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Technical Specification

Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Resource and Admission Control System (RACS); Protocol Signalling flows specification; RACS Stage 3

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN).

1 Scope

The present document specifies normative rules for how to use the Gq', Rq, Ia and Re protocols (TS 183 017 [4], ES 283 026 [3] ES 283 018 [7] and TS 183 060 [9]) as of TISPAN release 2. These rules apply to the interface between:

- P-CSCF and SPDF using Gq';

- IBCF and SPDF using Gq';

- SPDF and (C- and I-) BGF using Ia;

- SPDF and x-RACF using Rq;

- x-RACF and RCEF using Re.

In addition, to illustrate the usage of these rules, the present document contains informative signalling flows between the above-listed entities.

The present document covers both IMS and non-IMS AFs, and both conversational services such as telephony and non-conversational services such as IPTV.

For IPTV, both unicast and multicast are covered, as well as the push and pull models for interactions with the ECF/EFF. Conversational multicast services and the usage of pull for conversational services is out of the scope for the present document.

In case of any discrepancy between the end-to-end IMS signalling flows in the present document and the ETSI TISPAN IMS specifications (TS 182 006 [5], ES 283 003 [6] and TS 183 063 [10]), the ETSI TISPAN IMS specifications shall take precedence.

The following specific topics are covered in the present document;

- policy enforcement in the RCEF;

- error handling over Ia;

- transcoding in the I/C-BGF;

- reservations requests in overbooking mode;

- address latching for hosted NAPT/NAPT-PT traversal.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:

    - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;

    - for informative references.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

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2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

[1] IETF RFC 3550: "RTP: A Transport Protocol for Real-Time Applications".

[2] ETSI TS 129 207: "Digital cellular telecommunications system (Phase 2+);Universal Mobile Telecommunications System (UMTS); Policy control over Go interface (3GPP TS 29.207)".

[3] ETSI ES 283 026: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN);Resource and Admission Control; Protocol for QoS reservation information exchange between the Service Policy Decision Function (SPDF) and the Access-Resource and Admission Control Function (A-RACF) in the Resource and Protocol specification".

[4] ETSI TS 183 017: "Telecommunications and Internet Converged Services and Protocols for Advanced Networking (TISPAN); Resource and Admission Control: DIAMETER protocol for session based policy set-up information exchange between the Application Function (AF) and the Service Policy Decision Function (SPDF);Protocol specification".

[5] ETSI TS 182 006: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IP Multimedia Subsystem (IMS); Stage 2 description (3GPP TS 23.228 v7.2.0, modified)".

[6] ETSI ES 283 003: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IP Multimedia Call Control Protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP) Stage 3 [3GPP TS 24.229 [Release 7], modified]".

[7] ETSI ES 283 018: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Resource and Admission Control: H.248 Profile for controlling Border Gateway Functions (BGF) in the Resource and Admission Control Subsystem (RACS); Protocol specification".

[8] ETSI TS 124 229: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Internet Protocol (IP) multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3 (3GPP TS 24.229)".

[9] ETSI TS 183 060: "Telecommunications and Internet Converged Services and Protocols for Advanced Networking (TISPAN); Resource and Admission Control Subsystem (RACS); Re interface based on the DIAMETER protocol".

[10] ETSI TS 183 063: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IMS-based IPTV stage 3 specification".

[11] IETF RFC 3588: "Diameter Base Protocol".

[12] ITU-T Recommendation H.248.1: "Gateway control protocol: Version 3".

[13] IETF RFC 3246: "An Expedited Forwarding PHB (Per-Hop Behavior)".

[14] IETF RFC 4566: "SDP: Session Description Protocol".

[15] IETF RFC 2597: "Assured Forwarding PHB Group".

[16] ETSI TS 124 615: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Communication Waiting (CW) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol Specification. (3GPP TS 24.615)".

2.2   Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area**.** For non-specific references, the latest version of the referenced document (including any amendments) applies.

Not applicable.

3   Abbreviations

For the purposes of the present document, the following abbreviations apply:

AAA	AA-Answer
AAR	AA-Request
AF	Application Function
A-RACF	Access - Resource Admission Control Function
AS	Application Server
AVP	Attribute Value Pair
BGF	Border Gateway Function
C/I-BGF	Core/Interconnection Border Gateway Function
CLF	Connectivity session Location and repository Function
CW	Communication Waiting
DL	Down Link
FE	Functional Entity
IBCF	Interconnection Border Control Function
IMS	IP Multimedia Subsystem
IP	Internet Protocol
LD	Local Descriptor
MG	Media Gateway
MGC	Media Gateway Controller
NAPT	Network Address and Port Translation
NAPT-PT	Network Address and Port Translation - Protocol Translation
NAT	Network Address Translation
NDUB	Network Determined User Busy
PCMU	Pulse Code Modulation Mu-law
P-CSCF	Proxy - Call Session Control Function
RACS	Resource and Admission Control Subsystem
RCEF	Resource Control Enforcement Function
RTCP	Real Time Control Protocol
RTP	Real Time Protocol
SDP	Session Description Protocol
SIP	Session Initiation Protocol
SPDF	Service-based Policy Decision Function
UDP	User Datagram Protocol
UE	User Equipment
UL	Up Link
XML	eXtensible Markup Language

4 Example call flow

This clause contains a set of informative example call flows.
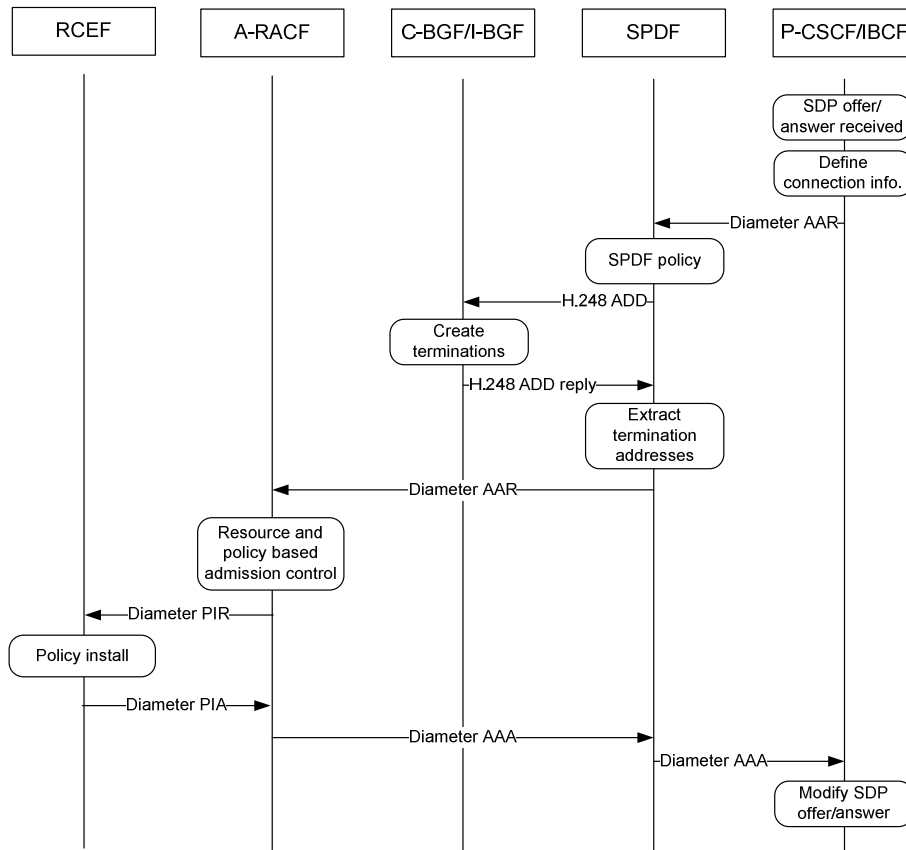
Figure 4.1: RACS, RCEF, BGF and P-CSCF/IBCF interactions (alternative 1)

Figure 4.1 illustrates the basic interactions involved when requesting a resource reservation from RACS for an IMS call. It should be noted that the SPDF may interrogate I/C-BGF and x-RACF (shown as A-RACF in figure 4.1) in any order. Hence, interacting with the C-BGF after the x-RACF as shown in figure 4.1 is not mandated, and the SPDF may instead interrogate the x-RACF before the I/C-BGF as shown in figure 4.2, or interrogate these entities in parallel.
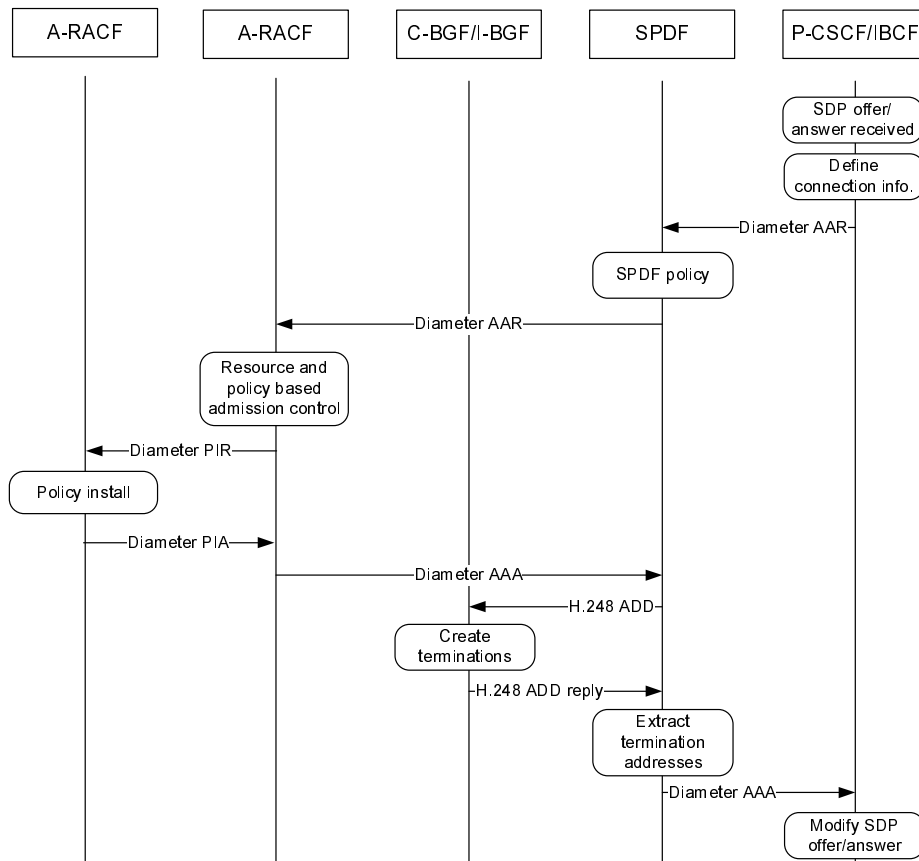
Figure 4.2: RACS, RCEF, BGF and P-CSCF/IBCF interactions (alternative 2)

For some deployments, the extraction of termination addresses done by the SPDF for signalling to the x-RACF may rely on information coming from I/C-BGF. For example, the x-RACF may need the local termination address at the C-BGF when performing resource and admission control for the network in between the RCEF and the C-BGF. Unless this address information can be derived by other means, the SPDF needs to interrogate the C-BGF to obtain the local termination address at the C-BGF before issuing a Diameter AAR to the x-RACF.

The interactions illustrated in figure 4.1 (and figure 4.2) are repeated twice for each call setup and each SPDF instance along the path of the attempted call as described in the following clauses.

5 RACS related procedures

This clause specifies normative rules for how to use the Gq', Rq, Ia and Re protocols.

5.1 Procedures at P-CSCF/IBCF

5.1.1 Resource and admission control

This clause describes the rules used by the P-CSCF/IBCF to derive the bandwidth to request from RACS.

In case being present, the b= attribute will correspond to the bandwidth required by the most bandwidth demanding codec in the list. Hence, the Max-Requested-Bandwidth-UL and -DL shall be set to the value given by the b= attribute if present.

In case the b= attribute is not present the P-CSCF/IBCF shall set these AVPs according to one of the following rules:

- Set the AVPs to the value locally associated to the codec received in the m= line when only one codec is listed in the m= line or the highest bandwidth required by the codecs listed in the SDP offer (when multiple codecs are proposed for this media component).

- Set the AVPs to the value locally associated to the codec received in the m= line when only one codec is listed in the m= line or the lowest bandwidth required by the codecs listed in the SDP offer (when multiple codecs are proposed for this media component). In this case the Max-Requested-Bandwidth-UL and -DL AVPs may not reflect the actual bandwidth value that will be negotiated for the session.

- Omit the AVPs and let RACS determine a default bandwidth based on the combination of Reservation-Class and Media-Type AVPs.

The above-given rules are in line with the description given in annex B (table B.1) of TS 183 017 (Gq') [4] for how to populate the Max-Requested-Bandwidth-UL and -DL AVPs. These rules provide however more details on how to populate these AVPs referred to from TS 183 017 [4] in annex B (table B.1).

It should be noted that the above-given rules imply that the Max-Requested-Bandwidth-UL and -DL AVPs may be modified during the SDP negotiation (i.e. when the codec to be used is finally agreed between the endpoints).

5.1.2   NAPT/NAPT-PT at the P-CSCF/IBCF

Details on NAPT/NAPT-PT operations at the P-CSCF are given in TS 124 229 [8].

The IBCF supports controlled NAPT/NAPT-PT but does not support hosted NAPT/NAPT-PT traversal. That is, the IBCF is capable of replacing addresses and ports in the SDP as ephemeral terminations are created following the rules given in clauses 5.2.1.3 and 5.2.1.4, but the IBCF cannot handle address latching as used for hosted NAPT/NAPT-PT traversal. The P-CSCF is capable of both hosted NAPT/NAPT-PT traversal and controlled NAPT/NAPT-PT.

5.2   Procedures at SPDF

For resource and admission control purposes the SPDF will determine on local policy as specified in TS 183 017 [4] whether a C-BGF and/or an A-RACF need to be involved in the AF session. The SPDF procedures related to the Gq' interface involved in supporting NAPT/NAPT-PT services provided by the BGF and in supporting resource and admission control services provided by the A-RACF are described in TS 183 017 [4]. Based on these procedures this clause describes the operations of the SPDF involved in co-ordinating requests for these services made over Gq' with the required signalling over the Ia and Rq interfaces.

The co-ordination of request made over Gq' with the required signalling over the Ia interface is described in clause 5.2.1, while the co-ordination required between Gq' and the Rq interface is described in clause 5.2.2. Clause 5.2.3 describes the co-ordination of signalling over the Ia and Rq interfaces.

5.2.1   Reservation with BGF involved

The translation of values not specific to address translation received over Gq' to values used for request made over Ia is described in clause 5.2.1.1, operations involved in co-ordinating requests for NAPT/NAPT-PT services are described in clauses 5.2.1.2, 5.2.1.3 and 5.2.1.4, BGF media transcoding is described in clause 5.2.1.5 and BGF transport plane failure detection is described in clause 5.2.1.6.

5.2.1.1   Resource reservation at the BGF

Upon reception of an initial reservation (SDP offer) the SPDF will extract from the information received with the AAR the important information in order to reserve resources at the transport layer, different AVPs will be received included in the AAR, only some of them will be retransmitted over the Ia interface. The aim of this clause is to provide the transcription for those AVPs:

- The Transport class AVP may be used for pointing to a class of transport services to be applied as detailed in TS 183 017 [4], in that way it may indicate the DSCP marking and the command syntax over the Ia interface may be ds/dscp, this information may be sent through the local control descriptor.

- The value of the Reservation priority AVP may be sent over the Ia interface as the priority of the context.

The following table summarizes the population rules for setting context and termination properties, based on received DIAMETER AVPs and local configuration data.

Table 5.2.1.1.1

Context parameters	Descriptor	Descriptor	Descriptor	Properties	Population rules
Context ID					Always set by the BGF
Priority Indicator					Set from the Reservation-Priority AVP
Emergency Indicator					Set from the Service Class AVP
	Term ID				See ES 283 018 [7]
	Media				
		Stream			
			Local Control		
				Mode	Set from Flow-Status in Media-Component-Description and/or Flow-Status in Media-Component. Media-Sub-Component.
				ds/dscp	Set from Transport-Class in Media-Component-Description.
				gm/saf	Depends on the Service-Class AVP and BGF profile information.
				gm/spf	Depends on the Service-Class AVP and BGF profile information.
				gm/sam	If gm/saf is set to ON, the gm/sam property is set from the Flow-Description in Media-Component. Media-Sub-Component.
				gm/spr	If gm/spf is set to ON, the gm/spr property is set from the Flow-Description in Media-Component. Media-Sub-Component.
				gm/rsb	Depends on the value of the Media-Type AVP and BGF profile information.
				gm/esas	Depends on the Service-Class AVP and whether NAP-PT is activated.
				gm/lsa	If gm/esas is set to ON, gm/lsa is set from the address (c= line) contained in the remote descriptor of the opposite termination.
				gm/esps	Depends on the Service-Class AVP and whether NAP-PT is activated.
				gm/lsp	If gm/esps is set to ON, gm/lsp is set from the port (m= line) contained in the remote descriptor of the opposite termination.
				tman/pdr	If the Transport-Class corresponds to constant bit rate traffic, the tman/pdr property shall be equivalent to the b= line of the local descriptor or absent. If the Transport-Class corresponds to variable bit rate traffic, the tman/pdr property shall be equivalent to the b= line of the local descriptor.
				tman/mbs	From Reservation-Class AVP
				tman/dvt	From Reservation-Class AVP
				tman/sdr	If the Transport-Class corresponds to constant bit rate traffic, this property shall be omitted or identical to tman/pdr. If the Transport-Class corresponds to variable bit rate traffic this property shall be derived from tman/pdr using rules specific to the transport class.
				tman/pol	Set from the Transport-Class AVP.
			Local		c= If NAPT-PT is activated, the address shall be assigned by the BGF. Otherwise the address is set from the contents of the remote descriptor of the opposite termination. See ES 283 018 [7] for the setting of other fields of the c= line.

Context parameters	Descriptor	Descriptor	Descriptor	Properties	Population rules
					m= If NAPT-PT is activated, the port shall be assigned by the BGF. Otherwise the port is set from the contents of the remote descriptor of the opposite termination. See ES 283 018 [7] for the setting of other fields of the m= line.
					b= Shall be set from the Max-Requested-Bandwidth-UL or Max-Requested-Bandwidth-DL depending on the termination (upstream or downstream). (see note)
			Remote		c= The address is set from the Flow-Description in Media-Component. Media-Sub-Component. See ES 283 018 [7] for the setting of other fields of the c= line.
					m= The port is set from the Flow-Description in Media-Component. Media-Sub-Component. See ES 283 018 [7] for the setting of other fields of the m= line.
					b= Shall be set from the Max-Requested-Bandwidth-UL or Max-Requested-Bandwidth-DL depending on the termination (upstream or downstream). (see note)
NOTE: If gm/rsb is set to ON, the value of the AVPs associated to the RTCP flow shall be added.					

5.2.1.2 Initial reservation for an session (SDP offer)

Upon reception of an initial AAR with connection information, the SPDF shall extract the connection information from the Media-Component-Description AVP(s).

Each Media-Component-Descriptor AVP received (one per m= line or media stream) contains one or more Media-Sub-Component AVP(s) carrying a set of Flow-Descriptor AVP(s) that describe a unidirectional IP flow associated with the media stream.

The SPDF shall from the set of Flow-Descriptor AVP(s) identify the direction of the corresponding IP flows i.e. uplink or downlink. The direction of each IP flow is given by the value of the direction attribute of the corresponding Flow-description AVP (i.e. "in" for uplink IP flows, and "out" for downlink IP flows). For each potential requesting application that requires the services of a BGF, the SPDF shall hold a local mapping table that enables SPDF to ensure, that both ephemeral terminations created for the session in the BGF are configured with connection information that matches appropriately the IP flow direction with the network interface connecting the ephemeral termination.

In the P-CSCF case, an uplink IP flow originates from the UE served by the P-CSCF, and a downlink IP flow is directed towards the UE served by the P-CSCF.

In the IBCF case, an uplink IP flow is directed from the local core network towards the peer core network, and a downlink IP flow is directed from the peer core network towards the local core network.

The Binding-Input-List AVP shall be populated with an even number of V4-Transport-Address AVP or V6-Transport-Address list elements. The first list element in each pair of list elements applies to the access side and the second element applies to the core side. In case one of the V4-Transport-Address AVP or V6-Transport-Address AVP in such pair is unknown, an even number of list elements shall be still provided with the unknown V4-Transport-Address AVP or V6-Transport-Address AVP wild-carded.

The above-given rules apply to the P-CSCF but are also valid for the IBCF provided that "access side" is replaced by "local core side" and "core side" by "peer core side". It shall be one pair of V4-Transport-Address AVP or V6-Transport-Address list elements in the Binding-Input-List AVP for each single Media-Component-Description AVP in an AAR. The list of such pairs shall be given in the same order as the list of Media-Component-Description AVPs. This provides an explicit coupling between each Media-Component-Description AVP, each pair of list elements in the Binding-Input-List AVP, and each pair of terminations in the BGF.

The following description for how to create ephemeral terminations applies to the P-CSCF but is also valid for the IBCF provided that "access network" is replaced by "local core network" and "core network" by "peer core network".

After selection of the BGF to be contacted for the session, the SPDF requests initial configuration of the BGF to create a context with two ephemeral terminations:

- ephemeral termination TA connecting the access network to the BGF; and

- ephemeral termination TC connecting the core network to the BGF.
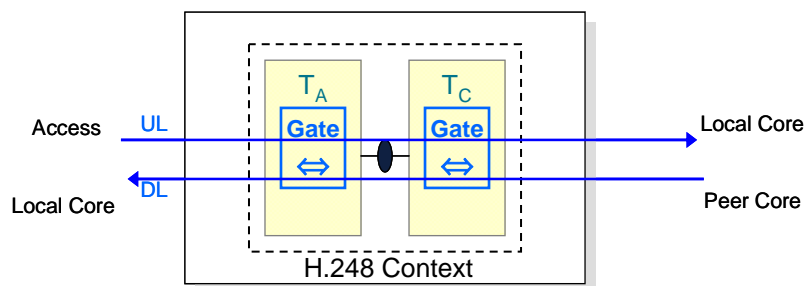
Figure 5.2.1.2.1: BGF connection and flow model representation

For connection information corresponding to a downlink IP flow, the SPDF shall:

- on termination TA:

    - define one media stream per Media-Component-Description AVP occurrence (see note 1):

        - for each media stream:

            - set the remote Descriptor to the corresponding destination IP and port address of the Flow-Description AVP marked with "out" direction and contained in the Media-Sub-Component AVP for which the Flow-Usage AVP is either absent or set to "no_information".

- on termination TC:

    - define one media stream per Media-Component-Description AVP occurrence (see note 1):

        - for each media stream:

            - if destination address NAPT(-PT) is activated for DL IP flows, request the BGF to select an IP and port address in the local Descriptor and store the selected value;

            - otherwise i.e. if destination address NAPT(-PT) is not activated for DL IP flows, set the local Descriptor to the value assigned to the remote Descriptor of termination TA;

            - optionally, configure the local control Descriptor with the gm/lsa and gm/lsp set to the value assigned to the remote Descriptor of termination TA (see note 2).

For connection information corresponding to an uplink IP flow, the SPDF shall:

- on termination TC:

    - define one media stream per Media-Component-Description AVP occurrence (see note 1):

        - for each media stream:

            - set the remote Descriptor to the corresponding destination IP and port address of the Flow-Description AVP marked with "in" direction and contained in the Media-Sub-Component AVP for which the Flow-Usage AVP is either absent or set to "no_information".

- on termination TA:

    - define one media stream per Media-Component-Description AVP occurrence (see note 1):

        ▪ for each media stream:

            - if destination address NAPT(-PT) is activated for UL IP flows, request the BGF to select an IP and port address in the local Descriptor and store the selected value;

            - otherwise i.e. if destination address NAPT(-PT) is not activated for UL IP flows, set the local Descriptor to the value assigned to the remote Descriptor of termination TC;

            - Optionally, configure the local control Descriptor with the gm/lsa and gm/lsp properties set to the value assigned to the Remote Descriptor of termination TC (see note 3).

NOTE 1:   The SPDF can also specify additional media stream for RTCP this is described in ES 283 018 [7].

NOTE 2:   This ensures that UL IP flows will be sent towards the core network using a source IP and port address identical to the address used by the UE for sending packets, assuming that the UE sends and receives packets using the same address and port.

NOTE 3:   This ensures that DL IP flows will be sent towards the access network using a source IP and port address identical to the address used to by the peer for sending packets, assuming that the peer sends and receives packets using the same address and port.

If destination address NAPT(-PT) is activated for UL and/or DL IP flows, the SPDF shall return in the AAA message the list of IP and port address(es) selected by the BGF as local Descriptors in the Binding-Output-List AVP for each media stream in the same order as the corresponding Binding-Input-List AVP of the AAR message. That is, each address and port pair received in the local Descriptor shall be included in the Binding-Output-List AVP in the same position as the address and port pair that has been included in the remote Descriptor to which it is connected and was given in the Binding-Input-List AVP. Note that the addresses and ports in the same positions in the Binding-Input-List and the Binding-Output-List AVPs correspond to terminations at different sides of the BGF.

5.2.1.3   Connection information received from the opposite direction (SDP answer)

Upon reception of a subsequent AAR with connection information, the SPDF shall extract the connection information from the Media-Component-Description AVP(s). These operations are performed as described in the previous clause.

The rules for how to populate the Binding-Input-List AVP and its relation to Media-Component-Description AVPs given in clause 5.2.1.3 apply also to this clause.

The following description for how to create ephemeral terminations applies to the P-CSCF but is also valid for the IBCF provided that "access network" is replaced by "local core network" and "core network" by "peer core network".

After selection of the BGF to be contacted for the session, the SPDF requests subsequent configuration of the context created within the BGF.

For connection information corresponding to a downlink IP flow, SPDF shall:

- modify termination TA:

    - for each media stream:

        ▪ set the remote Descriptor to the corresponding destination IP and port address of the Flow-Description AVP marked with "out" direction and contained in the Media-Sub-Component AVP for which the Flow-Usage AVP is either absent or set to "no_information".

- modify termination TC:

    - for each media stream:

        ▪ if destination address NAPT(-PT) is activated for DL IP flows, request the BGF to select an IP and port address in the local Descriptor and store the selected value;

        ▪ otherwise i.e. if destination address NAPT(-PT) is not activated for DL IP flows, set the local Descriptor to the value assigned to the remote Descriptor of termination TA;

- Optionally, configure the local control Descriptor with the gm/lsa and gm/lsp properties set to the value assigned to the Remote Descriptor of termination TA (see note 2).

For connection information corresponding to an uplink IP flow, the SPDF shall:

- modify termination TC:

    - for each media stream:

        - set the remote Descriptor to the corresponding destination IP and port address of the Flow-Description AVP marked with "in" direction and contained in the Media-Sub-Component AVP for which the Flow-Usage AVP is either absent or set to "no_information".

- modify termination TA:

    - for each media stream:

        - if destination address NAPT(-PT) is activated for UL IP flows, request the BGF to select an IP and port address in the local Descriptor and store the selected value;

        - otherwise i.e. if destination address NAPT(-PT) is not activated for UL IP flows, set the local Descriptor to the value assigned to the remote Descriptor of termination TC;

        - Optionally, configure the local control Descriptor with the gm/lsa and gm/lsp set to the value assigned to the remote Descriptor of termination TC (see note 1).

NOTE 1: This ensures that DL IP flows will be sent towards the access network using a source IP and port address identical to the address used to by the peer for sending packets, assuming that the peer sends and receives packets using the same address and port.

NOTE 2: This ensures that UL IP flows will be sent towards the core network using a source IP and port address identical to the address used by the UE for sending packets, assuming that the UE sends and receives packets using the same address and port.

If destination address NAPT(-PT) is activated for UL and/or DL IP flows, the SPDF shall return in the AAA message the list of IP and port address(es) selected by the BGF as local Descriptors in the Binding-Output-List AVP for each media stream in the same order as the corresponding Binding-Input-List AVP of the AAR message. That is, each address and port pair received in the local Descriptor shall be included in the Binding-Output-List AVP in the same position as the address and port pair that has been included in the remote Descriptor to which it is connected and was given in the Binding-Input-List AVP. Note that the addresses and ports in the same positions in the Binding-Input-List and the Binding-Output-List AVPs correspond to terminations at different sides of the BGF.

5.2.1.4 Connection information (SDP answer) received corresponding to multiple early dialogues

The SPDF may receive more than one AAR with SDP answer connection info in case the AF identifies that multiple early dialogues are being created. These AAR will be marked with a SIP-Forking-Indication AVP set to value SEVERAL_DIALOGUES. The SPDF shall request resources from the BGF as if this was an AAR (SDP answer) without Forking-Indication but shall be prepared to restore QoS requirements for one of the early dialogues. The final dialogue is identified when an AAR (SDP answer) is received without the SIP-Forking-Indication AVP.

5.2.1.5 BGF Media Transcoding

The BGF media transcoding abilities can be triggered by the Application Function (AF) in order to resolve codec incompatibilities between UEs or administratively through local configuration in order to enforce the use of specific codecs within the core network. If used to resolve codec incompatibilities between UEs, the procedures for Media Transcoding control described in TS 124 229 [8], clause 5.10.7.2 (Media transcoding control procedures) apply.

If used to administratively enforce the use of specific codecs within a core network, local configuration may trigger the BGF to transcode media going in to and out of the core network.

5.2.1.6   BGF transport plane failure detection

When detecting a transport plane event (like loss of RTP on an ephemeral termination), the BGF can send a Notify command to the SPDF indicating the cause of the event. In order for this to happen, the SPDF must first indicate that it wishes to be notified about the event in question. This is achieved by including the particular event in the Events descriptor in an Add or Modify request (depending on the type of event). When the SPDF receives notification of an event from the BGF, the SPDF can take appropriate action. It notifies the application function (P-CSCF A) which in turn terminates the session between the affected UEs. It then releases the resources affected by the event.

The AF uses the Specific-Action AVP in the AA-Request to indicate which events it wants to be informed of.

5.2.2   Reservation with x-RACF involved

The SPDF may provide different amounts of information over Rq to the x-RACF depending on the particular service being requested by the AF over Gq'. For example, for services that do not involve an policy enforcement in the RCEF, port numbers are not needed and may hence be left out by the SPDF for signalling over Rq although ports numbers are present in Gq' (and Ia) signalling. However, the recommended behaviour of the SPDF is to always provide complete information over Rq to the x-RACF. This is to avoid making the SPDF aware of x-RACF operations for different services and requiring it to operate differently for different services.

Some AVPs are transparently forwarded by the SPDF between the Gq' and Rq interfaces, while SPDF policies are applied to other AVPs, which consequently may be altered by the SPDF before it signals to the x-RACF. The following AVPs are forwarded transparently by the SPDF over Rq to the x-RACF:

- Media-Component-Description:

  - Media-Component-Number.

  - Media-Sub-Component.

  - AF-Application-Identifier.

  - Media-Type.

  - Max-Requested-Bandwidth-UL.

  - Max-Requested-Bandwidth-DL.

  - Flow-Status.

  - RS-Bandwidth.

  - RR-Bandwidth.

  - Codec-Data.

- Flow-Grouping.

- AF-Charging-Identifier.

- User-Name.

- Globally-Unique-Address.

- Overbooking-indicator.

The following AVPs may be altered by the SPDF before signalled to the x-RACF (AVPs with no specific information on the mapping may be mapped to a different value based on local configuration):

- Media-Component-Description:

    - Reservation-Class.

    - Reservation-Priority.

    - Transport-Class.

    - Media-Authorization-Context-Id.

- Specific-Action:

    INDICATION_OF_RELEASE_OF_BEARER shall be forwarded without change over Rq, while INDICATION_OF_LOSS_OF_BEARER and INDICATION_OF_RECOVERY_OF_BEARER shall not be forwarded over Rq at all (i.e. these values concerns BGF service only). The SPDF may decide to include INDICATION_OF_SUBSCRIBER_DETACHMENT and/or INDICATION_OF_RESERVATION_EXPIRATION values in Specific-Action AVPs sent over Rq to subscribe to the corresponding information from the x-RACF. These values are however not reported to the AF over Gq'.

- Reservation-Priority.

- Service-Class.

- Authorization-Lifetime.

    Should not by mapped to a value smaller than provided over Gq'. This would require the SPDF to periodically refresh session state in the x-RACF without being triggered by messages over Gq'.

- Authorization-Package-Id.

5.2.3   Reservation involving both x-RACF and BGF

The signalling flow when both the x-RACF and BGF are involved is a combination of the procedures for accessing the BGF specified in clause 5.2.1 and the procedures for accessing the x-RACF specified clause 5.2.2 and in ES 283 026 [3].

The sequence used by the SPDF to access x-RACF and BGF is a local decision in the SPDF, e.g. the SPDF is able to decide whether to access the x-RACF and then the BGF, or vice versa, or both in parallel. This is valid for request, modification and release.

However, the SPDF may need to interrogate the BGF before the x-RACF to firstly obtain local termination IP addresses and ports from the BGF to thereafter provide them to the x-RACF. This is needed when the x-RACF performs resource and admission control for the network segment between the RCEF and the C-BGF, and when the RCEF shall be instructed to perform policy enforcement on source IP addresses and ports.

When both x-RACF and BGF Functional Entities (FEs) are involved in a session, the SPDF needs to keep the previous service information before each resource modification operation. In case the resource modification operation succeeds in one or more external FEs but fails in a later FE, after receiving the modification failure response from the FE which fails in the modification, the SPDF is responsible to control all the relevant external FEs to recover. If any of the external FEs cannot recover by itself because of not keeping the previous state, the SPDF sends the previous corresponding service information to the FE for the FE to recover. In case the resource modification operation succeeds in all of the external FEs, the SPDF should remove the previous service information immediately for most scenarios. In certain scenarios where the resource modification is a preliminary operation (e.g. when a subsequent SDP answer from a remote UE is required to confirm the modification), the SPDF may need to keep the previous service information for a certain period in case the information is needed in the rollback procedures when the UE denies the modification.

5.3   Procedures at x-RACF

The x-RACF determines based on local configuration whether or not the RCEF service shall be requested for sessions established via Rq. The x-RACF may use information provided by the SPDF over Rq for this decision, but can also be configured to request service from the RCEF for all sessions established over Rq. In case RCEF service is needed for a particular session, the x-RACF request service for Re messages with the Flow-Status AVP set to ENABLED.

5.3.1   Determining RCEF involvement

In case the RCEF involvement is dynamically determined from Rq messages, one or more of the following AVPs are used by the x-RACF to decide whether or not to request service from the RCEF:

- Reservation-Priority.

- User-Name.

- Globally-Unique-Address.

- Service-Class.

- Authorization-Package-Id.

- AF-Application-Identifier.

- Media-Type.

- Reservation-Class.

- Transport-Class.

- Media-Authorization-Context-Id.

5.3.2   Reporting RCEF failure

In case of failure in activating the requested policy with a PI-Request, the value of the Rule-Failure-Code AVP reported over Re may be carried in the Error-Message AVP to report the failure over Rq and Gq'. In case the RCEF deactivates a policy with a CC-Request, any value of the Termination-Cause AVP reported over Re shall be translated into the BEARER_RELEASED value of the Abort-Cause AVP reported over Rq and Gq'.

5.3.3   Multicast authorization

When the x-RACF receives an Authorization-Package-Id AVP or a Media-Authorization-Context-Id AVP over Rq, it shall map the received AVP to information that is locally preconfigured on the allowed IP multicast addresses and ports for the currently authorized application service. These addresses are further used to populate the required number of Flow-Description AVPs in the corresponding PI-Request over Re.

5.4   Diameter request routing considerations

The same IETF vendor specific Diameter application with application ID 16777222 (vendor 3GPP) is reused for both the Gq' and Rq reference points. Since Diameter agents use the Auth-Application-Id AVP to decide where to forward a Diameter Gq' or Rq initial request, normal request routing rules do not apply due to the ambiguity of whether to forward the initial request to the SPDF or to the x-RACF. Use of the Destination-Host AVP is therefore advised when forwarding an initial request using a Diameter agent.

NOTE: Use of the Destination-Host AVP in the AA-Request command is permitted implicitly through the *[AVP] construct in the definition of the AA-Request command in [4], clause 7.1.1 and according to the normal Diameter request routing procedures described in [11], section 6.1.

6   Example signalling flows (informative)

The examples of stage 3 signalling flows for TISPAN NGN release 2 provided by the present document cover signalling between AFs and RACS as well as signalling within RACS. In addition, signalling between different AF entities are shown to clarify when RACS is interrogated for the illustrated signalling examples. The signalling between AF entities is however not complete for all signalling examples in the sense that some messages between AF entities are omitted for brevity.

6.1   Basic IMS end-to-end signalling flow

Figure 6.1.1 illustrates the example network architecture.
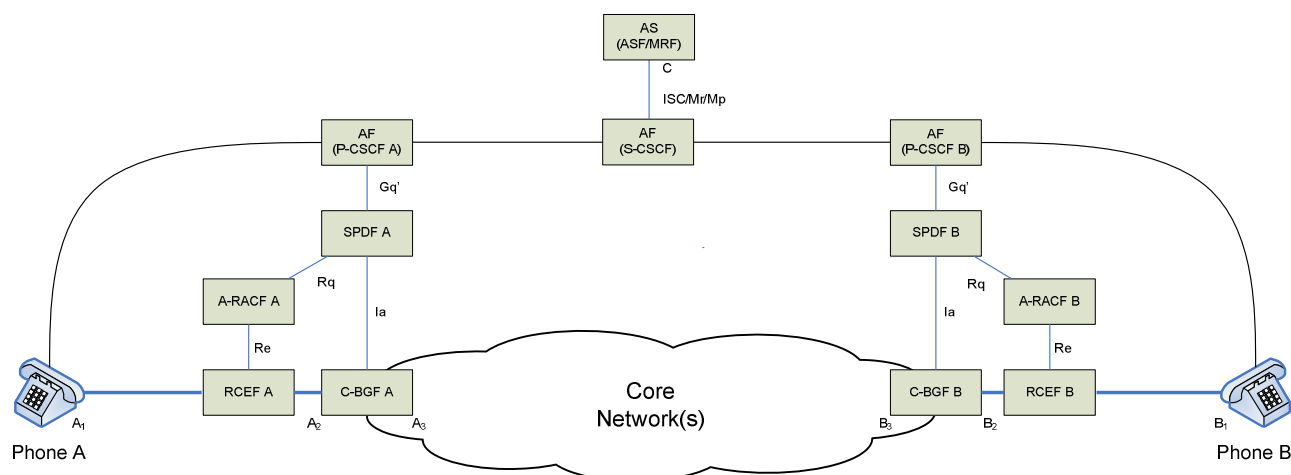
Figure 6.1.1: IMS end-to-end signalling flow between two SIP end-points - without IBGF

As indicated in [1] RTP should use an even destination port number and the corresponding RTCP stream should use the next higher (odd) destination port number. Following these recommendations the addresses and ports used in the example are as follows:

- A_1 = Voice: 192.168.0.2:23942 for RTP and 192.168.0.2:23943 for RTCP.

- A_1 = Video: 192.168.0.2:51372 for RTP and 192.168.0.2:51373 for RTCP.

- A_2 = Voice: 192.168.0.1:4444 for RTP and 192.168.0.1:4445 for RTCP.

- A_2 = Video: 192.168.0.1:31444 for RTP and 192.168.0.1:31445 for RTCP.

- A_3 = Voice: 10.0.0.1:2222 for RTP and 10.0.0.1:2223 for RTCP.

- A_3 = Video: 10.0.0.1:17462 for RTP and 10.0.0.1:17463 for RTCP.

- B_1 = Voice: 192.168.1.2:29792 for RTP and 192.168.1.2:29793 for RTCP.

- B_1 = Video: 192.168.1.2:25552 for RTP and 192.168.1.2:25553 for RTCP.

- B_2 = Voice: 192.168.1.1:3332 for RTP and 192.168.1.1:3333 for RTCP.

- B_2 = Video: 192.168.1.1:32124 for RTP and 192.168.1.1:32125 for RTCP.

- B_3 = Voice: 10.0.0.2:1110 for RTP and 10.0.0.2:1111 for RTCP.

- B_3 = Video: 10.0.0.2:1612 for RTP and 10.0.0.2:1613 for RTCP.

- C = 10.0.1.1:5555 for RTP and 10.0.1.1:5556 for RTCP.

The RTP stream is assumed to consume 96 kbps, while the RTCP is assumed to use 8 kbps. No packet loss occurs. The statistics are approximately chosen in the message flows. Identifiers used in the examples are selected to follow the formats defined for the respective protocols.

Figure 6.1.2 focuses on the two C-BGF entities, which are H.248-controlled MG entities, and highlights the "BGF Connection Model", which relates to single H.248 Contexts with each two H.248 IP terminations. It has to be noted that figure 6.1.2 is just an example, indicating only the single H.248 Stream solution for RTP and RTCP together.
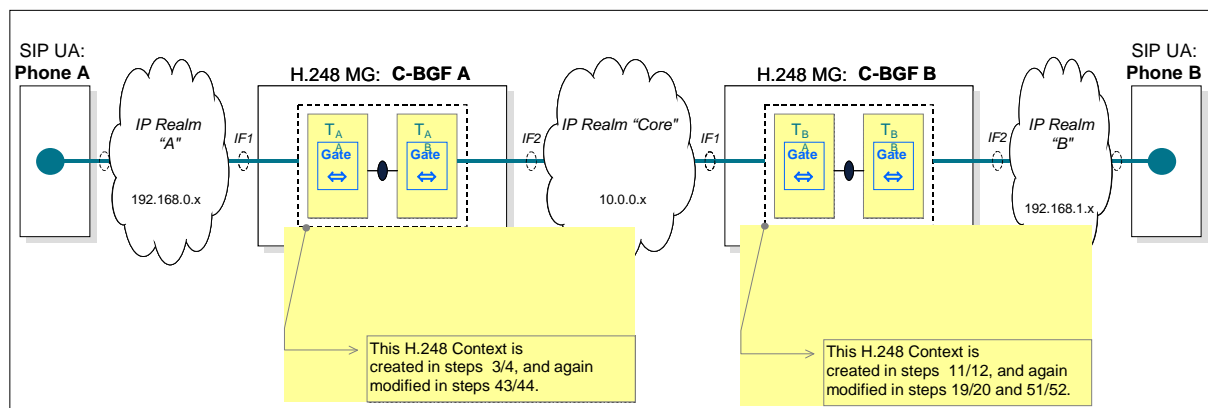
NOTE: The picture highlights the BGF Connection models.

Figure 6.1.2: Simplified network model with focus on BGF entities only

6.1.1   Session setup
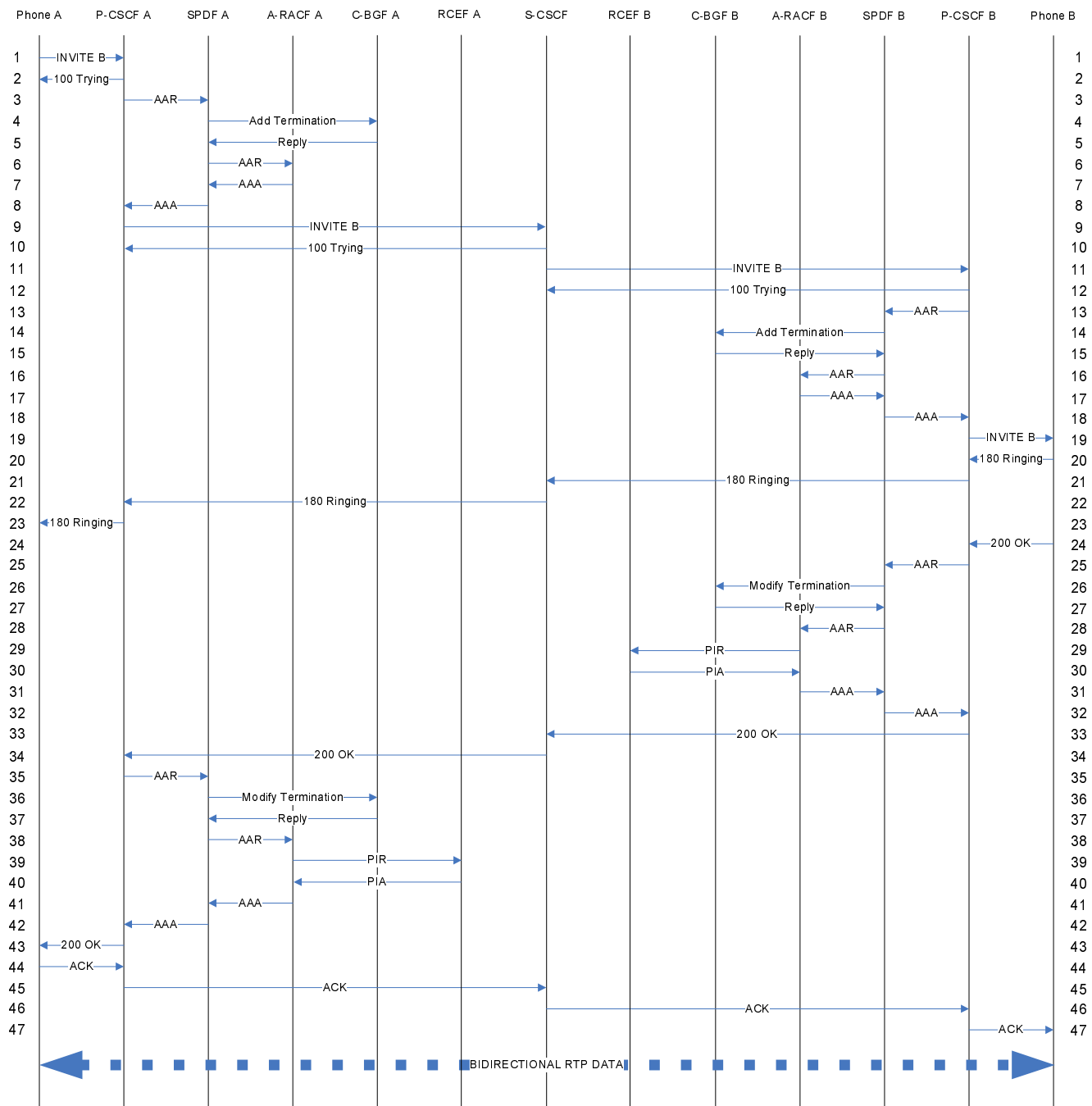
Figure 6.1.1.1: IMS end-to-end signalling chart between two SIP end-points - session setup

Table 6.1.1.1: IMS end-to-end messages between two SIP end-points - session setup

Step	Protocol	Interface	From	To	Message
1	SIP		Phone A	P-CSCF A	INVITE B

```
    INVITE sip:user_b@example.com SIP/2.0
    Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
    Max-Forwards: 70
    Route: <sip:p-cscf-a.example.com;lr>
    From: User A <sip:user_a@example.com>;tag=372183
    To: User B <sip:user_b@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 INVITE
    Contact: <sip:user_a@phone-a.example.com>
    Content-Type: application/sdp
    Content-Length: 129

    v=0
    o=user_a 2890844526 2890842807 IN IP4 phone-a.example.com
    s=-
    c=IN IP4 192.168.0.2
    t=0 0
    m=audio 23942 RTP/AVP 0
    a=sendrecv
```

Step	Protocol	Interface	From	To	Message
2	SIP		P-CSCF A	Phone A	100 Trying

```
    SIP/2.0 100 Trying
    Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
    From: User A <sip:user_a@example.com>;tag=372183
    To: User B <sip:user_b@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 INVITE
    Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
3	DIAMETER	Gq'	P-CSCF A	SPDF A	AAR

The P-CSCF uses the IP address registered for signalling as the Globally-Unique-Address.

The Gq' protocol specification [4] and the Rq protocol specification [3] both specify rules for how to assign numbers to the Flow-Number AVP and Media-Component-Number AVP respectively. The Flow-Number AVP is specified as the ordinal number of the IP flow(s), assigned according to the rules in annex C of [2] and the Media-Component-Number AVP is specified as the ordinal number of the media component, assigned according to the rules in annex C of [2]. In annex C.1 in [2] it is stated that both these numbers are to start at 1 for a given session.

Following the rules defined in clause 4, the P-CSCF translates the single codec indicated in the m= line to bandwidth using locally configured information on the mapping between codec and bandwidth taking account for the packetization overhead (i.e. AVP/RTP 0 translates to PCMU/8000, which is 64 kbps that becomes 96 kbps plus 8 kbps with packetization overhead).

Given the reception of a=sendrecv in the SDP the P-CSCF issues a bi-directional reservation request to the SPDF.

Following the rules given in clause 5.2.1.3 the Binding-Information AVPs are set to 0.0.0.0 and 0 respectively since no addresses or ports at the core side is available.

```
    <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                    < Session-Id = "p-cscf-a.example.com;13815C;391" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "p-cscf-a.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    [ Destination-Host = "spdf-a.example.com" ]
                    [ Media-Component-Description =
                            { Media-Component-Number = 1 }
                            [ Media-Sub-Component =
                                { Flow-Number = 1 }
                                [ Flow-Description = "permit out 17 from any to 192.168.0.2 23942" ]
                                [ Flow-Description = "permit in 17 from any to any" ]
                                [ Flow-Usage = NO_INFORMATION(0) ]
                                [ Max-Requested-Bandwidth-DL = 96000 ]
                                [ Max-Requested-Bandwidth-UL = 96000 ]
                            ]
                            [ Media-Sub-Component =
                                { Flow-Number = 2 }
                                [ Flow-Description = "permit out 17 from any to 192.168.0.2 23943" ]
                                [ Flow-Description = "permit in 17 from any to any" ]
                                [ Flow-Usage = RTCP (1) ]
                                [ Max-Requested-Bandwidth-DL = 8000 ]
                                [ Max-Requested-Bandwidth-UL = 8000 ]
                            ]
```

Step	Protocol	Interface	From	To	Message
					[AF-Application-Identifier = "GQPRIME_SAMPLE_APP"] [Media-Type = AUDIO (0)] [Flow-Status = DISABLED] [Reservation-Priority = DEFAULT (0)] [Codec-Data = "uplink offer m=audio 23942 RTP/AVP 0"]] [Binding-Information = { Binding-Input-List = [V4-Transport-Address = { Framed-IP-Address = 192.168.0.2 } { Port-Number = 23942 }] [V4-Transport-Address = { Framed-IP-Address = 0.0.0.0 } { Port-Number = 0 }] [V4-Transport-Address = { Framed-IP-Address = 192.168.0.2 } { Port-Number = 23943 }] [V4-Transport-Address = { Framed-IP-Address = 0.0.0.0 } { Port-Number = 0 }] }] [Reservation-Priority = DEFAULT (0)][Globally-Unique-Address = [Framed-IP-Address = 192.168.0.2] [Address-Realm = "example.com"]] [Authorization-Lifetime = 450]
4	H.248	Ia	SPDF A	C-BGF A	Add terminations

The default value of H.248 StreamMode is "Inactive", the H.248 Streams are by default created as "Inactive". Hence, the Mode descriptor is omitted in this message.

The Diameter <AA-Request> for an RTP flow and an RTCP flow is translated here into an H.248 Termination/Stream model by using the default RTP Specific behaviour of the BGF. The specific behaviour is controlled via the gm/rsb ("RTP Specific Behaviour") property. This property is disabled by default in version 2 of the H.248/Ia protocol profile so it must be explicitly enabled in order to allocate a port for the RTCP flow. Alternatively, RTCP port allocation could be controlled by the presence of an "a=rtcp" descriptor attribute as described in 5.17.1.7.1 in [7]. Alternatively, the RTP and RTCP flows could be mapped on two separate H.248 Streams (clause 5.17.1.1 in [7]).

The media type is implicitly provided as audio in the "m="-line by the payload type field (payload type 0 implies PCMU audio data). If the signalled BGF mode is media type aware, the "m="-line can also be written as: "m=audio <port number or '$'> RTP/AVP 0". If the signalled BGF mode is media agnostic, the "m="-line should be written as: "m=- $ - -" (e.g. as the only option in version 1 of the H.248 Ia profile).

NOTE 1: The port number provided in the Gq' Codec-Data AVP is not used to populate Local or Remote descriptors since the port number may be incorrect due to Network Address Translation.

```
MEGACO/3 [spdf-a.example.com]:55555
Transaction = 1 {
    Context = ${
        Add = ip/1/$/$ { /* NOTE 1 */
            Media {
                Stream = 1 {
                    LocalControl {
                        ipdc/realm = "A",
                        gm/rsb = ON
                    }
                    Local {
                        v=0
                        m=- $ RTP/AVP 0
                        c=IN IP4 $
                        b=AS:104
                    },
                    Remote {
                        v=0
                        o=- 0 0 IN IP4 192.168.0.2
                        s=-
```

Step	Protocol	Interface	From	To	Message
					t=0 0
					m=- 23942 RTP/AVP 0
					c=IN IP4 192.168.0.2
					b=AS:104
					}
					} /* Stream */
					} /* Media */
					} /* Add */
					Add = ip/1/$/$ {
					Media {
					Stream = 1 {
					LocalControl {
					ipdc/realm = "Core",
					gm/rsb = ON
					}
					Local {
					v=0
					m=- $ RTP/AVP 0
					c=IN IP4 $
					b=AS:104
					}
					} /* Stream */
					} /* Media */
					} /* Add */
					} /* Context */
					} /* Transaction */
NOTE 2:	The wildcard CHOOSE must be used for the interface part of the termination id. With the exception of the interface field, only the "Id" part may be wildcarded (see table 4 in [7]).				
5	H.248	Ia	C-BGF A	SPDF A	Reply (Add)
It should be noted that H.248 replies typically contain only new information not previously given in preceding H.248 request triggering the replies. The following H.248 message and all other H.248 replies shown in the present document includes however all information offered in the H.248 request together with the new information created by the BGF. The complete information is shown to clearly illustrate the interaction between the SPDF and the BGF for the depicted scenario.					

```
    MEGACO/3 [abgf-a.example.com]:55555
    Reply = 1 {
        Context = 1 {
        Add = ip/1/if1/1 {
            Media {
            Stream = 1 {
                LocalControl {
                ipdc/realm = "A",
                gm/rsb = ON
                }
                Local {
                v=0
                o=- 0 0 IN IP4 192.168.0.1
                s=-
                t=0 0
                m=- 4444 RTP/AVP 0
                c=IN IP4 192.168.0.1
                b=AS:104
                },
                Remote {
                v=0
                o=- 0 0 IN IP4 192.168.0.2
                s=-
                t=0 0
                m=- 23942 RTP/AVP 0
                c=IN IP4 192.168.0.2
                b=AS:104
                }
            } /* Stream */
            } /* Media */
        } /* Add */
        Add = ip/1/if2/1 {
            Media {
            Stream = 1 {
                LocalControl {
                ipdc/realm = "Core",
                gm/rsb = ON
                }
                Local {
                v=0
```

Step	Protocol	Interface	From	To	Message

```
                                o=- 0 0 IN IP4 10.0.0.1
                                s=-
                                t=0 0
                                m=- 2222 RTP/AVP 0
                                c=IN IP4 10.0.0.1
                                b=AS:104
                            }
                        } /* Stream */
                    } /* Media */
                } /* Add */
            } /* Context */
        } /* Reply */
```

NOTE 3: The origin, session name and time (o=, s= and t=) SDP information elements are optional when sent from the SPDF to the BGF but the SPDF shall accept them in command responses from the BGF according to clause 7.1.8 in [12].

NOTE 4: It is mandatory for the BGF to include the o=, s= and t= information elements in the Local Descriptor in command responses. If supplied by the SPDF in the initial command, the BGF must return the same values in the command response.

6	DIAMETER	Rq	SPDF A	A-RACF A	AAR

The A-RACF does not need the port numbers in this step. They are however needed for this signalling scenario in later steps when it interrogates the RCEF over Re for policy enforcement. These numbers should be included in all Rq AAR commands even if Re is not used since that is the desired default behaviour. That is, the SPDF should not need to keep track of whether or not port numbers are needed.

It should be noted that although source IP addresses are not provided the A-RACF can determine the sources from the Globally-Unique-Address of the subscriber (i.e. the A-RACF knows the location of each subscriber as this identifier comes associated with a Logical-Access-ID from the CLF over e4).

The SPDF uses the local IP address and port at if2 obtained from the C-BGF in its request over Rq. This is to facilitate resource and admission control to resources in the network between the RCEF and the C-BGF for cases when the A-RACF cannot determine the correct interface at the C-BGF by other means.

```
    <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                    < Session-Id = "spdf-a.example.com;429C3;412" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "spdf-a.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    [ Destination-Host = "aracf-a.example.com" ]
                    [ Media-Component-Description =
                            { Media-Component-Number = 1 }
                            [ Media-Sub-Component =
                                { Flow-Number = 1 }
                                [ Flow-Description = "permit out 17 from 192.168.0.1 4444
                                                        to 192.168.0.2 23942" ]
                                [ Flow-Description = "permit in 17 from any to any" ]
                                [ Flow-Usage = NO_INFORMATION(0) ]
                                [ Max-Requested-Bandwidth-DL = 96000 ]
                                [ Max-Requested-Bandwidth-UL = 96000 ]
                            ]
                            [ Media-Sub-Component =
                                { Flow-Number = 2 }
                                [ Flow-Description = "permit out 17 from 192.168.0.1 4445
                                                        to 192.168.0.2 23943" ]
                                [ Flow-Description = "permit in 17 from any to any" ]
                                [ Flow-Usage = RTCP (1) ]
                                [ Max-Requested-Bandwidth-DL = 8000 ]
                                [ Max-Requested-Bandwidth-UL = 8000 ]
                            ]
                            [ AF-Application-Identifier = "RQ_SAMPLE_APP"]
                            [ Media-Type = AUDIO (0) ]

                            [ Flow-Status = DISABLED ]
                            [ Reservation-Priority = DEFAULT (0) ]
                    ]
                    [ Reservation-Priority = DEFAULT (0) ]
                    [ Globally-Unique-Address =
                            [ Framed-IP-Address = 192.168.0.2 ]
                            [ Address-Realm = "example.com" ]
                    ]
                    [ Authorization-Lifetime = 450 ]
```

Step	Protocol	Interface	From	To	Message
7	DIAMETER	Rq	A-RACF A	SPDF A	AAA

```
<AA-Answer> ::= < Diameter Header: 265, PXY >
                < Session-Id = "spdf-a.example.com;429C3;412" >
                { Auth-Application-Id = 16777222 (Gq) }
                { Origin-Host = "aracf-a.example.com" }
                { Origin-Realm = "example.com" }
                [ Result-Code = DIAMETER_SUCCESS (2001) ]
                [ Authorization-Lifetime = 450 ]
                [ Auth-Grace-Period = 10 ]
```

Step	Protocol	Interface	From	To	Message
8	DIAMETER	Gq'	SPDF A	P-CSCF A	AAA

```
<AA-Answer> ::= < Diameter Header: 265, PXY >
                < Session-Id = "p-cscf-a.example.com;13815C;391" >
                { Auth-Application-Id = 16777222 (Gq) }
                { Origin-Host = "spdf-a.example.com" }
                { Origin-Realm = "example.com" }
                [ Result-Code = DIAMETER_SUCCESS (2001) ]
                [ Binding-Information =
                    { Binding-Input-List =
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 192.168.0.2 }
                            { Port-Number = 23942 }
                        ]
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 0.0.0.0 }
                            { Port-Number = 0 }
                        ]
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 192.168.0.2 }
                            { Port-Number = 23943 }
                        ]
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 0.0.0.0 }
                            { Port-Number = 0 }
                        ]
                    [ Binding-Output-List =
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 10.0.0.1 }
                            { Port-Number = 2222 }
                        ]
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 0.0.0.0 }
                            { Port-Number = 0 }
                        ]
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 10.0.0.1 }
                            { Port-Number = 2223 }
                        ]
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 0.0.0.0 }
                            { Port-Number = 0 }
                        ]
                    ]
                ]
                ]
                [ Authorization-Lifetime = 450 ]
                [ Auth-Grace-Period = 10 ]
```

Step	Protocol	Interface	From	To	Message
9	SIP		P-CSCF A	S-CSCF	INVITE B

```
    INVITE sip:user_b@example.com SIP/2.0
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
    Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
    Max-Forwards: 69
    Record-Route: <sip:p-cscf-a.example.com;lr>
    From: User A <sip:user_a@example.com>;tag=372183
    To: User B <sip:user_b@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 INVITE
    Contact: <sip:user_a@phone-a.example.com>
    Content-Type: application/sdp
    Content-Length: 129

    v=0
    o=user_a 2890844526 2890842807 IN IP4 phone-a.example.com
    s=-
    c=IN IP4 10.0.0.1
    t=0 0
    m=audio 2222 RTP/AVP 0
    a=sendrecv
```

Step	Protocol	Interface	From	To	Message
10	SIP		S-CSCF	P-CSCF A	100 Trying

```
    SIP/2.0 100 Trying
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
    Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
    From: User A <sip:user_a@example.com>;tag=372183
    To: User B <sip:user_b@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 INVITE
    Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
11	SIP		S-CSCF	P-CSCF B	INVITE B

```
    INVITE sip:user_b@example.com SIP/2.0
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
    Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
    Max-Forwards: 68
    Record-Route: <sip:s-cscf.example.com;lr>,<sip:p-cscf-a.example.com;lr>
    From: User A <sip:user_a@example.com>;tag=372183
    To: User B <sip:user_b@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 INVITE
    Contact: <sip:user_a@phone-a.example.com>
    Content-Type: application/sdp
    Content-Length: 125

    v=0
    o=user_a 2890844526 2890842807 IN IP4 phone-a.example.com
    s=-
    c=IN IP4 10.0.0.1
    t=0 0
    m=audio 2222 RTP/AVP 0
    a=sendrecv
```

Step	Protocol	Interface	From	To	Message
12	SIP		S-CSCF	P-CSCF B	100 Trying

```
    SIP/2.0 100 Trying
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
    Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
    From: User A <sip:user_a@example.com>;tag=372183
    To: User B <sip:user_b@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 INVITE
    Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
13	DIAMETER	Gq'	P-CSCF B	SPDF B	AAR

It should be noted that the IP address registered for signalling, which equals the Globally Unique IP Address, cannot be safely assumed to also be the source IP address for media. Hence, using this address as the source address for media may cause problems in case source filtering is applied. For this reason no source IP address is provided although the IP address registered for signalling to Phone B may be the same source IP address used for media.

```
    <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                    < Session-Id = "p-cscf-b.example.com;481C43;583" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "p-cscf-b.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    [ Destination-Host = "spdf-b.example.com" ]
                    [ Media-Component-Description =
                            { Media-Component-Number = 1 }
                            [ Media-Sub-Component =
                                { Flow-Number = 1 }
                                [ Flow-Description = "permit in 17 from any to any" ]
                                [ Flow-Description = "permit out 17 from any to any" ]
                                [ Flow-Usage = NO_INFORMATION(0) ]
                                [ Max-Requested-Bandwidth-UL = 96000 ]
                                [ Max-Requested-Bandwidth-DL = 96000 ]
                            ]
                            [ Media-Sub-Component =
                                { Flow-Number = 2 }
                                [ Flow-Description = "permit in 17 from any to any" ]
                                [ Flow-Description = "permit out 17 from any to any" ]
                                [ Flow-Usage = RTCP (1) ]
                                [ Max-Requested-Bandwidth-UL = 8000 ]
                                [ Max-Requested-Bandwidth-DL = 8000 ]
                            ]
                            [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                            [ Media-Type = AUDIO (0) ]
                            [ Flow-Status = DISABLED ]
                            [ Reservation-Priority = DEFAULT (0) ]
                            [ Codec-Data = "downlink
                                offer
                                m=audio 2222 RTP/AVP 0"
                            ]
                    ]
                    [ Binding-Information =
                            { Binding-Input-List =
                                [ V4-Transport-Address =
                                    { Framed-IP-Address = 0.0.0.0 }
                                    { Port-Number = 0 }
                                ]
                                [ V4-Transport-Address =
                                    { Framed-IP-Address = 10.0.0.1 }
                                    { Port-Number = 2222 }
                                ]
                                [ V4-Transport-Address =
                                    { Framed-IP-Address = 0.0.0.0 }
                                    { Port-Number = 0 }
                                ]
                                [ V4-Transport-Address =
                                    { Framed-IP-Address = 10.0.0.1 }
                                    { Port-Number = 2223 }
                                ]
                            }
                    ]
                    [ Reservation-Priority = DEFAULT (0) ]
                    [ Globally-Unique-Address =
                            [ Framed-IP-Address = 192.168.1.2 ]
                            [ Address-Realm = "example.com" ]
                    ]
                    [ Authorization-Lifetime = 450 ]
```

Step	Protocol	Interface	From	To	Message
14	H.248	Ia	SPDF B	C-BGF B	Add terminations

```
    MEGACO/3 [spdf-b.example.com]:43924
    Transaction = 1 {
        Context = $ {
            Add = ip/1/$/$ {
                Media {
                    Stream = 1 {
                        LocalControl {
                            ipdc/realm = "B",
                            gm/rsb = ON
                        }
                        Local {
                            v=0
                            m=- $ RTP/AVP 0
                            c=IN IP4 $
                            b=AS:104
                        }
                    } /* Stream */
                } /* Media */
            } /* Add */
            Add = ip/1/$/$ {
                Media {
                    Stream = 1 {
                        LocalControl {
                            ipdc/realm = "Core",
                            gm/rsb = ON
                        }
                        Local {
                            v=0
                            m=- $ RTP/AVP 0
                            c=IN IP4 $
                            b=AS:104
                        },
                        Remote {
                            v=0
                            o=- 0 0 IN IP4 10.0.0.1
                            s=-
                            t=0 0
                            m=- 2222 RTP/AVP 0
                            c=IN IP4 10.0.0.1
                            b=AS:104
                        }
                    } /* Stream */
                } /* Media */
            } /* Add */
        } /* Context */
    } /* Transaction */
```

Step	Protocol	Interface	From	To	Message
15	H.248	Ia	C-BGF B	SPDF B	Reply (Add)

```
    MEGACO/3 [abgf-b.example.com]:43924
    Reply = 1 {
        Context = 1 {
            Add = ip/1/if1/1{
                Media {
                    Stream = 1 {
                        LocalControl {
                            ipdc/realm = "B",
                            gm/rsb = ON
                        }
                        Local {
                            v=0
                            o=- 0 0 IN IP4 192.168.1.1
                            s=-
                            t=0 0
                            m=- 3332 RTP/AVP
                            c=IN IP4 192.168.1.1
                            b=AS:104
                        }
                    } /* Stream */
                } /* Media */
            } /* Add */
            Add = ip/1/if2/1{
                Media {
                    Stream = 1 {
                        LocalControl {
```

Step	Protocol	Interface	From	To	Message

					ipdc/realm = "Core",
					gm/rsb = ON
					}
					Local {
					   v=0
					   o=- 0 0 IN IP4 10.0.0.2
					   s=-
					   t=0 0
					   m=- 1110 RTP/AVP 0
					   c=IN IP4 10.0.0.2
					   b=AS:104
					},
					Remote {
					   v=0
					   o=- 0 0 IN IP4 10.0.0.1
					   s=-
					   t=0 0
					   m=- 2222 RTP/AVP 0
					   c=IN IP4 10.0.0.1
					   b=AS:104
					}
					} /* Stream */
					} /* Media */
					} /* Add */
					} /* Context */
					} /* Reply */

16	DIAMETER	Rq	SPDF B	A-RACF B	AAR

The A-RACF determines the access line from the Globally-Unique-Address AVP since the source and destination IP addresses for that reservation endpoint are not given in the request (i.e. they are both set to "any").

