `itc = 16`  
 or  
`itc = "3.1kHzAudio"`  
 or  
`itc = 0x10`

`ratingGroup`

**Syntax:** `ratingGroup = "number"`

**Description:** The number used to identify the rating group as part of a service triggering rule.

**Type:** String

**Optionality:** Optional

**Allowed:** The value in quotes must be a number.

**Default:**

**Notes:** This parameter must not be specified if `SelectionAVPs` is specified.

**Example:**            `ratingGroup = "2"`

#### `requestedAction`

**Syntax:**            `requestedAction = "action"`  
**Description:**      The action performed by the service  
**Type:**              String  
**Optionality:**      Optional  
**Allowed:**

- DIRECT\_DEBITING
- REFUND\_ACCOUNT
- CHECK\_BALANCE
- PRICE\_ENQUIRY

  
**Default:**            not present  
**Notes:**              Not present indicates this service is for session based transactions.  
                          See *RFC 4006 Requested-Action AVP*.  
**Example:**            `requestedAction = "DIRECT_DEBITING"`

#### `screeningService`

**Syntax:**            `screeningService = true|false`  
**Description:**      If a screening service is not found for a particular service context ID, then DCA assumes that no screening needs to take place, that is, the session is allowed.  
**Type:**              Boolean  
**Optionality:**      Optional (default used if not set).  
**Allowed:**            true, false  
**Default:**            false  
**Notes:**              If the `screeningService` flag is true, then `serviceIdentifier` and `ratingGroup` should be blank.  
**Example:**            `screeningService = false`

#### `SelectionAVPs`

**Syntax:**            `SelectionAVPs = [selection_avps]`  
**Description:**      Specifies the AVPs to be matched in an incoming request for the service to be triggered.  
**Type:**              Array  
**Optionality:**      Optional  
**Allowed:**  
**Default:**  
**Notes:**              All of the selection AVPs must be matched in an incoming request for the service to be triggered.  
                          If `SelectionAVPs` is specified then none of `serviceContextId`, `serviceIdentifier`, `ratingGroup`, or `unitType` can be specified.

**Example:**

```
SelectionAVPs = [
  {
    AvpCodes = [
      { avpCode=5, vendorId=16247 },
      { avpCode=7, vendorId=16247 } ],
    avpType = "Unsigned64"
    avpValue = 123
    avpValue = "-0x50000000000"
    avpValue ="This Really Is A String"
    isChargingKey = false
  }
]
```

### selectionAVPsIsChargingKey

**Syntax:** selectionAVPsIsChargingKey = true|false

**Description:** Indicates whether this AVP is a charging key.

**Type:** Boolean

**Optionality:** Optional (default used if not set).

**Allowed:**

- true – Incoming UPDATE\_REQUESTS messages matching this rule, for which there is no current session, will start a new session.
- false – Such messages will be rejected with a Diameter answer with an error result code.

**Default:** false

**Notes:**

**Example:** selectionAVPsIsChargingKey = false

### serviceContextId

**Syntax:** serviceContextId = "id"

**Description:** The ID of the Service Context

**Type:** String

**Optionality:** Mandatory, if SelectionAVPs is *not* specified.

**Notes:** This parameter must not be specified if SelectionAVPs is specified.  
You must specify both the ServiceContextId and serviceIdentifier to identify the service. See *RFC 4006*.

**Example:** serviceContextId = "3"

### serviceIdentifier

**Syntax:** serviceIdentifier = "Id"

**Description:** The service identifier number.

**Type:** Number string

**Optionality:** Optional

**Notes:** This parameter must not be specified if SelectionAVPs is specified.  
You must specify both the ServiceContextId and serviceIdentifier to identify the service. See *RFC 4006*.

**Example:** serviceIdentifier = "3"

`serviceName`

<b>Syntax:</b>	<code>serviceName = "name"</code>
<b>Description:</b>	The unique name of the service
<b>Type:</b>	String
<b>Optionality:</b>	Mandatory
<b>Allowed:</b>	Any string
<b>Default:</b>	
<b>Example:</b>	<code>serviceName = "DirectDebitService"</code>

`sleeServiceKey`

<b>Syntax:</b>	<code>sleeServiceKey = value</code>
<b>Description:</b>	The Service Key value
<b>Type:</b>	Integer
<b>Optionality:</b>	Optional
<b>Allowed:</b>	The value specified in the SERVICEKEY entry in the <b>SLEE.cfg</b> file. For more information about the SERVICEKEY configuration, see <i>SLEE Technical Guide</i>
<b>Default:</b>	no default
<b>Example:</b>	<code>sleeServiceKey = 1234</code>

`sleeTimeout`

<b>Syntax:</b>	<code>sleeTimeout = seconds</code>
<b>Description:</b>	How long (in seconds) to wait for a response from the SLEE before the session times out
<b>Type:</b>	Integer
<b>Optionality:</b>	Optional (default used if not set)
<b>Allowed:</b>	
<b>Default:</b>	10
<b>Notes:</b>	
<b>Example:</b>	<code>sleeTimeout = 15</code>

`tcc`

<b>Syntax:</b>	<code>tcc = seconds</code>
<b>Description:</b>	The session supervision timer timeout
<b>Type:</b>	Integer
<b>Optionality:</b>	Mandatory
<b>Allowed:</b>	number of seconds
<b>Default:</b>	3600
<b>Notes:</b>	Refer to <i>RFC 4006</i>
<b>Example:</b>	<code>tcc = 3600</code>

`terminateFlag`

<b>Syntax:</b>	<code>terminateFlag = true false</code>
<b>Description:</b>	The terminateFlag value.
<b>Type:</b>	Boolean

**Optionality:** Optional  
**Allowed:** true, false  
**Default:** true  
**Notes:**  
**Example:** `terminateFlag = true`

### unitType

**Syntax:** `unitType = "type"`  
**Description:** The unit type used in the service  
**Type:** String  
**Optionality:** Mandatory, if `SelectionAVPs` is *not* specified.  
**Allowed:**

- "Time"
- "Money"
- "Total-Octets"
- "Input-Octets"
- "Output-Octets"
- "Service-Specific"

**Default:** "Time"  
**Notes:** This parameter must not be specified if `SelectionAVPs` is specified.  
**Example:** `unitType = "Time"`

### validateDestinationNumber

**Syntax:** `validateDestinationNumber = true|false`  
**Description:** This flag controls the validation of destination number in connect signal. This validation happens in DCA.  
**Type:** Boolean  
**Optionality:** Optional (default used if not set).  
**Allowed:** true, false  
**Default:** true  
**Notes:** If this flag is set to false, then there will not be any validation of destination number which is present in the connect signal. This flag is useful in case of call redirection with Diameter protocol.  
**Example:** `validateDestinationNumber = true`

### validityTime

**Syntax:** `validityTime = seconds`  
**Description:** The validity time in seconds of granted units. Results in Validity-Time AVP being placed in CCA.  
**Type:** Integer  
**Optionality:** Optional (default used if not set).  
**Allowed:**  
**Default:** -1 (Not included)  
**Notes:**  
**Example:** `validityTime = 30`



## Service Specific AVP Mappings parameters

The `AVPMappings` configuration in the `Services` section contains the following parameters that are used only in the `Services` section, not in other sections of the DIAMETER configuration.

For AVP parameters used throughout the DIAMETER configuration see *AvpMappings Parameters* (on page 35).

### contextAVP

<b>Syntax:</b>	<code>contextAVP = true false</code>
<b>Description:</b>	Defines whether the <code>avpCode</code> in the specified <code>AVPs</code> array is the context AVP to use in an <i>Array with Context</i> (on page 109)
<b>Type:</b>	Boolean
<b>Optionality:</b>	Optional.
<b>Allowed:</b>	
<b>Default:</b>	
<b>Notes:</b>	<p>When only a single unique AVP is used to establish context, that AVP is typically the key AVP associated with a data record. However DCA also allows more than 1 sub-AVPs in a hierarchy to be marked for inclusion for context. These multiple AVPs which form the context are known as the Context AVP.</p> <p>Context AVPs are typically used when possible key values are not well known, or unique, or the key might otherwise rely on multiple items from the hierarchy.</p>
<b>Example:</b>	<code>contextAVP = true</code>

### dropMismatchedAVP

<b>Syntax:</b>	<code>dropMismatchedAVP = true false</code>
<b>Description:</b>	Defines whether to drop outgoing AVPs those were found mismatched by <code>includeIfMatches</code> / <code>excludeIfMatches</code> .
<b>Type:</b>	Boolean
<b>Optionality:</b>	Optional
<b>Allowed:</b>	true, false
<b>Default:</b>	
<b>Notes:</b>	This configuration is used in conjunction with <code>includeIfMatches</code> / <code>excludeIfMatches</code> and <code>literal</code> configurations only.

**Example:** `dropMismatchedAVP = true`

In the below example, if the value stored in profile tag 9503 is not equal to 2, then the AVP 2000 is dropped from the outgoing message.

```
{
  mappingTypes = ["EventResponse"]
  AvpCodes = [
    {
      avpCode = 2000
    }
  ]
  avpFormat = "Enumerated"
  includeIfMatches = [ 2 ]
  encodedExtension = {
    profileTag = 9503
    profileFormat = "INTEGER"
  }
  dropMismatchedAVP = true
}
```

#### encodedExtension

**Syntax:** `encodedExtension= {profile_parameters}`

**Description:** This identifies the target tag and type in an incoming extension profile block for this AVP, when `extensionFormat = "encoded"`.

**Type:** Parameter list

**Optionality:** Optional

**Allowed:**

**Default:**

**Notes:** If `encodedExtension` is present and `extensionFormat` is absent, `extensionFormat = "encoded"` is assumed. See *extensionFormat* (on page 38) for details.

RAW\_DATA profile mappings also have extra options (`octetsStart` and `octetsLength`) for specifying a part of the AVP (for inbound) or profile field (for outbound) to extract.

**Example:**

```
encodedExtension = {
  profileTag = 99123
  profileFormat = "INTEGER"
  octetsStart = 3
  octetsLength = 0
}
```

#### excludeIfMatches

**Syntax:** `excludeIfMatches = [ avpvalue ]`

**Description:** The value of the AVPs to exclude from the Type Criteria matching.

**Type:** Array

**Optionality:** Optional (default used if not set).

**Allowed:** Integer, string, hex string

**Default:**

**Notes:** This parameter can be used as part of the Base mapping outside AVPs = [ ... ].

If used inside AVPs = [ ... ] it must be used as part of the `typeCriteria` section. See *typeCriteria* (on page 82) for an example.

**Example:** **Example 1**

```
excludeIfMatches = [ 101, 105 ]
```

**Example 2**

```
excludeIfMatches = ["SPAM"]
```

`inapField`

**Syntax:** `inapField = [ field1, field2, ... ]`

**Description:** Identifies the:

- Target INAP field(s) for mapping from this AVP for Inbound Mapping
- Source INAP field(s) for mapping to this AVP for Outbound Mapping

**Type:** String array

**Optionality:** Optional

**Allowed:** The following INAP fields are allowed:

- "additionalCallingpartyId"
- "calledPartyBcdNumber"
- "calledPartyNumber"
- "callingPartyNumber"
- "cause"
- "destinationRoutingAddress"
- "imsi"
- "locationInformation" - see note below
- "locationNumber"
- "maxCallDuration"
- "mscAddress"
- "originalCalledPartyId"
- "redirectingPartyId"
- "timeIfNoTariffSwitch"

**Default:**

**Notes:** If the AVP mappings are to and from INAP Field(s), please do not configure or specify parameters associated with `acsProfile` mapping (that is, `extensionFormat` should not be set to "encoded". `encodedExtension` should be absent).

The location information in the AVP is an encoded field. In ACS the location information is split up, to populate the call context buffers of MCC, MNC, LAC, and Cell ID, for originating and terminating. Refer to the *ACS Buffers* topic in *ACS Feature Nodes User's Guide*.

**Example:** `inapField= ["CalledPartyNumber"]`

`includeIfMatches`

**Syntax:** `includeIfMatches = [ avpvalue ]`

**Description:** The value of the AVPs to include in the Type Criteria matching.

**Type:** Array

**Optionality:** Optional (default used if not set).  
**Allowed:** Integer, string, hex string  
**Default:**  
**Notes:** This parameter can be used as part of the Base mapping outside `AVPs = [ ... ]`.  
 If used inside `AVPs = [ ... ]` it must be used as part of the `typeCriteria` section. See *typeCriteria* (on page 82) for an example.

**Example:** **Example 1**  
`includeIfMatches = [ 1, 10, 101, 1001, 10001 ]`  
**Example 2**  
`includeIfMatches = ["GoodNews!", "PrettyGoodNews"]`

### keyArray

**Syntax:** `keyArray = true|false`  
**Description:** Defines whether the `avpCode` in the specified `AVPs` array is the key to use in a *Key Array* (on page 96).  
**Type:** Boolean  
**Optionality:** Optional  
**Allowed:** true, false  
**Default:**  
**Notes:**  
**Example:** `keyArray = true`

### literal

**Syntax:** `literal = "value"`  
**Description:** Applies the literal value to the AVP when the outbound message matches the types defined for that mapping.  
**Type:** String  
**Optionality:** Optional  
**Default:**  
**Notes:** Outbound AVP only.  
 If a mapping specifies both a literal and an `IncludesIfMatches` conditional AVP, then the literal will override the mapped value if the original value is found in the `IncludesIfMatches` array.  
**Example:** `literal = "1"`

### profileFormat

**Syntax:** `profileFormat = "format"`  
**Description:** The format of the profile.  
**Type:** String  
**Optionality:** Optional  
**Allowed:** The value given for this must be one of the valid storage formats for ACS profile fields. The allowable values for this parameter are:  

- INTEGER
- INTEGER64
- UINTEGER

- UINTEGER64
- LNSTRING
- NSTRING
- STRING
- TIME
- BOOLEAN
- ARRAY
- RAW\_DATA

**Default:** INTEGER

**Notes:** See also the related parameter, `profileTag`.

Part of `encodedExtension`.

If the `avpFormat` parameter is set to "Grouped" for the AVPs array, then `profileFormat` must be "ARRAY"

**Example:** `profileFormat = "LNSTRING"`

#### `profileTag`

**Syntax:** `profileTag = num`

**Description:** The profile tag.

**Type:** Integer

**Optionality:** Optional

**Notes:** This parameter is used to identify the profile tag it will be stored into/retrieved from. See also the related parameter, `profileFormat`.

Part of `encodedExtension`.

**Example:** `profileTag = 999`

#### `mappingTypes`

**Syntax:** `mappingTypes = ["mapping_types"]`

**Description:** Defines the message types between DCA and ACS that the mapping applies to.

**Type:** String Array

**Optionality:** Optional (default used if not set).

**Allowed:** For Inbound:

- "InitialRequest"
- "UpdateRequest"
- "EventRequest"
- "TerminateRequest"

For Outbound:

- "InitialResponse"
- "UpdateResponse"
- "EventResponse"
- "TerminateResponse"
- "FreeCallResponse" – See Notes.

One or more mapping types may be specified.

Note that the Configuration mappingType does not directly correspond to the CC-Request-Type. See *Mapping categories* (on page 80).

- Default:** `mappingTypes = ["InitialRequest", "InitialResponse", "EventRequest", "EventResponse"]`
- Notes:** If the configuration, within the `AVPs` array, for inbound is the same as for outbound, include the inbound and outbound message types in the list.  
Each inbound configuration "Request" `mappingType` has a counterpart outbound "Response" `mappingType` that (when defined) is applied to the outbound Diameter message.  
For example: If an inbound Diameter message has InitialRequest mappings applied, then InitialResponse mappings will be applied to the corresponding outbound Diameter answer. However, if a call is determined to be free, say after screening, or become free mid-session, then any mappings classified as "FreeCallResponse" (for the selected service) will be applied to the outbound Diameter answer instead of the default response mapping type.
- Example:** `mappingTypes = ["InitialRequest", "UpdateRequest", "EventRequest", "TerminateRequest"]`

### Mapping categories

This table describes the relationship between CC-Request-Type and Configuration `mappingTypes` for outbound request type mappings:

Diameter Message	CC-Request-Type	Credit Control	Service	Requested-Service-Unit	Used-Service-Unit	Configuration mappingTypes
CCR	INITIAL_REQ	MSCC	New	New	-	InitialRequest
CCR	INITIAL_REQ	Basic	New	New	-	InitialRequest
CCR	UPDATE_REQ	MSCC	New	New	-	InitialRequest
CCR	UPDATE_REQ	MSCC	Existing	Existing UT	Existing UT	UpdateRequest
CCR	UPDATE_REQ	Basic	Existing	Existing UT	Existing UT	UpdateRequest
CCR	UPDATE_REQ	MSCC	Existing	-	Existing UT	TerminateRequest
CCR	TERM_REQ	MSCC	any	-	-	TerminateRequest
CCR	TERM_REQ	Basic	any	-	-	TerminateRequest
CCR	EVENT_REQ	-	-	-	-	EventRequest

Here are the abbreviations used in the table.

Abbreviation	Description
CCR	Credit-Control-Request
INITIAL_REQ	INITIAL_REQUEST
UPDATE_REQ	UPDATE_REQUEST
TERM_REQ	TERMINATION_REQUEST
EVENT_REQ	EVENT_REQUEST
MSCC	Multiple-Services-Credit-Control
Basic	Basic Credit-Control
Existing UT	Existing Unit Type

`octetsLength`

- Syntax:** `octetsLength = num`
- Description:** The number of octets to extract from the source data.

<b>Type:</b>	Integer
<b>Optionality:</b>	Optional (default used if not set).
<b>Allowed:</b>	
<b>Default:</b>	0 (copy all octets from <code>octetsStart</code> until the end of the field)
<b>Notes:</b>	Part of <code>encodedExtension</code> . Used if <code>profileFormat</code> is <code>RAW_DATA</code> . Used in conjunction with <code>octetsStart</code> .
<b>Example:</b>	See examples in <code>octetsStart</code> .

