

# Troubleshoot Audio Call Transfer Problem at the Time of SRVCC Handover in VoLTE

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## Introduction

This document describes how to troubleshoot the problem that occurs when an audio call in VoLTE does not seamlessly transfer at the time of the SRVCC handover.

## Prerequisites

## Requirements

Cisco recommends that you have knowledge of these topics:

- Hardware knowledge of 5000/5500
- StarOS

## Components Used

This document is not restricted to specific software and hardware versions.

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, ensure that you understand the potential impact of any command.

## Abbreviations

VoLTE	Voice over Long Term Evolution
SRVCC	Single Radio Voice Call Continuity
CCR	Credit Control Request
CCA	Credit Control Answer
AVP	Attribute Value Pair
PCRF	Policy and Charging Rule Function
PCEF	Policy and Charging Enforcement Function

SGW  
PGW  
MME

Serving Gateway  
Packet Data Network Gateway  
Mobility Management Entity

## Problem

The Service provider reported that even though SRVCC handover was successful at MME, the VoLTE call was not seamlessly transferred to the legacy 2G/3G network. After SRVCC handover was completed, MME sent **DELETE\_BEARER\_COMMAND** message to SGW with voice bearer flag as true and the bearer release at PGW was successful.

But, on further communication from PGW to PCRF, it was observed that PGW does not notify PCRF as PS\_to\_CS\_Handover even though SRVCC was successful at MME end.

## Troubleshoot

This section provides information in order to troubleshoot the problem of audio call handling when it is transferred from VoLTE to legacy 2G/3G network through SRVCC handover.

Collected "mon sub" traces with the SRVCC handover. Here is the sequence of messages exchanged between MME, SGW, PGW, and PCRF.

**DELETE\_BEARER\_COMMAND** message from MME to SGW as voice bearer flag true:

```
INBOUND>>>>> 12:17:24:406 Eventid:141004(3)
[SGW-S11/S4]GTPv2C Rx PDU, from 10.206.33.X:30464 to 10.206.31.Y:2123 (57)
TEID: 0x81E0418E, Message type: EGTP_DELETE_BEARER_COMMAND (0x42)
Sequence Number: 0xD2101D (13766685)
GTP HEADER
  Version number: 2
  TEID flag: Present
  Piggybacking flag: Not present
  Message Priority flag: Not present
  Message Priority: NA
  Message Length: 0x0035 (53)

INFORMATION ELEMENTS
  BEARER CONTEXT:
    Type: 93 Length: 10 Inst: 0
    Value:
      EPS BEARER ID:
        Type: 73 Length: 1 Inst: 0
        Value: 7
      BEARER FLAGS:
        Type: 97 Length: 1 Inst: 0
        Value:
          VB : 1 >> voice bearer as true

  ULI TIMESTAMP:
    Type: 170 Length: 4 Inst: 0
    Value:
      Seconds: 3766718840

  USER LOCATION INFO:
    Type: 86 Length: 13 Inst: 0
    Value:
```

Location type: TAI  
MCC: XYZ  
MNC: AB  
TAC: 0x7D5  
Location type: ECGI  
MCC: XYZ  
MNC: AB  
ECI: 0xE02F902

UE TIME ZONE:

Type: 114 Length: 2 Inst: 0  
Value:  
TZ: +5:30  
DST: +0 hour

Further, SGW sends **EGTP\_DELETE\_BEARER\_COMMAND** message to PGW:

INBOUND>>>> 12:17:24:407 Eventid:141004(3)  
[PGW-S5/S2a/S2b]GTPv2C Rx PDU, from 223.224.X.Y:36368 to 223.224.A.B:2123 (57)  
TEID: 0x80F0E1DB, Message type: EGTP\_DELETE\_BEARER\_COMMAND (0x42)  
Sequence Number: 0xAD818E (11370894)

GTP HEADER

Version number: 2  
TEID flag: Present  
Piggybacking flag: Not present  
Message Priority flag: Not present  
Message Priority: NA  
Message Length: 0x0035 (53)

INFORMATION ELEMENTS

BEARER CONTEXT:

Type: 93 Length: 10 Inst: 0  
Value:

EPS BEARER ID:

