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STANDARDIZATION SECTOR  
OF ITU

**Series Q**  
**Supplement 59**  
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SERIES Q: SWITCHING AND SIGNALLING

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**Signalling flows and parameter mapping for  
resource control**

ITU-T Q-series Recommendations – Supplement 59



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## **Supplement 59 to ITU-T Q-series Recommendations**

### **Signalling flows and parameter mapping for resource control**

#### **Summary**

Supplement 59 to ITU-T Q-series Recommendations specifies the signalling flows for next generation network (NGN) resource and admission control functions (RACFs), which include the entities: policy decision physical entity (PD-PE); transport resource control physical entity (TRC-PE); and policy enforcement physical entity (PE-PE). It also specifies the quality of service (QoS) parameter mapping across the various protocols for different signalling flows.

#### **Source**

Supplement 59 to ITU-T Q-series Recommendations was agreed on 23 January 2008 by ITU-T Study Group 11 (2005-2008).

## FOREWORD

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- [ITU-T Q.3304.1] Recommendation ITU-T Q.3304.1 (2007), *Resource control protocol no. 4 (rcp4) – Protocols at the Rc interface between a transport resource control physical entity (TRC-PE) and a transport physical entity (T-PE): COPS alternative.*
- [ITU-T Q.3304.2] Recommendation ITU-T Q.3304.2 (2007), *Resource control protocol no. 4 (rcp4) – Protocols at the Rc interface between a transport resource control physical entity (TRC-PE) and a transport physical entity (T-PE): SNMP alternative.*
- [ITU-T Y.2012] Recommendation ITU-T Y.2012 (2006), *Functional requirements and architecture of the NGN release 1.*
- [ITU-T Y.2111] Recommendation ITU-T Y.2111 (2006), *Resource and admission control functions in Next Generation Networks.*
- [ETSI TS 129 208] ETSI TS 129 208 V6.7.0 (2007), *Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); End-to-end Quality of Service (QoS) signalling flows (3GPP TS 29.208 version 6.7.0 Release 6).*
- [ETSI ES 282 003] ETSI ES 282 003 V1.1.1 (2006), *Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Resource and Admission Control Sub-system (RACS); Functional Architecture.*
- [IETF RFC 2748] IETF RFC 2748 (2000), *The COPS (Common Open Policy Service) Protocol.*
- [IETF RFC 3084] IETF RFC 3084 (2001), *COPS Usage for Policy Provisioning (COPS-PR).*
- [IETF RFC 3318] IETF RFC 3318 (2003), *Framework Policy Information Base.*
- [IETF RFC 3588] IETF RFC 3588 (2003), *Diameter Base Protocol.*
- [IETF RFC 4005] IETF RFC 4005 (2005), *Diameter Network Access Server Application.*

### 3 Definitions

#### 3.1 Terms defined elsewhere

This supplement uses the following terms defined elsewhere:

- 3.1.1 absolute QoS** [ITU-T Y.2111]: Traffic delivery with numerical bounds on some or all QoS parameters. These bounds may be physical limits, or enforced limits such as those encountered through mechanisms like rate policing. The bounds may result from designating a class of network performance objectives for packet transfer.
- 3.1.2 gate** [ITU-T Y.2111]: A construct used to enable or disable the forwarding of IP packets based on the policy decision. A gate is identified by the classifier (e.g., IPv4 5-tuple) and direction of a media flow or a group of media flows that are in conformance to the same set of policy decisions.
- 3.1.3 gate control** [ITU-T Y.2111]: The operation of opening or closing a gate. When a gate is open, the packets in the media flows are allowed to pass through; when a gate is closed, the packets in the media flows are not allowed to pass through.
- 3.1.4 media flow** [ITU-T Y.2111]: A unidirectional media stream, which is specified by two endpoint identifiers and bandwidth, as well as class of service, if needed.
- 3.1.5 network address translation** [ITU-T Y.2111]: The operation by which IP addresses are translated (mapped) from one address domain to another address domain.
- 3.1.6 NAPT control** [ITU-T Y.2111]: The operation of providing network address mapping information and NAPT policy rules to a near-end NAT in the media flow.