`octetsStart`

<b>Syntax:</b>	<code>octetsStart = num</code>
<b>Description:</b>	The offset within the source data (AVP or profile field) to start copying from.
<b>Type:</b>	Integer
<b>Optionality:</b>	Optional (default used if not set).
<b>Allowed:</b>	
<b>Default:</b>	0 (start copying from the beginning)
<b>Notes:</b>	Negative values can be used to specify an offset from the end of the data. Part of <code>encodedExtension</code> . Used if <code>profileFormat</code> is <code>RAW_DATA</code> . Used in conjunction with <code>octetsLength</code> .
<b>Example:</b>	Example 1: Copy all data except for the first 3 octets. <code>octetsStart = 3</code> <code>octetsLength = 0</code> Example 2: Copy the third-to-last and second-to-last octets. <code>octetsStart = -3</code> <code>octetsLength = 2</code>

`repeating`

<b>Syntax:</b>	<code>repeating = true false</code>
<b>Description:</b>	Specifies whether the <code>avpCode</code> is repeating, that is the Diameter message contains an array-like structure where the <code>avpCode</code> is used more than once.
<b>Type:</b>	Boolean
<b>Optionality:</b>	Optional (default used if not set).
<b>Allowed:</b>	true, false
<b>Default:</b>	false
<b>Notes:</b>	For inbound mappings, the destination will need to be an Array, or Prefix Tree type profile tag, in order to handle the complex structure. Outbound mappings need to come from an Array or Prefix Tree.
<b>Example:</b>	<code>repeating = true</code>

`timestamp`

<b>Syntax:</b>	<code>timestamp = "timestamp"</code>
<b>Description:</b>	The timestamp to record
<b>Type:</b>	String
<b>Optionality:</b>	Optional

<b>Allowed:</b>	The available timestamps are: <ul style="list-style-type: none"><li>• "TIME_REQUEST_RECEIVED32"</li><li>• "TIME_REQUEST_RECEIVED64"</li><li>• "TIME_NOW32"</li><li>• "TIME_NOW64"</li></ul>
<b>Default:</b>	
<b>Notes:</b>	'NOW' refers to the time the mapping is processed. For an outbound mapping, it will be as the reply is being created, hopefully immediately before it is sent. 'REQUEST_RECEIVED' is the time the request [that we are processing] entered the Diameter stack. See <i>Timestamp</i> (on page 125) for example usage.
<b>Example:</b>	<code>timestamp = "TIME_REQUEST_RECEIVED32"</code>

### typeCriteria

<b>Syntax:</b>	<code>typeCriteria = [criteria]</code>
<b>Description:</b>	Lists the criteria to match on, then specifies the AVP that is searched and, if a match is found, mapped to a profile tag.
<b>Type:</b>	Parameter section
<b>Optionality:</b>	Optional (default used if not set).
<b>Allowed:</b>	
<b>Default:</b>	
<b>Notes:</b>	



**Example:** In this example, if the value of AVP of 1000.2000.3000 is 1, then map the value of each of the AVPs 1000.2000.3001 to array element as tag 100 in the sub-profile block, as a string.

Note, the parent AvpCodes 1000.2000 are not shown in this example configuration fragment.

```
typeCriteria = [
  {
    includeIfMatches = [ 1 ]
    AvpCodes = [
      { avpCode = 3000
      }
    ]
    avpFormat = "Integer32"
    # What is included if match found
    AVPs = [
      {
        AvpCodes = [
          { avpCode = 3001
            repeating = true
          }
        ]
        avpFormat = "UTF8String"
        encodedExtension = {
          profileTag = 100
          profileFormat = "STRING"
        }
      }
    ]
  }
]
```

See the example mapping for this configuration in *Mapping* (on page 102).

See more examples in:

- *Array with Conditions* (on page 99)
- *Conditional AVP* (on page 115)

## PeerSchemes Configuration Section

### PeerSchemes configuration structure

Here is a high level structure of the configuration of a scheme in the `PeerSchemes` section.

```
PeerSchemes = [
{
  schemeName = "SchemeA"

  Peers = [
  {
    name = "host1"
    protocol = "both"
    sctpBindAddress = "192.168.1.10"
    permittedOriginHosts = [
      "host1.realm1.oracle.com"
    ]
  }
]
```

```

    RemoteAddresses = [
        "192.168.1.10"
    ]

    netmaskBits = 32

    netmask6Bits = 128

    permittedInstances = 0

    reqSctpInboundStreams = 8
    reqSctpOutboundStreams = 8
} # end of Peer host1

{
    peer_host2_parameters
} # end of Peer host2

]

} # End of Scheme A

{
    schemeName = "SchemeB"

    SchemeB_parameters

} # End of Scheme B

] # End of PeerSchemes section

```

**Note:** Default settings are specified at installation time.

## PeerSchemes parameters

The following parameter is used in the `PeerSchemes` array.

schemeName

<b>Syntax:</b>	schemeName = "name"
<b>Description:</b>	The name identifying the scheme.
<b>Type:</b>	String
<b>Optionality:</b>	Mandatory
<b>Example:</b>	schemeName = "SchemeA"

## Peer host parameters

The following parameters are used for a peer host. They are members of the `Peers` array.

You can be set up as many peer hosts as required. A scheme can have no peers, in which case will accept all connections.

name

<b>Syntax:</b>	name = "name"
<b>Description:</b>	The name identifying either peer, or group of peers.
<b>Type:</b>	String
<b>Optionality:</b>	Mandatory
<b>Example:</b>	name = "host1"

`netmaskBits`

<b>Syntax:</b>	<code>netmaskBits = bits</code>
<b>Description:</b>	The number of bits for netmask.
<b>Type:</b>	Integer
<b>Optionality:</b>	Mandatory
<b>Default:</b>	32 (bits for netmask, that is, a single machine (/32))
<b>Example:</b>	<code>netmaskBits = 32</code>

`netmask6Bits`

<b>Syntax:</b>	<code>netmask6Bits = bits</code>
<b>Description:</b>	The number of bits for the IP version 6 prefix
<b>Type:</b>	Integer
<b>Optionality:</b>	Mandatory
<b>Default:</b>	128 (bits for the address prefix, that is, a single machine (/128))
<b>Example:</b>	<code>netmask6Bits = 128</code>

`permittedInstances`

<b>Syntax:</b>	<code>permittedInstances = num</code>
<b>Description:</b>	The number of permitted instances.
<b>Type:</b>	Integer
<b>Optionality:</b>	Mandatory
<b>Notes:</b>	If set to 0 then allow all.
<b>Example:</b>	<code>permittedInstances = 0</code>

`permittedOriginHosts`

<b>Syntax:</b>	<code>permittedOriginHosts = "host"</code>
<b>Description:</b>	The list of peer names which will be checked against the OriginHost AVP, during the capabilities exchange.
<b>Type:</b>	String
<b>Optionality:</b>	Mandatory
<b>Example value:</b>	<code>permittedOriginHosts = "host1.realm1.oracle.com"</code>

`protocol`

<b>Syntax:</b>	<code>protocol = "protocol"</code>
<b>Description:</b>	The protocol for this host peer.
<b>Type:</b>	String
<b>Optionality:</b>	Optional
<b>Allowed:</b>	<ul style="list-style-type: none"> <li>• "sctp"</li> <li>• "tcp"</li> <li>• "both"</li> </ul>
<b>Default:</b>	If not specified, then it uses the protocol from the <i>DiameterServer</i> section. (on page 55)
<b>Example:</b>	<code>protocol = "tcp"</code>

### RemoteAddresses

**Syntax:** `remoteAddresses = ["ipaddress"]`  
**Description:** The list of remote IP addresses.  
**Type:** Array of string parameters  
**Optionality:** Mandatory  
**Notes:** If an address becomes unavailable the list will be cycled through.  
**Example:**  
`remoteAddresses = [  
 "192.168.1.10"  
]`

### reqSctpInboundStreams

**Syntax:** `reqSctpInboundStreams = num`  
**Description:** The number of requested inbound sctp streams.  
**Type:** Integer  
**Optionality:** Mandatory  
**Notes:** There is no guarantee you will actually get these.  
**Example:** `reqSctpInboundStreams = 8`

### reqSctpOutboundStreams

**Syntax:** `reqSctpOutboundStreams = num`  
**Description:** The number of requested outbound sctp streams.  
**Type:** Integer  
**Optionality:** Mandatory  
**Notes:** There is no guarantee you will actually get these.  
**Example:** `reqSctpOutboundStreams = 8`

### sctpBindAddress

**Syntax:** `sctpBindAddress = "addr"`  
**Description:** The sctp address for this peer host.  
**Type:** String  
**Optionality:** Optional  
**Notes:** If not specified, `sctpBindAddress` from the `DiameterServer` section is used.  
**Example:** `sctpBindAddress = "192.168.1.10"`

## Example PeerSchemes section

Here is an example `PeerSchemes` section of the DIAMETER configuration in the `eserv.config` file.

```
PeerSchemes = [  
  {  
    schemeName = "SchemeA"  
  
    Peers = [  
      {  
        name = "host1"  
  
        protocol = "both"  
  
        permittedOriginHosts = [  

```

```

        "host1.realm1.oracle.com"
    ]

    RemoteAddresses = [
        "192.168.1.10"
    ]

    netmaskBits = 32

    netmask6Bits = 128

    permittedInstances = 0

    reqSctpInboundStreams = 8
    reqSctpOutboundStreams = 8
} # end of Peer host1

{
    name = "host2"

    protocol = "sctp"

    permittedOriginHosts = [
        "host1.realm1.oracle.com"
    ]

    RemoteAddresses = [
        "192.168.1.11"
    ]

    netmaskBits = 32

    netmask6Bits = 128

    permittedInstances = 0

    reqSctpInboundStreams = 8
    reqSctpOutboundStreams = 8
} # end of Peer host2
} # End of Scheme A

{
    schemeName = "SchemeB"

    Peers = [
    {
        name = "host1"

        protocol = "both"

        permittedOriginHosts = [
            "host1.realm1.oracle.com"
        ]

        RemoteAddresses = [
            "192.168.1.10"
        ]

        netmaskBits = 32

        netmask6Bits = 128

        permittedInstances = 0
    }
    ]
}

```

```

        reqSctpInboundStreams = 8
        reqSctpOutboundStreams = 8
    } # end of Peer host1

]
} # End of Scheme B
] # End of PeerSchemes section

```

## Statistics Logged by diameterControlAgent

### Introduction

Diameter statistics are generated by each SLC, and then transferred at periodic intervals to the Service Management System (SMS) for permanent storage and analysis.

An existing statistics system (smsStats) provides functions for the collection of basic statistical events. This is provided in the Convergent Charging Controller SMS application. Refer to *SMS Technical Guide* for details.

### DCA statistics

SMS statistics are logged with APPLICATION\_ID = 'DCA' (application number 96)

The following statistics are defined:

- DUPLICATES\_DETECTED
- INITIAL\_REQUESTS\_RECEIVED
- INITIAL\_REQUESTS\_ANSWERED
- UPDATE\_REQUESTS\_RECEIVED
- UPDATE\_REQUESTS\_REJECTED\_ANSWERED
- TERMINATION\_REQUESTS\_RECEIVED
- TERMINATION\_REQUESTS\_ANSWERED
- DIRECT\_DEBITS\_RECEIVED
- DIRECT\_DEBITS\_ANSWERED
- ACCOUNT\_REFUNDS\_RECEIVED
- ACCOUNT\_REFUNDS\_ANSWERED
- BALANCE\_CHECKS\_RECEIVED
- BALANCE\_CHECKS\_ANSWERED
- PRICE\_ENQUIRIES\_RECEIVED
- PRICE\_ENQUIRIES\_ANSWERED
- UNSUPPORTED\_MESSAGES
- SESSIONS\_TIMED\_OUT
- GENERIC\_ACTION\_RECEIVED (Tracks requests for non-standard triggering)
- GENERIC\_ACTION\_ANSWERED (Tracks answers for non-standard triggering)
- RAR\_UNABLE\_TO\_BE\_DELIVERED (RAR cannot deliver RAR to the Diameter client)
- RAR\_ERRORS\_RECEIVED (RAR received error response to RAR)
- RAR\_TIMEOUT (RAR has timed out)
- RAR\_SENT (RAR sent from DCA)
- RAR\_ANSWERS\_RECEIVED (RAA received in response to RAR)
- RAR\_UNABLE\_TO\_COMPLY\_RECIEVED (RAA received with UNABLE\_TO\_COMPLY)

- RAR\_LIMITED\_SUCCESS\_RECEIVED (RAA received with LIMITED\_SUCCESS)
- RAR\_UNSOLICITED\_ANSWER (Unexpected RAA received)
- RAA\_EXCEPTION (RAA exception handling)
- RAA\_UNKNOWN\_SESSION\_ID (RAA received with unknown session ID)

For all statistics, the Origin-Realm AVP from the message received is put into SMF\_STATISTICS.DETAIL.

## Reports

The following reports are available:

- DCA System Stats
- DCA System Stats by Realm

Reports are generated using the SMS Report Functions screen. Refer to the *SMS User's Guide* for details.

## Example report

Here is an example DCA System Stats by Realm report.

```
DCA Statistics Listing by Realm
=====
Start Date: 16 August 2007
Finish Date: 18 August 2007
Report Type: All Entries
Realm: realm2.oracle.com
```

28 August 2007, 22:50:56

Node Name	Statistics ID	Date	Value
mtv-tst-scp10	DUPLICATES_DETECTED	17 August 07 00:52	1
mtv-tst-scp10	DUPLICATES_DETECTED	17 August 07 00:54	1
mtv-tst-scp10	INITIAL_REQUESTS_ANSWERED	16 August 07 00:02	1
mtv-tst-scp10	INITIAL_REQUESTS_ANSWERED	16 August 07 03:04	1
mtv-tst-scp10	INITIAL_REQUESTS_ANSWERED	16 August 07 22:34	1
mtv-tst-scp10	INITIAL_REQUESTS_ANSWERED	7 August 07 00:52	2
mtv-tst-scp10	INITIAL_REQUESTS_ANSWERED	17 August 07 00:54	2
mtv-tst-scp10	INITIAL_REQUESTS_ANSWERED	17 August 07 01:00	1
mtv-tst-scp10	INITIAL_REQUESTS_RECEIVED	16 August 07 00:02	1
mtv-tst-scp10	INITIAL_REQUESTS_RECEIVED	16 August 07 03:04	1
mtv-tst-scp10	INITIAL_REQUESTS_RECEIVED	16 August 07 22:34	1
mtv-tst-scp10	INITIAL_REQUESTS_RECEIVED	17 August 07 00:52	2
mtv-tst-scp10	INITIAL_REQUESTS_RECEIVED	17 August 07 00:54	2
mtv-tst-scp10	INITIAL_REQUESTS_RECEIVED	17 August 07 01:00	1
mtv-tst-scp10	SESSIONS_TIMED_OUT	17 August 07 00:54	1
mtv-tst-scp10	UPDATE_REQUESTS_ANSWERED	16 August 07 00:02	1
mtv-tst-scp10	UPDATE_REQUESTS_ANSWERED	16 August 07 03:04	1
mtv-tst-scp10	UPDATE_REQUESTS_ANSWERED	16 August 07 22:34	1
mtv-tst-scp10	UPDATE_REQUESTS_ANSWERED	17 August 07 00:52	2
mtv-tst-scp10	UPDATE_REQUESTS_ANSWERED	17 August 07 00:54	2
mtv-tst-scp10	UPDATE_REQUESTS_ANSWERED	17 August 07 01:00	1
mtv-tst-scp10	UPDATE_REQUESTS_RECEIVED	16 August 07 00:02	1
mtv-tst-scp10	UPDATE_REQUESTS_RECEIVED	16 August 07 03:04	1
mtv-tst-scp10	UPDATE_REQUESTS_RECEIVED	16 August 07 22:34	1
mtv-tst-scp10	UPDATE_REQUESTS_RECEIVED	17 August 07 00:52	2
mtv-tst-scp10	UPDATE_REQUESTS_RECEIVED	17 August 07 00:54	2
mtv-tst-scp10	UPDATE_REQUESTS_RECEIVED	17 August 07 01:00	1

Completed





# Service Specific AVP Mappings

## Overview

### Introduction

This chapter explains the structure of the AVP mappings for a service.

### In this chapter

---

This chapter contains the following topics.

Introduction .....	91
Basic Array .....	93
Key Array .....	96
Array with Conditions .....	99
Array with Context .....	109
Conditional AVP .....	115
Prefix Tree .....	123
Timestamp .....	125
RAR Example .....	126

## Introduction

### Introduction

The AVP mappings within the `Services` parameter section are organized as shown in *Services configuration structure* (on page 66).

There are two types of configuration formats available:

- 'classic' format:
  - Base
- 'nested' format. These are configured within an array of format `AVPs = [ ]`
  - *Basic Array* (on page 93)
  - *Key Array* (on page 96)
  - *Array with Conditions* (on page 99)
  - *Array with Context* (on page 109)
  - *Conditional AVP* (on page 115)
  - *Prefix Tree* (on page 123)
  - *Timestamp* (on page 125)

**Note:** If you use classic format, you cannot use nested format in the `eserv.config` file.

### Base example

Here is an example of the base AVP mappings in the `Services AVPMappings` section.

General Example 1 – Classic Format. Specify AVP code(s) for this AVP. There MUST be one specified for the base AVP, plus list all extras for grouped AVPs.

```

{
  AvpCodes = [
  {
    avpCode = 1234
    mandatory = true|false
    vendorId = "VendorID"
  }
  ]
  # The AVP data format.
  avpFormat =
  "OctetString|Integer32|Integer64|UInteger32|UInteger64|Unsigned32|Unsigned64|
  Address|Time|UTF8String|DiameterIdentity|DiameterURI|Enumerated|"
  extensionType = 1234
  extensionFormat = "inapnumber|asn1integer|octets|encoded"

  encodedExtension= {
    profileTag = 99123
    profileFormat = "INTEGER | INTEGER64 | UINTEGER | UINTEGER64 | LNSTRING |
    NSTRING | STRING | TIME | BOOLEAN | RAW_DATA"
    octetsStart = 3
    octetsLength = 0
  }
  inapField = [ field1, field2, ... ]
}

```

## Simple conditional

Here is an example using `includeIfMatches` within `Services AvpMappings` section, that is, outside an AVPs array in a *typeCriteria* (on page 82) array.

```

{
  AvpCodes = [
    {
      avpCode = 4700
    }
    {
      avpCode = 2000
    }
  ]
  avpFormat = "UTF8String"
  includeIfMatches = [ "Good News!", "Pretty Good News!", "Over the moon!" ]
  encodedExtension = {
    profileTag = 94701
    profileFormat = "STRING"
  }
}

```

## Nested format

Nested formats are generally used to define arrays and conditional AVPs. Definitions are nested in the array formatted `AVPs = []` and mirror the hierarchy of a Grouped AVP.