```
<AA-Request> ::=< Diameter Header: 265, REQ, PXY >
              < Session-Id = "spdf-b.example.com;41295;512" >
              { Auth-Application-Id = 16777222 (Gq) }
              { Origin-Host = "spdf-b.example.com" }
              { Origin-Realm = "example.com" }
              { Destination-Realm = "example.com" }
              [ Destination-Host = "aracf-b.example.com" ]
              [ Media-Component-Description =
                      { Media-Component-Number = 1 }
                      [ Media-Sub-Component =
                          { Flow-Number = 1 }
                          [ Flow-Description = "permit in 17 from any to 192.168.1.1 3332" ]
                          [ Flow-Description = "permit out 17 from any to any" ]
                          [ Flow-Usage = NO_INFORMATION(0) ]
                          [ Max-Requested-Bandwidth-UL = 96000 ]
                          [ Max-Requested-Bandwidth-DL = 96000 ]
                      ]
                      [ Media-Sub-Component =
                          { Flow-Number = 2 }
                          [ Flow-Description = "permit in 17 from any to 192.168.1.1 3333" ]
                          [ Flow-Description = "permit out 17 from any to any" ]
                          [ Flow-Usage = RTCP (1) ]
                          [ Max-Requested-Bandwidth-UL = 8000 ]
                          [ Max-Requested-Bandwidth-DL = 8000 ]
                      ]
                      [ AF-Application-Identifier = "RQ_SAMPLE_APP"]
                      [ Media-Type = AUDIO (0) ]
                      [ Flow-Status = DISABLED ]
                      [ Reservation-Priority = DEFAULT (0) ]
              ]
              [ Reservation-Priority = DEFAULT (0) ]
              [ Globally-Unique-Address =
                      [ Framed-IP-Address = 192.168.1.2 ]
                      [ Address-Realm = "example.com" ]
              ]
              [ Authorization-Lifetime = 450 ]
```

Step	Protocol	Interface	From	To	Message
17	DIAMETER	Rq	A-RACF B	SPDF B	AAA

```
   <AA-Answer> ::= < Diameter Header: 265, PXY >
                 < Session-Id = "spdf-b.example.com;41295;512" >
                 { Auth-Application-Id = 16777222 (Gq) }
                 { Origin-Host = "aracf-b.example.com" }
                 { Origin-Realm = "example.com" }
                 [ Result-Code = DIAMETER_SUCCESS (2001) ]
                 [ Authorization-Lifetime = 450 ]
                 [ Auth-Grace-Period = 10 ]
```

Step	Protocol	Interface	From	To	Message
18	DIAMETER	Gq'	SPDF B	P-CSCF B	AAA

```
   <AA-Answer> ::= < Diameter Header: 265, PXY >
                 < Session-Id = "p-cscf-b.example.com;481C43;583" >
                 { Auth-Application-Id = 16777222 (Gq) }
                 { Origin-Host = "spdf-b.example.com" }
                 { Origin-Realm = "example.com" }
                 [ Result-Code = DIAMETER_SUCCESS (2001) ]
                 [ Binding-Information =
                     { Binding-Input-List =
                         [ V4-Transport-Address =
                             { Framed-IP-Address = 0.0.0.0 }
                             { Port-Number = 0 }
                         ]
                         [ V4-Transport-Address =
                             { Framed-IP-Address = 10.0.0.1 }
                             { Port-Number = 2222 }
                         ]
                         [ V4-Transport-Address =
                             { Framed-IP-Address = 0.0.0.0 }
                             { Port-Number = 0 }
                         ]
                         [ V4-Transport-Address =
                             { Framed-IP-Address = 10.0.0.1 }
                             { Port-Number = 2223 }
                         ]
                     }
                     [ Binding-Output-List =
                         [ V4-Transport-Address =
                             { Framed-IP-Address = 0.0.0.0 }
                             { Port-Number = 0 }
                         ]
                         [ V4-Transport-Address =
                             { Framed-IP-Address = 192.168.1.1 }
                             { Port-Number = 3332 }
                         ]
                         [ V4-Transport-Address =
                             { Framed-IP-Address = 0.0.0.0 }
                             { Port-Number = 0 }
                         ]
                         [ V4-Transport-Address =
                             { Framed-IP-Address = 192.168.1.1 }
                             { Port-Number = 3333 }
                         ]
                     ]
                 [ Authorization-Lifetime = 450 ]
                 [ Auth-Grace-Period = 10 ]
```

Step	Protocol	Interface	From	To	Message
19	SIP		P-CSCF B	Phone B	INVITE B

```
    INVITE sip:user_b@example.com SIP/2.0
    Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
    Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
    Max-Forwards: 67
    Record-Route: <sip:p-cscf-b.example.com;lr>,<sip:s-cscf.example.com;lr>,<sip:p-cscf-
a.example.com;lr>
    From: User A <sip:user_a@example.com>;tag=372183
    To: User B <sip:user_b@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 INVITE
    Contact: <sip:user_a@phone-a.example.com>
    Content-Type: application/sdp
    Content-Length: 128

    v=0
    o=user_a 2890844526 2890842807 IN IP4 phone-a.example.com
    s=-
    c=IN IP4 192.168.1.1
    t=0 0
    m=audio 3332 RTP/AVP 0
    a=sendrecv
```

Step	Protocol	Interface	From	To	Message
20	SIP		Phone B	P-CSCF B	180 Ringing

```
    SIP/2.0 180 Ringing
    Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
    Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
    Record-Route: <sip:p-cscf-b.example.com;lr>,<sip:s-cscf.example.com;lr>,<sip:p-cscf-
a.example.com;lr>
    From: User A <sip:user_a@example.com>;tag=372183
    To: User B <sip:user_b@example.com>
    Call-ID: 398174293@phone-a.example.com
    Contact: <sip:user_b@phone-b.example.com>
    CSeq: 1 INVITE
    Content-Type: application/sdp
    Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
21	SIP		P-CSCF B	S-CSCF	180 Ringing

```
    SIP/2.0 180 Ringing
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
    Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
    Record-Route: <sip:s-cscf.example.com;lr>,<sip:p-cscf-a.example.com;lr>
    From: User A <sip:user_a@example.com>;tag=372183
    To: User B <sip:user_b@example.com>
    Call-ID: 398174293@phone-a.example.com
    Contact: <sip:user_b@phone-b.example.com>
    CSeq: 1 INVITE
    Content-Type: application/sdp
    Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
22	SIP		S-CSCF	P-CSCF A	180 Ringing

```
    SIP/2.0 180 Ringing
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
    Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
    Record-Route: <sip:p-cscf-a.example.com;lr>
    From: User A <sip:user_a@example.com>;tag=372183
    To: User B <sip:user_b@example.com>
    Call-ID: 398174293@phone-a.example.com
    Contact: <sip:user_b@phone-b.example.com>
    CSeq: 1 INVITE
    Content-Type: application/sdp
    Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
23	SIP		P-CSCF A	Phone A	180 Ringing

```
    SIP/2.0 180 Ringing
    Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
    Record-Route: <sip:p-cscf-a.example.com;lr>
    From: User A <sip:user_a@example.com>;tag=372183
    To: User B <sip:user_b@example.com>
    Call-ID: 398174293@phone-a.example.com
    Contact: <sip:user_b@phone-b.example.com>
    CSeq: 1 INVITE
    Content-Type: application/sdp
    Content-Length: 0
```

| 24 | SIP | | Phone B | P-CSCF B | 200 OK (SDP) |

```
    SIP/2.0 200 OK
    Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
    Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
    Max-Forwards: 70
    From: User A <sip:user_a@example.com>;tag=372183
    To: User B <sip:user_b@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 INVITE
    Contact: <sip:user_b@phone-b.example.com>
    Content-Type: application/sdp
    Content-Length: 119

    v=0
    o=user_b 29381748101 2948193018 IN IP4 phone-b.example.com
    s=-
    c=IN IP4 192.168.1.2
    t=0 0
    m=audio 29792 RTP/AVP 0
```

| 25 | DIAMETER | Gq' | P-CSCF B | SPDF B | AAR (Modify) |

In this AAR modifying an existing session both in and out Flow-Description AVPs and both the Max-Requested-Bandwidth-UL and the Max-Requested-Bandwidth-DL are provided in the request. Although this may seem be redundant information (as the in Flow-Description AVP and Max-Requested-Bandwidth-UL are already provided to RACS) the Gq' specification does not explicitly allow any of those AVPs to be omitted. Hence, they are all included.

```
    <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                   < Session-Id = "p-cscf-b.example.com;481C43;583" >
                   { Auth-Application-Id = 16777222 (Gq) }
                   { Origin-Host = "p-cscf-b.example.com" }
                   { Origin-Realm = "example.com" }
                   { Destination-Realm = "example.com" }
                   [ Destination-Host = "spdf-b.example.com" ]
                   [ Media-Component-Description =
                         { Media-Component-Number = 1 }
                         [ Media-Sub-Component =
                             { Flow-Number = 1 }
                             [ Flow-Description = "permit out 17 from any to 192.168.1.2 29792" ]
                             [ Flow-Description = "permit in 17 from any to 192.168.1.1 3332" ]
                             [ Flow-Usage = NO_INFORMATION(0) ]
                             [ Max-Requested-Bandwidth-DL = 96000 ]
                             [ Max-Requested-Bandwidth-UL = 96000 ]
                         ]
                         [ Media-Sub-Component =
                             { Flow-Number = 2 }
                             [ Flow-Description = "permit out 17 from any to 192.168.1.2 29793" ]
                             [ Flow-Description = "permit in 17 from any to 192.168.1.1 3333" ]
                             [ Flow-Usage = RTCP (1) ]
                             [ Max-Requested-Bandwidth-DL = 8000 ]
                             [ Max-Requested-Bandwidth-UL = 8000 ]
                         ]
                         [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                         [ Media-Type = AUDIO (0) ]
                         [ Flow-Status = ENABLED ]
                         [ Reservation-Priority = DEFAULT (0) ]
                         [ Codec-Data = "uplink
                             answer
                             m=audio 29792 RTP/AVP 0"
                         ]
```

Step	Protocol	Interface	From	To	Message
					[Codec-Data = "downlink offer m=audio 3333 RTP/AVP 0"]] [Binding-Information = { Binding-Input-List = [V4-Transport-Address = { Framed-IP-Address = 192.168.1.2 } { Port-Number = 29792 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.1 } { Port-Number = 2222 }] [V4-Transport-Address = { Framed-IP-Address = 192.168.1.2 } { Port-Number = 29793 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.1 } { Port-Number = 2223 }] }] [Reservation-Priority = DEFAULT (0)] [Globally-Unique-Address = [Framed-IP-Address = 192.168.1.2] [Address-Realm = "example.com"]] [Authorization-Lifetime = 450]
26	H.248	Ia	SPDF B	C-BGF B	Modify terminations

```
MEGACO/3 [spdf-b.example.com]:43924
Transaction = 2 {
    Context = 1 {
        Modify = ip/1/if1/1 {
            Media {
                Stream = 1 {
                    LocalControl {
                        ipdc/realm = "B",
                        gm/rsb = ON,
                        mode = SendReceive
                    },
                    Local {
                        v=0
                        o=- 0 0 IN IP4 192.168.1.1
                        s=-
                        t=0 0
                        m=- 3332 RTP/AVP 0
                        c=IN IP4 192.168.1.1
                        b=AS:104
                    }
                    Remote {
                        v=0
                        o=- 0 0 IN IP4 192.168.1.2
                        s=-
                        t=0 0
                        m=- 29792 RTP/AVP 0
                        c=IN IP4 192.168.1.2
                        b=AS:104
                    }
                } /* Stream */
            } /* Media */
        } /* Modify */
        Modify = ip/1/if2/1 {
            Media {
                Stream = 1 {
                    LocalControl {
                        ipdc/realm = "Core",
                        gm/rsb = ON,
                        mode = SendReceive
                    },
                    Local {
                        v=0
                        o=- 0 0 IN IP4 10.0.0.2
```

Step	Protocol	Interface	From	To	Message

```
                         s=-
                         t=0 0
                         m=- 1110 RTP/AVP 0
                         c=IN IP4 10.0.0.2
                         b=AS:104
                      },
                      Remote {
                         v=0
                         o=- 0 0 IN IP4 10.0.0.1
                         s=-
                         t=0 0
                         m=- 2222 RTP/AVP 0
                         c=IN IP4 10.0.0.1
                         b=AS:104
                      }
                   } /* Stream */
                } /* Media */
             } /* Modify */
          } /* Context */
       } /* Transaction */
```

27	H.248	Ia	C-BGF B	SPDF B	Reply (Modify)

```
    MEGACO/3 [abgf-b.example.com]: 43924
    Reply = 2 {
          Context = 1 {
             Modify = ip/1/if1/1 {
                Media {
                   Stream = 1 {
                      LocalControl {
                         ipdc/realm = "B",
                         gm/rsb = ON,
                         mode = SendReceive
                      },
                      Local {
                         v=0
                         o=- 0 0 IN IP4 192.168.1.1
                         s=-
                         t=0 0
                         m=- 3332 RTP/AVP 0
                         c=IN IP4 192.168.1.1
                         b=AS:104
                      },
                      Remote {
                         v=0
                         o=- 0 0 IN IP4 192.168.1.2
                         s=-
                         t=0 0
                         m=- 29792 RTP/AVP 0
                         c=IN IP4 192.168.1.2
                         b=AS:104
                      }
                   } /* Stream */
                } /* Media */
             } /* Modify */
             Modify = ip/1/if2/1 {
                Media {
                   Stream = 1 {
                      LocalControl {
                         ipdc/realm = "Core",
                         gm/rsb = ON,
                         mode = SendReceive
                      },
                      Local {
                         v=0
                         m=- 1110 RTP/AVP 0
                         o=- 0 0 IN IP4 10.0.0.2
                         s=-
                         t=0 0
                         c=IN IP4 10.0.0.2
                         b=AS:104
                      },
                      Remote {
                         v=0
                         o=- 0 0 IN IP4 10.0.0.1
                         s=-
                         t=0 0
```

Step	Protocol	Interface	From	To	Message
					m=- 2222 RTP/AVP 0

```
                     m=- 2222 RTP/AVP 0
                     c=IN IP4 10.0.0.1
                     b=AS:104
                 }
             } /* Stream */
         } /* Media */
      } /* Modify */
    } /* Context */
  } /* Reply */
```

28	DIAMETER	Rq	SPDF B	A-RACF B	AAR (Modify)

```
   <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                 < Session-Id = "spdf-b.example.com;41295;512" >
                 { Auth-Application-Id = 16777222 (Gq) }
                 { Origin-Host = "spdf-b.example.com" }
                 { Origin-Realm = "example.com" }
                 { Destination-Realm = "example.com" }
                 [ Destination-Host = "aracf-b.example.com" ]
                 [ Media-Component-Description =
                        { Media-Component-Number = 1 }
                        [ Media-Sub-Component =
                            { Flow-Number = 1 }
                            [ Flow-Description = "permit out 17 from 192.168.1.1 3332
                                                    to 192.168.1.2 29792" ]
                            [ Flow-Description = "permit in 17 from 192.168.1.2 29792
                                                    to 192.168.1.1 3332" ]
                            [ Flow-Usage = NO_INFORMATION(0) ]
                            [ Max-Requested-Bandwidth-UL = 96000 ]
                            [ Max-Requested-Bandwidth-DL = 96000 ]
                        ]
                        [ Media-Sub-Component =
                            { Flow-Number = 2 }
                            [ Flow-Description = "permit out 17 from 192.168.1.1 3333
                                                    to 192.168.1.2 29793" ]
                            [ Flow-Description = "permit in 17 from 192.168.1.2 29793
                                                    to 192.168.1.1 3333" ]
                            [ Flow-Usage = RTCP(1) ]
                            [ Max-Requested-Bandwidth-UL = 8000 ]
                            [ Max-Requested-Bandwidth-DL = 8000 ]
                        ]
                        [ AF-Application-Identifier = "RQ_SAMPLE_APP"]
                        [ Media-Type = AUDIO (0) ]
                        [ Flow-Status = ENABLED }
                        [ Reservation-Priority = DEFAULT (0) ]
                 ]
                 [ Reservation-Priority = DEFAULT (0) ]
                 [ Globally-Unique-Address =
                        [ Framed-IP-Address = 192.168.1.2 ]
                        [ Address-Realm = "example.com" ]
                 ]
                 [ Authorization-Lifetime = 450 ]
```

29	DIAMETER	Re	A-RACF B	RCEF B	PIR

The Origin-State-Id AVP is left out of this command since the A-RACF is a statefull entity that can be assumed to preserve states at restart or failover to a backup entity. In that case, it is not an entity that always starts up with no active sessions and thereby it does not need this AVP [11].
The ToS-Traffic-Class AVP is set to 101110, which is the codepoint allocated by IANA for the EF DiffServ per-hop behaviour [13]. This value is herein provided as an example only.

```
   < PI-Request > ::=  < Diameter Header: 315, REQ, PXY >
                 < Session-Id = "aracf-b.example.com;66389;469" >
                 { Auth-Application-Id = 16777253 (Re) }
                 { Origin-Host = "aracf-b.example.com" }
                 { Origin-Realm = "example.com" }
                 { Destination-Realm = "example.com" }
                 { Destination-Host = "rcef-b.example.com" }
                 { PI-Request-Type = INITIAL_REQUEST }
                 { PI-Request-Number = 0 }
                 [ Auth-Session-State = NO_STATE_MAINTAINED (1) ]
                 [ Policy-Rule-Install =
                     [ Policy-Rule-Definition =
                         { Policy-Rule-Name = "policy-rule-example-B-UL" }
                         [ Service-Identifier = 1 ]
                         [ Rating-Group = 1 ]
                         [ Framed-IP-Address = 192.168.1.2 ]
```

Step	Protocol	Interface	From	To	Message
					[Address-Realm = "example.com"] [Flow-Description = "permit in 17 from 192.168.1.2 29792 to 192.168.1.1 3332"] [Flow-Description = "permit in 17 from 192.168.1.2 29793 to 192.168.1.1 3333"] [Flow-Status = ENABLED-UPLINK (0)] [QoS-Information **=** [Max-Requested-Bandwidth-UL = 104000] [ToS-Traffic-Class = 101110]] [Precedence = 1] [Flows = { Media-Component-Number = 1 } [Flow-Number = 1] [Flow-Number = 2]]]] [Policy-Rule-Install = [Policy-Rule-Definition = { Policy-Rule-Name = "policy-rule-example-B-DL" } [Service-Identifier = 1] [Rating-Group = 1] [Framed-IP-Address = 192.168.1.2] [Address-Realm = "example.com"] [Flow-Description = "permit out 17 from 192.168.1.1 3332 to 192.168.1.2 29792"] [Flow-Description = "permit out 17 from 192.168.1.1 3333 to 192.168.1.2 29793"] [Flow-Status = ENABLED-DOWNLINK (1)] [QoS-Information = [Max-Requested-Bandwidth-DL = 104000] [ToS-Traffic-Class = 101110]] [Precedence = 1] [Flows = { Media-Component-Number = 1 } [Flow-Number = 1] [Flow-Number = 2]]]]]
30	DIAMETER	Re	RCEF B	A-RACF B	PIA

					`<PI-Answer> ::= < Diameter Header: 315, PXY >`
					`< Session-Id = "aracf-b.example.com;66389;469" >`
					`{ Origin-Host = "rcef-b.example.com" }`
					`{ Origin-Realm = "example.com" }`
					`{ PI-Request-Type = INITIAL_REQUEST }`
					`{ PI-Request-Number = 0 }`
					`[ Result-Code DIAMETER_SUCCESS (2001) ]`

31	DIAMETER	Rq	A-RACF B	SPDF B	AAA (Modify)

					`<AA-Answer> ::= < Diameter Header: 265, PXY >`
					`< Session-Id = "spdf-b.example.com;41295;512" >`
					`{ Auth-Application-Id = 16777222 (Gq) }`
					`{ Origin-Host = "aracf-b.example.com" }`
					`{ Origin-Realm = "example.com" }`
					`[ Result-Code = DIAMETER_SUCCESS (2001) ]`
					`[ Authorization-Lifetime = 450 ]`
					`[ Auth-Grace-Period = 10 ]`

32	DIAMETER	Gq'	SPDF B	P-CSCF B	AAA (Modify)

					`<AA-Answer> ::= < Diameter Header: 265, PXY >`
					`< Session-Id = "p-cscf-b.example.com;481C43;583" >`
					`{ Auth-Application-Id = 16777222 (Gq) }`
					`{ Origin-Host = "spdf-b.example.com" }`
					`{ Origin-Realm = "example.com" }`
					`[ Result-Code = DIAMETER_SUCCESS (2001) ]`
					`[ Binding-Information =`
					`{ Binding-Input-List =`
					`[ V4-Transport-Address =`
					`{ Framed-IP-Address = 192.168.1.2 }`

Step	Protocol	Interface	From	To	Message
					{ Port-Number = 29792 }
					]
					[V4-Transport-Address =
					{ Framed-IP-Address = 10.0.0.1 }
					{ Port-Number = 2222 }
					]
					[V4-Transport-Address =
					{ Framed-IP-Address = 192.168.1.2 }
					{ Port-Number = 29793 }
					]
					[V4-Transport-Address =
					{ Framed-IP-Address = 10.0.0.1 }
					{ Port-Number = 2223 }
					]
					}
					[Binding-Output-List = 10.0.0.2
					[V4-Transport-Address =
					{ Framed-IP-Address = 10.0.0.2 }
					{ Port-Number = 1110 }
					]
					[V4-Transport-Address =
					{ Framed-IP-Address = 192.168.1.1 }
					{ Port-Number = 3332 }
					]
					[V4-Transport-Address =
					{ Framed-IP-Address = 10.0.0.2 }
					{ Port-Number = 1111 }
					]
					[V4-Transport-Address =
					{ Framed-IP-Address = 192.168.1.1 }
					{ Port-Number = 3333 }
					]
					]
					]
					[Authorization-Lifetime = 450]
					[Auth-Grace-Period = 10]
33	SIP		P-CSCF B	S-CSCF	200 OK (SDP)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 69
From: User A <sip:user_a@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 1 INVITE
Contact: <sip:user_b@phone-b.example.com>
Content-Type: application/sdp
Content-Length: 126

v=0
o=user_b 29381748101 2948193018 IN IP4 phone-b.example.com
s=-
c=IN IP4 10.0.0.2
t=0 0
m=audio 1110 RTP/AVP 0
a=sendrecv
```

Step	Protocol	Interface	From	To	Message
34	SIP		S-CSCF	P-CSCF A	200 OK (SDP)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 68
From: User A <sip:user_a@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 1 INVITE
Contact: <sip:user_b@phone-b.example.com>
Content-Type: application/sdp
Content-Length: 126

v=0
o=user_b 29381748101 2948193018 IN IP4 phone-b.example.com
s=-
c=IN IP4 10.0.0.2
t=0 0
m=audio 1110 RTP/AVP 0
a=sendrecv
```

Step	Protocol	Interface	From	To	Message
35	DIAMETER	Gq'	P-CSCF A	SPDF A	AAR (Modify)

```
<AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                < Session-Id = "p-cscf-a.example.com;13815C;391" >
                { Auth-Application-Id = 16777222 (Gq) }
                { Origin-Host = "p-cscf-a.example.com" }
                { Origin-Realm = "example.com" }
                { Destination-Realm = "example.com" }
                [ Destination-Host = "spdf-a.example.com" ]
                [ Media-Component-Description =
                        { Media-Component-Number = 1 }
                        [ Media-Sub-Component =
                            { Flow-Number = 1 }
                            [ Flow-Description = "permit in 17 from any to any" ]
                            [ Flow-Description = "permit out 17 from any to 192.168.0.2 23942" ]
                            [ Flow-Usage = NO_INFORMATION(0) ]
                            [ Max-Requested-Bandwidth-UL = 96000 ]
                            [ Max-Requested-Bandwidth-DL = 96000 ]
                        ]
                        [ Media-Sub-Component =
                            { Flow-Number = 2 }
                            [ Flow-Description = "permit in 17 from any to any" ]
                            [ Flow-Description = "permit out 17 from any to 192.168.0.2 23943" ]
                            [ Flow-Usage = RTCP(1) ]
                            [ Max-Requested-Bandwidth-UL = 8000 ]
                            [ Max-Requested-Bandwidth-DL = 8000 ]
                        ]
                        [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                        [ Media-Type = AUDIO (0) ]
                        [ Flow-Status = ENABLED ]
                        [ Reservation-Priority = DEFAULT (0) ]
                        [ Codec-Data = "uplink
                           offer
                           m=audio 23942 RTP/AVP 0"
                        ]
                ]
                [ Binding-Information =
                        { Binding-Input-List =
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 192.168.0.2 }
                                { Port-Number = 23942 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 10.0.0.2 }
                                { Port-Number = 1110 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 192.168.0.2 }
                                { Port-Number = 23943 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 10.0.0.2 }
                                { Port-Number = 1111 }
                            ]
```

Step	Protocol	Interface	From	To	Message
					}
					]
					[Reservation-Priority = DEFAULT (0)]
					[Globally-Unique-Address =
					[Framed-IP-Address = 192.168.0.2]
					[Address-Realm = "example.com"]
					]
					[Authorization-Lifetime = 450]
36	H.248	Ia	SPDF A	C-BGF A	Modify Terminations A (A to B)

```
MEGACO/3 [spdf-a.example.com]:55555
Transaction = 2 {
     Context = 1 {
        Modify = ip/1/if1/1 {
          Media {
            Stream = 1 {
               LocalControl {
                  ipdc/realm = "A",
                  gm/rsb = ON,
                  mode = SendReceive
               },
               Local {
                  v=0
                  o=- 0 0 IN IP4 192.168.0.1
                  s=-
                  t=0 0
                  m=- 4444 RTP/AVP 0
                  c=IN IP4 192.168.0.1
                  b=AS:104
               },
               Remote {
                  v=0
                  o=- 0 0 IN IP4 192.168.0.2
                  s=-
                  t=0 0
                  m=- 23942 RTP/AVP 0
                  c=IN IP4 192.168.0.2
                  b=AS:104
               }
            } /* Stream */
          } /* Media */
        } /* Modify */
        Modify = ip/1/if2/1 {
          Media {
            Stream = 1 {
               LocalControl {
                  ipdc/realm = "Core",
                  gm/rsb = ON,
                  mode = SendReceive
               },
               Local {
                  v=0
                  o=- 0 0 IN IP4 10.0.0.1
                  s=-
                  t=0 0
                  m=- 2222 RTP/AVP 0
                  c=IN IP4 10.0.0.1
                  b=AS:104
               },
               Remote {
                  v=0
                  o=- 0 0 IN IP4 10.0.0.2
                  s=-
                  t=0 0
                  m=- 1110 RTP/AVP 0
                  c=IN IP4 10.0.0.2
                  b=AS:104
               }
            } /* Stream */
          } /* Media */
        } /* Modify */
     } /* Context */
  } /* Transaction */
```

Step	Protocol	Interface	From	To	Message
37	H.248	Ia	C-BGF A	SPDF A	Reply (Modify)

```
MEGACO/3 [abgf-a.example.com]:55555
Reply = 2 {
     Context = 1 {
        Modify = ip/1/if1/1 {
           Media {
              Stream = 1 {
                 LocalControl {
                    ipdc/realm = "A",
                    gm/rsb = ON,
                    mode = SendReceive
                 },
                 Local {
                    v=0
                    o=- 0 0 IN IP4 192.168.0.1
                    s=-
                    t=0 0
                    m=- 4444 RTP/AVP 0
                    c=IN IP4 192.168.0.1
                    b=AS:104
                 },
                 Remote {
                    v=0
                    o=- 0 0 IN IP4 192.168.0.2
                    s=-
                    t=0 0
                    m=- 23942 RTP/AVP 0
                    c=IN IP4 192.168.0.2
                    b=AS:104
                 }
              } /* Stream */
           } /* Media */
        } /* Modify */
        Modify = ip/1/if2/1 {
           Media {
              Stream = 1 {
                 LocalControl {
                    ipdc/realm = "Core",
                    gm/rsb = ON,
                    mode = SendReceive
                 },
                 Local {
                    v=0
                    o=- 0 0 IN IP4 10.0.0.1
                    s=-
                    t=0 0
                    m=- 2222 RTP/AVP 0
                    c=IN IP4 10.0.0.1
                    b=AS:104
                 },
                 Remote {
                    v=0
                    o=- 0 0 IN IP4 10.0.0.2
                    s=-
                    t=0 0
                    m=- 1110 RTP/AVP 0
                    c=IN IP4 10.0.0.2
                    b=AS:104
                 }
              } /* Stream */
           } /* Media */
        } /* Modify */
     } /* Context */
} /* Reply */
```

Step	Protocol	Interface	From	To	Message
38	DIAMETER	Rq	SPDF A	A-RACF A	AAR (Modify)

```
    <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                  < Session-Id = "spdf-a.example.com;429C3;412" >
                  { Auth-Application-Id = 16777222 (Gq) }
                  { Origin-Host = "spdf-a.example.com" }
                  { Origin-Realm = "example.com" }
                  { Destination-Realm = "example.com" }
                  [ Destination-Host = "aracf-a.example.com" ]
                  [ Media-Component-Description =
                        { Media-Component-Number = 1 }
                        [ Media-Sub-Component =
                            { Flow-Number = 1 }
                            [ Flow-Description = "permit out 17 from 192.168.0.1 4444
                                                      to 192.168.0.2 23942" ]
                            [ Flow-Description = "permit in 17 from 192.168.0.2 23942
                                                      to 192.168.0.1 4444" ]
                            [ Flow-Usage = NO_INFORMATION(0) ]
                            [ Max-Requested-Bandwidth-UL = 96000 ]
                            [ Max-Requested-Bandwidth-DL = 96000 ]
                        ]
                        [ Media-Sub-Component =
                            { Flow-Number = 2 }
                            [ Flow-Description = "permit out 17 from 192.168.0.1 4445
                                                      to 192.168.0.2 23943" ]
                            [ Flow-Description = "permit in 17 from 192.168.0.2 23943
                                                      to 192.168.0.1 4445" ]
                            [ Flow-Usage = RTCP(1) ]
                            [ Max-Requested-Bandwidth-UL = 8000 ]
                            [ Max-Requested-Bandwidth-DL = 8000 ]
                        ]
                        [ AF-Application-Identifier = "RQ_SAMPLE_APP"]
                        [ Media-Type = AUDIO (0) ]
                        [ Flow-Status = ENABLED ]
                        [ Reservation-Priority = DEFAULT (0) ]
                  ]
                  [ Reservation-Priority = DEFAULT (0) ]
                  [ Globally-Unique-Address =
                        [ Framed-IP-Address = 192.168.0.2 ]
                        [ Address-Realm = "example.com" ]
                  ]
                  [ Authorization-Lifetime = 450 ]
```

Step	Protocol	Interface	From	To	Message
39	DIAMETER	Re	A-RACF A	RCEF A	PIR

```
    < PI-Request > ::=  < Diameter Header: 315, REQ, PXY >
                  < Session-Id = "aracf-a.example.com;32475;112" >
                  { Auth-Application-Id = 16777253 (Re) }
                  { Origin-Host = "aracf-a.example.com" }
                  { Origin-Realm = "example.com" }
                  { Destination-Realm = "example.com" }
                  { Destination-Host = "rcef-a.example.com" }
                  { PI-Request-Type = INITIAL_REQUEST }
                  { PI-Request-Number = 0 }
                  [ Auth-Session-State = NO_STATE_MAINTAINED (1) ]
                  [ Policy-Rule-Install =
                    [ Policy-Rule-Definition =
                        { Policy-Rule-Name = "policy-rule-example-A-UL" }
                        [ Service-Identifier = 1 ]
                        [ Rating-Group = 1 ]
                        [ Framed-IP-Address = 192.168.0.2 ]
                        [ Address-Realm = "example.com" ]
                        [ Flow-Description = "permit in 17 from 192.168.0.2 23942
                                                  to 192.168.0.1 4444" ]
                        [ Flow-Description = "permit in 17 from 192.168.0.2 23943
                                                  to 192.168.0.1 4445" ]
                        [ Flow-Status = ENABLED-UPLINK (0) ]
                        [ QoS-Information =
                            [ Max-Requested-Bandwidth-UL = 104000 ]
                            [ ToS-Traffic-Class = 101110 ]
                        ]
                        [ Precedence = 1]
                        [ Flows =
                            { Media-Component-Number = 1 }
                            [ Flow-Number = 1 ]
                            [ Flow-Number = 2 ]
                        ]
```

Step	Protocol	Interface	From	To	Message

```
                    ]
                ]
                [ Policy-Rule-Install =
                    [ Policy-Rule-Definition =
                        { Policy-Rule-Name = "policy-rule-example-A-DL" }
                        [ Service-Identifier = 1 ]
                        [ Rating-Group = 1 ]
                        [ Framed-IP-Address = 192.168.0.2 ]
                        [ Address-Realm = "example.com" ]
                        [ Flow-Description = "permit out 17 from 192.168.0.1 4444
                                                     to 192.168.0.2 23942" ]
                        [ Flow-Description = "permit out 17 from 192.168.0.1 4445
                                                     to 192.168.0.2 23943" ]
                        [ Flow-Status = ENABLED-DOWNLINK (1) ]
                        [ QoS-Information =
                            [ Max-Requested-Bandwidth-DL = 104000 ]
                            [ ToS-Traffic-Class = 101110 ]
                        ]
                        [ Precedence = 1]
                        [ Flows =
                            { Media-Component-Number = 1 }
                            [ Flow-Number = 1 ]
                            [ Flow-Number = 2 ]
                        ]
                    ]
                ]
```

Step	Protocol	Interface	From	To	Message
40	DIAMETER	Re	RCEF A	A-RACF A	PIA

```
   <PI-Answer> ::= < Diameter Header: 315, PXY >
                < Session-Id = "aracf-a.example.com;32475;112" >
                { Origin-Host = "rcef-a.example.com" }
                { Origin-Realm = "example.com" }
                { PI-Request-Type = INITIAL_REQUEST }
                { PI-Request-Number = 0 }
                [ Result-Code DIAMETER_SUCCESS (2001) ]
```

Step	Protocol	Interface	From	To	Message
41	DIAMETER	Rq	A-RACF A	SPDF A	AAA (Modify)

```
   <AA-Answer> ::= < Diameter Header: 265, PXY >
                < Session-Id = "spdf-a.example.com;429C3;412" >
                { Auth-Application-Id = 16777222 (Gq) }
                { Origin-Host = "aracf-a.example.com" }
                { Origin-Realm = "example.com" }
                [ Result-Code = DIAMETER_SUCCESS (2001) ]
                [ Authorization-Lifetime = 450 ]
                [ Auth-Grace-Period = 10 ]
```

Step	Protocol	Interface	From	To	Message
42	DIAMETER	Gq'	SPDF A	P-CSCF A	AAA (Modify)

```
   <AA-Answer> ::= < Diameter Header: 265, PXY >
                < Session-Id = "p-cscf-a.example.com;13815C;391" >
                { Auth-Application-Id = 16777222 (Gq) }
                { Origin-Host = "spdf-a.example.com" }
                { Origin-Realm = "example.com" }
                [ Result-Code = DIAMETER_SUCCESS (2001) ]
                [ Binding-Information =
                    { Binding-Input-List =
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 192.168.0.2 }
                            { Port-Number = 23942 }
                        ]
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 10.0.0.2 }
                            { Port-Number = 1110 }
                        ]
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 192.168.0.2 }
                            { Port-Number = 23943 }
                        ]
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 10.0.0.2 }
                            { Port-Number = 1111 }
                        ]
                    }
                    [ Binding-Output-List =
```

Step	Protocol	Interface	From	To	Message

```
                    [ V4-Transport-Address =
                        { Framed-IP-Address = 10.0.0.1 }
                        { Port-Number = 2222 }
                    ]
                    [ V4-Transport-Address =
                        { Framed-IP-Address = 192.168.0.1 }
                        { Port-Number = 4444 }
                    ]
                    [ V4-Transport-Address =
                        { Framed-IP-Address = 10.0.0.1 }
                        { Port-Number = 2223 }
                    ]
                    [ V4-Transport-Address =
                        { Framed-IP-Address = 192.168.0.1 }
                        { Port-Number = 4445 }
                    ]
                 ]
            ]
        [ Authorization-Lifetime = 450 ]
        { Auth-Grace-Period = 10 }
```

Step	Protocol	Interface	From	To	Message
43	SIP		P-CSCF A	Phone A	200 OK (SDP)

```
   SIP/2.0 200 OK
   Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
   Max-Forwards: 67
   From: User A <sip:user_a@example.com>;tag=372183
   To: User B <sip:user_b@example.com>
   Call-ID: 398174293@phone-a.example.com
   CSeq: 1 INVITE
   Contact: <sip:user_b@phone-b.example.com>
   Content-Type: application/sdp
   Content-Length: 129

   v=0
   o=user_b 29381748101 2948193018 IN IP4 phone-b.example.com
   s=-
   c=IN IP4 192.168.0.1
   t=0 0
   m=audio 4444 RTP/AVP 0
   a=sendrecv
```

Step	Protocol	Interface	From	To	Message
44	SIP		Phone A	P-CSCF A	ACK

```
   ACK sip:user_b@example.com SIP/2.0
   Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
   Max-Forwards: 70
   Route: <sip:p-cscf-a.example.com;lr>,<sip:s-cscf.example.com;lr>,<sip:p-cscf-b.example.com;lr>
   From: User A <sip:user_a@example.com>;tag=348123
   To: User B <sip:user_b@example.com>
   Call-ID: 398174293@phone-a.example.com
   CSeq: 1 ACK
   Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
45	SIP		P-CSCF A	S-CSCF	ACK

```
   ACK sip:user_b@example.com SIP/2.0
   Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
   Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
   Max-Forwards: 69
   Route: <sip:s-cscf.example.com;lr>,<sip:p-cscf-b.example.com;lr>
   From: User A <sip:user_a@example.com>;tag=348123
   To: User B <sip:user_b@example.com>
   Call-ID: 398174293@phone-a.example.com
   CSeq: 1 ACK
   Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
46	SIP		S-CSCF	P-CSCF B	ACK

```
    ACK sip:user_b@example.com SIP/2.0
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
    Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
    Max-Forwards: 68
    Route: <sip:p-cscf-b.example.com;lr>
    From: User A <sip:user_a@example.com>;tag=348123
    To: User B <sip:user_b@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 ACK
    Content-Length: 0
```

| 47 | SIP | | P-CSCF B | Phone B | ACK |

```
    ACK sip:user_b@example.com SIP/2.0
    Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
    Via: SIP/2.0/UDP phone-a.example.com:5060; branch=z9hG4bK74b03
    Max-Forwards: 67
    From: User A <sip:user_a@example.com>;tag=348123
    To: User B <sip:user_b@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 ACK
    Content-Length: 0
```

6.1.2   Session termination
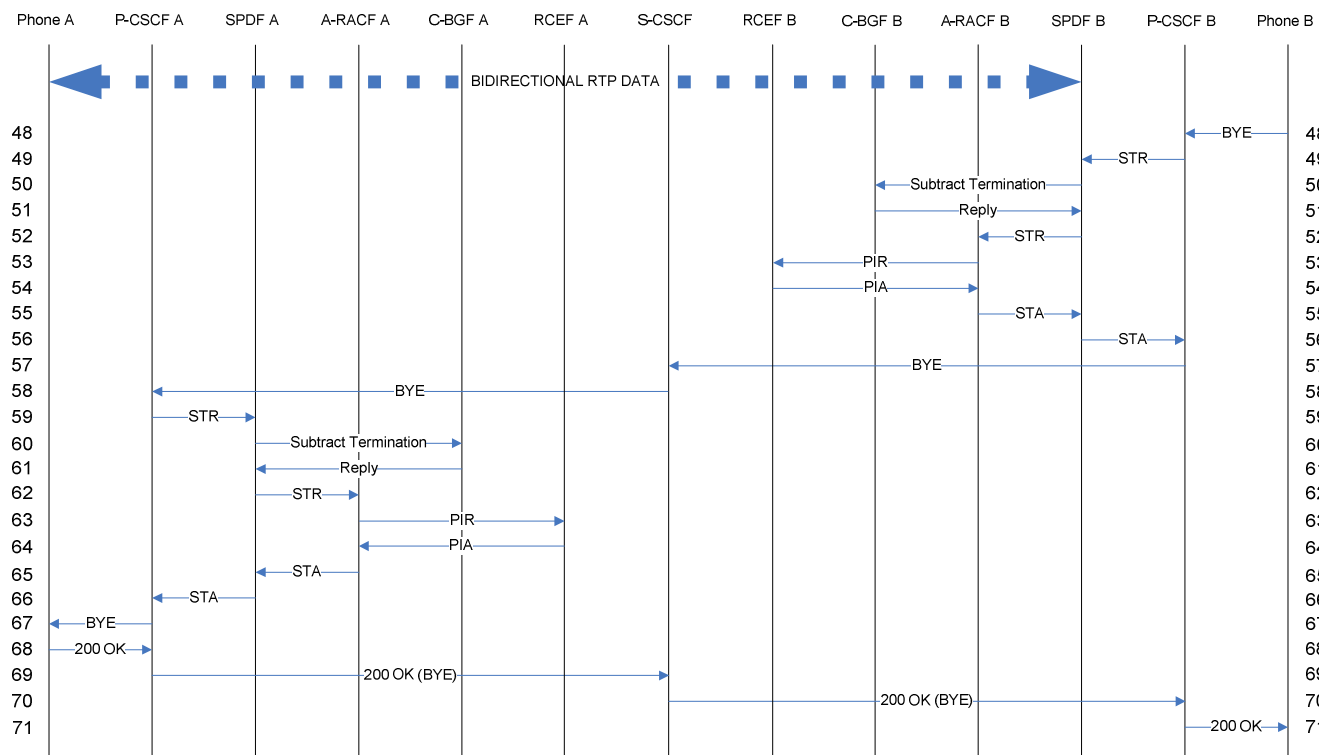
Figure 6.1.2.1: MS end-to-end signalling chart between two SIP end-points - session teardown

Table 6.1.2.1: IMS end-to-end messages between two SIP end-points - session teardown

Step	Protocol	Interface	From	To	Message
48	SIP		Phone B	P-CSCF B	BYE

```
    BYE sip:user_a@example.com SIP/2.0
    Via: SIP/2.0/UDP phone-b.example.com:5060;branch=z9hG4bKjwafcb9
    Max-Forwards: 70
    Route: <sip:p-cscf-b.example.com;lr>,<sip:s-cscf.example.com;lr>,<sip:p-cscf-a.example.com;lr>
    From: User B <sip:user_b@example.com>;tag=4fxdce12ls
    To: User A <sip:user_a@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 BYE
    Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
49	DIAMETER	Gq'	P-CSCF B	SPDF B	STR

```
    <ST-Request> ::=< Diameter Header: 275, REQ, PXY >
                    < Session-Id = "p-cscf-b.example.com;481C43;583" >
                    { Origin-Host = "p-cscf-b.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    { Termination-Cause = DIAMETER_LOGOUT }
                    { Auth-Application-Id = 16777222 (Gq) }
                    [ Destination-Host = " spdf-b.example.com" ]
```

Step	Protocol	Interface	From	To	Message
50	H.248	Ia	SPDF B	C-BGF B	Subtract termination B

```
    MEGACO/3 [spdf-b.example.com]:43924
    Transaction = 3 {
        Context = 1 {
          Subtract = ip/1/if1/1 {Audit{Statistics}}
          Subtract = ip/1/if2/1 {Audit{Statistics}}
        } /* Context */
    } /* Transaction */
```

Step	Protocol	Interface	From	To	Message
51	H.248	Ia	C-BGF B	SPDF B	Reply

```
    MEGACO/3 [abgf-b.example.com]:43924
    Reply = 3 {
        Context = 1 {
          Subtract = ip/1/if1/1 {
            Statistics {
              nt/dur=450000, ; in milliseconds
              nt/os=5400000, ; Octets Sent
              nt/or=5400000, ; Octets Received
              gm/dp=0        ; number of packets discarded
            }
          }
          Subtract = ip/1/if2/1 {
            Statistics {
              nt/dur=450000, ; in milliseconds
              nt/os=450000,  ; Octets Sent
              nt/or=450000,  ; Octets Received
              gm/dp=0        ; number of packets discarded
            } /* Statistics */
          } /* Subtract */
        } /* Context */
    } /* Reply */
```

Step	Protocol	Interface	From	To	Message
52	DIAMETER	Rq	SPDF B	A-RACF B	STR

```
    <ST-Request> ::=< Diameter Header: 275, REQ, PXY >
                    < Session-Id = "spdf-b.example.com;41295;512" >
                    { Origin-Host = "spdf-b.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Termination-Cause = DIAMETER_LOGOUT }
                    [ Destination-Host = " aracf-b.example.com" ]
```

Step	Protocol	Interface	From	To	Message
53	DIAMETER	Re	A-RACF B	RCEF B	PIR

```
    < PI-Request > ::=  < Diameter Header: 315, REQ, PXY >
                    < Session-Id = "aracf-b.example.com;66389;469" >
                    { Auth-Application-Id = 16777253 (Re) }
                    { Origin-Host = "aracf-b.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    { Destination-Host = "rcef-b.example.com" }
                    { PI-Request-Type = TERMINATION_REQUEST }
                    { PI-Request-Number = 1 }
                    [ Policy-Rule-Remove =
                       [ Policy-Rule-Definition =
                          [ Policy-Rule-Name = "policy-rule-example-B-UL" ]
                       ]
                    ]
                    [ Policy-Rule-Remove =
                       [ Policy-Rule-Definition =
                          [ Policy-Rule-Name = "policy-rule-example-B-DL" ]

                       ]
                    ]
```

Step	Protocol	Interface	From	To	Message
54	DIAMETER	Re	RCEF B	A-RACF B	PIA

```
    <PI-Answer> ::= < Diameter Header: 315, PXY >
                    < Session-Id = "aracf-b.example.com;66389;469" >
                    { Origin-Host = "rcef-b.example.com" }
                    { Origin-Realm = "example.com" }
                    { PI-Request-Type = TERMINATION_REQUEST }
                    { PI-Request-Number = 1 }
                    [ Result-Code DIAMETER_SUCCESS (2001) ]
```

Step	Protocol	Interface	From	To	Message
55	DIAMETER	Rq	A-RACF B	SPDF B	STA

```
    <ST-Answer> ::= < Diameter Header: 275, PXY >
                    < Session-Id = "spdf-b.example.com;41295;512" >
                    { Origin-Host = "aracf-b.example.com" }
                    { Origin-Realm = "example.com" }
                    [ Result-Code = DIAMETER_SUCCESS (2001) ]
```

Step	Protocol	Interface	From	To	Message
56	DIAMETER	Gq'	SPDF B	P-CSCF B	STA

```
    <ST-Answer> ::= < Diameter Header: 275, PXY >
                    < Session-Id = "p-cscf-b.example.com;481C43;583" >
                    { Origin-Host = "spdf-b.example.com" }
                    { Origin-Realm = "example.com" }
                     [ Result-Code = DIAMETER_SUCCESS (2001) ]
```

Step	Protocol	Interface	From	To	Message
57	SIP		P-CSCF B	S-CSCF	BYE

```
    BYE sip:user_a@example.com SIP/2.0
    Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
    Via: SIP/2.0/UDP phone-b.example.com:5060;branch=z9hG4bKjwafcb9
    Max-Forwards: 69
    Route: <sip:s-cscf.example.com;lr>,<sip:p-cscf-a.example.com;lr>
    From: User B <sip:user_b@example.com>;tag=4fxdce12ls
    To: User A <sip:user_a@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 BYE
    Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
58	SIP		S-CSCF	P-CSCF A	BYE

```
    BYE sip:user_a@example.com SIP/2.0
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
    Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
    Via: SIP/2.0/UDP phone-b.example.com:5060;branch=z9hG4bKjwafcb9
    Max-Forwards: 68
    Route: <sip:p-cscf-a.example.com;lr>
    From: User B <sip:user_b@example.com>;tag=4fxdce12ls
    To: User A <sip:user_a@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 BYE
    Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
59	DIAMETER	Gq'	P-CSCF A	SPDF A	STR

```
    <ST-Request> ::=< Diameter Header: 275, REQ, PXY >
                    < Session-Id = "p-cscf-a.example.com;13815C;391" >
                    { Origin-Host = "p-cscf-a.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    { Termination-Cause = DIAMETER_LOGOUT }
                    { Auth-Application-Id = 16777222 (Gq) }
                    [ Destination-Host = " spdf-a.example.com" ]
```

Step	Protocol	Interface	From	To	Message
60	H.248	Ia	SPDF A	C-BGF A	Subtract Termination A

```
    MEGACO/3 [spdf-a.example.com]:5555
    Transaction = 3 {
         Context = 1 {
             Subtract = ip/1/if1/1 {Audit{Statistics}}
             Subtract = ip/1/if2/1 {Audit{Statistics}}
         } /* Context */
    } /* Transaction */
```

Step	Protocol	Interface	From	To	Message
61	H.248	Ia	C-BGF A	SPDF A	Reply

```
    MEGACO/3 [abgf-a.example.com]:21398
    Reply = 3 {
         Context = 1 {
             Subtract = ip/1/if1/1 {
                Statistics {
                   nt/dur=450000, ; in milliseconds
                   nt/os=5400000, ; Octets Sent
                   nt/or=5400000, ; Octets Received
                   gm/dp=0         ; number of packets discarded
                }
             }
             Subtract = ip/1/if1/2 {
                Statistics {
                   nt/dur=450000, ; in milliseconds
                   nt/os=450000,  ; Octets Sent
                   nt/or=450000,  ; Octets Received
                   gm/dp=0         ; number of packets discarded
                } /* Statistics */
             } /* Subtract */
         } /* Context */
    } /* Reply */
```

Step	Protocol	Interface	From	To	Message
62	DIAMETER	Rq	SPDF A	A-RACF A	STR

```
    <ST-Request> ::=< Diameter Header: 275, REQ, PXY >
                    < Session-Id = "spdf-a.example.com;429C3;412" >
                    { Origin-Host = "spdf-a.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Termination-Cause = DIAMETER_LOGOUT }
                    [ Destination-Host = " aracf-a.example.com" ]
```

Step	Protocol	Interface	From	To	Message
63	DIAMETER	Re	A-RACF A	RCEF A	PIR

```
    < PI-Request > ::=  < Diameter Header: 315, REQ, PXY >
                    < Session-Id = "aracf-a.example.com;32475;112" >
                    { Auth-Application-Id = 16777253 (Re) }
                    { Origin-Host = "aracf-a.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    { Destination-Host = "rcef-a.example.com" }
                    { PI-Request-Type = TERMINATION_REQUEST }
                    { PI-Request-Number = 1 }
                    [ Policy-Rule-Remove =
                        [ Policy-Rule-Definition =
                            [ Policy-Rule-Name = "policy-rule-example-A-UL" ]
                        ]
                    ]
                    [ Policy-Rule-Remove =
                        [ Policy-Rule-Definition =
                            [ Policy-Rule-Name = "policy-rule-example-A-DL" ]
                        ]
                    ]
```

Step	Protocol	Interface	From	To	Message
64	DIAMETER	Re	RCEF A	A-RACF A	PIA

```
    <PI-Answer> ::= < Diameter Header: 315, PXY >
                    < Session-Id = "aracf-a.example.com;32475;112" >
                    { Origin-Host = "rcef-a.example.com" }
                    { Origin-Realm = "example.com" }
                    { PI-Request-Type = TERMINATION_REQUEST }
                    { PI-Request-Number = 1 }
                    [ Result-Code DIAMETER_SUCCESS (2001) ]
```

Step	Protocol	Interface	From	To	Message
65	DIAMETER	Rq	A-RACF A	SPDF A	STA

```
    <ST-Answer> ::= < Diameter Header: 275, PXY >
                    < Session-Id = "spdf-a.example.com;429C3;412" >
                    { Origin-Host = "aracf-a.example.com" }
                    { Origin-Realm = "example.com" }

                    [ Result-Code = DIAMETER_SUCCESS (2001) ]
```

Step	Protocol	Interface	From	To	Message
66	DIAMETER	Gq'	SPDF A	P-CSCF A	STA

```
    <ST-Answer> ::= < Diameter Header: 275, PXY >
                    < Session-Id = "p-cscf-a.example.com;13815C;391" >
                    { Origin-Host = "spdf-a.example.com" }
                    { Origin-Realm = "example.com" }

                    [ Result-Code = DIAMETER_SUCCESS (2001) ]
```

Step	Protocol	Interface	From	To	Message
67	SIP		P-CSCF B	Phone A	BYE

```
    BYE sip:user_a@example.com SIP/2.0
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKs1pp0
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
    Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
    Via: SIP/2.0/UDP phone-b.example.com:5060;branch=z9hG4bKjwafcb9
    Max-Forwards: 67
    From: User B <sip:user_b@example.com>;tag=4fxdce12ls
    To: User A <sip:user_a@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 BYE
    Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
68	SIP		Phone A	P-CSCF A	200 OK (BYE)

```
   SIP/2.0 200 OK
   Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKs1pp0
   Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
   Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
   Via: SIP/2.0/UDP phone-b.example.com:5060;branch=z9hG4bKjwafcb9
   Max-Forwards: 70
   From: User B <sip:user_b@example.com>;tag=4fxdce12ls
   To: User A <sip:user_a@example.com>
   Call-ID: 398174293@phone-a.example.com
   CSeq: 1 BYE
   Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
69	SIP		P-CSCF A	S-CSCF	200 OK (BYE)

```
   SIP/2.0 200 OK
   Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
   Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
   Via: SIP/2.0/UDP phone-b.example.com:5060;branch=z9hG4bKjwafcb9
   Max-Forwards: 69
   From: User B <sip:user_b@example.com>;tag=4fxdce12ls
   To: User A <sip:user_a@example.com>
   Call-ID: 398174293@phone-a.example.com
   CSeq: 1 BYE
   Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
70	SIP		S-CSCF	P-CSCF B	200 OK (BYE)

```
   SIP/2.0 200 OK
   Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
   Via: SIP/2.0/UDP phone-b.example.com:5060;branch=z9hG4bKjwafcb9
   Max-Forwards: 68
   From: User B <sip:user_b@example.com>;tag=4fxdce12ls
   To: User A <sip:user_a@example.com>
   Call-ID: 398174293@phone-a.example.com
   CSeq: 1 BYE
   Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
71	SIP		P-CSCF B	Phone B	200 OK (BYE)

```
   SIP/2.0 200 OK
   Via: SIP/2.0/UDP phone-b.example.com:5060;branch=z9hG4bKjwafcb9
   Max-Forwards: 67
   From: User B <sip:user_b@example.com>;tag=4fxdce12ls
   To: User A <sip:user_a@example.com>
   Call-ID: 398174293@phone-a.example.com
   CSeq: 1 BYE
   Content-Length: 0
```

6.1.3   Session failures

6.1.3.1   RCEF failure at session setup
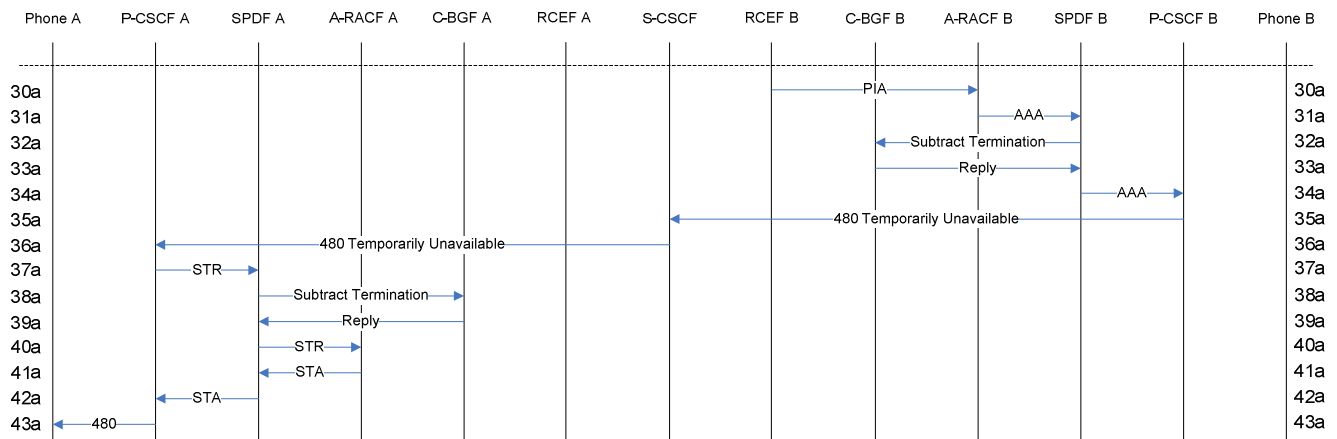
Figure 6.1.3.1.1: Failure in RCEF B at session setup

Table 6.1.3.1.1: Messages to handle failure in RCEF B at session setup

Step	Protocol	Interface	From	To	Message
30a	DIAMETER	Re	RCEF B	A-RACF B	PIA

```
    <PI-Answer> ::= < Diameter Header: 315, PXY >
                    < Session-Id = "aracf-b.example.com;66389;469" >
                    { Origin-Host = "rcef-b.example.com" }
                    { Origin-Realm = "example.com" }
                    { PI-Request-Type = INITIAL_REQUEST }
                    { PI-Request-Number = 0 }
                    [ Result-Code DIAMETER_UNABLE_TO_COMPLY (5012) ]
                    [ Policy-Rule-Report =
                        [ Policy-Rule-Name = "policy-rule-example-B-UL" ]
                        [ Policy-Rule-Name = "policy-rule-example-B-DL" ]
                        [ Policy-Rule-Status = INACTIVE (1) ]
                        [ Rule-Failure-Code = RESOURCES_LIMITATION (5) ]
                    ]
                    [ Failed-AVP =
                        [ Policy-Rule-Install =
                            [ Policy-Rule-Definition =
                                { Policy-Rule-Name = "policy-rule-example-B-UL" }
                                [ Service-Identifier = 1 ]
                                [ Rating-Group = 1 ]
                                [ Framed-IP-Address = 192.168.1.2 ]
                                [ Address-Realm = "example.com" ]
                                [ Flow-Description = "permit in 17 from 192.168.1.2 29792
                                                               to 192.168.1.1 3332" ]
                                [ Flow-Description = "permit in 17 from 192.168.1.2 29793
                                                               to 192.168.1.1 3333" ]
                                [ Flow-Status = ENABLED-UPLINK (0) ]
                                [ QoS-Information =
                                    [ Max-Requested-Bandwidth-UL = 104000 ]
                                    [ ToS-Traffic-Class = 101110 ]
                                ]
                                [ Precedence = 1]
                                [ Flows =
                                    { Media-Component-Number = 1 }
                                    [ Flow-Number = 1 ]
                                    [ Flow-Number = 2 ]
                                ]
                            ]
                        ]
                        [ Policy-Rule-Install =
                            [ Policy-Rule-Definition =
                                { Policy-Rule-Name = "policy-rule-example-B-DL" }
                                [ Service-Identifier = 1 ]
                                [ Rating-Group = 1 ]
                                [ Framed-IP-Address = 192.168.1.2 ]
```

Step	Protocol	Interface	From	To	Message
					[Address-Realm = "example.com"] [Flow-Description = "permit out 17 from 192.168.1.1 3332 to 192.168.1.2 29792"] [Flow-Description = "permit out 17 from 192.168.1.1 3333 to 192.168.1.2 29793"] [Flow-Status = ENABLED-DOWNLINK (1)] [QoS-Information = [Max-Requested-Bandwidth-DL = 104000] [ToS-Traffic-Class = 101110]] [Precedence = 1] [Flows = { Media-Component-Number = 1 } [Flow-Number = 1] [Flow-Number = 2]]]]]
31a	DIAMETER	Rq	A-RACF B	SPDF B	AAA (Modify)

```
<AA-Answer> ::= < Diameter Header: 265, PXY >
               < Session-Id = "spdf-b.example.com;41295;512" >
               { Auth-Application-Id = 16777222 (Gq) }
               { Origin-Host = "aracf-b.example.com" }
               { Origin-Realm = "example.com" }
               [ Result-Code = DIAMETER_UNABLE_TO_COMPLY (5012) ]
               [ Error-Message = "RCEF: Rule-Failure-Code = RESOURCES_LIMITATION (5)" ]
               [ Error-Reporting-Host = "rcef-b.example.com" ]
```

| 32a | H.248 | Ia | SPDF B | C-BGF B | Subtract termination B |

```
MEGACO/3 [spdf-b.example.com]:43924
Transaction = 2 {
     Context = 1 {
        Subtract = ip/1/if1/1 {Audit{Statistics}}
        Subtract = ip/1/if2/1 {Audit{Statistics}}
     } /* Context */
} /* Transaction */
```

| 33a | H.248 | Ia | C-BGF B | SPDF B | Reply |

```
MEGACO/3 [abgf-b.example.com]:43924
Reply = 2 {
     Context = 1 {
        Subtract = ip/1/if1/1 {
           Statistics {
              nt/dur=450, ; in milliseconds
              nt/os=0, ; Octets Sent
              nt/or=0, ; Octets Received
              gm/dp=0     ; number of packets discarded
           }
        }
        Subtract = ip/1/if2/1 {
           Statistics {
              nt/dur=450, ; in milliseconds
              nt/os=0, ; Octets Sent
              nt/or=0, ; Octets Received
              gm/dp=0     ; number of packets discarded
           } /* Statistics */
        } /* Subtract */
     } /* Context */
} /* Reply */
```

| 34a | DIAMETER | Gq' | SPDF B | P-CSCF B | AAA (Modify) |

```
<AA-Answer> ::= < Diameter Header: 265, PXY >
               < Session-Id = "p-cscf-b.example.com;481C43;583" >
               { Auth-Application-Id = 16777222 (Gq) }
               { Origin-Host = "spdf-b.example.com" }
               { Origin-Realm = "example.com" }
               [ Result-Code = DIAMETER_UNABLE_TO_COMPLY (5012) ]
               [ Error-Message = "RCEF: Rule-Failure-Code = RESOURCES_LIMITATION (5)" ]
               [ Error-Reporting-Host = "rcef-b.example.com" ]
```

Step	Protocol	Interface	From	To	Message
35a	SIP		P-CSCF B	S-CSCF	480 Temporarily Unavailable

```
SIP/2.0 480 Temporarily Unavailable
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 69
From: User A <sip:user_a@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 1 INVITE
Contact: <sip:user_b@phone-b.example.com>
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
36a	SIP		S-CSCF	P-CSCF A	480 Temporarily Unavailable

```
SIP/2.0 480 Temporarily Unavailable
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 68
From: User A <sip:user_a@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 1 INVITE
Contact: <sip:user_b@phone-b.example.com>
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
37a	DIAMETER	Gq'	P-CSCF A	SPDF A	STR

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

Step	Protocol	Interface	From	To	Message
38a	H.248	Ia	SPDF A	C-BGF A	Subtract Termination A

```
MEGACO/3 [spdf-a.example.com]:5555
Transaction = 2 {
    Context = 1 {
        Subtract = ip/1/if1/1 {Audit{Statistics}}
        Subtract = ip/1/if2/1 {Audit{Statistics}}
    } /* Context */
} /* Transaction */
```

Step	Protocol	Interface	From	To	Message
39a	H.248	Ia	C-BGF A	SPDF A	Reply

```
MEGACO/3 [abgf-a.example.com]:21398
Reply = 2 {
    Context = 1 {
        Subtract = ip/1/if1/1 {
            Statistics {
                nt/dur=450, ; in milliseconds
                nt/os=0, ; Octets Sent
                nt/or=0, ; Octets Received
                gm/dp=0     ; number of packets discarded
            }
        }
        Subtract = ip/1/if1/2 {
            Statistics {
                nt/dur=450, ; in milliseconds
                nt/os=0, ; Octets Sent
                nt/or=0, ; Octets Received
                gm/dp=0     ; number of packets discarded
            } /* Statistics */
        } /* Subtract */
    } /* Context */
} /* Reply */
```

Step	Protocol	Interface	From	To	Message
40a	DIAMETER	Rq	SPDF A	A-RACF A	STR

```
    <ST-Request> ::=< Diameter Header: 275, REQ, PXY >
                < Session-Id = "spdf-a.example.com;429C3;412" >
                { Origin-Host = "spdf-a.example.com" }
                { Origin-Realm = "example.com" }
                { Destination-Realm = "example.com" }
                { Auth-Application-Id = 16777222 (Gq) }
                { Termination-Cause = DIAMETER_LOGOUT (1) }
                [ Destination-Host = "aracf-a@example.com" ]
```

| 41a | DIAMETER | Rq | A-RACF A | SPDF A | STA |

```
    <ST-Answer> ::= < Diameter Header: 275, PXY >
                < Session-Id = "spdf-a.example.com;429C3;412" >
                { Origin-Host = "aracf-a.example.com" }
                { Origin-Realm = "example.com" }
                [ Result-Code = DIAMETER_SUCCESS (2001) ]
```

| 42a | DIAMETER | Gq' | SPDF A | P-CSCF A | STA |

```
    <ST-Answer> ::= < Diameter Header: 275, PXY >
                < Session-Id = "p-cscf-a.example.com;13815C;391" >
                { Origin-Host = "spdf-a.example.com" }
                { Origin-Realm = "example.com" }
                [ Result-Code = DIAMETER_SUCCESS (2001) ]
```

| 43a | SIP | | P-CSCF A | Phone A | 480 Temporarily Unavailable |

```
    SIP/2.0 480 Temporarily Unavailable
    Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
    Max-Forwards: 67
    From: User A <sip:user_a@example.com>;tag=372183
    To: User B <sip:user_b@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 INVITE
    Contact: <sip:user_b@phone-b.example.com>
    Content-Length: 0
```

6.1.3.2   RCEF failure after session setup
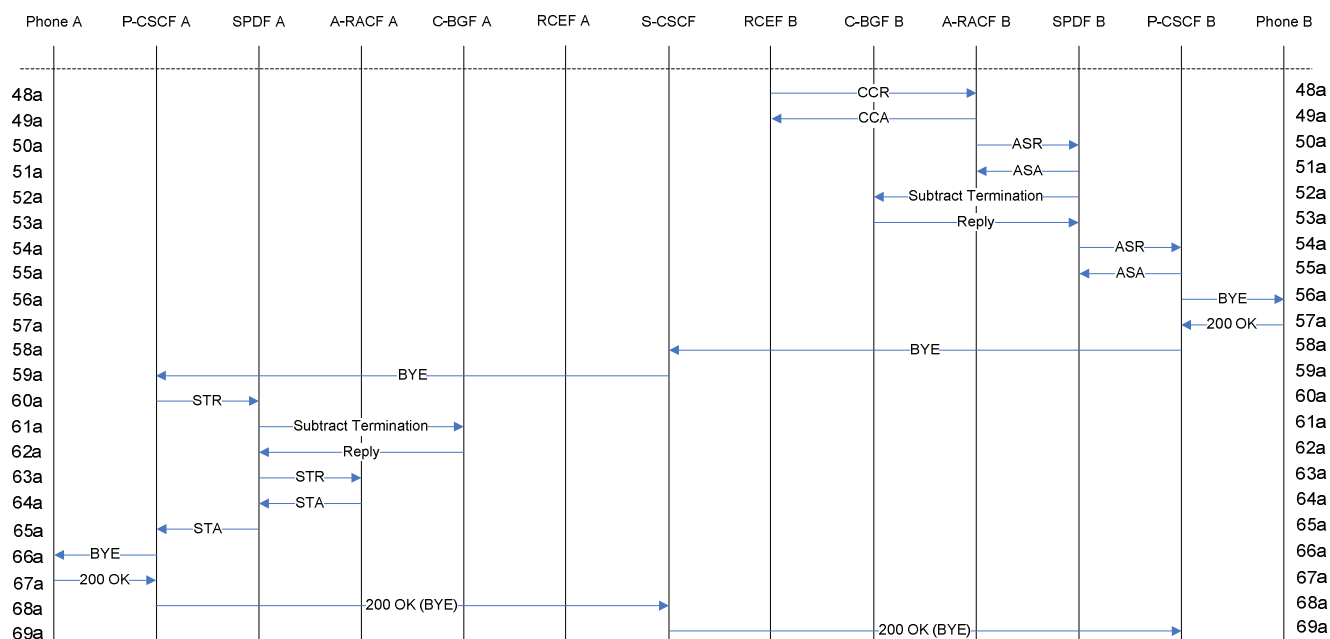
Figure 6.1.3.2.1: Failure in RCEF B after session setup

Table 6.1.3.2.1: Messages to handle failure in RCEF B after session setup

Step	Protocol	Interface	From	To	Message
48a	DIAMETER	Re	RCEF B	A-RACF B	CCR

In case the policy was established with a pull request from the RCEF to the A-RACF as illustrated in clause 6.4, the Logical-Access-Id AVP would be used as Transport Resource Classifier instead of the Framed-IP-Address AVP and the Address-Realm AVP, which are used in this example to match the policy established with a push request as illustrated in clause 6.1. That is, the same Transport Resource Classifier(s) as used when the policy was established shall be used by the RCEF when issuing a CCR to deactivate the policy.

