MultiService Forum

Implementation Agreement for Diameter interface to Bandwidth Manager

MSF-IA-DIAMETER.001v2-FINAL

MultiService Forum
Implementation Agreement

Contribution Number: **msf2005.187.03**
Document Filename: **MSF-IA-DIAMETER.001v2-FINAL**
Working Group: **Protocol and Control**
Title: **Implementation Agreement for Diameter interface to Bandwidth Manager**
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Abstract:
This document defines a Diameter interface between Call Session Control and Bandwidth Manager, denoted TC-0 in the MSF R3 architecture for GMI 2006. The interface is based on the standard for Gq´ (ETSI TS 183 017) defined by ETSI/TISPAN Release 1. Gq' is based on the 3GPP Gq interface and includes additional AVPs to support fixed access as required by the NGN architecture.
Gq' is the reference point between Session Control and the Resource Admission Control Subsystem (RACS) of the ETSI/TISPAN NGN architecture. The MSF Bandwidth Manager implements the functionality of ETSI/TISPAN RACS.

The goal of the MSF is to promote multi-vendor interoperability as part of a drive to accelerate the deployment of next generation networks. To this end the MSF looks to adopt pragmatic solutions in order to maximize the chances for early deployment in real world networks.

To date the MSF has defined a number of detailed Implementation Agreements and detailed Test Plans for the signaling protocols between network components and is developing additional Implementation Agreements and Test Plans addressing some of the other technical issues such as QoS and Security to assist vendors and operators in deploying interoperable solutions.

The MSF welcomes feedback and comment and would encourage interested parties to get involved in this work program. Information about the MSF and membership options can be found on the MSF website http://www.msforum.org/

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1 MultiService Forum

The MultiService Forum (MSF) is a global association of service providers and system suppliers committed to developing and promoting open-architecture, multiservice communication systems. Founded in 1998, the MSF is an open-membership organization comprised of the world's leading telecommunications companies.

The MSF's activities include developing implementation agreements, promoting worldwide compatibility and interoperability, and encouraging input to appropriate national and international standards bodies.

As part of MSF’s effort to drive and promote interoperability, MSF created the Global MSF Interoperability (GMI) event. GMI provides a real-world setting for vendors to test their solutions and offers proof that carriers can purchase their products, confident that they meet the interoperability standards set forth by MSF Implementation Agreements.

GMI 2006 is the third global interoperability event conducted by the MultiService Forum (MSF). Like GMI 2002 and GMI 2004, GMI 2006 provides an opportunity for equipment vendors to test products across multiple continents in real-time. The focus of GMI 2006 is to demonstrate multi-vendor interoperability to achieve Fixed Mobile Convergence supporting the IMS service framework. The event validates MSF Release 3 Implementation Agreements covering:

- Roaming services across multiple network types
- QoS (Session Border Controller and Bandwidth Manager)
- IP Carrier Interconnect/Interworking
- Security interoperability
- 3rd party applications and service brokering
- Network management and OSS
- IPv4/6 Interworking

2 The Gq´ interface

ETSI/TISPAN defines a standard for the interface known as Gq´ [1]. The standard is based on the IETF Diameter protocol [2] where the Diameter objects are transported by the IETF SCTP protocol [3] or TCP.

Gq´ is intended for communication between application functions (e.g., SIP based call session control functions) and the Resource and Admission Control Subsystem (RACS) to support resource-based and policy-based admission control.

The interface was introduced by the 3GPP as Gq [4] for policy setup information exchange between the 3GPP Application Function (AF) and Policy Decision Function (PDF). It has been adopted and modified by the ETSI/TISPAN (and renamed Gq’) to support fixed access.

The previous work in the MSF on the Network Resource Control Protocol (NRCP) [5] has served as input to ETSI/TISPAN.

The MSF has determined that Gq´ meets its needs for a protocol for making admission requests to a Bandwidth Manager. This MSF IA scopes the Gq´ standard for interoperability test in GMI 2006.

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3 Applicability and Scope

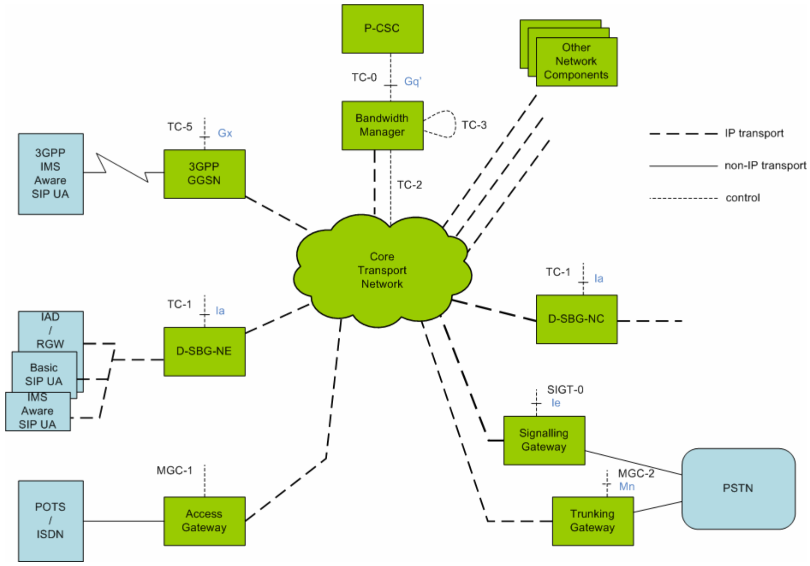

Figure 1 MSF R3 architecture (bandwidth manager interfaces)

This IA covers the interfaces for making resource and policy admission requests from call session control entities to the Bandwidth Manager. In the previous MSF architecture (release 2), this interface is known as IF-2. The interfaces covered by this IA according to the MSF R3 architecture [6] (Figure 1) are:

- Call Session Control entities to Bandwidth Manager (TC-0)
- Bandwidth Manager to Bandwidth Manager (TC-3).