Type: 73 Length: 1 Inst: 0  
Value: 7

BEARER FLAGS:

Type: 97 Length: 1 Inst: 0  
Value:

VB : 1

>> voice bearer as true

ULI TIMESTAMP:

Type: 170 Length: 4 Inst: 0  
Value:

Seconds: 3766718840

USER LOCATION INFO:

Type: 86 Length: 13 Inst: 0  
Value:

Location type: TAI  
MCC: XYZ  
MNC: AB  
TAC: 0x7D5  
Location type: ECGI  
MCC: XYZ  
MNC: AB  
ECI: 0xE02F902

UE TIME ZONE:

Type: 114 Length: 2 Inst: 0  
Value:  
TZ: +5:30  
DST: +0 hour

Further, **DELETE\_BEARER** is accepted by PGW and initiates delete of the bearer:

```
<<<<OUTBOUND 12:17:24:408 Eventid:141005(3)
[PGW-S5/S2a/S2b]GTPv2C Tx PDU, from 223.224.A.B:2123 to 223.224.X.Y:36368 (17)
TEID: 0x80F3C18E, Message type: EGTP_DELETE_BEARER_REQUEST (0x63)
Sequence Number: 0xAD818E (11370894)
GTP HEADER
  Version number: 2
  TEID flag: Present
  Piggybacking flag: Not present
  Message Priority flag: Not present
  Message Priority: NA
  Message Length: 0x000D (13)
```

```
INFORMATION ELEMENTS
  EPS BEARER ID:
    Type: 73 Length: 1 Inst: 1
    Value: 7
```

Further, PGW initiates CCR update message towards PCRF. Here, in Charging-Rule-Report AVP, PGW informs PCRF about Charging-Rule-Name, PCC-Rule-Status, and Rule-Failure-Code.

Here it is found that PGW sends the wrong Rule-Failure-Code to PCRF. As MME indicated the release of Voice bearer(as the flag was true), PGW should inform to PCRF as PS\_to\_CS handover. Instead of this, there is a Resource\_Allocation\_failure that is reported to PCRF.

As a result, PCRF was considering failure in 4G network and informing the same to IMS. Hence IMS was initiating VoLTE call termination. So, Although SRVCC was successful, the call was not seamlessly transferred to the legacy 2G/3G network.

```
In 3GPP TS 29.212 V13.5.0 (2016-03)
As mentioned in section 3.6, Request of IP-CAN Bearer Termination
If the IP-CAN bearer termination is caused by the PS to CS handover, the PCEF shall report
related PCC rules for this IP-CAN bearer by including the Rule-Failure-Code AVP
set to the value PS_TO_CS_HANDOVER.
```

```
In 3GPP TS 29.212 V14.3.0 (2017-03)
As mentioned in section 4.5.6 Indication of IP-CAN Bearer Termination Implications
When the PCEF detects that a dedicated IP-CAN bearer could not be activated or has been
terminated it shall remove the affected PCC rules and send a CCR command to the PCRF
with CC-Request-Type AVP set to the value "UPDATE_REQUEST", including the Charging-Rule-Report
AVP specifying the affected PCC rules with the PCC-Rule-Status set to inactive
and including the Rule-Failure-Code AVP assigned to the value RESOURCE_ALLOCATION_FAILURE.
```

```
SRVCC PS-to-CS Handover Indication Support in starOS
This feature helps in notifying the PCRF about the exact reason for PCC rule deactivation on
Voice bearer deletion.
This exact cause will help PCRF to then take further action appropriately.
This feature ensures complete compliance for SRVCC, including support for PS-to-CS handover
indication when voicebearers are released.
If the IP-CAN bearer termination is caused by the PS to CS handover, the PCEF may report related
PCC rules for thisIP-CAN bearer by including the Rule-Failure-Code AVP set to the value
PS_TO_CS_HANDOVER.
```

**CCR update message from PGW to PCRF with regards to Charging-Rule-Report AVP:**

```
<<<<OUTBOUND 12:17:24:413 Eventid:81990(5)
Diameter message from 10.0.232.X:32933 to 10.5.40.Y:3869
  Base Header Information:
    Version: 0x01 (1)
    Message Length: 0x000260 (608)
```