**3.1.7 NAT traversal** [ITU-T Y.2111]: The operation of adapting the IP addresses so that the packets in the media flow can pass through a far-end (remote) NAT.

**3.1.8 network address translator (NAT)** [ITU-T Y.2111]: An entity that implements network address translation or NAPT functions. It consists of two types of NATs: near-end NAT that can be controlled by the operators directly, and far-end (remote) NAT that cannot be controlled by the operators directly.

**3.1.9 network address port translation (NAPT)** [ITU-T Y.2111]: The operation by which IP addresses and transport or port identifiers such as TCP and UDP port numbers are translated (mapped) from one address domain to another address domain.

**3.1.10 path-coupled QoS signalling** [ITU-T Y.2111]: A mode of signalling where the signalling messages follow a path that is tied to the data packets. Signalling messages are routed only through nodes that are in the data path.

**3.1.11 policy decision physical entity (PD-PE)** [ITU-T Q.3300]: A device that implements the policy decision functional entity (PD-FE) as defined in clause 7.2.3.2 of [ITU-T Y.2111].

**3.1.12 policy enforcement physical entity (PE-PE)** [ITU-T Q.3300]: A device that implements the policy enforcement functional entity (PD-FE) as defined in clause 7.2.4.1 of [ITU-T Y.2111].

**3.1.13 relative QoS** [ITU-T Y.2111]: Traffic delivery where bounds on QoS parameters such as delay, etc. are not expressed in absolute terms. It describes the circumstances where certain classes of traffic are handled differently from other classes of traffic, and the classes achieve different levels of QoS.

**3.1.14 SCE session** [ITU-T Q.3301.1]: A session established by a service/session control signalling protocol offered by the SCE that requires a session set-up with explicit session description before the use of the service.

NOTE – One example of an SCE session is an IMS session.

**3.1.15 SCE session signalling protocol** [ITU-T Q.3301.1]: The signalling protocol used to control the SCE session.

NOTE – One example of an SCE session signalling protocol is SIP with SDP.

## 3.2 Terms defined in this supplement

This supplement defines the following terms:

**3.2.1 attribute-value pair (AVP)**: An attribute-value pair corresponds to an information element in a Diameter message as defined in [IETF RFC 3588].

**3.2.2 common open policy service protocol (COPS)**: COPS is the simple query/response protocol defined in [IETF RFC 2748], a protocol used to exchange policy information between a policy decision point (PDP) and a policy enforcement point (PEP).

## 4 Abbreviations and acronyms

This supplement uses the following abbreviations and acronyms:

AA Authentication/Authorization

AAA AA-Answer

NOTE – In this supplement AAA is the abbreviation for AA-answer, in distinction from the generally accepted *in extenso* 'Authentication, Authorization and Accounting'.

AAR AA-Request

ASA Abort-Session-Answer

ASR Abort-Session-Request

COPS	Common Open Policy Service
DEC	Common open policy service DECision message
DRQ	Common open policy service Delete ReQuest state message
NACE	Network Attachment Control Entity
NGN	Next Generation Network
OVE	OVERload indication
PD-PE	Policy Decision Physical Entity
PE-PE	Policy Enforcement Physical Entity
QoS	Quality of Service
RA	Resource Acceptance message
RAA	Re-Auth-Answer
RACF	Resource and Admission Control Function
RAR	Re-Auth-Request
RCIP	Resource Connection Initiation Protocol
REJ	resource REJection message
REQ	Common open policy service REQuest message
RLP	Resource reLase resPonse message
RLR	Resource reLase Request message
RPT	Common open policy service RePorT state message
RR	Resource Request message
RTCP	Real-time Transport Control Protocol
RTP	Real-time Transport Protocol
S-CSCF	Serving – Call Session Control Function
SCE	Service Control Entity
SDP	Session Description Protocol
SIP	Session Initiation Protocol
SNMP	Simple Network Management Protocol
STA	Session-Termination-Answer
STR	Session-Termination-Request
TRC-PE	Transport Resource Control Physical Entity
UE	User Equipment

## **5 Conventions**

None.