As groups can contain sub-groups, defined "AVPs" can contain sub-"AVPs".

### Example nested format

The following example shows an AVP nested up to four levels deep:

- A root-level AVPs with one entry
- A first-level AVPs with one entry
- A second-level AVPs with two entries
- A third-level AVPs with two entries, which are part of the first entry of the second level AVPs.

Here is the configuration structure in the `DIAMETER Services AvpMappings` array of the example `eserv.config`.

```
AVPs = [ # Root-Level AVPs
  { # 1st Entry of Root-Level AVPs
    AvpCodes = [ ... ]
    AVPs = [ # 1st-Level AVPs
      { # 1st Entry of 1st-Level AVPs
        AvpCodes = [ ... ]
        AVPs = [ # 2nd-Level AVPs
          { # 1st Entry of 2nd-Level AVPs
            AvpCodes = [ ... ]
            AVPs = [ # 3rd-Level AVPs
              { # 1st Entry of 3rd-Level AVPs
                AvpCodes = [ ... ]
                avpFormat = "...
                encodedExtension = {
                  profileTag = 80301
                  profileFormat = "...
                }
              }
              { # 2nd Entry of 3rd-Level AVPs
                AvpCodes = [ ... ]
                avpFormat = "...
                encodedExtension = {
                  profileTag = 80303
                  profileFormat = "...
                }
              } # End of 2nd Entry of 3rd-Level AVPs
            ] # End of 3rd-Level AVPs
          } # End of 1st Entry of 2nd-Level AVPs
        { # 2nd Entry of 2nd-Level AVPs (optional; specify if applicable)
          AvpCodes = [ ... ]
          avpFormat = "...
          encodedExtension = {
            profileTag = 80302
            profileFormat = "...
          }
        } # End of 2nd Entry of 2nd-Level AVPs
      ] # End of 2nd-Level AVPs
    } # End of 1st Entry of 1st-Level AVPs
  ] # End of 1st-Level AVPs
} # End of 1st Entry of Root-Level AVPs
] # End of Root-Level AVPs
avpFormat = "Grouped"
encodedExtension = {
  profileTag = 8234
  profileFormat = "ARRAY"
}
```

## Basic Array

### Introduction

Basic Arrays are also known as "simple repeating AVPs". In the simplest case, the repeating AVP is the one which requires mapping to an array in a profile block. DCA will need to establish multiple instances of the same AVP. However you only need define a single Basic Array type mapping definition. The mapping definition needs to establish:

- That the target (or source) profile field is an array

- The format of the elements in the target array (for example, STRING)
- The format of the AVP (such as UTF8String)
- That the AVP code is repeating, that is, `repeating = true`. For a definition, see *repeating* (on page 81).

Note that in this case (unlike Paired-AVPs or Array with Conditions), there is no key or sub-AVPs to consider.

## Basic Array configuration

Here is the example basic array configuration in the Services AVPMappings section of the `eserv.config`. In this example, the basic array contains a list of string-type (that is, `profileFormat = "STRING"`) elements.

```
{
  AVPs = [ # Root-Level AVPs
    { # 1st Entry in Root-Level AVPs
      AvpCodes = [
        {
          avpCode = 6000
        }
      ]
      AVPs = [ # 1st Level AVPs
        {
          AvpCodes = [
            {
              avpCode = 1000
            }
          ]
          AVPs = [ # 2nd Level AVPs
            {
              AvpCodes = [
                {
                  avpCode = 2000
                  repeating = true
                }
              ]
              avpFormat = "UTF8String"
              encodedExtension = {
                profileTag = 9998
                profileFormat = "STRING"
              }
            }
          ] # End of 2nd Level AVPs
        }
      ] # End of 1st Level AVPs
    } # End of 1st Entry in Root-Level AVPs
  ] # End of Root-Level AVPs

  # Specify mapping applies INBOUND only.
  mappingTypes = ["InitialRequest", "UpdateRequest", "EventRequest",
    "TerminateRequest"]

  avpFormat = "Grouped"
  encodedExtension = {
    profileTag = 8000
    profileFormat = "ARRAY"
  }
}
```

**Note:** The parameter setting of `avpFormat = "Grouped"` can only be used in this place in the config file, that is, *outside* an `"AVPs = [...]"` array. Also an `"AVPs = [...]"` array must be defined because "Grouped" makes all the AVPs defined inside the `"AVPs = [...]"` array as belonging to the one group. Because of this it makes no sense to put `avpFormat = "Grouped"` anywhere else except here.

## Example Basic Array configuration

Here is a worked example of a basic array: inbound configuration.

```
{
  AVPs = [
    {
      AvpCodes = [
        { avpCode = 1000 }
      ]
      AVPs = [
        {
          AvpCodes = [
            { avpCode = 2000 # <-- 1000.2000
              repeating = true # <-- 2000 is repeating
            }
          ]
          avpFormat = "UTF8String"
          encodedExtension {
            profileTag = 9998 # Array element in sub-profile block
            profileFormat = "STRING"
          }
        }
      ]
    }
  ]

  # Specify mapping applies INBOUND only.
  mappingTypes = ["InitialRequest", "UpdateRequest", "EventRequest",
    "TerminateRequest"]

  # AVPs above are encoded into an ARRAY-type in an ACS Profile Block.
  encodedExtension = {
    profileTag = 8000
    profileFormat = "ARRAY"
  }
}
```

The configuration for basic arrays: outbound is identical to above, except the mapping types are:

```
# Specify mapping applies OUTBOUND only.
mappingTypes = ["InitialResponse", "UpdateResponse", "EventResponse",
  "TerminateResponse"]
```

## Mapping

This table shows the mapping of Diameter AVPs to ACS profile blocks resulting from the worked example basic arrays configuration section above. This example is for inbound.

Diameter AVP			Profile Block			
Root AVP	1st Level	Value	Profile (ARRAY)	Sub-Profile Block	Tag	Value
1000	2000	"049772056"	8000	1	9998	"049772056"
	2000	"6449016000"		2	9998	"6449016000"
	2000	"0800500600"		3	9998	"0800500600"

The mapping is a simple 1:1 mapping. For outbound, the mappings are the same, but in the reverse direction.

## Key Array

### Introduction

A key array is a set of records where one of the elements within each record can be identified as a key for accessing the record, using the parameter setting `keyAVP = true`.

### Key Arrays configuration

Here is the example Key Array configuration in the `Services AVPMappings` section of the `eserv.config`. In this example, elements of the key array contain:

- an integer type Key AVP (`avpCodes = 3000`)
- three Data AVPs.

```
{
  AVPs = [ # Root-Level AVPs
    { # 1st Entry in Root-Level AVPs
      AvpCodes = [
        {
          avpCode = 6100
        }
      ]
    }
  ]
  AVPs = [ # 1st-Level AVPs
    { # 1st Entry in 1st-Level AVPs
      AvpCodes = [
        {
          avpCode = 1000
        }
      ]
    }
  ]
  AVPs = [ # 2nd-Level AVPs
    { # 1st Entry of 2nd-Level AVPs
      AvpCodes = [
        {
          avpCode = 2000
          repeating = true
        }
      ]
    }
  ]
  AVPs = [ # 3rd-Level AVPs (Final Level)
    { # Mapping for Key AVP
      AvpCodes = [
        {
          avpCode = 3000
        }
      ]
      keyAVP = true
      avpFormat = "Integer32"
      encodedExtension = {
        profileTag = 100
        profileFormat = "INTEGER"
      }
    } # End of Mapping for Key AVP
    { # Mapping for 1st Data AVP
      AvpCodes = [
        {
          avpCode = 3001
        }
      ]
    }
  ]
}
```

```

    ]
    avpFormat = "UTF8String"
    encodedExtension = {
        profileTag = 101
        profileFormat = "STRING"
    }
} # End of Mapping for 1st Data AVP
{ # Mapping for 2nd Data AVP
    AvpCodes = [
        {
            avpCode = 3002
        }
    ]
    avpFormat = "UTF8String"
    encodedExtension = {
        profileTag = 102
        profileFormat = "STRING"
    }
} # End of Mapping for 2nd Data AVP
{ # Mapping for 3rd Data AVP
    AvpCodes = [
        {
            avpCode = 3003
        }
    ]
    avpFormat = "UTF8String"
    encodedExtension = {
        profileTag = 103
        profileFormat = "STRING"
    }
} # End of Mapping for 3rd Data AVP
] # End of 3rd-Level AVPs
} # End of 1st entry of 2nd-Level AVPs
] # End of 2nd Level AVPs
} # End of 1st Entry in 1st-Level AVPs
] # End of 1st-Level AVPs
} # End of 1st Entry in Root-Level AVPs
] # End of Root-Level AVPs Mappings

# Specify mapping applies INBOUND only.
mappingTypes = ["InitialRequest", "UpdateRequest", "EventRequest",
"TerminateRequest"]

avpFormat = "Grouped"
encodedExtension = {
    profileTag = 8001
    profileFormat = "ARRAY"
}
}

```

## Example Key Arrays configuration

Here is a worked example of Key Arrays: Inbound configuration.

```

{
    AVPs = [
        {
            AvpCodes = [
                { avpCode = 1000 }
            ]
            AVPs = [
                {
                    AvpCodes = [

```

```

        { avpCode = 4400          # <-- 1000.4400
          repeating = true       # <-- 4400 is repeating
        }
      ]
    AVPs = [
      {
        AvpCodes = [
          { avpCode = 4410      # <-- 1000.4400.4410
          }
        ]
        keyAVP = true          # <-- 4410 is the key,
        others below are data AVPs.
        avpFormat = "Integer32"
        encodedExtension {
          profileTag = 9998    # Array element in sub-profile
                              block
          profileFormat = "INTEGER"
        }
      }
      {
        AvpCodes = [
          { avpCode = 4420      # <-- 1000.4400.4420
          }
        ]
        avpFormat = "UTF8String"
        encodedExtension {
          profileTag = 9999    # Array element in sub-profile
                              block
          profileFormat = "STRING"
        }
      }
      {
        AvpCodes = [
          { avpCode = 4410      # <-- 1000.4400.4430
          }
        ]
        avpFormat = "UTF8String"
        encodedExtension {
          profileTag = 10000   # Array element in sub-profile
                              block
          profileFormat = "STRING"
        }
      }
    ]
  }
]

# Specify mapping applies INBOUND only.
mappingTypes = ["InitialRequest", "UpdateRequest", "EventRequest",
"TerminateRequest"]

encodedExtension = {
  profileTag = 8000
  profileFormat = "ARRAY"
}
}

```

The configuration for Key Arrays: Outbound is identical to above, except the mapping types are:

```

# Specify mapping applies OUTBOUND only.
mappingTypes = ["InitialResponse", "UpdateResponse", "EventResponse",
"TerminateResponse"]

```



## Mapping

This table shows the mapping of Diameter AVPs to ACS profile blocks resulting from the worked example key array configuration section above. This example is for inbound.

Diameter AVP				Profile Block			
Root AVP	1 <sup>st</sup> Level	2 <sup>nd</sup> Level	Value	Profile Block (ARRAY)	Sub-Profile Block	Tag	Value
1000	4400	4410	220	8000	1	9998	220
		4420	"6449016000"			9999	"6449016000"
		4430	"Chris"			10000	"Chris"
	4400	4410	221		2	9998	221
		4420	"123123123"			9999	"123123123"
		4430	"Fred"			10000	"Fred"

The mapping is a simple 1:1 mapping. For outbound, the mappings are the same, but in the reverse direction.

## Array with Conditions

### Introduction

In the case where the AVP to be mapped is the child of a repeating AVP, or where there are multiple mappings, to be made for different child AVPs, you may apply Array With Conditions mapping.

Array with conditions is a means of performing selective mapping based on the values of other AVPs, that is, not all AVPs are mapped, as DCA only considers or allows specific AVPs to be mapped if and only if a specified criterion is met.

Depending on the mapping type (inbound or outbound), the criteria involves matching the value of an AVP or an acsProfile against a list of known values.

### Array with Conditions configuration

Here is the example Array with Conditions configuration in the Services AVPMappings section of the `eserv.config`.

```
{ # Array with Conditions Example
  AVPs = [ # Root-Level AVPs
    {
      AvpCodes = [ # 1st Entry in Root-Level AVPs
        {
          avpCode = 7020
        }
      ]
    }
  ]
  AVPs = [ # 1st-Level AVPs
    { # 1st Entry in 1st-Level AVPs
      AvpCodes = [
        {
          avpCode = 1000
          repeating = true
        }
      ]
    }
  ]
  AVPs = [ # 2nd-Level AVPs
    { # 1st Entry in 2nd-Level AVPs
      AvpCodes = [
        {
          avpCode = 2000
        }
      ]
    }
  ]
}
```

```

        repeating = true
    }
}
TypeCriteria = [
{ # 1st Type Criterion
  includeIfMatches = [ 1, 11, 101 ]
  AvpCodes = [
    {
      avpCode = 3000
    }
  ]
  avpFormat = "Integer32"
  encodedExtension = {
    profileTag = 80100
    profileFormat = "INTEGER"
  }

  # AVPs below will be included if a match is found
  for 1st Type Criterion
  AVPs = [ # Conditional AVPs for 1st Type
  Criterion
    {
      AvpCodes = [
        {
          avpCode = 3001
          repeating = true
        }
      ]
      avpFormat = "UTF8String"
      encodedExtension = {
        profileTag = 80101
        profileFormat = "STRING"
      }
    } # End of Conditional AVPs for 1st Type
  Criterion
  ]
} # End of 1st Type Criterion
{ # 2nd Type Criterion
  includeIfMatches = [ 2, 22, 202 ]
  AvpCodes = [
    {
      avpCode = 3000
    }
  ]
  avpFormat = "Integer32"
  encodedExtension = {
    profileTag = 80100
    profileFormat = "INTEGER"
  }

  # AVPs below will be included if a match is found
  for 2nd Type Criteria
  AVPs = [ # Conditional AVPs for 2nd Type Criterion
    {
      AvpCodes = [
        {
          avpCode = 3001
          repeating = true
        }
      ]
      avpFormat = "UTF8String"
      encodedExtension = {
        profileTag = 80101
        profileFormat = "STRING"
      }
    }
  ]
}

```

```

    }
  }
  ] # End of Conditional AVPs for 2nd Type Criterion
} # End of 2nd Type Criterion
] # End of TypeCriteria
} # End of 1st Entry of 2nd-Level AVPs
] # End of 2nd-Level AVPs
} # End of 1st Entry of 1st-Level AVPs
] # End of 1st-Level AVPs
} # End of 1st Entry of Root-Level AVPs
] # End of Root-Level AVPs

# Specify mapping applies INBOUND only.
mappingTypes = ["InitialRequest", "UpdateRequest", "EventRequest",
"TerminateRequest"]

avpFormat = "Grouped"
encodedExtension = {
  profileTag = 8020
  profileFormat = "ARRAY"
}
}

```

## Array with Conditions - inbound - example 1

Here is a worked example of an array with conditions: inbound configuration.

Map only matching entry, not condition (AVP(3000)==1) inbound

```

{
  AVPs = [
    {
      AvpCodes = [
        { avpCode = 1000 }
      ]
      AVPs = [
        {
          AvpCodes = [
            { avpCode = 2000          # <-- 1000.2000
              repeating = true        # <--      2000 is repeating
            }
          ]
          TypeCriteria = [
            {
              includeIfMatches = [ 1 ]
              AvpCodes = [
                { avpCode = 3000      # <-- 1000.2000.3000 Inbound
                  Only
                }
              ]
              avpFormat = "Integer32" # <-- Inbound Only

              # This is what is included if match found
              AVPs = [
                {
                  AvpCodes = [
                    { avpCode = 3001  # <-- 1000.2000.3001
                      repeating = true # <--      3001 is
repeating
                    }
                  ]
                  avpFormat = "UTF8String"
                  encodedExtension = {

```

```

        profileTag = 100    # Array element in sub-
        profile      block
        profileFormat = "STRING"
    }
}
]
}
]
}
]
# Specify mapping applies INBOUND only.
mappingTypes = ["InitialRequest", "UpdateRequest", "EventRequest",
               "TerminateRequest"]

encodedExtension = {
    profileTag = 8020
    profileFormat = "ARRAY"
}
}
```

## Mapping

This table shows the mapping of Diameter AVPs to ACS profile blocks resulting from the worked example array with conditions configuration section above. This example is for inbound. For outbound the arrows are reversed.

Diameter AVP				Profile Block				
Root AVP	1 <sup>st</sup> Level	2 <sup>nd</sup> Level	Value	Profile Block (ARRAY)	Sub-Profile Block	Tag	Value	
1000	2000	3000	1	8000	1	100	"6449016000"	
		3001	"6449016000"		2	100	"6449016001"	
		3001	"6449016001"		3	100	"666666666"	
	2000	3000	2					
		3001	"123123123"					
		3001	"6449016000"					
		3001	"6449016001"					
		3001	"6449016002"					
		3001	"6449016003"					
	2000	3000	1					
		3001	"666666666"					

## Array with Conditions - Inbound - example 2

Here is an example of the array with conditions configuration in the `Services AVPMappings` section.