In a Gq´ implementation as described in the standards, TC-0 would carry address binding information so that the S-SBG can interact with the bandwidth manager which in turn can control the D-SBGs through TC-1. In release 3 of the MSF architecture, however, the approach is that the S-SBG directly controls the D-SBG, based on the response from the Bandwidth Manager. Consequently, the parts of Gq´ concerning address bindings for NAT and FW control are not used.

For GMI 2006, reservations in the Bandwidth Managers are performed domain-by-domain using domain-internal address spaces. Requests over TC-0 may concern access, core or interconnect resources using the appropriate address space in each case.

TC-3 can be used for load balancing and wholesale/retail scenarios without requiring any additional extensions to the protocol. Since no such scenarios are planned for GMI 2006, this implementation agreement does not further describe the use of TC-3.

4 Protocol procedures for GMI 2006

The protocol for Gq´ is defined in [1] (ETSI TS 183 017).

Unless stated, implementations of TC-0 interface in MSF GMI 2006 architecture SHALL be in accordance with definitions in ETSI TS 183 017 [1].

Note: The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", "OPTIONAL", “CONDITIONAL” and “IF” in this document are to be interpreted as described in the Technical Committee Operating Procedures.

This section provides further clarification and scoping of required protocol procedures for GMI 2006. In section 6 we provide a detailed description of the procedures.

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- Only soft state reservations are supported. This means that reservations MUST be refreshed by call session control. This will make sure that timed out reservations are eventually removed in failure cases where call session control has lost state about individual sessions. The AA-Request message MUST therefore contain an Authorization-Lifetime AVP to indicate the maximum desired lifetime of the reservation. Reservations that are not refreshed within the authorization lifetime (plus a grace period) given in the AA-Answer will be removed by the BM.

- Reservations are REQUIRED to use only the single phase reservation method which means that reservations for bandwidth will be committed immediately. When bandwidth is requested, it will also be committed at the same time. This is communicated by setting the Flow-Status AVP to the value ENABLED, ENABLED-UPLINK or ENABLED-DOWNLINK. Note that committed bandwidth can be modified (and re-committed) at a later time.

- Support for the Reservation-Priority AVP is REQUIRED.

Support for the following AVPs is REQUIRED in addition to what is mandated by RFC3588:

- Media-Component-Description
- Media-Component-Number
- Media-Sub-Component
- Flow-Number
- Flow-Description
- Flow-Usage
- Max-Requested-Bandwidth-UL
- Max-Requested-Bandwidth-DL
- Flow-Status
- AF-Application-Identifier
- Media-Type
- Flow-Status
- Reservation-Priority
- SIP-Forking-Indication
- Authorization-Lifetime
- Experimental-Result

5 Call flow

The following section describes sample call flows for the network pictured below with two SIP endpoints communicating in a single domain through two different P-CSCs. The example describes the situation where an S-SBG-NE acts as a P-CSC (MSF) and controls a D-SBG-NE over H.248. The described reservations are unidirectional.

The interaction between P-CSC and D-SBG-NE in the call diagram serves only to illustrate the order in which information flows between the different components. For details regarding the H.248 flow, refer to MSF-IA-MEGACO.009-FINAL.

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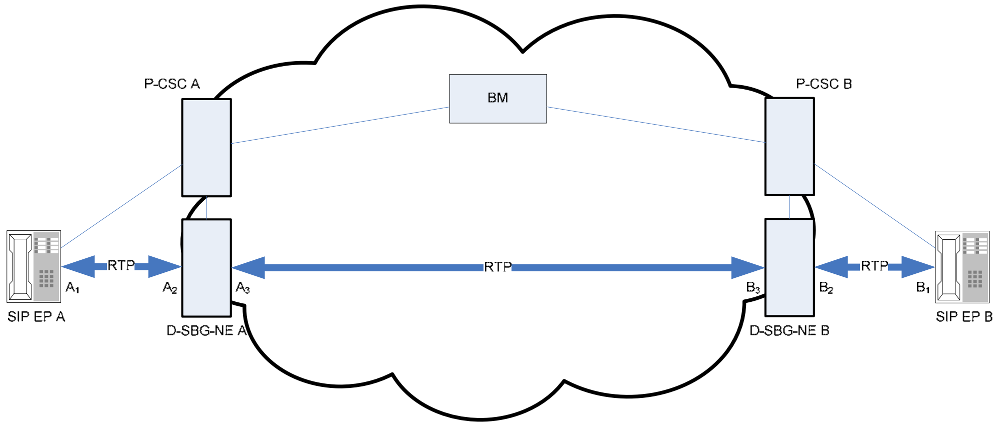

Figure 2 P-CSC(MSF)/Bandwidth Manager example scenario

A_3 and B_3 are IP addresses internal to the operator domain while A_1, A_2, B_1 and B_2 are external (public) addresses. Detailed information regarding the Diameter commands to the Bandwidth Manager (AAR, AAA, STR and STA) is provided in chapter 6.

5.1 Successful call

The following example call graph describes a situation where sufficient bandwidth is available in both directions.