```
<CC-Request> ::=< Diameter Header: 272, REQ, PXY >
                < Session-Id = "rcef-b.example.com;66389;469" >
                { Origin-Host = "rcef-b.example.com" }
                { Origin-Realm = "example.com " }
                { Destination-Realm = "example.com " }
                { Auth-Application-Id = 16777253 (Re) }
                { Service-Context-Id = "service_1@rcef-a.example.com" }
                { CC-Request-Type = "TERMINATION_REQUEST" }
                { CC-Request-Number = 0 }
                [ Termination-Cause "DIAMETER_LINK_BROKEN" ]
                [ Flow-Description = "permit in 17 from 192.168.1.2 29792
                                           to 192.168.1.1 3332" ]
                [ Flow-Description = "permit in 17 from 192.168.1.2 29793
                                           to 192.168.1.1 3333" ]
                [ Flow-Description = "permit out 17 from 192.168.1.1 3332
                                           to 192.168.1.2 29792" ]
                [ Flow-Description = "permit out 17 from 192.168.1.1 3333
                                           to 192.168.1.2 29793" ]
                [ Framed-IP-Address = 192.168.1.2 ]
                [ Address-Realm = "example.com"]
```

Step	Protocol	Interface	From	To	Message
49a	DIAMETER	Re	A-RACF B	RCEF B	CCA

```
<CC-Answer> ::= < Diameter Header: 272, PXY >
                < Session-Id = "rcef-b.example.com; 66389;469" >
                { Origin-Host = "a-racf-b.example.com" }
                { Origin-Realm = "example.com " }
                { Auth-Application-Id = 16777253 (Re) }
                { Result-Code = DIAMETER_SUCCESS (2001) }
                { CC-Request-Type = "TERMINATION_REQUEST" }
                { CC-Request-Number = 0 }
                [ Policy-Rule-Remove =
                   [ Policy-Rule-Definition =
                       [ Policy-Rule-Name = "policy-rule-example-B-UL" ]
                       [ Policy-Rule-Name = "policy-rule-example-B-DL" ]
                   ]
                ]
```

Step	Protocol	Interface	From	To	Message
50a	DIAMETER	Rq	A-RACF B	SPDF B	ASR

```
<AS-Request> ::=< Diameter Header: 274, REQ, PXY >
                < Session-Id = "spdf-b.example.com;41295;512" >
                { Origin-Host = "aracf-b.example.com" }
                { Origin-Realm = "example.com" }
                { Destination-Realm = "example.com" }
                { Destination-Host = "spdf-b.example.com" }
                { Auth-Application-ID = 16777222 (Gq) }
                { Abort-Cause = "BEARER_RELEASED" }
```

Step	Protocol	Interface	From	To	Message
51a	DIAMETER	Rq	SPDF B	A-RACF B	ASA

```
<AS-Answer> ::= < Diameter Header: 274, PXY >
                < Session-Id = "spdf-b.example.com;41295;512" >
                { Origin-Host = "spdf-b.example.com" }
                { Origin-Realm = "example.com" }
                [ Result-Code = DIAMETER_SUCCESS (2001) ]
```

Step	Protocol	Interface	From	To	Message
52a	H.248	Ia	SPDF B	C-BGF B	Subtract termination B

```
    MEGACO/3 [spdf-b.example.com]:43924
    Transaction = 3 {
         Context = 1 {
             Subtract = ip/1/if1/1 {Audit{Statistics}}
             Subtract = ip/1/if2/1 {Audit{Statistics}}
         } /* Context */
    } /* Transaction */
```

Step	Protocol	Interface	From	To	Message
53a	H.248	Ia	C-BGF B	SPDF B	Reply

```
    MEGACO/3 [abgf-b.example.com]:43924
    Reply = 3 {
         Context = 1 {
             Subtract = ip/1/if1/1 {
                Statistics {
                   nt/dur=45000,  ; in milliseconds
                   nt/os=540000,  ; Octets Sent
                   nt/or=540000,  ; Octets Received
                   gm/dp=0     ; number of packets discarded
                }
             }
             Subtract = ip/1/if2/1 {
                Statistics {
                   nt/dur=45000,  ; in milliseconds
                   nt/os=45000,   ; Octets Sent
                   nt/or=45000,   ; Octets Received
                   gm/dp=0     ; number of packets discarded
                } /* Statistics */
             } /* Subtract */
         } /* Context */
    } /* Reply */
```

Step	Protocol	Interface	From	To	Message
54a	DIAMETER	Gq'	SPDF B	P-CSCF B	ASR

```
    <AS Request> ::=< Diameter Header: 274, REQ, PXY >
                    < Session-Id = "p-cscf-b.example.com;481C43;583" >
                    { Origin-Host = "spdf-b.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    { Destination-Host = "p-cscf-b.example.com" }
                    { Auth-Application-ID = 16777222 (Gq) }
                    { Abort-Cause = "BEARER_RELEASED" }
```

Step	Protocol	Interface	From	To	Message
55a	DIAMETER	Gq'	P-CSCF B	SPDF B	ASA

```
    <AS-Answer> ::= < Diameter Header: 274, PXY >
                    < Session-Id = "p-cscf-b.example.com;481C43;583" >
                    { Origin-Host = "p-cscf-b.example.com" }
                    { Origin-Realm = "example.com" }
                    [ Result-Code = DIAMETER_SUCCESS (2001) ]
```

Step	Protocol	Interface	From	To	Message
56a	SIP		P-CSCF B	Phone B	BYE

```
    BYE sip:user_b@example.com SIP/2.0
    Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
    Max-Forwards: 70
    From: User A <sip:user_a@example.com>;tag=372183
    To: User B <sip:user_b@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 BYE
    Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
57a	SIP		Phone B	P-CSCF B	200 OK (BYE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
Max-Forwards: 70
From: User A <sip:user_a@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 1 BYE
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
58a	SIP		P-CSCF B	S-CSCF	BYE

```
BYE sip:user_a@example.com SIP/2.0
Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
Max-Forwards: 70
Route: <sip:s-cscf.example.com;lr>,<sip:p-cscf-a.example.com;lr>
From: User B <sip:user_b@example.com>;tag=4fxdce12ls
To: User A <sip:user_a@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 1 BYE
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
59a	SIP		S-CSCF	P-CSCF A	BYE

```
BYE sip:user_a@example.com SIP/2.0
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
Max-Forwards: 69
Route: <sip:p-cscf-a.example.com;lr>
From: User B <sip:user_b@example.com>;tag=372183
To: User A <sip:user_a@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 1 BYE
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
60a	DIAMETER	Gq'	P-CSCF A	SPDF A	STR

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

Step	Protocol	Interface	From	To	Message
61a	H.248	Ia	SPDF A	C-BGF A	Subtract Termination A

```
MEGACO/3 [spdf-a.example.com]:5555
Transaction = 3 {
     Context = 1 {
        Subtract = ip/1/if1/1 {Audit{Statistics}}
        Subtract = ip/1/if2/1 {Audit{Statistics}}
     } /* Context */
} /* Transaction */
```

Step	Protocol	Interface	From	To	Message
62a	H.248	Ia	C-BGF A	SPDF A	Reply

```
MEGACO/3 [abgf-a.example.com]:21398
Reply = 3 {
     Context = 1 {
        Subtract = ip/1/if1/1 {
           Statistics {
              nt/dur=45000,  ; in milliseconds
              nt/os=540000,  ; Octets Sent
              nt/or=540000,  ; Octets Received
              gm/dp=0     ; number of packets discarded
           }
        }
        Subtract = ip/1/if1/2 {
           Statistics {
              nt/dur=45000,  ; in milliseconds
              nt/os=45000,   ; Octets Sent
              nt/or=45000,   ; Octets Received
              gm/dp=0     ; number of packets discarded
```

Step	Protocol	Interface	From	To	Message

```
          } /* Statistics */
        } /* Subtract */
      } /* Context */
  } /* Reply */
```

63a	DIAMETER	Rq	SPDF A	A-RACF A	STR

```
    <ST-Request> ::=< Diameter Header: 275, REQ, PXY >
                    < Session-Id = "spdf-a.example.com;429C3;412" >
                    { Origin-Host = "spdf-a.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Termination-Cause = DIAMETER_LOGOUT (1) }
```

64a	DIAMETER	Rq	A-RACF A	SPDF A	STA

```
    <ST-Answer> ::= < Diameter Header: 275, PXY >
                    < Session-Id = "spdf-a.example.com;429C3;412" >
                    { Origin-Host = "aracf-a.example.com" }
                    { Origin-Realm = "example.com" }
                    [ Result-Code = DIAMETER_SUCCESS (2001) ]
```

65a	DIAMETER	Gq'	SPDF A	P-CSCF A	STA

```
    <ST-Answer> ::= < Diameter Header: 275, PXY >
                    < Session-Id = "p-cscf-a.example.com;13815C;391" >
                    { Origin-Host = "spdf-a.example.com" }
                    { Origin-Realm = "example.com" }
                    [ Result-Code = DIAMETER_SUCCESS (2001) ]
```

66a	SIP		P-CSCF A	Phone A	BYE

```
    BYE sip:user_a@example.com SIP/2.0
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKs1pp0
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
    Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
    Max-Forwards: 66
    From: User B <sip:user_b@example.com>;tag=372183
    To: User A <sip:user_a@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 BYE
    Content-Length: 0
```

67a	SIP		Phone A	P-CSCF A	200 OK (BYE)

```
    SIP/2.0 200 OK
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKs1pp0
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
    Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
    Max-Forwards: 70
    From: User B <sip:user_b@example.com>;tag=372183
    To: User A <sip:user_a@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 BYE
    Content-Length: 0
```

68a	SIP		P-CSCF A	S-CSCF	200 OK (BYE)

```
    SIP/2.0 200 OK
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
    Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
    Max-Forwards: 69
    From: User B <sip:user_b@example.com>;tag=372183
    To: User A <sip:user_a@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 BYE
    Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
69a	SIP		S-CSCF	P-CSCF B	200 OK (BYE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
Max-Forwards: 68
From: User B <sip:user_b@example.com>;tag=372183
To: User A <sip:user_a@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 1 BYE
Content-Length: 0
```

6.1.3.3 C-BGF A transport plane failure
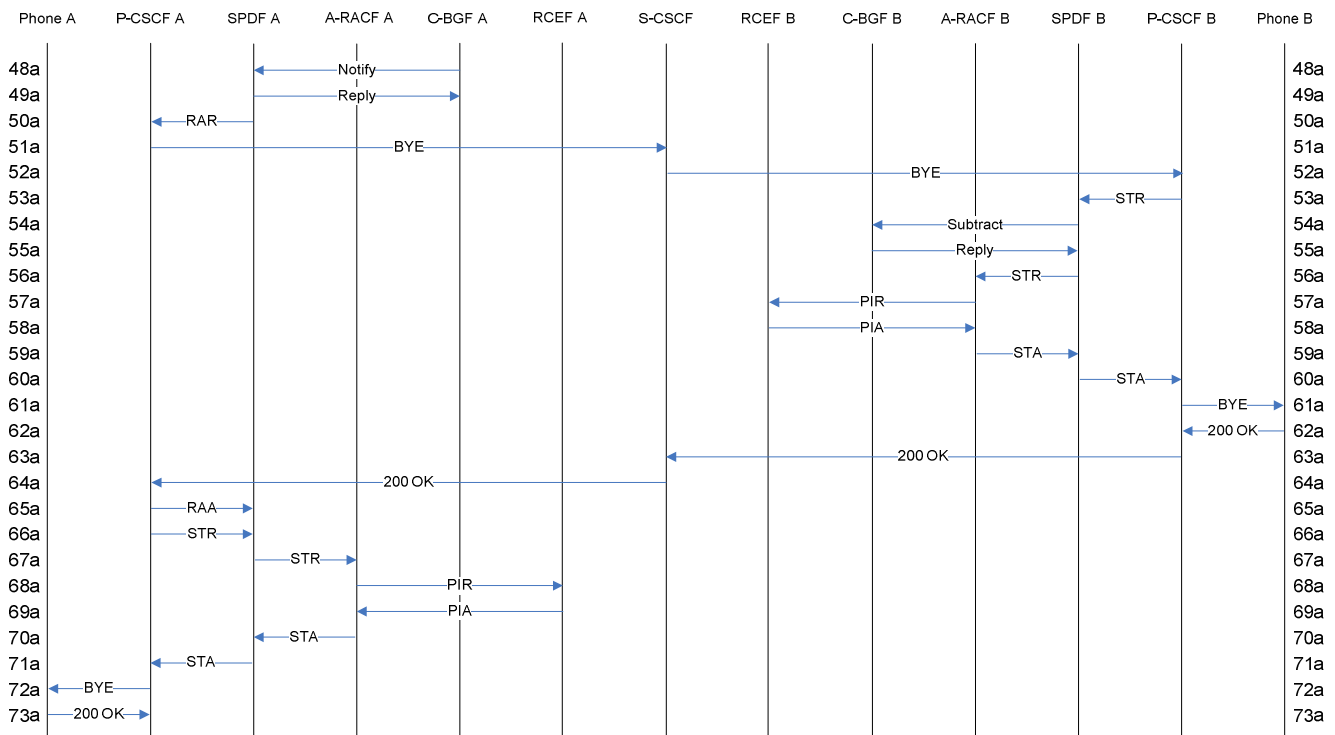
NOTE: In this scenario, session signalling according to clause 6.1.1 (with the exception of steps 3a, 4a and 35a shown in table 6.1.3.2.1) has been completed and the session is successfully established when C-BGF A detects a transport plane failure and sends a Notify command to SPDF A in step 48a.

Figure 6.1.3.3.1: C-BGF A transport plane failure after successful session establishment

Table 6.1.3.3.1: BGF transport plane failure

Step	Protocol	Interface	From	To	Message
3a	DIAMETER	Gq'	P-CSCF A	SPDF A	AAR

```
<AA-Request> ::=< Diameter Header: 265, REQ, PXY >
            < Session-Id = "p-cscf-a.example.com;13815C;391" >
            { Auth-Application-Id = 16777222 (Gq) }
            { Origin-Host = "p-cscf-a.example.com" }
            { Origin-Realm = "example.com" }
            { Destination-Realm = "example.com" }
            [ Destination-Host = "spdf-a.example.com" ]
            [ Media-Component-Description =
                    { Media-Component-Number = 1 }
                    [ Media-Sub-Component =
                        { Flow-Number = 1 }
                        [ Flow-Description = "permit out 17 from any to 192.168.0.2 23942" ]
                        [ Flow-Description = "permit in 17 from any to any" ]
                        [ Flow-Usage = NO_INFORMATION(0) ]
                        [ Max-Requested-Bandwidth-DL = 96000 ]
```

Step	Protocol	Interface	From	To	Message
					[Max-Requested-Bandwidth-UL = 96000]] [Media-Sub-Component = { Flow-Number = 2 } [Flow-Description = "permit out 17 from any to 192.168.0.2 23943"] [Flow-Description = "permit in 17 from any to any"] [Flow-Usage = RTCP (1)] [Max-Requested-Bandwidth-DL = 8000] [Max-Requested-Bandwidth-UL = 8000]] [AF-Application-Identifier = "GQPRIME_SAMPLE_APP"] [Media-Type = AUDIO (0)] [Flow-Status = DISABLED] [Reservation-Priority = DEFAULT (0)] [Codec-Data = "uplink offer m=audio 23942 RTP/AVP 0"]] [Specific-Action = INDICATION_OF_LOSS_OF_BEARER (2)] [Binding-Information = { Binding-Input-List = [V4-Transport-Address = { Framed-IP-Address = 192.168.0.2 } { Port-Number = 23942 }] [V4-Transport-Address = { Framed-IP-Address = 0.0.0.0 } { Port-Number = 0 }] [V4-Transport-Address = { Framed-IP-Address = 192.168.0.2 } { Port-Number = 23943 }] [V4-Transport-Address = { Framed-IP-Address = 0.0.0.0 } { Port-Number = 0 }] }] [Reservation-Priority = DEFAULT (0)][Globally-Unique-Address = [Framed-IP-Address = 192.168.0.2] [Address-Realm = "example.com"]] [Authorization-Lifetime = 450]
NOTE 1:	By including the Specific-Action AVP, P-CSCF A requests the SPDF to provide a notification at the loss of a bearer.				
4a	H.248	Ia	SPDF A	C-BGF A	Add terminations
	``` MEGACO/3 [spdf-a.example.com]:55555 Transaction = 1 { Context = ${ Add = ip/1/$/$ { /* NOTE 1 */ Media { Stream = 1 { LocalControl { ipdc/realm = "A", gm/rsb = ON } Local { v=0 m=- $ RTP/AVP 0 c=IN IP4 $ b=AS:104 }, Remote { v=0 o=- 0 0 IN IP4 192.168.0.2 s=- t=0 0 m=- 23942 RTP/AVP 0 c=IN IP4 192.168.0.2 b=AS:104 } } /* Stream */ }, /* Media */ ```				

Step	Protocol	Interface	From	To	Message

```
              Events = 1234 {
                  g/cause
              } /* Events */
          } /* Add */
          Add = ip/1/$/$ {
              Media {
                  Stream = 1 {
                      LocalControl {
                          ipdc/realm = "Core",
                          gm/rsb = ON
                      }
                      Local {
                          v=0
                          m=- $ RTP/AVP 97
                          a=rtpmap:97 AMR/8000/1
                          c=IN IP4 $
                          b=AS:104
                      }
                  } /* Stream */
              }, /* Media */
              Events = 1235 {
                  g/cause
              } /* Events */
          } /* Add */
      } /* Context */
  } /* Transaction */
```

35a	DIAMETER	Gq'	P-CSCF A	SPDF A	AAR (Modify)

```
  <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
              < Session-Id = "p-cscf-a.example.com;13815C;391" >
              { Auth-Application-Id = 16777222 (Gq) }
              { Origin-Host = "p-cscf-a.example.com" }
              { Origin-Realm = "example.com" }
              { Destination-Realm = "example.com" }
              [ Destination-Host = "spdf-a.example.com" ]
              [ Media-Component-Description =
                      { Media-Component-Number = 1 }
                      [ Media-Sub-Component =
                          { Flow-Number = 1 }
                          [ Flow-Description = "permit in 17 from any to any" ]
                          [ Flow-Description = "permit out 17 from any to 192.168.0.2 23942" ]
                          [ Flow-Usage = NO_INFORMATION(0) ]
                          [ Max-Requested-Bandwidth-UL = 96000 ]
                          [ Max-Requested-Bandwidth-DL = 96000 ]
                      ]
                      [ Media-Sub-Component =
                          { Flow-Number = 2 }
                          [ Flow-Description = "permit in 17 from any to any" ]
                          [ Flow-Description = "permit out 17 from any to 192.168.0.2 23943" ]
                          [ Flow-Usage = RTCP(1) ]
                          [ Max-Requested-Bandwidth-UL = 8000 ]
                          [ Max-Requested-Bandwidth-DL = 8000 ]
                      ]
                      [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                      [ Media-Type = AUDIO (0) ]
                      [ Flow-Status = ENABLED ]
                      [ Reservation-Priority = DEFAULT (0) ]
                      [ Codec-Data = "uplink
                          offer
                          m=audio 23942 RTP/AVP 0"
                      ]
              ]
              [ Specific-Action = INDICATION_OF_LOSS_OF_BEARER (2) ]
              [ Binding-Information =
                      { Binding-Input-List =
                          [ V4-Transport-Address =
                              { Framed-IP-Address = 192.168.0.2 }
                              { Port-Number = 23942 }
                          ]
                          [ V4-Transport-Address =
                              { Framed-IP-Address = 10.0.0.2 }
                              { Port-Number = 1110 }
                          ]
                          [ V4-Transport-Address =
                              { Framed-IP-Address = 192.168.0.2 }
                              { Port-Number = 23943 }
```

Step	Protocol	Interface	From	To	Message
					] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.2 } { Port-Number = 1111 }] }] [Reservation-Priority = DEFAULT (0)] [Globally-Unique-Address = [Framed-IP-Address = 192.168.0.2] [Address-Realm = "example.com"]] [Authorization-Lifetime = 450]

NOTE 2: If the Specific-Action AVP is provided in an initial AA-Request, it shall have the same value if provided also in a modifying AA-Request.

Step	Protocol	Interface	From	To	Message
48a	H.248	Ia	C-BGF A	SPDF A	Notify

The session was successfully established as in 6.1.1.1 with modifications according to the steps above.
Mid-session, C-BGF A detects loss of RTP on the ephemeral termination ip/1/if1/1 and sends a Notify command containing the g/cause event in the ObservedEvents descriptor to SPDF A.

```
MEGACO/3 [abgf-a.example.com]:55555
Transaction = 3 {
  Context = 1 {
    Notify = ip/1/if1/1 {
        ObservedEvents { g/cause }
    } /* Notify */
  } /* Context */
} /* Transaction */
```

Step	Protocol	Interface	From	To	Message
49a	H.248	Ia	SPDF A	C-BGF A	Reply (Notify)

```
MEGACO/3 [abgf-a.example.com]:55555
Reply = 3 {
  Context = 1 {
    Notify = ip/1/if1/1
  } /* Context */
} /* Transaction */
```

Step	Protocol	Interface	From	To	Message
50a	DIAMETER	Gq'	SPDF A	P-CSCF A	RAR

SPDF A correlates the termination id in the Notify command sent in step 48a with the corresponding Session-Id and sends a Re-Authorization Request containing the session id affected by the occurred event to P-CSCF A.

```
<RA-Request> ::=< Diameter Header: 258, REQ, PXY >
            < Session-Id = "p-cscf-a.example.com;13815C;391" >
            { Origin-Host = "spdf-a.example.com" }
            { Origin-Realm = "example.com" }
            { Destination-Realm = "example.com" }
            { Destination-Host = "p-cscf-a.example.com" }
            { Auth-Application-Id = 16777222 (Gq) }
            { Specific-Action = INDICATION_OF_LOSS_OF_BEARER (2) }
```

Step	Protocol	Interface	From	To	Message
51a	SIP	Mw	P-CSCF A	S-CSCF	BYE

```
BYE sip:user_a@example.com SIP/2.0
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKjwafcb9
Max-Forwards: 69
From: User B <sip:user_b@example.com>;tag=4fxdce12ls
To: User A <sip:user_a@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 1 BYE
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
52a	SIP	Mw	S-CSCF	P-CSCF B	BYE

```
    BYE sip:user_a@example.com SIP/2.0
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKjwafcb9
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKjwafcb9
    Max-Forwards: 68
    From: User B <sip:user_b@example.com>;tag=4fxdce12ls
    To: User A <sip:user_a@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 BYE
    Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
53a	DIAMETER	Gq'	P-CSCF B	SPDF B	STR

```
    <ST-Request> ::=< Diameter Header: 275, REQ, PXY >
                   < Session-Id = "p-cscf-b.example.com;481C43;583" >
                   { Origin-Host = "p-cscf-b.example.com" }
                   { Origin-Realm = "example.com" }
                   { Destination-Realm = "example.com" }
                   { Termination-Cause = DIAMETER_LOGOUT }
                   { Auth-Application-Id = 16777222 (Gq) }
                   [ Destination-Host = " spdf-b.example.com" ]
```

Step	Protocol	Interface	From	To	Message
54a	H.248	Ia	SPDF B	C-BGF B	Subtract termination B

```
    MEGACO/3 [spdf-b.example.com]:43924
    Transaction = 3 {
        Context = 1 {
           Subtract = ip/1/if1/1 {Audit{Statistics}}
           Subtract = ip/1/if2/1 {Audit{Statistics}}
        } /* Context */
    } /* Transaction */
```

Step	Protocol	Interface	From	To	Message
55a	H.248	Ia	C-BGF B	SPDF B	Reply (Subtract)

```
    MEGACO/3 [abgf-b.example.com]:43924
    Reply = 3 {
        Context = 1 {
          Subtract = ip/1/if1/1 {
            Statistics {
               nt/dur=450000, ; in milliseconds
               nt/os=5400000, ; Octets Sent
               nt/or=5400000, ; Octets Received
               gm/dp=0        ; number of packets discarded
            }
          }
          Subtract = ip/1/if2/1 {
            Statistics {
               nt/dur=450000, ; in milliseconds
               nt/os=450000,  ; Octets Sent
               nt/or=450000,  ; Octets Received
               gm/dp=0        ; number of packets discarded
            } /* Statistics */
          } /* Subtract */
        } /* Context */
    } /* Reply */
```

Step	Protocol	Interface	From	To	Message
56a	DIAMETER	Rq	SPDF B	A-RACF B	STR

```
    <ST-Request> ::=< Diameter Header: 275, REQ, PXY >
                   < Session-Id = "spdf-b.example.com;41295;512" >
                   { Origin-Host = "spdf-b.example.com" }
                   { Origin-Realm = "example.com" }
                   { Destination-Realm = "example.com" }
                   { Auth-Application-Id = 16777222 (Gq) }
                   { Termination-Cause = DIAMETER_LOGOUT }
                   [ Destination-Host = " aracf-b.example.com" ]
```

Step	Protocol	Interface	From	To	Message
57a	DIAMETER	Re	A-RACF B	RCEF B	PIR

```
    < PI-Request > ::=  < Diameter Header: 315, REQ, PXY >
                  < Session-Id = "aracf-b.example.com;66389;469" >
                  { Auth-Application-Id = 16777253 (Re) }
                  { Origin-Host = "aracf-b.example.com" }
                  { Origin-Realm = "example.com" }
                  { Destination-Realm = "example.com" }
                  { Destination-Host = "rcef-b.example.com" }
                  { PI-Request-Type = TERMINATION_REQUEST }
                  { PI-Request-Number = 1 }
                  [ Policy-Rule-Remove =
                     [ Policy-Rule-Definition =
                         [ Policy-Rule-Name = "policy-rule-example-B-UL" ]
                     ]
                  ]
                  [ Policy-Rule-Remove =
                     [ Policy-Rule-Definition =
                         [ Policy-Rule-Name = "policy-rule-example-B-DL" ]
                     ]
                  ]
```

Step	Protocol	Interface	From	To	Message
58a	DIAMETER	Re	RCEF B	A-RACF	PIA

```
    <PI-Answer> ::= < Diameter Header: 315, PXY >
                  < Session-Id = "aracf-b.example.com;66389;469" >
                  { Origin-Host = "rcef-b.example.com" }
                  { Origin-Realm = "example.com" }
                  { PI-Request-Type = TERMINATION_REQUEST }
                  { PI-Request-Number = 1 }
                  [ Result-Code DIAMETER_SUCCESS (2001) ]
```

Step	Protocol	Interface	From	To	Message
59a	DIAMETER	Rq	A-RACF B	SPDF B	STA

```
    <ST-Answer> ::= < Diameter Header: 275, PXY >
                  < Session-Id = "spdf-b.example.com;41295;512" >
                  { Origin-Host = "aracf-b.example.com" }
                  { Origin-Realm = "example.com" }
                  [ Result-Code = DIAMETER_SUCCESS (2001) ]
```

Step	Protocol	Interface	From	To	Message
60a	DIAMETER	Gq'	SPDF B	P-CSCF B	STA

```
    <ST-Answer> ::= < Diameter Header: 275, PXY >
                  < Session-Id = "p-cscf-b.example.com;481C43;583" >
                  { Origin-Host = "spdf-b.example.com" }
                  { Origin-Realm = "example.com" }
                  [ Result-Code = DIAMETER_SUCCESS (2001)
```

Step	Protocol	Interface	From	To	Message
61a	SIP	Gm	P-CSCF B	Phone B	BYE

```
    BYE sip:user_a@example.com SIP/2.0
    Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKjwafcb9
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKjwafcb9
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKjwafcb9
    Max-Forwards: 67
    From: User B <sip:user_b@example.com>;tag=372183
    To: User A <sip:user_a@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 BYE
    Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
62a	SIP	Gm	Phone B	P-CSCF B	200 OK (BYE)

```
    SIP/2.0 200 OK
    Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKs1pp0
    Max-Forwards: 70
    From: User B <sip:user_b@example.com>;tag=372183
    To: User A <sip:user_a@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 BYE
    Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
63a	SIP	Mw	P-CSCF B	S-CSCF	200 OK (BYE)

```
   SIP/2.0 200 OK
   Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
   Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKs1pp0
   Max-Forwards: 69
   From: User B <sip:user_b@example.com>;tag=372183
   To: User A <sip:user_a@example.com>
   Call-ID: 398174293@phone-a.example.com
   CSeq: 1 BYE
   Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
64a	SIP	Mw	S-CSCF	P-CSCF A	200 OK (BYE)

```
   SIP/2.0 200 OK
   Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKs1pp0
   Max-Forwards: 68
   From: User B <sip:user_b@example.com>;tag=372183
   To: User A <sip:user_a@example.com>
   Call-ID: 398174293@phone-a.example.com
   CSeq: 1 BYE
   Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
65a	DIAMETER	Gq'	P-CSCF A	SPDF A	RAA

```
   <RA-Answer > ::=< Diameter Header: 258, PXY >
                < Session-Id = "p-cscf-a.example.com;13815C;391" >
                { Origin-Host = "p-cscf-a.example.com" }
                { Origin-Realm = "example.com" }
                [ Result-Code = DIAMETER_SUCCESS (2001) ]
```

Step	Protocol	Interface	From	To	Message
66a	DIAMETER	Gq'	P-CSCF A	SPDF A	STR

```
   <ST-Request> ::=< Diameter Header: 275, REQ, PXY >
                < Session-Id = "p-cscf-a.example.com;13815C;391" >
                { Origin-Host = "p-cscf-a.example.com" }
                { Origin-Realm = "example.com" }
                { Destination-Realm = "example.com" }
                { Termination-Cause = DIAMETER_LOGOUT }
                { Auth-Application-Id = 16777222 (Gq) }
                [ Destination-Host = " spdf-a.example.com" ]
```

Step	Protocol	Interface	From	To	Message
67a	H.248	Ia	SPDF A	C-BGF A	Subtract

```
   MEGACO/3 [spdf-a.example.com]:5555
   Transaction = 3 {
       Context = 1 {
          Subtract = ip/1/if1/1 {Audit{Statistics}}
          Subtract = ip/1/if2/1 {Audit{Statistics}}
       } /* Context */
   } /* Transaction */
```

Step	Protocol	Interface	From	To	Message
68a	H.248	Ia	C-BGF A	SPDF A	Reply (Subtract)

```
   MEGACO/3 [abgf-a.example.com]:21398
   Reply = 3 {
        Context = 1 {
           Subtract = ip/1/if1/1 {
              Statistics {
                 nt/dur=450000, ; in milliseconds
                 nt/os=5400000, ; Octets Sent
                 nt/or=5400000, ; Octets Received
                 gm/dp=0         ; number of packets discarded
              }
           }
           Subtract = ip/1/if1/2 {
              Statistics {
                 nt/dur=450000, ; in milliseconds
                 nt/os=450000,  ; Octets Sent
                 nt/or=450000,  ; Octets Received
                 gm/dp=0         ; number of packets discarded
              } /* Statistics */
           } /* Subtract */
        } /* Context */
   } /* Reply */
```

Step	Protocol	Interface	From	To	Message
69a	DIAMETER	Rq	SPDF A	A-RACF A	STR

```
   <ST-Request> ::=< Diameter Header: 275, REQ, PXY >
                   < Session-Id = "spdf-a.example.com;429C3;412" >
                   { Origin-Host = "spdf-a.example.com" }
                   { Origin-Realm = "example.com" }
                   { Destination-Realm = "example.com" }
                   { Auth-Application-Id = 16777222 (Gq) }
                   { Termination-Cause = DIAMETER_LOGOUT }
                   [ Destination-Host = " aracf-a.example.com" ]
```

Step	Protocol	Interface	From	To	Message
70a	DIAMETER	Re	A-RACF A	RCEF A	PIR

```
   < PI-Request > ::=  < Diameter Header: 315, REQ, PXY >
                   < Session-Id = "aracf-a.example.com;32475;112" >
                   { Auth-Application-Id = 16777253 (Re) }
                   { Origin-Host = "aracf-a.example.com" }
                   { Origin-Realm = "example.com" }
                   { Destination-Realm = "example.com" }
                   { Destination-Host = "rcef-a.example.com" }
                   { PI-Request-Type = TERMINATION_REQUEST }
                   { PI-Request-Number = 1 }
                   [ Policy-Rule-Remove =
                       [ Policy-Rule-Definition =
                           [ Policy-Rule-Name = "policy-rule-example-A-UL" ]
                       ]
                   ]
                   [ Policy-Rule-Remove =
                       [ Policy-Rule-Definition =
                           [ Policy-Rule-Name = "policy-rule-example-A-DL" ]
                       ]
                   ]
```

Step	Protocol	Interface	From	To	Message
71a	DIAMETER	Re	RCEF A	A-RACF A	PIA

```
   <PI-Answer> ::= < Diameter Header: 315, PXY >
                   < Session-Id = "aracf-a.example.com;32475;112" >
                   { Origin-Host = "rcef-a.example.com" }
                   { Origin-Realm = "example.com" }
                   { PI-Request-Type = TERMINATION_REQUEST }
                   { PI-Request-Number = 1 }
                   [ Result-Code DIAMETER_SUCCESS (2001) ]
```

Step	Protocol	Interface	From	To	Message
72a	DIAMETER	Rq	A-RACF A	SPDF A	STA

```
    <ST-Answer> ::= < Diameter Header: 275, PXY >
                  < Session-Id = "spdf-a.example.com;429C3;412" >
                  { Origin-Host = "aracf-a.example.com" }
                  { Origin-Realm = "example.com" }
                  [ Result-Code = DIAMETER_SUCCESS (2001) ]
```

Step	Protocol	Interface	From	To	Message
73a	DIAMETER	Gq'	SPDF A	P-CSCF A	STA

```
    <ST-Answer> ::= < Diameter Header: 275, PXY >
                  < Session-Id = "p-cscf-a.example.com;13815C;391" >
                  { Origin-Host = "spdf-a.example.com" }
                  { Origin-Realm = "example.com" }
                  [ Result-Code = DIAMETER_SUCCESS (2001) ]
```

Step	Protocol	Interface	From	To	Message
74a	SIP	Gm	P-CSCF A	Phone A	BYE

```
    BYE sip:user_a@example.com SIP/2.0
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKs1pp0
    Max-Forwards: 69
    From: User B <sip:user_b@example.com>;tag=372183
    To: User A <sip:user_a@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 BYE
    Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
75a	SIP	Gm	Phone A	P-CSCF A	200 OK (BYE)

```
    SIP/2.0 200 OK
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKs1pp0
    Max-Forwards: 69
    From: User B <sip:user_b@example.com>;tag=372183
    To: User A <sip:user_a@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 BYE
    Content-Length: 0
```

6.1.3.4   Admission denial
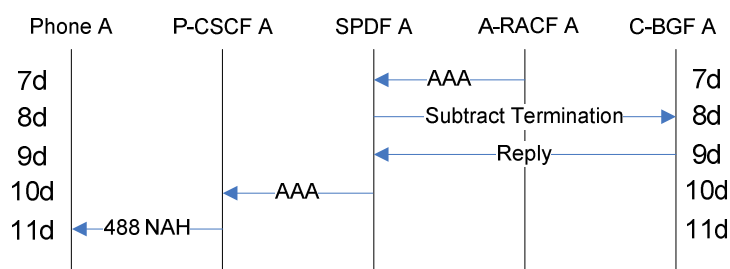
Figure 6.1.3.4.1: Signalling for admission denial in A-RACF A at session setup

Table 6.1.3.4.1: Messages for admission denial in A-RACF A at session setup

Step	Protocol	Interface	From	To	Message
7d	DIAMETER	Rq	A-RACF A	SPDF A	AAA

```
<AA-Answer> ::= < Diameter Header: 265, PXY >
               < Session-Id = "spdf-a.example.com;429C3;412" >
               { Auth-Application-Id = 16777222 (Gq) }
               { Origin-Host = "aracf-a.example.com" }
               { Origin-Realm = "example.com" }
               [ Experimental-Result =
                   { Vendor-Id = ETSI (13019) }
                   { Experimental-Result-Code = INSUFFICIENT_RESOURCES (4041) }
               ]
```

Step	Protocol	Interface	From	To	Message
8d	H.248	Ia	SPDF A	C-BGF A	Subtract termination A

```
MEGACO/3 [spdf-a.example.com]:5555
Transaction = 2 {
     Context = 1 {
         Subtract = ip/1/if1/1 {Audit{Statistics}}
         Subtract = ip/1/if2/1 {Audit{Statistics}}
     } /* Context */
} /* Transaction */
```

Step	Protocol	Interface	From	To	Message
9d	H.248	Ia	C-BGF A	SPDF A	Reply

```
MEGACO/3 [abgf-a.example.com]:21398
Reply = 2 {
     Context = 1 {
         Subtract = ip/1/if1/1 {
            Statistics {
               nt/dur=450, ; in milliseconds
               nt/os=0, ; Octets Sent
               nt/or=0, ; Octets Received
               gm/dp=0     ; number of packets discarded
            }
         }
         Subtract = ip/1/if1/2 {
            Statistics {
               nt/dur=450, ; in milliseconds
               nt/os=0, ; Octets Sent
               nt/or=0, ; Octets Received
               gm/dp=0         ; number of packets discarded
            } /* Statistics */
         } /* Subtract */
     } /* Context */
} /* Reply */
```

Step	Protocol	Interface	From	To	Message
10d	DIAMETER	Gq'	SPDF A	P-CSCF A	AAA

```
<AA-Answer> ::= < Diameter Header: 265, PXY >
               < Session-Id = "p-cscf-a.example.com;13815C;391" >
               { Auth-Application-Id = 16777222 (Gq) }
               { Origin-Host = "spdf-a.example.com" }
               { Origin-Realm = "example.com" }
               [ Experimental-Result =
                   { Vendor-Id = ETSI (13019) }
                   { Experimental-Result-Code = INSUFFICIENT_RESOURCES (4041) }
               ]
```

Step	Protocol	Interface	From	To	Message
11d	SIP		P-CSCF A	Phone A	488 Not Acceptable Here

```
SIP/2.0 488 Not Acceptable Here
Warning: 370 example.com "RACS: INSUFFICIENT_RESOURCES (4041)"
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 70
From: User A <sip:user_a@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 1 MESSAGE
Contact: <sip:user_b@phone-b.example.com>
Content-Length: 0
```

6.1.4   Session Update
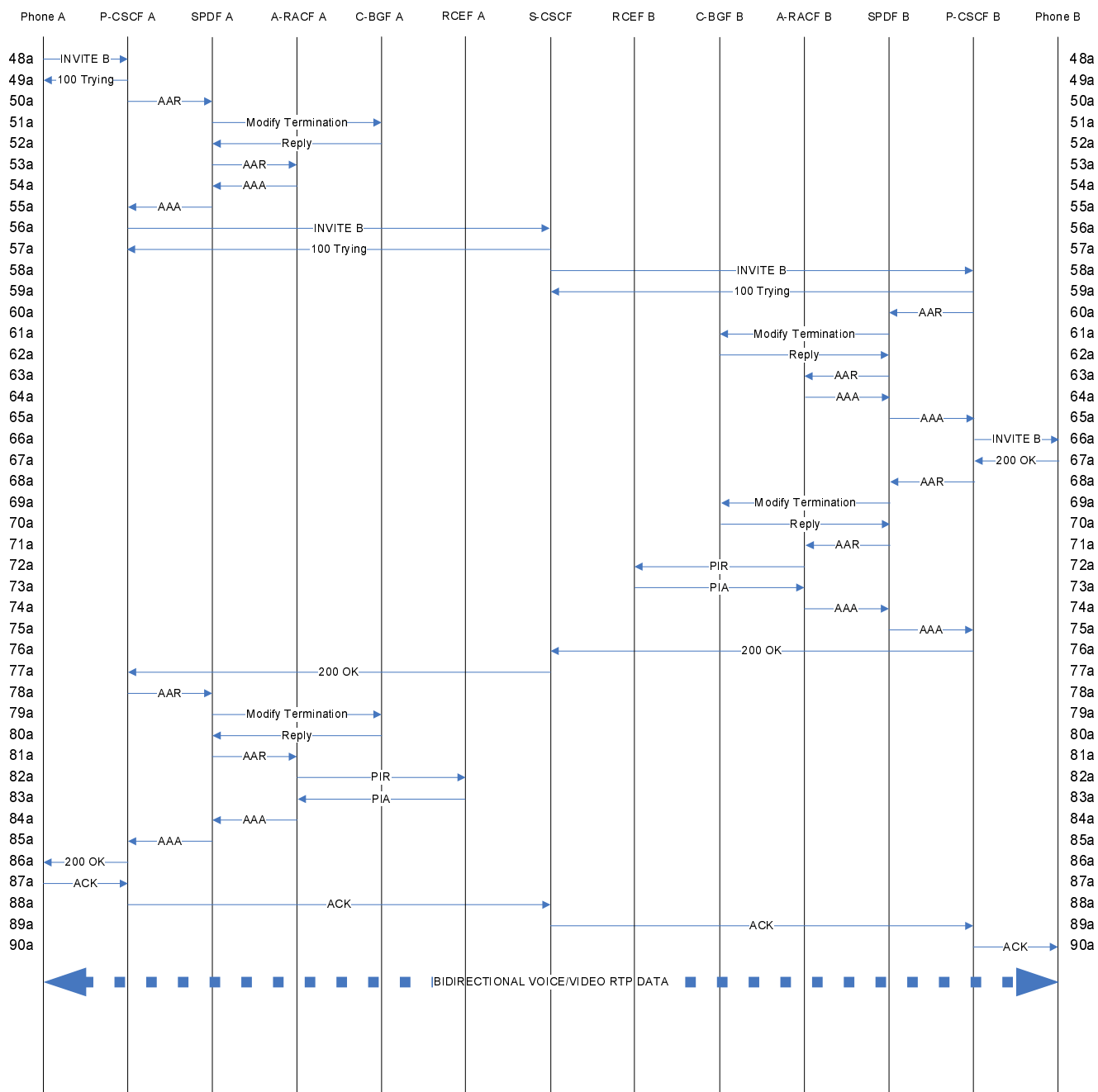
Figure 6.1.4.1: IMS end-to-end signalling chart between two SIP end-points - session update

Table 6.1.4.1: IMS end-to-end messages between two SIP end-points - session update

Step	Protocol	Interface	From	To	Message
48a	SIP		Phone A	P-CSCF A	INVITE B

Phone A updates the session to include video by sending a mid-session re-invite to Phone B indicating the desired video codec to use in the call, in this case H.261. The b= SDP header element is used to advertise the maximum bandwidth the UE can receive for the advertised codec as described in annex B of [5].

```
INVITE sip:user_b@example.com SIP/2.0
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 70
Route: <sip:p-cscf-a.example.com;lr>
From: User A <sip:user_a@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 2 INVITE
Contact: <sip:user_a@phone-a.example.com>
Content-Type: application/sdp
Content-Length: 204

v=0
o=user_a 2890844526 2890842807 IN IP4 phone-a.example.com
s=-
c=IN IP4 192.168.0.2
t=0 0
m=audio 23942 RTP/AVP 0
a=sendrecv
m=video 51372 RTP/AVP 31
a=rtpmap:31 H261/90000
a=sendrecv
b=AS:640
```

Step	Protocol	Interface	From	To	Message
49a	SIP		P-CSCF A	Phone A	100 Trying

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
From: User A <sip:user_a@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 2 INVITE
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
50a	DIAMETER	Gq'	P-CSCF A	SPDF A	AAR

Given the reception of a=sendrecv in the SDP the P-CSCF issues a bi-directional reservation modification request to the SPDF in order to reserve bandwidth for the added video media flow. A second media component is added to the Diameter session. The SPDF already contain the state for the first media component of this session. Therefore, only the new media component describing the video media flow need be present in the AA-Request.
Following the rules given in clause 5.2.1.3, the Binding-Information AVPs are set to 0.0.0.0 and 0 respectively since no addresses or ports at the core side are allocated yet for the video flow. RTCP bandwidth is set to 5 % of the media stream bit rate in accordance with RFC 3556.

```
<AA-Request> ::=< Diameter Header: 265, REQ, PXY >
              < Session-Id = "p-cscf-a.example.com;13815C;391" >
              { Auth-Application-Id = 16777222 (Gq) }
              { Origin-Host = "p-cscf-a.example.com" }
              { Origin-Realm = "example.com" }
              { Destination-Realm = "example.com" }
              [ Destination-Host = "spdf-a@example.com" ]
              [ Media-Component-Description =
                      { Media-Component-Number = 2 }
                      [ Media-Sub-Component =
                          { Flow-Number = 1 }
                          [ Flow-Description = "permit out 17 from any to 192.168.0.2 51372" ]
                          [ Flow-Description = "permit in 17 from any to any" ]
                          [ Flow-Usage = NO_INFORMATION(0) ]
                          [ Max-Requested-Bandwidth-DL = 640000 ]
                          [ Max-Requested-Bandwidth-UL = 640000 ]
                      ]
                      [ Media-Sub-Component =
                          { Flow-Number = 2 }
                          [ Flow-Description = "permit out 17 from any to 192.168.0.2 51373" ]
                          [ Flow-Description = "permit in 17 from any to any" ]
                          [ Flow-Usage = RTCP (1) ]
                          [ Max-Requested-Bandwidth-DL = 32000 ]
                          [ Max-Requested-Bandwidth-UL = 32000 ]
```

Step	Protocol	Interface	From	To	Message
					]
					[AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
					[Media-Type = VIDEO (1)]
					[Flow-Status = DISABLED]
					[Reservation-Priority = DEFAULT (0)]
					[Codec-Data = "uplink
					offer
					m=video 51372 RTP/AVP 31
					a=rtpmap:31 H261/90000
					b=AS:640"
					]
					]
					[Binding-Information =
					{ Binding-Input-List =
					[V4-Transport-Address =
					{ Framed-IP-Address = 192.168.0.2 }
					{ Port-Number = 51372 }
					]
					[V4-Transport-Address =
					{ Framed-IP-Address = 0.0.0.0 }
					{ Port-Number = 0 }
					]
					[V4-Transport-Address =
					{ Framed-IP-Address = 192.168.0.2 }
					{ Port-Number = 51373 }
					]
					[V4-Transport-Address =
					{ Framed-IP-Address = 0.0.0.0 }
					{ Port-Number = 0 }
					]
					}
					]
					[Reservation-Priority = DEFAULT (0)]
					[Globally-Unique-Address =
					[Framed-IP-Address = 192.168.0.2]
					[Address-Realm = "example.com"]
					]
					[Authorization-Lifetime = 450]
51a	H.248	Ia	SPDF A	C-BGF A	Modify terminations

A Modify is sent to C-BGF A to add a second stream to the termination for the video media flow. Since the SPDF already contains the state for the first media component of this session, the SPDF ignores the information for the voice media flow knowing that that terminations are already established in the C-BGF for the voice media flow.

```
MEGACO/3 [spdf-a.example.com]:55555
Transaction = 3 {
    Context = 1 {
        Modify = ip/1/if1/1 {
            Media {
                Stream = 2 {
                    LocalControl {
                        ipdc/realm = "A",
                        gm/rsb = ON
                    }
                    Local {
                        v=0
                        c=IN IP4 $
                        m=video $ RTP/AVP 31
                        a=rtpmap:31 H261/90000
                        b=AS:640
                    },
                    Remote {
                        v=0
                        o=- 0 0 IN IP4 192.168.0.2
                        s=-
                        t=0 0
                        c=IN IP4 192.168.0.2
                        m=video 51372 RTP/AVP 31
                        a=rtpmap:31 H261/90000
                        b=AS:640
                    }
                } /* Stream */
            } /* Media */
        } /* Modify */
        Modify = ip/1/if2/1 {
```

Step	Protocol	Interface	From	To	Message

					<pre>Media {
					    Stream = 2 {
					        LocalControl {
					            ipdc/realm = "Core",
					            gm/rsb = ON
					        }
					        Local {
					            v=0
					            c=IN IP4 $
					            m=video $ RTP/AVP 31
					            a=rtpmap:31 H261/90000
					            b=AS:640
					        }
					    } /* Stream */
					} /* Media */
					        } /* Modify */
					    } /* Context */
					} /* Transaction */</pre>

52a	H.248	Ia	C-BGF A	SPDF A	Reply (Modify)

					<pre>MEGACO/3 [abgf-a.example.com]:55555
					Reply = 3 {
					    Context = 1 {
					        Modify = ip/1/if1/1 {
					            Media {
					                Stream = 2 {
					                    LocalControl {
					                        ipdc/realm = "A",
					                        gm/rsb = ON
					                    }
					                    Local {
					                        v=0
					                        o=- 0 0 IN IP4 192.168.0.1
					                        s=-
					                        t=0 0
					                        c=IN IP4 192.168.0.1
					                        m=video 31782 RTP/AVP 31
					                        a=rtpmap:31 H261/90000
					                        b=AS:640
					                    },
					                    Remote {
					                        v=0
					                        o=- 0 0 IN IP4 192.168.0.2
					                        s=-
					                        t=0 0
					                        c=IN IP4 192.168.0.2
					                        m=video 51372 RTP/AVP 31
					                        a=rtpmap:31 H261/90000
					                        b=AS:640
					                    }
					                } /* Stream */
					            } /* Media */
					        } /* Modify */
					        Modify = ip/1/if2/1 {
					            Media {
					                Stream = 2 {
					                    LocalControl {
					                        ipdc/realm = "Core",
					                        gm/rsb = ON
					                    }
					                    Local {
					                        v=0
					                        o=- 0 0 IN IP4 10.0.0.1
					                        s=-
					                        t=0 0
					                        c=IN IP4 10.0.0.1
					                        m=video 17462 RTP/AVP 31
					                        a=rtpmap:31 H261/90000
					                        b=AS:640
					                    }
					                } /* Stream */
					            } /* Media */
					        } /* Modify */
					    } /* Context */
					} /* Reply */</pre>

Step	Protocol	Interface	From	To	Message
53a	DIAMETER	Rq	SPDF A	A-RACF A	AAR

Since the SPDF already contains the state for the first media component of this session, the SPDF ignores the information for the voice media flow knowing that that admission and policy control are already performed in the A-RACF for the voice media flow.

```
    <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                     < Session-Id = "spdf-a.example.com;429C3;412" >
                     { Auth-Application-Id = 16777222 (Gq) }
                     { Origin-Host = "spdf-a.example.com" }
                     { Origin-Realm = "example.com" }
                     { Destination-Realm = "example.com" }
                     [ Destination-Host = "aracf-a@example.com" ]
                     [ Media-Component-Description =
                             { Media-Component-Number = 2 }
                             [ Media-Sub-Component =
                                 { Flow-Number = 1 }
                                 [ Flow-Description = "permit out 17 from 192.168.0.1 31782
                                                              to 192.168.0.2 51372" ]
                                 [ Flow-Description = "permit in 17 from any to any" ]
                                 [ Flow-Usage = NO_INFORMATION(0) ]
                                 [ Max-Requested-Bandwidth-DL = 640000 ]
                                 [ Max-Requested-Bandwidth-UL = 640000 ]
                             ]
                             [ Media-Sub-Component =
                                 { Flow-Number = 2 }
                                 [ Flow-Description = "permit out 17 from 192.168.0.1 31783
                                                              to 192.168.0.2 51373" ]
                                 [ Flow-Description = "permit in 17 from any to any" ]
                                 [ Flow-Usage = RTCP (1) ]
                                 [ Max-Requested-Bandwidth-DL = 32000 ]
                                 [ Max-Requested-Bandwidth-UL = 32000 ]
                             ]
                             [ AF-Application-Identifier = "RQ_SAMPLE_APP"]
                             [ Media-Type = VIDEO (1) ]
                             [ Flow-Status = DISABLED ]
                             [ Reservation-Priority = DEFAULT (0) ]
                     ]
                     [ Reservation-Priority = DEFAULT (0) ]
                     [ Globally-Unique-Address =
                             [ Framed-IP-Address = 192.168.0.2 ]
                             [ Address-Realm = "example.com" ]
                     ]
                     [ Authorization-Lifetime = 450 ]
```

Step	Protocol	Interface	From	To	Message
54a	DIAMETER	Rq	A-RACF A	SPDF A	AAA

```
    <AA-Answer> ::= < Diameter Header: 265, PXY >
                    < Session-Id = "spdf-a.example.com;429C3;412" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "aracf-a.example.com" }
                    { Origin-Realm = "example.com" }
                    [ Result-Code = DIAMETER_SUCCESS (2001) ]
                    [ Authorization-Lifetime = 450 ]
                    [ Auth-Grace-Period = 10 ]
```

Step	Protocol	Interface	From	To	Message
55a	DIAMETER	Gq'	SPDF A	P-CSCF A	AAA

Because the AA-Request contained binding information for both the voice and the video media flows, the SPDF returns the complete set of binding information to the P-CSCF. In case the P-CSCF had not provided information on the previously established voice media flow, the SPDF would neither have returned binding information for this flow.

```
    <AA-Answer> ::= < Diameter Header: 265, PXY >
                    < Session-Id = "p-cscf-a.example.com;13815C;391" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "spdf-a.example.com" }
                    { Origin-Realm = "example.com" }
                    [ Result-Code = DIAMETER_SUCCESS (2001) ]
                    [ Binding-Information =
                        { Binding-Input-List =

                          [ V4-Transport-Address =
                              { Framed-IP-Address = 192.168.0.2 }
                              { Port-Number = 51372 }
                          ]
                          [ V4-Transport-Address =
                              { Framed-IP-Address = 0.0.0.0 }
```

Step	Protocol	Interface	From	To	Message

					`{ Port-Number = 0 }`
					`]`
					`[ V4-Transport-Address =`
					`    { Framed-IP-Address = 192.168.0.2 }`
					`    { Port-Number = 51373 }`
					`]`
					`[ V4-Transport-Address =`
					`    { Framed-IP-Address = 0.0.0.0 }`
					`    { Port-Number = 0 }`
					`]`
					`[ Binding-Output-List =`
					
					`    [ V4-Transport-Address =`
					`        { Framed-IP-Address = 10.0.0.1 }`
					`        { Port-Number = 17462 }`
					`    ]`
					`    [ V4-Transport-Address =`
					`        { Framed-IP-Address = 0.0.0.0 }`
					`        { Port-Number = 0 }`
					`    ]`
					`    [ V4-Transport-Address =`
					`        { Framed-IP-Address = 10.0.0.1 }`
					`        { Port-Number = 17463 }`
					`    ]`
					`    [ V4-Transport-Address =`
					`        { Framed-IP-Address = 0.0.0.0 }`
					`        { Port-Number = 0 }`
					`    ]`
					`    ]`
					`]`
					`]`
					`[ Authorization-Lifetime = 450 ]`
					`[ Auth-Grace-Period = 10 ]`

56a	SIP		P-CSCF A	S-CSCF	INVITE B

					`INVITE sip:user_b@example.com SIP/2.0`
					`Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml`
					`Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03`
					`Max-Forwards: 69`
					`Record-Route: <sip:p-cscf-a.example.com;lr>`
					`From: User A <sip:user_a@example.com>;tag=372183`
					`To: User B <sip:user_b@example.com>`
					`Call-ID: 398174293@phone-a.example.com`
					`CSeq: 2 INVITE`
					`Contact: <sip:user_a@phone-a.example.com>`
					`Content-Type: application/sdp`
					`Content-Length: 201`
					
					`o=user_a 2890844526 2890842807 IN IP4 phone-a.example.com`
					`s=-`
					`c=IN IP4 10.0.0.1`
					`t=0 0`
					`m=audio 2222 RTP/AVP 0`
					`a=sendrecv`
					`m=video 17462 RTP/AVP 31`
					`a=rtpmap:31 H261/90000`
					`a=sendrecv`
					`b=AS:640`

57a	SIP		S-CSCF	P-CSCF A	100 Trying

					`SIP/2.0 100 Trying`
					`Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml`
					`Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03`
					`From: User A <sip:user_a@example.com>;tag=372183`
					`To: User B <sip:user_b@example.com>`
					`Call-ID: 398174293@phone-a.example.com`
					`CSeq: 2 INVITE`
					`Content-Length: 0`

Step	Protocol	Interface	From	To	Message
58a	SIP		S-CSCF	P-CSCF B	INVITE B

```
INVITE sip:user_b@example.com SIP/2.0
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 68
Record-Route: <sip:s-cscf.example.com;lr>,<sip:p-cscf-a.example.com;lr>
From: User A <sip:user_a@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 2 INVITE
Contact: <sip:user_a@phone-a.example.com>
Content-Type: application/sdp
Content-Length: 201

o=user_a 2890844526 2890842807 IN IP4 phone-a.example.com
s=-
c=IN IP4 10.0.0.1
t=0 0
m=audio 2222 RTP/AVP 0
a=sendrecv
m=video 17462 RTP/AVP 31
a=rtpmap:31 H261/90000
a=sendrecv
b=AS:640
```

Step	Protocol	Interface	From	To	Message
59a	SIP		P-CSCF B	S-CSCF	100 Trying

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
From: User A <sip:user_a@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 2 INVITE
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
60a	DIAMETER	Gq'	P-CSCF B	SPDF B	AAR

```
<AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                < Session-Id = "p-cscf-b.example.com;481C43;583" >
                { Auth-Application-Id = 16777222 (Gq) }
                { Origin-Host = "p-cscf-b.example.com" }
                { Origin-Realm = "example.com" }
                { Destination-Realm = "example.com" }
                [ Destination-Host = "spdf-b@example.com" ]
                [ Media-Component-Description =
                        { Media-Component-Number = 2 }
                        [ Media-Sub-Component =
                            { Flow-Number = 1 }
                            [ Flow-Description = "permit in 17 from any to any" ]
                            [ Flow-Description = "permit out 17 from any to any" ]
                            [ Flow-Usage = NO_INFORMATION(0) ]
                            [ Max-Requested-Bandwidth-UL = 640000 ]
                            [ Max-Requested-Bandwidth-DL = 640000]
                        ]
                        [ Media-Sub-Component =
                            { Flow-Number = 2 }
                            [ Flow-Description = "permit in 17 from any to any" ]
                            [ Flow-Description = "permit out 17 from any to any" ]
                            [ Flow-Usage = RTCP (1) ]
                            [ Max-Requested-Bandwidth-UL = 32000 ]
                            [ Max-Requested-Bandwidth-DL = 32000 ]
                        ]
                        [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                        [ Media-Type = AUDIO (0) ]
                        [ Flow-Status = DISABLED ]
                        [ Reservation-Priority = DEFAULT (0) ]
                        [ Codec-Data = "downlink
                            Offer
                            m=video 17462 RTP/AVP 31
                            a=rtpmap:31 H261/90000
                            b=AS:640
                        ]
```

Step	Protocol	Interface	From	To	Message
					]
					[Binding-Information =
					{ Binding-Input-List =
					[V4-Transport-Address =
					{ Framed-IP-Address = 0.0.0.0 }
					{ Port-Number = 0 }
					]
					[V4-Transport-Address =
					{ Framed-IP-Address = 10.0.0.1 }
					{ Port-Number = 17462 }
					]
					[V4-Transport-Address =
					{ Framed-IP-Address = 0.0.0.0 }
					{ Port-Number = 0 }
					]
					[V4-Transport-Address =
					{ Framed-IP-Address = 10.0.0.1 }
					{ Port-Number = 17463 }
					]
					}
					]
					[Reservation-Priority = DEFAULT (0)]
					[Globally-Unique-Address =
					[Framed-IP-Address = 192.168.1.2]
					[Address-Realm = "example.com"]
					]
					[Authorization-Lifetime = 450]
61a	H.248	Ia	SPDF B	C-BGF B	Modify terminations

```
MEGACO/3 [spdf-b.example.com]:43924
Transaction = 3 {
    Context = 1 {
        Modify = ip/1/if1/1 {
            Media {
                Stream = 2 {
                    LocalControl {
                        ipdc/realm = "B",
                        gm/rsb = ON
                    }
                    Local {
                        v=0
                        c=IN IP4 $
                        m=video $ RTP/AVP 31
                        a=rtpmap:31 H261/90000
                        b=AS:640
                    }
                } /* Stream */
            } /* Media */
        } /* Modify */
        Modify = ip/1/if2/1 {
            Media {
                Stream = 2 {
                    LocalControl {
                        ipdc/realm = "Core",
                        gm/rsb = ON
                    }
                    Local {
                        v=0
                        c=IN IP4 $
                        m=video $ RTP/AVP 31
                        a=rtpmap:31 H261/90000
                        b=AS:640
                    },
                    Remote {
                        v=0
                        o=- 0 0 IN IP4 10.0.0.1
                        s=-
                        t=0 0
                        c=IN IP4 10.0.0.1
                        m=video 17462 RTP/AVP 31
                        a=rtpmap:31 H261/90000
                        b=AS:640
                    }
                } /* Stream */
            } /* Media */
```

Step	Protocol	Interface	From	To	Message

					`} /* Modify */`
					`} /* Context */`
					`} /* Transaction */`

62a	H.248	Ia	C-BGF B	SPDF B	Reply (Add)

```
    MEGACO/3 [abgf-b.example.com]:43924
    Reply = 3 {
        Context = 1 {
            Modify = ip/1/if1/1{
                Media {
                    Stream = 2 {
                        LocalControl {
                            ipdc/realm = "B",
                            gm/rsb = ON
                        }
                        Local {
                            v=0
                            o=- 0 0 IN IP4 192.168.1.1
                            s=-
                            t=0 0
                            c=IN IP4 192.168.1.1
                            m=video 32124 RTP/AVP 31
                            a=rtpmap:31 H261/90000
                            b=AS:640
                        }
                    } /* Stream */
                } /* Media */
            } /* Modify */
            Modify = ip/1/if2/1{
                Media {
                    Stream = 1 {
                        LocalControl {
                            ipdc/realm = "Core",
                            gm/rsb = ON
                        }
                        Local {
                            v=0
                            o=- 0 0 IN IP4 10.0.0.2
                            s=-
                            t=0 0
                            c=IN IP4 10.0.0.2
                            m=video 1612 RTP/AVP 31
                            a=rtpmap:31 H261/90000
                            b=AS:640
                        },
                        Remote {
                            v=0
                            o=- 0 0 IN IP4 10.0.0.1
                            s=-
                            t=0 0
                            c=IN IP4 10.0.0.1
                            m=video 2222 RTP/AVP 31
                            a=rtpmap:31 H261/90000
                            b=AS:640
                        }
                    } /* Stream */
                } /* Media */
            } /* Modify */
        } /* Context */
    } /* Reply */
```

| 63a | DIAMETER | Rq | SPDF B | A-RACF B | AAR |

```
    <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                    < Session-Id = "spdf-b.example.com;41295;512" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "spdf-b.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    [ Destination-Host = "aracf-b@example.com" ]
                    [ Media-Component-Description =
                            { Media-Component-Number = 2 }
                            [ Media-Sub-Component =
                                { Flow-Number = 1 }
                                [ Flow-Description = "permit in 17 from any to 192.168.1.1 32124" ]
                                [ Flow-Description = "permit out 17 from any to any" ]
```