## **6 Signalling flow scenarios**

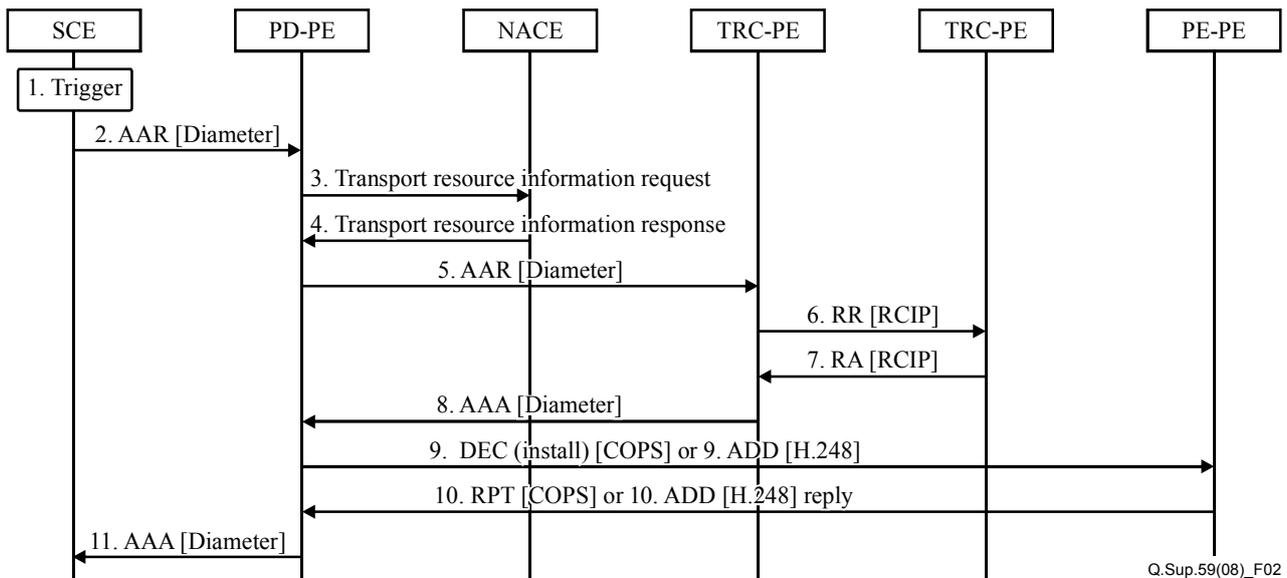
The scenarios considered for the signalling flows are as follows.

## 6.1 Push mode scenarios

The three phase scheme of authorization, reservation and commitment is not applicable for push mode, thus resource authorization and resource reservation (at least) will always be carried out together.

### 6.1.1 Resource authorization and reservation (and also commitment, in the case of single phase scheme)

The single phase scheme of authorization, reservation and commitment shall not involve path-coupled UEs. The two phase scheme shall involve authorization and reservation as the first phase, and commitment as the second phase.



- 1) SCE receives a trigger for sending a resource authorization, reservation (and also commitment, in the case of single phase) request towards PD-PE. This trigger could be a service request (e.g., SIP invite) sent by UE, for requesting an application-specific service. The service request may or may not contain any explicit service QoS requirement parameters.
- 2) The SCE extracts or derives the service QoS requirement parameters (e.g., bandwidth) of the requested service, and then requests QoS resource authorization, reservation and commitment from the PD-PE by sending a Diameter AAR command which contains AVPs containing explicit QoS requirement parameters.
- 3) PD-PE sends a transport resource information request message (stage 2 message) towards NACE for pulling the user's transport profile.
- 4) NACE responds with a transport resource information response (stage 2 message) which contains the user's transport profile.
- 5) The PD-PE may, optionally, send a Diameter AAR command towards TRC-PE for detecting and determining the requested QoS resource in the involved access network and core network for media flows along the media flow path. In addition, the PD-PE can relay access network information from NACE to TRC-PE.
- 6) If there are multiple TRC-PE instances in the involved network, the TRC-PE sends an RCIP RR command towards the interconnected TRC-PE, from edge to edge in the involved network for resource availability check.
- 7) The TRC-PE that receives the RCIP RR command responds with an RCIP RA command if the resource is available.