Map both matching entry and condition.

```
{
  AVPs = [
    {
      AvpCodes = [
        { avpCode = 1000 }
      ]
      AVPs = [
        {
          AvpCodes = [
            { avpCode = 2000 # <-- 1000.2000
              repeating = true # <-- 2000 is repeating
            }
          ]
        }
      ]
    }
  ]
}
```

```

    }
  ]
  TypeCriteria = [
    {
      includeIfMatches = [ 1 ]
      AvpCodes = [
        { avpCode = 3000      # <-- 1000.2000.3000 Inbound
          Only
        }
      ]
      avpFormat = "Integer32"  # <-- Inbound Only

      # This is what is included if match found
      AVPs = [
        {
          AvpCodes = [
            { avpCode = 3000  # <-- 1000.2000.3000
              }
            ]
          avpFormat = "Integer32"
          encodedExtension = {
            profileTag = 99  # Array element in sub-
profile block
            profileFormat = "INTEGER"
          }
        }
        {
          AvpCodes = [
            { avpCode = 3001  # <-- 1000.2000.3001
              repeating = true # <--          3001 is
repeating
            }
            ]
          avpFormat = "UTF8String"
          encodedExtension = {
            profileTag = 100  # Array element in sub-
profile block
            profileFormat = "STRING"
          }
        }
      ]
    }
  ]
}

]
}

]
}

]
}

# Specify mapping applies INBOUND only.
mappingTypes = ["InitialRequest", "UpdateRequest", "EventRequest",
"TerminateRequest"]

encodedExtension = {
  profileTag = 8020
  profileFormat = "ARRAY"
}
}

```

## Mapping

This table shows the mapping of Diameter AVPs to ACS Profile Blocks resulting from the worked example array with conditions configuration section above. This example is for inbound.

Diameter AVP				Profile Block			
Root AVP	1 <sup>st</sup> Level	2 <sup>nd</sup> Level	Value	Profile Block (ARRAY)	Sub-Profile Block	Tag	Value
1000	2000	3000	1	8000	1	99	1
		3001	"6449016000"			100	"6449016000"
		3001	"6449016001"		2	99	1
	2000	3000	2			100	"6449016001"
		3001	"123123123"		3	99	1
		3001	"6449016000"			100	"666666666"
		3001	"6449016001"				
		3001	"6449016002"				
		3001	"6449016003"				
	2000	3000	1				
		3001	"666666666"				

## Array with Conditions - outbound - example 1

Here is the example array with conditions: outbound configuration.

Map only profileTag100. No typeCriteria against a profileTag. Outgoing AVP 3000 is set using a literal.

```
{
  AVPs = [
    {
      AvpCodes = [
        { avpCode = 1000 }
      ]
      AVPs = [
        {
          AvpCodes = [
            { avpCode = 2000          # <-- 1000.2000
            ]
          ]

          # Just map as follows (no type Criteria specified)
          AVPs = [
            {
              AvpCodes = [
                { avpCode = 3000      # <-- 1000.2000.3000
                ]
              avpFormat = "Integer32"
              literal = 1           # i.e. Outbound only (*not*
                                   mapping from profileTag99)
            }
          ]

          AvpCodes = [
            { avpCode = 3001        # <-- 1000.2000.3001
              repeating = true      # <--          3001 is repeating
            }
          ]
          avpFormat = "UTF8String"
          encodedExtension = {
            profileTag = 100        # Array element in sub-profile
                                   block
            profileFormat = "STRING"
          }
        }
      ]
    }
  ]
}
```

```

    }
  }
]
}
]
# Specify mapping applies OUTBOUND only.
mappingTypes = ["InitialResponse", "UpdateResponse", "EventResponse",
"TerminateResponse"]

encodedExtension = {
  profileTag = 8000
  profileFormat = "ARRAY"
}
}

```

## Mapping

This table shows the mapping ACS profile blocks to AVPs in the example array with conditions configuration section in this topic. This example is for outbound.

Profile Block				Diameter AVP			
Profile Block (ARRAY)	Sub-Profile Block	Tag	Value	Root AVP	1 <sup>st</sup> Level AVP	2 <sup>nd</sup> Level AVP	Value
8000	1	99	1	1000	2000	3000	1
		100	"6449016000"			3001	"6449016000"
		101	"something"			3001	"6449016001"
	2	99	1			3001	"666666666"
		100	"6449016001"				
		101	"something"				
		102	"else"				
	3	99	1				
		100	"6666666666"				
		101	"other"				

## Array with Conditions - outbound - example 2

Here is the example array with conditions: outbound configuration.

Map only profileTag 100. No typeCriteria against a profileTag. Outgoing AVP 3000 is set using a literal.

```

{
  AVPs = [
    {
      AvpCodes = [
        { avpCode = 1000 }
      ]
      AVPs = [
        {
          AvpCodes = [
            { avpCode = 2000           # <-- 1000.2000
              repeating = true         # <--      2000 is repeating
            }
          ]
          # Just map as follows (no type Criteria specified)
          AVPs = [
            {
              AvpCodes = [

```

```

        { avpCode = 3000    # <-- 1000.2000.3000
        }
    ]
    avpFormat = "Integer32"
    literal = 1          # i.e. Outbound only (*not*
                        mapping from profileTag99)
}
{
    AvpCodes = [
        { avpCode = 3001    # <-- 1000.2000.3001
        }
    ]
    avpFormat = "UTF8String"
    encodedExtension = {
        profileTag = 100    # Array element in sub-profile
                           block
        profileFormat = "STRING"
    }
}
    ]
}
]
}
# Specify mapping applies OUTBOUND only.
mappingTypes = ["InitialResponse", "UpdateResponse", "EventResponse",
"TerminateResponse"]

encodedExtension = {
    profileTag = 8000
    profileFormat = "ARRAY"
}
}

```

## Mapping

This table shows the mapping ACS profile blocks to AVPs in the example array with conditions configuration section in this topic. This example is for outbound.

Profile Block				Diameter AVP					
Profile Block (ARRAY)	Sub-Profile Block	Tag	Value	Root AVP	1 <sup>st</sup> Level AVP	2 <sup>nd</sup> Level AVP	Value		
8000	1	100	"6449016000"	1000	2000	3000	1		
		101	"something"			3001	"6449016000"		
		102	"else"		2000	3000	1		
		103	"and more"			3001	"6449016001"		
	2	100	"6449016001"			2000	3000	1	
		101	"another"				3001	"666666666"	
		102	"something"						
		103	"more"						
	3	100	"666666666"						
		100	"and"						
		101	"others"						

## Array with Conditions - outbound - example 3

Here is the example array with conditions: outbound configuration.

Map only profileTag 100 with typeCriteria specified against profileTag 99. Outgoing AVP 3000 is set based on profileTag 99.



```

{
  AVPs = [
    {
      AvpCodes = [
        { avpCode = 1000 }
      ]
      AVPs = [
        {
          AvpCodes = [
            {avpCode = 2000          # <-- 1000.2000
            }
          ]
          TypeCriteria = [
            {
              includeIfMatches = [ 1 ] # <-- Only profileTag(99)==1
              are mapped
              encodedExtension = {
                profileTag = 99 # Array element in sub-profile
                block
                profileFormat = "INTEGER"
              }

              # This is what is included if match found:
              AVPs = [
                {
                  AvpCodes = [
                    { avpCode = 3000 # <-- 1000.2000.3000
                    }
                  ]
                  avpFormat = "Integer32"
                  encodedExtension = {
                    profileTag = 99 # Also include the matched
                    value(1) in outbound msg
                    profileFormat = "INTEGER"
                  }
                }
              {
                AvpCodes = [
                  { avpCode = 3001 # <-- 1000.2000.3001
                    repeating = true # <-- 3001 is
                    repeating
                  }
                ]
                avpFormat = "UTF8String"
                encodedExtension = {
                  profileTag = 100 # Array element in sub-
                  profile block
                  profileFormat = "STRING"
                }
              }
            ]
          }
        ]
      ]
    }
  ]

  # Specify mapping applies OUTBOUND only.
  mappingTypes = ["InitialResponse", "UpdateResponse", "EventResponse",
    "TerminateResponse"]

  encodedExtension = {
    profileTag = 8000
  }
}

```

```

    profileFormat = "ARRAY"
  }
}

```

## Mapping

This table shows the mapping ACS profile blocks to AVPs in the example array with conditions configuration section in this topic. This example is for outbound.

Profile Block				Diameter AVP			
Profile Block (ARRAY)	Sub-Profile Block	Tag	Value	Root AVP	1 <sup>st</sup> Level AVP	2 <sup>nd</sup> Level AVP	Value
8000	1	99	1	1000	2000	3000	1
		100	"6449016000"-----			3001	"6449016000"
		101	"something"			3001	"666666666"
	2	99	2				
		100	"6449016001"				
		101	"something"				
		102	"else"				
	3	99	1				
		100	"666666666"				
		101	"others"				

## Array with Conditions - outbound - example 4

Here is the example array with conditions: outbound configuration.

Map only profileTag 100 with typeCriteria specified against profileTag 99. No AVP 3000 in outgoing diameter message.

```

{
  AVPs = [
    {
      AvpCodes = [
        { avpCode = 1000 }
      ]
      AVPs = [
        {
          AvpCodes = [
            {avpCode = 2000          # <-- 1000.2000
            }
          ]
          TypeCriteria = [
            {
              includeIfMatches = [ 1 ] # <-- Only profileTag(99)==1
              are mapped
              encodedExtension = {
                profileTag = 99 # Array element in sub-profile
                block
                profileFormat = "INTEGER"
              }
            }

            # This is what is included if match found:
            AVPs = [
              AvpCodes = [
                { avpCode = 3001 # <-- 1000.2000.3001
                  repeating = true # <-- 3001 is
                }
              ]
              avpFormat = "UTF8String"
            }
          ]
        }
      ]
    }
  ]
}

```

```

        encodedExtension = {
            profileTag = 100    # Array element in sub-
profile block
            profileFormat = "STRING"
        }
    ]
}
]
}
]
}
]
]
# Specify mapping applies OUTBOUND only.
mappingTypes = ["InitialResponse", "UpdateResponse", "EventResponse",
"TerminateResponse"]

encodedExtension = {
    profileTag = 8000
    profileFormat = "ARRAY"
}
}
}

```

## Mapping

This table shows the mapping ACS profile blocks to AVPs in the example array with conditions configuration section in this topic. This example is for outbound.

Profile Block				Diameter AVP			
Profile Block (ARRAY)	Sub-Profile Block	Tag	Value	Root AVP	1 <sup>st</sup> Level AVP	2 <sup>nd</sup> Level AVP	Value
8000	1	99	1	1000	2000	3001	"6449016000"
		100	"6449016000"			3001	"666666666"
		101	"something"				
	2	99	2				
		100	"6449016001"				
		101	"something"				
		102	"else"				
	3	99	1				
		100	"6666666666"				
		101	"others"				

## Array with Context

### Introduction

A key array has a limitation in that it cannot handle the situation when the possible key values are not well known, for example, in cases when we may not have a unique key, or the key might otherwise rely on multiple items from the hierarchy. For these cases, you may use Array with Context mapping.

The key here is that DCA allows other sub-AVPs in a hierarchy to be marked as a Context AVP, using the parameter setting `contextAVP = true`. All AVPs marked as a Context AVP then collectively make the items which provide context.

## Array with Context configuration

Here is the example Array with Context configuration in the Services AVPMappings section of the `eserv.config`.

```
{ # Array with Context Example
  AVPs = [ # Root-Level AVPs
    { # 1st Entry of Root-Level AVPs
      AvpCodes = [
        {
          avpCode = 7030
        }
      ]
    }
  ]
  AVPs = [ # 1st-Level AVPs
    { # 1st Entry of 1st-Level AVPs
      AvpCodes = [
        {
          avpCode = 1000
        }
      ]
    }
  ]
  AVPs = [ # 2nd-Level AVPs
    { # 1st Entry of 2nd-Level AVPs
      AvpCodes = [
        {
          avpCode = 2000
          repeating = true
        }
      ]
    }
  ]
  AVPs = [ # 3rd-Level AVPs
    { # Context AVP
      AvpCodes = [
        {
          avpCode = 3000    # This is AVP
          7030.1000.2000.3000
        }
      ]
      contextAVP = true
      avpFormat = "UTF8String"
      encodedExtension = {
        profileTag = 80301
        profileFormat = "STRING"
      }
    }
    { # Data AVP
      AvpCodes = [
        {
          avpCode = 3001    # This is AVP
          7030.1000.2000.3001
          repeating = true
        }
      ]
      avpFormat = "UTF8String"
      encodedExtension = {
        profileTag = 80303
        profileFormat = "STRING"
      }
    }
  ] # End of Data AVP
] # End of 3rd-Level AVPs
} # End of 1st Entry of 2nd-Level AVPs
{ # 2nd Entry of 2nd-Level AVPs (Context AVP)
  AvpCodes = [
    {
      avpCode = 2001      # This is AVP 7030.1000.2001
    }
  ]
}
```

```

        ]
        contextAVP = true
        avpFormat = "UTF8String"
        encodedExtension = {
            profileTag = 80302
            profileFormat = "STRING"
        }
    } # End of 2nd Entry of 2nd-Level AVPs (Content AVP)
] # End of 2nd-Level AVPs
} # End of 1st Entry of 1st-Level AVPs
] # End 1st-Level AVPs
} # End of 1st Entry of Root-Level AVPs
] # End of Root-Level AVPs

# Specify mapping applies INBOUND only.
mappingTypes = ["InitialRequest", "UpdateRequest", "EventRequest",
"TerminateRequest"]

avpFormat = "Grouped"
encodedExtension = {
    profileTag = 8030
    profileFormat = "ARRAY"
}
} # End of Array with Context Example

```

## Array with Context - inbound example

Here is an example of the Array with Context configuration in the Services AVPMappings section.

```

{
    AVPs = [
        {
            AvpCodes = [
                {
                    avpCode = 1000
                }
            ]
            AVPs = [
                {
                    AvpCodes = [
                        {
                            avpCode = 2000      # <-- 1000.2000
                            repeating = true    # <--      2000 is repeating
                        }
                    ]
                }
            ]
            AVPs = [
                {
                    AvpCodes = [
                        { avpCode = 3000 # <-- 1000.2000.3000
                        }
                    ]
                    avpFormat = "UTF8String"
                    encodedExtension = {
                        profileTag = 101 # Array element in sub-profile
                        block
                        profileFormat = "STRING"
                    }
                    contextAVP = true
                }
            ]
            {
                AvpCodes = [
                    { avpCode = 3001 # <-- 1000.2000.3001

```

```

        repeating = true # <--          3001 is repeating
    }
]
avpFormat = "UTF8String"
encodedExtension = {
    profileTag = 102    # <-- Array element in sub-profile
    block
    profileFormat = "STRING"
}
}
]
}
{
    AvpCodes = [
        { avpCode = 2001    # <-- 1000.2001
        }
    ]
    avpFormat = "UTF8String"
    encodedExtension = {
        profileTag = 100    # <-- Array element in sub-profile block
        profileFormat = "STRING"
    }
    contextAVP = true
}
]
}
]

# Specify mapping applies INBOUND only.
mappingTypes = ["InitialRequest", "UpdateRequest", "EventRequest",
"TerminateRequest"]

encodedExtension = {
    profileTag = 8000
    profileFormat = "ARRAY"
}
}
```

Mapping

This table shows the mapping AVPs to ACS profile blocks in the example array with context configuration section in this topic. This example is for inbound.

Diameter Message				Profile Block			
Root AVP	1st Level	2nd Level	Value	Profile Block (ARRAY)	Sub-Profile Block	Tag	Value
1000	2000	3000	"ContextB"	8000	1	100	"RootContext"
		3001	"6449016000"			101	"ContextB"
		3001	"6449016001"			102	"6449016000"
	2001		"RootContext"		2	100	"RootContext"
	2000	3000	"ContextC"			101	"ContextB"
		3001	"123123123"			102	"6449016001"
					3	100	"RootContext"
						101	"ContextC"
						102	"123123123"

Array with Context - outbound example 1

Here is an example of the array with context outbound configuration in the Services AVPMappings section.

AVP 3001 is not repeating in the outbound Diameter message.

```
{
  AVPs = [
    {
      AvpCodes = [
        {
          avpCode = 1000
        }
      ]
      AVPs = [
        {
          AvpCodes = [
            {
              avpCode = 2000      # <-- 1000.2000
              repeating = true    # <--      2000 is repeating
            }
          ]
          AVPs = [
            {
              AvpCodes = [
                { avpCode = 3000  # <-- 1000.2000.3000
                }
              ]
              avpFormat = "UTF8String"
              encodedExtension = {
                profileTag = 101  # Array element in sub-profile
                                block
                profileFormat = "STRING"
              }
              contextAVP = true
            }
          ]
        }
      ]
    }
  ]
  {
    AvpCodes = [
      { avpCode = 2001      # <-- 1000.2001
      }
    ]
    avpFormat = "UTF8String"
    encodedExtension = {
      profileTag = 100      # <-- Array element in sub-profile block
      profileFormat = "STRING"
    }
    contextAVP = true
  }
]
}
```

## Chapter 4

```
# Specify mapping applies OUTBOUND only.
mappingTypes = ["InitialResponse", "UpdateResponse", "EventResponse",
"TerminateResponse"]

encodedExtension = {
  profileTag = 8000
  profileFormat = "ARRAY"
}
```

### Mapping

AVP 3001 is not repeating in the outbound Diameter message.

Profile Block				Diameter AVP			
Profile Block (ARRAY)	Sub-Profile Block	Tag	Value	Root AVP	1 <sup>st</sup> Level AVP	2 <sup>nd</sup> Level AVP	Value
8000	1	100	"RootContext"	1000	2000	3000	"ContextB"
		101	"ContextB"			3001	"6449016000"
		102	"6449016000"				
	2	100	"RootContext"		2000	3000	"ContextB"
		101	"ContextB"			3001	"6449016001"
		102	"6449016001"				
	3	100	"RootContext"		2000	3000	"ContextC"
		101	"ContextC"			3001	"123123123"
		102	"123123123"				
					2001		"RootContext"

### Array with Context - outbound example 2

Adding `repeating` to the AVP 3001 configuration shown in *Array with Context - outbound example 1* (on page 112), produces the mapping shown in mapping example 2.

```
AvpCodes = [
  { avpCode = 3001 # <-- 1000.2000.3001
    repeating = true # <-- 3001 is repeating
  }
]
```

### Mapping

AVP 3001 is repeating in the outbound Diameter message.