Step	Protocol	Interface	From	To	Message
					[Flow-Usage = NO_INFORMATION(0)] [Max-Requested-Bandwidth-UL = 640000] [Max-Requested-Bandwidth-DL = 640000]] [Media-Sub-Component = { Flow-Number = 2 } [Flow-Description = "permit in 17 from any to 192.168.1.1 32125"] [Flow-Description = "permit out 17 from any to any"] [Flow-Usage = RTCP (1)] [Max-Requested-Bandwidth-UL = 32000] [Max-Requested-Bandwidth-DL = 32000]] [AF-Application-Identifier = "RQ_SAMPLE_APP"] [Media-Type = VIDEO (1)] [Flow-Status = DISABLED] [Reservation-Priority = DEFAULT (0)]] [Reservation-Priority = DEFAULT (0)] [Globally-Unique-Address = [Framed-IP-Address = 192.168.1.2] [Address-Realm = "example.com"]] [Authorization-Lifetime = 450]
64a	DIAMETER	Rq	A-RACF B	SPDF B	AAA

					`<AA-Answer> ::= < Diameter Header: 265, PXY >`
					`< Session-Id = "spdf-b.example.com;41295;512" >`
					`{ Auth-Application-Id = 16777222 (Gq) }`
					`{ Origin-Host = "aracf-b.example.com" }`
					`{ Origin-Realm = "example.com" }`
					`[ Result-Code = DIAMETER_SUCCESS (2001) ]`
					`[ Authorization-Lifetime = 450 ]`
					`[ Auth-Grace-Period = 10 ]`

65a	DIAMETER	Gq'	SPDF B	P-CSCF B	AAA

					`<AA-Answer> ::= < Diameter Header: 265, PXY >`
					`< Session-Id = "p-cscf-b.example.com;481C43;583" >`
					`{ Auth-Application-Id = 16777222 (Gq) }`
					`{ Origin-Host = "spdf-b.example.com" }`
					`{ Origin-Realm = "example.com" }`
					`[ Result-Code = DIAMETER_SUCCESS (2001) ]`
					`[ Binding-Information =`
					`  { Binding-Input-List =`
					`      [ V4-Transport-Address =`
					`          { Framed-IP-Address = 0.0.0.0 }`
					`          { Port-Number = 0 }`
					`      ]`
					`      [ V4-Transport-Address =`
					`          { Framed-IP-Address = 10.0.0.1 }`
					`          { Port-Number = 17462 }`
					`      ]`
					`      [ V4-Transport-Address =`
					`          { Framed-IP-Address = 0.0.0.0 }`
					`          { Port-Number = 0 }`
					`      ]`
					`      [ V4-Transport-Address =`
					`          { Framed-IP-Address = 10.0.0.1 }`
					`          { Port-Number = 17463 }`
					`      ]`
					`  }`
					`  [ Binding-Output-List =`
					`      [ V4-Transport-Address =`
					`          { Framed-IP-Address = 0.0.0.0 }`
					`          { Port-Number = 0 }`
					`      ]`
					`      [ V4-Transport-Address =`
					`          { Framed-IP-Address = 192.168.1.1 }`
					`          { Port-Number = 32124 }`
					`      ]`
					`      [ V4-Transport-Address =`
					`          { Framed-IP-Address = 0.0.0.0 }`
					`          { Port-Number = 0 }`
					`      ]`

Step	Protocol	Interface	From	To	Message
					[V4-Transport-Address =
					{ Framed-IP-Address = 192.168.1.1 }
					{ Port-Number = 32125 }
					]
					]
					[Authorization-Lifetime = 450]
					[Auth-Grace-Period = 10]
66a	SIP		P-CSCF B	Phone B	INVITE B
					``
					INVITE sip:user_b@example.com SIP/2.0
					Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
					Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
					Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
					Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
					Max-Forwards: 67
					Record-Route: <sip:p-cscf-b.example.com;lr>,<sip:s-cscf.example.com;lr>,<sip:p-cscf-a.example.com;lr>
					From: User A <sip:user_a@example.com>;tag=372183
					To: User B <sip:user_b@example.com>
					Call-ID: 398174293@phone-a.example.com
					CSeq: 2 INVITE
					Contact: <sip:user_a@phone-a.example.com>
					Content-Type: application/sdp
					Content-Length: 194
					v=0
					o=user_a 2890844526 2890842807 IN IP4 phone-a.example.com
					s=-
					c=IN IP4 192.168.1.1
					t=0 0
					m=audio 3332 RTP/AVP 0
					a=sendrecv
					m=video 32124 RTP/AVP 31
					a=rtpmap:31 H261/90000
					a=sendrecv
					b=AS:640
67a	SIP		Phone B	P-CSCF B	200 OK (SDP)
					SIP/2.0 200 OK
					Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
					Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
					Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
					Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
					Max-Forwards: 70
					From: User A <sip:user_a@example.com>;tag=372183
					To: User B <sip:user_b@example.com>
					Call-ID: 398174293@phone-a.example.com
					CSeq: 2 INVITE
					Contact: <sip:user_b@phone-b.example.com>
					Content-Type: application/sdp
					Content-Length: 194
					v=0
					o=user_b 29381748101 2948193018 IN IP4 phone-b.example.com
					s=-
					c=IN IP4 192.168.1.2
					t=0 0
					m=audio 29792 RTP/AVP 0
					a=sendrecv
					m=video 25552 RTP/AVP 31
					a=rtpmap:31 H261/90000
					a=sendrecv
					b=AS:640
68a	DIAMETER	Gq'	P-CSCF B	SPDF B	AAR (Modify)
					<AA-Request> ::=< Diameter Header: 265, REQ, PXY >
					< Session-Id = "p-cscf-b.example.com;481C43;583" >
					{ Auth-Application-Id = 16777222 (Gq) }
					{ Origin-Host = "p-cscf-b.example.com" }
					{ Origin-Realm = "example.com" }
					{ Destination-Realm = "example.com" }
					[Destination-Host = "spdf-b@example.com"]
					[Media-Component-Description =

Step	Protocol	Interface	From	To	Message
					{ Media-Component-Number = 2 }
					[Media-Sub-Component =
					{ Flow-Number = 1 }
					[Flow-Description = "permit out 17 from any to 192.168.1.2 25552"]
					[Flow-Description = "permit in 17 from any to 192.168.1.1 32124"]
					[Flow-Usage = NO_INFORMATION(0)]
					[Max-Requested-Bandwidth-DL = 640000]
					[Max-Requested-Bandwidth-UL = 640000]
					]
					[Media-Sub-Component =
					{ Flow-Number = 2 }
					[Flow-Description = "permit out 17 from any to 192.168.1.2 25553"]
					[Flow-Description = "permit in 17 from any to 192.168.1.1 32124"]
					[Flow-Usage = RTCP (1)]
					[Max-Requested-Bandwidth-DL = 32000]
					[Max-Requested-Bandwidth-UL = 32000]
					]
					[AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
					[Media-Type = VIDEO (1)]
					[Flow-Status = ENABLED]
					[Reservation-Priority = DEFAULT (0)]
					[Codec-Data = "uplink
					answer
					m=video 25552 RTP/AVP 31
					a=rtpmap:31 H261/90000
					b=AS:640"
					]
					[Codec-Data = "downlink
					offer
					m=video 32124 RTP/AVP 31
					a=rtpmap:31 H261/90000
					b=as:640"
					]
					]
					[Binding-Information =
					{ Binding-Input-List =
					[V4-Transport-Address =
					{ Framed-IP-Address = 192.168.1.2 }
					{ Port-Number = 25552 }
					]
					[V4-Transport-Address =
					{ Framed-IP-Address = 10.0.0.1 }
					{ Port-Number = 17462 }
					]
					[V4-Transport-Address =
					{ Framed-IP-Address = 192.168.1.2 }
					{ Port-Number = 25553 }
					]
					[V4-Transport-Address =
					{ Framed-IP-Address = 10.0.0.1 }
					{ Port-Number = 17463 }
					]
					}
					]
					[Reservation-Priority = DEFAULT (0)]
					[Globally-Unique-Address =
					[Framed-IP-Address = 192.168.1.2]
					[Address-Realm = "example.com"]
					]
					[Authorization-Lifetime = 450]
69a	H.248	Ia	SPDF B	C-BGF B	Modify terminations

```
MEGACO/3 [spdf-b.example.com]:43924
Transaction = 4 {
     Context = 1 {
        Modify = ip/1/if1/1 {
            Media {
                Stream = 2 {
                    LocalControl {
                        ipdc/realm = "B",
                        gm/rsb = ON,
                        mode = SendReceive
                    },
                    Local {
                        v=0
```

Step	Protocol	Interface	From	To	Message
| | | | | | ```
o=- 0 0 IN IP4 192.168.1.1
s=-
t=0 0
c=IN IP4 192.168.1.1
m=video 32124 RTP/AVP 31
a=rtpmap:31 H261/90000
b=AS:640
                    }
                    Remote {
                        v=0
                        o=- 0 0 IN IP4 192.168.1.2
                        s=-
                        t=0 0
                        c=IN IP4 192.168.1.2
                        m=video 25552 RTP/AVP 31
                        a=rtpmap:31 H261/90000
                        b=AS:640
                    }
                } /* Stream */
            } /* Media */
        } /* Modify */
        Modify = ip/1/if2/1 {
            Media {
                Stream = 2 {
                    LocalControl {
                        ipdc/realm = "Core",
                        gm/rsb = ON,
                        mode = SendReceive
                    },
                    Local {
                        v=0
                        o=- 0 0 IN IP4 10.0.0.2
                        s=-
                        t=0 0
                        c=IN IP4 10.0.0.2
                        m=video $ RTP/AVP 31
                        a=rtpmap:31 H261/90000
                        b=AS:640
                    },
                    Remote {
                        v=0
                        o=- 0 0 IN IP4 10.0.0.1
                        s=-
                        t=0 0
                        c=IN IP4 10.0.0.1
                        m=video 17462 RTP/AVP 31
                        a=rtpmap:31 H261/90000
                        b=AS:640
                    }
                } /* Stream */
            } /* Media */
        } /* Modify */
    } /* Context */
} /* Transaction */
``` |
| 70a | H.248 | Ia | C-BGF B | SPDF B | Reply (Modify) |
| | | | | | ```
MEGACO/3 [abgf-b.example.com]: 43924
Reply = 4 {
    Context = 1 {
        Modify = ip/1/if1/1 {
            Media {
                Stream = 1 {
                    LocalControl {
                        ipdc/realm = "B",
                        gm/rsb = ON,
                        mode = SendReceive
                    },
                    Local {
                        v=0
                        o=- 0 0 IN IP4 192.168.1.1
                        s=-
                        t=0 0
                        c=IN IP4 192.168.1.1
                        m=video 32124 RTP/AVP 31
                        a=rtpmap:31 H261/90000
                        b=AS:640
``` |

Step	Protocol	Interface	From	To	Message

					<pre> },
					                Remote {
					                    v=0
					                    o=- 0 0 IN IP4 192.168.1.2
					                    s=-
					                    t=0 0
					                    c=IN IP4 192.168.1.2
					                    m=video 25552 RTP/AVP 31
					                    a=rtpmap:31 H261/90000
					                    b=AS:640
					                }
					            } /* Stream */
					        } /* Media */
					    } /* Modify */
					    Modify = ip/1/if2/1 {
					        Media {
					            Stream = 1 {
					                LocalControl {
					                    ipdc/realm = "Core",
					                    gm/rsb = ON,
					                    mode = SendReceive
					                },
					                Local {
					                    v=0
					                    o=- 0 0 IN IP4 10.0.0.2
					                    s=-
					                    t=0 0
					                    c=IN IP4 10.0.0.2
					                    m=video 1612 RTP/AVP 31
					                    a=rtpmap:31 H261/90000
					                    b=AS:640
					                },
					                Remote {
					                    v=0
					                    o=- 0 0 IN IP4 10.0.0.1
					                    s=-
					                    t=0 0
					                    c=IN IP4 10.0.0.1
					                    m=video 17462 RTP/AVP 31
					                    a=rtpmap:31 H261/90000
					                    b=AS:640
					                }
					            } /* Stream */
					        } /* Media */
					    } /* Modify */
					  } /* Context */
					} /* Reply */</pre>

71a	DIAMETER	Rq	SPDF B	A-RACF B	AAR (Modify)
					<pre> <AA-Request> ::=< Diameter Header: 265, REQ, PXY > < Session-Id = "spdf-b.example.com;41295;512" > { Auth-Application-Id = 16777222 (Gq) } { Origin-Host = "spdf-b.example.com" } { Origin-Realm = "example.com" } { Destination-Realm = "example.com" } [Destination-Host = "aracf-b@example.com"] [Media-Component-Description = { Media-Component-Number = 2 } [Media-Sub-Component = { Flow-Number = 1 } [Flow-Description = "permit out 17 from 192.168.1.1 32124 to 192.168.1.2 25552"] [Flow-Description = "permit in 17 from 192.168.1.2 25552 to 192.168.1.1 32124"] [Flow-Usage = NO_INFORMATION(0)] [Max-Requested-Bandwidth-UL = 640000] [Max-Requested-Bandwidth-DL = 640000]] [Media-Sub-Component = { Flow-Number = 2 } [Flow-Description = "permit out 17 from 192.168.1.1 32125 to 192.168.1.2 25553"] [Flow-Description = "permit in 17 from 192.168.1.2 25553 to 192.168.1.1 32125"] [Flow-Usage = RTCP(1)] [Max-Requested-Bandwidth-UL = 32000]</pre>

Step	Protocol	Interface	From	To	Message

					`[ Max-Requested-Bandwidth-DL = 32000 ]`
					`]`
					`[ AF-Application-Identifier = "RQ_SAMPLE_APP"]`
					`[ Media-Type = VIDEO (1) ]`
					`[ Flow-Status = ENABLED }`
					`[ Reservation-Priority = DEFAULT (0) ]`
					`]`
					`[ Reservation-Priority = DEFAULT (0) ]`
					`[ Globally-Unique-Address =`
					`    [ Framed-IP-Address = 192.168.1.2 ]`
					`    [ Address-Realm = "example.com" ]`
					`]`
					`[ Authorization-Lifetime = 450 ]`

72a	DIAMETER	Re	A-RACF B	RCEF B	PIR
					A policy modification request is sent to the RCEF by sending the Policy Install Request command with the PI-Request-Type AVP value set to UPDATE_REQUEST (2). The maximum requested bandwidth value in the QoS-Information AVP is set to the sum of the video media flow bandwidth and the RTCP bandwidth (672 000 bits/second).

```
< PI-Request > ::=  < Diameter Header: 315, REQ, PXY >
                    < Session-Id = "aracf-b.example.com;66389;469" >
                    { Auth-Application-Id = 16777253 (Re) }
                    { Origin-Host = "aracf-b.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    { Destination-Host = "rcef-b.example.com" }
                    { PI-Request-Type = UPDATE_REQUEST (2) }
                    { PI-Request-Number = 1 }
                    [ Auth-Session-State = NO_STATE_MAINTAINED (1) ]
                    [ Policy-Rule-Install =
                        [ Policy-Rule-Definition =
                            { Policy-Rule-Name = "policy-rule-example-B-UL" }
                            [ Service-Identifier = 1 ]
                            [ Rating-Group = 1 ]
                            [ Framed-IP-Address = 192.168.1.2 ]
                            [ Address-Realm = "example.com" ]
                            [ Flow-Description = "permit in 17 from 192.168.1.2 25552
                                                            to 192.168.1.1 32124" ]
                            [ Flow-Description = "permit in 17 from 192.168.1.2 25553
                                                            to 192.168.1.1 32125" ]
                            [ Flow-Status = ENABLED-UPLINK (0) ]
                            [ QoS-Information =
                                [ Max-Requested-Bandwidth-UL = 672000 ]
                                [ ToS-Traffic-Class = 101110 ]
                            ]
                            [ Precedence = 1]
                            [ Flows =
                                { Media-Component-Number = 2 }
                                [ Flow-Number = 1 ]
                                [ Flow-Number = 2 ]
                            ]
                        ]
                    ]
                    [ Policy-Rule-Install =
                        [ Policy-Rule-Definition =
                            { Policy-Rule-Name = "policy-rule-example-B-DL" }
                            [ Service-Identifier = 1 ]
                            [ Rating-Group = 1 ]
                            [ Framed-IP-Address = 192.168.1.2 ]
                            [ Address-Realm = "example.com" ]
                            [ Flow-Description = "permit out 17 from 192.168.1.1 31124
                                                             to 192.168.1.2 25552" ]
                            [ Flow-Description = "permit out 17 from 192.168.1.1 31125
                                                             to 192.168.1.2 25553" ]
                            [ Flow-Status = ENABLED-DOWNLINK (1) ]
                            [ QoS-Information =
                                [ Max-Requested-Bandwidth-DL = 672000 ]
                                [ ToS-Traffic-Class = 101110 ]
                            ]
                            [ Precedence = 1]
                            [ Flows =
                                { Media-Component-Number = 2 }
                                [ Flow-Number = 1 ]
                                [ Flow-Number = 2 ]
                            ]
```

Step	Protocol	Interface	From	To	Message
					]]
73a	DIAMETER	Re	RCEF B	A-RACF B	PIA
					``` <PI-Answer> ::= < Diameter Header: 315, PXY > < Session-Id = "aracf-b.example.com;66389;469" > { Origin-Host = "rcef-b.example.com" } { Origin-Realm = "example.com" } { PI-Request-Type = UPDATE_REQUEST (2) } { PI-Request-Number = 1 } [Result-Code DIAMETER_SUCCESS (2001)] ```
74a	DIAMETER	Rq	A-RACF B	SPDF B	AAA (Modify)
					``` <AA-Answer> ::= < Diameter Header: 265, PXY > < Session-Id = "spdf-b.example.com;41295;512" > { Auth-Application-Id = 16777222 (Gq) } { Origin-Host = "aracf-b.example.com" } { Origin-Realm = "example.com" } [Result-Code = DIAMETER_SUCCESS (2001)] [Authorization-Lifetime = 450] [Auth-Grace-Period = 10] ```
75a	DIAMETER	Gq'	SPDF B	P-CSCF B	AAA (Modify)

					``
					<AA-Answer> ::= < Diameter Header: 265, PXY >
					              < Session-Id = "p-cscf-b.example.com;481C43;583" >
					              { Auth-Application-Id = 16777222 (Gq) }
					              { Origin-Host = "spdf-b.example.com" }
					              { Origin-Realm = "example.com" }
					              [Result-Code = DIAMETER_SUCCESS (2001)]
					              [Binding-Information =
					                 { Binding-Input-List =
					
					                     [V4-Transport-Address =
					                         { Framed-IP-Address = 192.168.1.2 }
					                         { Port-Number = 25552 }
					                     ]
					                     [V4-Transport-Address =
					                         { Framed-IP-Address = 10.0.0.1 }
					                         { Port-Number = 17462 }
					                     ]
					                     [V4-Transport-Address =
					                         { Framed-IP-Address = 192.168.1.2 }
					                         { Port-Number = 25553 }
					                     ]
					                     [V4-Transport-Address =
					                         { Framed-IP-Address = 10.0.0.1 }
					                         { Port-Number = 17463 }
					                     ]
					                 }
					                 [Binding-Output-List =
					
					                     [V4-Transport-Address =
					                         { Framed-IP-Address = 10.0.0.2 }
					                         { Port-Number = 1612 }
					                     ]
					                     [V4-Transport-Address =
					                         { Framed-IP-Address = 192.168.1.1 }
					                         { Port-Number = 32124 }
					                     ]
					                     [V4-Transport-Address =
					                         { Framed-IP-Address = 10.0.0.2 }
					                         { Port-Number = 1613 }
					                     ]
					                     [V4-Transport-Address =
					                         { Framed-IP-Address = 192.168.1.1 }
					                         { Port-Number = 32125 }
					                     ]
					                 ]
					              [Authorization-Lifetime = 450]
					              [Auth-Grace-Period = 10]
					``

Step	Protocol	Interface	From	To	Message
76a	SIP		P-CSCF B	S-CSCF	200 OK (SDP)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 69
From: User A <sip:user_a@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 1 INVITE
Contact: <sip:user_b@phone-b.example.com>
Content-Type: application/sdp
Content-Length: 189

v=0
o=user_b 29381748101 2948193018 IN IP4 phone-b.example.com
s=-
c=IN IP4 10.0.0.2
t=0 0
m=audio 1110 RTP/AVP 0
a=sendrecv
m=video 1612 RTP/AVP 31
a=rtpmap:31 H261/90000
a=sendrecv
b=AS:640
```

Step	Protocol	Interface	From	To	Message
77a	SIP		S-CSCF	P-CSCF A	200 OK (SDP)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 68
From: User A <sip:user_a@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 1 INVITE
Contact: <sip:user_b@phone-b.example.com>
Content-Type: application/sdp
Content-Length: 189

v=0
o=user_b 29381748101 2948193018 IN IP4 phone-b.example.com
s=-
c=IN IP4 10.0.0.2
t=0 0
m=audio 1110 RTP/AVP 0
a=sendrecv
m=video 1612 RTP/AVP 31
a=rtpmap:31 H261/90000
a=sendrecv
b=AS:640
```

Step	Protocol	Interface	From	To	Message
78a	DIAMETER	Gq'	P-CSCF A	SPDF A	AAR (Modify)

```
<AA-Request> ::=< Diameter Header: 265, REQ, PXY >
               < Session-Id = "p-cscf-a.example.com;13815C;391" >
               { Auth-Application-Id = 16777222 (Gq) }
               { Origin-Host = "p-cscf-a.example.com" }
               { Origin-Realm = "example.com" }
               { Destination-Realm = "example.com" }
               [ Destination-Host = "spdf-a@example.com" ]
               [ Media-Component-Description =
                       { Media-Component-Number = 2 }
                       [ Media-Sub-Component =
                           { Flow-Number = 1 }
                           [ Flow-Description = "permit in 17 from any to any" ]
                           [ Flow-Description = "permit out 17 from any to 192.168.0.2 51372" ]
                           [ Flow-Usage = NO_INFORMATION(0) ]
                           [ Max-Requested-Bandwidth-UL = 640000 ]
                           [ Max-Requested-Bandwidth-DL = 640000 ]
                       ]
                       [ Media-Sub-Component =
                           { Flow-Number = 2 }
                           [ Flow-Description = "permit in 17 from any to any" ]
                           [ Flow-Description = "permit out 17 from any to 192.168.0.2 51373" ]
```

Step	Protocol	Interface	From	To	Message
					[Flow-Usage = RTCP(1)]
					[Max-Requested-Bandwidth-UL = 32000]
					[Max-Requested-Bandwidth-DL = 32000]

```
                                    ]
                              [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                              [ Media-Type = VIDEO (1) ]
                              [ Flow-Status = ENABLED ]
                              [ Reservation-Priority = DEFAULT (0) ]
                              [ Codec-Data = "uplink
                                   offer
                                   m=video 31372 RTP/AVP 31
                                   a=rtpmap:31 H261/90000
                                   b=AS:640"
                              ]
                        ]
                      [ Binding-Information =
                              { Binding-Input-List =

                                  [ V4-Transport-Address =
                                      { Framed-IP-Address = 192.168.0.2 }
                                      { Port-Number = 31372 }
                                  ]
                                  [ V4-Transport-Address =
                                      { Framed-IP-Address = 10.0.0.2 }
                                      { Port-Number = 1612 }
                                  ]
                                  [ V4-Transport-Address =
                                      { Framed-IP-Address = 192.168.0.2 }
                                      { Port-Number = 31373 }
                                  ]
                                  [ V4-Transport-Address =
                                      { Framed-IP-Address = 10.0.0.2 }
                                      { Port-Number = 1613 }
                                  ]
                              }
                      ]
                      [ Reservation-Priority = DEFAULT (0) ]
                      [ Globally-Unique-Address =
                              [ Framed-IP-Address = 192.168.0.2 ]
                              [ Address-Realm = "example.com" ]
                      ]
                      [ Authorization-Lifetime = 450 ]
```

Step	Protocol	Interface	From	To	Message
79a	H.248	Ia	SPDF A	C-BGF A	Modify Terminations A (A to B)

```
    MEGACO/3 [spdf-a.example.com]:55555
    Transaction = 4 {
        Context = 1 {
          Modify = ip/1/if1/1 {
            Media {
              Stream = 2 {
                LocalControl {
                   ipdc/realm = "A",
                   gm/rsb = ON,
                   mode = SendReceive
                },
                Local {
                   v=0
                   o=- 0 0 IN IP4 192.168.0.1
                   s=-
                   t=0 0
                   c=IN IP4 192.168.0.1
                   m=video $ RTP/AVP 31
                   a=rtpmap:31 H261/90000
                   b=AS:640
                },
                Remote {
                   v=0
                   o=- 0 0 IN IP4 192.168.0.2
                   s=-
                   t=0 0
                   c=IN IP4 192.168.0.2
                   m=video 51372 RTP/AVP 31
                   a=rtpmap:31 H261/90000
                   b=AS:640
                }
              } /* Stream */
```

Step	Protocol	Interface	From	To	Message
| | | | | | ```
        } /* Media */
    } /* Modify */
    Modify = ip/1/if2/1 {
        Media {
            Stream = 2 {
                LocalControl {
                    ipdc/realm = "Core",
                    gm/rsb = ON,
                    mode = SendReceive
                },
                Local {
                    v=0
                    o=- 0 0 IN IP4 10.0.0.1
                    s=-
                    t=0 0
                    c=IN IP4 10.0.0.1
                    m=video 17462 RTP/AVP 31
                    a=rtpmap:31 H261/90000
                    b=AS:640
                },
                Remote {
                    v=0
                    o=- 0 0 IN IP4 10.0.0.2
                    s=-
                    t=0 0
                    c=IN IP4 10.0.0.2
                    m=video 1612 RTP/AVP 31
                    a=rtpmap:31 H261/90000
                    b=AS:640
                }
            } /* Stream */
        } /* Media */
    } /* Modify */
} /* Context */
} /* Transaction */
``` |
| 80a | H.248 | Ia | C-BGF A | SPDF A | Reply (Modify) |
| | | | | | ```
MEGACO/3 [abgf-a.example.com]:55555
Reply = 4 {
    Context = 1 {
        Modify = ip/1/if1/1 {
            Media {
                Stream = 2 {
                    LocalControl {
                        ipdc/realm = "A",
                        gm/rsb = ON,
                        mode = SendReceive
                    },
                    Local {
                        v=0
                        o=- 0 0 IN IP4 10.0.0.2
                        s=-
                        t=0 0
                        c=IN IP4 192.168.0.1
                        m=video 31444 RTP/AVP 31
                        a=rtpmap:31 H261/90000
                        b=AS:640
                    },
                    Remote {
                        v=0
                        o=- 0 0 IN IP4 192.168.0.2
                        s=-
                        t=0 0
                        c=IN IP4 192.168.0.2
                        m=video 51372 RTP/AVP 31
                        a=rtpmap:31 H261/90000
                        b=AS:640
                    }
                } /* Stream */
            } /* Media */
        } /* Modify */
        Modify = ip/1/if2/1 {
            Media {
                Stream = 2 {
                    LocalControl {
                        ipdc/realm = "Core",
                        gm/rsb = ON,
``` |

Step	Protocol	Interface	From	To	Message
					mode = SendReceive

```
                     },
                     Local {
                        v=0
                        o=- 0 0 IN IP4 10.0.0.1
                        s=-
                        t=0 0
                        c=IN IP4 10.0.0.1
                        m=video 17462 RTP/AVP 31
                        a=rtpmap:31 H261/90000
                        b=AS:640
                     },
                     Remote {
                        v=0
                        o=- 0 0 IN IP4 10.0.0.2
                        s=-
                        t=0 0
                        c=IN IP4 10.0.0.2
                        m=video 1612 RTP/AVP 31
                        a=rtpmap:31 H261/90000
                        b=AS:640
                     }
                  } /* Stream */
               } /* Media */
            } /* Modify */
         } /* Context */
      } /* Transaction */
```

Step	Protocol	Interface	From	To	Message
81a	DIAMETER	Rq	SPDF A	A-RACF A	AAR (Modify)

```
    <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                    < Session-Id = "spdf-a.example.com;429C3;412" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "spdf-a.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    [ Destination-Host = "aracf-a@example.com" ]
                    [ Media-Component-Description =
                            { Media-Component-Number = 2 }
                            [ Media-Sub-Component =
                                { Flow-Number = 1 }
                                [ Flow-Description = "permit out 17 from 192.168.0.1 31444
                                                        to 192.168.0.2 51372" ]
                                [ Flow-Description = "permit in 17 from 192.168.0.2 51372
                                                        to 192.168.0.1 31444" ]
                                [ Flow-Usage = NO_INFORMATION(0) ]
                                [ Max-Requested-Bandwidth-UL = 640000 ]
                                [ Max-Requested-Bandwidth-DL = 640000 ]
                            ]
                            [ Media-Sub-Component =
                                { Flow-Number = 2 }
                                [ Flow-Description = "permit out 17 from 192.168.0.1 31445
                                                         to 192.168.0.2 51373" ]
                                [ Flow-Description = "permit in 17 from 192.168.0.2 51373
                                                         to 192.168.0.1 31445" ]
                                [ Flow-Usage = RTCP(1) ]
                                [ Max-Requested-Bandwidth-UL = 32000 ]
                                [ Max-Requested-Bandwidth-DL = 32000 ]
                            ]
                            [ AF-Application-Identifier = "RQ_SAMPLE_APP"]
                            [ Media-Type = VIDEO (1) ]
                            [ Flow-Status = ENABLED ]
                            [ Reservation-Priority = DEFAULT (0) ]
                    ]
                    [ Reservation-Priority = DEFAULT (0) ]
                    [ Globally-Unique-Address =
                            [ Framed-IP-Address = 192.168.0.2 ]
                            [ Address-Realm = "example.com" ]
                    ]
                    [ Authorization-Lifetime = 450 ]
```

Step	Protocol	Interface	From	To	Message
82a	DIAMETER	Re	A-RACF A	RCEF A	PIR

```
   < PI-Request > ::=  < Diameter Header: 315, REQ, PXY >
                    < Session-Id = "aracf-a.example.com;32475;112" >
                    { Auth-Application-Id = 16777253 (Re) }
                    { Origin-Host = "aracf-a.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
```

Step	Protocol	Interface	From	To	Message

					{ Destination-Host = "rcef-a.example.com" }
					{ PI-Request-Type = UPDATE_REQUEST (2) }
					{ PI-Request-Number = 1 }
					[Auth-Session-State = NO_STATE_MAINTAINED (1)]
					[Policy-Rule-Install =
					    [Policy-Rule-Definition =
					        { Policy-Rule-Name = "policy-rule-example-A-UL" }
					        [Service-Identifier = 1]
					        [Rating-Group = 1]
					        [Framed-IP-Address = 192.168.0.2]
					        [Address-Realm = "example.com"]
					        [Flow-Description = "permit in 17 from 192.168.0.2 51372
					                            to 192.168.0.1 31444"]
					        [Flow-Description = "permit in 17 from 192.168.0.2 51373
					                            to 192.168.0.1 31445"]
					        [Flow-Status = ENABLED-UPLINK (0)]
					        [QoS-Information =
					            [Max-Requested-Bandwidth-UL = 672000]
					            [ToS-Traffic-Class = 101110]
					        ]
					        [Precedence = 1]
					        [Flows =
					            { Media-Component-Number = 2 }
					            [Flow-Number = 1]
					            [Flow-Number = 2]
					        ]
					    ]
					]
					[Policy-Rule-Install =
					    [Policy-Rule-Definition =
					        { Policy-Rule-Name = "policy-rule-example-A-DL" }
					        [Service-Identifier = 1]
					        [Rating-Group = 1]
					        [Framed-IP-Address = 192.168.0.2]
					        [Address-Realm = "example.com"]
					        [Flow-Description = "permit out 17 from 192.168.0.1 31444
					                              to 192.168.0.2 51372"]
					        [Flow-Description = "permit out 17 from 192.168.0.1 31445
					                              to 192.168.0.2 51373"]
					        [Flow-Status = ENABLED-DOWNLINK (1)]
					        [QoS-Information =
					            [Max-Requested-Bandwidth-DL = 672000]
					            [ToS-Traffic-Class = 101110]
					        ]
					        [Precedence = 1]
					        [Flows =
					            { Media-Component-Number = 2 }
					            [Flow-Number = 1]
					            [Flow-Number = 2]
					        ]
					    ]
					]

83a	DIAMETER	Re	RCEF A	A-RACF A	PIA
					
					<PI-Answer> ::= < Diameter Header: 315, PXY >
					        < Session-Id = "aracf-a.example.com;32475;112" >
					        { Origin-Host = "rcef-a.example.com" }
					        { Origin-Realm = "example.com" }
					        { PI-Request-Type = UPDATE_REQUEST (2) }
					        { PI-Request-Number = 1 }
					        [Result-Code DIAMETER_SUCCESS (2001)]

84a	DIAMETER	Rq	A-RACF A	SPDF A	AAA (Modify)
					
					<AA-Answer> ::= < Diameter Header: 265, PXY >
					        < Session-Id = "spdf-a.example.com;429C3;412" >
					        { Auth-Application-Id = 16777222 (Gq) }
					        { Origin-Host = "aracf-a.example.com" }
					        { Origin-Realm = "example.com" }
					        [Result-Code = DIAMETER_SUCCESS (2001)]
					        [Authorization-Lifetime = 450]
					        [Auth-Grace-Period = 10]

Step	Protocol	Interface	From	To	Message
85a	DIAMETER	Gq'	SPDF A	P-CSCF A	AAA (Modify)

```
<AA-Answer> ::= < Diameter Header: 265, PXY >
              < Session-Id = "p-cscf-a.example.com;13815C;391" >
              { Auth-Application-Id = 16777222 (Gq) }
              { Origin-Host = "spdf-a.example.com" }
              { Origin-Realm = "example.com" }
              [ Result-Code = DIAMETER_SUCCESS (2001) ]
              [ Binding-Information =
                  { Binding-Input-List =

                        [ V4-Transport-Address =
                            { Framed-IP-Address = 192.168.0.2 }
                            { Port-Number = 51371 }
                        ]
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 10.0.0.2 }
                            { Port-Number = 1612 }
                        ]
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 192.168.0.2 }
                            { Port-Number = 51373 }
                        ]
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 10.0.0.2 }
                            { Port-Number = 1613 }
                        ]
                  }
                  [ Binding-Output-List =

                        [ V4-Transport-Address =
                            { Framed-IP-Address = 10.0.0.1 }
                            { Port-Number = 17462 }
                        ]
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 192.168.0.1 }
                            { Port-Number = 31444 }
                        ]
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 10.0.0.1 }
                            { Port-Number = 17463 }
                        ]
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 192.168.0.1 }
                            { Port-Number = 31445 }
                        ]
                  ]
              ]
              [ Authorization-Lifetime = 450 ]
              { Auth-Grace-Period = 10 }
```

Step	Protocol	Interface	From	To	Message
86a	SIP		P-CSCF A	Phone A	200 OK (SDP)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 67
From: User A <sip:user_a@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 1 INVITE
Contact: <sip:user_b@phone-b.example.com>
Content-Type: application/sdp
Content-Length: 192

v=0
o=user_b 29381748101 2948193018 IN IP4 phone-b.example.com
s=-
c=IN IP4 192.168.0.1
t=0 0
m=audio 4444 RTP/AVP 0
a=sendrecv
m=video 31444 RTP/AVP 31
a=rtpmap:31 H261/90000
a=sendrecv
b=AS:640
```

Step	Protocol	Interface	From	To	Message
87a	SIP		Phone A	P-CSCF A	ACK

```
ACK sip:user_b@example.com SIP/2.0
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 70
Route: <sip:p-cscf-a.example.com;lr>,<sip:s-cscf.example.com;lr>,<sip:p-cscf-b.example.com;lr>
From: User A <sip:user_a@example.com>;tag=348123
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 2 ACK
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
88a	SIP		P-CSCF A	S-CSCF	ACK

```
ACK sip:user_b@example.com SIP/2.0
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 69
Route: <sip:s-cscf.example.com;lr>,<sip:p-cscf-b.example.com;lr>
From: User A <sip:user_a@example.com>;tag=348123
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 2 ACK
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
89a	SIP		S-CSCF	P-CSCF B	ACK

```
ACK sip:user_b@example.com SIP/2.0
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 68
Route: <sip:p-cscf-b.example.com;lr>
From: User A <sip:user_a@example.com>;tag=348123
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 2 ACK
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
90a	SIP		P-CSCF B	Phone B	ACK

```
ACK sip:user_b@example.com SIP/2.0
Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP phone-a.example.com:5060; branch=z9hG4bK74b03
Max-Forwards: 67
From: User A <sip:user_a@example.com>;tag=348123
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 2 ACK
Content-Length: 0
```

6.2   IMS signalling flow involving IBCF entities

Figure 6.2.1 illustrates the example network architecture.

Figure 6.2.1: IMS end-to-end signalling flow between two SIP end-points - including IBGF

The additional addresses and ports used in the example compared to the basic call flow described in clause 5.1 are as follows:

- A_4 = 10.0.0.3:5554 for RTP and 10.0.0.3:5555 for RTCP.

- A_5 = 10.0.1.1:6666 for RTP and 10.0.1.1:6667 for RTCP.

- B_4 = 10.0.0.5:7776 for RTP and 10.0.0.5:7777 for RTCP.

- B_5 = 10.0.1.2:8888 for RTP and 10.0.1.2:8889 for RTCP.

6.2.1 Session setup

Figure 6.2.1.1: IMS end-to-end signalling chart for the IBCF - session setup

Table 6.2.1.1: IMS end-to-end messages for IBCF - session setup

Step	Protocol	Interface	From	To	Message
10.0	SIP		S-CSCF A	IBCF A	INVITE B

```
INVITE sip:user_b@example.com SIP/2.0
Via: SIP/2.0/UDP s-cscf-a.example.com:5060;branch=z9hG4bKpm5lmx
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 68
Record-Route: <sip:s-cscf-a.example.com;lr>,<sip:p-cscf-a.example.com;lr>
From: User A <sip:user_a@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 1 INVITE
Contact: <sip:user_a@phone-a.example.com>
Content-Type: application/sdp
Content-Length: 135
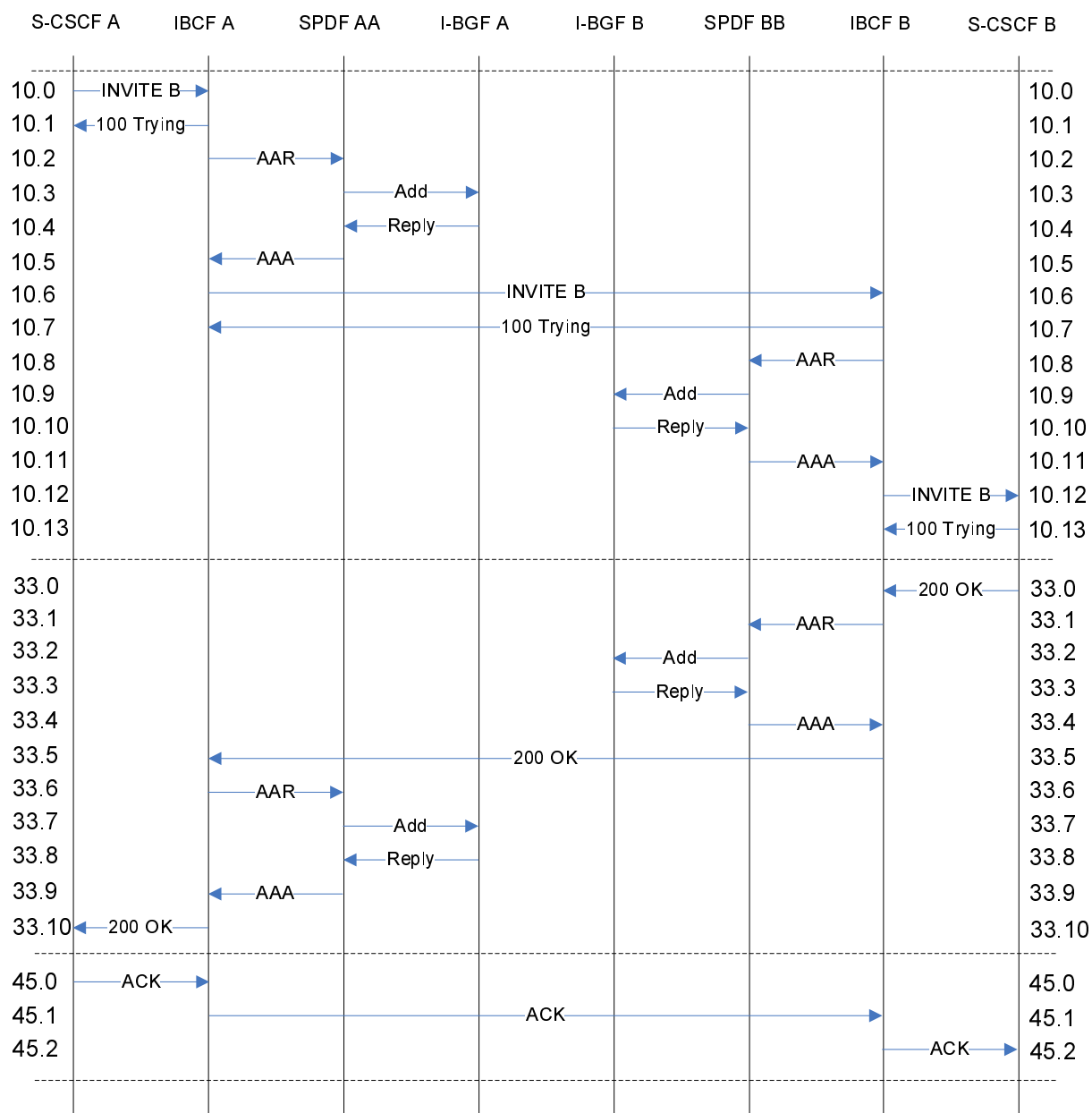
v=0
o=user_a 2890844526 2890842807 IN IP4 phone-a.example.com
s=-
c=IN IP4 10.0.0.1
t=0 0
m=audio 2222 RTP/AVP 0
a=sendrecv
```

Step	Protocol	Interface	From	To	Message
10.1	SIP		IBCF A	S-CSCF A	100 Trying

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP s-cscf-a.example.com:5060;branch=z9hG4bKpm5lmx
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
From: User A <sip:user_a@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 1 INVITE
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
10.2	DIAMETER	Gq'	IBCF A	SPDF AA	AAR

IBCF A uses the IP address of the SDP as the Globally-Unique-Address (i.e. the local IP address and port of the termination in C-BGF A that is associated with the IP address and port of Phone A). It is assumed that this association is statically established in C-BGF A to facilitate SIP signalling between the different address domains.
It should be noted that the out direction indicates when given by an IBCF the inbound direction towards the local core network (i.e. for this message from B to A).

```
<AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                < Session-Id = "ibcf-a.example.com;14511D;557" >
                { Auth-Application-Id = 16777222 (Gq) }
                { Origin-Host = "ibcf-a.example.com" }
                { Origin-Realm = "example.com" }
                { Destination-Realm = "example.com" }
                [ Destination-Host = "spdf-aa.example.com" ]
                [ Media-Component-Description =
                        { Media-Component-Number = 1 }
                        [ Media-Sub-Component =
                            { Flow-Number = 1 }
                            [ Flow-Description = "permit out 17 from any to 10.0.0.1 2222" ]
                            [ Flow-Usage = NO_INFORMATION(0) ]
                            [ Max-Requested-Bandwidth-DL = 96000 ]
                        ]
                        [ Media-Sub-Component =
                            { Flow-Number = 2 }
                            [ Flow-Description = "permit out 17 from any to 10.0.0.1 2223" ]
                            [ Flow-Usage = RTCP (1) ]
                            [ Max-Requested-Bandwidth-DL = 8000 ]
                        ]
                        [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                        [ Media-Type = AUDIO (0) ]
                        [ Flow-Status = DISABLED ]
                        [ Reservation-Priority = DEFAULT (0) ]
                ]
                [ Binding-Information =
                        { Binding-Input-List =
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 10.0.0.1 }
```
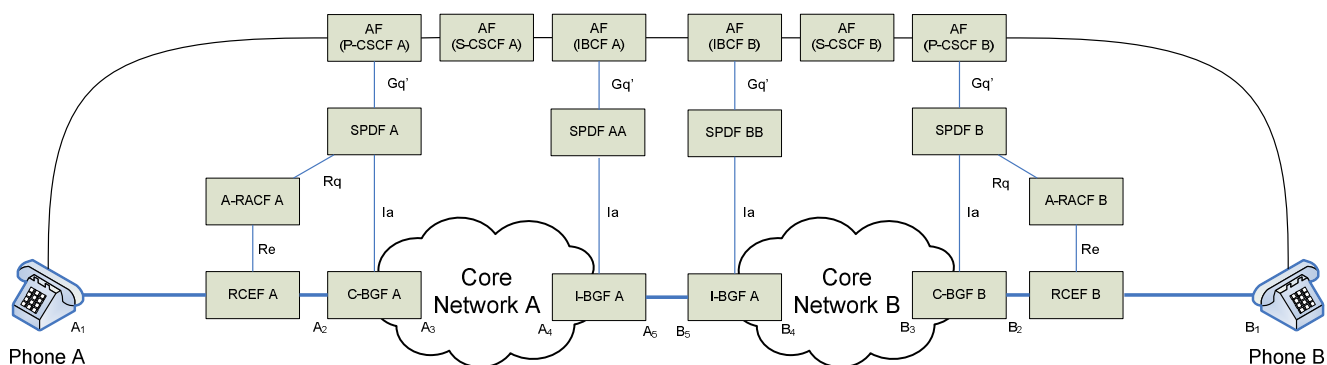
Step	Protocol	Interface	From	To	Message

```
                                { Port-Number = 2222 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 0.0.0.0 }
                                { Port-Number = 0 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 10.0.0.1 }
                                { Port-Number = 2223 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 0.0.0.0 }
                                { Port-Number = 0 }
                            ]
                        }
                    ]
                    [ Reservation-Priority = DEFAULT (0) ]
                    [ Globally-Unique-Address =
                            [ Framed-IP-Address = 10.0.0.1 ]
                            [ Address-Realm = "example.com" ]
                    ]
                    [ Authorization-Lifetime = 450 ]
```

Step	Protocol	Interface	From	To	Message
10.3	H.248	Ia	SPDF AA	I-BGF A	Add terminations

The terminations are by default created as Inactive. Hence, the LocalControl descriptor is omitted in this message. SPDF AA defines all IP termination fields except the Id field. The Interface field is set to if1, which is at the peer core network side of I-BGF A, to define the direction at which the termination is to be created.

```
    MEGACO/3 [ibcf-a.example.com]:55555
    Transaction = 1 {
        Context = ${
            Add = ip/1/$/$ {
                Media {
                    Stream = 1 {
                        LocalControl {
                            ipdc/realm = "CoreA",
                            gm/rsb = ON
                        }
                        Local {
                            v=0
                            m=- $ - -
                            c=IN IP4 $
                            b=AS:104
                        },
                        Remote {
                            v=0
                            o=- 0 0 IN IP4 10.0.0.1
                            s=-
                            t=0 0
                            m=- 2222 - -
                            c=IN IP4 10.0.0.1
                            b=AS:104
                        }
                    } /* Stream */
                } /* Media */
            } /* Add */
            Add = ip/1/$/$ {
                Media {
                    Stream = 1 {
                        LocalControl {
                            ipdc/realm = "BCoreNNI",
                            gm/rsb = ON
                        }
                        Local {
                            v=0
                            m=- $ - -
                            c=IN IP4 $
                            b=AS:104
                        }
                    } /* Stream */
                } /* Media */
            } /* Add */
        } /* Context */
    } /* Transaction */
```

Step	Protocol	Interface	From	To	Message
10.4	H.248	Ia	I-BGF A	SPDF AA	Reply (Add)

```
   MEGACO/3 [ibgf-a.example.com]:55555
   Reply = 1 {
       Context = 1 {
          Add = ip/1/if1/1,
             Media {
                Stream = 1 {
                   LocalControl {
                      ipdc/realm = "CoreA",
                      gm/rsb = ON
                   }
                   Local {
                      v=0
                      o=- 0 0 IN IP4 10.0.0.3
                      s=-
                      t=0 0
                      m=- 5554 - -
                      c=IN IP4 10.0.0.3
                      b=AS:104
                   },
                   Remote {
                      v=0
                      o=- 0 0 IN IP4 10.0.0.1
                      s=-
                      t=0 0
                      m=- 2222 - -
                      c=IN IP4 10.0.0.1
                      b=AS:104
                   }
                } /* Stream */
             } /* Media */
          } /* Add */
          Add = ip/1/if2/1,
             Media {
                Stream = 1 {
                   LocalControl {
                      ipdc/realm = "BCoreNNI",
                      gm/rsb = ON
                   }
                   Local {
                      v=0
                      o=- 0 0 IN IP4 10.0.1.1
                      s=-
                      t=0 0
                      m=- 6666 - -
                      c=IN IP4 10.0.1.1
                      b=AS:104
                   }
                } /* Stream */
             } /* Media */
          } /* Add */
       } /* Context */
   } /* Reply */
```

Step	Protocol	Interface	From	To	Message
10.5	DIAMETER	Gq'	SPDF AA	IBCF A	AAA

```
   <AA-Answer> ::= < Diameter Header: 265, PXY >
                   < Session-Id = "ibcf-a.example.com; 14511D;557" >
                   { Auth-Application-Id = 16777222 (Gq) }
                   { Origin-Host = "spdf-aa.example.com" }
                   { Origin-Realm = "example.com" }
                   [ Result-Code = DIAMETER_SUCCESS (2001) ]
                   [ Binding-Information =
                      { Binding-Input-List =
                         [ V4-Transport-Address =
                            { Framed-IP-Address = 10.0.0.1 }
                            { Port-Number = 2222 }
                         ]
                         [ V4-Transport-Address =
                            { Framed-IP-Address = 0.0.0.0 }
                            { Port-Number = 0 }
                         ]
                         [ V4-Transport-Address =
                            { Framed-IP-Address = 10.0.0.1 }
                            { Port-Number = 2223 }
                         ]
```

Step	Protocol	Interface	From	To	Message
					[V4-Transport-Address = { Framed-IP-Address = 0.0.0.0 } { Port-Number = 0 }] [Binding-Output-List = [V4-Transport-Address = { Framed-IP-Address = 10.0.1.1 } { Port-Number = 6666 }] [V4-Transport-Address = { Framed-IP-Address = 0.0.0.0 } { Port-Number = 0 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.1.1 } { Port-Number = 6667 }] [V4-Transport-Address = { Framed-IP-Address = 0.0.0.0 } { Port-Number = 0 }]]]] [Authorization-Lifetime = 450] [Auth-Grace-Period = 10]
10.6	SIP		IBCF A	IBCF B	INVITE B

```
    INVITE sip:user_b@example.com SIP/2.0
    Via: SIP/2.0/UDP ibcf-a.example.com:5060;branch=z9hG4bKhfj55z
    Via: SIP/2.0/UDP s-cscf-a.example.com:5060;branch=z9hG4bKpm5lmx
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
    Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
    Max-Forwards: 67
    Record-Route: <sip:ibcf-a.example.com;lr>,<sip:s-cscf-a.example.com;lr>,<sip:p-cscf-
a.example.com;lr>
    From: User A <sip:user_a@example.com>;tag=372183
    To: User B <sip:user_b@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 INVITE
    Contact: <sip:user_a@phone-a.example.com>
    Content-Type: application/sdp
    Content-Length: 135

    v=0
    o=user_a 2890844526 2890842807 IN IP4 phone-a.example.com
    s=-
    c=IN IP4 10.0.1.1
    t=0 0
    m=audio 6666 RTP/AVP 0
    a=sendrecv
```

Step	Protocol	Interface	From	To	Message
10.7	SIP		IBCF B	IBCF A	100 Trying

```
    SIP/2.0 100 Trying
    Via: SIP/2.0/UDP ibcf-a.example.com:5060;branch=z9hG4bKhfj55z
    Via: SIP/2.0/UDP s-cscf-a.example.com:5060;branch=z9hG4bKpm5lmx
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
    Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
    From: User A <sip:user_a@example.com>;tag=372183
    To: User B <sip:user_b@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 INVITE
    Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
10.8	DIAMETER	Gq'	IBCF B	SPDF BB	AAR

IBCF B uses the IP address of the signalling destination as the Globally-Unique-Address (i.e. the IP address and port of the IP address and port of C-BGF B that is associated with the IP address and port of Phone B). It is assumed that this association is statically established in C-BGF B to facilitate SIP signalling between the different address domains.

It should be noted that the "in" direction indicates when given by an IBCF the inbound direction towards the peer core network (i.e. for this message from B to A).

The Flow-Description is given from any to any based on the decision that it is to provide addresses for the local core network and not the link between the two core networks. This decision follows the same logic as used for the access where the Flow-Description provides addresses for the access network domain only.

```
    <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                    < Session-Id = "ibcf-b.example.com;25536F;231" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "ibcf-b.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    [ Destination-Host = "spdf-bb.example.com" ]
                    [ Media-Component-Description =
                            { Media-Component-Number = 1 }
                            [ Media-Sub-Component =
                                { Flow-Number = 1 }
                                [ Flow-Description = "permit in 17 from any to any" ]
                                [ Flow-Usage = NO_INFORMATION(0) ]
                                [ Max-Requested-Bandwidth-DL = 96000 ]
                            ]
                            [ Media-Sub-Component =
                                { Flow-Number = 2 }
                                [ Flow-Description = "permit in 17 from any to any" ]
                                [ Flow-Usage = RTCP (1) ]
                                [ Max-Requested-Bandwidth-DL = 8000 ]
                            ]
                            [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                            [ Media-Type = AUDIO (0) ]
                            [ Flow-Status = DISABLED ]
                            [ Reservation-Priority = DEFAULT (0) ]
                    ]
                    [ Binding-Information =
                            { Binding-Input-List =
                                [ V4-Transport-Address =
                                    { Framed-IP-Address = 0.0.0.0 }
                                    { Port-Number = 0 }
                                ]
                                [ V4-Transport-Address =
                                    { Framed-IP-Address = 10.0.1.1 }
                                    { Port-Number = 6666 }
                                ]
                                [ V4-Transport-Address =
                                    { Framed-IP-Address = 0.0.0.0 }
                                    { Port-Number = 0 }
                                ]
                                [ V4-Transport-Address =
                                    { Framed-IP-Address = 10.0.1.1 }
                                    { Port-Number = 6667 }
                                ]
                            }
                    ]
                    [ Reservation-Priority = DEFAULT (0) ]
                    [ Globally-Unique-Address =
                            [ Framed-IP-Address = 10.0.0.2 ]
                            [ Address-Realm = "example.com" ]
                    ]
                    [ Authorization-Lifetime = 450 ]
```

| 10.9 | H.248 | Ia | SPDF BB | I-BGF B | Add terminations |

```
    MEGACO/3 [ibcf-b.example.com]:55555
    Transaction = 1 {
        Context = $ {
            Add = ip/1/$/$ {
                Media {
                    Stream = 1 {
                        LocalControl {
                            ipdc/realm = "CoreB",
                            gm/rsb = ON
                        }
```

Step	Protocol	Interface	From	To	Message

```
                   Local {
                       v=0
                       m=- $ - -
                       c=IN IP4 $
                       b=AS:104
                   }
               } /* Stream */
           } /* Media */
       } /* Add */
       Add = ip/1/$/$ {
           Media {
               Stream = 1 {
                   LocalControl {
                       ipdc/realm = "ACoreNNI",
                       gm/rsb = ON
                   }
                   Local {
                       v=0
                       m=- $ - -
                       c=IN IP4 $
                       b=AS:104
                   },
                   Remote {
                       v=0
                       o=- 0 0 IN IP4 10.0.1.1
                       s=-
                       t=0 0
                       m=- 6666 - -
                       c=IN IP4 10.0.1.1
                       b=AS:104
                   }
               } /* Stream */
           } /* Media */
       } /* Add */
     } /* Context */
   } /* Transaction */
```

Step	Protocol	Interface	From	To	Message
10.10	H.248	Ia	I-BGF B	SPDF BB	Reply (Add)

```
   MEGACO/3 [ibgf-b.example.com]:55555
   Reply = 1 {
       Context = 1 {
           Add = ip/1/if1/1
               Media {
                   Stream = 1 {
                       LocalControl {
                           ipdc/realm = "CoreB",
                           gm/rsb = ON
                       }
                       Local {
                           v=0
                           o=- 0 0 IN IP4 10.0.0.5
                           s=-
                           t=0 0
                           m=- 7776 - -
                           c=IN IP4 10.0.0.5
                           b=AS:104
                       }
                   } /* Stream */
               } /* Media */
           } /* Add */
           Add = ip/1/if2/1
               Media {
                   Stream = 1 {
                       LocalControl {
                           ipdc/realm = "ACoreNNI",
                           gm/rsb = ON
                       }
                       Local {
                           v=0
                           o=- 0 0 IN IP4 10.0.1.2
                           s=-
                           t=0 0
                           m=- 8888 - -
                           c=IN IP4 10.0.1.2
                           b=AS:104
                       },
```

Step	Protocol	Interface	From	To	Message

			Remote {
			    v=0
			    o=- 0 0 IN IP4 10.0.1.1
			    s=-
			    t=0 0
			    m=audio 6666 RTP/AVP 0
			    c=IN IP4 10.0.1.1
			    b=AS:104
			    }
			  } /* Stream */
			 } /* Media */
			} /* Add */
			} /* Context */
			} /* Reply */				

10.11	DIAMETER	Gq'	SPDF BB	IBCF B	AAA

```
<AA-Answer> ::= < Diameter Header: 265, PXY >
               < Session-Id = "ibcf-b.example.com;25536F;231" >
               { Auth-Application-Id = 16777222 (Gq) }
               { Origin-Host = "spdf-bb.example.com" }
               { Origin-Realm = "example.com" }
               [ Result-Code = DIAMETER_SUCCESS (2001) ]
               [ Binding-Information =
                   { Binding-Input-List =
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 0.0.0.0 }
                           { Port-Number = 0 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 10.0.1.1 }
                           { Port-Number = 6666 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 0.0.0.0 }
                           { Port-Number = 0 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 10.0.1.1 }
                           { Port-Number = 6667 }
                       ]
                     [ Binding-Output-List =
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 0.0.0.0 }
                           { Port-Number = 0 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 10.0.0.5 }
                           { Port-Number = 7776 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 0.0.0.0 }
                           { Port-Number = 0 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 10.0.0.5 }
                           { Port-Number = 7777 }
                       ]
                     ]
                   ]
                 ]
               [ Authorization-Lifetime = 450 ]
               [ Auth-Grace-Period = 10 ]
```

| 10.12 | SIP | | IBCF B | S-CSCF B | INVITE B |

```
INVITE sip:user_b@example.com SIP/2.0
Via: SIP/2.0/UDP ibcf-b.example.com:5060;branch=z9hG4bKH23gzx
Via: SIP/2.0/UDP ibcf-a.example.com:5060;branch=z9hG4bKhfj55z
Via: SIP/2.0/UDP s-cscf-a.example.com:5060;branch=z9hG4bKpm5lmx
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 66
Record-Route: <sip:ibcf-b.example.com;lr>,<sip:ibcf-a.example.com;lr>,<sip:s-cscf-
a.example.com;lr>,<sip:p-cscf-a.example.com;lr>
From: User A <sip:user_a@example.com>;tag=372183
To: User B <sip:user_b@example.com>
```

Step	Protocol	Interface	From	To	Message
					Call-ID: 398174293@phone-a.example.com CSeq: 1 INVITE Contact: <sip:user_a@phone-a.example.com> Content-Type: application/sdp Content-Length: 125 v=0 o=user_a 2890844526 2890842807 IN IP4 phone-a.example.com s=- c=IN IP4 10.0.0.5 t=0 0 m=audio 7776 RTP/AVP 0 a=sendrecv
10.13	SIP		S-CSCF B	IBCF B	100 Trying
					SIP/2.0 100 Trying Via: SIP/2.0/UDP ibcf-b.example.com:5060;branch=z9hG4bKH23gzx Via: SIP/2.0/UDP ibcf-a.example.com:5060;branch=z9hG4bKhfj55z Via: SIP/2.0/UDP s-cscf-a.example.com:5060;branch=z9hG4bKpm5lmx Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03 From: User A <sip:user_a@example.com>;tag=372183 To: User B <sip:user_b@example.com> Call-ID: 398174293@phone-a.example.com CSeq: 1 INVITE Content-Length: 0
The above message finishes the first addition to the basic call setup signalling flow. Below follows the second addition to that signalling flow.					
33.0	SIP		S-CSCF B	IBCF B	200 OK (SDP)
					SIP/2.0 200 OK Via: SIP/2.0/UDP ibcf-b.example.com:5060;branch=z9hG4bKH23gzx Via: SIP/2.0/UDP ibcf-a.example.com:5060;branch=z9hG4bKhfj55z Via: SIP/2.0/UDP s-cscf-a.example.com:5060;branch=z9hG4bKpm5lmx Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03 Max-Forwards: 68 Record-Route: <sip:p-cscf-b.example.com;lr>,<sip:s-cscf-b.example.com;lr>,<sip:ibcf-b.example.com;lr>,<sip:ibcf-a.example.com;lr>,<sip:s-cscf-a.example.com;lr>,<sip:p-cscf-a.example.com;lr> From: User A <sip:user_a@example.com>;tag=372183 To: User B <sip:user_b@example.com> Call-ID: 398174293@phone-a.example.com CSeq: 1 INVITE Contact: <sip:user_b@phone-b.example.com> Content-Type: application/sdp Content-Length: 126 v=0 o=user_b 29381748101 2948193018 IN IP4 phone-b.example.com s=- c=IN IP4 10.0.0.2 t=0 0 m=audio 1110 RTP/AVP 0 a=sendrecv
33.1	DIAMETER	Gq'	IBCF B	SPDF BB	AAR (Modify)
IBCF B uses the IP address of the signalling destination as the Globally-Unique-Address (i.e. the IP address and port of the IP address and port of C-BGF B that is associated with the IP address and port of Phone B). It should be noted that the "in" direction indicates when given by an IBCF the inbound direction towards the peer core network (i.e. for this message from B to A) and out direction indicates when given by an IBCF the inbound direction towards the local core network (i.e. for this message from A to B). This message contains addresses and ports for both directions in the Binding-Input-List to allow these addresses and ports to be uniquely related to the directions given in the Flow-Descriptions (i.e. although the termination for the "in" direction is already established). That is, the direction given by the first Flow-Description refers to the first V4-Transport-Address in the Binding-Input-List, the second Flow-Description gives the direction of the second V4-Transport-Address in the Binding-Input-List, and so on.					

Step	Protocol	Interface	From	To	Message

```
<AA-Request> ::=< Diameter Header: 265, REQ, PXY >
              < Session-Id = "ibcf-b.example.com;25536F;231" >
              { Auth-Application-Id = 16777222 (Gq) }
              { Origin-Host = "ibcf-b.example.com" }
              { Origin-Realm = "example.com" }
              { Destination-Realm = "example.com" }
              [ Destination-Host = "spdf-bb.example.com" ]
              [ Media-Component-Description =
                      { Media-Component-Number = 1 }
                      [ Media-Sub-Component =
                          { Flow-Number = 1 }
                          [ Flow-Description = "permit out 17 from any to 10.0.0.2 1110" ]
                          [ Flow-Usage = NO_INFORMATION(0) ]
                          [ Max-Requested-Bandwidth-DL = 96000 ]
                      ]
                      [ Media-Sub-Component =
                          { Flow-Number = 2 }
                          [ Flow-Description = "permit out 17 from any to 10.0.0.2 1111" ]
                          [ Flow-Usage = RTCP (1) ]
                          [ Max-Requested-Bandwidth-DL = 8000 ]
                      ]
                      [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                      [ Media-Type = AUDIO (0) ]
                      [ Flow-Status = ENABLED ]
                      [ Reservation-Priority = DEFAULT (0) ]
              ]
              [ Binding-Information =
                      { Binding-Input-List =
                          [ V4-Transport-Address =
                              { Framed-IP-Address = 10.0.0.2 }
                              { Port-Number = 1110 }
                          ]
                          [ V4-Transport-Address =
                              { Framed-IP-Address = 10.0.1.1 }
                              { Port-Number = 6666 }
                          ]
                          [ V4-Transport-Address =
                              { Framed-IP-Address = 10.0.0.2 }
                              { Port-Number = 1111 }
                          ]
                          [ V4-Transport-Address =
                              { Framed-IP-Address = 10.0.1.1 }
                              { Port-Number = 6667 }
                          ]
                      }
              ]
              [ Reservation-Priority = DEFAULT (0) ]
              [ Globally-Unique-Address =
                      [ Framed-IP-Address = 10.0.0.2 ]
                      [ Address-Realm = "example.com" ]
              ]
              [ Authorization-Lifetime = 450 ]
```

| 33.2 | H.248 | Ia | SPDF BB | I-BGF B | Modify terminations |

SPDF BB (i.e. since it is a state full MGC) knows that the termination for the "in" direction is already established and therefore issues an add message for the "out" direction only.