Command Flags: 0xc0 (192) REQ\_PXY  
Command Code: 0x000110 (272) Credit-Control-Request  
Application ID: 0x01000016 (16777238) 3GPP-Gx  
Hop2Hop-ID: 0xb7cf10ce (3083800782)  
End2End-ID: 0x3b6b4886 (996886662)

AVP Information:

[M] Session-Id

Code: 0x00000107 (263) Session-Id  
Flags: 0x40 (64) [M]  
Length: 0x00004f (79)  
Data: 0003-diamproxy.asr55k.gx;1385806608;584234203;5cd9037d-1db02

[M] Auth-Application-Id

Code: 0x00000102 (258) Auth-Application-Id  
Flags: 0x40 (64) [M]  
Length: 0x00000c (12)  
Data: 16777238

[M] Origin-Host

Code: 0x00000108 (264) Origin-Host  
Flags: 0x40 (64) [M]  
Length: 0x00002b (43)  
Data: 0003-diamproxy.asr55k.gx

[M] Origin-Realm

Code: 0x00000128 (296) Origin-Realm  
Flags: 0x40 (64) [M]  
Length: 0x00001a (26)  
Data: cisco.com

[M] Destination-Realm

Code: 0x0000011b (283) Destination-Realm  
Flags: 0x40 (64) [M]  
Length: 0x00002a (42)  
Data: PCRF.MNC0AB.MCCXYZ.3GPPNETWORK.ORG

[M] CC-Request-Type

Code: 0x000001a0 (416) CC-Request-Type  
Flags: 0x40 (64) [M]  
Length: 0x00000c (12)  
Data: UPDATE\_REQUEST (2)

[M] CC-Request-Number

Code: 0x0000019f (415) CC-Request-Number  
Flags: 0x40 (64) [M]  
Length: 0x00000c (12)  
Data: 2

[M] Destination-Host

Code: 0x00000125 (293) Destination-Host  
Flags: 0x40 (64) [M]  
Length: 0x000037 (55)  
Data: PCRF01.PCRF.MNC0AB.MCCXYZ.3GPPNETWORK.ORG

[M] Origin-State-Id

Code: 0x00000116 (278) Origin-State-Id  
Flags: 0x40 (64) [M]  
Length: 0x00000c (12)  
Data: 1552081338