Profile Block				Diameter AVP			
Profile Block (ARRAY)	Sub-Profile Block	Tag	Value	Root AVP	1 <sup>st</sup> Level AVP	2 <sup>nd</sup> Level AVP	Value
8000	1	100	"RootContext"	1000	2000	3000	"ContextB"
		101	"ContextB"			3001	"6449016000"
		102	"6449016000"				
	2	100	"RootContext"		2000	3000	"ContextC"
		101	"ContextB"			3001	"123123123"
		102	"6449016001"				
	3	100	"RootContext"		2001		
		101	"ContextC"				
		102	"123123123"				
							"RootContext"



## Conditional AVP

### Introduction

Conditional AVP enables you to perform a mapping based on the value of another AVP. For example, we might want to map the Service-Parameter-Value AVP in a grouped Service-Parameter-Info AVP to a profile field, but only if its type (specified in the Service-Parameter-Type AVP) is one we are interested in. The conditional AVP includes the `typeCriteria` array to specify the condition to match.

For outbound mapping, conditional AVPs enable mapping to be performed based on the value:

- In a profile block, and/or
- Of another AVP in the outbound message being constructed

### Conditional AVP configuration

Here is an example of the Conditional AVP configuration in the `Services AVPMappings` section of the `eserv.config`.

```
{
  AVPs = [ # Root-Level AVPs
    { # 1st Entry of Root-Level AVPs
      AvpCodes = [
        {
          avpCode = 4000
        }
      ]
      TypeCriteria = [
        { # 1st Criterion
          AvpCodes = [
            {
              avpCode = 4001
            }
          ]
          includeIfMatches = [ 1, 10, 101, 1001, 10001 ]
          avpFormat = "Integer32"

          # This is the AVP that is searched and map if a match is found
          AVPs = [ # Conditional AVPs for 1st Criterion
            {
              AvpCodes = [
                {
                  avpCode = 4002
                }
              ]
              avpFormat = "UTF8String"
              encodedExtension = {
                profileTag = 99123
                profileFormat = "STRING"
              }
            }
          ] # End of Conditional AVPs for 1st Criterion
        } # End of 1st Criterion
        { # 2nd Criterion
          AvpCodes = [
            {
              avpCode = 4001
            }
          ]
          includeIfMatches = [ 2, 20, 202, 2002, 20002 ]
          avpFormat = "Integer32"
        }
      ]
    }
  ]
}
```

```

# This is the AVP that is searched and map if a match is found
AVPs = [ # Conditional AVPs for 2nd Criterion
{
    AvpCodes = [
        {
            avpCode = 4002
        }
    ]
    avpFormat = "UTF8String"
    encodedExtension = {
        profileTag = 99124
        profileFormat = "STRING"
    }
}
] # End of Conditional AVPs for 2nd Criterion
} # End of 2nd Criterion
] # End of TypeCriteria
} # End of 1st Entry of Root-Level AVPs
] # End of Root-Level AVPs

# Specify mapping applies INBOUND only.
mappingTypes = ["InitialRequest", "UpdateRequest", "EventRequest",
"TerminateRequest"]

# Profile tag 99123 or 99124 is encoded as a child element inside an acsProfile
Array.
encodedExtension = {
    profileTag = 8000
    profileFormat = "ARRAY"
}
} # End of Conditional AVP Example

```

**Note:** "Conditional AVPs" look similar to a non-repeating/non-ProfileArray case of "Array with Conditions". See *Array with Conditions - inbound - example 1* (on page 101).

If the `avpCode` being matched is not nested, you can map it without using `typeCriteria`, by configuring the condition outside `AVPs = [ ... ]`. See *Simple conditional* (on page 92).

## Conditional AVP - inbound example 1

Here is an example of the conditional AVP configuration in the Services `AVPMappings` section.

Service-Parameter-Info (440)

- Service-Parameter-Type (441)
- Service-Parameter-Value (442)

Map only matching entry, not condition.

In this example, no parent level (ARRAY-type) encoding format is specified here as encoding specified in leaf or child element of AVPs above are encoded at the root level of the ACS profile block.

```

{
    AVPs = [
        {
            AvpCodes = [
                {
                    avpCode = 440
                }
            ]
            TypeCriteria = [
                { # Criteria for match value [ 1 ]
                    includeIfMatches = [ 1 ]
                    AvpCodes = [

```

```

        { avpCode = 441          # <-- Inbound only: 441
        }
    ]
    # or if specifying a fully qualified path:
    # AvpCodes = [
    #   { avpCode = 440 }
    #   { avpCode = 441 }
    # ]
    avpFormat = "Integer32"      # <-- Inbound only

    # This is what to include if match found:
    AVPs = [
        {
            AvpCodes = [
                { avpCode = 442 # <-- 440.442
                }
            ]
            avpFormat = "UTF8String"
            encodedExtension = {
                profileTag = 99123 # Array element in sub-profile
                block
                profileFormat = "STRING"
            }
        }
    ]
}
{ # Criteria for match value [ 2 ]
  includeIfMatches = [ 2 ]
  AvpCodes = [
    { avpCode = 441          # <-- Inbound only: 441
    }
  ]
  avpFormat = "Integer32"    # <-- Inbound only

  # This is what to include if match found:
  AVPs = [
    {
      AvpCodes = [
        { avpCode = 442 # <-- 440.442
        }
      ]
      avpFormat = "UTF8String"
      encodedExtension = {
        profileTag = 99124 # Array element in sub-profile
        block
        profileFormat = "STRING"
      }
    }
  ]
}
]
}

# Specify mapping applies INBOUND only.
mappingTypes = ["InitialRequest", "UpdateRequest", "EventRequest",
"TerminateRequest"]
}

```

### Mapping example 1

This table shows the mapping AVPs to ACS profile blocks in the example conditional AVPs configuration section in this topic. This example is for inbound.

Diameter AVP			Profile Block	
Root AVP	1 <sup>st</sup> Level	Value	Tag	Value
440	441	1	99123	"Value for Type 1"
	442	"Value for Type 1"		

or

Diameter AVP			Profile Block	
Root AVP	1 <sup>st</sup> Level	Value	Tag	Value
440	441	2	99124	"Value for Type 2"
	442	"Value for Type 2"		

### Conditional AVP example 1

Here is an example of the conditional AVP configuration in the Services AVPMappings section.

Adding the following configuration to the AVPs to include if match is found to each criterion for match value produces the mapping shown in mapping example 2.

Map only matching entry, not condition.

```
{
  AvpCodes = [
    { avpCode = 441 # <-- 440.441
    }
  ]
  avpFormat = "Integer32"
  encodedExtension = {
    profileTag = 99001 # Array element in sub-profile block
    profileFormat = "INTEGER"
  }
}
```

### Mapping example 2

This table shows the mapping AVPs to ACS profile blocks in the example conditional AVPs configuration section in this topic. This example is for inbound.

Diameter AVP			Profile Block	
Root AVP	1 <sup>st</sup> Level	Value	Tag	Value
440	441	1	90001	1
	442	"Value for Type 1"	99123	"Value for Type 1"

or

Diameter AVP			Profile Block	
Root AVP	1 <sup>st</sup> Level	Value	Tag	Value
440	441	2	90001	2
	442	"Value for Type 2"	99124	"Value for Type 2"

### Conditional AVP example 3

Here is an example of the conditional AVP configuration in the Services AVPMappings section.

This is the same as *Conditional AVP - inbound example 1* (on page 116) but maps to an acsProfile ARRAY, by adding the following configuration to the end.

Map only matching entry, not condition, but map to an acsProfile ARRAY.

```
encodedExtension = {
  profileTag = 8000
  profileFormat = "ARRAY"
}
```

### Mapping example 3

This table shows the mapping AVPs to ACS profile blocks in the example conditional AVPs configuration section in this topic. This example is for inbound.

Note similarity with the non-repeating array with conditions.

Diameter AVP			Profile Block			
Root AVP	1 <sup>st</sup> Level	Value	Profile Block (ARRAY)	Sub-Profile Block	Tag	Value
440	441	1	80001	1	99123	"Value for Type 1"
	442	"Value for Type 1"				

Diameter AVP			Profile Block			
Root AVP	1 <sup>st</sup> Level	Value	Profile Block (ARRAY)	Sub-Profile Block	Tag	Value
440	441	2	80001	2	99123	"Value for Type 2"
	442	"Value for Type 2"				

### Conditional AVP - outbound example 1

Here is an example outbound conditional AVP configuration in the Services AVPMappings section.

No ACS profileTag conditions applicable when mapping to outbound Diameter message.

In this example, no parent level (ARRAY-type) encoding format is specified here as encoding specified in leaf or child element of AVPs above are encoded at the root level of the ACS Profile Block.

```
{
  AVPs = [
    {
      AvpCodes = [
        {
          avpCode = 440
        }
      ]
      TypeCriteria = [
        {
          # Criteria for match tag 99123
          includeIfMatches = [ ] # <-- Match any value as long as
            profileTag 99123 is present
          encodedExtension = {
            profileTag = 99123          # <-- Outbound Only
            profileFormat = "STRING"   # <-- Outbound Only
          }

          # This is what to include if match found:
          AVPs = [
            #Include type sub-AVP 1
            {
              AvpCodes = [
                { avpCode = 441 # <-- 440.441
                }
              ]
            }
          ]
        }
      ]
    }
  ]
}
```

```

        ]
        avpFormat = "UTF8String"
        encodedExtension = {
            profileTag = 99123 # Array element in sub-profile
            block
            profileFormat = "STRING"
        }
    }
]
}
{ # Criteria for match tag 99124
    includeIfMatches = [ ] # <-- Match any value as long as
    profileTag 99124 is present
    encodedExtension = {
        profileTag = 99124 # <-- Outbound Only
        profileFormat = "STRING" # <-- Outbound Only
    }

    # This is what to include if match found:
    AVPs = [
        #Include type sub-AVP 2
        {
            AvpCodes = [
                { avpCode = 441 # <-- 440.441
                }
            ]
            avpFormat = "Integer32"
            literal = 2 # not mapped from a tag in the profile
            block
        }
        {
            AvpCodes = [
                { avpCode = 442 # <-- 440.442
                }
            ]
            avpFormat = "UTF8String"
            encodedExtension = {
                profileTag = 99124 # Array element in sub-profile
                block
                profileFormat = "STRING"
            }
        }
    ]
}
]
}

# Specify mapping applies OUTBOUND only.
mappingTypes = ["InitialResponse", "UpdateResponse", "EventResponse",
"TerminateResponse"]
}

```

### Mapping example 1 - conditional - outbound

This table shows the mapping ACS profile blocks to AVPs to in the example conditional AVPs configuration section in this topic. This example is for outbound.

Profile Block		Diameter AVP		
Tag	Value	Root AVP	1 <sup>st</sup> Level	2 <sup>nd</sup> Level
99123	"Value for Type 1"	440	441	1
			442	"Value for Type 1"

or

Profile Block		Diameter AVP		
Tag	Value	Root AVP	1 <sup>st</sup> Level	2 <sup>nd</sup> Level
99124	"Value for Type 2"	440	441	2
			442	"Value for Type 2"

### Conditional AVP - outbound example 2

Here is an example outbound conditional AVP configuration in the Services AVPMappings section.

Only the matching entries in ACS Profile Block are mapped in outbound Diameter message (Condition is "profileTag(90001) == 2")

In this example, no parent level (ARRAY-type) encoding format is specified here as encoding specified in leaf or child element of AVPs above are encoded at the root level of the ACS Profile Block.

```
{
  AVPs = [
    {
      AvpCodes = [
        {
          avpCode = 440
        }
      ]
      TypeCriteria = [
        {
          # Criteria for match value [1] In this example, this is NOT the
          matching entry.
          includeIfMatches = [ 1 ]
          encodedExtension = {
            profileTag = 90001          # <-- Outbound Only
            profileFormat = "STRING"    # <-- Outbound Only
          }

          # This is what to include if match found:
          AVPs = [
            #Include type sub-AVP (the matching condition)
            {
              AvpCodes = [
                { avpCode = 441 # <-- 440.441
                }
              ]
              avpFormat = "Integer32"
              encodedExtension = {
                profileTag = 90001 # Array element in sub-profile
                block
                profileFormat = "INTEGER"
              }
            }
          ]
        }
      ]
    }
  ]
}
```

```

        { avpCode = 442 # <-- 440.442
        }
    ]
    avpFormat = "UTF8String"
    encodedExtension = {
        profileTag = 99123 # Array element in sub-profile
        block
        profileFormat = "STRING"
    }
}
]
}
{ # Criteria for match value [2] In this example, this is the
matching entry.
    includeIfMatches = [ 2 ]
    encodedExtension = {
        profileTag = 90001 # <-- Outbound Only
        profileFormat = "INTEGER" # <-- Outbound Only
    }

    # This is what to include if match found:
    AVPs = [
        #Include type sub-AVP (the matching condition)
        {
            AvpCodes = [
                { avpCode = 441 # <-- 440.441
                }
            ]
            avpFormat = "Integer32"
            encodedExtension = {
                profileTag = 90001 # Array element in sub-profile
                block
                profileFormat = "INTEGER"
            }
        }
        {
            AvpCodes = [
                { avpCode = 442 # <-- 440.442
                }
            ]
            avpFormat = "UTF8String"
            encodedExtension = {
                profileTag = 99124 # Array element in sub-profile
                block
                profileFormat = "STRING"
            }
        }
    ]
}
]
}

# Specify mapping applies OUTBOUND only.
mappingTypes = ["InitialResponse", "UpdateResponse", "EventResponse",
"TerminateResponse"]
}

```



### Mapping example 2 - conditional - outbound

This table shows the mapping ACS profile blocks to AVPs to in the example conditional AVPs configuration section in this topic. This example is for outbound.

Profile Block		Diameter AVP		
Tag	Value	Root AVP	1 <sup>st</sup> Level	2 <sup>nd</sup> Level
90001	2	440	441	2
99124	"Value for Type 2"		442	"Value for Type 2"

## Prefix Tree

### Introduction

Prefix Tree enables you to map repeating AVPs to and from a prefix tree ACS profile block, specified using `profileFormat = "PREFIXTREE"`.

### Prefix Tree configuration

Here is an example of the Prefix Tree configuration in the `Services AVPMappings` section of the `eserv.config` file.

```
{
  AVPs = [ # Root-Level AVPs
    {
      AvpCodes = [
        {
          avpCode = 7100
          vendorId = "<Vendor ID>" # Optional. Vendor specific AVP, if
            present.
        }
      ]
      AVPs = [ # 1st-Level AVPs
        {
          AvpCodes = [
            {
              avpCode = 1000
            }
          ]
          AVPs = [ # 2nd-Level AVPs
            {
              AvpCodes = [
                {
                  avpCode = 2000
                  repeating = true
                }
              ]
              avpFormat = "UTF8String"
            }
          ] # End of 2nd-Level AVPs
        }
      ] # End of 1st-Level AVPs
    }
  ] # End of Root-Level AVPs
  avpFormat = "Grouped"
  encodedExtension = {
    profileTag = 8100
    profileFormat = "PREFIXTREE"
  }
}
```

```
# Specify mapping applies INBOUND only.
mappingTypes = ["InitialRequest", "UpdateRequest", "EventRequest",
"TerminateRequest"]

# AVPs above are encoded into a PREFIXTREE-type in an ACS Profile Block.
encodedExtension = {
  profileTag = 7000
  profileFormat = "PREFIXTREE"
}
} # End of Prefix Tree example
```

## Prefix Tree example

Here is an example of the prefix tree configuration in the Services AVPMappings section.

Note that the parent tag is specified outside of the AVPs array block. Parent tag 7000 has type "PREFIXTREE", hence `profileTag` and `profileFormat` for child elements are not applicable as this child AVP is encoded as entries within a prefix tree.

```
{
  AvpCodes = [
    avpCode = 1000
  ]
  AVPs = [
    {
      AvpCodes = [
        {
          avpCode = 2000          # <-- 1000.2000
          repeating = true        # <--      2000 is repeating
        }
      ]
      avpFormat = "UTF8String"
    }
  ]
  # Specify mapping applies INBOUND only.
  mappingTypes = ["InitialRequest", "UpdateRequest", "EventRequest",
"TerminateRequest"]

  encodedExtension = {
    profileTag = 7000
    profileFormat = "PREFIXTREE"
  }
}
```

To specify outbound, the `mappingTypes` are specified as:

```
# Specify mapping applies OUTBOUND only.
mappingTypes = ["InitialResponse", "UpdateResponse", "EventResponse",
"TerminateResponse"]
```

## Mapping

This table shows the mapping AVPs to ACS profile blocks in the example prefix tree configuration section in this topic. This example is for inbound. For outbound, the mapping direction is reversed.

Diameter AVP			Profile Block	
Root AVP	1st Level	Value	Profile Block (Prefix Tree)	Value
1000	2000	"049772"	7000	"049772"
	2000	"644901"		"644901"
	2000	"0800500"		"0800500"

# Timestamp

## Introduction

The DCA interface on the SLC is able to record the time that the:

- Credit-Control-Request (CCR) was received (Time-In)
- Credit-Control-Answer (CCA) was ready to be assembled and sent (Time-Out)

This allows you to track processing time and, for example, identify bottle-necks.

You can map:

- The time a CCR was received into a configurable AVP in the CCA message
- The time a Credit-Control processing for a request was completed, into a configurable AVP in the CCA message

You can copy the timestamp from the incoming Diameter message to the outgoing Diameter message.

## Timestamp example 1

This example copies a timestamp (the 3GPP eventtimestamp) from the incoming Diameter message to the outgoing Diameter message.