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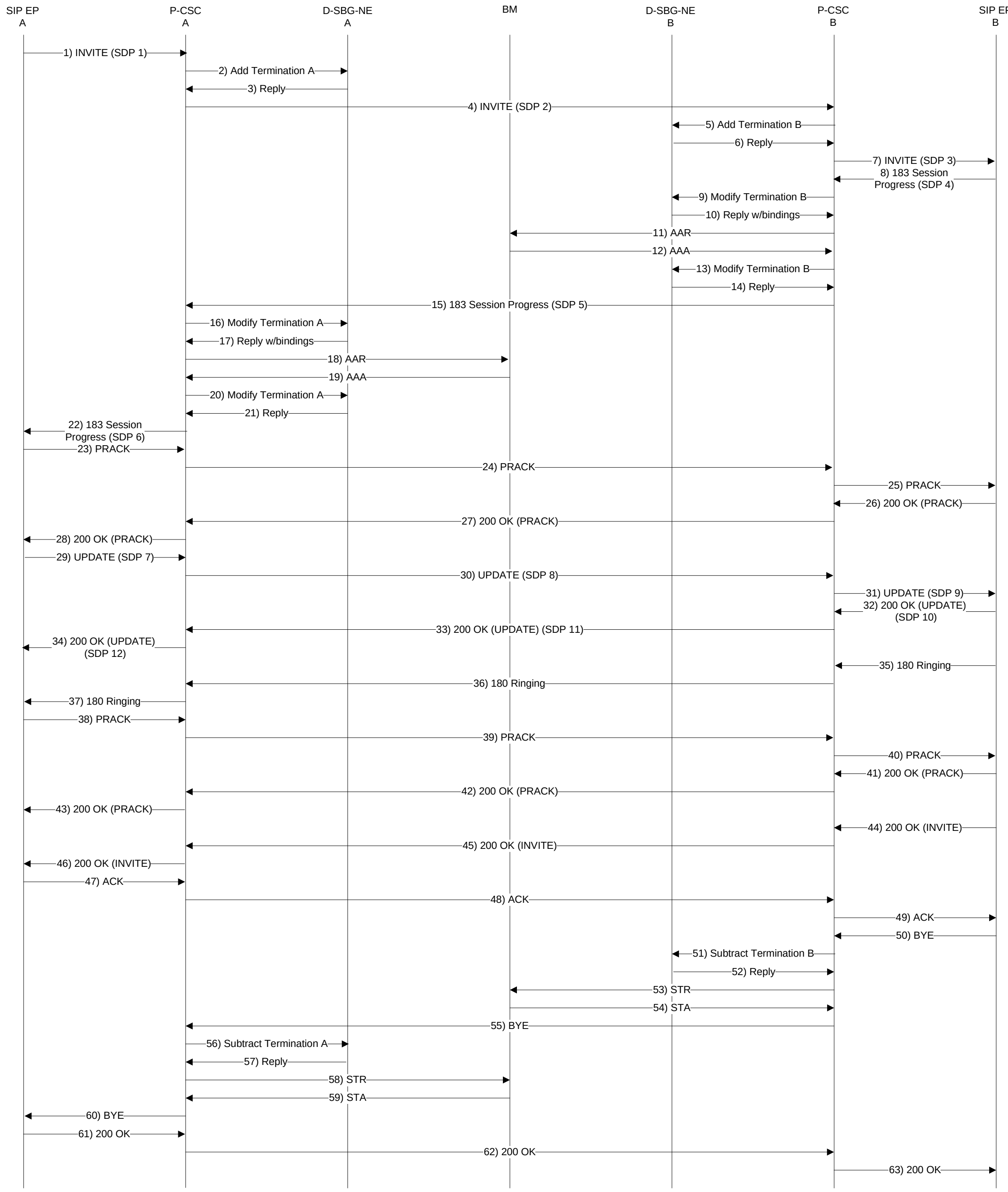

Note: In this example, the P-CSC awaits all the address information from the SIP signaling and D-SBG interaction before reserving network resources. If the P-CSC knows the media addresses used, the bandwidth reservation may be performed earlier.

1. EP A sends an INVITE to EP B over P-CSC A, providing its own media address A_1 in SDP 1.
2. P-CSC A adds two ephemeral terminations for the media stream, one termination (A_2) in the same domain as EP A and the other (A_3) in the operator domain.
3. D-SBG-NE A replies with the created context and terminations (A_2 and A_3).
4. P-CSC A forwards the invite to P-CSC B, replacing EP A's media address/port A_1 in the SDP (creating SDP 2) with the internal address/port A_3 allocated in step 3.