```
MEGACO/3 [ibcf-b.example.com]:55555
Transaction = 2 {
     Context = 1{
        Modify = ip/1/if1/1 {
           Media {
              Stream = 1 {
                 LocalControl {
                    ipdc/realm = "CoreB",
                    gm/rsb = ON,
                    mode = SendReceive
                 },
                 Local {
                    v=0
                    o=- 0 0 IN IP4 10.0.0.5
                    s=-
                    t=0 0
                    m=- 7776 - -
                    c=IN IP4 10.0.0.5
```

Step	Protocol	Interface	From	To	Message

```
                        b=AS:104
                    },
                    Remote {
                        v=0
                        o=- 0 0 IN IP4 10.0.0.2
                        s=-
                        t=0 0
                        m=- 1110 - -
                        c=IN IP4 10.0.0.2
                        b=AS:104
                    }
                } /* Stream */
            } /* Media */
        } /* Modify */
        Modify = ip/1/if2/1 {
            Media {
                Stream = 1 {
                    LocalControl {
                        ipdc/realm = "ACoreNNI",
                        gm/rsb = ON,
                        mode = SendReceive
                    },
                    Local {
                        v=0
                        o=- 0 0 IN IP4 10.0.1.2
                        s=-
                        t=0 0
                        m=- 8888 - -
                        c=IN IP4 10.0.1.2
                        b=AS:104
                    },
                    Remote {
                        v=0
                        o=- 0 0 IN IP4 10.0.1.1
                        s=-
                        t=0 0
                        m=- 6666 - -
                        c=IN IP4 10.0.1.1
                        b=AS:104
                    }
                } /* Stream */
            } /* Media */
        } /* Modify */
    } /* Context */
} /* Transaction */
```

Step	Protocol	Interface	From	To	Message
33.3	H.248	Ia	I-BGF B	SPDF BB	Reply (Modify)

```
    MEGACO/3 [ibgf-b.example.com]:55555
    Reply = 2 {
        Context = 1 {
            Modify = ip/1/if1/1 {
                Media {
                    Stream = 1 {
                        LocalControl {
                            ipdc/realm = "CoreB",
                            gm/rsb = ON,
                            mode = SendReceive
                        },
                        Local {
                            v=0
                            o=- 0 0 IN IP4 10.0.0.5
                            s=-
                            t=0 0
                            m=- 7776 - -
                            c=IN IP4 10.0.0.5
                            b=AS:104
                        },
                        Remote {
                            v=0
                            o=- 0 0 IN IP4 10.0.0.2
                            s=-
                            t=0 0
                            m=- 1110 - -
                            c=IN IP4 10.0.0.2
                            b=AS:104
                        }
```

Step	Protocol	Interface	From	To	Message

```
                        } /* Stream */
                    } /* Media */
                } /* Modify */
                Modify = ip/1/if2/1 {
                    Media {
                        Stream = 1 {
                            LocalControl {
                                ipdc/realm = "ACoreNNI",
                                gm/rsb = ON,
                                mode = SendReceive
                            },
                            Local {
                                v=0
                                o=- 0 0 IN IP4 10.0.1.2
                                s=-
                                t=0 0
                                m=- 8888 - -
                                c=IN IP4 10.0.1.2
                                b=AS:104
                            },
                            Remote {
                                v=0
                                o=- 0 0 IN IP4 10.0.1.1
                                s=-
                                t=0 0
                                m=- 6666 - -
                                c=IN IP4 10.0.1.1
                                b=AS:104
                            }
                        } /* Stream */
                    } /* Media */
                } /* Modify */
            } /* Context */
    } /* Reply */
```

Step	Protocol	Interface	From	To	Message
33.4	DIAMETER	Gq'	SPDF BB	IBCF B	AAA

Since SPDF BB provided Binding-Input-Lists for all addresses and ports in both directions the AAA will include this complete set of addresses and ports in the Binding-Information AVP as well.

```
    <AA-Answer> ::= < Diameter Header: 265, PXY >
                    < Session-Id = "ibcf-b.example.com;25536F;231" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "spdf-bb.example.com" }
                    { Origin-Realm = "example.com" }
                    [ Result-Code = DIAMETER_SUCCESS (2001) ]
                    [ Binding-Information =
                        { Binding-Input-List =
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 10.0.0.2 }
                                { Port-Number = 1110 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 10.0.1.1 }
                                { Port-Number = 6666 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 10.0.0.2 }
                                { Port-Number = 1111 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 10.0.1.1 }
                                { Port-Number = 6667 }
                            ]
                        [ Binding-Output-List =
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 10.0.1.2 }
                                { Port-Number = 8888 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 10.0.0.5 }
                                { Port-Number = 7776 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 10.0.1.2 }
                                { Port-Number = 8889 }
                            ]
```

Step	Protocol	Interface	From	To	Message

```
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 10.0.0.5 }
                            { Port-Number = 7777 }
                        ]
                    ]
                ]
            ]
            [ Authorization-Lifetime = 450 ]
            [ Auth-Grace-Period = 10 ]
```

33.5	SIP		IBCF B	IBCF A	200 OK (SDP)

```
   SIP/2.0 200 OK
   Via: SIP/2.0/UDP ibcf-a.example.com:5060;branch=z9hG4bKhfj55z
   Via: SIP/2.0/UDP s-cscf-a.example.com:5060;branch=z9hG4bKpm5lmx
   Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
   Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
   Max-Forwards: 67
   Record-Route: <sip:p-cscf-b.example.com;lr>,<sip:s-cscf-b.example.com;lr>,<sip:ibcf-
b.example.com;lr>,<sip:ibcf-a.example.com;lr>,<sip:s-cscf-a.example.com;lr>,<sip:p-cscf-
a.example.com;lr>
   From: User A <sip:user_a@example.com>;tag=372183
   To: User B <sip:user_b@example.com>
   Call-ID: 398174293@phone-a.example.com
   CSeq: 1 INVITE
   Contact: <sip:user_b@phone-b.example.com>
   Content-Type: application/sdp
   Content-Length: 126

   v=0
   o=user_b 29381748101 2948193018 IN IP4 phone-b.example.com
   s=-
   c=IN IP4 10.0.1.2
   t=0 0
   m=audio 8888 RTP/AVP 0
   a=sendrecv
```

33.6	DIAMETER	Gq'	IBCF A	SPDF AA	AAR (Modify)

It should be noted that the "in" direction indicates when given by an IBCF the inbound direction towards the peer core network (i.e. for this message from A to B) and "out" direction indicates when given by an IBCF the inbound direction towards the local core network (i.e. for this message from B to A).

```
   <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                < Session-Id = "ibcf-a.example.com;14511D;557" >
                { Auth-Application-Id = 16777222 (Gq) }
                { Origin-Host = "ibcf-a.example.com" }
                { Origin-Realm = "example.com" }
                { Destination-Realm = "example.com" }
                [ Destination-Host = "spdf-aa.example.com" ]
                [ Media-Component-Description =
                    { Media-Component-Number = 1 }
                    [ Media-Sub-Component =
                        { Flow-Number = 1 }
                        [ Flow-Description = "permit in 17 from any to any" ]
                        [ Flow-Usage = NO_INFORMATION(0) ]
                        [ Max-Requested-Bandwidth-DL = 96000 ]
                    ]
                    [ Media-Sub-Component =
                        { Flow-Number = 2 }
                        [ Flow-Description = "permit in 17 from any to any" ]
                        [ Flow-Usage = RTCP (1) ]
                        [ Max-Requested-Bandwidth-DL = 8000 ]
                    ]
                    [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                    [ Media-Type = AUDIO (0) ]
                    [ Flow-Status = ENABLED ]
                    [ Reservation-Priority = DEFAULT (0) ]
                ]
                [ Binding-Information =
                    { Binding-Input-List =
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 10.0.0.1 }
                            { Port-Number = 2222 }
                        ]
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 10.0.1.2 }
```

Step	Protocol	Interface	From	To	Message
			{ Port-Number = 8888 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.1 } { Port-Number = 2223 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.1.2 } { Port-Number = 8887 }] }] [Reservation-Priority = DEFAULT (0)] [Globally-Unique-Address = [Framed-IP-Address = 10.0.0.1] [Address-Realm = "example.com"]] [Authorization-Lifetime = 450]				
33.7	H.248	Ia	SPDF AA	I-BGF A	Modify terminations

SPDF AA (i.e. since it is a state full MGC) knows that the termination for the "out" direction is already established and therefore issues an add message for the "in" direction only.

```
MEGACO/3 [ibcf-b.example.com]:55555
Transaction = 2 {
    Context = 1{
        Modify = ip/1/if1/1 {
            Media {
                Stream = 1 {
                    LocalControl {
                        ipdc/realm = "CoreA",
                        gm/rsb = ON,
                        mode = SendReceive
                    },
                    Local {
                        v=0
                        o=- 0 0 IN IP4 10.0.0.3
                        s=-
                        t=0 0
                        m=- 5554 - -
                        c=IN IP4 10.0.0.3
                        b=AS:104
                    },
                    Remote {
                        v=0
                        o=- 0 0 IN IP4 10.0.0.1
                        s=-
                        t=0 0
                        m=- 2222 - -
                        c=IN IP4 10.0.0.1
                        b=AS:104
                    }
                } /* Stream */
            } /* Media */
        } /* Modify */
        Modify = ip/1/if2/1 {
            Media {
                Stream = 1 {
                    LocalControl {
                        ipdc/realm = "BCoreNNI",
                        gm/rsb = ON,
                        mode = SendReceive
                    },
                    Local {
                        v=0
                        o=- 0 0 IN IP4 10.0.1.1
                        s=-
                        t=0 0
                        m=- 6666 - -
                        c=IN IP4 10.0.1.1
                        b=AS:104
                    },
                    Remote {
                        v=0
                        o=- 0 0 IN IP4 10.0.1.2
                        s=-
```

Step	Protocol	Interface	From	To	Message
					t=0 0 m=- 8888 - - c=IN IP4 10.0.1.2 b=AS:104 } } /* Stream */ } /* Media */ } /* Modify */ } /* Context */ } /* Transaction */
33.8	H.248	Ia	I-BGF A	SPDF AA	Reply (Modify)

```
   MEGACO/3 [ibgf-b.example.com]:55555
   Reply = 2 {
        Context = 1 {
          Modify = ip/1/if1/1 {
            Media {
              Stream = 1 {
                LocalControl {
                    ipdc/realm = "CoreA",
                    gm/rsb = ON,
                    mode = SendReceive
                },
                Local {
                    v=0
                    o=- 0 0 IN IP4 10.0.0.3
                    s=-
                    t=0 0
                    m=- 5554 - -
                    c=IN IP4 10.0.0.3
                    b=AS:104
                },
                Remote {
                    v=0
                    o=- 0 0 IN IP4 10.0.0.1
                    s=-
                    t=0 0
                    m=- 2222 - -
                    c=IN IP4 10.0.0.1
                    b=AS:104
                }
              } /* Stream */
            } /* Media */
          } /* Modify */
          Modify = ip/1/if2/1 {
            Media {
              Stream = 1 {
                LocalControl {
                    ipdc/realm = "BCoreNNI",
                    gm/rsb = ON,
                    mode = SendReceive
                },
                Local {
                    v=0
                    o=- 0 0 IN IP4 10.0.1.1
                    s=-
                    t=0 0
                    m=- 6666 - -
                    c=IN IP4 10.0.1.1
                    b=AS:104
                },
                Remote {
                    v=0
                    o=- 0 0 IN IP4 10.0.1.2
                    s=-
                    t=0 0
                    m=- 8888 - -
                    c=IN IP4 10.0.1.2
                    b=AS:104
                }
              } /* Stream */
            } /* Media */
          } /* Modify */
        } /* Context */
   } /* Reply */
```

Step	Protocol	Interface	From	To	Message
33.9	DIAMETER	Gq'	SPDF AA	IBCF A	AAA

```
<AA-Answer> ::= < Diameter Header: 265, PXY >
              < Session-Id = "ibcf-a.example.com;14511D;557" >
            { Auth-Application-Id = 16777222 (Gq) }
            { Origin-Host = "spdf-aa.example.com" }
            { Origin-Realm = "example.com" }
            [ Result-Code = DIAMETER_SUCCESS (2001) ]
            [ Binding-Information =
                { Binding-Input-List =
                    [ V4-Transport-Address =
                        { Framed-IP-Address = 10.0.0.1 }
                        { Port-Number = 2222 }
                    ]
                    [ V4-Transport-Address =
                        { Framed-IP-Address = 10.0.1.2 }
                        { Port-Number = 8888 }
                    ]
                    [ V4-Transport-Address =
                        { Framed-IP-Address = 10.0.0.1 }
                        { Port-Number = 2223 }
                    ]
                    [ V4-Transport-Address =
                        { Framed-IP-Address = 10.0.1.2 }
                        { Port-Number = 8889 }
                    ]
                [ Binding-Output-List =
                    [ V4-Transport-Address =
                        { Framed-IP-Address = 10.0.1.1 }
                        { Port-Number = 6666 }
                    ]
                    [ V4-Transport-Address =
                        { Framed-IP-Address = 10.0.0.3 }
                        { Port-Number = 5554 }
                    ]
                    [ V4-Transport-Address =
                        { Framed-IP-Address = 10.0.1.1 }
                        { Port-Number = 6667 }
                    ]
                    [ V4-Transport-Address =
                        { Framed-IP-Address = 10.0.0.3 }
                        { Port-Number = 5555 }
                    ]
                ]
            ]
            [ Authorization-Lifetime = 450 ]
            [ Auth-Grace-Period = 10 ]
```

Step	Protocol	Interface	From	To	Message
33.10	SIP		IBCF A	S-CSCF A	200 OK (SDP)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP ibcf-a.example.com:5060;branch=z9hG4bKhfj55z
Via: SIP/2.0/UDP s-cscf-a.example.com:5060;branch=z9hG4bKpm5lmx
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 66
Record-Route: <sip:p-cscf-b.example.com;lr>,<sip:s-cscf-b.example.com;lr>,<sip:ibcf-
b.example.com;lr>,<sip:ibcf-a.example.com;lr>,<sip:s-cscf-a.example.com;lr>,<sip:p-cscf-
a.example.com;lr>
From: User A <sip:user_a@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 1 INVITE
Contact: <sip:user_b@phone-b.example.com>
Content-Type: application/sdp
Content-Length: 126

v=0
o=user_b 29381748101 2948193018 IN IP4 phone-b.example.com
s=-
c=IN IP4 10.0.0.3
t=0 0
m=audio 5554 RTP/AVP 0
a=sendrecv
```

Step	Protocol	Interface	From	To	Message
The above message finishes the second addition to the basic call setup signalling flow. Below follows the third addition to that signalling flow.					
45.0	SIP		S-CSCF A	IBCF A	ACK

```
ACK sip:user_b@example.com SIP/2.0
Via: SIP/2.0/UDP s-cscf-a.example.com:5060;branch=z9hG4bKpm5lmx
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 68
From: User A <sip:user_a@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 2 ACK
Contact: <sip:user_a@phone-a.example.com>
Content-Length: 0
```

| 45.2 | SIP | | IBCF A | IBCF B | ACK |

```
ACK sip:user_b@example.com SIP/2.0
Via: SIP/2.0/UDP ibcf-a.example.com:5060;branch=z9hG4bKhfj55z
Via: SIP/2.0/UDP s-cscf-a.example.com:5060;branch=z9hG4bKpm5lmx
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 67
From: User A <sip:user_a@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 2 ACK
Contact: <sip:user_a@phone-a.example.com>
Content-Length: 0
```

| 45.3 | SIP | | IBCF B | S-CSCF B | ACK |

```
ACK sip:user_b@example.com SIP/2.0
Via: SIP/2.0/UDP ibcf-b.example.com:5060;branch=z9hG4bKH23gzx
Via: SIP/2.0/UDP ibcf-a.example.com:5060;branch=z9hG4bKhfj55z
Via: SIP/2.0/UDP s-cscf-a.example.com:5060;branch=z9hG4bKpm5lmx
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 66
From: User A <sip:user_a@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 4 UPDATE
Contact: <sip:user_a@phone-a.example.com>
Content-Length: 0
```

6.2.2   Session termination

Figure 6.2.2.1: IMS end-to-end signalling chart for IBCF - session teardown

Table 6.2.2.1: IMS end-to-end messages for IBCF - session teardown

Step	Protocol	Interface	From	To	Message
57.0	SIP		S-CSCF B	IBCF B	BYE

```
BYE sip:user_a@example.com SIP/2.0
Via: SIP/2.0/UDP s-cscf-b.example.com:5060;branch=fg7gjHl3ss8r
Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
Via: SIP/2.0/UDP phone-b.example.com:5060;branch=z9hG4bKjwafcb9
Max-Forwards: 68
Route: <sip:ibcf-b.example.com;lr>,<sip:ibcf-a.example.com;lr>, <sip:s-cscf-a.example.com;lr>,
<sip:p-cscf-a.example.com;lr
From: User B <sip:user_b@example.com>;tag=4fxdce12ls
To: User A <sip:user_a@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 1 BYE
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
57.1	DIAMETER	Gq´	IBCF B	SPDF BB	STR

```
<ST-Request> ::=< Diameter Header: 275, REQ, PXY >
              < Session-Id = "ibcf-b.example.com;25536F;231" >
              { Origin-Host = "ibcf-b.example.com" }
              { Origin-Realm = "example.com" }
              { Destination-Realm = "example.com" }
              { Termination-Cause = DIAMETER_LOGOUT }
              { Auth-Application-Id = 16777222 (Gq) }
              [ Destination-Host = " spdf-bb.example.com" ]
```

Step	Protocol	Interface	From	To	Message
57.2	H.248	Ia	SPDF BB	I-BGF B	Subtract termination BB

```
MEGACO/3 [ibcf-b.example.com]:55555
Transaction = 3 {
    Context = 1 {
        Subtract = ip/1/if1/1 {Audit{Statistics}}
        Subtract = ip/1/if2/1 {Audit{Statistics}}
    } /* Context */
} /* Transaction */
```

Step	Protocol	Interface	From	To	Message
57.3	H.248	Ia	I-BGF B	SPDF BB	Reply

```
MEGACO/3 [ibgf-b.example.com]:55555
Reply = 3 {
    Context = 1 {
        Subtract = ip/1/if1/1 {
            Statistics {
                nt/dur=450000,  ; in milliseconds
                nt/os=5400000,  ; Octets Sent
```

Step	Protocol	Interface	From	To	Message

```
              nt/or=5400000,  ; Octets Received
              gm/dp=0         ; number of packets discarded
          }
      }
      Subtract = ip/1/if2/1 {
          Statistics {
              nt/dur=450000,  ; in milliseconds
              nt/os=450000,   ; Octets Sent
              nt/or=450000,   ; Octets Received
              gm/dp=0         ; number of packets discarded
          }
      } /* Subtract */
  } /* Context */
} /* Reply */
```

Step	Protocol	Interface	From	To	Message
57.4	DIAMETER	Gq'	SPDF BB	IBCF B	STA

```
   <ST-Answer> ::= < Diameter Header: 275, PXY >
               < Session-Id = "ibcf-b.example.com;25536F;231" >
               { Origin-Host = "spdf-bb.example.com" }
               { Origin-Realm = "example.com" }
                [ Result-Code = DIAMETER_SUCCESS (2001) ]
```

Step	Protocol	Interface	From	To	Message
57.5	SIP		IBCF B	IBCF A	BYE

```
   BYE sip:user_a@example.com SIP/2.0
   Via: SIP/2.0/UDP ibcf-b.example.com:5060;branch=z9hG4bKH23gzx
   Via: SIP/2.0/UDP s-cscf-b.example.com:5060;branch=fg7gjHl3ss8r
   Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
   Via: SIP/2.0/UDP phone-b.example.com:5060;branch=z9hG4bKjwafcb9
   Max-Forwards: 67
   Route: <sip:ibcf-a.example.com;lr>, <sip:s-cscf-a.example.com;lr>, <sip:p-cscf-a.example.com;lr
   From: User B <sip:user_b@example.com>;tag=4fxdce12ls
   To: User A <sip:user_a@example.com>
   Call-ID: 398174293@phone-a.example.com
   CSeq: 1 BYE
   Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
57.6	DIAMETER	Gq'	IBCF A	SPDF AA	STR

```
   <ST-Request> ::=< Diameter Header: 275, REQ, PXY >
               < Session-Id = "ibcf-a.example.com;14511D;557" >
               { Origin-Host = "ibcf-a.example.com" }
               { Origin-Realm = "example.com" }
               { Destination-Realm = "example.com" }
               { Termination-Cause = DIAMETER_LOGOUT }
               { Auth-Application-Id = 16777222 (Gq) }
               [ Destination-Host = " spdf-aa.example.com" ]
```

Step	Protocol	Interface	From	To	Message
57.7	H.248	Ia	SPDF AA	I-BGF A	Subtract termination AA

```
   MEGACO/3 [ibcf-a.example.com]:55555
   Transaction = 3 {
       Context = 1 {
           Subtract = ip/1/if1/1 {Audit{Statistics}}
           Subtract = ip/1/if2/1 {Audit{Statistics}}
       } /* Context */
   } /* Transaction */
```

Step	Protocol	Interface	From	To	Message
57.8	H.248	Ia	I-BGF A	SPDF AA	Reply

```
   MEGACO/3 [ibgf-a.example.com]:55555
   Reply = 3 {
       Context = 1 {
           Subtract = ip/1/if1/1 {
               Statistics {
                   nt/dur=450000,  ; in milliseconds
                   nt/os=5400000,  ; Octets Sent
                   nt/or=5400000,  ; Octets Received
                   gm/dp=0         ; number of packets discarded
               }
           }
           Subtract = ip/1/if2/1 {
               Statistics {
                   nt/dur=450000,  ; in milliseconds
                   nt/os=450000,   ; Octets Sent
```

Step	Protocol	Interface	From	To	Message

```
                        nt/or=450000,    ; Octets Received
                        gm/dp=0          ; number of packets discarded
                }
            } /* Subtract */
        } /* Context */
    } /* Reply */
```

57.9	DIAMETER	Gq'	SPDF AA	IBCF A	STA

```
    <ST-Answer> ::= < Diameter Header: 275, PXY >
                    < Session-Id = "ibcf-a.example.com;14511D;557" >
                    { Origin-Host = "spdf-aa.example.com" }
                    { Origin-Realm = "example.com" }
                     [ Result-Code = DIAMETER_SUCCESS (2001) ]
```

57.10	SIP		IBCF A	S-CSCF A	BYE

```
    BYE sip:user_a@example.com SIP/2.0
    Via: SIP/2.0/UDP ibcf-a.example.com:5060;branch=z9hG4bKhfj55z
    Via: SIP/2.0/UDP ibcf-b.example.com:5060;branch=z9hG4bKH23gzx
    Via: SIP/2.0/UDP s-cscf-b.example.com:5060;branch=fg7gjHl3ss8r
    Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
    Via: SIP/2.0/UDP phone-b.example.com:5060;branch=z9hG4bKjwafcb9
    Max-Forwards: 66
    Route: <sip:s-cscf-a.example.com;lr>, <sip:p-cscf-a.example.com;lr
    From: User B <sip:user_b@example.com>;tag=4fxdce12ls
    To: User A <sip:user_a@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 BYE
    Content-Length: 0
```

6.3   IMS-based IPTV

6.3.1   Enabling BC service

Figure 6.3.1.1 illustrates the example network architecture.

Figure 6.3.1.1: IMS-based IPTV -BC service

The addresses and ports used in the example are as follows:

- A_1 = 192.168.0.2 (used as identifier of the user only).

- A_2 = 192.168.0.3 (the MDF uses different port numbers for different BC channels and IP multicast addresses).

- Three BC channels:

    - Source 192.168.0.3 14368, Multicast 235.160.32.14 12954.

    - Source 192.168.0.3 14370, Multicast 235.160.32.10 12832.

    - Source 192.168.0.3 14368, Multicast 235.160.32.12 12996.

The RTP stream is assumed to consume 2 500 000 kbps for HD TV. The TTL set for the multicast streams is 10. Note that the TTL is required at the c-line by [14]. However, as stated in [14] its use to scope multicast traffic is deprecated and applications SHOULD use an administratively scoped address instead.

Figure 6.3.1.2: Enabling BC service -IMS-based IPTV

Table 6.3.1.1: Messages for enabling BC service -IMS-based IPTV

Step	Protocol	Interface	From	To	Message
1	SIP	Gm	UE A	P-CSCF A	INVITE BC
Before issuing the INVITE for BC IPTV, the UE needs to perform Service Discovery and Service Selection following the procedures defined in [10]. The signalling involved in performing those procedures is out of the scope for the present document.					

```
    INVITE sip:bc_service@example.com SIP/2.0
    Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
    Max-Forwards: 70
    Route: <sip:p-cscf-a.example.com;lr>
    From: UE A <sip:ue_a@example.com>;tag=372183
    To: BC service <sip:bc_service@example.com>
    Call-ID: 398174293@ue-a.example.com
    CSeq: 1 INVITE
    Contact: <sip:user_a@ue-a.example.com>
    Content-Type: application/sdp
    Content-Length: 256
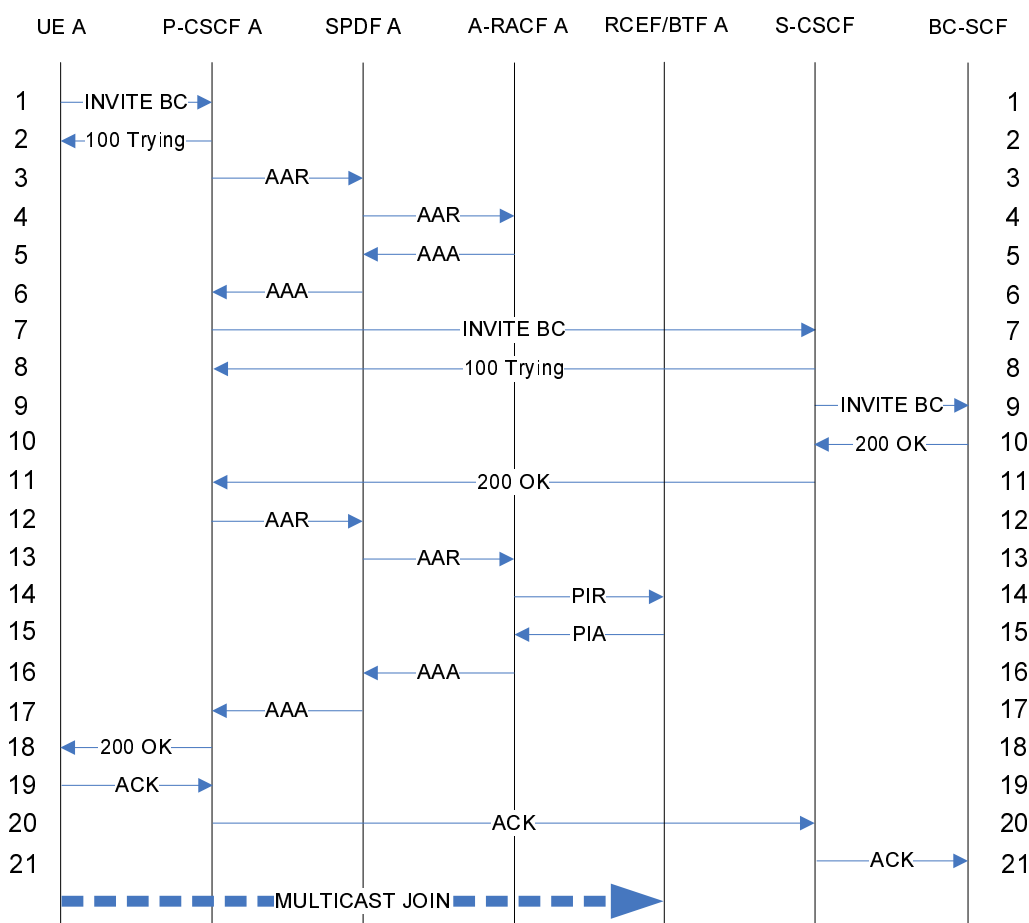
    v=0
    o=user_a 2890844526 2890842807 IN IP4 ue-a.example.com
    s=-
    c=IN IP4 235.160.32.14/10
    m=video 12954 RTP/AVP 33
    a=rtpmap:33 dvbip-alfec-base/90000
    a=bc_service:channel_1@iptv_broadcast_example
    a=bc_service_package:package_1@3FB7
    a=recvonly
    b=AS:2500
```

Step	Protocol	Interface	From	To	Message
2	SIP	Gm	P-CSCF A	UE A	100 Trying

```
    SIP/2.0 100 Trying
    Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
    From: User A <sip:user_a@example.com>;tag=372183
    To: BC service <sip:bc_service@example.com>
    Call-ID: 398174293@ue-a.example.com
    CSeq: 1 INVITE
    Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
3	DIAMETER	Gq'	P-CSCF A	SPDF A	AAR
The P-CSCF maps the parameters in the SDP to service information for Diameter AVPs in the AA-Request over Gq' according to annex C.1 in (TS 183 017 V2.3.1 [4]).					

```
    <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                    < Session-Id = "p-cscf-a.example.com;13815C;391" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "p-cscf-a.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    [ Destination-Host = spdf-a@example.com ]
                    [ Media-Component-Description =
                            { Media-Component-Number = 1 }
                            [ Media-Sub-Component =
                                { Flow-Number = 1 }
                                [ Flow-Description = "permit out 17 from any to 235.160.32.14 12954"
                    ]
                            [ Flow-Usage = NO_INFORMATION(0) ]
                            [ Max-Requested-Bandwidth-DL = 2500000 ]
                    ]
                            [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                            [ Media-Type = VIDEO (1) ]
                            [ Flow-Status = DISABLED (3) ]
                            [ Reservation-Priority = DEFAULT (0) ]
                            [ Media-Authorization-Context-Id = "package_1@3FB7"]
                    ]
                    [ Reservation-Priority = DEFAULT (0) ]
                    [ Globally-Unique-Address =
                            [ Framed-IP-Address = 192.168.0.2 ]
                            [ Address-Realm = "example.com" ]
                    ]
                    [ Authorization-Lifetime = 450 ]
```

Step	Protocol	Interface	From	To	Message
4	DIAMETER	Rq	SPDF A	A-RACF A	AAR

```
    <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                   < Session-Id = "spdf-a.example.com;429C3;412" >
                   { Auth-Application-Id = 16777222 (Gq) }
                   { Origin-Host = "spdf-a.example.com" }
                   { Origin-Realm = "example.com" }
                   { Destination-Realm = "example.com" }
                   [ Destination-Host = aracf-a@example.com ]
                   [ Media-Component-Description =
                          { Media-Component-Number = 1 }
                          [ Media-Sub-Component =
                             { Flow-Number = 1 }
                             [ Flow-Description = "permit out 17 from any to 235.160.32.14 12954"
                          ]
                             [ Flow-Usage = NO_INFORMATION(0) ]
                             [ Max-Requested-Bandwidth-DL = 2500000 ]
                          ]
                          [ AF-Application-Identifier = "RQ_SAMPLE_APP"]
                          [ Media-Type = VIDEO (1) ]
                          [ Flow-Status = DISABLED (3)]
                          [ Reservation-Priority = DEFAULT (0) ]
                          [ Media-Authorization-Context-Id = "package_1@3FB7"]
                   ]
                   [ Reservation-Priority = DEFAULT (0) ]
                   [ Globally-Unique-Address =
                          [ Framed-IP-Address = 192.168.0.2 ]
                          [ Address-Realm = "example.com" ]
                   ]
                   [ Authorization-Lifetime = 450 ]
```

Step	Protocol	Interface	From	To	Message
5	DIAMETER	Rq	A-RACF A	SPDF A	AAA

```
    <AA-Answer> ::= < Diameter Header: 265, PXY >
                   < Session-Id = "spdf-a.example.com;429C3;412" >
                   { Auth-Application-Id = 16777222 (Gq) }
                   { Origin-Host = "aracf-a.example.com" }
                   { Origin-Realm = "example.com" }
                   [ Result-Code = DIAMETER_SUCCESS (2001) ]
                   [ Authorization-Lifetime = 450 ]
                   [ Auth-Grace-Period = 10 ]
```

Step	Protocol	Interface	From	To	Message
6	DIAMETER	Gq'	SPDF A	P-CSCF A	AAA

```
    <AA-Answer> ::= < Diameter Header: 265, PXY >
                   < Session-Id = "p-cscf-a.example.com;13815C;391" >
                   { Auth-Application-Id = 16777222 (Gq) }
                   { Origin-Host = "spdf-a.example.com" }
                   { Origin-Realm = "example.com" }
                   [ Result-Code = DIAMETER_SUCCESS (2001) ]
                   [ Authorization-Lifetime = 450 ]
                   [ Auth-Grace-Period = 10 ]
```

Step	Protocol	Interface	From	To	Message
7	SIP	Mw	P-CSCF A	S-CSCF	INVITE BC

```
    INVITE sip:user_b@example.com SIP/2.0
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
    Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
    Max-Forwards: 69
    Record-Route: <sip:p-cscf-a.example.com;lr>
    From: UE A <sip:ue_a@example.com>;tag=372183
    To: BC service <sip:bc_service@example.com>
    Call-ID: 398174293@ue-a.example.com
    CSeq: 1 INVITE
    Contact: <sip:user_a@ue-a.example.com>
    Content-Type: application/sdp
    Content-Length: 256

    v=0
    o=user_a 2890844526 2890842807 IN IP4 ue-a.example.com
    s=-
    c=IN IP4 235.160.32.14/10
    m=video 12954 RTP/AVP 33
    a=rtpmap:33 dvbip-alfec-base/90000
    a=bc_service:channel_1@iptv_broadcast_example
    a=bc_service_package:package_1@3FB7
```

Step	Protocol	Interface	From	To	Message
					a=recvonly b=AS:2500
8	SIP	Mw	S-CSCF	P-CSCF A	100 Trying
					SIP/2.0 100 Trying Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03 From: User A <sip:user_a@example.com>;tag=372183 To: BC service <sip:bc_service@example.com> Call-ID: 398174293@ue-a.example.com CSeq: 1 INVITE Content-Length: 0
9	SIP	ISC	S-CSCF	BC-SCF	INVITE BC
					INVITE sip:user_b@example.com SIP/2.0 Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03 Max-Forwards: 68 Record-Route: <sip:s-cscf.example.com;lr>,<sip:p-cscf-a.example.com;lr> From: UE A <sip:ue_a@example.com>;tag=372183 To: BC service <sip:bc_service@example.com> Call-ID: 398174293@ue-a.example.com CSeq: 1 INVITE Contact: <sip:user_a@ue-a.example.com> Content-Type: application/sdp Content-Length: 256 v=0 o=user_a 2890844526 2890842807 IN IP4 ue-a.example.com s=- c=IN IP4 235.160.32.14/10 m=video 12954 RTP/AVP 33 a=rtpmap:33 dvbip-alfec-base/90000 a=bc_service:channel_1@iptv_broadcast_example a=bc_service_package:package_1@3FB7 a=recvonly b=AS:2500
10	SIP	ISC	BC-SCF A	S-CSCF	200 OK (SDP)
					SIP/2.0 200 OK Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03 Max-Forwards: 70 From: User A <sip:user_a@example.com>;tag=372183 To: BC service <sip:bc_service@example.com> Call-ID: 398174293@phone-a.example.com CSeq: 1 INVITE Contact: <sip:bc_service@bc-scf.example.com> Content-Type: application/sdp Content-Length: 264 v=0 o=BC service 2890844526 2890842807 IN IP4 bc_service.example.com s=- c=IN IP4 235.160.32.14/10 m=video 12954 RTP/AVP 33 a=rtpmap:33 dvbip-alfec-base/90000 a=bc_service:channel_1@iptv_broadcast_example a=bc_service_package:package_1@3FB7 a=sendonly b=AS:2500
11	SIP	Mw	S-CSCF	P-CSCF A	200 OK (SDP)
					SIP/2.0 200 OK Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03 Max-Forwards: 69 From: User A <sip:user_a@example.com>;tag=372183 To: BC service <sip:bc_service@example.com> Call-ID: 398174293@phone-a.example.com

Step	Protocol	Interface	From	To	Message
	CSeq: 1 INVITE Contact: <sip:bc_service@bc-scf.example.com> Content-Type: application/sdp Content-Length: 264 v=0 o=BC service 2890844526 2890842807 IN IP4 bc_service.example.com s=- c=IN IP4 235.160.32.14/10 m=video 12954 RTP/AVP 33 a=rtpmap:33 dvbip-alfec-base/90000 a=bc_service:channel_1@iptv_broadcast_example a=bc_service_package:package_1@3FB7 a=sendonly b=AS:2500				
12	DIAMETER	Gq'	P-CSCF A	SPDF A	AAR

	<AA-Request> ::=< Diameter Header: 265, REQ, PXY >
	    < Session-Id = "p-cscf-a.example.com;13815C;391" >
	    { Auth-Application-Id = 16777222 (Gq) }
	    { Origin-Host = "p-cscf-a.example.com" }
	    { Origin-Realm = "example.com" }
	    { Destination-Realm = "example.com" }
	    [Media-Component-Description =
	       { Media-Component-Number = 1 }
	       [Media-Sub-Component =
	         { Flow-Number = 1 }
	         [Flow-Description = "permit out 17 from any to 235.160.32.14 12954"
	       ]
	         [Flow-Usage = NO_INFORMATION(0)]
	         [Max-Requested-Bandwidth-DL = 2500000]
	       ]
	       [AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
	       [Media-Type = VIDEO (1)]
	       [Flow-Status = ENABLED DOWNLINK (1)]
	       [Reservation-Priority = DEFAULT (0)]
	       [Media-Authorization-Context-Id = "package_1@3FB7"]
	    ]
	    [Reservation-Priority = DEFAULT (0)]
	    [Globally-Unique-Address =
	       [Framed-IP-Address = 192.168.0.2]
	       [Address-Realm = "example.com"]
	    ]
	    [Authorization-Lifetime = 450]				

13	DIAMETER	Rq	SPDF A	A-RACF A	AAR

	<AA-Request> ::=< Diameter Header: 265, REQ, PXY >
	    < Session-Id = "spdf-a.example.com;429C3;412" >
	    { Auth-Application-Id = 16777222 (Gq) }
	    { Origin-Host = "spdf-a.example.com" }
	    { Origin-Realm = "example.com" }
	    { Destination-Realm = "example.com" }
	    [Media-Component-Description =
	       { Media-Component-Number = 1 }
	       [Media-Sub-Component =
	         { Flow-Number = 1 }
	         [Flow-Description = "permit out 17 from any to 235.160.32.14 12954"
	       ]
	         [Flow-Usage = NO_INFORMATION(0)]
	         [Max-Requested-Bandwidth-DL = 2500000]
	       ]
	       [AF-Application-Identifier = "RQ_SAMPLE_APP"]
	       [Media-Type = VIDEO (1)]
	       [Flow-Status = ENABLED DOWNLINK (1)]
	       [Reservation-Priority = DEFAULT (0)]
	       [Media-Authorization-Context-Id = "package_1@3FB7"]
	    ]
	    [Reservation-Priority = DEFAULT (0)]
	    [Globally-Unique-Address =
	       [Framed-IP-Address = 192.168.0.2]
	       [Address-Realm = "example.com"]
	    ]
	    [Authorization-Lifetime = 450]				

Step	Protocol	Interface	From	To	Message
14	DIAMETER	Re	A-RACF A	RCEF A	PIR

The A-RACF maps the value of the Authorization-Package-Id AVP to information that is locally preconfigured on the allowed IP multicast addresses and ports for the currently authorized application service. In this example, "package_1@3FB7" maps into a set of three IP multicast addresses and ports, whereof one is provided in the Rq AAR command since it is the IP multicast address that the UE intends to join first. This address and port is provided in the SDP offer according to [10]. The activation of the policy occurs however shown in this step with the arrival of the 200 OK following the example signalling flow given in clause A.4.1 of [10].
Furthermore, the A-RACF maps the value of the Media-Authorization-Context-Id AVP to source IP addresses and ports that are locally preconfigured,
The ToS-Traffic-Class AVP is set to 001010, which is the codepoint allocated by IANA for the AF11 DiffServ per-hop behaviour [15]. This value is herein provided as an example only.

```
< PI-Request > ::=  < Diameter Header: 315, REQ, PXY >
                < Session-Id = "aracf-a.example.com;32475;112" >
                { Auth-Application-Id = 16777253 (Re) }
                { Origin-Host = "aracf-a.example.com" }
                { Origin-Realm = "example.com" }
                { Destination-Realm = "example.com" }
                { Destination-Host = "rcef-a.example.com" }
                { PI-Request-Type = INITIAL_REQUEST }
                { PI-Request-Number = 0 }
                [ Auth-Session-State = NO_STATE_MAINTAINED (1) ]
                [ Policy-Rule-Install =
                    [ Policy-Rule-Definition =
                        { Policy-Rule-Name = "policy-rule-example-BC-IPTV-DL" }
                        [ Service-Identifier = 1 ]
                        [ Rating-Group = 1 ]
                        [ Framed-IP-Address = 192.168.0.2 ]
                        [ Address-Realm = "example.com" ]
                        [ Flow-Description = "permit out 17 from 192.168.0.3 14368
                                                    to 235.160.32.14 12954" ]
                        [ Flow-Description = "permit out 17 from 192.168.0.3 14370
                                                    to 235.160.32.10 12832" ]
                        [ Flow-Description = "permit out 17 from 192.168.0.3 14368
                                                    to 235.160.32.12 12996" ]
                        [ Flow-Status = ENABLED-DOWNLINK (1) ]
                        [ QoS-Information =
                            [ Max-Requested-Bandwidth-UL = 2500000 ]
                            [ ToS-Traffic-Class = 001010]
                        ]
                        [ Precedence = 1]
                        [ Flows =
                            { Media-Component-Number = 1 }
                            [ Flow-Number = 1 ]
                        ]
                    ]
                ]
```

Step	Protocol	Interface	From	To	Message
15	DIAMETER	Re	RCEF A	A-RACF A	PIA

```
<PI-Answer> ::= < Diameter Header: 315, PXY >
                < Session-Id = "aracf-a.example.com;32475;112" >
                { Origin-Host = "rcef-a.example.com" }
                { Origin-Realm = "example.com" }
                { PI-Request-Type = INITIAL_REQUEST }
                { PI-Request-Number = 0 }
                [ Result-Code DIAMETER_SUCCESS (2001) ]
```

Step	Protocol	Interface	From	To	Message
16	DIAMETER	Rq	A-RACF A	SPDF A	AAA

```
<AA-Answer> ::= < Diameter Header: 265, PXY >
                < Session-Id = "spdf-a.example.com;429C3;412" >
                { Auth-Application-Id = 16777222 (Gq) }
                { Origin-Host = "aracf-a.example.com" }
                { Origin-Realm = "example.com" }
                [ Result-Code = DIAMETER_SUCCESS (2001) ]
                [ Authorization-Lifetime = 450 ]
                [ Auth-Grace-Period = 10 ]
```

Step	Protocol	Interface	From	To	Message
17	DIAMETER	Gq'	SPDF A	P-CSCF A	AAA

```
<AA-Answer> ::= < Diameter Header: 265, PXY >
               < Session-Id = "p-cscf-a.example.com;13815C;391" >
               { Auth-Application-Id = 16777222 (Gq) }
               { Origin-Host = "spdf-a.example.com" }
               { Origin-Realm = "example.com" }
               [ Result-Code = DIAMETER_SUCCESS (2001) ]
               [ Authorization-Lifetime = 450 ]
               [ Auth-Grace-Period = 10 ]
```

Step	Protocol	Interface	From	To	Message
18	SIP	Gm	P-CSCF A	UE A	200 OK (SDP)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 68
From: User A <sip:user_a@example.com>;tag=372183
To: BC service <sip:bc_service@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 1 INVITE
Contact: <sip:bc_service@bc-scf.example.com>
Content-Type: application/sdp
Content-Length: 264

v=0
o=BC service 2890844526 2890842807 IN IP4 bc_service.example.com
s=-
c=IN IP4 235.160.32.14/10
m=video 12954 RTP/AVP 33
a=rtpmap:33 dvbip-alfec-base/90000
a=bc_service:channel_1@iptv_broadcast_example
a=bc_service_package:package_1@3FB7
a=sendonly
b=AS:2500
```

Step	Protocol	Interface	From	To	Message
19	SIP	Gm	UE A	P-CSCF A	ACK

```
ACK sip:user_b@example.com SIP/2.0
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 70
Route: <sip:p-cscf-a.example.com;lr>,<sip:s-cscf.example.com;lr>
From: User A <sip:user_a@example.com>;tag=348123
To: BC service <sip:bc_service@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 1 ACK
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
20	SIP	Mw	P-CSCF A	S-CSCF	ACK

```
ACK sip:user_b@example.com SIP/2.0
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 69
Route: <sip:s-cscf.example.com;lr>
From: User A <sip:user_a@example.com>;tag=348123
To: BC service <sip:bc_service@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 1 ACK
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
21	SIP	ISC	S-CSCF	BC-SCF	ACK

```
ACK sip:user_b@example.com SIP/2.0
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 68
From: User A <sip:user_a@example.com>;tag=348123
To: BC service <sip:bc_service@example.com>
Call-ID: 398174293@phone-a.example.com
CSeq: 1 ACK
Content-Length: 0
```

6.3.2   Enabling CoD service

Figure 6.3.2.1 illustrates the example network architecture [10].

Figure 6.3.2.1: IMS-based IPTV -CoD service

The addresses and ports used in the example are as follows:

- A_1 = RTSP: 192.168.0.2: 33942.

- A_1 = Audio: 192.168.0.2: 23942 for RTP and 192.168.0.2:23943 for RTCP.

- A_1 = Video: 192.168.0.2:51372 for RTP and 192.168.0.2:51373 for RTCP.

- A_2 = RTSP: 192.168.0.1:34444.

- A_2 = Audio: 192.168.0.1:4444 for RTP and 192.168.0.1:4445 for RTCP.

- A_2 = Video: 192.168.0.1:31444 for RTP and 192.168.0.1:31445 for RTCP.

- A_3 = RTSP: 10.0.0.1:32222.

- A_3 = Audio: 10.0.0.1:2222 for RTP and 10.0.0.1:2223 for RTCP.

- A_3 = Video: 10.0.0.1:17462 for RTP and 10.0.0.1:17463 for RTCP.

- B_1 = RTSP: 192.168.1.2:39792.

- B_1 = Audio: 192.168.1.2:39792 for RTP and 192.168.1.2:29793 for RTCP.

- B_1 = Video: 192.168.1.2:25552 for RTP and 192.168.1.2:25553 for RTCP.

- B_2 = RTSP: 192.168.1.1:33332.

- B_2 = Audio: 192.168.1.1:3332 for RTP and 192.168.1.1:3333 for RTCP.

- B_2 = Video: 192.168.1.1:32124 for RTP and 192.168.1.1:32125 for RTCP.

- B_3 = RTSP: 10.0.0.2:31110.

- B_3 = Audio: 10.0.0.2:31110 for RTP and 10.0.0.2:1111 for RTCP.

- B_3 = Video: 10.0.0.2:1612 for RTP and 10.0.0.2:1613 for RTCP.

- RTSP-URL of MF : media.example.com.

UE A   P-CSCF A   SPDF A   A-RACF A   C-BGF A   RCEF A   S-CSCF   RCEF B   C-BGF B   A-RACF B   SPDF B   P-CSCF B   MF

1   INVITE B
2   100 Trying
3   AAR
4   Add Termination
5   Reply
6   AAR
7   AAA
8   AAA
9   INVITE B
10   100Trying
11   INVITE B
12   100Trying
13   AAR
14   Add Termination
15   Reply
16   AAR
17   AAA
18   AAA
19   INVITE B
20   200OK
21   AAR
22   Modify Termination
23   Reply
24   AAR
25   PIR
26   PIA
27   AAA
28   AAA
29   200OK
30   200OK
31   AAR
32   Modify Termination
33   Reply
34   AAR
35   PIR
36   PIA
37   AAA
38   AAA
39   200OK
40   ACK
41   ACK
42   ACK
43   ACK
44   RTSP DESCRIBE
45   RTSP 200 OK
46   RTSP SETUP (audio)
47   RTSP 200 OK
48   RTSP SETUP (video)
49   RTSP 200 OK
50   INVITE B
51   100 Trying
52   AAR
53   Modify Termination
54   Reply
55   AAR
56   AAA
57   AAA
58   INVITE B
59   100Trying
60   INVITE B
61   100Trying
62   AAR
63   Modify Termination
64   Reply
65   AAR
66   AAA
67   AAA
68   INVITE B
69   200OK
70   AAR
71   Modify Termination
72   Reply
73   AAR
74   PIR
75   PIA
76   AAA
77   AAA
78   200OK
79   200OK
80   AAR
81   Modify Termination
82   Reply
83   AAR
84   PIR
85   PIA
86   AAA
87   AAA
88   200OK
89   ACK
90   ACK
91   ACK
92   ACK
93   RTSP PALY
94   RTSP 200 OK
     BIDIRECTIONAL RTP DATA

Figure 6.3.2.2: Enabling CoD service -IMS-based IPTV (based on A.3.1.1 of [10])

Table 6.3.2.1: Messages for enabling CoD service -IMS-based IPTV

Step	Protocol	Interface	From	To	Message
1	SIP		UE A	P-CSCF A	INVITE B

```
INVITE sip:mf_b@example.com SIP/2.0
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 70
Route: <sip:p-cscf-a.example.com;lr>
From: User A <sip:user_a@example.com>;tag=372183
To: MF <sip:mf_b@example.com>
Call-ID: 398174293@ue-a.example.com
CSeq: 1 INVITE
Contact: <sip:user_a@ue-a.example.com>
Content-Type: application/sdp
Content-Length: 129

v=0
o=user_a 2890844526 2890842807 IN IP4 ue-a.example.com
s=-
c=IN IP4 192.168.0.2
t=0 0
m=application 9 tcp iptv_rtsp
a=sendrecv
a=setup:active
a=connection:new
```
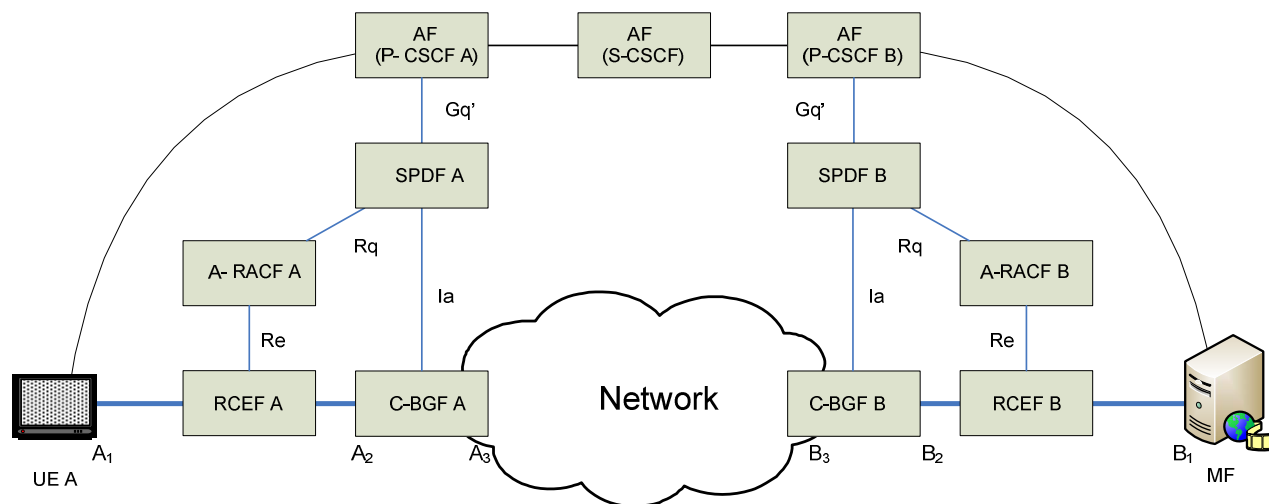
Step	Protocol	Interface	From	To	Message
2	SIP		P-CSCF A	UE A	100 Trying

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
From: User A <sip:user_a@example.com>;tag=372183
To: MF <sip:mf_b@example.com>
Call-ID: 398174293@ue-a.example.com
CSeq: 1 INVITE
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
3	DIAMETER	Gq'	P-CSCF A	SPDF A	AAR

The value of Max-Requested-Bandwidth-DL / Max-Requested-Bandwidth-UL may be pre-configured in P-CSCF.

```
<AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                < Session-Id = "p-cscf-a.example.com;13815C;391" >
                { Auth-Application-Id = 16777222 (Gq) }
                { Origin-Host = "p-cscf-a.example.com" }
                { Origin-Realm = "example.com" }
                { Destination-Realm = "example.com" }
                [ Destination-Host = "spdf-a.example.com" ]
                [ Media-Component-Description =
                      { Media-Component-Number = 1 }
                      [ Media-Sub-Component =
                          { Flow-Number = 1 }
                          [ Flow-Description = "permit out 6 from any to 192.168.0.2 9" ]
                          [ Flow-Description = "permit in 6 from any to any" ]
                          [ Flow-Usage = NO_INFORMATION(0) ]
                          [ Max-Requested-Bandwidth-DL = 20000 ]
                          [ Max-Requested-Bandwidth-UL = 20000 ]
                      ]
                      [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                      [ Media-Type = APPLICATION (3) ]
                      [ Flow-Status = DISABLED ]
                      [ Reservation-Priority = DEFAULT (0) ]
                      [ Codec-Data = "uplink
                          offer
                          m=application 9 tcp iptv_rtsp"
                      ]

                ]
                [ Binding-Information =
                      { Binding-Input-List =
                          [ V4-Transport-Address =
                              { Framed-IP-Address = 192.168.0.2 }
                              { Port-Number = 9 }
                          ]
                          [ V4-Transport-Address =
                              { Framed-IP-Address = 0.0.0.0 }
                              { Port-Number = 0 }
                          ]
                      }
```

Step	Protocol	Interface	From	To	Message

					]
					[Reservation-Priority = DEFAULT (0)]
					[Globally-Unique-Address =
					    [Framed-IP-Address = 192.168.0.2]
					    [Address-Realm = "example.com"]
					]
					[Authorization-Lifetime = 450]

4	H.248	Ia	SPDF A	C-BGF A	Add terminations

```
MEGACO/3 [spdf-a.example.com]:55555
Transaction = 1 {
    Context = ${
        Add = ip/1/$/$ { /* NOTE 1 */
            Media {
                Stream = 1 {
                    LocalControl {
                        ipdc/realm = "A",
                        gm/rsb = ON
                    }
                    Local {
                        v=0
                        m=- $ tcp 0
                        c=IN IP4 $
                        b=AS:20
                    },
                    Remote {
                        v=0
                        o=- 0 0 IN IP4 0.0.0.0
                        s=-
                        t=0 0
                        m=- 0 tcp 0
                        c=IN IP4 0.0.0.0
                        b=AS:20
                    }
                } /* Stream */
            } /* Media */
        } /* Add */
        Add = ip/1/$/$ {
            Media {
                Stream = 1 {
                    LocalControl {
                        ipdc/realm = "Core",
                        gm/rsb = ON
                    }
                    Local {
                        v=0
                        m=- $ tcp 0
                        c=IN IP4 $
                        b=AS:20
                    }
                } /* Stream */
            } /* Media */
        } /* Add */
    } /* Context */
} /* Transaction */
```

NOTE:	The wildcard CHOOSE must be used for the interface part of the termination id. With the exception of the interface field, only the "Id" part may be wildcarded (see table 4 in [7]).				
5	H.248	Ia	C-BGF A	SPDF A	Reply (Add)

```
MEGACO/3 [abgf-a.example.com]:55555
Reply = 1 {
    Context = 1 {
        Add = ip/1/if1/1 {
            Media {
                Stream = 1 {
                    LocalControl {
                        ipdc/realm = "A",
                        gm/rsb = ON
                    }
                    Local {
                        v=0
                        o=- 0 0 IN IP4 192.168.0.1
                        s=-
                        t=0 0
```

Step	Protocol	Interface	From	To	Message

```
                          m=- 34444 tcp 0
                          c=IN IP4 192.168.0.1
                          b=AS:20
                      },
                      Remote {
                          v=0
                          o=- 0 0 IN IP4 0.0.0.0
                          s=-
                          t=0 0
                          m=- 0 tcp 0
                          c=IN IP4 0.0.0.0
                          b=AS:20
                      }
                  } /* Stream */
              } /* Media */
          } /* Add */
          Add = ip/1/if2/1 {
              Media {
                  Stream = 1 {
                      LocalControl {
                          ipdc/realm = "Core",
                          gm/rsb = ON
                      }
                      Local {
                          v=0
                          o=- 0 0 IN IP4 10.0.0.1
                          s=-
                          t=0 0
                          m=- 32222 tcp 0
                          c=IN IP4 10.0.0.1
                          b=AS:20
                      }
                  } /* Stream */
              } /* Media */
          } /* Add */
      } /* Context */
  } /* Reply */
```

Step	Protocol	Interface	From	To	Message
6	DIAMETER	Rq	SPDF A	A-RACF A	AAR

```
  <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                  < Session-Id = "spdf-a.example.com;429C3;412" >
                  { Auth-Application-Id = 16777222 (Gq) }
                  { Origin-Host = "spdf-a.example.com" }
                  { Origin-Realm = "example.com" }
                  { Destination-Realm = "example.com" }
                  [ Destination-Host = "aracf-a.example.com" ]
                  [ Media-Component-Description =
                          { Media-Component-Number = 1 }
                          [ Media-Sub-Component =
                              { Flow-Number = 1 }
                              [ Flow-Description = "permit out 6 from 192.168.0.1 34444
                                                        to 192.168.0.2 9" ]
                              [ Flow-Description = "permit in 6 from any to any" ]
                              [ Flow-Usage = NO_INFORMATION(0) ]
                              [ Max-Requested-Bandwidth-DL = 20000 ]
                              [ Max-Requested-Bandwidth-UL = 20000 ]
                          ]
                          [ AF-Application-Identifier = "RQ_SAMPLE_APP"]
                          [ Media-Type = APPLICATION (3) ]

                          [ Flow-Status = DISABLED ]
                          [ Reservation-Priority = DEFAULT (0) ]
                  ]
                  [ Reservation-Priority = DEFAULT (0) ]
                  [ Globally-Unique-Address =
                          [ Framed-IP-Address = 192.168.0.2 ]
                          [ Address-Realm = "example.com" ]
                  ]
                  [ Authorization-Lifetime = 450 ]
```

Step	Protocol	Interface	From	To	Message
7	DIAMETER	Rq	A-RACF A	SPDF A	AAA

```
<AA-Answer> ::= < Diameter Header: 265, PXY >
            < Session-Id = "spdf-a.example.com;429C3;412" >
            { Auth-Application-Id = 16777222 (Gq) }
            { Origin-Host = "aracf-a.example.com" }
            { Origin-Realm = "example.com" }
            [ Result-Code = DIAMETER_SUCCESS (2001) ]
            [ Authorization-Lifetime = 450 ]
            [ Auth-Grace-Period = 10 ]
```

Step	Protocol	Interface	From	To	Message
8	DIAMETER	Gq'	SPDF A	P-CSCF A	AAA

```
<AA-Answer> ::= < Diameter Header: 265, PXY >
            < Session-Id = "p-cscf-a.example.com;13815C;391" >
            { Auth-Application-Id = 16777222 (Gq) }
            { Origin-Host = "spdf-a.example.com" }
            { Origin-Realm = "example.com" }
            [ Result-Code = DIAMETER_SUCCESS (2001) ]
            [ Binding-Information =
                { Binding-Input-List =
                    [ V4-Transport-Address =
                        { Framed-IP-Address = 192.168.0.2 }
                        { Port-Number = 9 }
                    ]
                    [ V4-Transport-Address =
                        { Framed-IP-Address = 0.0.0.0 }
                        { Port-Number = 0 }
                    ]
                [ Binding-Output-List =
                    [ V4-Transport-Address =
                        { Framed-IP-Address = 10.0.0.1 }
                        { Port-Number = 32222 }
                    ]
                    [ V4-Transport-Address =
                        { Framed-IP-Address = 0.0.0.0 }
                        { Port-Number = 0 }
                    ]
                ]
            ]
            ]
            [ Authorization-Lifetime = 450 ]
            [ Auth-Grace-Period = 10 ]
```

Step	Protocol	Interface	From	To	Message
9	SIP		P-CSCF A	S-CSCF	INVITE B

```
INVITE sip:mf_b@example.com SIP/2.0
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 69
Record-Route: <sip:p-cscf-a.example.com;lr>
From: User A <sip:user_a@example.com>;tag=372183
To: MF <sip:mf_b@example.com>
Call-ID: 398174293@ue-a.example.com
CSeq: 1 INVITE
Contact: <sip:user_a@ue-a.example.com>
Content-Type: application/sdp
Content-Length: 129

v=0
o=user_a 2890844526 2890842807 IN IP4 ue-a.example.com
s=-
c=IN IP4 10.0.0.1
t=0 0
m=application 32222 tcp iptv_rtsp
a=sendrecv
a=setup:active
a=connection:new
```

Step	Protocol	Interface	From	To	Message
10	SIP		S-CSCF	P-CSCF A	100 Trying

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
From: User A <sip:user_a@example.com>;tag=372183
To: MF <sip:mf_b@example.com>
Call-ID: 398174293@ue-a.example.com
CSeq: 1 INVITE
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
11	SIP		S-CSCF	P-CSCF B	INVITE B

```
INVITE sip:mf_b@example.com SIP/2.0
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 68
Record-Route: <sip:s-cscf.example.com;lr>,<sip:p-cscf-a.example.com;lr>
From: User A <sip:user_a@example.com>;tag=372183
To: MF <sip:mf_b@example.com>
Call-ID: 398174293@ue-a.example.com
CSeq: 1 INVITE
Contact: <sip:user_a@ue-a.example.com>
Content-Type: application/sdp
Content-Length: 125

v=0
o=user_a 2890844526 2890842807 IN IP4 ue-a.example.com
s=-
c=IN IP4 10.0.0.1
t=0 0
m=application 32222 tcp iptv_rtsp
a=sendrecv
a=setup:active
a=connection:new
```

Step	Protocol	Interface	From	To	Message
12	SIP		S-CSCF	P-CSCF B	100 Trying

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
From: User A <sip:user_a@example.com>;tag=372183
To: MF <sip:mf_b@example.com>
Call-ID: 398174293@ue-a.example.com
CSeq: 1 INVITE
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
13	DIAMETER	Gq'	P-CSCF B	SPDF B	AAR

```
<AA-Request> ::=< Diameter Header: 265, REQ, PXY >
              < Session-Id = "p-cscf-b.example.com;481C43;583" >
              { Auth-Application-Id = 16777222 (Gq) }
              { Origin-Host = "p-cscf-b.example.com" }
              { Origin-Realm = "example.com" }
              { Destination-Realm = "example.com" }
              [ Destination-Host = "spdf-b.example.com" ]
              [ Media-Component-Description =
                     { Media-Component-Number = 1 }
                     [ Media-Sub-Component =
                        { Flow-Number = 1 }
                        [ Flow-Description = "permit in 6 from any to any" ]
                        [ Flow-Description = "permit out 6 from any to any" ]
                        [ Flow-Usage = NO_INFORMATION(0) ]
                        [ Max-Requested-Bandwidth-UL = 20000 ]
                        [ Max-Requested-Bandwidth-DL = 20000 ]
                     ]
                     [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                     [ Media-Type = APPLICATION (3) ]
                     [ Flow-Status = DISABLED ]
                     [ Reservation-Priority = DEFAULT (0) ]
                     [ Codec-Data = "downlink
                        offer
                        m=application 32222 tcp iptv_rtsp"
                     ]
```

Step	Protocol	Interface	From	To	Message
					] [Binding-Information = { Binding-Input-List = [V4-Transport-Address = { Framed-IP-Address = 0.0.0.0 } { Port-Number = 0 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.1 } { Port-Number = 32222 }] }] [Reservation-Priority = DEFAULT (0)] [Globally-Unique-Address = [Framed-IP-Address = 192.168.1.2] [Address-Realm = "example.com"]] [Authorization-Lifetime = 450]
14	H.248	Ia	SPDF B	C-BGF B	Add terminations

```
MEGACO/3 [spdf-b.example.com]:43924
Transaction = 1 {
    Context = $ {
        Add = ip/1/$/$ {
            Media {
                Stream = 1 {
                    LocalControl {
                        ipdc/realm = "B",
                        gm/rsb = ON
                    }
                    Local {
                        v=0
                        m=- $ tcp 0
                        c=IN IP4 $
                        b=AS:20
                    }
                } /* Stream */
            } /* Media */
        } /* Add */
        Add = ip/1/$/$ {
            Media {
                Stream = 1 {
                    LocalControl {
                        ipdc/realm = "Core",
                        gm/rsb = ON
                    }
                    Local {
                        v=0
                        m=- $ tcp 0
                        c=IN IP4 $
                        b=AS:20
                    },
                    Remote {
                        v=0
                        o=- 0 0 IN IP4 10.0.0.1
                        s=-
                        t=0 0
                        m=- 32222 tcp 0
                        c=IN IP4 10.0.0.1
                        b=AS:20
                    }
                } /* Stream */
            } /* Media */
        } /* Add */
    } /* Context */
} /* Transaction */
```

Step	Protocol	Interface	From	To	Message
15	H.248	Ia	C-BGF B	SPDF B	Reply (Add)

```
    MEGACO/3 [abgf-b.example.com]:43924
    Reply = 1 {
        Context = 1 {
            Add = ip/1/if1/1{
                Media {
                    Stream = 1 {
                        LocalControl {
                            ipdc/realm = "B",
                            gm/rsb = ON
                        }
                        Local {
                            v=0
                            o=- 0 0 IN IP4 192.168.1.1
                            s=-
                            t=0 0
                            m=- 33332 tcp 0
                            c=IN IP4 192.168.1.1
                            b=AS:20
                        }
                    } /* Stream */
                } /* Media */
            } /* Add */
            Add = ip/1/if2/1{
                Media {
                    Stream = 1 {
                        LocalControl {
                            ipdc/realm = "Core",
                            gm/rsb = ON
                        }
                        Local {
                            v=0
                            o=- 0 0 IN IP4 10.0.0.2
                            s=-
                            t=0 0
                            m=- 31110 tcp 0
                            c=IN IP4 10.0.0.2
                            b=AS:20
                        },
                        Remote {
                            v=0
                            o=- 0 0 IN IP4 10.0.0.1
                            s=-
                            t=0 0
                            m=- 32222 tcp 0
                            c=IN IP4 10.0.0.1
                            b=AS:20
                        }
                    } /* Stream */
                } /* Media */
            } /* Add */
        } /* Context */
    } /* Reply */
```

| 16 | DIAMETER | Rq | SPDF B | A-RACF B | AAR |

```
    <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                    < Session-Id = "spdf-b.example.com;41295;512" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "spdf-b.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    [ Destination-Host = "aracf-b.example.com" ]
                    [ Media-Component-Description =
                            { Media-Component-Number = 1 }
                            [ Media-Sub-Component =
                                { Flow-Number = 1 }
                                [ Flow-Description = "permit in 6 from any to 192.168.1.1 33332" ]
                                [ Flow-Description = "permit out 6 from any to any" ]
                                [ Flow-Usage = NO_INFORMATION(0) ]
                                [ Max-Requested-Bandwidth-UL = 20000 ]
                                [ Max-Requested-Bandwidth-DL = 20000 ]
                            ]
                            [ AF-Application-Identifier = "RQ_SAMPLE_APP"]
                            [ Media-Type = APPLICATION (3) ]
                            [ Flow-Status = DISABLED ]
```