[M] Subscription-Id

Code: 0x000001bb (443) Subscription-Id  
Flags: 0x40 (64) [M]  
Length: 0x000028 (40)

```
[M] Subscription-Id-Type
Code:      0x000001c2 (450) Subscription-Id-Type
Flags:     0x40      (64) [M]
Length:    0x00000c  (12)
Data: END_USER_E164 (0)

[M] Subscription-Id-Data
Code:      0x000001bc (444) Subscription-Id-Data
Flags:     0x40      (64) [M]
Length:    0x000014  (20)
Data: 121234567891

[M] Subscription-Id
Code:      0x000001bb (443) Subscription-Id
Flags:     0x40      (64) [M]
Length:    0x00002c  (44)
[M] Subscription-Id-Type
Code:      0x000001c2 (450) Subscription-Id-Type
Flags:     0x40      (64) [M]
Length:    0x00000c  (12)
Data: END_USER_IMSI (1)

[M] Subscription-Id-Data
Code:      0x000001bc (444) Subscription-Id-Data
Flags:     0x40      (64) [M]
Length:    0x000017  (23)
Data: XYZAB1234567891

[M] Framed-IPv6-Prefix
Code:      0x00000061 (97) Framed-IPv6-Prefix
Flags:     0x40      (64) [M]
Length:    0x000012  (18)
Data: Reserved: 00 Prefixlen: 64 IPv6 prefix: 2401:4900:4097:f050::

[M] User-Equipment-Info
Code:      0x000001ca (458) User-Equipment-Info
Flags:     0x40      (64) [M]
Length:    0x00002c  (44)
[M] User-Equipment-Info-Type
Code:      0x000001cb (459) User-Equipment-Info-Type
Flags:     0x40      (64) [M]
Length:    0x00000c  (12)
Data: IMEISV (0)

[M] User-Equipment-Info-Value
Code:      0x000001cc (460) User-Equipment-Info-Value
Flags:     0x40      (64) [M]
Length:    0x000018  (24)
Data: 9876543211234

[M] Called-Station-Id
Code:      0x0000001e (30) Called-Station-Id
Flags:     0x40      (64) [M]
Length:    0x00000b  (11)
Data: ims

[V] [M] Charging-Rule-Report
Code:      0x000003fa (1018) Charging-Rule-Report
Flags:     0xc0      (192) [V] [M]
Length:    0x00006c  (108)
Vendor-Id: 0x000028af (10415) 3GPP
[V] [M] Charging-Rule-Name
Code:      0x000003ed (1005) Charging-Rule-Name
Flags:     0xc0      (192) [V] [M]
```

```
Length: 0x00001e (30)
Vendor-Id: 0x000028af (10415) 3GPP
Data: I_AD_VOLTE00F72513
```

```
[V] [M] Charging-Rule-Name
Code: 0x000003ed (1005) Charging-Rule-Name
Flags: 0xc0 (192) [V] [M]
Length: 0x00001e (30)
Vendor-Id: 0x000028af (10415) 3GPP
Data: I_AD_VOLTE00F72512
```

```
[V] [M] PCC-Rule-Status
Code: 0x000003fb (1019) PCC-Rule-Status
Flags: 0xc0 (192) [V] [M]
Length: 0x000010 (16)
Vendor-Id: 0x000028af (10415) 3GPP
Data: INACTIVE (1)
```

```
[V] [M] Rule-Failure-Code
Code: 0x00000407 (1031) Rule-Failure-Code
Flags: 0xc0 (192) [V] [M]
Length: 0x000010 (16)
Vendor-Id: 0x000028af (10415) 3GPP
Data: RESOURCE_ALLOCATION_FAILURE (10)
```

>> failure code is incorrect. It should be PS\_CS\_Handover

```
[V] [M] Access-Network-Charging-Address
Code: 0x000001f5 (501) Access-Network-Charging-Address
Flags: 0xc0 (192) [V] [M]
Length: 0x000012 (18)
Vendor-Id: 0x000028af (10415) 3GPP
Data: IPv4 223.224.X.Y
```

## Solution

In the customer network rel-8 diameter dictionary was used. It is found PS\_CS\_Handover was not supported in rel-8.

So, you need to update the dictionary to 3gpp-r10. After you have updated the dictionary to 3gpp-r10, the cause is properly sent as PS\_CS\_Handover.

After this, the end-users audio calls might be able to seamlessly handover to legacy 2G/3G network from VoLTE.

```
ims-auth-service DRA_Gx_SPG
  policy-control
    diameter dictionary r8-gx-standard
    diameter update-dictionary-avps 3gpp-r10 << diameter dictionary updated to 3gpp-r10
```

**DELETE\_BEARER\_COMMAND** message from SGW to PGW as voice bearer flag true:

```
INBOUND>>>> From sessmgr:205 tpc_interface.c:1338 (Callid 3cda3ef4) 13:28:21:659
Eventid:141004(3)
[PGW-S5/S2a/S2b]GTPv2C Rx PDU, from 223.224.M.N:39632 to 223.224.P.Q:2123 (57)
TEID: 0x845800CD, Message type: EGTP_DELETE_BEARER_COMMAND (0x42)
Sequence Number: 0xE9625A (15295066)
GTP HEADER
  Version number: 2
  TEID flag: Present
  Piggybacking flag: Not present
  Message Priority flag: Not present
  Message Priority: NA
```

Message Length: 0x0035 (53)

INFORMATION ELEMENTS

BEARER CONTEXT:

Type: 93 Length: 10 Inst: 0

Value:

EPS BEARER ID:

Type: 73 Length: 1 Inst: 0

Value: 7

BEARER FLAGS:

Type: 97 Length: 1 Inst: 0

Value:

**VB : 1**

**>> voice bearer as true**

ULI TIMESTAMP:

Type: 170 Length: 4 Inst: 0

Value:

Seconds: 3769747091

USER LOCATION INFO:

Type: 86 Length: 13 Inst: 0

Value:

Location type: TAI

MCC: XYZ

MNC: AB

TAC: 0x844

Location type: ECGI

MCC: XYZ

MNC: AB

ECI: 0xDCf8C02

UE TIME ZONE:

Type: 114 Length: 2 Inst: 0

Value:

TZ: +5:30

DST: +0 hour

Further, it is accepted by PGW and initiates the release of the bearer.