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5. P-CSC B adds two ephemeral terminations for the media stream (B_3 in the operator domain and B_2 in the same domain as EP B).
6. D-SBG-NE B replies with the created context and terminations (B_2 and B_3).
7. P-CSC B sends the invite to EP B, replacing SDP 2's internal media address/port combination A_3 with B_2, the public routable address/port combination received in step 6, creating SDP 3.
8. EP B sends a 183 Session Progress to P-CSC B including its own media address, B_1 in SDP 4.
9. P-CSC B modifies the terminations with information from SDP 4.
10. D-SBG-NE B replies with the modified terminations and bindings.
11. P-CSC B reserves bandwidth unidirectionally in the network for the media stream from A_3 to B_3 inside the operator domain.
12. BM replies that the requested bandwidth is available.
13. P-CSC B modifies the terminations by opening the created pinholes (Pinholes are closed at creation).
14. D-SBG-NE B replies that the pinholes are opened.
15. P-CSC B forwards the 183 Session Progress message with its own allocated internal address/port combination B_3 in SDP 5.
16. P-CSC A modifies the terminations with information from SDP 5.
17. D-SBG-NE A replies with modified termination information and bindings.
18. P-CSC A reserves bandwidth unidirectionally in the network for the media stream from B_3 to A_3.
19. The Bandwidth Manager replies that the requested bandwidth is available.
20. P-CSC A opens the created pinholes.
21. D-SBG-NE A replies that the pinholes have been opened.
22. P-CSC A forwards the 183 Session Progress message with an updated SDP (SDP 6) containing the address A_2 acquired in step 3.
23. EP A acknowledges the Session Progress messages by sending PRACK to P-CSC A
24. P-CSC A forwards the PRACK to P-CSC B.
25. P-CSC B forwards the PRACK to EP B.
26. EP B sends 200 OK to P-CSC B to indicate that the PRACK was received.
27. P-CSC B passes the 200 OK on to P-CSC A.
28. P-CSC A forwards the 200 OK to EP A.
29. EP A creates SDP 7 to indicate with preconditions that it has reserved bandwidth for the path from EP B to EP A.
30. P-CSC A forwards UPDATE to P-CSC B creating SDP 8 indicating that bandwidth has been reserved.
31. P-CSC B sends the UPDATE to EP B with SDP 9 stating in the precondition header that bandwidth is reserved from EP B to EP A.
32. EP B acknowledges this with a 200 OK to P-CSC B and includes an SDP (SDP 10) stating that EP B has reserved bandwidth for the traffic from EP A to EP B (The e2e sendrecv precondition is now met).
33. P-CSC B creates SDP 11 with preconditions stating that bandwidth is reserved end-to-end and forwards the 200 OK to P-CSC A.
34. P-CSC A includes preconditions (e2e sendrecv) in SDP 12 and forwards the 200 OK to P-CSC A.
35. EP B sends 180 Ringing to P-CSC B.[1]
36. P-CSC B forwards the 180 Ringing to P-CSC A.
37. P-CSC A sends the 180 Ringing to EP A. (EP A rings)
38. EP A acknowledges the 180 Ringing by sending a PRACK to P-CSC A.
39. P-CSC A forwards the PRACK to P-CSC B.
40. P-CSC B sends the PRACK to EP B.
41. EP B acknowledges the PRACK with a 200 OK.
42. P-CSC B forwards the 200 OK (PRACK) to P-CSC A.
43. P-CSC A sends the 200 OK (PRACK) on to EP A.
44. EP B goes off-hook causing EP B to acknowledge the initial INVITE by sending a 200 OK to P-CSC B.
45. P-CSC B forwards the 200 OK to P-CSC A.
46. P-CSC A passes the 200 OK on to EP A.
47. EP A sends an ACK to P-CSC A.

[1] 180 Ringing can be initiated from EP B at any point in time after EP B has sent an OK to acknowledge the UPDATE (step 28)

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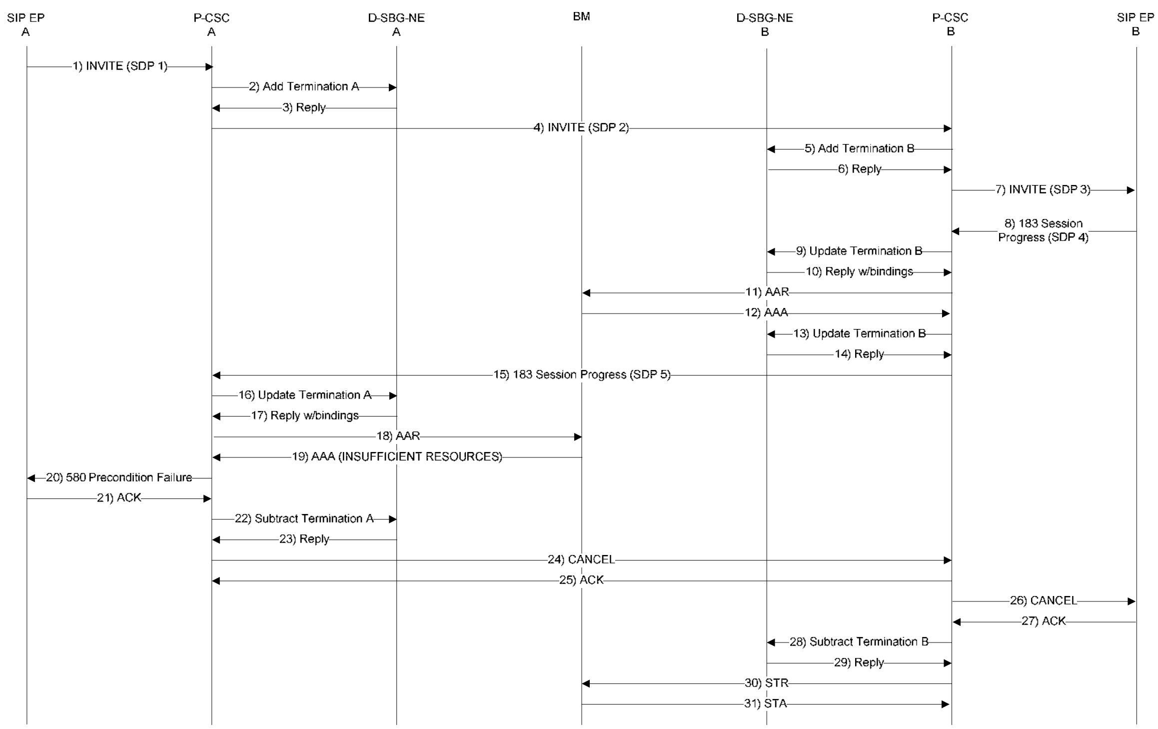
48. P-CSC forwards the ACK to P-CSC B.
49. P-CSC B sends the ACK to EP B and media can begin to flow between the endpoints in both directions through both session border gateways.
50. EP B goes on-hook and sends a BYE to P-CSC B.
51. PCSC B requests D-SBG-NE B to subtract the terminations created for the media stream.
52. D-SBG-NE replies that the terminations have been subtracted and the pinhole/NAT mapping created for the media stream from EP A to EP B no longer exists.
53. P-CSC B stops the bandwidth reservation for the media from EP A to EP B by sending a Session Termination Request (STR) to the Bandwidth Manager.
54. The BM replies with a Session Termination Answer confirming that the bandwidth reservation has been removed.
55. P-CSC B forwards the BYE to P-CSC A.
56. P-CSC A requests D-SBG A to subtract the terminations created for the call.
57. D-SBG A replies to indicate that the terminations have been subtracted.
58. P-CSC A sends STR to the BM.
59. The BM replies with STA. Both unidirectional reservations for the media stream have now been stopped.
60. P-CSC A forwards the BYE to EP A.
61. EP A acknowledges the BYE by sending a 200 OK to P-CSC A.
62. P-CSC A forwards the 200 OK to P-CSC B.
63. P-CSC B sends the 200 OK to EP B and the call is completed.