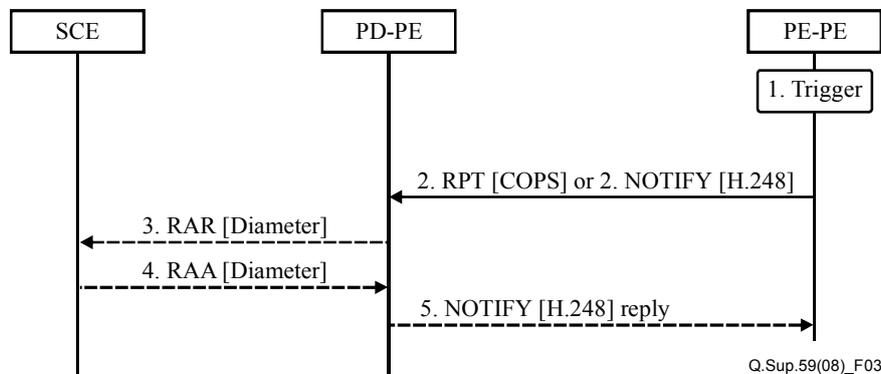
- 8) The TRC-PE responds to the Diameter AAR command sent in step 5, with a Diameter AAA command.
- 9) The PD-PE sends COPS DEC or an ITU-T H.248 ADD message(s) to the PE-PE to install (and open the 'gates'; e.g., enable the use of the authorized QoS resources in case of single phase scheme).
- 10) The PE-PE responds to the PD-PE with a COPS RPT or ITU-T H.248 ADD reply message informing the outcome of the DEC or ADD message, respectively.
- 11) PD-PE responds to the Diameter AAR command sent in step 2 with a Diameter AAA command.

### 6.1.2 Resource commitment

The separate resource commitment flow shall be applicable only in a two phase scheme.

#### 6.1.2.1 Path coupled

##### 6.1.2.1.1 Stateful PD-FE case



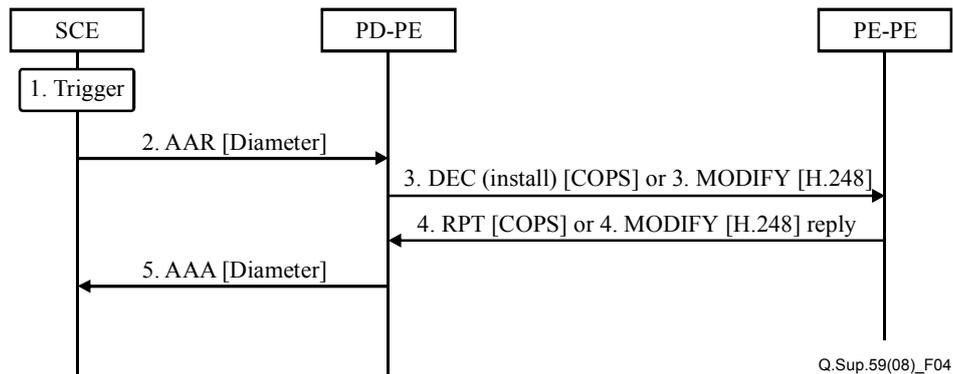
- 1) PE-PE receives a trigger for sending a COPS RPT or ITU-T H.248 NOTIFY (see Note) message. This trigger could be an UE-initiated explicit QoS request for resource commitment to the PE-PE through dedicated path-coupled transport QoS signalling.  
NOTE – [ITU-T Q.3303.2] has not yet provided any detailed ITU-T H.248 command level procedure in clause 6.16.
- 2) PE-PE sends a COPS RPT or ITU-T H.248 NOTIFY message to PD-PE to notify the commitment (if the event has been subscribed).
- 3) PD-PE may, optionally, send a Diameter RAR command towards SCE. This message will be sent if SCE had previously subscribed this event through a Diameter AAR command.
- 4) SCE responds with Diameter RAA command, on receiving the RAR request.
- 5) If PD-PE received an ITU-T H.248 NOTIFY message in step 2, it sends an ITU-T H.248 NOTIFY reply message towards PE-PE.

##### 6.1.2.1.2 Stateless PD-FE case

For further study.