<<<<OUTBOUND From sessmgr:205 sessmgr\_egtp.c:2984 (Callid 3cda3ef4) 13:28:21:670

Eventid:141005(3)

[PGW-S5/S2a/S2b]GTPv2C Tx PDU, from 223.224.M.N:2123 to 223.224.P.Q:39632 (17)

TEID: 0x8064A25A, Message type: EGTP\_DELETE\_BEARER\_REQUEST (0x63)

Sequence Number: 0xE9625A (15295066)

GTP HEADER

Version number: 2

TEID flag: Present

Piggybacking flag: Not present

Message Priority flag: Not present

Message Priority: NA

Message Length: 0x000D (13)

INFORMATION ELEMENTS

EPS BEARER ID:

Type: 73 Length: 1 Inst: 1

Value: 7

CCR from PGW to PCRF with regards to the Charging-Rule-Report AVP with failure code seen as PS\_CS\_Handover.

<<<<OUTBOUND From diamproxy:55 diamproxy\_rlf.c:553 (Callid 3cda3ef4) 13:28:21:679

Eventid:81990(5)



Diameter message from 10.206.17.X:51119 to 10.5.40.Y:3007

Base Header Information:

Version: 0x01 (1)  
Message Length: 0x000260 (608)  
Command Flags: 0xc0 (192) REQ PXY  
Command Code: 0x000110 (272) Credit-Control-Request  
Application ID: 0x01000016 (16777238) 3GPP-Gx  
Hop2Hop-ID: 0xaebac4d3 (2931475667)  
End2End-ID: 0x19b8ec95 (431549589)

AVP Information:

[M] Session-Id

Code: 0x00000107 (263) Session-Id  
Flags: 0x40 (64) [M]  
Length: 0x00004e (78)  
Data: 0007-diamproxy.asr55k.dra.gx;1020935924;202167245;5d0747d1-cd02

[M] Auth-Application-Id

Code: 0x00000102 (258) Auth-Application-Id  
Flags: 0x40 (64) [M]  
Length: 0x00000c (12)  
Data: 16777238

[M] Origin-Host

Code: 0x00000108 (264) Origin-Host  
Flags: 0x40 (64) [M]  
Length: 0x00002b (43)  
Data: 0007-diamproxy.asr55k.dra.gx

[M] Origin-Realm

Code: 0x00000128 (296) Origin-Realm  
Flags: 0x40 (64) [M]  
Length: 0x00001a (26)  
Data: cisco.com

[M] Destination-Realm

Code: 0x0000011b (283) Destination-Realm  
Flags: 0x40 (64) [M]  
Length: 0x00002a (42)  
Data: PCRF.MNC0AB.MCCXYZ.3GPPNETWORK.ORG

[M] CC-Request-Type

Code: 0x000001a0 (416) CC-Request-Type  
Flags: 0x40 (64) [M]  
Length: 0x00000c (12)  
Data: UPDATE\_REQUEST (2)

[M] CC-Request-Number

Code: 0x0000019f (415) CC-Request-Number  
Flags: 0x40 (64) [M]  
Length: 0x00000c (12)  
Data: 2

[M] Destination-Host

Code: 0x00000125 (293) Destination-Host  
Flags: 0x40 (64) [M]  
Length: 0x000037 (55)  
Data: PCRF01.NO.DC.PCRF.MNC0AB.MCCXYZ.3GPPNETWORK.ORG