The data is copied through the profile tag 6291458; this is special cased to be copied from the incoming profile block to the outgoing one. It is an ARRAY tag, so that you can put whatever data you like in it.

```
{
  mappingTypes = ["InitialRequest", "InitialResponse", "UpdateRequest",
    "UpdateResponse"]
  avpFormat = "Grouped"
  extensionFormat = "encoded"
  encodedExtension = {
    profileTag = 6291458
    profileFormat = "ARRAY"
  }
  AVPs = [
    {
      AvpCodes = [
        {
          avpCode = 833
          vendorId = 10415
        }
        {
          avpCode = 6
          vendorId = 16247
          repeating = True
        }
      ]
      avpFormat = "Integer32"
      extensionFormat = "encoded"
      encodedExtension = {
        profileTag = 8192004
        profileFormat = "INTEGER"
      }
    }
  ]
}
```

## Timestamp example 2

This example places a received timestamp in the outgoing message. This uses the same repeating AVP as the previous example, so it gets appended to the group.

```
{
  mappingTypes = [ "InitialResponse", "UpdateResponse" ]
  # Any Integer/Unsigned 32/64 or OctetString may be used.
  avpFormat = "Integer32"
  timestamp = "TIME_REQUEST_RECEIVED32"
  AvpCodes = [
    {
      avpCode = 833
      vendorId = 10415
    }
    {
      avpCode = 6
      vendorId = 16247
      repeating = True
    }
  ]
}
```

**Note:** See the *timestamp* (on page 81) parameter description for a list of values.

## Timestamp example 3

This example places a replying timestamp in the outgoing message.

```
{
  mappingTypes = [ "InitialResponse", "UpdateResponse" ]
  avpFormat = "Integer64"
  timestamp = "TIME_NOW64"
  AvpCodes = [
    {
      avpCode = 833
      vendorId = 10415
    }
    {
      avpCode = 7
      vendorId = 16247
      repeating = True
    }
  ]
}
```

## RAR Example

```
AvpMappings = [
  #
  # Request Mapping set
  #
  {
    AVPs = [
      {
        AvpCodes = [
          {
            # Session-Id
            avpCode = 263
            vendorId = -1
          }
        ]
        avpFormat = "UTF8String"
        extensionFormat = "encoded"
      }
    ]
  }
]
```

```

        encodedExtension = {
            profileTag = 6291461
            profileFormat = "STRING"
        }
    }
    {
        AvpCodes = [
            {
                # Origin-Host
                avpCode = 264
                vendorId = -1
            }
        ]
        avpFormat = "UTF8String"
        extensionFormat = "encoded"
        encodedExtension = {
            profileTag = 6291466
            profileFormat = "STRING"
        }
    }
    {
        AvpCodes = [
            {
                # Multiple-Services-Credit-Control
                avpCode = 456
                vendorId = -1
            }
        ]
    }
    AVPs = [
    {
        AvpCodes = [
            {
                avpCode = 439
            }
        ]
        #name = "Service-Identifier"
        #ccsConcept = "acsProfile"
        avpFormat = "Unsigned32"
        extensionFormat = "encoded"
        encodedExtension = {
            profileBlock = 19 #Incoming Extensions Block
            profileTag = 6291480 # Diameter Service Identifier
            profileFormat = "UINTINTEGER"
        }
    }
    {
        AvpCodes = [
            {
                avpCode = 432
            }
        ]
        #name = "Rating-Group"
        #ccsConcept = "acsProfile"
        avpFormat = "Unsigned32"
        extensionFormat = "encoded"
        encodedExtension = {
            profileBlock = 19 # Incoming Extensions Block
            profileTag = 6291481 # Diameter Rating Group
            profileFormat = "UINTINTEGER"
        }
    }
    ]
}

```

```

    ]
}

#
# Response Mapping set
#
{
  mappingTypes = [
    "InitialResponse"
    "UpdateResponse"
  ]
  AVPs = [
    {
      AvpCodes = [
        {
          # da_final_unit_indication
          avpCode = 430
          vendorId = -1
        }
      ]
      AVPs = [
        {
          AvpCodes = [
            {
              # da_redirect_server
              avpCode = 434
              vendorId = -1
            }
          ]
          AVPs = [
            {
              AvpCodes = [
                {
                  # da_redirect_address_type
                  avpCode = 433
                  vendorId = -1
                }
              ]
              #avpFormat = "Enumerated"
              avpFormat = "UTF8String"
              extensionFormat = "encoded"
              encodedExtension = {
                # DCA Redirect Address Type
                profileTag = 6291464
                profileFormat = "STRING"
              }
            }
          ]
          {
            AvpCodes = [
              {
                # da_redirect_address
                avpCode = 435
                vendorId = -1
              }
            ]
            avpFormat = "UTF8String"
            extensionFormat = "encoded"
            encodedExtension = {
              # DCA Redirect Address
              profileTag = 6291465
              profileFormat = "STRING"
            }
          }
        }
      ]
    }
  ]
}

```

```
        ] # 3rd level
      }
    ] # 2nd level
  }
] # 1st level
}

] # end of AVP Mappings
```





# Control Plans

## Overview

### Introduction

This chapter explains the example Control Plans that are shipped with Oracle Communications Convergent Charging Controller Diameter Control Agent.

These are sufficient to run simple Diameter services. There are:

- for event based services:
  - CHECK\_BALANCE
  - DIRECT\_DEBITING
  - PRICE\_ENQUIRY
  - REFUND\_ACCOUNT
- for session based services:
  - Without redirect
  - With redirect to top-up-server functionality
  - Screening

### In this chapter

---

This chapter contains the following topics.

Check Balance .....	131
Direct Debiting.....	132
Price Enquiry .....	134
Refund Account.....	134
Session No Redirect.....	136
Session Redirect .....	137
Screening .....	138

## Check Balance

### Introduction

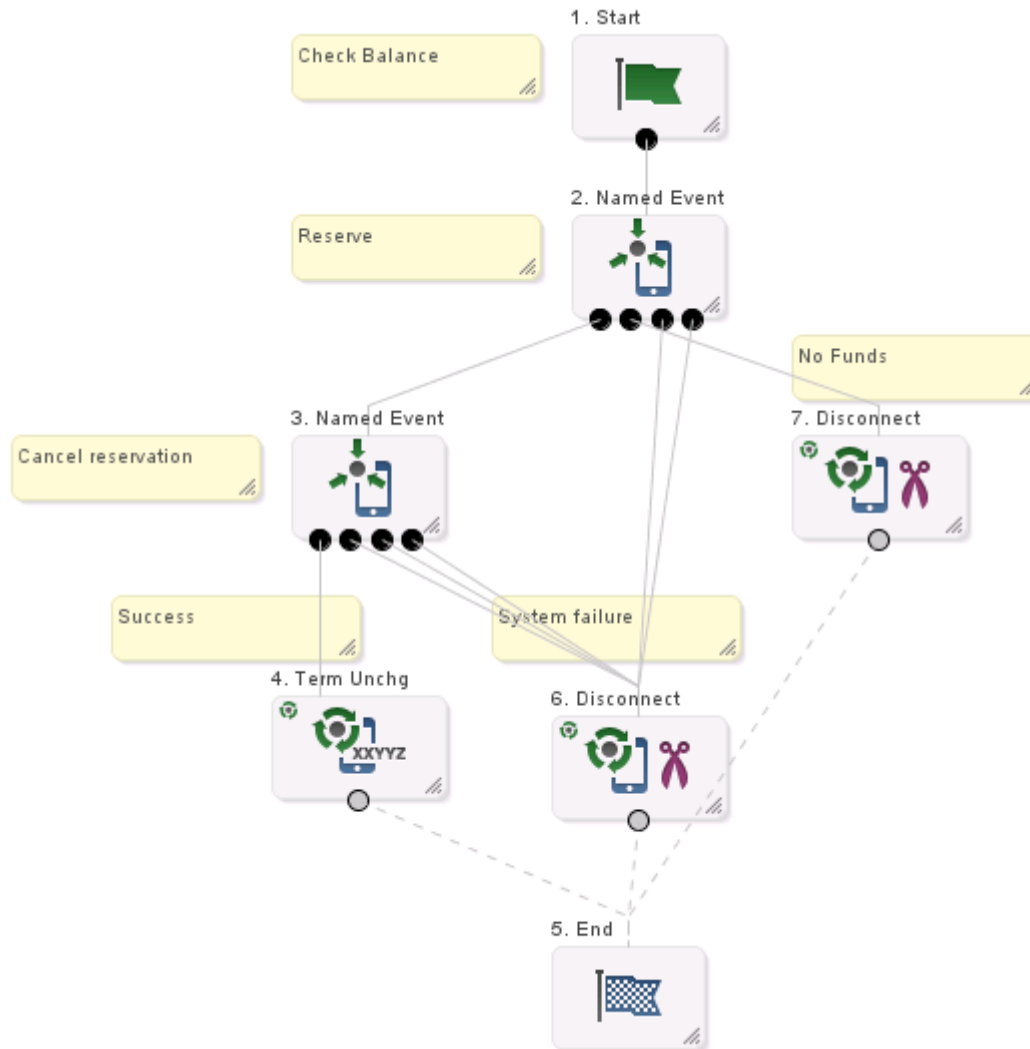
The Check Balance control plan determines if the user is able to reserve a specified number of units. It returns either a success or failure only; it does not return the number of units in the balance.

This control plan consists of a start node followed by two Named Event nodes and a terminate unchanged node, with Disconnect nodes as appropriate. The first Named Event node reserves an event type (the `Reserve Event` option selected), appropriate for this service. If the first Named Event node:

- Fails to reserve the event, it goes to a Disconnect node with the reason set to the configured no funds cause.  
 Successfully reserves the event, the second Named Event node cancels the reservation (the `Revoke Event` option selected). Then, a Terminate Unchanged node sends an INAP Continue, which signals to `diameterControlAgent` that the balance check succeeded.

## Check Balance control plan

Here is an example Check Balance control plan.



## Direct Debiting

### Introduction

This control plan starts with two profile branching nodes to determine if this is a time-based direct debit (through INAP extension 502) with an Event-Timestamp AVP (INAP extension 504).

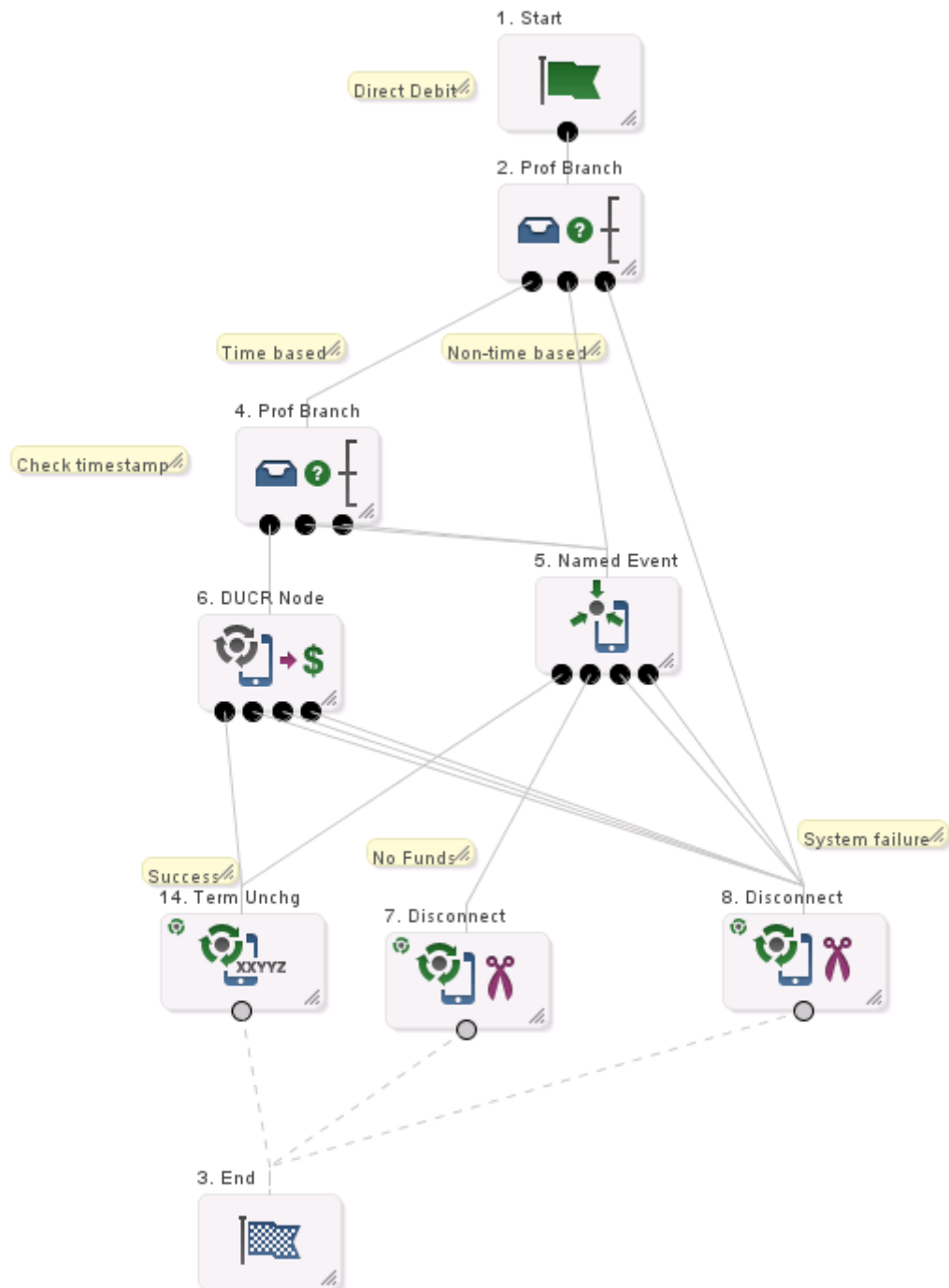
- If it is, a DUCR node is used with the `Debit` option selected to debit the account.
- If it is not, a Named Event node is used with the `Direct Event` option selected to debit the account. The Named Event node reads its number of events from INAP extension 501 (Requested-Service-Units).

Failure branches are connected to Disconnect nodes with appropriate cause values to produce the correct Diameter Result-Code values.

Refer to *INAP Extensions* (on page 14) for details.

## Direct Debiting control plan

Here is an example Direct Debiting control plan.



## Price Enquiry

### Introduction

This control plan has a Named Event node connected to:

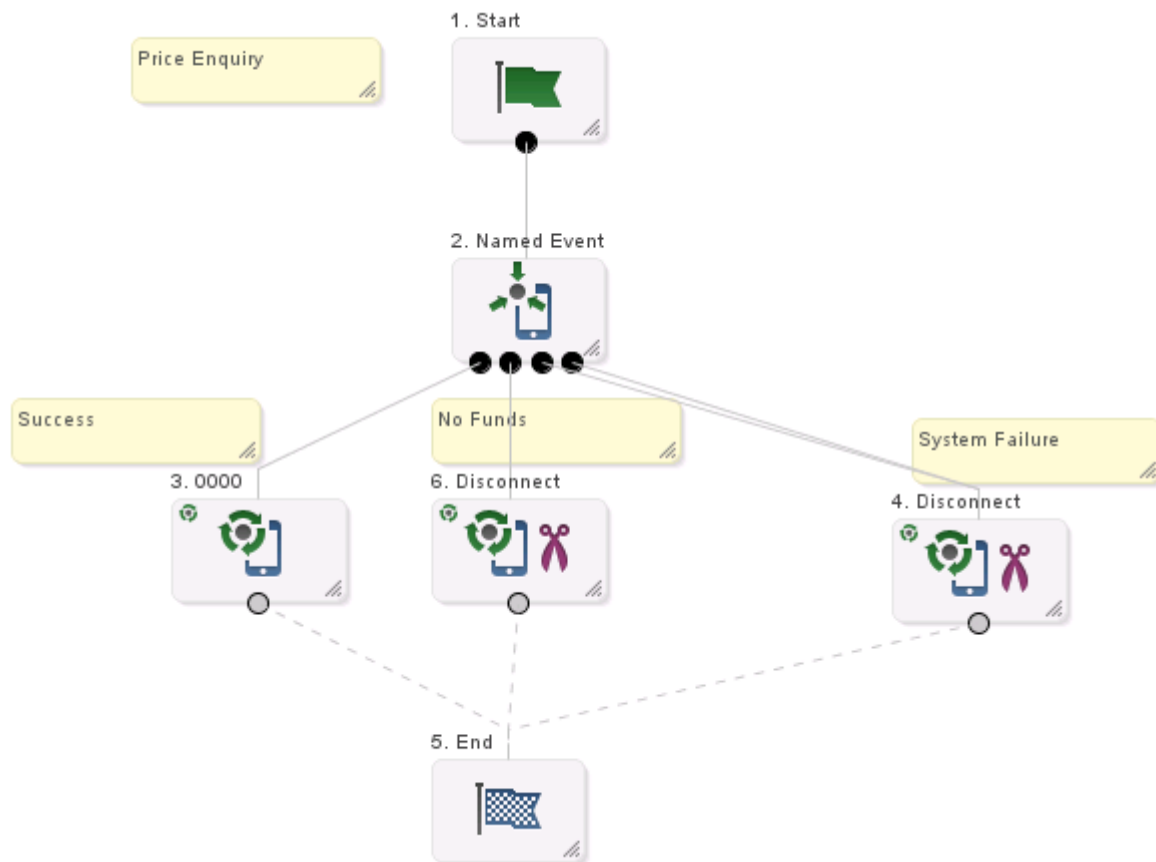
- Disconnect nodes (for failures)
- An unconditional terminate node (for successes)

The Named Event node has the *Cost of event* option selected and is configured to store the cost of the event under a tag in the ACS temporary storage area. Then, the DCA service loader plug-in picks up this tag and puts it in INAP extension 603 in the Connect. The diameterControlAgent copies this into the Cost-information AVP.

Refer to *INAP Extensions* (on page 14) for details.

### Price Enquiry control plan

Here is an example Price Enquiry control plan.



## Refund Account

### Introduction

The Refund Account control plan is identical to the *Direct Debiting* (on page 132) control plan, except, in the DUCR node, the **Credit** option is selected.