Step	Protocol	Interface	From	To	Message
					[Reservation-Priority = DEFAULT (0)]

```
                ]
                [ Reservation-Priority = DEFAULT (0) ]
                [ Globally-Unique-Address =
                        [ Framed-IP-Address = 192.168.1.2 ]
                        [ Address-Realm = "example.com" ]
                ]
                [ Authorization-Lifetime = 450 ]
```

Step	Protocol	Interface	From	To	Message
17	DIAMETER	Rq	A-RACF B	SPDF B	AAA

```
    <AA-Answer> ::= < Diameter Header: 265, PXY >
                < Session-Id = "spdf-b.example.com;41295;512" >
                { Auth-Application-Id = 16777222 (Gq) }
                { Origin-Host = "aracf-b.example.com" }
                { Origin-Realm = "example.com" }
                [ Result-Code = DIAMETER_SUCCESS (2001) ]
                [ Authorization-Lifetime = 450 ]
                [ Auth-Grace-Period = 10 ]
```

Step	Protocol	Interface	From	To	Message
18	DIAMETER	Gq'	SPDF B	P-CSCF B	AAA

```
    <AA-Answer> ::= < Diameter Header: 265, PXY >
                < Session-Id = "p-cscf-b.example.com;481C43;583" >
                { Auth-Application-Id = 16777222 (Gq) }
                { Origin-Host = "spdf-b.example.com" }
                { Origin-Realm = "example.com" }
                [ Result-Code = DIAMETER_SUCCESS (2001) ]
                [ Binding-Information =
                    { Binding-Input-List =
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 0.0.0.0 }
                            { Port-Number = 0 }
                        ]
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 10.0.0.1 }
                            { Port-Number = 32222 }
                        ]
                    }
                    [ Binding-Output-List =
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 0.0.0.0 }
                            { Port-Number = 0 }
                        ]
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 192.168.1.1 }
                            { Port-Number = 33332 }
                        ]
                    ]
                [ Authorization-Lifetime = 450 ]
                [ Auth-Grace-Period = 10 ]
```

Step	Protocol	Interface	From	To	Message
19	SIP		P-CSCF B	MF	INVITE B

```
    INVITE sip:mf_b@example.com SIP/2.0
    Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
    Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
    Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
    Max-Forwards: 67
    Record-Route: <sip:p-cscf-b.example.com;lr>,<sip:s-cscf.example.com;lr>,<sip:p-cscf-
a.example.com;lr>
    From: User A <sip:user_a@example.com>;tag=372183
    To: MF <sip:mf_b@example.com>
    Call-ID: 398174293@ue-a.example.com
    CSeq: 1 INVITE
    Contact: <sip:user_a@ue-a.example.com>
    Content-Type: application/sdp
    Content-Length: 128

    v=0
    o=user_a 2890844526 2890842807 IN IP4 ue-a.example.com
    s=-
    c=IN IP4 192.168.1.1
    t=0 0
    m=application 33332 tcp iptv_rtsp
```

Step	Protocol	Interface	From	To	Message
	a=sendrecv a=setup:active a=connection:new				
20	SIP		MF	P-CSCF B	200 OK (SDP)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 70
From: User A <sip:user_a@example.com>;tag=372183
To: MF <sip:mf_b@example.com>
Call-ID: 398174293@ue-a.example.com
CSeq: 1 INVITE
Contact: <sip:mf_b@mf-b.example.com>
Content-Type: application/sdp
Content-Length: 119

v=0
o=mf_b 29381748101 2948193018 IN IP4 mf-b.example.com
s=-
c=IN IP4 192.168.1.2
t=0 0
m=application 39792 tcp iptv_rtsp
a=setup:passive
a=connection:new
```

| 21 | DIAMETER | Gq' | P-CSCF B | SPDF B | AAR (Modify) |

```
<AA-Request> ::=< Diameter Header: 265, REQ, PXY >
            < Session-Id = "p-cscf-b.example.com;481C43;583" >
            { Auth-Application-Id = 16777222 (Gq) }
            { Origin-Host = "p-cscf-b.example.com" }
            { Origin-Realm = "example.com" }
            { Destination-Realm = "example.com" }
            [ Destination-Host = "spdf-b.example.com" ]
            [ Media-Component-Description =
                    { Media-Component-Number = 1 }
                    [ Media-Sub-Component =
                        { Flow-Number = 1 }
                        [ Flow-Description = "permit out 6 from any to 192.168.1.2 39792" ]
                        [ Flow-Description = "permit in 6 from any to 192.168.1.1 33332" ]
                        [ Flow-Usage = NO_INFORMATION(0) ]
                        [ Max-Requested-Bandwidth-DL = 20000 ]
                        [ Max-Requested-Bandwidth-UL = 20000 ]
                    ]
                    [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                    [ Media-Type = APPLICATION (3) ]
                    [ Flow-Status = ENABLED ]
                    [ Reservation-Priority = DEFAULT (0) ]
                    [ Codec-Data = "uplink
                        answer
                        m=application 39792 tcp iptv_rtsp"
                    ]
                    [ Codec-Data = "downlink
                        offer
                        m=application 3333 tcp iptv_rtsp"
                    ]
            ]
            [ Binding-Information =
                    { Binding-Input-List =
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 192.168.1.2 }
                            { Port-Number = 39792 }
                        ]
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 10.0.0.1 }
                            { Port-Number = 32222 }
                        ]
                    }
            ]
            [ Reservation-Priority = DEFAULT (0) ]
            [ Globally-Unique-Address =
                    [ Framed-IP-Address = 192.168.1.2 ]
```

Step	Protocol	Interface	From	To	Message
					[Address-Realm = "example.com"]
					]
					[Authorization-Lifetime = 450]
22	H.248	Ia	SPDF B	C-BGF B	Modify terminations

```
   MEGACO/3 [spdf-b.example.com]:43924
   Transaction = 2 {
        Context = 1 {
          Modify = ip/1/if1/1 {
            Media {
               Stream = 1 {
                 LocalControl {
                    ipdc/realm = "B",
                    gm/rsb = ON,
                    mode = SendReceive
                 },
                 Local {
                    v=0
                    o=- 0 0 IN IP4 192.168.1.1
                    s=-
                    t=0 0
                    m=- 33332 tcp 0
                    c=IN IP4 192.168.1.1
                    b=AS:20
                 }
                 Remote {
                    v=0
                    o=- 0 0 IN IP4 192.168.1.2
                    s=-
                    t=0 0
                    m=- 39792 tcp 0
                    c=IN IP4 192.168.1.2
                    b=AS:20
                 }
               } /* Stream */
            } /* Media */
          } /* Modify */
          Modify = ip/1/if2/1 {
            Media {
               Stream = 1 {
                 LocalControl {
                    ipdc/realm = "Core",
                    gm/rsb = ON,
                    mode = SendReceive
                 },
                 Local {
                    v=0
                    o=- 0 0 IN IP4 10.0.0.2
                    s=-
                    t=0 0
                    m=- 31110 tcp 0
                    c=IN IP4 10.0.0.2
                    b=AS:20
                 },
                 Remote {
                    v=0
                    o=- 0 0 IN IP4 10.0.0.1
                    s=-
                    t=0 0
                    m=- 32222 tcp 0
                    c=IN IP4 10.0.0.1
                    b=AS:20
                 }
               } /* Stream */
            } /* Media */
          } /* Modify */
        } /* Context */
   } /* Transaction */
```

| 23 | H.248 | Ia | C-BGF B | SPDF B | Reply (Modify) |

```
   MEGACO/3 [abgf-b.example.com]: 43924
   Reply = 2 {
        Context = 1 {
          Modify = ip/1/if1/1 {
```

Step	Protocol	Interface	From	To	Message
| | | | | | ```
Media {
    Stream = 1 {
        LocalControl {
            ipdc/realm = "B",
            gm/rsb = ON,
            mode = SendReceive
        },
        Local {
            v=0
            o=- 0 0 IN IP4 192.168.1.1
            s=-
            t=0 0
            m=- 33332 tcp 0
            c=IN IP4 192.168.1.1
            b=AS:20
        },
        Remote {
            v=0
            o=- 0 0 IN IP4 192.168.1.2
            s=-
            t=0 0
            m=- 39792 tcp 0
            c=IN IP4 192.168.1.2
            b=AS:20
        }
    } /* Stream */
} /* Media */
} /* Modify */
Modify = ip/1/if2/1 {
    Media {
        Stream = 1 {
            LocalControl {
                ipdc/realm = "Core",
                gm/rsb = ON,
                mode = SendReceive
            },
            Local {
                v=0
                o=- 0 0 IN IP4 10.0.0.2
                s=-
                t=0 0
                m=- 31110 tcp 0
                c=IN IP4 10.0.0.2
                b=AS:20
            },
            Remote {
                v=0
                o=- 0 0 IN IP4 10.0.0.1
                s=-
                t=0 0
                m=- 32222 tcp 0
                c=IN IP4 10.0.0.1
                b=AS:20
            }
        } /* Stream */
    } /* Media */
} /* Modify */
} /* Context */
} /* Reply */
``` |

Step	Protocol	Interface	From	To	Message
24	DIAMETER	Rq	SPDF B	A-RACF B	AAR (Modify)

```
    <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                    < Session-Id = "spdf-b.example.com;41295;512" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "spdf-b.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    [ Destination-Host = "aracf-b.example.com" ]
                    [ Media-Component-Description =
                            { Media-Component-Number = 1 }
                            [ Media-Sub-Component =
                                { Flow-Number = 1 }
                                [ Flow-Description = "permit out 6 from 192.168.1.1 33332
                                                            to 192.168.1.2 39792" ]
                                [ Flow-Description = "permit in 6 from 192.168.1.2 39792
                                                            to 192.168.1.1 33332" ]
                                [ Flow-Usage = NO_INFORMATION(0) ]
                                [ Max-Requested-Bandwidth-UL = 20000 ]
                                [ Max-Requested-Bandwidth-DL = 20000 ]
                            ]
                            [ AF-Application-Identifier = "RQ_SAMPLE_APP"]
                            [ Media-Type = APPLICATION (3) ]
                            [ Flow-Status = ENABLED }
                            [ Reservation-Priority = DEFAULT (0) ]
                    ]
                    [ Reservation-Priority = DEFAULT (0) ]
                    [ Globally-Unique-Address =
                            [ Framed-IP-Address = 192.168.1.2 ]
                            [ Address-Realm = "example.com" ]
                    ]
                    [ Authorization-Lifetime = 450 ]
```

Step	Protocol	Interface	From	To	Message
25	DIAMETER	Re	A-RACF B	RCEF B	PIR

```
    < PI-Request > ::=  < Diameter Header: 315, REQ, PXY >
                    < Session-Id = "aracf-b.example.com;66389;469" >
                    { Auth-Application-Id = 16777253 (Re) }
                    { Origin-Host = "aracf-b.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    { Destination-Host = "rcef-b.example.com" }
                    { PI-Request-Type = INITIAL_REQUEST }
                    { PI-Request-Number = 0 }
                    [ Auth-Session-State = NO_STATE_MAINTAINED (1) ]
                    [ Policy-Rule-Install =
                        [ Policy-Rule-Definition =
                            { Policy-Rule-Name = "policy-rule-example-B-UL" }
                            [ Service-Identifier = 1 ]
                            [ Rating-Group = 1 ]
                            [ Framed-IP-Address = 192.168.1.2 ]
                            [ Address-Realm = "example.com" ]
                            [ Flow-Description = "permit in 6 from 192.168.1.2 39792
                                                        to 192.168.1.1 33332" ]
                            [ Flow-Status = ENABLED-UPLINK (0) ]
                            [ QoS-Information =
                                [ Max-Requested-Bandwidth-UL = 20000 ]
                                [ ToS-Traffic-Class = 1031110 ]
                            ]
                            [ Precedence = 1]
                            [ Flows =
                                { Media-Component-Number = 1 }
                                [ Flow-Number = 1 ]
                                [ Flow-Number = 2 ]
                            ]
                        ]
                    ]
                    [ Policy-Rule-Install =
                        [ Policy-Rule-Definition =
                            { Policy-Rule-Name = "policy-rule-example-B-DL" }
                            [ Service-Identifier = 1 ]
                            [ Rating-Group = 1 ]
                            [ Framed-IP-Address = 192.168.1.2 ]
                            [ Address-Realm = "example.com" ]
                            [ Flow-Description = "permit out 6 from 192.168.1.1 33332
                                                        to 192.168.1.2 39792" ]
                            [ Flow-Status = ENABLED-DOWNLINK (1) ]
```

Step	Protocol	Interface	From	To	Message
					[QoS-Information =
					[Max-Requested-Bandwidth-DL = 20000]
					[ToS-Traffic-Class = 1031110]
					]
					[Precedence = 1]
					[Flows =
					{ Media-Component-Number = 1 }
					[Flow-Number = 1]
					[Flow-Number = 2]
					]
					]
					]
26	DIAMETER	Re	RCEF B	A-RACF B	PIA

```
<PI-Answer> ::= < Diameter Header: 315, PXY >
            < Session-Id = "aracf-b.example.com;66389;469" >
            { Origin-Host = "rcef-b.example.com" }
            { Origin-Realm = "example.com" }
            { PI-Request-Type = INITIAL_REQUEST }
            { PI-Request-Number = 0 }
            [ Result-Code DIAMETER_SUCCESS (2001) ]
```

| 27 | DIAMETER | Rq | A-RACF B | SPDF B | AAA (Modify) |

```
<AA-Answer> ::= < Diameter Header: 265, PXY >
            < Session-Id = "spdf-b.example.com;41295;512" >
            { Auth-Application-Id = 16777222 (Gq) }
            { Origin-Host = "aracf-b.example.com" }
            { Origin-Realm = "example.com" }
            [ Result-Code = DIAMETER_SUCCESS (2001) ]
            [ Authorization-Lifetime = 450 ]
            [ Auth-Grace-Period = 10 ]
```

| 28 | DIAMETER | Gq' | SPDF B | P-CSCF B | AAA (Modify) |

```
<AA-Answer> ::= < Diameter Header: 265, PXY >
            < Session-Id = "p-cscf-b.example.com;481C43;583" >
            { Auth-Application-Id = 16777222 (Gq) }
            { Origin-Host = "spdf-b.example.com" }
            { Origin-Realm = "example.com" }
            [ Result-Code = DIAMETER_SUCCESS (2001) ]
            [ Binding-Information =
                { Binding-Input-List =
                    [ V4-Transport-Address =
                        { Framed-IP-Address = 192.168.1.2 }
                        { Port-Number = 39792 }
                    ]
                    [ V4-Transport-Address =
                        { Framed-IP-Address = 10.0.0.1 }
                        { Port-Number = 32222 }
                    ]
                }
                [ Binding-Output-List =
                    [ V4-Transport-Address =
                        { Framed-IP-Address = 10.0.0.2 }
                        { Port-Number = 31110 }
                    ]
                    [ V4-Transport-Address =
                        { Framed-IP-Address = 192.168.1.1 }
                        { Port-Number = 33332 }
                    ]
                ]
            ]
            [ Authorization-Lifetime = 450 ]
            [ Auth-Grace-Period = 10 ]
```

Step	Protocol	Interface	From	To	Message
29	SIP		P-CSCF B	S-CSCF	200 OK (SDP)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 69
From: User A <sip:user_a@example.com>;tag=372183
To: MF <sip:mf_b@example.com>
Call-ID: 398174293@ue-a.example.com
CSeq: 1 INVITE
Contact: <sip:mf_b@mf-b.example.com>
Content-Type: application/sdp
Content-Length: 126

v=0
o=mf_b 29381748101 2948193018 IN IP4 mf-b.example.com
s=-
c=IN IP4 10.0.0.2
t=0 0
m=application 31110 tcp iptv_rtsp
a=sendrecv
a=setup:passive
a=connection:new
```

Step	Protocol	Interface	From	To	Message
30	SIP		S-CSCF	P-CSCF A	200 OK (SDP)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 68
From: User A <sip:user_a@example.com>;tag=372183
To: MF <sip:mf_b@example.com>
Call-ID: 398174293@ue-a.example.com
CSeq: 1 INVITE
Contact: <sip:mf_b@mf-b.example.com>
Content-Type: application/sdp
Content-Length: 126

v=0
o=mf_b 29381748101 2948193018 IN IP4 mf-b.example.com
s=-
c=IN IP4 10.0.0.2
t=0 0
m=application 31110 tcp iptv_rtsp
a=sendrecv
a=setup:passive
a=connection:new
```

Step	Protocol	Interface	From	To	Message
31	DIAMETER	Gq'	P-CSCF A	SPDF A	AAR (Modify)

```
<AA-Request> ::=< Diameter Header: 265, REQ, PXY >
            < Session-Id = "p-cscf-a.example.com;13815C;391" >
            { Auth-Application-Id = 16777222 (Gq) }
            { Origin-Host = "p-cscf-a.example.com" }
            { Origin-Realm = "example.com" }
            { Destination-Realm = "example.com" }
            [ Destination-Host = "spdf-a.example.com" ]
            [ Media-Component-Description =
                  { Media-Component-Number = 1 }
                  [ Media-Sub-Component =
                      { Flow-Number = 1 }
                      [ Flow-Description = "permit in 6 from any to any" ]
                      [ Flow-Description = "permit out 6 from any to 192.168.0.2 9" ]
                      [ Flow-Usage = NO_INFORMATION(0) ]
                      [ Max-Requested-Bandwidth-UL = 20000 ]
                      [ Max-Requested-Bandwidth-DL = 20000 ]
                  ]
                  [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                  [ Media-Type = APPLICATION (3) ]
                  [ Flow-Status = ENABLED ]
                  [ Reservation-Priority = DEFAULT (0) ]
                  [ Codec-Data = "uplink
                      offer
                      m=application 9 tcp iptv_rtsp"
                  ]
```

Step	Protocol	Interface	From	To	Message
					]
					[Binding-Information =
					{ Binding-Input-List =
					[V4-Transport-Address =
					{ Framed-IP-Address = 192.168.0.2 }
					{ Port-Number = 9 }
					]
					[V4-Transport-Address =
					{ Framed-IP-Address = 10.0.0.2 }
					{ Port-Number = 31110 }
					]
					}
					]
					[Reservation-Priority = DEFAULT (0)]
					[Globally-Unique-Address =
					[Framed-IP-Address = 192.168.0.2]
					[Address-Realm = "example.com"]
					]
					[Authorization-Lifetime = 450]
32	H.248	Ia	SPDF A	C-BGF A	Modify Terminations A (A to B)

```
MEGACO/3 [spdf-a.example.com]:55555
Transaction = 2 {
     Context = 1 {
        Modify = ip/1/if1/1 {
           Media {
              Stream = 1 {
                 LocalControl {
                    ipdc/realm = "A",
                    gm/rsb = ON,
                    mode = SendReceive
                 },
                 Local {
                    v=0
                    o=- 0 0 IN IP4 192.168.0.1
                    s=-
                    t=0 0
                    m=- 34444 tcp 0
                    c=IN IP4 192.168.0.1
                    b=AS:20
                 },
                 Remote {
                    v=0
                    o=- 0 0 IN IP4 192.168.0.2
                    s=-
                    t=0 0
                    m=- 9 tcp 0
                    c=IN IP4 192.168.0.2
                    b=AS:20
                 }
              } /* Stream */
           } /* Media */
        } /* Modify */
        Modify = ip/1/if2/1 {
           Media {
              Stream = 1 {
                 LocalControl {
                    ipdc/realm = "Core",
                    gm/rsb = ON,
                    mode = SendReceive
                 },
                 Local {
                    v=0
                    o=- 0 0 IN IP4 10.0.0.1
                    s=-
                    t=0 0
                    m=- 32222 tcp iptv_rtsp
                    c=IN IP4 10.0.0.1
                    b=AS:20
                 },
                 Remote {
                    v=0
                    o=- 0 0 IN IP4 10.0.0.2
                    s=-
                    t=0 0
```

Step	Protocol	Interface	From	To	Message

					`m=- 31110 tcp iptv_rtsp`
					`c=IN IP4 10.0.0.2`
					`b=AS:20`
					`                    }`
					`                } /* Stream */`
					`            } /* Media */`
					`        } /* Modify */`
					`    } /* Context */`
					`} /* Transaction */`

33	H.248	Ia	C-BGF A	SPDF A	Reply (Modify)

```
    MEGACO/3 [abgf-a.example.com]:55555
    Reply = 2 {
        Context = 1 {
            Modify = ip/1/if1/1 {
                Media {
                    Stream = 1 {
                        LocalControl {
                            ipdc/realm = "A",
                            gm/rsb = ON,
                            mode = SendReceive
                        },
                        Local {
                            v=0
                            o=- 0 0 IN IP4 192.168.0.1
                            s=-
                            t=0 0
                            m=- 34444 tcp 0
                            c=IN IP4 192.168.0.1
                            b=AS:20
                        },
                        Remote {
                            v=0
                            o=- 0 0 IN IP4 0.0.0.0
                            s=-
                            t=0 0
                            m=- $ tcp 0
                            c=IN IP4 0.0.0.0
                            b=AS:20
                        }
                    } /* Stream */
                } /* Media */
            } /* Modify */
            Modify = ip/1/if2/1 {
                Media {
                    Stream = 1 {
                        LocalControl {
                            ipdc/realm = "Core",
                            gm/rsb = ON,
                            mode = SendReceive
                        },
                        Local {
                            v=0
                            o=- 0 0 IN IP4 10.0.0.1
                            s=-
                            t=0 0
                            m=- 32222 tcp 0
                            c=IN IP4 10.0.0.1
                            b=AS:20
                        },
                        Remote {
                            v=0
                            o=- 0 0 IN IP4 10.0.0.2
                            s=-
                            t=0 0
                            m=- 31110 tcp 0
                            c=IN IP4 10.0.0.2
                            b=AS:20
                        }
                    } /* Stream */
                } /* Media */
            } /* Modify */
        } /* Context */
    } /* Reply */
```

Step	Protocol	Interface	From	To	Message
34	DIAMETER	Rq	SPDF A	A-RACF A	AAR (Modify)

```
    <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                    < Session-Id = "spdf-a.example.com;429C3;412" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "spdf-a.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    [ Destination-Host = "aracf-a.example.com" ]
                    [ Media-Component-Description =
                            { Media-Component-Number = 1 }
                            [ Media-Sub-Component =
                                { Flow-Number = 1 }
                                [ Flow-Description = "permit out 6 from 192.168.0.1 34444
                                                        to 192.168.0.2 9" ]
                                [ Flow-Description = "permit in 6 from 192.168.0.2 9
                                                        to 192.168.0.1 34444" ]
                                [ Flow-Usage = NO_INFORMATION(0) ]
                                [ Max-Requested-Bandwidth-UL = 20000 ]
                                [ Max-Requested-Bandwidth-DL = 20000 ]
                            ]
                            [ AF-Application-Identifier = "RQ_SAMPLE_APP"]
                            [ Media-Type = APPLICATION (3) ]
                            [ Flow-Status = ENABLED ]
                            [ Reservation-Priority = DEFAULT (0) ]
                    ]
                    [ Reservation-Priority = DEFAULT (0) ]
                    [ Globally-Unique-Address =
                            [ Framed-IP-Address = 192.168.0.2 ]
                            [ Address-Realm = "example.com" ]
                    ]
                    [ Authorization-Lifetime = 450 ]
```

Step	Protocol	Interface	From	To	Message
35	DIAMETER	Re	A-RACF A	RCEF A	PIR

```
    < PI-Request > ::=  < Diameter Header: 315, REQ, PXY >
                    < Session-Id = "aracf-a.example.com;32475;112" >
                    { Auth-Application-Id = 16777253 (Re) }
                    { Origin-Host = "aracf-a.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    { Destination-Host = "rcef-a.example.com" }
                    { PI-Request-Type = INITIAL_REQUEST }
                    { PI-Request-Number = 0 }
                    [ Auth-Session-State = NO_STATE_MAINTAINED (1) ]
                    [ Policy-Rule-Install =
                        [ Policy-Rule-Definition =
                            { Policy-Rule-Name = "policy-rule-example-A-UL" }
                            [ Service-Identifier = 1 ]
                            [ Rating-Group = 1 ]
                            [ Framed-IP-Address = 192.168.0.2 ]
                            [ Address-Realm = "example.com" ]
                            [ Flow-Description = "permit in 6 from 192.168.0.2 9
                                                        to 192.168.0.1 34444" ]
                            [ Flow-Status = ENABLED-UPLINK (0) ]
                            [ QoS-Information =
                                [ Max-Requested-Bandwidth-UL = 20000 ]
                                [ ToS-Traffic-Class = 1031110 ]
                            ]
                            [ Precedence = 1]
                            [ Flows =
                                { Media-Component-Number = 1 }
                                [ Flow-Number = 1 ]
                                [ Flow-Number = 2 ]
                            ]
                        ]
                    ]
                    [ Policy-Rule-Install =
                        [ Policy-Rule-Definition =
                            { Policy-Rule-Name = "policy-rule-example-A-DL" }
                            [ Service-Identifier = 1 ]
                            [ Rating-Group = 1 ]
                            [ Framed-IP-Address = 192.168.0.2 ]
                            [ Address-Realm = "example.com" ]
                            [ Flow-Description = "permit out 6 from 192.168.0.1 34444
                                                        to 192.168.0.2 9" ]
```

Step	Protocol	Interface	From	To	Message
			[Flow-Status = ENABLED-DOWNLINK (1)] [QoS-Information = [Max-Requested-Bandwidth-DL = 20000] [ToS-Traffic-Class = 1031110]] [Precedence = 1] [Flows = { Media-Component-Number = 1 } [Flow-Number = 1] [Flow-Number = 2]]]]			
36	DIAMETER	Re	RCEF A	A-RACF A	PIA

```
<PI-Answer> ::= < Diameter Header: 315, PXY >
                < Session-Id = "aracf-a.example.com;32475;112" >
                { Origin-Host = "rcef-a.example.com" }
                { Origin-Realm = "example.com" }
                { PI-Request-Type = INITIAL_REQUEST }
                { PI-Request-Number = 0 }
                [ Result-Code DIAMETER_SUCCESS (2001) ]
```

Step	Protocol	Interface	From	To	Message
37	DIAMETER	Rq	A-RACF A	SPDF A	AAA (Modify)

```
<AA-Answer> ::= < Diameter Header: 265, PXY >
                < Session-Id = "spdf-a.example.com;429C3;412" >
                { Auth-Application-Id = 16777222 (Gq) }
                { Origin-Host = "aracf-a.example.com" }
                { Origin-Realm = "example.com" }
                [ Result-Code = DIAMETER_SUCCESS (2001) ]
                [ Authorization-Lifetime = 450 ]
                [ Auth-Grace-Period = 10 ]
```

Step	Protocol	Interface	From	To	Message
38	DIAMETER	Gq'	SPDF A	P-CSCF A	AAA (Modify)

```
<AA-Answer> ::= < Diameter Header: 265, PXY >
                < Session-Id = "p-cscf-a.example.com;13815C;391" >
                { Auth-Application-Id = 16777222 (Gq) }
                { Origin-Host = "spdf-a.example.com" }
                { Origin-Realm = "example.com" }
                [ Result-Code = DIAMETER_SUCCESS (2001) ]
                [ Binding-Information =
                    { Binding-Input-List =
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 192.168.0.2 }
                            { Port-Number = 9 }
                        ]
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 10.0.0.2 }
                            { Port-Number = 31110 }
                        ]
                    }
                    [ Binding-Output-List =
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 10.0.0.1 }
                            { Port-Number = 32222 }
                        ]
                        [ V4-Transport-Address =
                            { Framed-IP-Address = 192.168.0.1 }
                            { Port-Number = 34444 }
                        ]
                    ]
                ]
                [ Authorization-Lifetime = 450 ]
                { Auth-Grace-Period = 10 }
```

Step	Protocol	Interface	From	To	Message
39	SIP		P-CSCF A	UE A	200 OK (SDP)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 67
From: User A <sip:user_a@example.com>;tag=372183
To: MF <sip:mf_b@example.com>
Call-ID: 398174293@ue-a.example.com
CSeq: 1 INVITE
Contact: <sip:mf_b@mf-b.example.com>
Content-Type: application/sdp
Content-Length: 129

v=0
o=mf_b 29381748101 2948193018 IN IP4 mf-b.example.com
s=-
c=IN IP4 192.168.0.1
t=0 0
m=application 34444 tcp iptv_rtsp
a=sendrecv
a=setup:passive
a=connection:new
```

Step	Protocol	Interface	From	To	Message
40	SIP		UE A	P-CSCF A	ACK

```
ACK sip:mf_b@example.com SIP/2.0
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 70
Route: <sip:p-cscf-a.example.com;lr>,<sip:s-cscf.example.com;lr>,<sip:p-cscf-b.example.com;lr>
From: User A <sip:user_a@example.com>;tag=348123
To: MF <sip:mf_b@example.com>
Call-ID: 398174293@ue-a.example.com
CSeq: 1 ACK
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
41	SIP		P-CSCF A	S-CSCF	ACK

```
ACK sip:mf_b@example.com SIP/2.0
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 69
Route: <sip:s-cscf.example.com;lr>,<sip:p-cscf-b.example.com;lr>
From: User A <sip:user_a@example.com>;tag=348123
To: MF <sip:mf_b@example.com>
Call-ID: 398174293@ue-a.example.com
CSeq: 1 ACK
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
42	SIP		S-CSCF	P-CSCF B	ACK

```
ACK sip:mf_b@example.com SIP/2.0
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 68
Route: <sip:p-cscf-b.example.com;lr>
From: User A <sip:user_a@example.com>;tag=348123
To: MF <sip:mf_b@example.com>
Call-ID: 398174293@ue-a.example.com
CSeq: 1 ACK
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
43	SIP		P-CSCF B	MF	ACK

```
ACK sip:mf_b@example.com SIP/2.0
Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP ue-a.example.com:5060; branch=z9hG4bK74b03
Max-Forwards: 67
From: User A <sip:user_a@example.com>;tag=348123
To: MF <sip:mf_b@example.com>
Call-ID: 398174293@ue-a.example.com
CSeq: 1 ACK
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
44	RTSP		UE A	MF	DESCRIBE

```
DESCRIBE rtsp://media.example.com RTSP/1.0
Accept: application/sdp
Cseq: 1
```

Step	Protocol	Interface	From	To	Message
45	RTSP		MF	UE A	200 OK

```
RTSP/1.0 200 OK
CSeq: 1
Content-Type: application/sdp
Content-Length: xxx

v=0
o=- 29382748101 2948293018 IN IP4 10.0.0.2
s=-
c=IN IP4 0.0.0.0
t=0 0
a=control:rtsp://media.example.com
m=audio 0 RTP/AVP 0
b=AS:512
a=control:rtsp://media.example.com/audio
a=rtpmap:14 MPA/90000
m=video 0 RTP/AVP 31
b=AS:4096
a=rtpmap:31 H261/90000
a=control:rtsp://media.example.com/video
```

Step	Protocol	Interface	From	To	Message
46	RTSP		UE A	MF	SETUP (audio)

```
SETUP rtsp://media.example.com/audio RTSP/1.0
CSeq: 2
Transport: RTP/AVP/UDP;unicast;client_port=23942-23943
```

Step	Protocol	Interface	From	To	Message
47	RTSP		MF	UE A	200 OK (SETUP (audio))

```
RTSP/1.0 200 OK
CSeq: 2
Transport: RTP/AVP/UDP;unicast;client_port=23942-23943;server_port=39792-39793
Session: 11111111
```

Step	Protocol	Interface	From	To	Message
48	RTSP		UE A	MF	SETUP (video)

```
SETUP rtsp://media.example.com/video RTSP/1.0
CSeq: 3
Transport: RTP/AVP/UDP;unicast;client_port=51372-51373
Session: 11111111
```

Step	Protocol	Interface	From	To	Message
49	RTSP		MF	UE A	200 OK (SETUP (video))

```
RTSP/1.0 200 OK
CSeq: 3
Transport: RTP/AVP/UDP;unicast;client_port=51372-51373;server_port=25552-25553
Session: 11111111
```

Step	Protocol	Interface	From	To	Message
50	SIP		UE A	P-CSCF A	INVITE B

```
    INVITE sip:mf_b@example.com SIP/2.0
    Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
    Max-Forwards: 70
    Route: <sip:p-cscf-a.example.com;lr>
    From: User A <sip:user_a@example.com>;tag=372183
    To: MF <sip:mf_b@example.com>
    Call-ID: 398174293@ue-a.example.com
    CSeq: 2 INVITE
    Contact: <sip:user_a@ue-a.example.com>
    Content-Type: application/sdp
    Content-Length: 129

    v=0
    o=user_a 2890844526 2890842807 IN IP4 ue-a.example.com
    s=-
    c=IN IP4 192.168.0.2
    t=0 0
    m=application 33942 tcp iptv_rtsp
    a=sendrecv
    a=setup:active
    a=connection:existing
    m=audio 23942 RTP/AVP 0
    b=AS:512
    a=recvonly
    m=video 51372 RTP/AVP 31
    b=AS:4096
    a=rtpmap:31 H261/90000
    a=recvonly
```

Step	Protocol	Interface	From	To	Message
51	SIP		P-CSCF A	UE A	100 Trying

```
    SIP/2.0 100 Trying
    Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
    From: User A <sip:user_a@example.com>;tag=372183
    To: MF <sip:mf_b@example.com>
    Call-ID: 398174293@ue-a.example.com
    CSeq: 2 INVITE
    Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
52	DIAMETER	Gq'	P-CSCF A	SPDF A	AAR

```
    <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                  < Session-Id = "p-cscf-a.example.com;13815C;391" >
                  { Auth-Application-Id = 16777222 (Gq) }
                  { Origin-Host = "p-cscf-a.example.com" }
                  { Origin-Realm = "example.com" }
                  { Destination-Realm = "example.com" }
                  [ Destination-Host = "spdf-a.example.com" ]
                  [ Media-Component-Description =
                        { Media-Component-Number = 2 }
                        [ Media-Sub-Component =
                            { Flow-Number = 1 }
                            [ Flow-Description = "permit out 17 from any to 192.168.0.2 23942" ]
                            [ Flow-Usage = NO_INFORMATION(0) ]
                            [ Max-Requested-Bandwidth-DL = 512000 ]
                        ]
                        [ Media-Sub-Component =
                            { Flow-Number = 2 }
                            [ Flow-Description = "permit out 17 from any to 192.168.0.2 23943" ]
                            [ Flow-Usage = RTCP (1) ]
                            [ Max-Requested-Bandwidth-DL = 20000 ]
                        ]
                        [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                        [ Media-Type = AUDIO (0) ]
                        [ Flow-Status = DISABLED ]
                        [ Reservation-Priority = DEFAULT (0) ]
                        [ Codec-Data = "uplink
                            offer
                            m=audio 23942 RTP/AVP 0"
                        ]

                  ]
                  [ Media-Component-Description =
                        { Media-Component-Number = 3 }
```

Step	Protocol	Interface	From	To	Message
					...

```
                                 [ Media-Sub-Component =
                                     { Flow-Number = 1 }
                                     [ Flow-Description = "permit out 17 from any to 192.168.0.2 51372" ]
                                     [ Flow-Usage = NO_INFORMATION(0) ]
                                     [ Max-Requested-Bandwidth-DL = 4096000 ]
                                 ]
                                 [ Media-Sub-Component =
                                     { Flow-Number = 2 }
                                     [ Flow-Description = "permit out 17 from any to 192.168.0.2 51373" ]
                                     [ Flow-Usage = RTCP (1) ]
                                     [ Max-Requested-Bandwidth-DL = 100000 ]
                                 ]
                                 [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                                 [ Media-Type = VIDEO (1) ]
                                 [ Flow-Status = DISABLED ]
                                 [ Reservation-Priority = DEFAULT (0) ]
                                 [ Codec-Data = "uplink
                                     offer
                                     m=video 51372 RTP/AVP 31
                                     a=rtpmap:31 H261/90000
                                     b=AS:4196"
                                 ]
                             ]
                         [ Binding-Information =
                             { Binding-Input-List =
                                 [ V4-Transport-Address =
                                     { Framed-IP-Address = 192.168.0.2 }
                                     { Port-Number = 23942 }
                                 ]
                                 [ V4-Transport-Address =
                                     { Framed-IP-Address = 0.0.0.0 }
                                     { Port-Number = 0 }
                                 ]
                                 [ V4-Transport-Address =
                                     { Framed-IP-Address = 192.168.0.2 }
                                     { Port-Number = 23943 }
                                 ]
                                 [ V4-Transport-Address =
                                     { Framed-IP-Address = 0.0.0.0 }
                                     { Port-Number = 0 }
                                 ]
                                 [ V4-Transport-Address =
                                     { Framed-IP-Address = 192.168.0.2 }
                                     { Port-Number = 51372 }
                                 ]
                                 [ V4-Transport-Address =
                                     { Framed-IP-Address = 0.0.0.0 }
                                     { Port-Number = 0 }
                                 ]
                                 [ V4-Transport-Address =
                                     { Framed-IP-Address = 192.168.0.2 }
                                     { Port-Number = 51373 }
                                 ]
                                 [ V4-Transport-Address =
                                     { Framed-IP-Address = 0.0.0.0 }
                                     { Port-Number = 0 }
                                 ]
                             }
                         ]
                         [ Reservation-Priority = DEFAULT (0) ]
                         [ Globally-Unique-Address =
                             [ Framed-IP-Address = 192.168.0.2 ]
                             [ Address-Realm = "example.com" ]
                         ]
                         [ Authorization-Lifetime = 450 ]
```

ETSI

Step	Protocol	Interface	From	To	Message
53	H.248	Ia	SPDF A	C-BGF A	Modify terminations

```
   MEGACO/3 [spdf-a.example.com]:55555
   Transaction = 3 {
        Context = 1 {
          Modify = ip/1/if1/1 {
            Media {
               Stream = 2 {
                  LocalControl {
                     ipdc/realm = "A",
                     gm/rsb = ON
                  }
                  Local {
                     v=0
                     m=- $ RTP/AVP 0
                     c=IN IP4 $
                     b=AS:532
                  },
                  Remote {
                  v=0
                  o=- 0 0 IN IP4 192.168.0.2
                  s=-
                  t=0 0
                  m=- 23942 RTP/AVP 0
                  c=IN IP4 192.168.0.2
                  b=AS:532
                  }
               } /* Stream */
               Stream = 3 {
                  LocalControl {
                     ipdc/realm = "A",
                     gm/rsb = ON
                  }
                  Local {
                     v=0
                     c=IN IP4 $
                     m=video $ RTP/AVP 31
                     a=rtpmap:31 H261/90000
                     b=AS:4196
                  },
                  Remote {
                  v=0
                  o=- 0 0 IN IP4 192.168.0.2
                  s=-
                  t=0 0
                  c=IN IP4 192.168.0.2
                  m=video 51372 RTP/AVP 31
                     a=rtpmap:31 H261/90000
                  b=AS:4196
                  }
               } /* Stream */
            } /* Media */
          } /* Modify */
          Modify = ip/1/if2/1 {
            Media {
               Stream = 2 {
                  LocalControl {
                     ipdc/realm = "Core",
                     gm/rsb = ON
                  }
                  Local {
                     v=0
                     m=- $ RTP/AVP 0
                     c=IN IP4 $
                     b=AS:532
                  }
               } /* Stream */
               Stream = 3 {
                  LocalControl {
                     ipdc/realm = "Core",
                     gm/rsb = ON
                  }
                  Local {
                     v=0
                     c=IN IP4 $
                     m=video $ RTP/AVP 31
                     a=rtpmap:31 H261/90000
```

Step	Protocol	Interface	From	To	Message
					b=AS:4196
					}
					} /* Stream */
					} /* Media */
					} /* Modify */
					} /* Context */
					} /* Transaction */
54	H.248	Ia	C-BGF A	SPDF A	Reply (Modify)

```
MEGACO/3 [abgf-a.example.com]:55555
Reply = 3 {
     Context = 1 {
        Modify = ip/1/if1/1 {
           Media {
              Stream = 2 {
                 LocalControl {
                    ipdc/realm = "A",
                    gm/rsb = ON
                 }
                 Local {
                    v=0
                    o=- 0 0 IN IP4 192.168.0.1
                    s=-
                    t=0 0
                    m=- 4444 RTP/AVP 0
                    c=IN IP4 192.168.0.1
                    b=AS:532
                 },
                 Remote {
                    v=0
                    o=- 0 0 IN IP4 192.168.0.2
                    s=-
                    t=0 0
                    m=- 23942 RTP/AVP 0
                    c=IN IP4 192.168.0.2
                    b=AS:532
                 }
              } /* Stream */
              Stream = 3 {
                 LocalControl {
                    ipdc/realm = "A",
                    gm/rsb = ON
                 }
                 Local {
                    v=0
                    o=- 0 0 IN IP4 192.168.0.1
                    s=-
                    t=0 0
                    c=IN IP4 192.168.0.1
                    m=video 31782 RTP/AVP 31
                    a=rtpmap:31 H261/90000
                    b=AS:4196
                 },
                 Remote {
                    v=0
                    o=- 0 0 IN IP4 192.168.0.2
                    s=-
                    t=0 0
                    c=IN IP4 192.168.0.2
                    m=video 51372 RTP/AVP 31
                    a=rtpmap:31 H261/90000
                    b=AS:4196
                 }
              } /* Stream */
           } /* Media */
        } /* Modify */
        Modify = ip/1/if2/1 {
           Media {
              Stream = 2 {
                 LocalControl {
                    ipdc/realm = "Core",
                    gm/rsb = ON
                 }
                 Local {
                    v=0
                    o=- 0 0 IN IP4 10.0.0.1
```

Step	Protocol	Interface	From	To	Message
| | | | | | ```
                                 s=-
                                 t=0 0
                                 m=- 2222 RTP/AVP 0
                                 c=IN IP4 10.0.0.1
                                 b=AS:532
                             }
                     } /* Stream */
                     Stream = 3 {
                         LocalControl {
                             ipdc/realm = "Core",
                             gm/rsb = ON
                         }
                         Local {
                             v=0
                             o=- 0 0 IN IP4 10.0.0.1
                             s=-
                             t=0 0
                             c=IN IP4 10.0.0.1
                             m=video 17462 RTP/AVP 31
                             a=rtpmap:31 H261/90000
                             b=AS:4196
                         }
                     } /* Stream */
                 } /* Media */
             } /* Modify */
         } /* Context */
     } /* Reply */
``` |
| 55 | DIAMETER | Rq | SPDF A | A-RACF A | AAR |
| | | | | | ```
<AA-Request> ::=< Diameter Header: 265, REQ, PXY >
             < Session-Id = "spdf-a.example.com;429C3;412" >
             { Auth-Application-Id = 16777222 (Gq) }
             { Origin-Host = "spdf-a.example.com" }
             { Origin-Realm = "example.com" }
             { Destination-Realm = "example.com" }
             [ Media-Component-Description =
                     { Media-Component-Number = 2 }
                     [ Media-Sub-Component =
                         { Flow-Number = 1 }
                         [ Flow-Description = "permit out 17 from 192.168.0.1 4444
                                                     to 192.168.0.2 23942" ]
                         [ Flow-Usage = NO_INFORMATION(0) ]
                         [ Max-Requested-Bandwidth-DL = 512000 ]
                     ]
                     [ Media-Sub-Component =
                         { Flow-Number = 2 }
                         [ Flow-Description = "permit out 17 from 192.168.0.1 4445
                                                     to 192.168.0.2 23943" ]
                         [ Flow-Usage = RTCP (1) ]
                         [ Max-Requested-Bandwidth-DL = 20000 ]
                     ]
                     [ AF-Application-Identifier = "RQ_SAMPLE_APP"]
                     [ Media-Type = AUDIO (0) ]

                     [ Flow-Status = DISABLED ]
                     [ Reservation-Priority = DEFAULT (0) ]
             ]
             [ Media-Component-Description =
                     { Media-Component-Number = 3 }
                     [ Media-Sub-Component =
                         { Flow-Number = 1 }
                         [ Flow-Description = "permit out 17 from 192.168.0.1 31782
                                                     to 192.168.0.2 51372" ]
                         [ Flow-Usage = NO_INFORMATION(0) ]
                         [ Max-Requested-Bandwidth-DL = 4096000 ]
                     ]
                     [ Media-Sub-Component =
                         { Flow-Number = 2 }
                         [ Flow-Description = "permit out 17 from 192.168.0.1 31783
                                                     to 192.168.0.2 51373" ]
                         [ Flow-Usage = RTCP (1) ]
                         [ Max-Requested-Bandwidth-DL = 100000 ]
                     ]
                     [ AF-Application-Identifier = "RQ_SAMPLE_APP"]
                     [ Media-Type = VIDEO (1) ]
                     [ Flow-Status = DISABLED ]
``` |

Step	Protocol	Interface	From	To	Message
					[Reservation-Priority = DEFAULT (0)]] [Reservation-Priority = DEFAULT (0)] [Globally-Unique-Address = [Framed-IP-Address = 192.168.0.2] [Address-Realm = "example.com"]] [Authorization-Lifetime = 450]
56	DIAMETER	Rq	A-RACF A	SPDF A	AAA

					`<AA-Answer> ::= < Diameter Header: 265, PXY >`
					`< Session-Id = "spdf-a.example.com;429C3;412" >`
					`{ Auth-Application-Id = 16777222 (Gq) }`
					`{ Origin-Host = "aracf-a.example.com" }`
					`{ Origin-Realm = "example.com" }`
					`[ Result-Code = DIAMETER_SUCCESS (2001) ]`
					`[ Authorization-Lifetime = 450 ]`
					`[ Auth-Grace-Period = 10 ]`

57	DIAMETER	Gq'	SPDF A	P-CSCF A	AAA

					`<AA-Answer> ::= < Diameter Header: 265, PXY >`
					`< Session-Id = "p-cscf-a.example.com;13815C;391" >`
					`{ Auth-Application-Id = 16777222 (Gq) }`
					`{ Origin-Host = "spdf-a.example.com" }`
					`{ Origin-Realm = "example.com" }`
					`[ Result-Code = DIAMETER_SUCCESS (2001) ]`
					`[ Binding-Information =`
					`   { Binding-Input-List =`
					`      [ V4-Transport-Address =`
					`         { Framed-IP-Address = 192.168.0.2 }`
					`         { Port-Number = 23942 }`
					`      ]`
					`      [ V4-Transport-Address =`
					`         { Framed-IP-Address = 0.0.0.0 }`
					`         { Port-Number = 0 }`
					`      ]`
					`      [ V4-Transport-Address =`
					`         { Framed-IP-Address = 192.168.0.2 }`
					`         { Port-Number = 23943 }`
					`      ]`
					`      [ V4-Transport-Address =`
					`         { Framed-IP-Address = 0.0.0.0 }`
					`         { Port-Number = 0 }`
					`      ]`
					`      [ V4-Transport-Address =`
					`         { Framed-IP-Address = 192.168.0.2 }`
					`         { Port-Number = 51372 }`
					`      ]`
					`      [ V4-Transport-Address =`
					`         { Framed-IP-Address = 0.0.0.0 }`
					`         { Port-Number = 0 }`
					`      ]`
					`      [ V4-Transport-Address =`
					`         { Framed-IP-Address = 192.168.0.2 }`
					`         { Port-Number = 51373 }`
					`      ]`
					`      [ V4-Transport-Address =`
					`         { Framed-IP-Address = 0.0.0.0 }`
					`         { Port-Number = 0 }`
					`      ]`
					`   [ Binding-Output-List =`
					`      [ V4-Transport-Address =`
					`         { Framed-IP-Address = 10.0.0.1 }`
					`         { Port-Number = 2222 }`
					`      ]`
					`      [ V4-Transport-Address =`
					`         { Framed-IP-Address = 0.0.0.0 }`
					`         { Port-Number = 0 }`
					`      ]`
					`      [ V4-Transport-Address =`
					`         { Framed-IP-Address = 10.0.0.1 }`
					`         { Port-Number = 2223 }`
					`      ]`
					`      [ V4-Transport-Address =`
					`         { Framed-IP-Address = 0.0.0.0 }`

Step	Protocol	Interface	From	To	Message

					`{ Port-Number = 0 }`
					`]`
					`[ V4-Transport-Address =`
					`    { Framed-IP-Address = 10.0.0.1 }`
					`    { Port-Number = 17462 }`
					`]`
					`[ V4-Transport-Address =`
					`    { Framed-IP-Address = 0.0.0.0 }`
					`    { Port-Number = 0 }`
					`]`
					`[ V4-Transport-Address =`
					`    { Framed-IP-Address = 10.0.0.1 }`
					`    { Port-Number = 17463 }`
					`]`
					`[ V4-Transport-Address =`
					`    { Framed-IP-Address = 0.0.0.0 }`
					`    { Port-Number = 0 }`
					`]`
					`]`
					`]`
					`]`
					`[ Authorization-Lifetime = 450 ]`
					`[ Auth-Grace-Period = 10 ]`

58	SIP		P-CSCF A	S-CSCF	INVITE B

```
INVITE sip:mf_b@example.com SIP/2.0
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 69
Record-Route: <sip:p-cscf-a.example.com;lr>
From: User A <sip:user_a@example.com>;tag=372183
To: MF <sip:mf_b@example.com>
Call-ID: 398174293@ue-a.example.com
CSeq: 2 INVITE
Contact: <sip:user_a@ue-a.example.com>
Content-Type: application/sdp
Content-Length: 129

v=0
o=user_a 2890844526 2890842807 IN IP4 ue-a.example.com
s=-
c=IN IP4 10.0.0.1
t=0 0
m=application 32222 tcp iptv_rtsp
a=sendrecv
a=setup:active
a=connection:existing
m=audio 2222 RTP/AVP 0
b=AS:512
a=recvonly
m=video 17462 RTP/AVP 31
b=AS:4096
a=rtpmap:31 H261/90000
a=recvonly
```

| 59 | SIP | | S-CSCF | P-CSCF A | 100 Trying |

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
From: User A <sip:user_a@example.com>;tag=372183
To: MF <sip:mf_b@example.com>
Call-ID: 398174293@ue-a.example.com
CSeq: 2 INVITE
Content-Length: 0
```

| 60 | SIP | | S-CSCF | P-CSCF B | INVITE B |

```
INVITE sip:mf_b@example.com SIP/2.0
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 68
Record-Route: <sip:s-cscf.example.com;lr>,<sip:p-cscf-a.example.com;lr>
```

Step	Protocol	Interface	From	To	Message
					From: User A <sip:user_a@example.com>;tag=372183 To: MF <sip:mf_b@example.com> Call-ID: 398174293@ue-a.example.com CSeq: 2 INVITE Contact: <sip:user_a@ue-a.example.com> Content-Type: application/sdp Content-Length: 125 v=0 o=user_a 2890844526 2890842807 IN IP4 ue-a.example.com s=- c=IN IP4 10.0.0.1 t=0 0 m=application 32222 tcp iptv_rtsp a=sendrecv a=setup:active a=connection:existing m=audio 2222 RTP/AVP 0 b=AS:512 a=recvonly m=video 17462 RTP/AVP 31 b=AS:4096 a=rtpmap:31 H261/90000 a=recvonly
61	SIP		S-CSCF	P-CSCF B	100 Trying
					SIP/2.0 100 Trying Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03 From: User A <sip:user_a@example.com>;tag=372183 To: MF <sip:mf_b@example.com> Call-ID: 398174293@ue-a.example.com CSeq: 2 INVITE Content-Length: 0
62	DIAMETER	Gq'	P-CSCF B	SPDF B	AAR
					<AA-Request> ::=< Diameter Header: 265, REQ, PXY > < Session-Id = "p-cscf-b.example.com;481C43;583" > { Auth-Application-Id = 16777222 (Gq) } { Origin-Host = "p-cscf-b.example.com" } { Origin-Realm = "example.com" } { Destination-Realm = "example.com" } [Media-Component-Description = { Media-Component-Number = 2 } [Media-Sub-Component = { Flow-Number = 1 } [Flow-Description = "permit in 17 from any to any"] [Flow-Usage = NO_INFORMATION(0)] [Max-Requested-Bandwidth-UL = 512000]] [Media-Sub-Component = { Flow-Number = 2 } [Flow-Description = "permit in 17 from any to any"] [Flow-Usage = RTCP (1)] [Max-Requested-Bandwidth-UL = 20000]] [AF-Application-Identifier = "GQPRIME_SAMPLE_APP"] [Media-Type = AUDIO (0)] [Flow-Status = DISABLED] [Reservation-Priority = DEFAULT (0)] [Codec-Data = "downlink offer m=audio 2222 RTP/AVP 0"]] [Media-Component-Description = { Media-Component-Number = 3 } [Media-Sub-Component = { Flow-Number = 1 } [Flow-Description = "permit in 17 from any to any"] [Flow-Usage = NO_INFORMATION(0)] [Max-Requested-Bandwidth-UL = 4096000]] [Media-Sub-Component =

Step	Protocol	Interface	From	To	Message
					{ Flow-Number = 2 } [Flow-Description = "permit in 17 from any to any"] [Flow-Usage = RTCP (1)] [Max-Requested-Bandwidth-UL = 100000]] [AF-Application-Identifier = "GQPRIME_SAMPLE_APP"] [Media-Type = AUDIO (0)] [Flow-Status = DISABLED] [Reservation-Priority = DEFAULT (0)] [Codec-Data = "downlink Offer m=video 17462 RTP/AVP 31 a=rtpmap:31 H261/90000 b=AS:4196]] [Binding-Information = { Binding-Input-List = [V4-Transport-Address = { Framed-IP-Address = 0.0.0.0 } { Port-Number = 0 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.1 } { Port-Number = 2222 }] [V4-Transport-Address = { Framed-IP-Address = 0.0.0.0 } { Port-Number = 0 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.1 } { Port-Number = 2223 }] [V4-Transport-Address = { Framed-IP-Address = 0.0.0.0 } { Port-Number = 0 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.1 } { Port-Number = 17462 }] [V4-Transport-Address = { Framed-IP-Address = 0.0.0.0 } { Port-Number = 0 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.1 } { Port-Number = 17463 }] }] [Reservation-Priority = DEFAULT (0)] [Globally-Unique-Address = [Framed-IP-Address = 192.168.1.2] [Address-Realm = "example.com"]] [Authorization-Lifetime = 450]

Step	Protocol	Interface	From	To	Message
63	H.248	Ia	SPDF B	C-BGF B	Modify terminations

```
   MEGACO/3 [spdf-b.example.com]:43924
   Transaction = 3 {
        Context = 1 {
          Modify = ip/1/if1/1 {
            Media {
              Stream = 2 {
                LocalControl {
                  ipdc/realm = "B",
                  gm/rsb = ON
                }
                Local {
                  v=0
                  m=- $ RTP/AVP 0
                  c=IN IP4 $
                  b=AS:532
                }
              } /* Stream */
              Stream = 3 {
                LocalControl {
                  ipdc/realm = "B",
                  gm/rsb = ON
                }
                Local {
                  v=0
                  c=IN IP4 $
                  m=video $ RTP/AVP 31
                  a=rtpmap:31 H261/90000
                  b=AS:4196
                }
              } /* Stream */
            } /* Media */
          } /* Modify */
          Modify = ip/1/if2/1 {
            Media {
              Stream = 2 {
                LocalControl {
                  ipdc/realm = "Core",
                  gm/rsb = ON
                }
                Local {
                  v=0
                  m=- $ RTP/AVP 0
                  c=IN IP4 $
                  b=AS:532
                },
                Remote {
                  v=0
                  o=- 0 0 IN IP4 10.0.0.1
                  s=-
                  t=0 0
                  m=- 2222 RTP/AVP 0
                  c=IN IP4 10.0.0.1
                  b=AS:532
                }
              } /* Stream */
              Stream = 3 {
                LocalControl {
                  ipdc/realm = "Core",
                  gm/rsb = ON
                }
                Local {
                  v=0
                  c=IN IP4 $
                  m=video $ RTP/AVP 31
                  a=rtpmap:31 H261/90000
                  b=AS:4196
                },
                Remote {
                  v=0
                  o=- 0 0 IN IP4 10.0.0.1
                  s=-
                  t=0 0
                  c=IN IP4 10.0.0.1
                  m=video 17462 RTP/AVP 31
                  a=rtpmap:31 H261/90000
```

Step	Protocol	Interface	From	To	Message
					b=AS:4196 } } /* Stream */ } /* Media */ } /* Modify */ } /* Context */ } /* Transaction */
64	H.248	Ia	C-BGF B	SPDF B	Reply (Modify)

```
MEGACO/3 [abgf-b.example.com]:43924
Reply = 3 {
    Context = 1 {
        Modify = ip/1/if1/1{
            Media {
                Stream = 2 {
                    LocalControl {
                        ipdc/realm = "B",
                        gm/rsb = ON
                    }
                    Local {
                        v=0
                        o=- 0 0 IN IP4 192.168.1.1
                        s=-
                        t=0 0
                        m=- 3332 RTP/AVP
                        c=IN IP4 192.168.1.1 0
                        b=AS:532
                    }
                } /* Stream */
                Stream = 3 {
                    LocalControl {
                        ipdc/realm = "B",
                        gm/rsb = ON
                    }
                    Local {
                        v=0
                        o=- 0 0 IN IP4 192.168.1.1
                        s=-
                        t=0 0
                        c=IN IP4 192.168.1.1
                        m=video 32124 RTP/AVP 31
                        a=rtpmap:31 H261/90000
                        b=AS:4196
                    }
                } /* Stream */
            } /* Media */
        } /* Modify */
        Modify = ip/1/if2/1{
            Media {
                Stream = 2 {
                    LocalControl {
                        ipdc/realm = "Core",
                        gm/rsb = ON
                    }
                    Local {
                        v=0
                        o=- 0 0 IN IP4 10.0.0.2
                        s=-
                        t=0 0
                        m=- 1110 RTP/AVP 0
                        c=IN IP4 10.0.0.2
                        b=AS:532
                    },
                    Remote {
                        v=0
                        o=- 0 0 IN IP4 10.0.0.1
                        s=-
                        t=0 0
                        m=- 2222 RTP/AVP 0
                        c=IN IP4 10.0.0.1
                        b=AS:532
                    }
                } /* Stream */
                Stream = 3 {
                    LocalControl {
                        ipdc/realm = "Core",
```

Step	Protocol	Interface	From	To	Message
					gm/rsb = ON

```
                        }
                        Local {
                           v=0
                           o=- 0 0 IN IP4 10.0.0.2
                           s=-
                           t=0 0
                           c=IN IP4 10.0.0.2
                           m=video 1612 RTP/AVP 31
                           a=rtpmap:31 H261/90000
                           b=AS:4196
                        },
                        Remote {
                           v=0
                           o=- 0 0 IN IP4 10.0.0.1
                           s=-
                           t=0 0
                           c=IN IP4 10.0.0.1
                           m=video 2222 RTP/AVP 31
                           a=rtpmap:31 H261/90000
                           b=AS:4196
                        }
                     } /* Stream */
                  } /* Media */
               } /* Modify */
            } /* Context */
      } /* Reply */
```

65	DIAMETER	Rq	SPDF B	A-RACF B	AAR

```
    <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                  < Session-Id = "spdf-b.example.com;41295;512" >
                  { Auth-Application-Id = 16777222 (Gq) }
                  { Origin-Host = "spdf-b.example.com" }
                  { Origin-Realm = "example.com" }
                  { Destination-Realm = "example.com" }
                  [ Media-Component-Description =
                        { Media-Component-Number = 2 }
                        [ Media-Sub-Component =
                           { Flow-Number = 1 }
                           [ Flow-Description = "permit in 17 from any to 192.168.1.1 3332" ]
                           [ Flow-Usage = NO_INFORMATION(0) ]
                           [ Max-Requested-Bandwidth-UL = 512000 ]
                        ]
                        [ Media-Sub-Component =
                           { Flow-Number = 2 }
                           [ Flow-Description = "permit in 17 from any to 192.168.1.1 3333" ]
                           [ Flow-Usage = RTCP (1) ]
                           [ Max-Requested-Bandwidth-UL = 20000 ]
                        ]
                        [ AF-Application-Identifier = "RQ_SAMPLE_APP"]
                        [ Media-Type = AUDIO (0) ]
                        [ Flow-Status = DISABLED ]
                        [ Reservation-Priority = DEFAULT (0) ]
                  ]
                  [ Media-Component-Description =
                        { Media-Component-Number = 3 }
                        [ Media-Sub-Component =
                           { Flow-Number = 1 }
                           [ Flow-Description = "permit in 17 from any to 192.168.1.1 32124" ]
                           [ Flow-Usage = NO_INFORMATION(0) ]
                           [ Max-Requested-Bandwidth-UL = 4096000 ]
                        ]
                        [ Media-Sub-Component =
                           { Flow-Number = 2 }
                           [ Flow-Description = "permit in 17 from any to 192.168.1.1 32125" ]
                           [ Flow-Usage = RTCP (1) ]
                           [ Max-Requested-Bandwidth-UL = 100000 ]
                        ]
                        [ AF-Application-Identifier = "RQ_SAMPLE_APP"]
                        [ Media-Type = VIDEO (1) ]
                        [ Flow-Status = DISABLED ]
                        [ Reservation-Priority = DEFAULT (0) ]
                  ]
                  [ Reservation-Priority = DEFAULT (0) ]
                  [ Globally-Unique-Address =
                        [ Framed-IP-Address = 192.168.1.2 ]
```

Step	Protocol	Interface	From	To	Message
					[Address-Realm = "example.com"]] [Authorization-Lifetime = 450]
66	DIAMETER	Rq	A-RACF B	SPDF B	AAA

					<pre><AA-Answer> ::= < Diameter Header: 265, PXY >
					              < Session-Id = "spdf-b.example.com;41295;512" >
					              { Auth-Application-Id = 16777222 (Gq) }
					              { Origin-Host = "aracf-b.example.com" }
					              { Origin-Realm = "example.com" }
					              [Result-Code = DIAMETER_SUCCESS (2001)]
					              [Authorization-Lifetime = 450]
					              [Auth-Grace-Period = 10]</pre>

67	DIAMETER	Gq'	SPDF B	P-CSCF B	AAA

					<pre><AA-Answer> ::= < Diameter Header: 265, PXY >
					              < Session-Id = "p-cscf-b.example.com;481C43;583" >
					              { Auth-Application-Id = 16777222 (Gq) }
					              { Origin-Host = "spdf-b.example.com" }
					              { Origin-Realm = "example.com" }
					              [Result-Code = DIAMETER_SUCCESS (2001)]
					              [Binding-Information =
					                  { Binding-Input-List =
					                      [V4-Transport-Address =
					                          { Framed-IP-Address = 0.0.0.0 }
					                          { Port-Number = 0 }
					                      ]
					                      [V4-Transport-Address =
					                          { Framed-IP-Address = 10.0.0.1 }
					                          { Port-Number = 2222 }
					                      ]
					                      [V4-Transport-Address =
					                          { Framed-IP-Address = 0.0.0.0 }
					                          { Port-Number = 0 }
					                      ]
					                      [V4-Transport-Address =
					                          { Framed-IP-Address = 10.0.0.1 }
					                          { Port-Number = 2223 }
					                      ]
					                      [V4-Transport-Address =
					                          { Framed-IP-Address = 0.0.0.0 }
					                          { Port-Number = 0 }
					                      ]
					                      [V4-Transport-Address =
					                          { Framed-IP-Address = 10.0.0.1 }
					                          { Port-Number = 17462 }
					                      ]
					                      [V4-Transport-Address =
					                          { Framed-IP-Address = 0.0.0.0 }
					                          { Port-Number = 0 }
					                      ]
					                      [V4-Transport-Address =
					                          { Framed-IP-Address = 10.0.0.1 }
					                          { Port-Number = 17463 }
					                      ]
					                  }
					                  [Binding-Output-List =
					                      [V4-Transport-Address =
					                          { Framed-IP-Address = 0.0.0.0 }
					                          { Port-Number = 0 }
					                      ]
					                      [V4-Transport-Address =
					                          { Framed-IP-Address = 192.168.1.1 }
					                          { Port-Number = 3332 }
					                      ]
					                      [V4-Transport-Address =
					                          { Framed-IP-Address = 0.0.0.0 }
					                          { Port-Number = 0 }
					                      ]
					                      [V4-Transport-Address =
					                          { Framed-IP-Address = 192.168.1.1 }
					                          { Port-Number = 3333 }
					                      ]
					                      [V4-Transport-Address =
					                          { Framed-IP-Address = 0.0.0.0 }</pre>

Step	Protocol	Interface	From	To	Message
					{ Port-Number = 0 }] [V4-Transport-Address = { Framed-IP-Address = 192.168.1.1 } { Port-Number = 32124 }] [V4-Transport-Address = { Framed-IP-Address = 0.0.0.0 } { Port-Number = 0 }] [V4-Transport-Address = { Framed-IP-Address = 192.168.1.1 } { Port-Number = 32125 }]] [Authorization-Lifetime = 450] [Auth-Grace-Period = 10]
68	SIP		P-CSCF B	MF	INVITE B