[M] Origin-State-Id

Code: 0x00000116 (278) Origin-State-Id  
Flags: 0x40 (64) [M]  
Length: 0x00000c (12)  
Data: 1559087623

```
[M] Subscription-Id
Code:      0x000001bb (443) Subscription-Id
Flags:     0x40      (64) [M]
Length:    0x000028 (40)
  [M] Subscription-Id-Type
    Code:    0x000001c2 (450) Subscription-Id-Type
    Flags:   0x40      (64) [M]
    Length:  0x00000c (12)
    Data: END_USER_E164 (0)

  [M] Subscription-Id-Data
    Code:    0x000001bc (444) Subscription-Id-Data
    Flags:   0x40      (64) [M]
    Length:  0x000014 (20)
    Data: 121234567891

[M] Subscription-Id
Code:      0x000001bb (443) Subscription-Id
Flags:     0x40      (64) [M]
Length:    0x00002c (44)
  [M] Subscription-Id-Type
    Code:    0x000001c2 (450) Subscription-Id-Type
    Flags:   0x40      (64) [M]
    Length:  0x00000c (12)
    Data: END_USER_IMSI (1)

  [M] Subscription-Id-Data
    Code:    0x000001bc (444) Subscription-Id-Data
    Flags:   0x40      (64) [M]
    Length:  0x000017 (23)
    Data: XYZAB1234567891

[M] Framed-IPv6-Prefix
Code:      0x00000061 (97) Framed-IPv6-Prefix
Flags:     0x40      (64) [M]
Length:    0x000012 (18)
Data: Reserved: 00 Prefixlen: 64 IPv6 prefix: 2401:4900:4071:32ec::

[M] User-Equipment-Info
Code:      0x000001ca (458) User-Equipment-Info
Flags:     0x40      (64) [M]
Length:    0x00002c (44)
  [M] User-Equipment-Info-Type
    Code:    0x000001cb (459) User-Equipment-Info-Type
    Flags:   0x40      (64) [M]
    Length:  0x00000c (12)
    Data: IMEISV (0)

  [M] User-Equipment-Info-Value
    Code:    0x000001cc (460) User-Equipment-Info-Value
    Flags:   0x40      (64) [M]
    Length:  0x000018 (24)
    Data: 9876543211234

[M] Called-Station-Id
Code:      0x0000001e (30) Called-Station-Id
Flags:     0x40      (64) [M]
Length:    0x00000b (11)
Data: ims

[V] [M] Charging-Rule-Report
Code:      0x000003fa (1018) Charging-Rule-Report
Flags:     0xc0      (192) [V] [M]
Length:    0x00006c (108)
```

Vendor-Id: 0x000028af (10415) 3GPP

[V] [M] Charging-Rule-Name

Code: 0x000003ed (1005) Charging-Rule-Name  
Flags: 0xc0 (192) [V] [M]  
Length: 0x00001e (30)  
Vendor-Id: 0x000028af (10415) 3GPP  
Data: I\_AD\_VOLTE03D4E98A

[V] [M] Charging-Rule-Name

Code: 0x000003ed (1005) Charging-Rule-Name  
Flags: 0xc0 (192) [V] [M]  
Length: 0x00001e (30)  
Vendor-Id: 0x000028af (10415) 3GPP  
Data: I\_AD\_VOLTE03D4E989

[V] [M] PCC-Rule-Status

Code: 0x000003fb (1019) PCC-Rule-Status  
Flags: 0xc0 (192) [V] [M]  
Length: 0x000010 (16)  
Vendor-Id: 0x000028af (10415) 3GPP  
Data: INACTIVE (1)

[V] [M] Rule-Failure-Code

Code: 0x00000407 (1031) Rule-Failure-Code  
Flags: 0xc0 (192) [V] [M]  
Length: 0x000010 (16)  
Vendor-Id: 0x000028af (10415) 3GPP  
Data: PS\_TO\_CS\_HANDOVER (13)

>> failure code seen as

PS\_to\_CS\_Handover

[V] [M] Access-Network-Charging-Address

Code: 0x000001f5 (501) Access-Network-Charging-Address  
Flags: 0xc0 (192) [V] [M]  
Length: 0x000012 (18)  
Vendor-Id: 0x000028af (10415) 3GPP  
Data: IPv4 223.224.X.Y

Appropriate diameter dictionary needs to be used for seamless handover of an audio call from VoLTE in 4G to legacy 2G/3G network through SRVCC handover. This was supported after the diameter dictionary was updated to 3gpp-rel10 under ims-auth-service.