## Session No Redirect

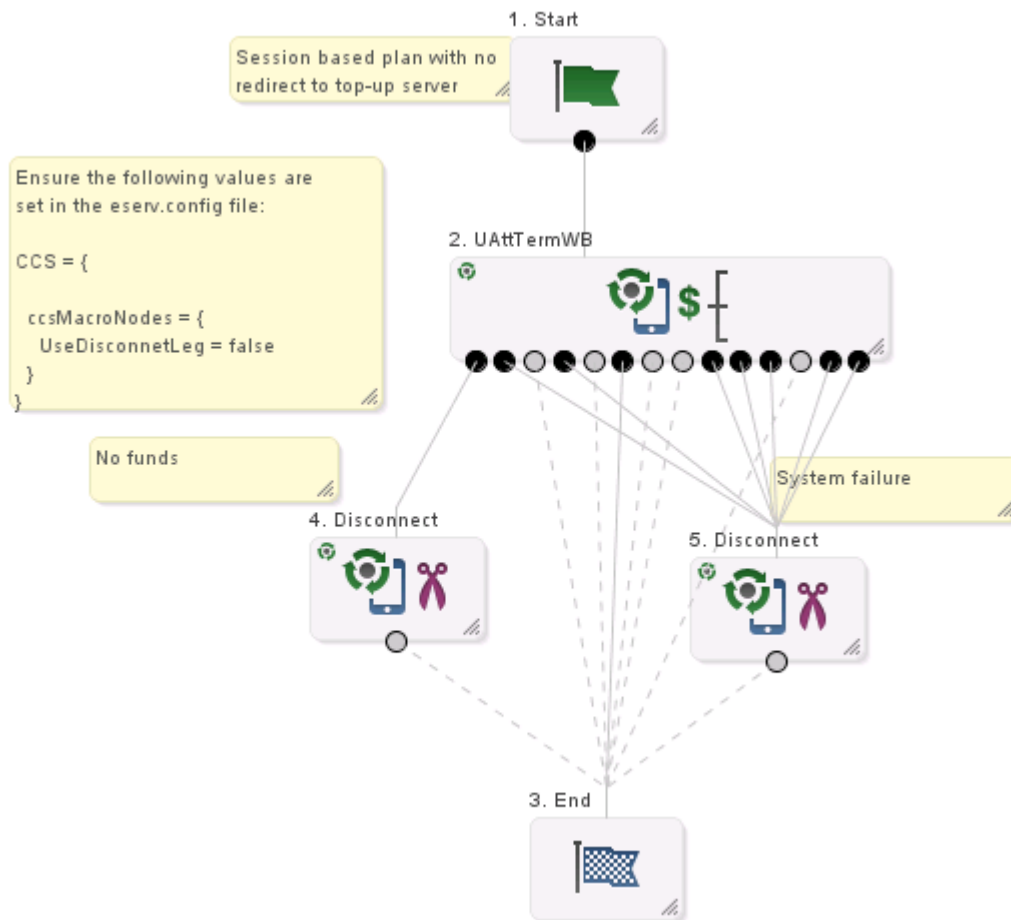
### Introduction

The Session No Redirect control plan is a session based plan with no redirect to a top-up server.

This consists of a Start node connected to a UATB node. The exits of the UATB node are connected to an End node (Success cases) and to the Disconnect nodes with various release causes. The release causes in the Disconnect nodes are such as to cause diameterControlAgent to use the appropriate Result-Code.

### Session No Redirect control plan

Here is an example Session No Redirect control plan.



### eserv.config configuration

As shown in the notes with this control plan, you need to ensure that the following values are set in the `CCS.ccsMacroNodes` section of the `eserv.config` file.

```
CCS = {
  ccsMacroNodes = {
    UseDisconnectLeg = false
  }
}
```

Refer to the *CCS Technical Guide* for details.

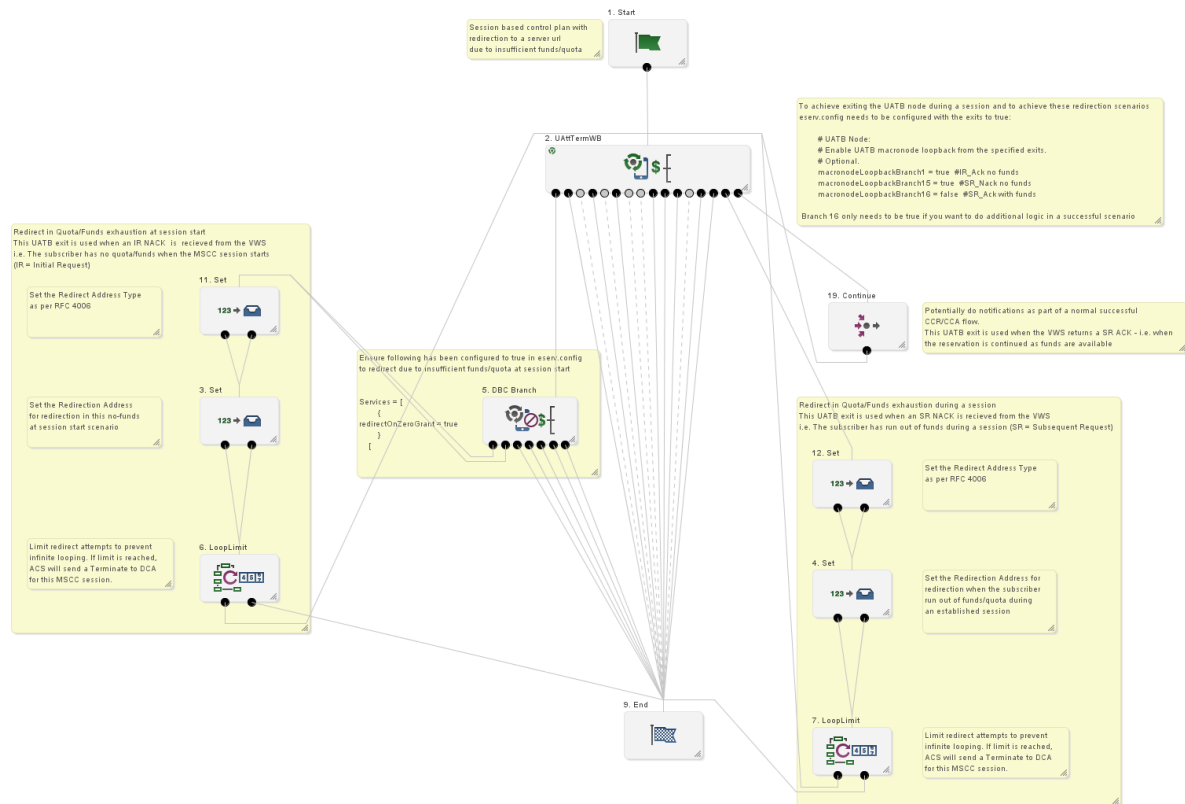
# Session Redirect

## Introduction

The Session Redirect control plan is a session based plan which will redirect to a top-up server on Declined (no funds) and NSF branch exits from UATB node. This consists of a Start node connected to a UATB node. The exits of the UATB node are connected to an End node (Success cases) and to the DBC node with Declined (no funds) exit. From DBC node, on Not declined and No funds exits should go to Set node to set the Redirection Address type. On success or failure it should go to another set node which is used to set the Redirection Address for redirection in this no-funds at session start scenario.

## Session Redirect control plan

Here is an example Session Redirect control plan.



## eserv.config configuration

As shown in the notes with this control plan, you need to ensure that the following values are set in the `CCS.ccsMacroNodes` section of the `eserv.config` file.

To achieve exiting the UATB node during a session, and to achieve these redirection scenarios, `eserv.config` needs to be configured with the exits to true:

```
CCS = {
  ccsMacroNodes = {
    # UATB Node:
    # Enable UATB macronode loopback from the specified exits.
    # Optional.
    macronodeLoopbackBranch1 = true #IR_Ack no funds
```

```
macronodeLoopbackBranch15 = true  #SR_Nack no funds
macronodeLoopbackBranch16 = false  #SR_Ack with funds
}
```

Branch 16 only needs to be true if you want to do additional logic in a successful scenario.

Ensure that the following parameter is set to true in **eserv.config** to redirect due to insufficient funds/quota at session start:

```
Services = [
    {
        redirectOnZeroGrant = true
    }
]
```

Refer to *CCS Technical Guide* for details.

# Screening

## Introduction

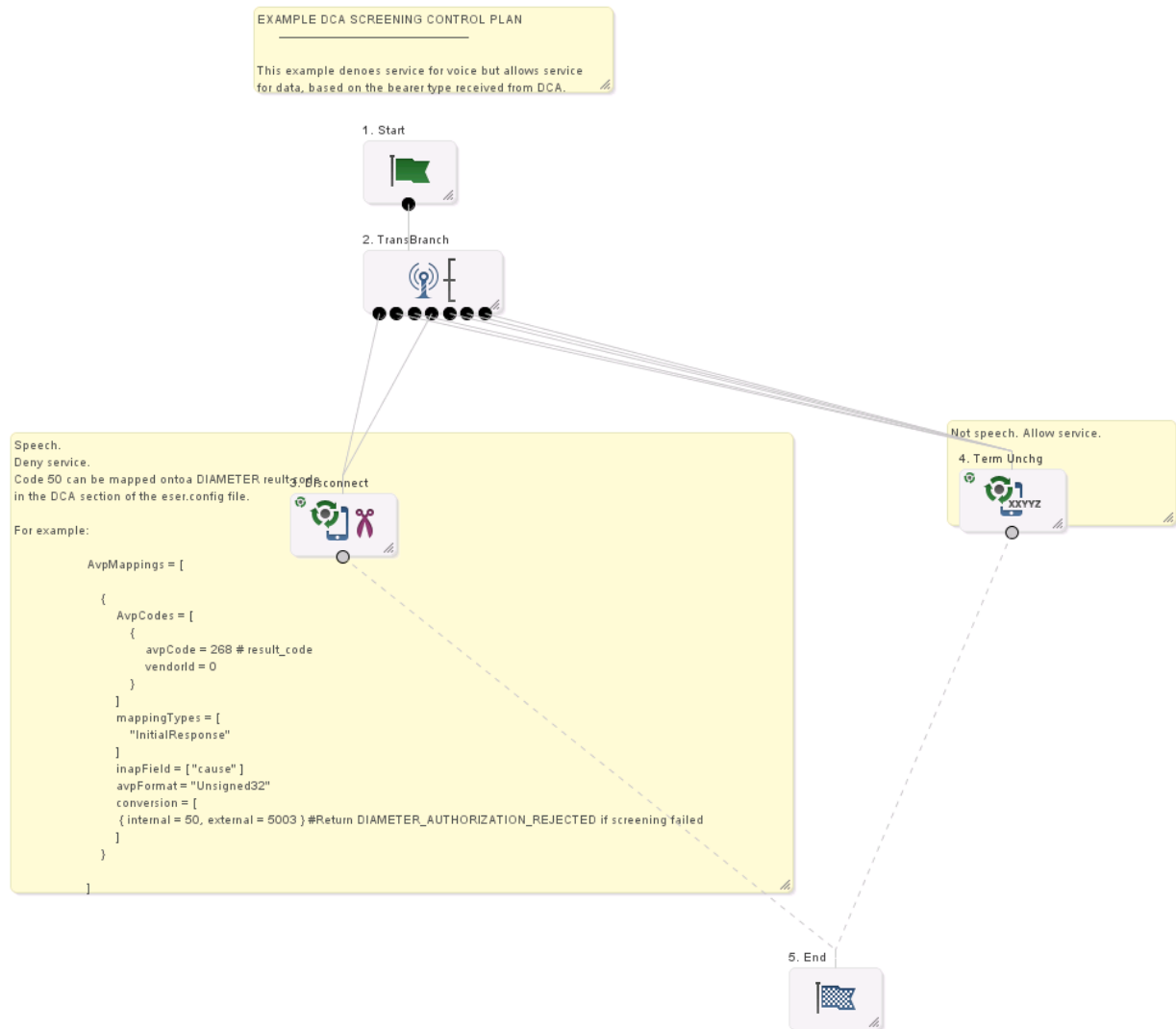
The Screening control plan denies service for voice but allows service for data, based on the bearer type received from DCA.

This consists of a Start node connected to a Transmission Type Branch node. The Transmission Type Branch node exits for voice (Exits 1 and 4) are connected to a Disconnect node with a release cause of 50. The exits for non-voice are connected to a Terminate Uncharged node.



## Screening control plan

Here is an example Screening control plan.



## eserv.config configuration

As shown in the notes with this control plan, for this example, you need to ensure that the following values are set in the DIAMETER Services section of the **eserv.config** file.

```
AvpMappings = [
  {
    AvpCodes = [
      {
        avpCode = 268 # result_code
        vendorId = 0
      }
    ]
    mappingTypes = [
      "InitialResponse"
    ]
    inapField = [ "cause" ]
  }
]
```

```
    avpFormat = "Unsigned32"
    conversion = [
        { internal = 50, external = 5003 } #Return
        DIAMETER_AUTHORIZATION_REJECTED if screening failed
    ]
}
```

# About Installation and Removal

## Overview

### Introduction

This chapter provides information about the installed components for the Oracle Communications Convergent Charging Controller application described in this guide. It also lists the files installed by the application that you can check for, to ensure that the application installed successfully.

### In this Chapter

---

This chapter contains the following topics.

Installation and Removal Overview .....	141
Checking the Installation .....	141

## Installation and Removal Overview

### Introduction

For information about the following requirements and tasks, see *Installation Guide*:

- Convergent Charging Controller system requirements
- Pre-installation tasks
- Installing and removing Convergent Charging Controller packages

### DCA packages

An installation of Diameter Control Agent includes the following packages, on the:

- SMS:
  - dcaSms
- SLC:
  - dcaScp

## Checking the Installation

### Introduction

Refer to these check lists to ensure the Diameter Control Agent has been installed correctly.

### DCA Scp directories and files

The DCA installation on the SLC creates the following directories:

- /IN/service\_packages/DCA/bin
- /IN/service\_packages/DCA/etc

- `/IN/service_packages/DCA/lib`
- `/IN/service_packages/DCA/tmp`

The DCA installation installs the following binaries and interfaces:

- `/IN/services_packages/DCA/bin/diameterControlAgent`

The DCA installation installs the following example configuration file:

- `/IN/services_packages/eserv.config.dca.example`

The DCA installation installs the following shared library:

- `/IN/services_packages/DCA/lib/libdcaCcsSvcExtra.so`

### **DCA Sms directories**

Check that the statistics and control plans have been installed correctly.

The DCA installation on the SMS creates the following directories:

- `/IN/service_packages/DCA/db`
- `/IN/service_packages/DCA/lib`

# Diameter Charging Agent Call Flows

## Call Flow Overview

### Introduction

This chapter lists a sample set of DCA message flows.

### In this chapter

This chapter contains the following topics.

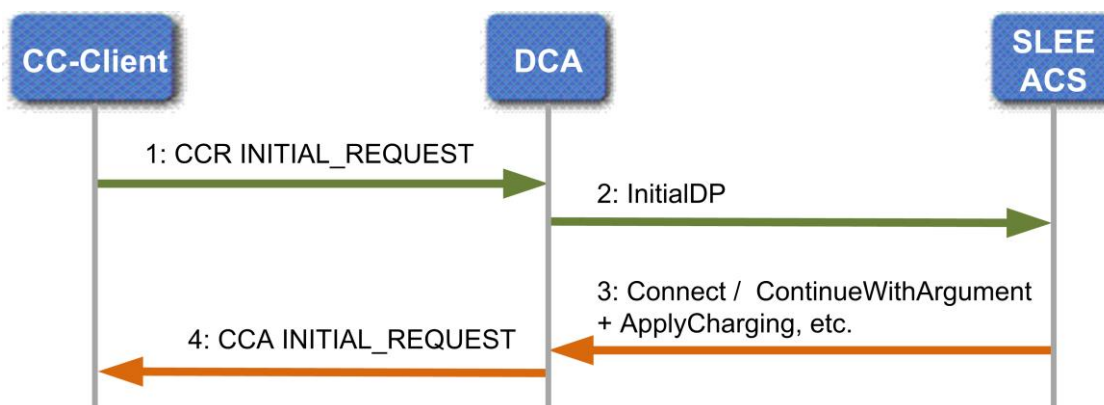
Initial Request Success .....	143
Initial Request Release Call .....	144
Initial Request Multiple Requested Service Units .....	144
AVP Pass-Through DCA to DCD .....	146
Screening Successful .....	148
Screening Call Disallowed .....	148
Screening Failure .....	149
Update Request .....	149
Terminate Request .....	150

## Initial Request Success

### Introduction

This example shows the flow for a successful initial request.

### Call flow



## Comments

This table provides additional comments on the call flow.

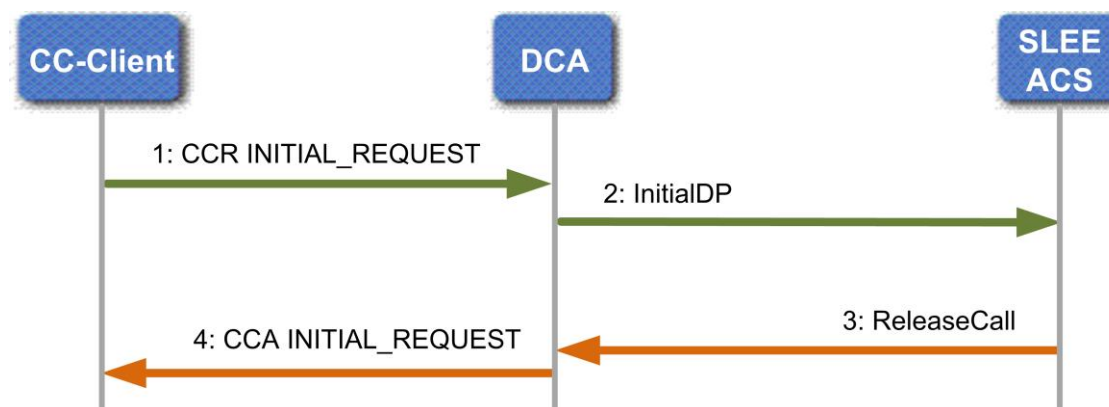
Operation	Comment
2	This operation contains a profile block encoded in extension 701, consisting of data mapped from AVPs.
3	This operation contains a profile block encoded in extension 701, consisting of data mapped to AVPs.