```
INVITE sip:mf_b@example.com SIP/2.0
Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 67
Record-Route: <sip:p-cscf-b.example.com;lr>,<sip:s-cscf.example.com;lr>,<sip:p-cscf-
a.example.com;lr>
From: User A <sip:user_a@example.com>;tag=372183
To: MF <sip:mf_b@example.com>
Call-ID: 398174293@ue-a.example.com
CSeq: 2 INVITE
Contact: <sip:user_a@ue-a.example.com>
Content-Type: application/sdp
Content-Length: 128

v=0
o=user_a 2890844526 2890842807 IN IP4 ue-a.example.com
s=-
c=IN IP4 192.168.1.1
t=0 0
m=application 33332 tcp iptv_rtsp
a=sendrecv
a=setup:active
a=connection:existing
m=audio 3332 RTP/AVP 0
b=AS:512
a=sendonly
m=video 32124 RTP/AVP 31
b=AS:4096
a=rtpmap:31 H261/90000
a=sendonly
```

Step	Protocol	Interface	From	To	Message
69	SIP		MF	P-CSCF B	200 OK (SDP)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 70
From: User A <sip:user_a@example.com>;tag=372183
To: MF <sip:mf_b@example.com>
Call-ID: 398174293@ue-a.example.com
CSeq: 2 INVITE
Contact: <sip:mf_b@mf-b.example.com>
Content-Type: application/sdp
Content-Length: 119

v=0
o=mf_b 29381748101 2948193018 IN IP4 mf-b.example.com
s=-
c=IN IP4 192.168.1.1
t=0 0
m=application 33332 tcp iptv_rtsp
a=sendrecv
a=setup:passive
```

Step	Protocol	Interface	From	To	Message
	a=connection:existing m=audio 3332 RTP/AVP 0 b=AS:512 a=sendonly m=video 32124 RTP/AVP 31 b=AS:4096 a=rtpmap:31 H261/90000 a=sendonly				
70	DIAMETER	Gq'	P-CSCF B	SPDF B	AAR (Modify)

```
<AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                < Session-Id = "p-cscf-b.example.com;481C43;583" >
                { Auth-Application-Id = 16777222 (Gq) }
                { Origin-Host = "p-cscf-b.example.com" }
                { Origin-Realm = "example.com" }
                { Destination-Realm = "example.com" }
                [ Media-Component-Description =
                        { Media-Component-Number = 2 }
                        [ Media-Sub-Component =
                            { Flow-Number = 1 }
                            [ Flow-Description = "permit in 17 from any to 192.168.1.1 3332" ]
                            [ Flow-Usage = NO_INFORMATION(0) ]
                            [ Max-Requested-Bandwidth-UL = 512000 ]
                        ]
                        [ Media-Sub-Component =
                            { Flow-Number = 2 }
                            [ Flow-Description = "permit in 17 from any to 192.168.1.1 3333" ]
                            [ Flow-Usage = RTCP (1) ]
                            [ Max-Requested-Bandwidth-UL = 20000 ]
                        ]
                        [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                        [ Media-Type = AUDIO (0) ]
                        [ Flow-Status = ENABLED-UPLINK (0) ]
                        [ Reservation-Priority = DEFAULT (0) ]
                        [ Codec-Data = "uplink
                            answer
                            m=audio 29792 RTP/AVP 0"
                        ]
                        [ Codec-Data = "downlink
                            offer
                            m=audio 3333 RTP/AVP 0"
                        ]
                ]
                [ Media-Component-Description =
                        { Media-Component-Number = 3 }
                        [ Media-Sub-Component =
                            { Flow-Number = 1 }
                            [ Flow-Description = "permit in 17 from any to 192.168.1.1 32124" ]
                            [ Flow-Usage = NO_INFORMATION(0) ]
                            [ Max-Requested-Bandwidth-UL = 4096000 ]
                        ]
                        [ Media-Sub-Component =
                            { Flow-Number = 2 }
                            [ Flow-Description = "permit in 17 from any to 192.168.1.1 32124" ]
                            [ Flow-Usage = RTCP (1) ]
                            [ Max-Requested-Bandwidth-UL = 100000 ]
                        ]
                        [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                        [ Media-Type = VIDEO (1) ]
                        [ Flow-Status = ENABLED-UPLINK (0) ]
                        [ Reservation-Priority = DEFAULT (0) ]
                        [ Codec-Data = "uplink
                            answer
                            m=video 25552 RTP/AVP 31
                            a=rtpmap:31 H261/90000
                            b=AS:4196"
                        ]
                        [ Codec-Data = "downlink
                            offer
                            m=video 32124 RTP/AVP 31
                            a=rtpmap:31 H261/90000
                            b=as:640"
                        ]
                ]
                [ Binding-Information =
                        { Binding-Input-List =
```

Step	Protocol	Interface	From	To	Message
					[V4-Transport-Address = { Framed-IP-Address = 192.168.1.2 } { Port-Number = 29792 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.1 } { Port-Number = 2222 }] [V4-Transport-Address = { Framed-IP-Address = 192.168.1.2 } { Port-Number = 29793 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.1 } { Port-Number = 2223 }] [V4-Transport-Address = { Framed-IP-Address = 192.168.1.2 } { Port-Number = 25552 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.1 } { Port-Number = 17462 }] [V4-Transport-Address = { Framed-IP-Address = 192.168.1.2 } { Port-Number = 25553 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.1 } { Port-Number = 17463 }] }] [Reservation-Priority = DEFAULT (0)] [Globally-Unique-Address = [Framed-IP-Address = 192.168.1.2] [Address-Realm = "example.com"]] [Authorization-Lifetime = 450]
71	H.248	Ia	SPDF B	C-BGF B	Modify terminations

```
MEGACO/3 [spdf-b.example.com]:43924
Transaction = 4 {
     Context = 1 {
        Modify = ip/1/if1/1 {
           Media {
              Stream = 2 {
                 LocalControl {
                    ipdc/realm = "B",
                    gm/rsb = ON,
                    mode = ReceiveOnly
                 },
                 Local {
                    v=0
                    o=- 0 0 IN IP4 192.168.1.1
                    s=-
                    t=0 0
                    m=- 3332 RTP/AVP 0
                    c=IN IP4 192.168.1.1
                    b=AS:532
                 }
                 Remote {
                    v=0
                    o=- 0 0 IN IP4 192.168.1.2
                    s=-
                    t=0 0
                    m=- 29792 RTP/AVP 0
                    c=IN IP4 192.168.1.2
                    b=AS:532
                 }
              } /* Stream */
              Stream = 3 {
                 LocalControl {
                    ipdc/realm = "B",
                    gm/rsb = ON,
```

Step	Protocol	Interface	From	To	Message
					mode = ReceiveOnly

```
                       },
                       Local {
                          v=0
                          o=- 0 0 IN IP4 192.168.1.1
                          s=-
                          t=0 0
                          c=IN IP4 192.168.1.1
                          m=video 32124 RTP/AVP 31
                          a=rtpmap:31 H261/90000
                          b=AS:4196
                       }
                       Remote {
                          v=0
                          o=- 0 0 IN IP4 192.168.1.2
                          s=-
                          t=0 0
                          c=IN IP4 192.168.1.2
                          m=video 25552 RTP/AVP 31
                          a=rtpmap:31 H261/90000
                          b=AS:4196
                       }
                    } /* Stream */
                 } /* Media */
              } /* Modify */
              Modify = ip/1/if2/1 {
                 Media {
                    Stream = 2 {
                       LocalControl {
                          ipdc/realm = "Core",
                          gm/rsb = ON,
                          mode = ReceiveOnly
                       },
                       Local {
                          v=0
                          o=- 0 0 IN IP4 10.0.0.2
                          s=-
                          t=0 0
                          m=- 1110 RTP/AVP 0
                          c=IN IP4 10.0.0.2
                          b=AS:532
                       },
                       Remote {
                          v=0
                          o=- 0 0 IN IP4 10.0.0.1
                          s=-
                          t=0 0
                          m=- 2222 RTP/AVP 0
                          c=IN IP4 10.0.0.1
                          b=AS:532
                       }
                    } /* Stream */
                    Stream = 3 {
                       LocalControl {
                          ipdc/realm = "Core",
                          gm/rsb = ON,
                          mode = ReceiveOnly
                       },
                       Local {
                          v=0
                          o=- 0 0 IN IP4 10.0.0.2
                          s=-
                          t=0 0
                          c=IN IP4 10.0.0.2
                          m=video $ RTP/AVP 31
                          a=rtpmap:31 H261/90000
                          b=AS:4196
                       },
                       Remote {
                          v=0
                          o=- 0 0 IN IP4 10.0.0.1
                          s=-
                          t=0 0
                          c=IN IP4 10.0.0.1
                          m=video 17462 RTP/AVP 31
                          a=rtpmap:31 H261/90000
                          b=AS:4196
```

Step	Protocol	Interface	From	To	Message
					}
					} /* Stream */
					} /* Media */
					} /* Modify */
					} /* Context */
					} /* Transaction */
72	H.248	Ia	C-BGF B	SPDF B	Reply (Modify)

```
    MEGACO/3 [abgf-b.example.com]: 43924
    Reply = 4 {
        Context = 1 {
            Modify = ip/1/if1/1 {
                Media {
                    Stream = 2 {
                        LocalControl {
                            ipdc/realm = "B",
                            gm/rsb = ON,
                            mode = ReceiveOnly
                        },
                        Local {
                            v=0
                            o=- 0 0 IN IP4 192.168.1.1
                            s=-
                            t=0 0
                            m=- 3332 RTP/AVP 0
                            c=IN IP4 192.168.1.1
                            b=AS:532
                        },
                        Remote {
                            v=0
                            o=- 0 0 IN IP4 192.168.1.2
                            s=-
                            t=0 0
                            m=- 29792 RTP/AVP 0
                            c=IN IP4 192.168.1.2
                            b=AS:532
                        }
                    } /* Stream */
                    Stream = 3 {
                        LocalControl {
                            ipdc/realm = "B",
                            gm/rsb = ON,
                            mode = ReceiveOnly
                        },
                        Local {
                            v=0
                            o=- 0 0 IN IP4 192.168.1.1
                            s=-
                            t=0 0
                            c=IN IP4 192.168.1.1
                            m=video 32124 RTP/AVP 31
                            a=rtpmap:31 H261/90000
                            b=AS:4196
                        },
                        Remote {
                            v=0
                            o=- 0 0 IN IP4 192.168.1.2
                            s=-
                            t=0 0
                            c=IN IP4 192.168.1.2
                            m=video 25552 RTP/AVP 31
                            a=rtpmap:31 H261/90000
                            b=AS:4196
                        }
                    } /* Stream */
                } /* Media */
            } /* Modify */
            Modify = ip/1/if2/1 {
                Media {
                    Stream = 2 {
                        LocalControl {
                            ipdc/realm = "Core",
                            gm/rsb = ON,
                            mode = ReceiveOnly
                        },
                        Local {
```

Step	Protocol	Interface	From	To	Message
| | | | | | ```
                v=0
                o=- 0 0 IN IP4 10.0.0.2
                s=-
                t=0 0
                m=- 1110 RTP/AVP 0
                c=IN IP4 10.0.0.2
                b=AS:532
            },
            Remote {
                v=0
                o=- 0 0 IN IP4 10.0.0.1
                s=-
                t=0 0
                m=- 2222 RTP/AVP 0
                c=IN IP4 10.0.0.1
                b=AS:532
            }
        } /* Stream */
        Stream = 3 {
            LocalControl {
                ipdc/realm = "Core",
                gm/rsb = ON,
                mode = ReceiveOnly
            },
            Local {
                v=0
                o=- 0 0 IN IP4 10.0.0.2
                s=-
                t=0 0
                c=IN IP4 10.0.0.2
                m=video 1612 RTP/AVP 31
                a=rtpmap:31 H261/90000
                b=AS:4196
            },
            Remote {
                v=0
                o=- 0 0 IN IP4 10.0.0.1
                s=-
                t=0 0
                c=IN IP4 10.0.0.1
                m=video 17462 RTP/AVP 31
                a=rtpmap:31 H261/90000
                b=AS:4196
            }
        } /* Stream */
    } /* Media */
  } /* Modify */
 } /* Context */
} /* Reply */
``` |
| 73 | DIAMETER | Rq | SPDF B | A-RACF B | AAR (Modify) |
| | | | | | ```
<AA-Request> ::=< Diameter Header: 265, REQ, PXY >
            < Session-Id = "spdf-b.example.com;41295;512" >
            { Auth-Application-Id = 16777222 (Gq) }
            { Origin-Host = "spdf-b.example.com" }
            { Origin-Realm = "example.com" }
            { Destination-Realm = "example.com" }
            [ Media-Component-Description =
                 { Media-Component-Number = 2 }
                 [ Media-Sub-Component =
                     { Flow-Number = 1 }
                     [ Flow-Description = "permit in 17 from 192.168.1.2 29792
                                                    to 192.168.1.1 3332" ]
                     [ Flow-Usage = NO_INFORMATION(0) ]
                     [ Max-Requested-Bandwidth-UL = 512000 ]
                 ]
                 [ Media-Sub-Component =
                     { Flow-Number = 2 }
                     [ Flow-Description = "permit in 17 from 192.168.1.2 29793
                                                    to 192.168.1.1 3333" ]
                     [ Flow-Usage = RTCP(1) ]
                     [ Max-Requested-Bandwidth-UL = 20000 ]
                 ]
                 [ AF-Application-Identifier = "RQ_SAMPLE_APP"]
                 [ Media-Type = AUDIO (0) ]
                 [ Flow-Status = ENABLED-UPLINK (0) }
``` |

Step	Protocol	Interface	From	To	Message
					[Reservation-Priority = DEFAULT (0)]

```
                                 ]
                         [ Media-Component-Description =
                                 { Media-Component-Number = 3 }
                                 [ Media-Sub-Component =
                                     { Flow-Number = 1 }
                                     [ Flow-Description = "permit in 17 from 192.168.1.2 25552
                                                             to 192.168.1.1 32124" ]
                                     [ Flow-Usage = NO_INFORMATION(0) ]
                                     [ Max-Requested-Bandwidth-DL = 4096000 ]
                                 ]
                                 [ Media-Sub-Component =
                                     { Flow-Number = 2 }
                                     [ Flow-Description = "permit in 17 from 192.168.1.2 25553
                                                             to 192.168.1.1 32125" ]
                                     [ Flow-Usage = RTCP(1) ]
                                     [ Max-Requested-Bandwidth-DL = 100000 ]
                                 ]
                                 [ AF-Application-Identifier = "RQ_SAMPLE_APP"]
                                 [ Media-Type = VIDEO (1) ]
                                 [ Flow-Status = ENABLED-UPLINK (0) }
                                 [ Reservation-Priority = DEFAULT (0) ]
                         ]
                         [ Reservation-Priority = DEFAULT (0) ]
                         [ Globally-Unique-Address =
                                 [ Framed-IP-Address = 192.168.1.2 ]
                                 [ Address-Realm = "example.com" ]
                         ]
                         [ Authorization-Lifetime = 450 ]
```

Step	Protocol	Interface	From	To	Message
74	DIAMETER	Re	A-RACF B	RCEF B	PIR

```
     < PI-Request > ::=   < Diameter Header: 315, REQ, PXY >
                     < Session-Id = "aracf-b.example.com;66389;469" >
                     { Auth-Application-Id = 16777253 (Re) }
                     { Origin-Host = "aracf-b.example.com" }
                     { Origin-Realm = "example.com" }
                     { Destination-Realm = "example.com" }
                     { Destination-Host = "rcef-b.example.com" }
                     { PI-Request-Type = UPDATE_REQUEST (2) }
                     { PI-Request-Number = 1 }
                     [ Auth-Session-State = NO_STATE_MAINTAINED (1) ]
                     [ Policy-Rule-Install =
                         [ Policy-Rule-Definition =
                             { Policy-Rule-Name = "policy-rule-example-B-UL" }
                             [ Service-Identifier = 1 ]
                             [ Rating-Group = 1 ]
                             [ Framed-IP-Address = 192.168.1.2 ]
                             [ Address-Realm = "example.com" ]
                             [ Flow-Description = "permit in 17 from 192.168.1.2 25552
                                                             to 192.168.1.1 32124" ]
                             [ Flow-Description = "permit in 17 from 192.168.1.2 25553
                                                             to 192.168.1.1 32125" ]
                             [ Flow-Status = ENABLED-UPLINK (0) ]
                             [ QoS-Information =
                                 [ Max-Requested-Bandwidth-UL = 672000 ]
                                 [ ToS-Traffic-Class = 101110 ]
                             ]
                             [ Precedence = 1]
                             [ Flows =
                                 { Media-Component-Number = 3 }
                                 [ Flow-Number = 1 ]
                                 [ Flow-Number = 2 ]
                             ]
                         ]
                     ]
```

Step	Protocol	Interface	From	To	Message
75	DIAMETER	Re	RCEF B	A-RACF B	PIA

```
   <PI-Answer> ::= < Diameter Header: 315, PXY >
                 < Session-Id = "aracf-b.example.com;66389;469" >
                 { Origin-Host = "rcef-b.example.com" }
                 { Origin-Realm = "example.com" }
                 { PI-Request-Type = UPDATE_REQUEST (2) }
                 { PI-Request-Number = 1 }
                 [ Result-Code DIAMETER_SUCCESS (2001) ]
```

Step	Protocol	Interface	From	To	Message
76	DIAMETER	Rq	A-RACF B	SPDF B	AAA (Modify)

```
   <AA-Answer> ::= < Diameter Header: 265, PXY >
                 < Session-Id = "spdf-b.example.com;41295;512" >
                 { Auth-Application-Id = 16777222 (Gq) }
                 { Origin-Host = "aracf-b.example.com" }
                 { Origin-Realm = "example.com" }
                 [ Result-Code = DIAMETER_SUCCESS (2001) ]
                 [ Authorization-Lifetime = 450 ]
                 [ Auth-Grace-Period = 10 ]
```

Step	Protocol	Interface	From	To	Message
77	DIAMETER	Gq'	SPDF B	P-CSCF B	AAA (Modify)

```
   <AA-Answer> ::= < Diameter Header: 265, PXY >
                 < Session-Id = "p-cscf-b.example.com;481C43;583" >
                 { Auth-Application-Id = 16777222 (Gq) }
                 { Origin-Host = "spdf-b.example.com" }
                 { Origin-Realm = "example.com" }
                 [ Result-Code = DIAMETER_SUCCESS (2001) ]
                 [ Binding-Information =
                    { Binding-Input-List =
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 192.168.1.2 }
                           { Port-Number = 29792 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 10.0.0.1 }
                           { Port-Number = 2222 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 192.168.1.2 }
                           { Port-Number = 29793 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 10.0.0.1 }
                           { Port-Number = 2223 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 192.168.1.2 }
                           { Port-Number = 25552 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 10.0.0.1 }
                           { Port-Number = 17462 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 192.168.1.2 }
                           { Port-Number = 25553 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 10.0.0.1 }
                           { Port-Number = 17463 }
                       ]
                    }
                    [ Binding-Output-List =
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 10.0.0.2 }
                           { Port-Number = 1110 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 192.168.1.1 }
                           { Port-Number = 3332 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 10.0.0.2 }
                           { Port-Number = 1111 }
```

Step	Protocol	Interface	From	To	Message
					] [V4-Transport-Address = { Framed-IP-Address = 192.168.1.1 } { Port-Number = 3333 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.2 } { Port-Number = 1612 }] [V4-Transport-Address = { Framed-IP-Address = 192.168.1.1 } { Port-Number = 32124 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.2 } { Port-Number = 1613 }] [V4-Transport-Address = { Framed-IP-Address = 192.168.1.1 } { Port-Number = 32125 }]] [Authorization-Lifetime = 450] [Auth-Grace-Period = 10]
78	SIP		P-CSCF B	S-CSCF	200 OK (SDP)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 69
From: User A <sip:user_a@example.com>;tag=372183
To: MF <sip:mf_b@example.com>
Call-ID: 398174293@ue-a.example.com
CSeq: 1 INVITE
Contact: <sip:mf_b@mf-b.example.com>
Content-Type: application/sdp
Content-Length: 189

v=0
o=mf_b 29381748101 2948193018 IN IP4 mf-b.example.com
s=-
c=IN IP4 10.0.0.2
t=0 0
m=application 31110 tcp iptv_rtsp
a=sendrecv
a=setup:passive
a=connection:existing
m=audio 1110 RTP/AVP 0
b=AS:512
a=sendonly
m=video 1612 RTP/AVP 31
b=AS:4096
a=rtpmap:31 H261/90000
a=sendonly
```

Step	Protocol	Interface	From	To	Message
79	SIP		S-CSCF	P-CSCF A	200 OK (SDP)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 68
From: User A <sip:user_a@example.com>;tag=372183
To: MF <sip:mf_b@example.com>
Call-ID: 398174293@ue-a.example.com
CSeq: 2 INVITE
Contact: <sip:mf_b@mf-b.example.com>
Content-Type: application/sdp
Content-Length: 126

v=0
o=mf_b 29381748101 2948193018 IN IP4 mf-b.example.com
s=-
c=IN IP4 10.0.0.2
t=0 0
m=application 31110 tcp iptv_rtsp
a=sendrecv
a=setup:passive
a=connection:existing
m=audio 1110 RTP/AVP 0
b=AS:512
a=sendonly
m=video 1612 RTP/AVP 31
b=AS:4096
a=rtpmap:31 H261/90000
a=sendonly
```

Step	Protocol	Interface	From	To	Message
80	DIAMETER	Gq'	P-CSCF A	SPDF A	AAR (Modify)

```
<AA-Request> ::=< Diameter Header: 265, REQ, PXY >
            < Session-Id = "p-cscf-a.example.com;13815C;391" >
            { Auth-Application-Id = 16777222 (Gq) }
            { Origin-Host = "p-cscf-a.example.com" }
            { Origin-Realm = "example.com" }
            { Destination-Realm = "example.com" }
            [ Media-Component-Description =
                  { Media-Component-Number = 2 }
                  [ Media-Sub-Component =
                      { Flow-Number = 1 }
                      [ Flow-Description = "permit out 17 from any to 192.168.0.2 23942" ]
                      [ Flow-Usage = NO_INFORMATION(0) ]
                      [ Max-Requested-Bandwidth-DL = 512000 ]
                  ]
                  [ Media-Sub-Component =
                      { Flow-Number = 2 }
                      [ Flow-Description = "permit out 17 from any to 192.168.0.2 23943" ]
                      [ Flow-Usage = RTCP(1) ]
                      [ Max-Requested-Bandwidth-DL = 20000 ]
                  ]
                  [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                  [ Media-Type = AUDIO (0) ]
                  [ Flow-Status = ENABLED-DOWNLINK (1) ]
                  [ Reservation-Priority = DEFAULT (0) ]
                  [ Codec-Data = "uplink
                      offer
                      m=audio 23942 RTP/AVP 0"
                  ]
            ]
            [ Media-Component-Description =
                  { Media-Component-Number = 3 }
                  [ Media-Sub-Component =
                      { Flow-Number = 1 }
                      [ Flow-Description = "permit out 17 from any to 192.168.0.2 51372" ]
                      [ Flow-Usage = NO_INFORMATION(0) ]
                      [ Max-Requested-Bandwidth-DL = 4096000 ]
                  ]
                  [ Media-Sub-Component =
                      { Flow-Number = 2 }
                      [ Flow-Description = "permit out 17 from any to 192.168.0.2 51373" ]
                      [ Flow-Usage = RTCP(1) ]
                      [ Max-Requested-Bandwidth-DL = 100000 ]
                  ]
```

Step	Protocol	Interface	From	To	Message
					[AF-Application-Identifier = "GQPRIME_SAMPLE_APP"] [Media-Type = VIDEO (1)] [Flow-Status = ENABLED-DOWNLINK (1)] [Reservation-Priority = DEFAULT (0)] [Codec-Data = "uplink offer m=video 31372 RTP/AVP 31 a=rtpmap:31 H261/90000 b=AS:4196"]] [Binding-Information = { Binding-Input-List = [V4-Transport-Address = { Framed-IP-Address = 192.168.0.2 } { Port-Number = 23942 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.2 } { Port-Number = 1110 }] [V4-Transport-Address = { Framed-IP-Address = 192.168.0.2 } { Port-Number = 23943 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.2 } { Port-Number = 1111 }] [V4-Transport-Address = { Framed-IP-Address = 192.168.0.2 } { Port-Number = 31372 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.2 } { Port-Number = 1612 }] [V4-Transport-Address = { Framed-IP-Address = 192.168.0.2 } { Port-Number = 31373 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.2 } { Port-Number = 1613 }] }] [Reservation-Priority = DEFAULT (0)] [Globally-Unique-Address = [Framed-IP-Address = 192.168.0.2] [Address-Realm = "example.com"]] [Authorization-Lifetime = 450]
81	H.248	Ia	SPDF A	C-BGF A	Modify Terminations A (A to B)

					``MEGACO/3 [spdf-a.example.com]:55555
					Transaction = 4 {
					    Context = 1 {
					      Modify = ip/1/if1/1 {
					        Media {
					          Stream = 2 {
					            LocalControl {
					              ipdc/realm = "A",
					              gm/rsb = ON,
					              mode = Sendonly
					            },
					            Local {
					              v=0
					              o=- 0 0 IN IP4 192.168.0.1
					              s=-
					              t=0 0
					              m=- 4444 RTP/AVP 0
					              c=IN IP4 192.168.0.1```

Step	Protocol	Interface	From	To	Message
					b=AS:532
					},
					Remote {
					v=0
					o=- 0 0 IN IP4 192.168.0.2
					s=-
					t=0 0
					m=- 23942 RTP/AVP 0
					c=IN IP4 192.168.0.2
					b=AS:532
					}
					} /* Stream */
					Stream = 3 {
					LocalControl {
					ipdc/realm = "A",
					gm/rsb = ON,
					mode = Sendonly
					},
					Local {
					v=0
					o=- 0 0 IN IP4 192.168.0.1
					s=-
					t=0 0
					c=IN IP4 192.168.0.1
					m=video $ RTP/AVP 31
					a=rtpmap:31 H261/90000
					b=AS:4196
					},
					Remote {
					v=0
					o=- 0 0 IN IP4 192.168.0.2
					s=-
					t=0 0
					c=IN IP4 192.168.0.2
					m=video 51372 RTP/AVP 31
					a=rtpmap:31 H261/90000
					b=AS:4196
					}
					} /* Stream */
					} /* Media */
					} /* Modify */
					Modify = ip/1/if2/1 {
					Media {
					Stream = 2 {
					LocalControl {
					ipdc/realm = "Core",
					gm/rsb = ON,
					mode = Sendonly
					},
					Local {
					v=0
					o=- 0 0 IN IP4 10.0.0.1
					s=-
					t=0 0
					m=- 2222 RTP/AVP 0
					c=IN IP4 10.0.0.1
					b=AS:532
					},
					Remote {
					v=0
					o=- 0 0 IN IP4 10.0.0.2
					s=-
					t=0 0
					m=- 1110 RTP/AVP 0
					c=IN IP4 10.0.0.2
					b=AS:532
					}
					} /* Stream */
					Stream = 3 {
					LocalControl {
					ipdc/realm = "Core",
					gm/rsb = ON,
					mode = Sendonly
					},
					Local {
					v=0
					o=- 0 0 IN IP4 10.0.0.1

Step	Protocol	Interface	From	To	Message

					s=-
					t=0 0
					c=IN IP4 10.0.0.1
					m=video 17462 RTP/AVP 31
					a=rtpmap:31 H261/90000
					b=AS:4196
					   },
					   Remote {
					     v=0
					     o=- 0 0 IN IP4 10.0.0.2
					     s=-
					     t=0 0
					     c=IN IP4 10.0.0.2
					     m=video 1612 RTP/AVP 31
					     a=rtpmap:31 H261/90000
					     b=AS:4196
					   }
					  } /* Stream */
					 } /* Media */
					} /* Modify */
					} /* Context */
					} /* Transaction */

82	H.248	Ia	C-BGF A	SPDF A	Reply (Modify)

```
MEGACO/3 [abgf-a.example.com]:55555
Reply = 4 {
     Context = 1 {
        Modify = ip/1/if1/1 {
           Media {
              Stream = 2 {
                 LocalControl {
                    ipdc/realm = "A",
                    gm/rsb = ON,
                    mode = Sendonly
                 },
                 Local {
                    v=0
                    o=- 0 0 IN IP4 192.168.0.1
                    s=-
                    t=0 0
                    m=- 4444 RTP/AVP 0
                    c=IN IP4 192.168.0.1
                    b=AS:532
                 },
                 Remote {
                    v=0
                    o=- 0 0 IN IP4 192.168.0.2
                    s=-
                    t=0 0
                    m=- 23942 RTP/AVP 0
                    c=IN IP4 192.168.0.2
                    b=AS:532
                 }
              } /* Stream */
              Stream = 3 {
                 LocalControl {
                    ipdc/realm = "A",
                    gm/rsb = ON,
                    mode = Sendonly
                 },
                 Local {
                    v=0
                    o=- 0 0 IN IP4 192.168.0.1
                    s=-
                    t=0 0
                    c=IN IP4 192.168.0.1
                    m=video 31444 RTP/AVP 31
                    a=rtpmap:31 H261/90000
                    b=AS:4196
                 },
                 Remote {
                    v=0
                    o=- 0 0 IN IP4 192.168.0.2
                    s=-
                    t=0 0
                    c=IN IP4 192.168.0.2
```

Step	Protocol	Interface	From	To	Message
					m=video 51372 RTP/AVP 31

```
                        m=video 51372 RTP/AVP 31
                        a=rtpmap:31 H261/90000
                        b=AS:4196
                  }
               } /* Stream */
            } /* Media */
         } /* Modify */
         Modify = ip/1/if2/1 {
            Media {
               Stream = 2 {
                  LocalControl {
                     ipdc/realm = "Core",
                     gm/rsb = ON,
                     mode = Sendonly
                  },
                  Local {
                     v=0
                     o=- 0 0 IN IP4 10.0.0.1
                     s=-
                     t=0 0
                     m=- 2222 RTP/AVP 0
                     c=IN IP4 10.0.0.1
                     b=AS:532
                  },
                  Remote {
                     v=0
                     o=- 0 0 IN IP4 10.0.0.2
                     s=-
                     t=0 0
                     m=- 1110 RTP/AVP 0
                     c=IN IP4 10.0.0.2
                     b=AS:532
                  }
               } /* Stream */
               Stream = 3 {
                  LocalControl {
                     ipdc/realm = "Core",
                     gm/rsb = ON,
                     mode = Sendonly
                  },
                  Local {
                     v=0
                     o=- 0 0 IN IP4 10.0.0.1
                     s=-
                     t=0 0
                     c=IN IP4 10.0.0.1
                     m=video 17462 RTP/AVP 31
                     a=rtpmap:31 H261/90000
                     b=AS:4196
                  },
                  Remote {
                     v=0
                     o=- 0 0 IN IP4 10.0.0.2
                     s=-
                     t=0 0
                     c=IN IP4 10.0.0.2
                     m=video 1612 RTP/AVP 31
                     a=rtpmap:31 H261/90000
                     b=AS:4196
                  }
               } /* Stream */
            } /* Media */
         } /* Modify */
      } /* Context */
   } /* Transaction */
```

| 83 | DIAMETER | Rq | SPDF A | A-RACF A | AAR (Modify) |

```
   <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                  < Session-Id = "spdf-a.example.com;429C3;412" >
                  { Auth-Application-Id = 16777222 (Gq) }
                  { Origin-Host = "spdf-a.example.com" }
                  { Origin-Realm = "example.com" }
                  { Destination-Realm = "example.com" }
                  [ Media-Component-Description =
                        { Media-Component-Number = 3 }
                        [ Media-Sub-Component =
```

Step	Protocol	Interface	From	To	Message

					`{ Flow-Number = 1 }`
					`[ Flow-Description = "permit out 17 from 192.168.0.1 31444`
					`                                        to 192.168.0.2 51372" ]`
					`[ Flow-Usage = NO_INFORMATION(0) ]`
					`[ Max-Requested-Bandwidth-DL = 4096000 ]`
					`]`
					`[ Media-Sub-Component =`
					`    { Flow-Number = 2 }`
					`[ Flow-Description = "permit out 17 from 192.168.0.1 31445`
					`                                        to 192.168.0.2 51373" ]`
					`[ Flow-Usage = RTCP(1) ]`
					`[ Max-Requested-Bandwidth-DL = 100000 ]`
					`]`
					`[ AF-Application-Identifier = "RQ_SAMPLE_APP"]`
					`[ Media-Type = VIDEO (1) ]`
					`[ Flow-Status = ENABLED-DOWNLINK (1) ]`
					`[ Reservation-Priority = DEFAULT (0) ]`
					`]`
					`[ Reservation-Priority = DEFAULT (0) ]`
					`[ Globally-Unique-Address =`
					`        [ Framed-IP-Address = 192.168.0.2 ]`
					`        [ Address-Realm = "example.com" ]`
					`]`
					`[ Authorization-Lifetime = 450 ]`

84	DIAMETER	Re	A-RACF A	RCEF A	PIR

					`< PI-Request > ::=  < Diameter Header: 315, REQ, PXY >`
					`              < Session-Id = "aracf-a.example.com;32475;112" >`
					`              { Auth-Application-Id = 16777253 (Re) }`
					`              { Origin-Host = "aracf-a.example.com" }`
					`              { Origin-Realm = "example.com" }`
					`              { Destination-Realm = "example.com" }`
					`              { Destination-Host = "rcef-a.example.com" }`
					`              { PI-Request-Type = UPDATE_REQUEST (2) }`
					`              { PI-Request-Number = 1 }`
					`              [ Auth-Session-State = NO_STATE_MAINTAINED (1) ]`
					`              [ Policy-Rule-Install =`
					`                  [ Policy-Rule-Definition =`
					`                      { Policy-Rule-Name = "policy-rule-example-A-DL" }`
					`                      [ Service-Identifier = 1 ]`
					`                      [ Rating-Group = 1 ]`
					`                      [ Framed-IP-Address = 192.168.0.2 ]`
					`                      [ Address-Realm = "example.com" ]`
					`                      [ Flow-Description = "permit out 17 from 192.168.0.1 31444`
					`                                                    to 192.168.0.2 51372" ]`
					`                      [ Flow-Description = "permit out 17 from 192.168.0.1 31445`
					`                                                    to 192.168.0.2 51373" ]`
					`                      [ Flow-Status = ENABLED-DOWNLINK (1) ]`
					`                      [ QoS-Information =`
					`                          [ Max-Requested-Bandwidth-DL = 672000 ]`
					`                          [ ToS-Traffic-Class = 101110 ]`
					`                      ]`
					`                      [ Precedence = 1]`
					`                      [ Flows =`
					`                          { Media-Component-Number = 3 }`
					`                          [ Flow-Number = 1 ]`
					`                          [ Flow-Number = 2 ]`
					`                      ]`
					`                  ]`
					`              ]`

85	DIAMETER	Re	RCEF A	A-RACF A	PIA

					`<PI-Answer> ::= < Diameter Header: 315, PXY >`
					`              < Session-Id = "aracf-a.example.com;32475;112" >`
					`              { Origin-Host = "rcef-a.example.com" }`
					`              { Origin-Realm = "example.com" }`
					`              { PI-Request-Type = UPDATE_REQUEST (2) }`
					`              { PI-Request-Number = 1 }`
					`              [ Result-Code DIAMETER_SUCCESS (2001) ]`

Step	Protocol	Interface	From	To	Message
86	DIAMETER	Rq	A-RACF A	SPDF A	AAA (Modify)

```
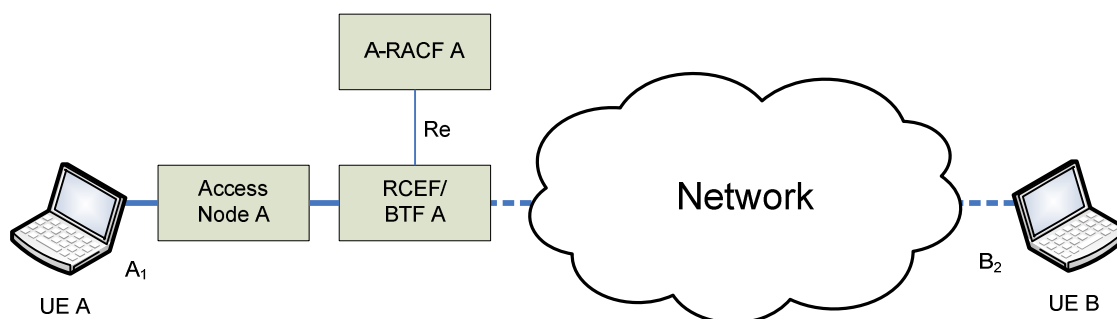<AA-Answer> ::= < Diameter Header: 265, PXY >
               < Session-Id = "spdf-a.example.com;429C3;412" >
               { Auth-Application-Id = 16777222 (Gq) }
               { Origin-Host = "aracf-a.example.com" }
               { Origin-Realm = "example.com" }
               [ Result-Code = DIAMETER_SUCCESS (2001) ]
               [ Authorization-Lifetime = 450 ]
               [ Auth-Grace-Period = 10 ]
```

Step	Protocol	Interface	From	To	Message
87	DIAMETER	Gq'	SPDF A	P-CSCF A	AAA (Modify)

```
<AA-Answer> ::= < Diameter Header: 265, PXY >
               < Session-Id = "p-cscf-a.example.com;13815C;391" >
               { Auth-Application-Id = 16777222 (Gq) }
               { Origin-Host = "spdf-a.example.com" }
               { Origin-Realm = "example.com" }
               [ Result-Code = DIAMETER_SUCCESS (2001) ]
               [ Binding-Information =
                   { Binding-Input-List =
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 192.168.0.2 }
                           { Port-Number = 23942 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 10.0.0.2 }
                           { Port-Number = 1110 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 192.168.0.2 }
                           { Port-Number = 23943 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 10.0.0.2 }
                           { Port-Number = 1111 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 192.168.0.2 }
                           { Port-Number = 51371 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 10.0.0.2 }
                           { Port-Number = 1612 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 192.168.0.2 }
                           { Port-Number = 51373 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 10.0.0.2 }
                           { Port-Number = 1613 }
                       ]
                   }
                   [ Binding-Output-List =
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 10.0.0.1 }
                           { Port-Number = 2222 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 192.168.0.1 }
                           { Port-Number = 4444 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 10.0.0.1 }
                           { Port-Number = 2223 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 192.168.0.1 }
                           { Port-Number = 4445 }
                       ]
                       [ V4-Transport-Address =
                           { Framed-IP-Address = 10.0.0.1 }
                           { Port-Number = 17462 }
                       ]
                       [ V4-Transport-Address =
```

ETSI

Step	Protocol	Interface	From	To	Message

					`{ Framed-IP-Address = 192.168.0.1 }`
					`{ Port-Number = 31444 }`
					`]`
					`[ V4-Transport-Address =`
					`{ Framed-IP-Address = 10.0.0.1 }`
					`{ Port-Number = 17463 }`
					`]`
					`[ V4-Transport-Address =`
					`{ Framed-IP-Address = 192.168.0.1 }`
					`{ Port-Number = 31445 }`
					`]`
					`]`
					`]`
					`[ Authorization-Lifetime = 450 ]`
					`{ Auth-Grace-Period = 10 }`

88	SIP		P-CSCF A	UE A	200 OK (SDP)

					`SIP/2.0 200 OK`
					`Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03`
					`Max-Forwards: 67`
					`From: User A <sip:user_a@example.com>;tag=372183`
					`To: MF <sip:mf_b@example.com>`
					`Call-ID: 398174293@ue-a.example.com`
					`CSeq: 2 INVITE`
					`Contact: <sip:mf_b@mf-b.example.com>`
					`Content-Type: application/sdp`
					`Content-Length: 129`
					
					`v=0`
					`o=mf_b 29381748101 2948193018 IN IP4 mf-b.example.com`
					`s=-`
					`c=IN IP4 192.168.0.1`
					`t=0 0`
					`m=audio 34444 tcp iptv_rtsp`
					`a=sendrecv`
					`a=setup:passive`
					`a=connection:existing`
					`m=audio 4444 RTP/AVP 0`
					`b=AS:512`
					`a=sendonly`
					`m=video 31444 RTP/AVP 31`
					`b=AS:4096`
					`a=rtpmap:31 H261/90000`
					`a=sendonly`

89	SIP		UE A	P-CSCF A	ACK

					`ACK sip:mf_b@example.com SIP/2.0`
					`Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03`
					`Max-Forwards: 70`
					`Route: <sip:p-cscf-a.example.com;lr>,<sip:s-cscf.example.com;lr>,<sip:p-cscf-b.example.com;lr>`
					`From: User A <sip:user_a@example.com>;tag=348123`
					`To: MF <sip:mf_b@example.com>`
					`Call-ID: 398174293@ue-a.example.com`
					`CSeq: 2 ACK`
					`Content-Length: 0`

90	SIP		P-CSCF A	S-CSCF	ACK

					`ACK sip:mf_b@example.com SIP/2.0`
					`Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml`
					`Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03`
					`Max-Forwards: 69`
					`Route: <sip:s-cscf.example.com;lr>,<sip:p-cscf-b.example.com;lr>`
					`From: User A <sip:user_a@example.com>;tag=348123`
					`To: MF <sip:mf_b@example.com>`
					`Call-ID: 398174293@ue-a.example.com`
					`CSeq: 2 ACK`
					`Content-Length: 0`

Step	Protocol	Interface	From	To	Message
91	SIP		S-CSCF	P-CSCF B	ACK

```
ACK sip:mf_b@example.com SIP/2.0
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP ue-a.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 68
Route: <sip:p-cscf-b.example.com;lr>
From: User A <sip:user_a@example.com>;tag=348123
To: MF <sip:mf_b@example.com>
Call-ID: 398174293@ue-a.example.com
CSeq: 2 ACK
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
92	SIP		P-CSCF B	MF	ACK

```
ACK sip:mf_b@example.com SIP/2.0
Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bKs1pp0
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar
Via: SIP/2.0/UDP p-cscf-a.example.com:5060;branch=z9hG4bKvp2yml
Via: SIP/2.0/UDP ue-a.example.com:5060; branch=z9hG4bK74b03
Max-Forwards: 67
From: User A <sip:user_a@example.com>;tag=348123
To: MF <sip:mf_b@example.com>
Call-ID: 398174293@ue-a.example.com
CSeq: 2 ACK
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
93	RTSP		UE A	MF	PLAY

```
PLAY rtsp://media.example.com RTSP/1.0
CSeq: 4
Session: 11111111
Range: npt=0-
```

Step	Protocol	Interface	From	To	Message
94	RTSP		MF	UE A	200 OK

```
RTSP/1.0 200 OK
CSeq: 4
Session: 11111111
Range: npt=0-100
RTP-Info: url=rtsp:// media.example.com;seq=232433;rtptime=148274937
```

6.4 Traffic policy activation request -PULL mode

Figure 6.4.1 illustrates the example network architecture.

Figure 6.4.1: Traffic policy request -PULL mode

The addresses and ports used in the example are as follows:

- A_1 = 192.168.0.2:23942 for RTP and 192.168.0.2:23943 for RTCP.

- B_1 = 192.168.1.2:29792 for RTP and 192.168.1.2:29793 for RTCP.

6.4.1   Policy activation

Figure 6.4.1.1: Traffic policy activation request signalling chart -PULL mode

Table 6.4.1.1: Traffic policy activation request messages chart -PULL mode

Step	Protocol	Interface	From	To	Message
1	DIAMETER	Re	RCEF A	A-RACF A	CCR

```
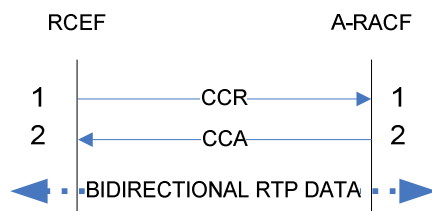<CC-Request> ::=< Diameter Header: 272, REQ, PXY >
              < Session-Id = "rcef-a.example.com;13815C;391" >
              { Origin-Host = "rcef-a.example.com" }
              { Origin-Realm = "example.com " }
              { Destination-Realm = "example.com " }
              { Auth-Application-Id = 16777253 (Re) }
              { Service-Context-Id = "service_1@drcef-a.example.com" }
              { CC-Request-Type = "INITIAL_REQUEST" }
              { CC-Request-Number = 0 }
              [ Logical-Access-Id = "ue_a" ]
              [ Flow-Description = "permit out 17 from 192.168.1.2 29792
                                               to 192.168.0.2 23942" ]
              [ Flow-Description = "permit in 17 from 192.168.0.2 23942
                                               to 192.168.1.2 29792" ]
              [ Flow-Description = "permit out 17 from 192.168.1.2 29793
                                               to 192.168.0.2 23943" ]
              [ Flow-Description = "permit in 17 from 192.168.0.2 23943
                                               to 192.168.1.2 29793" ]

              [ QoS-Information =
                 [ Max-Requested-Bandwidth-UL = 104000 ]
                 [ Max-Requested-Bandwidth-DL = 104000 ]
              ]
```

2	DIAMETER	Re	A-RACF A	RCEF A	CCA

```
<CC-Answer> ::= < Diameter Header: 272, PXY >
              < Session-Id = "rcef-a.example.com;13815C;391" >
              { Origin-Host = "a-racf-a.example.com" }
              { Origin-Realm = "example.com " }
              { Auth-Application-Id = 16777253 (Re) }
              { Result-Code = DIAMETER_SUCCESS (2001) }
              { CC-Request-Type = "INITIAL_REQUEST" }
              { CC-Request-Number = 0 }
              [ Policy-Rule-Install =
                 [ Policy-Rule-Definition =
                    { Policy-Rule-Name = "policy-rule-example-pull-UL" }
                    [ Flow-Status = ENABLED-UPLINK (0) ]
                    [ QoS-Information =
                            [ ToS-Traffic-Class = 101110 ]
                    ]
                    [ Precedence = 1]
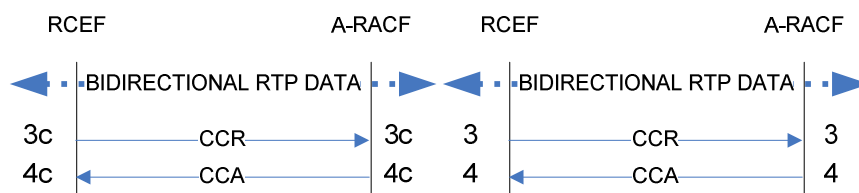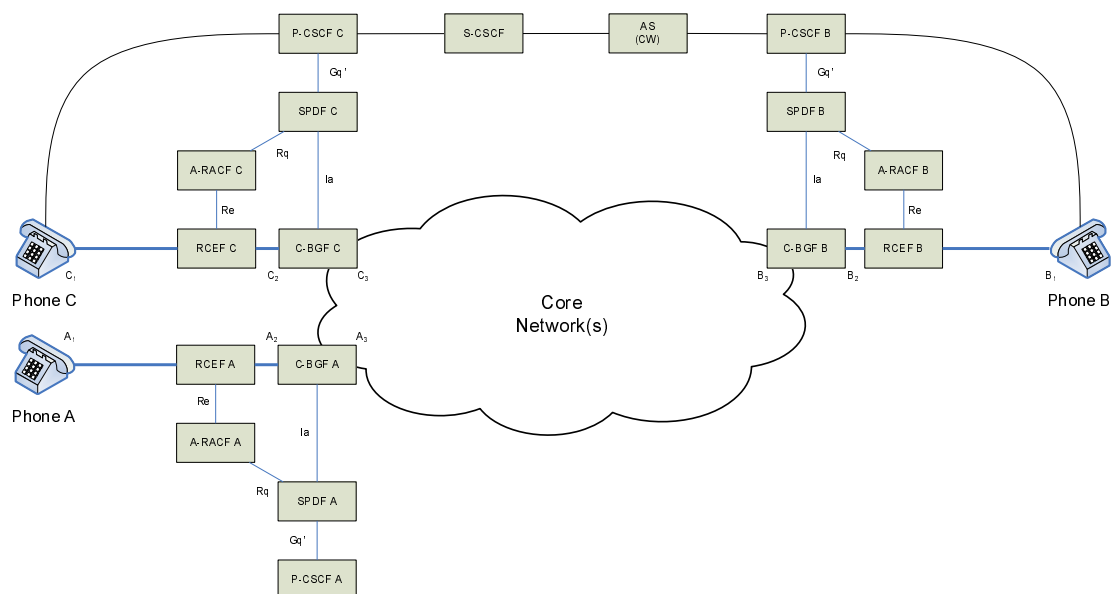                 ]
              ]
              [ Policy-Rule-Install =
                 [ Policy-Rule-Definition =
                    { Policy-Rule-Name = "policy-rule-example-pull-DL" }
                    [ Flow-Status = ENABLED-DOWNLINK (1) ]
                    [ QoS-Information =
                       [ ToS-Traffic-Class = 101110 ]
                    ]
                    [ Precedence = 1]
                 ]
              ]
```

6.4.2 Policy deactivation

Figure 6.4.2.1: Traffic policy deactivation request signalling chart -PULL mode

Table 6.4.2.1: Traffic policy deactivation request messages chart -PULL mode

Step	Protocol	Interface	From	To	Message
3	DIAMETER	Re	RCEF A	A-RACF A	CCR

```
    <CC-Request> ::=< Diameter Header: 272, REQ, PXY >
                    < Session-Id = "rcef-a.example.com;13815C;391" >
                    { Origin-Host = "rcef-a.example.com" }
                    { Origin-Realm = "example.com " }
                    { Destination-Realm = "example.com " }
                    { Auth-Application-Id = 16777253 (Re) }
                    { Service-Context-Id = "service_1@drcef-a.example.com" }
                    { CC-Request-Type = "TERMINATION_REQUEST" }
                    { CC-Request-Number = 1 }
                    [ Logical-Access-Id = "ue_a" ]
```

Step	Protocol	Interface	From	To	Message
4	DIAMETER	Re	A-RACF A	RCEF A	CCA

```
    <CC-Answer> ::= < Diameter Header: 272, PXY >
                    < Session-Id = "rcef-a.example.com;13815C;391" >
                    { Origin-Host = "a-racf-a.example.com" }
                    { Origin-Realm = "example.com " }
                    { Auth-Application-Id = 16777253 (Re) }
                    { Result-Code = DIAMETER_SUCCESS (2001) }
                    { CC-Request-Type = "TERMINATION_REQUEST" }
                    { CC-Request-Number = 1 }
                    [ Policy-Rule-Remove =
                        [ Policy-Rule-Name = "policy-rule-example-pull-UL" ]
                        [ Policy-Rule-Name = "policy-rule-example-pull-DL" ]
                    ]
```

6.5 Communication Waiting

Figure 6.5.1: Communication Waiting Scenario network architecture

The communication waiting scenario call flow uses the above network architecture. User C calls User B while User A and User B has a session in progress. An Application Server, AS(CW), inserts a communication waiting indication XML tag in the SDP sent to Phone B when the AS detects a Network Determined User Busy (NDUB) condition.

Addresses and ports used in the example are as follows:

- B_1 = 192.168.1.2:25552 for RTP and 192.168.1.2:25553 for RTCP.

- B_2 = 192.168.1.1:32124 for RTP and 192.168.1.1:32125 for RTCP.

- B_3 = 10.0.0.2:16120 for RTP and 10.0.0.2:16121 for RTCP.

- C_3 = 10.0.0.3:33942 for RTP and 10.0.0.3:33943 for RTCP.

NOTE: Details are omitted on the C side. Address/port combinations C_2 and C_1 are therefore not used/shown in this example.

Note: Figure 6.5.2 is simplified. Only network elements on the B side are shown in detail. Communication between Phone C and P-CSCF C is omitted. Regular procedures between P-CSCF C and RACS elements in domain C apply but are omitted for brevity. Application Server AS is a SIP proxy or B2BUA providing Communication Waiting indication functionality as described in [16], clause 4 in the event of NDUB (Network Determined User Busy) condition.

Figure 6.5.2: IMS end-to-end signalling chart between two SIP end-points -communication waiting

Table 6.5.1: IMS end-to-end messages between two SIP end-points -communication waiting

Step	Protocol	Interface	From	To	Message
48	SIP	Mw	P-CSCF C	S-CSCF	INVITE B
Phone A has established a session with Phone B with active RTP data. Phone C calls Phone B. An invite is sent from Phone C and bandwidth is reserved in Phone C's access network according to the procedures described in clause 6.1.1.						

```
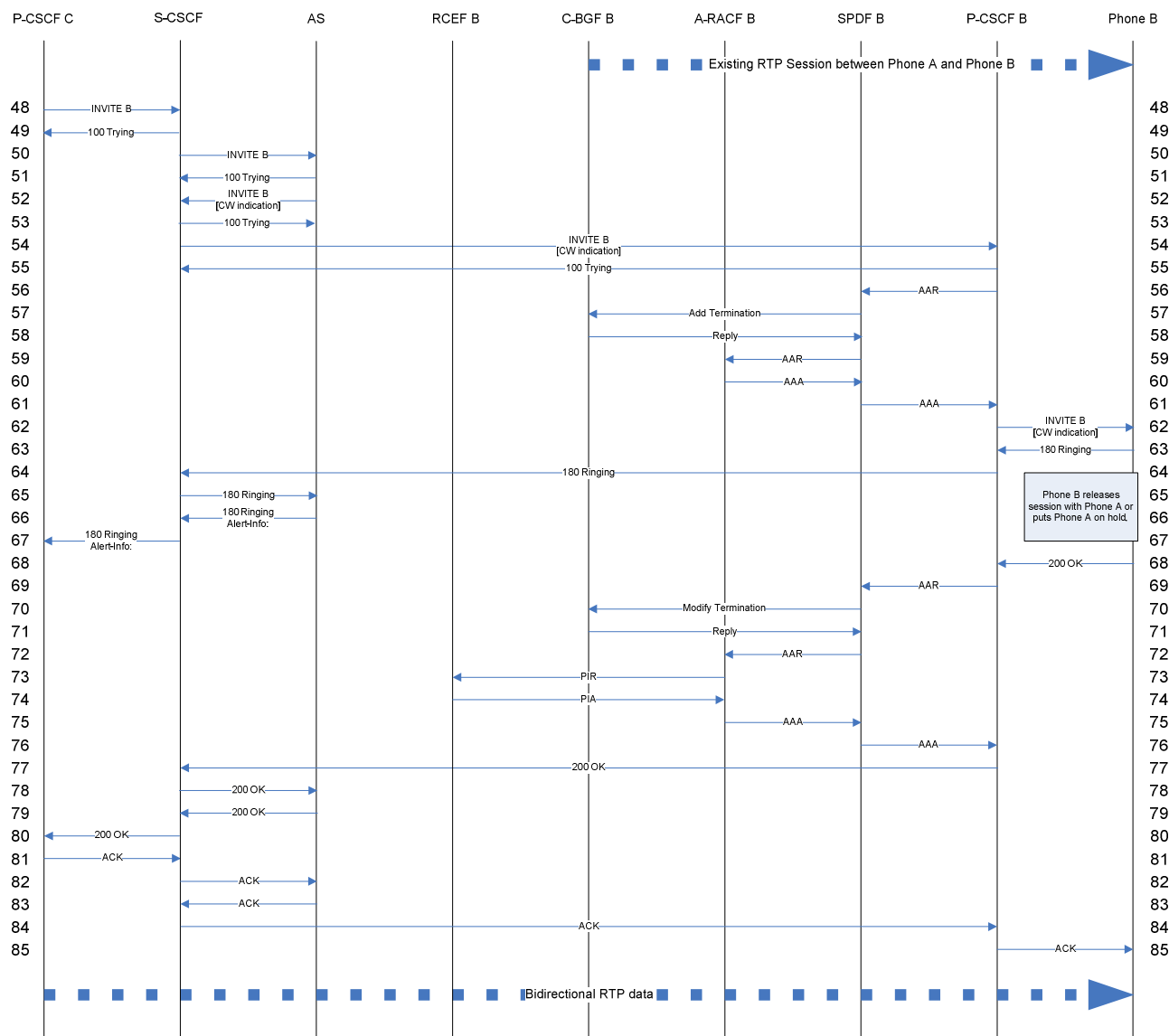    INVITE sip:user_b@example.com SIP/2.0
    Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b
    Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9
    Max-Forwards: 69
    Route: <sip:p-cscf-c.example.com;lr>,<sip:phone-c.example.com;lr>
    From: User C <sip:user_c@example.com>;tag=372183
    To: User B <sip:user_b@example.com>
    Call-ID: 88490-3838@phone-c.example.com
    CSeq: 1 INVITE
    Contact: <sip:user_c@phone-c.example.com>
    Content-Type: application/sdp
    Content-Length: (…)
```

Step	Protocol	Interface	From	To	Message
| | | | | | ```
v=0
o=user_c 2890844526 2890842807 IN IP4 phone-c.example.com
s=-
c=IN IP4 10.0.0.3
t=0 0
m=audio 33942 RTP/AVP 0
a=sendrecv
b=AS:96000
``` |
| 49 | SIP | Mw | S-CSCF | P-CSCF | 100 Trying |
| | | | | | ```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b
Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9
From: User C <sip:user_c@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 88490-3838@phone-c.example.com
CSeq: 1 INVITE
Content-Length: 0
``` |
| 50 | SIP | Mw | S-CSCF | AS | INVITE |
| | | | | | ```
INVITE sip:user_b@example.com SIP/2.0
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b
Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9
Max-Forwards: 68
Route: <sip:s-cscf.example.com;lr>,<sip:p-cscf-c.example.com;lr>,<sip:phone-c.example.com;lr>
From: User C <sip:user_c@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 88490-3838@phone-c.example.com
CSeq: 1 INVITE
Contact: <sip:user_c@phone-c.example.com>
Content-Type: application/sdp
Content-Length: (…)

v=0
o=user_c 2890844526 2890842807 IN IP4 phone-c.example.com
s=-
c=IN IP4 10.0.0.3
t=0 0
m=audio 33942 RTP/AVP 0
a=sendrecv
b=AS:96000
``` |
| 51 | SIP | Mw | AS | S-CSCF | 100 Trying |
| | | | | | ```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b
Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9
From: User C <sip:user_c@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 88490-3838@phone-c.example.com
CSeq: 1 INVITE
Content-Length: 0
``` |

Step	Protocol	Interface	From	To	Message
52	SIP	Mw	AS	S-CSCF	INVITE (CW Indication)

The Application Server has determined an approaching NDUB (Network Determined User Busy) condition and inserts a Communications Waiting indication in the request before sending it to the S-CSCF.

```
INVITE sip:user_b@example.com SIP/2.0
Via: SIP/2.0/UDP as.example.com:5060;branch=z9hG4bK80c3bb6b24e50
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b
Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9
Max-Forwards: 67
Route: <sip:as.example.com;lr>,<sip:s-cscf.example.com;lr>,<sip:p-cscf-
c.example.com;lr>,<sip:phone-c.example.com;lr>
From: User C <sip:user_c@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 88490-3838@phone-c.example.com
CSeq: 1 INVITE
Contact: <sip:user_c@phone-c.example.com>
Accept: application/sdp,application/3gpp-ims+xml
Content-Type: multipart/mixed;boundary="boundary1"
Content-Length: (…)

--boundary1
Content-Type: application/sdp

v=0
o=user_c 2890844526 2890842807 IN IP4 phone-c.example.com
s=-
c=IN IP4 10.0.0.3
t=0 0
m=audio 33942 RTP/AVP 0
a=sendrecv
b=AS:96000
--boundary1
Content-Type: application/3gpp-ims+xml
Content_Disposition: 3gpp-alternative-service

<3gpp-ims version="1">
  <alternative-service>
    <type/>
    <reason/>
    <action>
      <call-waiting-indication/>
    </action>
  </alternative-service>
</3gpp-ims>
--boundary1--
```

| 53 | SIP | Mw | S-CSCF | AS | 100 Trying |

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP as.example.com:5060;branch=z9hG4bK80c3bb6b24e50
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b
Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9
From: User C <sip:user_c@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 88490-3838@phone-c.example.com
CSeq: 1 INVITE
Content-Length: 0
```

| 54 | SIP | Mw | S-CSCF | P-CSCF B | INVITE (CW Indication) |

```
INVITE sip:user_b@example.com SIP/2.0
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
Via: SIP/2.0/UDP as.example.com:5060;branch=z9hG4bK80c3bb6b24e50
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b
Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9
Max-Forwards: 66
Route: <sip:s-cscf.example.com;lr>,<sip:as.example.com;lr>,<sip:s-cscf.example.com;lr>,<sip:p-
cscf-c.example.com;lr>,<sip:phone-c.example.com;lr>
From: User C <sip:user_c@example.com>;tag=372183
To: User B <sip:user_b@example.com>
Call-ID: 88490-3838@phone-c.example.com
CSeq: 1 INVITE
Contact: <sip:user_c@phone-c.example.com>
```

Step	Protocol	Interface	From	To	Message
					Accept: application/sdp,application/3gpp-ims+xml Content-Type: multipart/mixed;boundary="boundary1" Content-Length: (…) --boundary1 Content-Type: application/sdp v=0 o=user_c 2890844526 2890842807 IN IP4 phone-c.example.com s=- c=IN IP4 10.0.0.3 t=0 0 m=audio 33942 RTP/AVP 0 a=sendrecv b=AS:96000 --boundary1 Content-Type: application/3gpp-ims+xml Content_Disposition: 3gpp-alternative-service <3gpp-ims version="1"> <alternative-service> <type/> <reason/> <action> <call-waiting-indication/> </action> </alternative-service> </3gpp-ims> **--boundary1--**
55	SIP	Mw	P-CSCF B	S-CSCF	100 Trying
					SIP/2.0 100 Trying Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51 Via: SIP/2.0/UDP as.example.com:5060;branch=z9hG4bK80c3bb6b24e50 Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51 Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9 From: User C <sip:user_c@example.com>;tag=372183 To: User B <sip:user_b@example.com> Call-ID: 88490-3838@phone-c.example.com CSeq: 1 INVITE Content-Length: 0
56	Diameter	Gq'	P-CSCF B	SPDF B	AAR

Triggered by the presence of the CW indication in the SIP INVITE, the P-CSCF inserts the Overbooking-Indicator AVP (AVP Code 460) set to the value OVERBOOKING_MODE_REQUIRED (1) into the AAR indicating that no extra resources are required for this session since Phone B must either release the ongoing call or put the ongoing call on hold in order to establish the session requested by Phone C.

NOTE 1: Bandwidth resources on the path shared for both sessions between from User B to any of User A and User C are not booked twice due to the presence of the Overbooking-Indication AVP in the AAR below. Neither are they relinquished if User B releases the session with User A to respond to User C's invite.