5.2 Unsuccessful call

The call graph below describes a situation where sufficient resources are not available in the network. The Bandwidth Manager denies the resource reservation request; the P-CSCs cancel the call and subtract their respective terminations set up for the media stream. IP Address information follows the previous example.



1. EP A sends an INVITE to EP B over P-CSC A, providing its own media address in SDP 1.
2. P-CSC A adds two ephemeral terminations for the media stream.
3. D-SBG-NE A replies with the created context and terminations.

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4. P-CSC A forwards the invite to P-CSC B, replacing EP A's media address/port in the SDP (creating SDP 2) with the internal address/port allocated in step 2.
5. P-CSC B adds two ephemeral terminations for the media stream.
6. D-SBG-NE B replies with the created context and terminations.
7. P-CSC B sends the invite to EP B, replacing SDP 2's internal media address/port combination with the public routable address/port combination received in step 6 (SDP 3).
8. EP B sends a 183 Session Progress to P-CSC B including its own media address in SDP 4.
9. P-CSC B modifies the terminations with information from SDP 4.
10. D-SBG-NE B replies with terminations and bindings.
11. P-CSC B reserves bandwidth unidirectionally in the network for the media stream from D-SBG-NE B to D-SBG-NE A.
12. BM replies that the requested bandwidth is available.
13. P-CSC B modifies the terminations to open pinholes for the media traffic.
14. D-SBG-NE B replies to inform P-CSC B that the pinholes are now opened.
15. P-CSC B forwards the 183 Session Progress message with its own allocated internal address/port combination (SDP 5) for the media flow.
16. P-CSC A modifies the termination with information from SDP 5.
17. D-SBG-NE A replies with updated termination information and bindings.
18. P-CSC A attempts to reserve bandwidth unidirectionally in the network for the media stream between D-SBG-NE B and D-SBG-NE A.
19. The Bandwidth Manager replies with the error message: "INSUFFICIENT RESOURCES" to indicate that admitting the reservation would have caused congestion and deterioration of existing sessions in the network.
20. P-CSC A sends a 580 Precondition Failure to EP A to inform EPA that resource reservation failed and the call can not be completed.
21. EP A indicates that the 580 Precondition Failure was received by sending an ACK to P-CSC A.
22. P-CSC detects that the call failed and instructs the D-SBG-NE A to remove the context and subtract the terminations.
23. D-SBG-NE A replies to acknowledge that the context has been removed and the terminations have been subtracted.
24. P-CSC A sends CANCEL to P-CSC B.
25. P-CSC B ACKs the CANCEL back to P-CSC A
26. P-CSC B forwards the CANCEL message to EP B
27. EP B sends an ACK to P-CSC B
28. P-CSC B requests D-SBG-NE B to remove the context, and subtract the terminations since the call is cancelled
29. D-SBG-NE B replies to acknowledge that the context has been removed and the terminations have been subtracted.
30. P-CSC B sends STR to BM to release the reserved resources for the cancelled call.
31. BM replies with STA to indicate that the unidirectional reservation from D-SBG-NE B to D-SBG-NE A (B_3 to A_3) has been stopped.

6 Gq' procedures

6.1 Procedures at the P-CSC

6.1.1 Capability information exchange

Before any initial resource requests can be made, the P-CSC must first establish a transport connection with the BM and exchange information regarding the supported capabilities to make sure that the P-CSC and the BM support the same command set. This is done through the Diameter CER/CEA commands. The Capability Exchange Request command is defined by:

```
<CE-Request> ::= < Diameter Header: 257, REQ >
                 { Origin-Host }
                 { Origin-Realm }
```

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```
                  1* { Host-IP-Address }
                  { Vendor-Id }
                  { Product-Name }
                  2* { Supported-Vendor-Id }
                  1* { Vendor-Specific-Application-Id }
```

The value of the Auth-Application-Id AVP in the grouped Vendor-Specific-Application-Id shall be set to 16777222 to advertise support of the Gq specific application and the vendor identifier AVP (Vendor-Id) shall be set to 10145 (3GPP) in the CER/CEA. In addition to this, the AF and SPDF shall advertise the support of additional Vendor-ID AVPs by including the value ETSI (13019) and 3GPP (10415) in two Supported-Vendor-Id AVPs of the CER and CEA commands to advertise support for Gq'.

6.1.2 Request for network resources

A bandwidth reservation request is made over Gq' through an AA-Request in which the value of the Session-ID AVP is new (i.e. currently unused in the BM system). When relevant IP addresses and ports are available in the SDP, the P-CSC shall reserve bandwidth for the media streams between D-SBG-NE A and D-SBG-NE B. A Media-Component-Description AVP with one Media-Sub-Component AVP for each direction shall be included in the AA-Request. By including these AVPs, the P-CSC requests resources for the defined media flows. All Flow-Status AVPs shall be set to ENABLED in their respective direction.

The P-CSC may, in an AA-Request, include the Reservation-Priority AVP at request level in the AA-Request in order to assign a priority to the request or in the Media-Sub-Component AVP to request priority to individual media. Components implementing TC-0 MUST support the Reservation-Priority AVP. The AA-Request message may contain the Authorization-Lifetime AVP set to the maximum lifetime requested for the reservation. If the duration of the call exceeds the authorization lifetime received in the reply, the reservation must be periodically refreshed according to the procedures described in the next section.

An initial AA-Request is composed as follows:

```
<AA-Request> ::= < Diameter Header: 265, REQ, PXY >
                 < Session-Id >
                 { Auth-Application-Id }
                 { Origin-Host }
                 { Origin-Realm }
                 { Destination-Realm }
              1* { Media-Component-Description }
                 [ Authorization-Lifetime ]
                 [ Reservation-Priority ]
                 [ SIP-Forking-Indication ]
```

For GMI, an initial AA-Request MUST contain at least one Media-Component-Description.

The Session-Id MUST be composed of the sender's identity encoded in the DiameterIdentity type as described in [2] followed by a semicolon and a globally unique string that can be used to uniquely identify a user session without reference to any other information. The Bandwidth Manager will correlate reservations or groups of reservations to this globally unique string.

6.1.3 SIP Forking

The SIP-Forking-Indication AVP is optional and MAY be used by the P-CSC to inform the Bandwidth Manager that network resources common to all the call legs described in the Media-Component-Description should be shared.

When a SIP session has been originated by a connected User Agent, the P-CSC may receive multiple provisional responses due to forking before the first final answer is received. The UA and the P-CSC become aware of the forking only when the second provisional response arrives. For this, and any subsequent provisional response, the P-CSC shall use an AA-Request with the existing Diameter session containing the SIP-Forking-Indication AVP and include the service information derived from the latest provisional response.

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6.1.4 Extending the lifetime of an existing session

For each active SIP session longer than the authorization lifetime provided by the Bandwidth Manager, a P-CSC MUST issue periodic refresh AA-Requests to extend the lifetime of the corresponding resource reservation. For such AA-Requests, it is sufficient to provide the session-id and the mandatory AVPs.

A refresh AA-Request is composed as follows:

```
<AA-Request> ::= < Diameter Header: 265, REQ, PXY >
                 < Session-Id >
                 { Auth-Application-Id }
                 { Origin-Host }
                 { Origin-Realm }
                 { Destination-Realm }
                 [ Authorization-Lifetime ]
```

6.1.5 Session modification

To modify a session, the P-CSC shall send an update for the session description information to the BM based on the new session description information exchanged in the P-CSC session signalling. This is done by sending an AA-Request message with an existing Session-Id and Media-Component-Description AVP containing the updated service information. Modification must be atomic so that already reserved bandwidth on network elements shared by the old and new reservation may not be unreserved by the BM during modification. (I.e. by modifying a session, the bandwidth manager must ensure that already reserved bandwidth on any parts of the path between source and destination common to both the old and new reservation is not unreserved during modification.)

6.1.6 Session termination

When a SIP session is terminated, each involved P-CSC shall terminate the corresponding BM Diameter session by sending a Session-Termination-Request message to the BM with which it established the BM Diameter session.

An ST-Request is composed as follows:

```
<ST-Request> ::= < Diameter Header: 275, REQ, PXY >
                 < Session-Id >
                 { Origin-Host }
                 { Origin-Realm }
                 { Destination-Realm }
                 { Termination-Cause }
                 { Auth-Application-Id }
```

6.1.7 Lifetime expiration

Should a P-CSC not extend the lifetime of a Diameter session within the period defined by the sum of the Authorization-Lifetime AVP and Auth-Grace-Period AVP (as supplied from the BM in the AA-Answer) the Diameter session is terminated by the BM. No notification for lifetime expiration is provided by the BM (i.e. notification via the Specific-Action AVP is not supported by this IA).

6.2 Procedures at the BM

6.2.1 Capability information exchange

The reply to the capability information exchange request is composed similar to the request but with the REQ flag in the Diameter header cleared to indicate that the command is an answer to a request.

```
<CE-Answer> ::= < Diameter Header: 257 >
                { Result-Code }
                { Origin-Host }
                { Origin-Realm }
             1* { Host-IP-Address }
                { Vendor-Id }
```

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```
                 { Product-Name }
              2* { Supported-Vendor-Id }
                 { Vendor-Specific-Application-Id }
```

Once the capability exchange is complete, the BM is ready to accept requests.

6.2.2 Request for network resources

An initial request is identified by a new Session-ID (i.e. not currently associated with an active session for which states are maintained by the BM).

When receiving an initial request, the BM shall create the required soft-state for a new session with a life-time equal to the Authorization-Lifetime AVP provided in the AA-Request up to its maximum configured authorization lifetime. The Authorization-Lifetime AVP defines the maximum number of seconds a user may make use of the resources before another authorization request is expected.

The AA-Answer contains the following information:

```
<AA-Answer> ::= < Diameter Header: 265, PXY >
                < Session-Id >
                { Auth-Application-Id }
                { Origin-Host }
                { Origin-Realm }
                { Result-Code }
                { Authorization-Lifetime }
                { Auth-Grace-Period }
```

Upon receipt of an initial AA-Request, the BM determines based on local policy and the current resource utilization level whether or not the reservation can be granted. In case the resource situation does not admit the additional traffic described by the AA-Request, the AA-Answer shall include the Experimental-Result AVP set to INSUFFICIENT_RESOURCES.

6.2.3 SIP Forking

When receiving an AA request containing the SIP-Forking-Indication AVP with the value SEVERAL_DIALOGUES (1), the BM shall identify the existing authorization information for that Diameter session. The BM shall authorize any additional media components and any increased QoS requirements for the previously authorized media components, as requested within the service information.