## Initial Request Release Call

### Introduction

This example shows the flow for a release call.

### Call flow



## Comments

This table provides additional comments on the call flow.

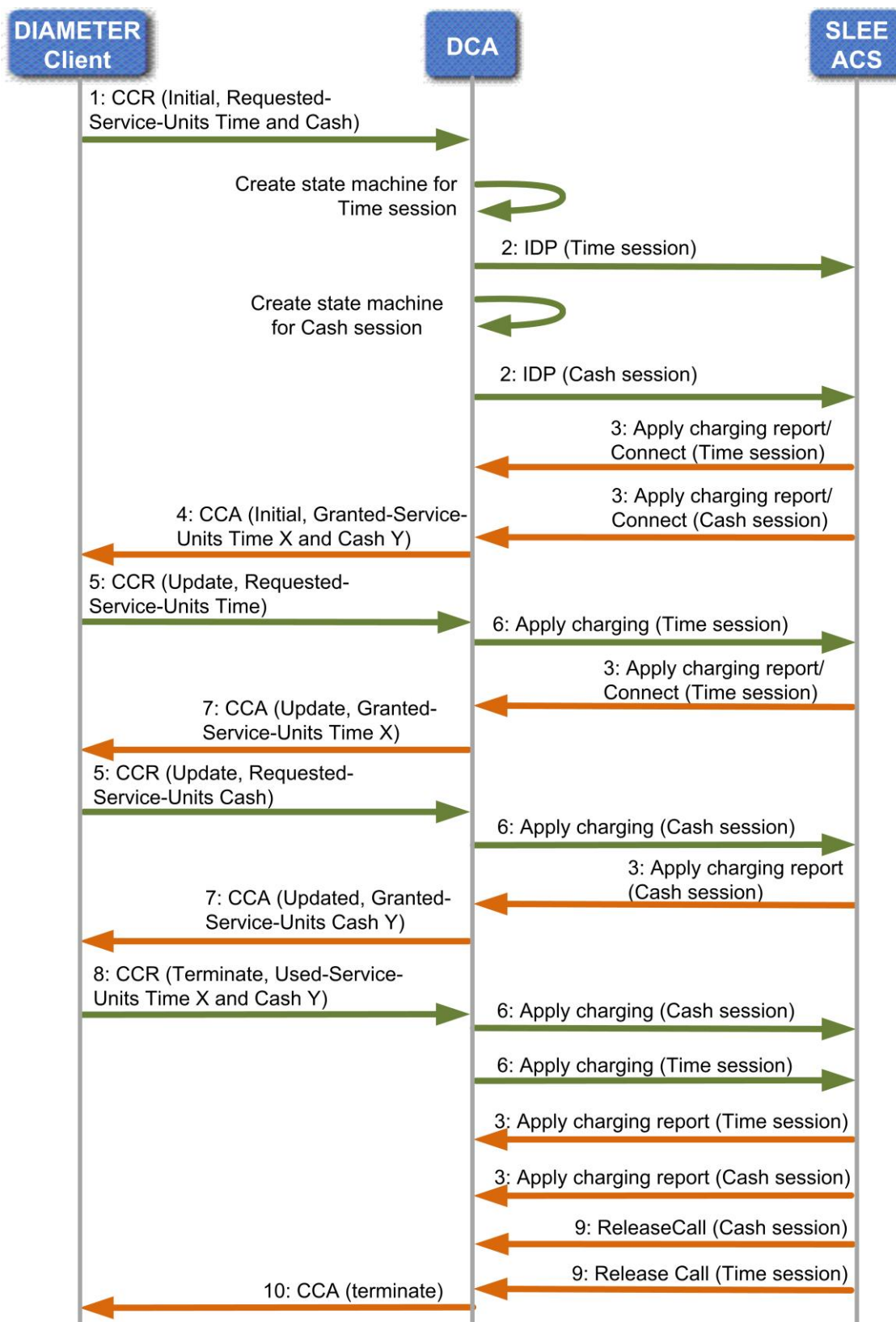
Operation	Comment
2	This operation contains a profile block encoded in extension 701, consisting of data mapped from AVPs.
3	This operation contains a profile block encoded in extension 701, consisting of data mapped to AVPs.

## Initial Request Multiple Requested Service Units

### Introduction

This example shows the flow when multiple requests for service units (cash or time) are made.

## Call flow



## AVP Pass-Through DCA to DCD

### Introduction

This example shows the flow when a simple pass through from DCA to DCD is made.

### DCA Parameters

A large part of configuration for DCA are AVP to profile block definitions.

The following configuration is required to allow an AVP received by DCA from a CC-Client to be passed through to DCD.

- ACS is configured with an Inbound ARRAY-type profile tag, which is used to pass a repeating AVP to ACS.

**Note:** This may not be necessary if data is not going to be manipulated in a Control Plan, however this would risk having data corrupted if the chosen tag number already exists, and is used in the Control Plan.

- DCA is configured with an inbound mapping from a repeating AVP in a single grouped AVP to an ARRAY-type profile.
- DCD is configured with an outbound mapping from an ARRAY profile tag in the INCOMING\_EXTENSIONS profile block.

The following configuration is required to allow an AVP received from a CC-Server by DCD to be passed through to DCA.

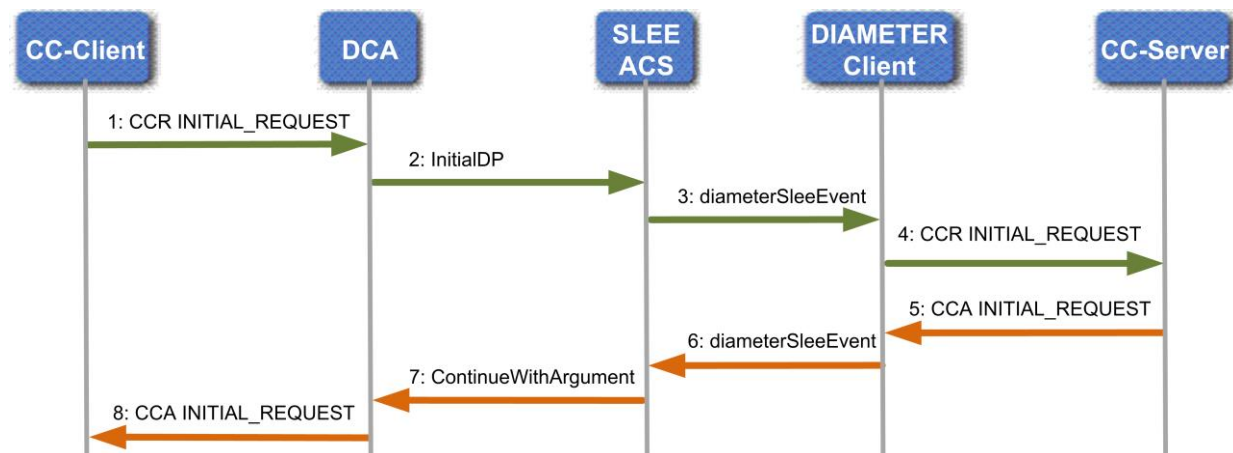
- ACS is configured with an Outbound ARRAY-type profile tag, which is used to pass data from ACS to DCA in the OUTGOING\_EXTENSIONS profile block.

**Note:** This may not be necessary if data is not going to be manipulated in a Control Plan, however this would risk having data corrupted if the chosen tag number already exists, and is used in the control Plan.

- DCD is configured with an inbound mapping to map a repeating AVP in a single grouped AVP to an ARRAY profile in the OUTGOING\_EXTENSIONS profile block.
- DCA is configured with an outbound mapping to map an ARRAY profile tag to an AVP.

### Call flow

This diagram shows the flow.





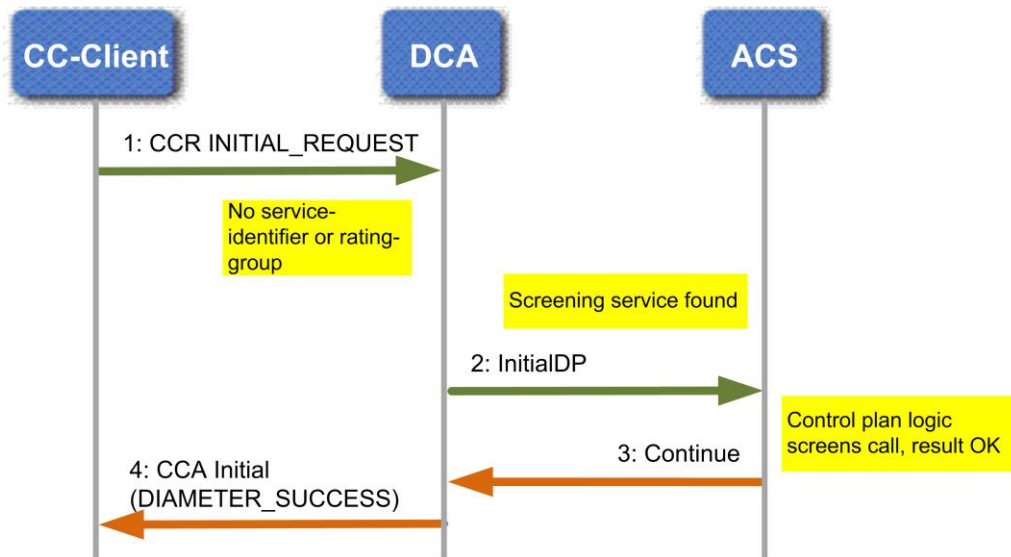
## Comments

This table provides additional comments on the call flow.

Operation	Comment
1	CC-Client sends a CCR INITIAL_REQUEST to DCA.
2	DCA sends an InitialDP to ACS containing an ARRAY profile tag in the profile block encoded in the generic_extension_val_extended_os extension (id: 701), in the extensions argument.
3	<p>Upon receipt of the operation, ACS copies the profile tags specified in the generic_extension_val_extended_os into the INCOMING_EXTENSIONS profile block.</p> <ul style="list-style-type: none"> <li>• The INCOMING_EXTENSIONS profile block is stored in tsMap-&gt;incomingExtensionsBlock in acsChassisContext.</li> <li>• In the case of an IDP, the whole generic_extension_val_extended_os extension buffer is re-assigned to tsMap-&gt;incomingExtensionsBlock; for an ACR, each profile tag in the extension is individually applied to tsMap-&gt;incomingExtensionsBlock.</li> </ul>
4	A billing node in the invoked Control Plan results in the DCD actions library being invoked.
5	<p>The DCD actions library:</p> <ul style="list-style-type: none"> <li>• encodes the ARRAY profile tag found in the INCOMING_EXTENSIONS profile block as an AVP</li> <li>• sends a request in a DiameterSleeEvent to the DCD diameterBeClient.</li> </ul>
6	The diameterBeClient sends the CCR request to the CC-Server.
7	CC-Server send a CCA INITIAL_REQUEST.
8	The diameterBeClient sends the response encoded in a DiameterSleeEvent back to ACS

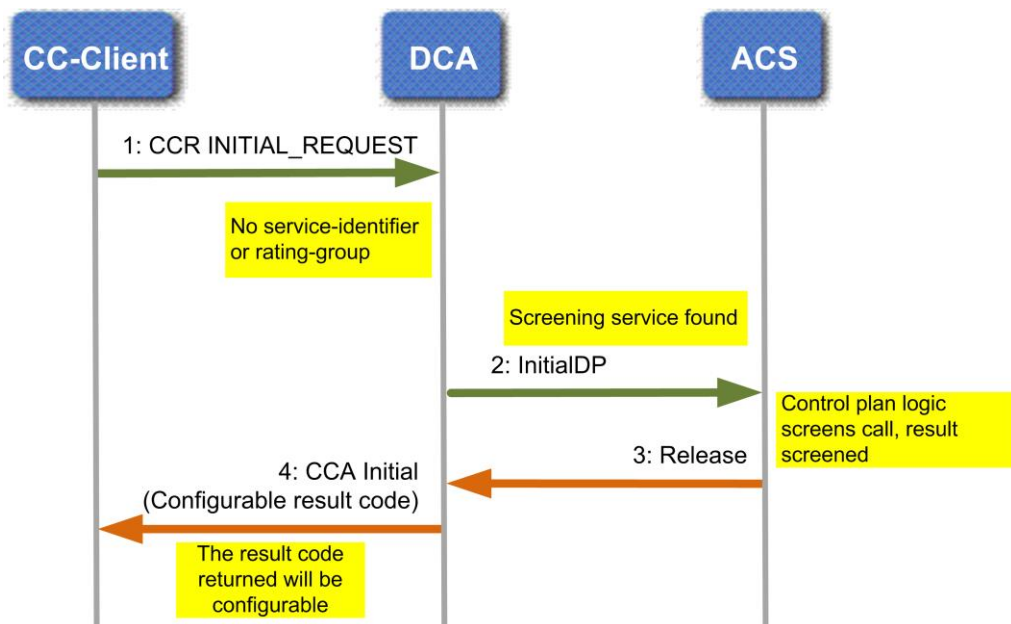
## Screening Successful

### Call flow



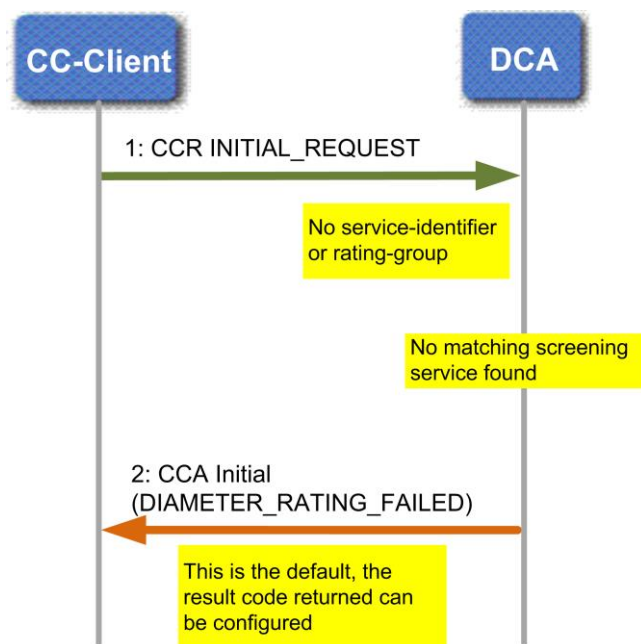
## Screening Call Disallowed

### Call flow



## Screening Failure

### Call flow

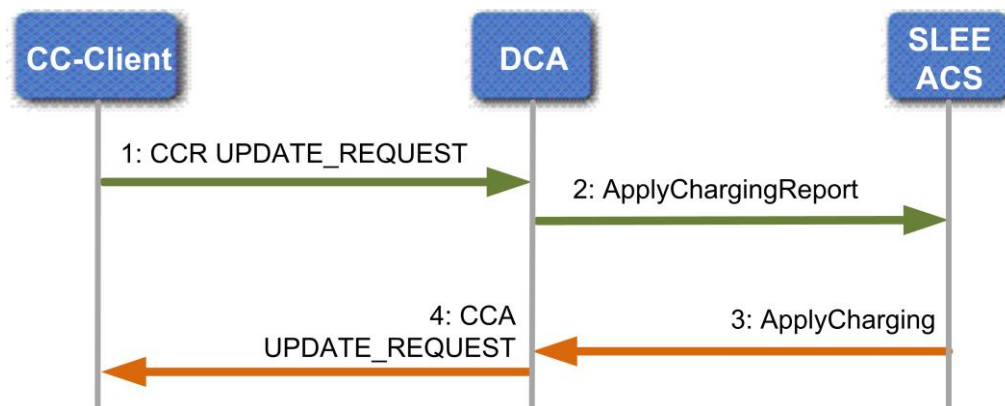


### Comments

The call flow shows DIAMETER\_RATING\_FAILED being returned. This is the default, however the actual returned Result-Code is configurable.

## Update Request

### Call flow



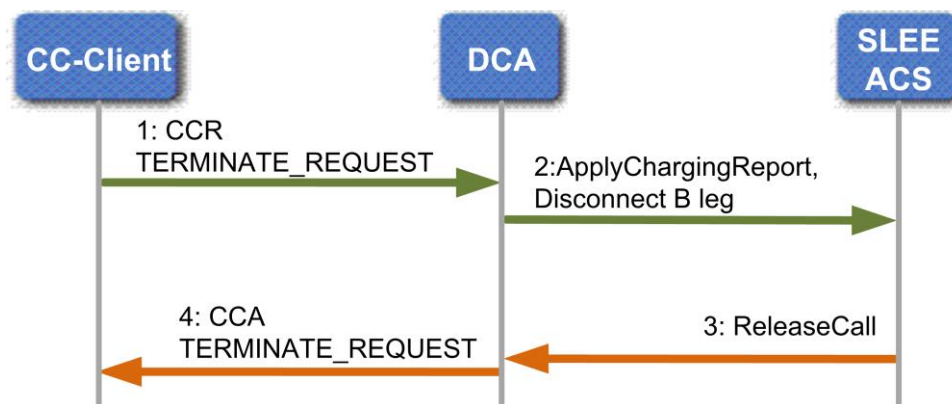
## Comments

This table provides additional comments on the call flow.

Operation	Comment
2	This operation contains a profile block encoded in extension 701, consisting of data mapped from AVPs.
3	This operation contains a profile block encoded in extension 701, consisting of data mapped to AVPs.

## Terminate Request

### Call flow



## Comments

This table provides additional comments on the call flow.

Operation	Comment
2	This operation contains a profile block encoded in extension 701, consisting of data mapped from AVPs.
3	This operation contains a profile block encoded in extension 701, consisting of data mapped to AVPs.