```
<AA-Request> ::=< Diameter Header: 265, REQ, PXY >
              < Session-Id = "p-cscf-b.example.com;481C43;583" >
              { Auth-Application-Id = 16777222 (Gq) }
              { Origin-Host = "p-cscf-b.example.com" }
              { Origin-Realm = "example.com" }
              { Destination-Realm = "example.com" }
              [ Destination-Host = spdf-b@example.com ]
              [ Media-Component-Description =
                    { Media-Component-Number = 2 }
                    [ Media-Sub-Component =
                        { Flow-Number = 1 }
                        [ Flow-Description = "permit in 17 from any to any" ]
                        [ Flow-Description = "permit out 17 from any to any" ]
                        [ Flow-Usage = NO_INFORMATION(0) ]
                        [ Max-Requested-Bandwidth-UL = 96000 ]
                        [ Max-Requested-Bandwidth-DL = 96000 ]
                    ]
                    [ Media-Sub-Component =
                        { Flow-Number = 2 }
                        [ Flow-Description = "permit in 17 from any to any" ]
                        [ Flow-Description = "permit out 17 from any to any" ]
```

Step	Protocol	Interface	From	To	Message
					`[ Flow-Usage = RTCP (1) ]`
					`[ Max-Requested-Bandwidth-UL = 8000 ]`
					`[ Max-Requested-Bandwidth-DL = 8000 ]`

```
                                ]
                        [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                        [ Media-Type = AUDIO (0) ]
                        [ Flow-Status = DISABLED ]
                        [ Reservation-Priority = DEFAULT (0) ]
                        [ Codec-Data = "downlink
                              Offer
                              m=audio 33942 RTP/AVP 0
                        ]
                 ]
                 [ Binding-Information =
                        { Binding-Input-List =
                              [ V4-Transport-Address =
                                    { Framed-IP-Address = 0.0.0.0 }
                                    { Port-Number = 0 }
                              ]
                              [ V4-Transport-Address =
                                    { Framed-IP-Address = 10.0.0.3 }
                                    { Port-Number = 33942 }
                              ]
                              [ V4-Transport-Address =
                                    { Framed-IP-Address = 0.0.0.0 }
                                    { Port-Number = 0 }
                              ]
                              [ V4-Transport-Address =
                                    { Framed-IP-Address = 10.0.0.3 }
                                    { Port-Number = 33943 }
                              ]
                        }
                 ]
                 [ Reservation-Priority = DEFAULT (0) ]
                 [ Globally-Unique-Address =
                        [ Framed-IP-Address = 192.168.1.2 ]
                        [ Address-Realm = "example.com" ]
                 ]
                 [ Authorization-Lifetime = 450 ]
                 [ Overbooking-Indicator = OVERBOOKING_MODE_REQUIRED (1) ]
```

57	H.248	Ia	SPDF B	C-BGF B	Add Termination

```
   MEGACO/3 [spdf-b.example.com]:43924
   Transaction = 3 {
        Context = $ {
           Add = ip/1/$/$ {
               Media {
                   Stream = 1 {
                       LocalControl {
                           ipdc/realm = "B",
                           gm/rsb = ON
                       }
                       Local {
                           v=0
                           c=IN IP4 $
                           m=audio $ RTP/AVP 0
                           a=rtpmap:0 PCMU/8000
                       }
                   } /* Stream */
               } /* Media */
           } /* Add */
           Add = ip/1/$/$ {
               Media {
                   Stream = 1 {
                       LocalControl {
                           ipdc/realm = "Core",
                           gm/rsb = ON
                       }
                       Local {
                           v=0
                           c=IN IP4 $
                           m=audio $ RTP/AVP 0
                           a=rtpmap:0 PCMU/8000
                       },
                       Remote {
                           v=0
                           o=- 0 0 IN IP4 10.0.0.3
```

Step	Protocol	Interface	From	To	Message
					s=-
					t=0 0
					c=IN IP4 10.0.0.3
					m=audio 33942 RTP/AVP 0
					a=rtpmap:0 PCMU/8000
					}
					} /* Stream */
					} /* Media */
					} /* Add */
					} /* Context */
					} /* Transaction */

58	H.248	Ia	C-BGF B	SPDF B	Add (reply)

```
    MEGACO/3 [abgf-b.example.com]:43924
    Reply = 3 {
         Context = 2 {
            Add = ip/1/if1/2{
               Media {
                   Stream = 1 {
                       LocalControl {
                           ipdc/realm = "B",
                           gm/rsb = ON
                       }
                       Local {
                          v=0
                          o=- 0 0 IN IP4 192.168.1.1
                          s=-
                          t=0 0
                          c=IN IP4 192.168.1.1
                          m=audio 32124 RTP/AVP 0
                          a=rtpmap:0 PCMU/8000
                       }
                   } /* Stream */
               } /* Media */
            } /* Add */
            Add = ip/1/if2/2{
               Media {
                   Stream = 1 {
                       LocalControl {
                           ipdc/realm = "Core",
                           gm/rsb = ON
                       }
                       Local {
                          v=0
                          o=- 0 0 IN IP4 10.0.0.2
                          s=-
                          t=0 0
                          c=IN IP4 10.0.0.2
                          m=audio 16120 RTP/AVP 0
                          a=rtpmap:0 PCMU/8000
                       },
                       Remote {
                          v=0
                          o=- 0 0 IN IP4 10.0.0.3
                          s=-
                          t=0 0
                          c=IN IP4 10.0.0.3
                          m=audio 33942 RTP/AVP 0
                          a=rtpmap:0 PCMU/8000
                       }
                   } /* Stream */
               } /* Media */
            } /* Add */
         } /* Context */
    } /* Reply */
```

59	Diameter	Rq	SPDF B	A-RACF B	AAR

```
    <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                    < Session-Id = "spdf-b.example.com;41295;512" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "spdf-b.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    [ Destination-Host = aracf-b@example.com ]
```

Step	Protocol	Interface	From	To	Message
					[Media-Component-Description =

```
                          [ Media-Component-Description =
                              { Media-Component-Number = 2 }
                              [ Media-Sub-Component =
                                  { Flow-Number = 1 }
                                  [ Flow-Description = "permit in 17 from any to 192.168.1.1 32124" ]
                                  [ Flow-Description = "permit out 17 from any to any" ]
                                  [ Flow-Usage = NO_INFORMATION(0) ]
                                  [ Max-Requested-Bandwidth-UL = 96000 ]
                                  [ Max-Requested-Bandwidth-DL = 96000 ]
                              ]
                              [ Media-Sub-Component =
                                  { Flow-Number = 2 }
                                  [ Flow-Description = "permit in 17 from any to 192.168.1.1 32125" ]
                                  [ Flow-Description = "permit out 17 from any to any" ]
                                  [ Flow-Usage = RTCP (1) ]
                                  [ Max-Requested-Bandwidth-UL = 8000 ]
                                  [ Max-Requested-Bandwidth-DL = 8000 ]
                              ]
                              [ AF-Application-Identifier = "RQ_SAMPLE_APP"]
                              [ Media-Type = AUDIO (1) ]
                              [ Flow-Status = DISABLED ]
                              [ Reservation-Priority = DEFAULT (0) ]
                          ]
                          [ Reservation-Priority = DEFAULT (0) ]
                          [ Globally-Unique-Address =
                              [ Framed-IP-Address = 192.168.1.2 ]
                              [ Address-Realm = "example.com" ]
                          ]
                          [ Authorization-Lifetime = 450 ]
                          [ Overbooking-Indicator = OVERBOOKING_MODE_REQUIRED (1) ]
```

60	Diameter	Rq	A-RACF B	SPDF B	AAA

```
    <AA-Answer> ::= < Diameter Header: 265, PXY >
                    < Session-Id = "spdf-b.example.com;41295;512" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "aracf-b.example.com" }
                    { Origin-Realm = "example.com" }
                    [ Result-Code = DIAMETER_SUCCESS (2001) ]
                    [ Authorization-Lifetime = 450 ]
                    [ Auth-Grace-Period = 10 ]
```

61	DIAMETER	Gq'	SPDF B	P-CSCF B	AAA

```
    <AA-Answer> ::= < Diameter Header: 265, PXY >
                    < Session-Id = "p-cscf-b.example.com;481C43;583" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "spdf-b.example.com" }
                    { Origin-Realm = "example.com" }
                    [ Result-Code = DIAMETER_SUCCESS (2001) ]
                    [ Binding-Information =
                        { Binding-Input-List =
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 0.0.0.0 }
                                { Port-Number = 0 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 10.0.0.3 }
                                { Port-Number = 33942 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 0.0.0.0 }
                                { Port-Number = 0 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 10.0.0.3 }
                                { Port-Number = 33943 }
                            ]
                        }
                        [ Binding-Output-List =
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 0.0.0.0 }
                                { Port-Number = 0 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 192.168.1.1 }
                                { Port-Number = 32124 }
```

Step	Protocol	Interface	From	To	Message
					] [V4-Transport-Address = { Framed-IP-Address = 0.0.0.0 } { Port-Number = 0 }] [V4-Transport-Address = { Framed-IP-Address = 192.168.1.1 } { Port-Number = 32125 }]] [Authorization-Lifetime = 450] [Auth-Grace-Period = 10]
62	SIP	Gm	P-CSCF B	Phone B	INVITE (CW indication)

Recognizing the 3GPP IMS XML Communication Waiting indication, phone B sounds an alert or presents User B with a visible indication that either a termination of the current session with User A is required or User B needs to put User A on hold in order to accept the invite from User C.

NOTE 2:   The action taken by User B (and corresponding signalling) is not shown here. If User B puts User A on hold, allocated resources unique for the session with User A will become inactive. If User B releases the call, allocated resources unique for the session with user A will be relinquished.

```
    INVITE sip:user_b@example.com SIP/2.0
    Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bK74b03
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
    Via: SIP/2.0/UDP as.example.com:5060;branch=z9hG4bK80c3bb6b24e50
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
    Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b
    Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9
    Max-Forwards: 65
    Record-Route: <sip:p-cscf-b.example.com;lr>,<sip:s-
cscf.example.com;lr>,<sip:as.example.com;lr>,<sip:s-cscf.example.com;lr>,<sip:p-cscf-
c.example.com;lr>,<sip:phone-c.example.com;lr>
    From: User C <sip:user_c@example.com>;tag=372183
    To: User B <sip:user_b@example.com>
    Call-ID: 88490-3838@phone-c.example.com
    CSeq: 1 INVITE
    Contact: <sip:user_c@phone-c.example.com>
    Accept: application/sdp,application/3gpp-ims+xml
    Content-Type: multipart/mixed;boundary="boundary1"
    Content-Length: (…)

    --boundary1
    Content-Type: application/sdp

    v=0
    o=user_c 2890844526 2890842807 IN IP4 phone-c.example.com
    s=-
    c=IN IP4 192.168.1.1
    t=0 0
    m=audio 32124 RTP/AVP 0
    a=sendrecv
    b=AS:96000
    --boundary1
    Content-Type: application/3gpp-ims+xml
    Content_Disposition: 3gpp-alternative-service

    <3gpp-ims version="1">
      <alternative-service>
        <type/>
        <reason/>
        <action>
          <call-waiting-indication/>
        </action>
      </alternative-service>
    </3gpp-ims>
    --boundary1--
```

Step	Protocol	Interface	From	To	Message
63	SIP	Gm	Phone B	P-CSCF B	180 Ringing

```
   SIP/2.0 180 Ringing
   Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bK74b03
   Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
   Via: SIP/2.0/UDP as.example.com:5060;branch=z9hG4bK80c3bb6b24e50
   Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
   Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b
   Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9
   Record-Route: <sip:p-cscf-b.example.com;lr>,<sip:s-
cscf.example.com;lr>,<sip:as.example.com;lr>,<sip:s-cscf.example.com;lr>,<sip:p-cscf-
c.example.com;lr>,<sip:phone-c.example.com;lr>
   From: User C <sip:user_c@example.com>;tag=372183
   To: User B <sip:user_b@example.com>
   Call-ID: 88490-3838@phone-c.example.com
   Contact: <sip:user_b@phone-b.example.com>
   CSeq: 1 INVITE
   Content-Type: application/sdp
   Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
64	SIP	Mw	P-CSCF B	S-CSCF	180 Ringing

```
   SIP/2.0 180 Ringing
   Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
   Via: SIP/2.0/UDP as.example.com:5060;branch=z9hG4bK80c3bb6b24e50
   Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
   Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b
   Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9
   Record-Route: <sip:s-cscf.example.com;lr>,<sip:as.example.com;lr>,<sip:s-
cscf.example.com;lr>,<sip:p-cscf-c.example.com;lr>,<sip:phone-c.example.com;lr>
   From: User C <sip:user_c@example.com>;tag=372183
   To: User B <sip:user_b@example.com>
   Call-ID: 88490-3838@phone-c.example.com
   Contact: <sip:user_b@phone-b.example.com>
   CSeq: 1 INVITE
   Content-Type: application/sdp
   Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
65	SIP	Mw	S-CSCF	AS	180 Ringing

```
   SIP/2.0 180 Ringing
   Via: SIP/2.0/UDP as.example.com:5060;branch=z9hG4bK80c3bb6b24e50
   Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
   Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b
   Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9
   Record-Route: <sip:as.example.com;lr>,<sip:s-cscf.example.com;lr>,<sip:p-cscf-
c.example.com;lr>,<sip:phone-c.example.com;lr>
   From: User C <sip:user_c@example.com>;tag=372183
   To: User B <sip:user_b@example.com>
   Call-ID: 88490-3838@phone-c.example.com
   Contact: <sip:user_b@phone-b.example.com>
   CSeq: 1 INVITE
   Content-Type: application/sdp
   Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
66	SIP	Mw	AS	S-CSCF	180 Ringing (Alert-Info:)

```
   SIP/2.0 180 Ringing
   Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
   Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b
   Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9
   Record-Route: <sip:s-cscf.example.com;lr>,<sip:p-cscf-c.example.com;lr>,<sip:phone-
c.example.com;lr>
   From: User C <sip:user_c@example.com>;tag=372183
   To: User B <sip:user_b@example.com>
   Call-ID: 88490-3838@phone-c.example.com
   Contact: <sip:user_b@phone-b.example.com>
   CSeq: 1 INVITE
   Content-Type: application/sdp
   Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
67	SIP	Mw	S-CSCF	P-CSCF C	180 Ringing (Alert-Info:)
NOTE 3:	The last 180 Ringing from P-CSCF C to Phone C is omitted.				

```
    SIP/2.0 180 Ringing
    Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b
    Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9
    Record-Route: <sip:p-cscf-c.example.com;lr>,<sip:phone-c.example.com;lr>
    From: User C <sip:user_c@example.com>;tag=372183
    To: User B <sip:user_b@example.com>
    Call-ID: 88490-3838@phone-c.example.com
    Contact: <sip:user_b@phone-b.example.com>
    CSeq: 1 INVITE
    Content-Type: application/sdp
    Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
68	SIP	Gm	Phone B	P-CSCF B	200 OK (SDP)
NOTE 4:	User B has either released the session with User A or put User A on hold. Details are omitted for brevity.				

```
    SIP/2.0 200 OK
    Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bK74b03
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
    Via: SIP/2.0/UDP as.example.com:5060;branch=z9hG4bK80c3bb6b24e50
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
    Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b
    Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9
    Record-Route: <sip:p-cscf-b.example.com;lr>,<sip:s-
cscf.example.com;lr>,<sip:as.example.com;lr>,<sip:s-cscf.example.com;lr>,<sip:p-cscf-
c.example.com;lr>,<sip:phone-c.example.com;lr>
    From: User C <sip:user_c@example.com>;tag=372183
    To: User B <sip:user_b@example.com>
    Call-ID: 88490-3838@phone-c.example.com
    CSeq: 1 INVITE
    Contact: <sip:user_b@phone-b.example.com>
    Content-Type: application/sdp
    Content-Length: (…)

    v=0
    o=user_b 29381748101 2948193018 IN IP4 phone-b.example.com
    s=-
    c=IN IP4 192.168.1.2
    t=0 0
    m=audio 25552 RTP/AVP 0
    a=sendrecv
    b=AS:96000
```

Step	Protocol	Interface	From	To	Message
69	DIAMETER	Gq'	P-CSCF B	SPDF B	AAR (Modify)

```
    <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                    < Session-Id = "p-cscf-b.example.com;481C43;583" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "p-cscf-b.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    [ Destination-Host = spdf-b@example.com ]
                    [ Media-Component-Description =
                            { Media-Component-Number = 1 }
                            [ Media-Sub-Component =
                                { Flow-Number = 1 }
                                [ Flow-Description = "permit out 17 from any to 192.168.1.2 25552" ]
                                [ Flow-Description = "permit in 17 from any to 192.168.1.1 32124" ]
                                [ Flow-Usage = NO_INFORMATION(0) ]
                                [ Max-Requested-Bandwidth-DL = 96000 ]
                                [ Max-Requested-Bandwidth-UL = 96000 ]
                            ]
                            [ Media-Sub-Component =
                                { Flow-Number = 2 }
                                [ Flow-Description = "permit out 17 from any to 192.168.1.2 25553" ]
                                [ Flow-Description = "permit in 17 from any to 192.168.1.1 32123" ]
                                [ Flow-Usage = RTCP (1) ]
                                [ Max-Requested-Bandwidth-DL = 8000 ]
                                [ Max-Requested-Bandwidth-UL = 8000 ]
                            ]
                            [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                            [ Media-Type = AUDIO (0) ]
                            [ Flow-Status = ENABLED ]
```

Step	Protocol	Interface	From	To	Message
					[Reservation-Priority = DEFAULT (0)] [Codec-Data = "uplink answer m=audio 25552 RTP/AVP 0 a=rtpmap:0 PCMU/8000] [Codec-Data = "downlink offer m=audio 32124 RTP/AVP 0 a=rtpmap:0 PCMU/8000]] [Binding-Information = { Binding-Input-List = [V4-Transport-Address = { Framed-IP-Address = 192.168.1.2 } { Port-Number = 25552 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.3 } { Port-Number = 33942 }] [V4-Transport-Address = { Framed-IP-Address = 192.168.1.2 } { Port-Number = 25553 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.3 } { Port-Number = 33943 }] }] [Reservation-Priority = DEFAULT (0)] [Globally-Unique-Address = [Framed-IP-Address = 192.168.1.2] [Address-Realm = "example.com"]] [Authorization-Lifetime = 450]
70	H.248	Ia	SPDF B	C-BGF B	Modify terminations

```
MEGACO/3 [spdf-b.example.com]:43924
Transaction = 4 {
     Context = 2 {
        Modify = ip/1/if1/2 {
           Media {
              Stream = 1 {
                 LocalControl {
                    ipdc/realm = "B",
                    gm/rsb = ON,
                    mode = SendReceive
                 },
                 Local {
                    v=0
                    o=- 0 0 IN IP4 192.168.1.1
                    s=-
                    t=0 0
                    c=IN IP4 192.168.1.1
                    m=audio 32124 RTP/AVP 0
                    a=rtpmap:0 PCMU/8000
                 }
                 Remote {
                    v=0
                    o=- 0 0 IN IP4 192.168.1.2
                    s=-
                    t=0 0
                    c=IN IP4 192.168.1.2
                    m=audio 25552 RTP/AVP 0
                    a=rtpmap:0 PCMU/8000
                 }
              } /* Stream */
           } /* Media */
        } /* Modify */
        Modify = ip/1/if2/2 {
           Media {
              Stream = 1 {
                 LocalControl {
```

Step	Protocol	Interface	From	To	Message
					ipdc/realm = "Core",
					gm/rsb = ON,
					mode = SendReceive
					},
					Local {
					v=0
					o=- 0 0 IN IP4 10.0.0.2
					s=-
					t=0 0
					c=IN IP4 10.0.0.2
					m=audio $ RTP/AVP 0
					a=rtpmap:0 PCMU/8000
					},
					Remote {
					v=0
					o=- 0 0 IN IP4 10.0.0.3
					s=-
					t=0 0
					c=IN IP4 10.0.0.3
					m=audio 33942 RTP/AVP 0
					a=rtpmap:0 PCMU/8000
					}
					} /* Stream */
					} /* Media */
					} /* Modify */
					} /* Context */
					} /* Transaction */
71	H.248	Ia	C-BGF B	SPDF B	Reply (Modify)

```
MEGACO/3 [abgf-b.example.com]: 43924
Reply = 4 {
     Context = 2 {
        Modify = ip/1/if1/2 {
           Media {
              Stream = 1 {
                 LocalControl {
                    ipdc/realm = "B",
                    gm/rsb = ON,
                    mode = SendReceive
                 },
                 Local {
                    v=0
                    o=- 0 0 IN IP4 192.168.1.1
                    s=-
                    t=0 0
                    c=IN IP4 192.168.1.1
                    m=audio 32124 RTP/AVP 0
                    a=rtpmap:0 PCMU/8000
                 },
                 Remote {
                    v=0
                    o=- 0 0 IN IP4 192.168.1.2
                    s=-
                    t=0 0
                    c=IN IP4 192.168.1.2
                    m=audio 25552 RTP/AVP 0
                    a=rtpmap:0 PCMU/8000
                 }
              } /* Stream */
           } /* Media */
        } /* Modify */
        Modify = ip/1/if2/2 {
           Media {
              Stream = 1 {
                 LocalControl {
                    ipdc/realm = "Core",
                    gm/rsb = ON,
                    mode = SendReceive
                 },
                 Local {
                    v=0
                    o=- 0 0 IN IP4 10.0.0.2
                    s=-
                    t=0 0
                    c=IN IP4 10.0.0.2
                    m=audio 16120 RTP/AVP 0
```

Step	Protocol	Interface	From	To	Message
| | | | | | ```
                          a=rtpmap:0 PCMU/8000
                       },
                       Remote {
                          v=0
                          o=- 0 0 IN IP4 10.0.0.3
                          s=-
                          t=0 0
                          c=IN IP4 10.0.0.3
                          m=audio 33942 RTP/AVP 0
                          a=rtpmap:0 PCMU/8000
                       }
                    } /* Stream */
                 } /* Media */
              } /* Modify */
           } /* Context */
        } /* Reply */
``` |
| 72 | DIAMETER | Rq | SPDF B | A-RACF B | AAR (Modify) |
| | | | | | ```
   <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                    < Session-Id = "spdf-b.example.com;41295;512" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "spdf-b.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    [ Destination-Host = aracf-b@example.com ]
                    [ Media-Component-Description =
                          { Media-Component-Number = 2 }
                          [ Media-Sub-Component =
                             { Flow-Number = 1 }
                             [ Flow-Description = "permit out 17 from 192.168.1.1 32124
                                                     to 192.168.1.2 25552" ]
                             [ Flow-Description = "permit in 17 from 192.168.1.2 25552
                                                     to 192.168.1.1 32124" ]
                             [ Flow-Usage = NO_INFORMATION(0) ]
                             [ Max-Requested-Bandwidth-UL = 640000 ]
                             [ Max-Requested-Bandwidth-DL = 640000 ]
                          ]
                          [ Media-Sub-Component =
                             { Flow-Number = 2 }
                             [ Flow-Description = "permit out 17 from 192.168.1.1 32125
                                                      to 192.168.1.2 25553" ]
                             [ Flow-Description = "permit in 17 from 192.168.1.2 25553
                                                      to 192.168.1.1 32125" ]
                             [ Flow-Usage = RTCP(1) ]
                             [ Max-Requested-Bandwidth-UL = 32000 ]
                             [ Max-Requested-Bandwidth-DL = 32000 ]
                          ]
                          [ AF-Application-Identifier = "RQ_SAMPLE_APP"]
                          [ Media-Type = AUDIO (1) ]
                          [ Flow-Status = ENABLED }
                          [ Reservation-Priority = DEFAULT (0) ]
                    ]
                    [ Reservation-Priority = DEFAULT (0) ]
                    [ Globally-Unique-Address =
                          [ Framed-IP-Address = 192.168.1.2 ]
                          [ Address-Realm = "example.com" ]
                    ]
                    [ Authorization-Lifetime = 450 ]
``` |
| 73 | DIAMETER | Re | A-RACF B | RCEF B | PIR |
| | | | | | A policy modification request is sent to the RCEF by sending the Policy Install Request command with the PI-Request-Type AVP value set to UPDATE_REQUEST (2). The maximum requested bandwidth value in the QoS-Information AVP is set to the sum of the audio media flow bandwidth and the RTCP bandwidth (104 000 bits/second). |

A policy modification request is sent to the RCEF by sending the Policy Install Request command with the PI-Request-Type AVP value set to UPDATE_REQUEST (2). The maximum requested bandwidth value in the QoS-Information AVP is set to the sum of the audio media flow bandwidth and the RTCP bandwidth (104 000 bits/second).

```
   < PI-Request > ::=  < Diameter Header: 315, REQ, PXY >
                    < Session-Id = "aracf-b.example.com;66389;469" >
                    { Auth-Application-Id = 16777253 (Re) }
                    { Origin-Host = "aracf-b.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    { Destination-Host = "rcef-b.example.com" }
                    { PI-Request-Type = UPDATE_REQUEST (2) }
                    { PI-Request-Number = 1 }
                    [ Auth-Session-State = NO_STATE_MAINTAINED (1) ]
```

Step	Protocol	Interface	From	To	Message
					``[Policy-Rule-Install =
[Policy-Rule-Definition =
{ Policy-Rule-Name = "policy-rule-example-B-UL" }
[Service-Identifier = 1]
[Rating-Group = 1]
[Framed-IP-Address = 192.168.1.2]
[Address-Realm = "example.com"]
[Flow-Description = "permit in 17 from 192.168.1.2 25552
to 192.168.1.1 32124"]
[Flow-Description = "permit in 17 from 192.168.1.2 25553
to 192.168.1.1 32125"]
[Flow-Status = ENABLED-UPLINK (0)]
[QoS-Information =
[Max-Requested-Bandwidth-UL = 104000]
[ToS-Traffic-Class = 101110]
]
[Precedence = 1]
[Flows =
{ Media-Component-Number = 1 }
[Flow-Number = 1]
[Flow-Number = 2]
]
]
]
[Policy-Rule-Install =
[Policy-Rule-Definition =
{ Policy-Rule-Name = "policy-rule-example-B-DL" }
[Service-Identifier = 1]
[Rating-Group = 1]
[Framed-IP-Address = 192.168.1.2]
[Address-Realm = "example.com"]
[Flow-Description = "permit out 17 from 192.168.1.1 31124
to 192.168.1.2 25552"]
[Flow-Description = "permit out 17 from 192.168.1.1 31125
to 192.168.1.2 25553"]
[Flow-Status = ENABLED-DOWNLINK (1)]
[QoS-Information =
[Max-Requested-Bandwidth-DL = 104000]
[ToS-Traffic-Class = 101110]
]
[Precedence = 1]
[Flows =
{ Media-Component-Number = 1 }
[Flow-Number = 1]
[Flow-Number = 2]
]
]
]```
74	DIAMETER	Re	RCEF B	A-RACF B	PIA
					``<PI-Answer> ::= < Diameter Header: 315, PXY >
< Session-Id = "aracf-b.example.com;66389;469" >
{ Origin-Host = "rcef-b.example.com" }
{ Origin-Realm = "example.com" }
{ PI-Request-Type = UPDATE_REQUEST (2) }
{ PI-Request-Number = 1 }
[Result-Code DIAMETER_SUCCESS (2001)]```
75	DIAMETER	Rq	A-RACF B	SPDF B	AAA (Modify)
					``<AA-Answer> ::= < Diameter Header: 265, PXY >
< Session-Id = "spdf-b.example.com;41295;512" >
{ Auth-Application-Id = 16777222 (Gq) }
{ Origin-Host = "aracf-b.example.com" }
{ Origin-Realm = "example.com" }
[Result-Code = DIAMETER_SUCCESS (2001)]
[Authorization-Lifetime = 450]
[Auth-Grace-Period = 10]```
76	DIAMETER	Gq'	SPDF B	P-CSCF B	AAA (Modify)
					``<AA-Answer> ::= < Diameter Header: 265, PXY >
< Session-Id = "p-cscf-b.example.com;481C43;583" >
{ Auth-Application-Id = 16777222 (Gq) }
{ Origin-Host = "spdf-b.example.com" }```

Step	Protocol	Interface	From	To	Message
					{ Origin-Realm = "example.com" } [Result-Code = DIAMETER_SUCCESS (2001)] [Binding-Information = { Binding-Input-List = [V4-Transport-Address = { Framed-IP-Address = 192.168.1.2 } { Port-Number = 25552 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.3 } { Port-Number = 33942 }] [V4-Transport-Address = { Framed-IP-Address = 192.168.1.2 } { Port-Number = 25553 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.3 } { Port-Number = 33943 }] } [Binding-Output-List = 10.0.0.2 [V4-Transport-Address = { Framed-IP-Address = 10.0.0.2 } { Port-Number = 16120 }] [V4-Transport-Address = { Framed-IP-Address = 192.168.1.1 } { Port-Number = 32124 }] [V4-Transport-Address = { Framed-IP-Address = 10.0.0.2 } { Port-Number = 16121 }] [V4-Transport-Address = { Framed-IP-Address = 192.168.1.1 } { Port-Number = 32125 }]]] [Authorization-Lifetime = 450] [Auth-Grace-Period = 10]
77	SIP		P-CSCF B	S-CSCF	200 OK (SDP)

```
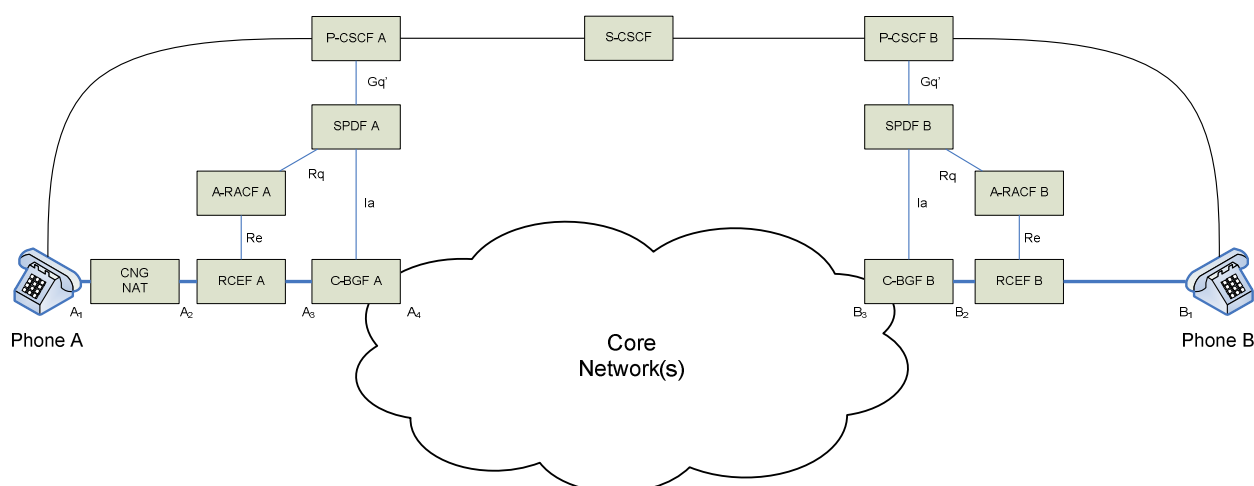    SIP/2.0 200 OK
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
    Via: SIP/2.0/UDP as.example.com:5060;branch=z9hG4bK80c3bb6b24e50
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
    Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b
    Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9
    Record-Route: <sip:s-cscf.example.com;lr>,<sip:as.example.com;lr>,<sip:s-
cscf.example.com;lr>,<sip:p-cscf-c.example.com;lr>,<sip:phone-c.example.com;lr>
    From: User C <sip:user_c@example.com>;tag=372183
    To: User B <sip:user_b@example.com>
    Call-ID: 88490-3838@phone-c.example.com
    CSeq: 1 INVITE
    Contact: <sip:user_b@phone-b.example.com>
    Content-Type: application/sdp
    Content-Length: (…)

    v=0
    o=user_b 29381748101 2948193018 IN IP4 phone-b.example.com
    s=-
    c=IN IP4 10.0.0.2
    t=0 0
    m=audio 16120 RTP/AVP 0
    a=sendrecv
    b=AS:96000
```

| 78 | SIP | Mw | S-CSCF | AS | 200 OK |

```
    SIP/2.0 200 OK
    Via: SIP/2.0/UDP as.example.com:5060;branch=z9hG4bK80c3bb6b24e50
    Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
    Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b
    Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9
```

Step	Protocol	Interface	From	To	Message
					Record-Route: <sip:as.example.com;lr>,<sip:s-cscf.example.com;lr>,<sip:p-cscf-c.example.com;lr>,<sip:phone-c.example.com;lr> From: User C <sip:user_c@example.com>;tag=372183 To: User B <sip:user_b@example.com> Call-ID: 88490-3838@phone-c.example.com CSeq: 1 INVITE Contact: <sip:user_b@phone-b.example.com> Content-Type: application/sdp Content-Length: (…) v=0 o=user_b 29381748101 2948193018 IN IP4 phone-b.example.com s=- c=IN IP4 10.0.0.2 t=0 0 m=audio 16120 RTP/AVP 0 a=sendrecv b=AS:96000
79	SIP	Mw	AS	S-CSCF	200 OK
					SIP/2.0 200 OK Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51 Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9 Record-Route: <sip:s-cscf.example.com;lr>,<sip:p-cscf-c.example.com;lr>,<sip:phone-c.example.com;lr> From: User C <sip:user_c@example.com>;tag=372183 To: User B <sip:user_b@example.com> Call-ID: 88490-3838@phone-c.example.com CSeq: 1 INVITE Contact: <sip:user_b@phone-b.example.com> Content-Type: application/sdp Content-Length: (…) v=0 o=user_b 29381748101 2948193018 IN IP4 phone-b.example.com s=- c=IN IP4 10.0.0.2 t=0 0 m=audio 16120 RTP/AVP 0 a=sendrecv b=AS:96000
80	SIP	Mw	S-CSCF	P-CSCF C	200 OK
NOTE 5:	Details of the signalling between P-CSCF C and Phone C and associated resource reservation procedures are omitted for brevity.				
					SIP/2.0 200 OK Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9 Record-Route: <sip:p-cscf-c.example.com;lr>,<sip:phone-c.example.com;lr> From: User C <sip:user_c@example.com>;tag=372183 To: User B <sip:user_b@example.com> Call-ID: 88490-3838@phone-c.example.com CSeq: 1 INVITE Contact: <sip:user_b@phone-b.example.com> Content-Type: application/sdp Content-Length: (…) v=0 o=user_b 29381748101 2948193018 IN IP4 phone-b.example.com s=- c=IN IP4 10.0.0.2 t=0 0 m=audio 16120 RTP/AVP 0 a=sendrecv b=AS:96000

Step	Protocol	Interface	From	To	Message
81	SIP	Mw	P-CSCF C	S-CSCF	ACK

```
ACK sip:user_b@example.com SIP/2.0
Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b
Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9
Max-Forwards: 69
Route: <sip:s-cscf.example.com;lr>,<sip:as.example.com;lr>,<sip:s-cscf.example.com;lr>,<sip:p-
cscf-b.example.com;lr>
From: User C <sip:user_c@example.com>;tag=348123
To: User B <sip:user_b@example.com>
Call-ID: 88490-3838@phone-c.example.com
CSeq: 2 ACK
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
82	SIP	Mw	S-CSCF	AS	ACK

```
ACK sip:user_b@example.com SIP/2.0
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b
Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9
Max-Forwards: 68
Route: <sip:as.example.com;lr>,<sip:s-cscf.example.com;lr>,<sip:p-cscf-b.example.com;lr>
From: User C <sip:user_c@example.com>;tag=348123
To: User B <sip:user_b@example.com>
Call-ID: 88490-3838@phone-c.example.com
CSeq: 2 ACK
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
83	SIP	Mw	AS	S-CSCF	ACK

```
ACK sip:user_b@example.com SIP/2.09
Via: SIP/2.0/UDP as.example.com:5060;branch=z9hG4bK80c3bb6b24e50
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b
Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9
Max-Forwards: 67
Route: <sip:s-cscf.example.com;lr>,<sip:p-cscf-b.example.com;lr>
From: User C <sip:user_c@example.com>;tag=348123
To: User B <sip:user_b@example.com>
Call-ID: 88490-3838@phone-c.example.com
CSeq: 2 ACK
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
84	SIP	Mw	S-CSCF	P-CSCF B	ACK

```
ACK sip:user_b@example.com SIP/2.0
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
Via: SIP/2.0/UDP as.example.com:5060;branch=z9hG4bK80c3bb6b24e50
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b
Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9
Max-Forwards: 66
Route: <sip:p-cscf-b.example.com;lr>
From: User C <sip:user_c@example.com>;tag=348123
To: User B <sip:user_b@example.com>
Call-ID: 88490-3838@phone-c.example.com
CSeq: 2 ACK
Content-Length: 0
```

Step	Protocol	Interface	From	To	Message
85	SIP	Gm	P-CSCF B	Phone B	ACK

```
ACK sip:user_b@example.com SIP/2.0
Via: SIP/2.0/UDP p-cscf-b.example.com:5060;branch=z9hG4bK74b03
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
Via: SIP/2.0/UDP as.example.com:5060;branch=z9hG4bK80c3bb6b24e50
Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bK07eeac51
Via: SIP/2.0/UDP p-cscf-c.example.com:5060;branch=z9hG4bK0691563b
Via: SIP/2.0/UDP phone-c.example.com:5060;branch=z9hG4bK1594C1AB9
Max-Forwards: 65
From: User C <sip:user_c@example.com>;tag=348123
To: User B <sip:user_b@example.com>
Call-ID: 88490-3838@phone-c.example.com
CSeq: 2 ACK
Content-Length: 0
```

6.6   Media Latching/Hosted NAT traversal

Figure 6.6.1: Media Latching/Hosted NAT architecture

Support for Hosted NAT traversal is required for the scenario where an interim NAT device is placed between the client and the Border Gateway Function (BGF) The interim NAT device (in this scenario: CNG NAT between Phone A and RCEF A in the figure above) translates the local internal IP address A_1 used inside the CNG to the external address A_2 residing in the same address space as the access side interface of C-BGF A with IP address A_3.

Phone A will use its local IP address in SDP information. C-BGF A will be instructed to latch on to the media stream sent from Phone A in order to correlate RTP flows between Phone A and Phone B.

NOTE 1: It is required that the CNG NAT device performs symmetric Network Address Translation for this scenario to work.

- A_1 = Voice: 172.16.0.2:11212 for RTP and 172.16.0.2:11213 for RTCP.

- A_2 = Voice: 192.168.0.2:29412 for RTP and 192.168.0.2:29413 for RTCP.

- A_3 = Voice: 192.168.0.1:4444 for RTP and 192.168.0.1:4445 for RTCP.

- A_4 = Voice: 10.0.0.1:2222 for RTP and 10.0.0.1:2223 for RTCP.

- B_1 = Voice: 192.168.1.2:29792 for RTP and 192.168.1.2:29793 for RTCP.

- B_2 = Voice: 192.168.1.1:3332 for RTP and 192.168.1.1:3333 for RTCP.

- B_3 = Voice: 10.0.0.2:1110 for RTP and 10.0.0.2:1111 for RTCP.

NOTE 2:   Port allocation for address A_2 is performed by the CNG NAT device. It may (depending on the type of device) not allocate an even port to RTP and adjacent higher port to RTCP. Any downstream device requiring such a port allocation scheme may therefore not work in this scenario.

Figure 6.6.2: Media Latching/CNG NAT call flow

Table 6.61 describes the call flow in a hosted NAT traversal scenario.

NOTE 3: Only steps that differ from the signalling in clause 6.1.1 are shown below. They are represented in the table as 1a, 3a, 4a etc.

Table 6.6.1: Media Latching with CNG NAT traversal

Step	Protocol	Interface	From	To	Message
1a	SIP	Gm	Phone A	P-CSCF A	INVITE B
Phone A uses its internal address to populate the SDP information.					

```
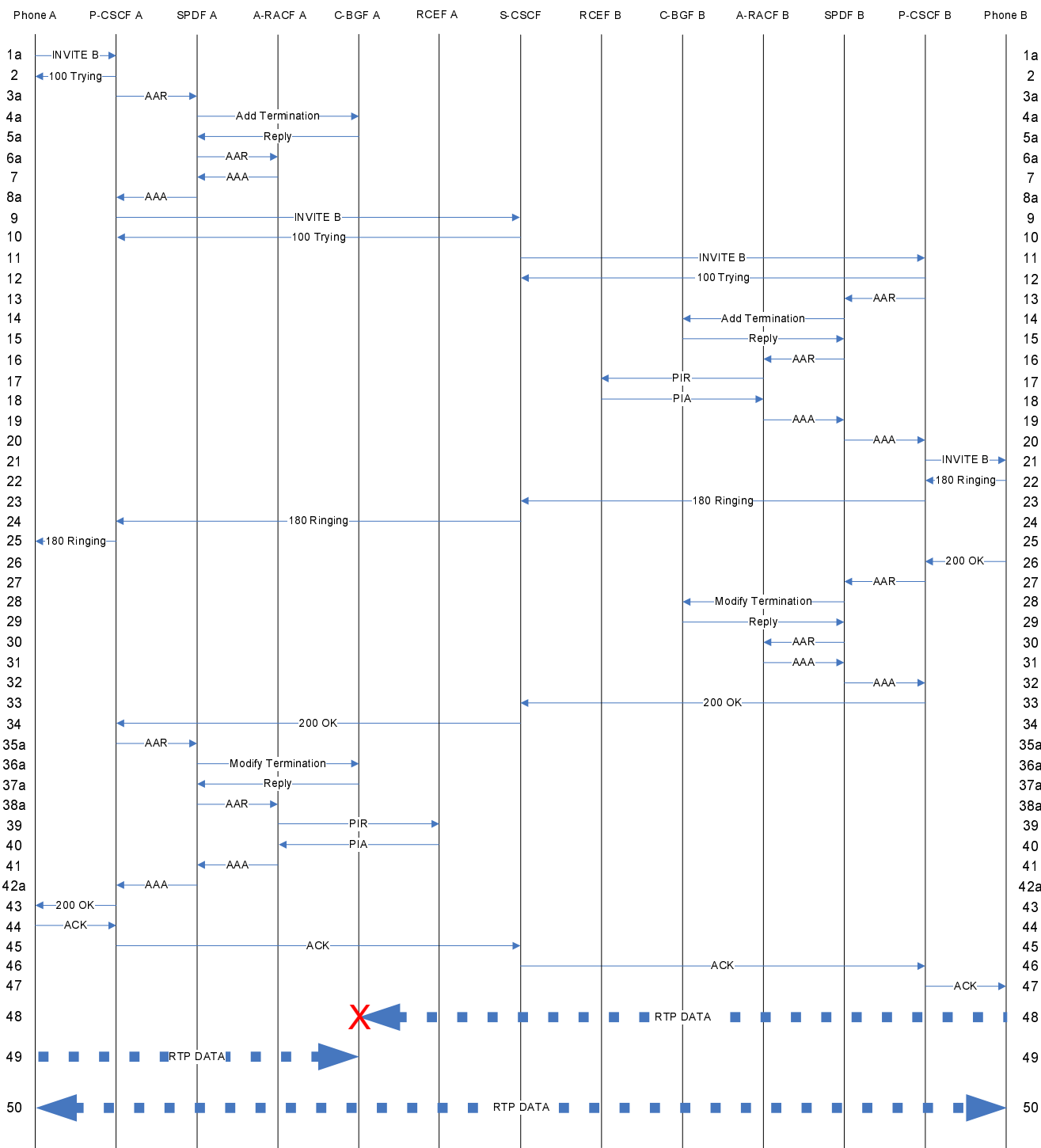    INVITE sip:user_b@example.com SIP/2.0
    Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03
    Max-Forwards: 70
    Route: <sip:p-cscf-a.example.com;lr>
    From: User A <sip:user_a@example.com>;tag=372183
    To: User B <sip:user_b@example.com>
    Call-ID: 398174293@phone-a.example.com
    CSeq: 1 INVITE
    Contact: <sip:user_a@phone-a.example.com>
    Content-Type: application/sdp
    Content-Length: 129

    v=0
    o=user_a 2890844526 2890842807 IN IP4 phone-a.example.com
    s=-
    c=IN IP4 172.16.0.2
    t=0 0
    m=audio 11212 RTP/AVP 0
    a=sendrecv
```

NOTE 1: Please refer to table 6.1.1 for details of signalling in step 2.					
3a	DIAMETER	Gq'	P-CSCF A	SPDF A	AAR

The P-CSCF identifies that phone A resides behind NAT based on local policies, e.g. by figuring out that the source IP address used for SIP signalling differs from the IP address conveyed in the c-line of SDP. It therefore sets the Latching-Indication AVP to the value LATCH (0) in order for SPDF A to trigger the Media Latching capability in C-BGF A.

NOTE 2: The source IP address A_2 from the SIP INVITE message to P-CSCF A is used to populate the Globally-Unique-Address AVP in the AA-Request to SPDF A.

```
    <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                    < Session-Id = "p-cscf-a.example.com;13815C;391" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "p-cscf-a.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    [ Destination-Host = "spdf-a.example.com" ]
                    [ Media-Component-Description =
                            { Media-Component-Number = 1 }
                            [ Media-Sub-Component =
                                { Flow-Number = 1 }
                                [ Flow-Description = "permit out 17 from any to 172.16.0.2 11212" ]
                                [ Flow-Description = "permit in 17 from any to any" ]
                                [ Flow-Usage = NO_INFORMATION(0) ]
                                [ Max-Requested-Bandwidth-DL = 96000 ]
                                [ Max-Requested-Bandwidth-UL = 96000 ]
                            ]
                            [ Media-Sub-Component =
                                { Flow-Number = 2 }
                                [ Flow-Description = "permit out 17 from any to 172.16.0.2 11213" ]
                                [ Flow-Description = "permit in 17 from any to any" ]
                                [ Flow-Usage = RTCP (1) ]
                                [ Max-Requested-Bandwidth-DL = 8000 ]
                                [ Max-Requested-Bandwidth-UL = 8000 ]
                            ]
                            [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                            [ Media-Type = AUDIO (0) ]
                            [ Flow-Status = DISABLED ]
                            [ Reservation-Priority = DEFAULT (0) ]
                            [ Codec-Data = "uplink
                                offer
                                m=audio 11212 RTP/AVP 0"
                            ]
                    ]
                    [ Binding-Information =
```

Step	Protocol	Interface	From	To	Message
					{ Binding-Input-List =

```
                                { Binding-Input-List =
                                    [ V4-Transport-Address =
                                        { Framed-IP-Address = 172.16.0.2 }
                                        { Port-Number = 11212 }
                                    ]
                                    [ V4-Transport-Address =
                                        { Framed-IP-Address = 0.0.0.0 }
                                        { Port-Number = 0 }
                                    ]
                                    [ V4-Transport-Address =
                                        { Framed-IP-Address = 172.16.0.2 }
                                        { Port-Number = 11213 }
                                    ]
                                    [ V4-Transport-Address =
                                        { Framed-IP-Address = 0.0.0.0 }
                                        { Port-Number = 0 }
                                    ]
                                }
                            ]
                            [ Latching-Indication = LATCH (0) ]
                            [ Reservation-Priority = DEFAULT (0) ]
                            [ Globally-Unique-Address =
                                    [ Framed-IP-Address = 192.168.0.2 ]
                                    [ Address-Realm = "example.com" ]
                            ]
                            [ Authorization-Lifetime = 450 ]
```

Step	Protocol	Interface	From	To	Message
4a	H.248	Ia	SPDF A	C-BGF A	Add terminations

The ipnapt/napt signal is set to inform C-BGF A that the true remote address of Phone A is unavailable due to Phone A being located behind a NA(P)T device incapable of performing ALG services. C-BGF A should therefore latch on to the media stream being sent from Phone A to the address allocated in the Local Descriptor (LD) on the interface in realm "A".

```
    MEGACO/3 [spdf-a.example.com]:55555
    Transaction = 1 {
        Context = ${
            Add = ip/1/$/$ { /* NOTE 1 */
                Media {
                    Stream = 1 {
                        LocalControl {
                            ipdc/realm = "A",
                            gm/rsb = ON
                        }
                        Local {
                            v=0
                            m=- $ RTP/AVP 0
                            c=IN IP4 $
                            b=AS:104
                        },
                        Remote {
                            v=0
                            o=- 0 0 IN IP4 172.16.0.2
                            s=-
                            t=0 0
                            m=- 11212 RTP/AVP 0
                            c=IN IP4 172.16.0.2
                            b=AS:104
                        }
                    } /* Stream */
                }, /* Media */
                Signals {
                    ipnapt/latch {
                        napt=LATCH,
                        stream=1
                    } /* ipnapt/latch */
                } /* Signals */
            } /* Add */
            Add = ip/1/$/$ {
                Media {
                    Stream = 1 {
                        LocalControl {
                            ipdc/realm = "Core",
                            gm/rsb = ON
                        }
                        Local {
                            v=0
```

Step	Protocol	Interface	From	To	Message
					m=- $ RTP/AVP 0
					c=IN IP4 $
					b=AS:104
					}
					} /* Stream */
					} /* Media */
					} /* Add */
					} /* Context */
					} /* Transaction */
5a	H.248	Ia	C-BGF A	SPDF A	Reply (Add)

C-BGF A will correlate the incoming media flow to 192.168.0.1:4444 with the source address of Phone A.

```
MEGACO/3 [abgf-a.example.com]:55555
Reply = 1 {
    Context = 1 {
        Add = ip/1/if1/1 {
            Media {
                Stream = 1 {
                    LocalControl {
                        ipdc/realm = "A",
                        gm/rsb = ON
                    }
                    Local {
                        v=0
                        o=- 0 0 IN IP4 192.168.0.1
                        s=-
                        t=0 0
                        m=- 4444 RTP/AVP 0
                        c=IN IP4 192.168.0.1
                        b=AS:104
                    },
                    Remote {
                        v=0
                        o=- 0 0 IN IP4 192.168.0.2
                        s=-
                        t=0 0
                        m=- 11212 RTP/AVP 0
                        c=IN IP4 172.16.0.2
                        b=AS:104
                    }
                } /* Stream */
            }, /* Media */
            Signals {
                ipnapt/latch {
                    napt=LATCH,
                    stream=1
                } /* ipnapt/latch */
            } /* Signals */
        } /* Add */
        Add = ip/1/if2/1 {
            Media {
                Stream = 1 {
                    LocalControl {
                        ipdc/realm = "Core",
                        gm/rsb = ON
                    }
                    Local {
                        v=0
                        o=- 0 0 IN IP4 10.0.0.1
                        s=-
                        t=0 0
                        m=- 2222 RTP/AVP 0
                        c=IN IP4 10.0.0.1
                        b=AS:104
                    }
                } /* Stream */
            } /* Media */
        } /* Add */
    } /* Context */
} /* Reply */
```

Step	Protocol	Interface	From	To	Message
6a	DIAMETER	Rq	SPDF A	A-RACF A	AAR

```
    <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                    < Session-Id = "spdf-a.example.com;429C3;412" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "spdf-a.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    [ Destination-Host = "aracf-a.example.com" ]
                    [ Media-Component-Description =
                            { Media-Component-Number = 1 }
                            [ Media-Sub-Component =
                                { Flow-Number = 1 }
                                [ Flow-Description = "permit out 17 from 192.168.0.1 4444
                                                           to 172.16.0.2 11212" ]
                                [ Flow-Description = "permit in 17 from any to any" ]
                                [ Flow-Usage = NO_INFORMATION(0) ]
                                [ Max-Requested-Bandwidth-DL = 96000 ]
                                [ Max-Requested-Bandwidth-UL = 96000 ]
                            ]
                            [ Media-Sub-Component =
                                { Flow-Number = 2 }
                                [ Flow-Description = "permit out 17 from 192.168.0.1 4445
                                                           to 172.16.0.2 11213" ]
                                [ Flow-Description = "permit in 17 from any to any" ]
                                [ Flow-Usage = RTCP (1) ]
                                [ Max-Requested-Bandwidth-DL = 8000 ]
                                [ Max-Requested-Bandwidth-UL = 8000 ]
                            ]
                            [ AF-Application-Identifier = "RQ_SAMPLE_APP"]
                            [ Media-Type = AUDIO (0) ]

                            [ Flow-Status = DISABLED ]
                            [ Reservation-Priority = DEFAULT (0) ]
                    ]
                    [ Reservation-Priority = DEFAULT (0) ]
                    [ Globally-Unique-Address =
                            [ Framed-IP-Address = 192.168.0.2 ]
                            [ Address-Realm = "example.com" ]
                    ]
                    [ Authorization-Lifetime = 450
```

NOTE 3:	Refer to table 6.1.1 for signalling details of step 7.				
8a	DIAMETER	Gq'	SPDF A	P-CSCF A	AAA

```
    <AA-Answer> ::= < Diameter Header: 265, PXY >
                    < Session-Id = "p-cscf-a.example.com;13815C;391" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "spdf-a.example.com" }
                    { Origin-Realm = "example.com" }
                    [ Result-Code = DIAMETER_SUCCESS (2001) ]
                    [ Binding-Information =
                        { Binding-Input-List =
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 172.16.0.2 }
                                { Port-Number = 11212 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 0.0.0.0 }
                                { Port-Number = 0 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 172.16.0.2 }
                                { Port-Number = 11213 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 0.0.0.0 }
                                { Port-Number = 0 }
                            ]
                        [ Binding-Output-List =
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 10.0.0.1 }
                                { Port-Number = 2222 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 0.0.0.0 }
```

Step	Protocol	Interface	From	To	Message

					`{ Port-Number = 0 }`
					`]`
					`[ V4-Transport-Address =`
					`    { Framed-IP-Address = 10.0.0.1 }`
					`    { Port-Number = 2223 }`
					`]`
					`[ V4-Transport-Address =`
					`    { Framed-IP-Address = 0.0.0.0 }`
					`    { Port-Number = 0 }`
					`]`
					`    ]`
					`    ]`
					`]`
					`[ Authorization-Lifetime = 450 ]`
					`[ Auth-Grace-Period = 10 ]`

NOTE 4:		Address/port information used in the next step (see table 6.1.1, step 9 for details) is allocated by C-BGF A in step 5a.			
NOTE 5:		Please refer to table 6.1.1 for steps 9 to 34.			
35a	DIAMETER	Gq'	P-CSCF A	SPDF A	AAR (Modify)

```
    <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                < Session-Id = "p-cscf-a.example.com;13815C;391" >
                { Auth-Application-Id = 16777222 (Gq) }
                { Origin-Host = "p-cscf-a.example.com" }
                { Origin-Realm = "example.com" }
                { Destination-Realm = "example.com" }
                [ Destination-Host = "spdf-a.example.com" ]
                [ Media-Component-Description =
                        { Media-Component-Number = 1 }
                        [ Media-Sub-Component =
                            { Flow-Number = 1 }
                            [ Flow-Description = "permit in 17 from any to any" ]
                            [ Flow-Description = "permit out 17 from any to 172.16.0.2 11212" ]
                            [ Flow-Usage = NO_INFORMATION(0) ]
                            [ Max-Requested-Bandwidth-UL = 96000 ]
                            [ Max-Requested-Bandwidth-DL = 96000 ]
                        ]
                        [ Media-Sub-Component =
                            { Flow-Number = 2 }
                            [ Flow-Description = "permit in 17 from any to any" ]
                            [ Flow-Description = "permit out 17 from any to 172.16.0.2 11213" ]
                            [ Flow-Usage = RTCP(1) ]
                            [ Max-Requested-Bandwidth-UL = 8000 ]
                            [ Max-Requested-Bandwidth-DL = 8000 ]
                        ]
                        [ AF-Application-Identifier = "GQPRIME_SAMPLE_APP"]
                        [ Media-Type = AUDIO (0) ]
                        [ Flow-Status = ENABLED ]
                        [ Reservation-Priority = DEFAULT (0) ]
                        [ Codec-Data = "uplink
                            offer
                            m=audio 11212 RTP/AVP 0"
                        ]
                ]
                [ Binding-Information =
                        { Binding-Input-List =
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 172.16.0.2 }
                                { Port-Number = 11212 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 10.0.0.2 }
                                { Port-Number = 1110 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 172.16.0.2 }
                                { Port-Number = 11213 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 10.0.0.2 }
                                { Port-Number = 1111 }
                            ]
                        }
                ]
                [ Latching-Indication = LATCH (0) ]
```

Step	Protocol	Interface	From	To	Message
	[Reservation-Priority = DEFAULT (0)] [Globally-Unique-Address = [Framed-IP-Address = 192.168.0.2] [Address-Realm = "example.com"]] [Authorization-Lifetime = 450]				
36a	H.248	Ia	SPDF A	C-BGF A	Modify Terminations

```
MEGACO/3 [spdf-a.example.com]:55555
Transaction = 2 {
     Context = 1 {
        Modify = ip/1/if1/1 {
           Media {
              Stream = 1 {
                 LocalControl {
                    ipdc/realm = "A",
                    gm/rsb = ON,
                    mode = SendReceive
                 },
                 Local {
                    v=0
                    o=- 0 0 IN IP4 192.168.0.1
                    s=-
                    t=0 0
                    m=- 4444 RTP/AVP 0
                    c=IN IP4 192.168.0.1
                    b=AS:104
                 },
                 Remote {
                    v=0
                    o=- 0 0 IN IP4 172.16.0.2
                    s=-
                    t=0 0
                    m=- 11212 RTP/AVP 0
                    c=IN IP4 172.16.0.2
                    b=AS:104
                 }
              } /* Stream */
           }, /* Media */
           Signals {
              ipnapt/latch {
                 napt=LATCH,
                 stream=1
              } /* ipnapt/latch */
           } /* Signals */
        } /* Modify */
        Modify = ip/1/if2/1 {
           Media {
              Stream = 1 {
                 LocalControl {
                    ipdc/realm = "Core",
                    gm/rsb = ON,
                    mode = SendReceive
                 },
                 Local {
                    v=0
                    o=- 0 0 IN IP4 10.0.0.1
                    s=-
                    t=0 0
                    m=- 2222 RTP/AVP 0
                    c=IN IP4 10.0.0.1
                    b=AS:104
                 },
                 Remote {
                    v=0
                    o=- 0 0 IN IP4 10.0.0.2
                    s=-
                    t=0 0
                    m=- 1110 RTP/AVP 0
                    c=IN IP4 10.0.0.2
                    b=AS:104
                 }
              } /* Stream */
           } /* Media */
        } /* Modify */
```

Step	Protocol	Interface	From	To	Message
	} /* Context */ } /* Transaction */				
37a	H.248	Ia	C-BGF A	SPDF A	Reply (Modify)

```
   MEGACO/3 [abgf-a.example.com]:55555
   Reply = 2 {
        Context = 1 {
          Modify = ip/1/if1/1 {
            Media {
               Stream = 1 {
                  LocalControl {
                     ipdc/realm = "A",
                     gm/rsb = ON,
                     mode = SendReceive
                  },
                  Local {
                     v=0
                     o=- 0 0 IN IP4 192.168.0.1
                     s=-
                     t=0 0
                     m=- 4444 RTP/AVP 0
                     c=IN IP4 192.168.0.1
                     b=AS:104
                  },
                  Remote {
                     v=0
                     o=- 0 0 IN IP4 172.16.0.2
                     s=-
                     t=0 0
                     m=- 11212 RTP/AVP 0
                     c=IN IP4 172.16.0.2
                     b=AS:104
                  }
               }, /* Stream */
            }, /* Media */
            Signals {
               ipnapt/latch {
                  napt=LATCH,
                  stream=1
               } /* ipnapt/latch */
            } /* Signals */
          } /* Modify */
          Modify = ip/1/if2/1 {
            Media {
               Stream = 1 {
                  LocalControl {
                     ipdc/realm = "Core",
                     gm/rsb = ON,
                     mode = SendReceive
                  },
                  Local {
                     v=0
                     o=- 0 0 IN IP4 10.0.0.1
                     s=-
                     t=0 0
                     m=- 2222 RTP/AVP 0
                     c=IN IP4 10.0.0.1
                     b=AS:104
                  },
                  Remote {
                     v=0
                     o=- 0 0 IN IP4 10.0.0.2
                     s=-
                     t=0 0
                     m=- 1110 RTP/AVP 0
                     c=IN IP4 10.0.0.2
                     b=AS:104
                  }
               } /* Stream */
            } /* Media */
          } /* Modify */
        } /* Context */
   } /* Reply */
```

Step	Protocol	Interface	From	To	Message
38a	DIAMETER	Rq	SPDF-A	A-RACF A	AAR (Modify)

```
    <AA-Request> ::=< Diameter Header: 265, REQ, PXY >
                    < Session-Id = "spdf-a.example.com;429C3;412" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "spdf-a.example.com" }
                    { Origin-Realm = "example.com" }
                    { Destination-Realm = "example.com" }
                    [ Destination-Host = "aracf-a.example.com" ]
                    [ Media-Component-Description =
                            { Media-Component-Number = 1 }
                            [ Media-Sub-Component =
                                { Flow-Number = 1 }
                                [ Flow-Description = "permit out 17 from 192.168.0.1 4444
                                                        to 172.16.0.2 11212" ]
                                [ Flow-Description = "permit in 17 from 172.16.0.2 11212
                                                        to 192.168.0.1 4444" ]
                                [ Flow-Usage = NO_INFORMATION(0) ]
                                [ Max-Requested-Bandwidth-UL = 96000 ]
                                [ Max-Requested-Bandwidth-DL = 96000 ]
                            ]
                            [ Media-Sub-Component =
                                { Flow-Number = 2 }
                                [ Flow-Description = "permit out 17 from 192.168.0.1 4445
                                                        to 172.16.0.2 11213" ]
                                [ Flow-Description = "permit in 17 from 172.16.0.2 11213
                                                        to 192.168.0.1 4445" ]
                                [ Flow-Usage = RTCP(1) ]
                                [ Max-Requested-Bandwidth-UL = 8000 ]
                                [ Max-Requested-Bandwidth-DL = 8000 ]
                            ]
                            [ AF-Application-Identifier = "RQ_SAMPLE_APP"]
                            [ Media-Type = AUDIO (0) ]
                            [ Flow-Status = ENABLED ]
                            [ Reservation-Priority = DEFAULT (0) ]
                    ]
                    [ Reservation-Priority = DEFAULT (0) ]
                    [ Globally-Unique-Address =
                            [ Framed-IP-Address = 192.168.0.2 ]
                            [ Address-Realm = "example.com" ]
                    ]
                    [ Authorization-Lifetime = 450 ]
```

NOTE 6:	Please refer to table 6.1.1 for details on steps 39 to 41.				
42a	DIAMETER	Gq'	SPDF A	P-CSCF A	AAA

```
    <AA-Answer> ::= < Diameter Header: 265, PXY >
                    < Session-Id = "p-cscf-a.example.com;13815C;391" >
                    { Auth-Application-Id = 16777222 (Gq) }
                    { Origin-Host = "spdf-a.example.com" }
                    { Origin-Realm = "example.com" }
                    [ Result-Code = DIAMETER_SUCCESS (2001) ]
                    [ Binding-Information =
                        { Binding-Input-List =
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 172.16.0.2 }
                                { Port-Number = 11212 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 10.0.0.2 }
                                { Port-Number = 1110 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 172.16.0.2 }
                                { Port-Number = 11213 }
                            ]
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 10.0.0.2 }
                                { Port-Number = 1111 }
                            ]
                        }
                        [ Binding-Output-List =
                            [ V4-Transport-Address =
                                { Framed-IP-Address = 10.0.0.1 }
                                { Port-Number = 2222 }
                            ]
```

Step	Protocol	Interface	From	To	Message

					`[ V4-Transport-Address =`
					`    { Framed-IP-Address = 192.168.0.1 }`
					`    { Port-Number = 4444 }`
					`]`
					`[ V4-Transport-Address =`
					`    { Framed-IP-Address = 10.0.0.1 }`
					`    { Port-Number = 2223 }`
					`]`
					`[ V4-Transport-Address =`
					`    { Framed-IP-Address = 192.168.0.1 }`
					`    { Port-Number = 4445 }`
					`]`
					`    ]`
					`]`
					`[ Authorization-Lifetime = 450 ]`
					`{ Auth-Grace-Period = 10 }`

NOTE 7:	Please refer to table 6.1.1 for details of steps 43 to 47.				
48	RTP		Phone B	C-BGF A	Media Flow
RTP media flows from Phone B (through C-BGF B) to C-BGF A but since C-BGF A is still awaiting media from Phone A, the latching procedure is incomplete and the media flow is dropped at C-BGF A.					
49	RTP		Phone A	C-BGF A	Media Flow
Phone A starts sending media through its CNG NAT device to address 192.168.0.1:4444. C-BGF A latches on to the media flow and associates the source address from the CNG NAT device with the media flow destined for Phone B. The latching procedure is now complete and bidirectional media can flow through C-BGF A.					
50	RTP		Phone A	Phone B	Media Flow
Bidirectional media flows from Phone A to Phone B through C-BGF A and C-BGF B.					

Annex A (informative):
Bibliography

- IETF RFC 2865: "Remote Authentication Dial In User Service (RADIUS)".

Annex B (informative):
Change history

Date	WG Doc.	CR	Rev	CAT	Title / Comment	Current Version	New Version
23/01/09	19tTD270	001	-	F	New version of the RACS signalling version 2. It is based on TS 183 048 v1.4.0.	1.4.0	2.0.1
	19tTD271		-		Output draft from TISPAN19ter	2.0.1	2.0.2
27/02/09	20WTD156	002	1	D	Input draft to TISPAN20wg	2.0.2	2.0.3
27/02/09	20WTD059	009	3	F	Update of clause 4	2.0.1	2.0.4
27/02/09	20WTD061	003	2	B	Update of clause 6 with Re commands	2.0.1	2.0.4
27/02/09	20WTD063	004	2	F	Revision of clause 6 H.248/Ia signalling to H.248/Ia v.2	2.0.1	2.0.4
27/02/09	20WTD080	005	1	B	Update of clause 1 (scope)	2.0.1	2.0.4
27/02/09	20WTD098	008	1	F	Update of clause 6, Rq commands	2.0.1	2.0.4
27/02/09	20WTD157	006	1	C	Update of clause 5	2.0.1	2.0.4
27/02/09	20WTD225	007	1	F	Initial example of signalling with BGF transcoding.	2.0.1	2.0.4
28/02/09	20WTD295				Output draft from TISPAN20WGs	2.0.3	2.0.4
18/03/09	20bTD146	010	1	B	Diameter request routing and Diameter-Host AVP Usage	2.0.4	2.1.1
18/03/09	20bTD023	011	2	F	Update of signalling diagrams in clause 6	2.0.4	2.1.1
18/03/09	20bTD029	012	1	B	Failure in RCEF at session setup, clause 6	2.0.4	2.1.1
18/03/09	20bTD036	013	1	B	Session Update Procedures, clause 6	2.0.4	2.1.1
18/03/09	20bTD101	014	1	B	Usage of Authorization-Package AVP, clause 6	2.0.4	2.1.1
18/03/09	20bTD114	015	1	B	Re PULL, clause 6	2.0.4	2.1.1
18/03/09	20bTD144	016	1	F	Addition of procedure of Session Modification	2.0.4	2.1.1
18/03/09	20bTD258	017	3	B	Overbooking-Indication AVP and Communication Waiting	2.0.4	2.1.1
18/03/09	20bTD268	018	1	B	Admission denial, clause 6	2.0.4	2.1.1
18/03/09	20bTD058	019	2	F	Remove Destination-Realm and Auth-Application-Id AVPs	2.0.4	2.1.1
18/03/09	20bTD057	020	2	F	Add Termination Cause to Gq'/Rq STR	2.0.4	2.1.1
18/03/09	20bTD053	021	2	F	Add Destination Host to Gq' AAR	2.0.4	2.1.1
18/03/09	20bTD054	022	2	F	Add Destination Host to Gq'/Rq STR	2.0.4	2.1.1
18/03/09	20bTD055	023	2	F	Add Destination Host to the Rq AAR messages	2.0.4	2.1.1
19/03/09	20bTD285				Output draft from TISPAN20WGs	2.0.4	2.1.1
29/05/09	WG3-05-001	024	2	B	Re call-back upon RCEF failure, and session teardown	2.1.1	2.1.2
29/05/09	WG3-05-002	025	1	B	x-RACF procedures	2.1.1	2.1.2
29/05/09	WG3-05-003	026	1	B	List of AVPs for Gq' to Rq mapping	2.1.1	2.1.2
29/05/09	WG3-05-004	027	1	B	H248 signalling update	2.1.1	2.1.2
29/05/09	WG3-05-005	028	1	B	BGF Media Transcoding	2.1.1	2.1.2
29/05/09	WG3-05-006	029	3	B	BGF Transport Plane Failure	2.1.1	2.1.2
29/05/09	WG3-05-008	032	1	F	Session update, P-CSCF keeping state on established flows	2.1.1	2.1.2
29/05/09	WG3-05-009	033	1	F	Clarification of ordering of elements in binding lists	2.1.1	2.1.2
29/05/09	WG3-05-010	034	1	F	Correction of message flow for establishing BC service	2.1.1	2.1.2
29/05/09	WG3-05-011	035	3	B	Hosted NAT traversal/Media Latching	2.1.1	2.1.2
29/05/09	WG3-05-012	036	1	B	Update of clause 6.5	2.1.1	2.1.2
29/05/09	WG3-05-013	037	1	F	Adding Destination-Host to messages missing this AVP	2.1.1	2.1.2
29/05/09	WG3-05-014	038	1	F	Correction of change history	2.1.1	2.1.2
29/05/09	WG3-05-015	030	3	F	Addition of procedure of IMS-based CoD service	2.1.1	2.1.2
29/05/09	WG3-05-016	031	1	F	Clarification of SIP URI for session modification	2.1.1	2.1.2
29/05/09	21WTD042				Input draft to TISPAN21WGs	2.1.1	2.1.2
08/06/09	21WTD159	039	2	B	Clarification of SPDF state	2.1.2	2.1.3

Date	WG Doc.	CR	Rev	CAT	Title / Comment	Current Version	New Version
08/06/09	21WTD160	040	1	F	Update of scope, adding that non-IMS is supported	2.1.2	2.1.3
08/06/09	21WTD161	041	1	F	Correction of CoD flow	2.1.2	2.1.3
08/06/09	21WTD202	042	1	F	Removal of incomplete message flow for session modification	2.1.2	2.1.3
08/06/09	21WTD206	043	1	D	Editorial corrections	2.1.2	2.1.3
09/06/09	21WTD242	044	3	F	Removal of media transcoding examples	2.1.2	2.1.3
09/06/09	21WTD261				Output draft from TISPAN21WGs	2.1.2	2.1.3
					Publication	2.1.3	2.2.1

History

Document history		
V1.4.0	June 2008	Publication
V2.2.1	August 2009	Publication