The BM shall authorize the maximum bandwidth required by any of the dialogues, but not the sum of the bandwidths required by all dialogues. Thus, the QoS authorized for a media component is equal to the highest QoS requested for that media component by any of the forked responses.

6.2.4 Extending the lifetime of an existing session

A refresh request is identified by an existing Session-ID (i.e. associated with an active session for which states are maintained by the BM) and that no Binding-Information AVP or Media-Component-Description AVP is included in the AA-Request. When receiving a refresh request, the BM shall update the lifetime of the corresponding session using the Authorization-Lifetime AVP provided in the request or, in case the request specifies a value longer than the maximum allowed authorization period, the BM shall update the lifetime of the session with its configured maximum value which should be included in the AA-Answer. An AA-Answer shall be returned that contains both the Authorization-Lifetime AVP and the Auth-Grace-Period AVP.

In case the refresh request can not be granted, the AA-Answer shall include the Experimental-Result AVP set to REFRESH_FAILURE.

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6.2.5 Session termination

Upon reception of an STR message, the BM shall terminate the indicated Diameter session and release the resources allocated for the session. Thereafter, the BM shall return a STA message confirming that the Diameter session is terminated.

```
<ST-Answer> ::= < Diameter Header: 275, PXY >
                < Session-Id >
                { Origin-Host }
                { Origin-Realm }
                [ Result-Code ]
```

6.2.6 Reservation Lifetime expiration

Should the lifetime of a Diameter session expire (i.e. no refresh is issued within the period defined by the sum of the Authorization-Lifetime AVP and Auth-Grace-Period AVP) the BM shall terminate the indicated Diameter session and release the resources allocated for the session. No RAR message is sent by the BM in this case (i.e. notification via the Specific-Action AVP is not supported by this IA).

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7 References

[1]	ETSI TS 183 017 Gq’ interface based on Diameter protocol
[2]	IETF RFC 3588 Diameter Base Protocol
[3]	IETF RFC 2960 Stream Control Transmission Protocol
[4]	3GPP TS 23.209 Policy control over Gq interface
[5]	MSF-IA-NRCP.001-FINAL- Implementation Agreement for a Network Resource Control Protocol (NRCP)
[6]	msf2005.179 MSF Release 3 Architecture

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Appendix A Diameter Information

1 Diameter Header

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    Version    |                 Message Length                |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| command flags |                  Command-Code                 |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                         Application-ID                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                      Hop-by-Hop Identifier                    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                      End-to-End Identifier                    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  AVPs ...
+-+-+-+-+-+-+-+-+-+-+-+-+-
```

The Application-ID field of the Diameter header must be set to 16777222 to advertise support for the Gq application.

2 AVP Headers and Vendor-Id

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                           AVP Code                            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|V M P r r r r r|                  AVP Length                   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        Vendor-ID (opt)                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    Data ...
+-+-+-+-+-+-+-+-+
```

The Vendor-ID field in the AVP header information defines the application for which the AVP is defined. It is optional for backwards compatibility with RADIUS. AVPs common to both RADIUS and Diameter with an AVP code lower than 255 can have the Vendor-Id-field set to 0 but do not require the Vendor-ID field to be present.

AVP	**Vendor-Id**
Reservation-Priority	ETSI (13019)
AF-Application-Identifier	3GPP (10415)
Flow-Description	3GPP (10415)
Flow-Number	3GPP (10415)
Flow-Status	3GPP (10415)
Flow-Usage	3GPP (10415)
Max-Requested-Bandwidth-DL	3GPP (10415)
Max-Requested-Bandwidth-UL	3GPP (10415)
Media-Component-Description	3GPP (10415)
Media-Component-Number	3GPP (10415)
Media-Sub-Component AVP	3GPP (10415)
Media-Type	3GPP (10415)
SIP-Forking-Indication	3GPP (10415)
Authorization-Lifetime	0 (Optional)

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Vendor Id for Experimental-Result-Code AVPs

Result code AVP	**Vendor-Id**
Experimental-Result-Code INSUFFICIENT_RESOURCES (4041)	ETSI (13019)
Experimental-Result-Code REFRESH_FAILURE (4044)	ETSI (13019)
Experimental-Result-Code PRIORITY_NOT_GRANTED (4047)	ETSI (13019)
Experimental-Result-Code MODIFICATION_FAILURE (5041)	ETSI (13019)

3 Diameter Examples

The following describes example Diameter commands with sample AVPs. Fields in angle brackets are mandatory and position dependent. Fields in curly brackets are mandatory and fields in square brackets are optional. The Media-Component-Description is mandatory in the initial reservation request but optional in reservation refresh requests.

3.1 Capabilities Exchange Request (CE-Request)

```
<CE-Request> ::=    < Diameter Header: 257, REQ >
                    { Origin-Host = “csc.net-a.gmi2006.com”}
                    { Origin-Realm = “net-a.gmi2006.com”}
                 1* { Host-IP-Address = 172.16.0.1 }
                    { Vendor-Id = Example Inc. (999999) }
                    { Product-Name = “Example Inc. P-CSC”}
                    { Supported-Vendor-Id = 10145 (3GPP) }
                    { Supported-Vendor-Id = 13019 (ETSI) }
                    { Vendor-Specific-Application-Id =
                            { Vendor-Id = 3GPP (10415) }
                            { Auth-Application-Id = 16777222 (Gq) }
                    }
```

Including a Supported-Vendor-Id AVP with the value 13019 (ETSI) in addition to 10145 (3GPP) in the capabilities exchange command indicates support for ETSI/TISPAN Gq’ and the extensions defined in [1].

3.2 Capabilities Exchange Answer (CE-Answer)

```
<CE-Answer> ::=     < Diameter Header: 257 >
                    { Result-Code = DIAMETER_SUCCESS (2001) }
                    { Origin-Host = “bm.net-a.gmi2006.com” }
                    { Origin-Realm = “net-a.gmi2006.com” }
                 1* { Host-IP-Address = 172.16.0.2 }
                    { Vendor-Id = Example Inc. (999999) }
                    { Product-Name = “Example Inc. Bandwidth Manager” }
                    { Supported-Vendor-Id = 10145 (3GPP) }
                    { Supported-Vendor-Id = 13019 (ETSI) }
                    { Vendor-Specific-Application-Id =
                            { Vendor-Id = 3GPP (10415) }
                            { Auth-Application-Id = 16777222 (Gq) }
                    }
```

3.3 Authenticate and Authorize Request (AA-Request)

```
<AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                < Session-Id = “csc.net-a.gmi2006.com;13815C;391” >
                { Auth-Application-Id = 16777222 (Gq) }
                { Origin-Host = “csc.net-a.gmi2006.com” }
                { Origin-Realm = “net-a.gmi2006.com” }
                { Destination-Realm = “net-a.gmi2006.com” }
                [ Media-Component-Description =
                        { Media-Component-Number = 1 }
                        { Media-Sub-Component =
                            { Flow-Number = 1 }
                            { Flow-Description = “permit in 17 from any to 2.3.4.5
                24322” }
```

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```
                                        [ Flow-Usage = NO_INFORMATION(0) ]
                                    }
                                    [ AF-Application-Identifier = "MSF_IMS_GMI2006"]
                                    { Media-Type = AUDIO (0) }
                                    { Max-Requested-Bandwidth-UL = 120000 }
                                    { Flow-Status = ENABLED_UPLINK }
                                    [ Reservation-Priority = DEFAULT (0) ]
                            ]
                            [ Reservation-Priority = DEFAULT (0) ]
                            { Authorization-Lifetime = 450 }
```

Since the Bandwidth Manager does not perform gate control in the MSF R3 architecture, the port number given in the example above is not used. It is only there to satisfy the syntactic structure of the Flow-Description AVP. The wildcard 'any' is used to denote unknown IP addresses and ports and may be replaced with IP address information when/if such would become available.

The Reservation-Priority AVP can occur both in the Media-Component-Description AVP to request priority to individual media and at request level to assign priority to the request. If the Reservation-Priority AVP is not specified, the requested priority is DEFAULT (0). While the AVP is optional, components communicating over TC-0 MUST support the Reservation-Priority AVP to enable correct treatment of emergency and priority calls.

The Flow-Status AVP in this example is set to ENABLED_UPLINK representing the unidirectional media flow from SIP EP A to SIP EP B in Figure 1.

Note: The following example shows a bidirectional reservation.
It is not aligned with the call flow example in section 5.

```
<AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                < Session-Id = "csc.net-a.gmi2006.com;524950;2043444C" >
                { Auth-Application-Id = 16777222 (Gq) }
                { Origin-Host = "csc.net-a.gmi2006.com" }
                { Origin-Realm = "net-a.gmi2006.com" }
                { Destination-Realm = "net-a.gmi2006.com" }
                [ Media-Component-Description =
                        { Media-Component-Number = 1 }
                        { Media-Sub-Component =
                            { Flow-Number = 1 }
                            { Flow-Description = "permit in 17 from 2.3.4.5 24322 to
                1.2.3.4 29358" }
                            { Flow-Description = "permit out 17 from 1.2.3.4 29358 to
                2.3.4.5 24322" }
                            [ Flow-Usage = NO_INFORMATION(0) ]
                        }
                        [ AF-Application-Identifier = "MSF_IMS_GMI2006"]
                        { Media-Type = AUDIO (0) }
                        { Max-Requested-Bandwidth-UL = 120000 }
                        { Max-Requested-Bandwidth-DL = 120000 }
                        { Flow-Status = ENABLED }
                        [ Reservation-Priority = DEFAULT (0) ]
                ]
                [ Reservation-Priority = DEFAULT (0) ]
                { Authorization-Lifetime = 450 }
```

Note that the Flow-Status AVP set to ENABLED indicates a bidirectional flow.

3.4 Authenticate and Authorize Answer (AA-Answer)

```
<AA-Answer> ::= < Diameter Header: 265, PXY >
                < Session-Id = "csc.net-a.gmi2006.com;13815C;391" >
                { Auth-Application-Id = 16777222 (Gq) }
                { Origin-Host = "bm.net-a.gmi2006.com" }
                { Origin-Realm = "net-a.gmi2006.com" }
                { Result-Code = DIAMETER_SUCCESS (2001) }
```

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```
                { Authorization-Lifetime = 450 }
                { Auth-Grace-Period = 10 }
```

3.5 Session Termination Request (ST-Request)

```
<ST-Request> ::=< Diameter Header: 275, REQ, PXY >
                < Session-Id = "csc.net-a.gmi2006.com;13815C;391" >
                { Auth-Application-Id = 16777222 (Gq) }
                { Origin-Host = "csc.net-a.gmi2006.com" }
                { Origin-Realm = "net-a.gmi2006.com" }
                { Destination-Realm = "net-a.gmi2006.com" }
                { Termination-Cause = DIAMETER_LOGOUT (1) }
```

3.6 Session Termination Answer (ST-Answer)

```
<ST-Answer> ::= < Diameter Header: 275, PXY >
                < Session-Id = "csc.net-a.gmi2006.com;13815C;391" >
                { Result-Code = DIAMETER_SUCCESS (2001) }
                { Origin-Host = "bm.net-a.gmi2006.com" }
                { Origin-Realm = "net-a.gmi2006.com" }
```

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