### 6.1.2.2 Path de-coupled

#### 6.1.2.2.1 Stateful PD-FE case

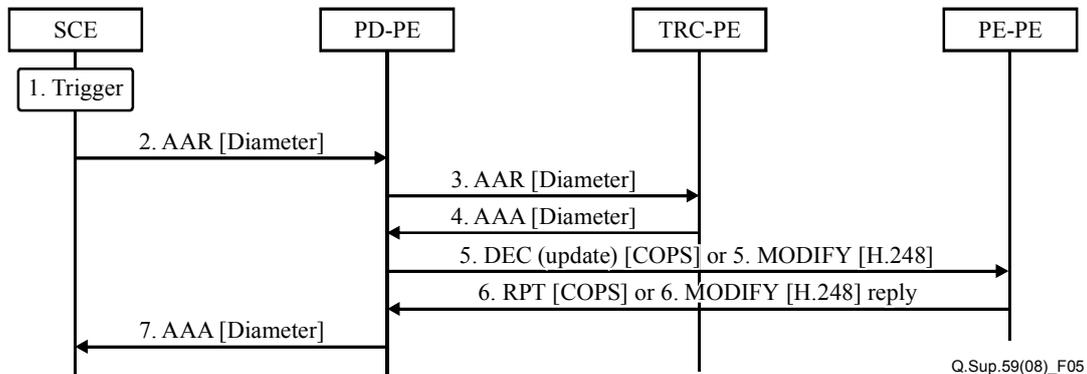


- 1) SCE receives a trigger for sending a Diameter AAR command. This trigger could be a service request sent by the UE.
- 2) SCE sends a Diameter AAR command towards PD-PE for resource commitment.
- 3) The PD-PE sends a COPS DEC or an ITU-T H.248 MODIFY message towards PE-PE for opening the installed 'gates'.
- 4) PE-PE responds to PD-PE with a COPS RPT or an ITU-T H.248 MODIFY reply message informing the outcome of the DEC or the MODIFY message, respectively.
- 5) PD-PE responds to the Diameter AAR command sent in step 2 with Diameter AAA command.

#### 6.1.2.2.2 Stateless PD-FE case

For further study.

### 6.1.3 Resource modification



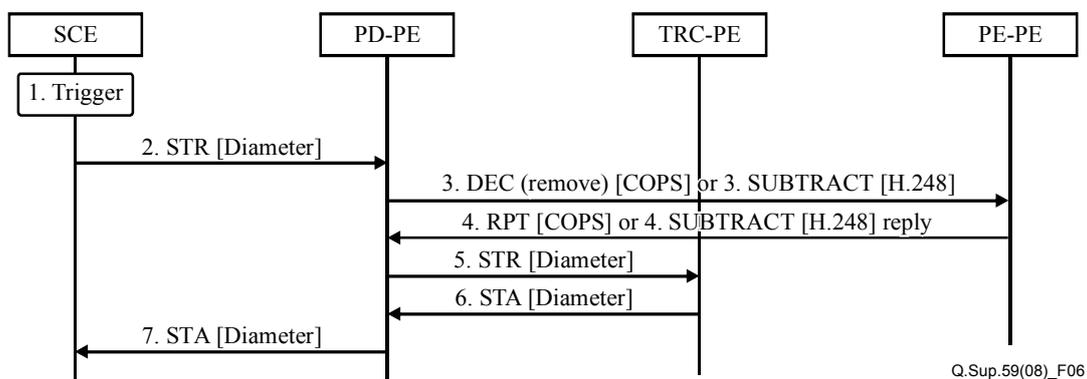
- 1) SCE receives a trigger for sending a resource modification request towards PD-PE. This trigger could be a service request (e.g., SIP update) sent by UE for requesting an application-specific service.
- 2) The SCE extracts or derives the service QoS requirement parameters (e.g., bandwidth) of the requested service, and then requests QoS resource modification from the PD-PE by sending a Diameter AAR command that contains AVPs containing explicit QoS requirement parameters.
- 3) PD-PE sends a Diameter AAR command towards the TRC-PE for detecting and determining the requested QoS resource in the involved access network and core network for media flows along the media flow path.

- 4) TRC-PE responds to the Diameter AAR command sent in step 3 with a Diameter AAA command.
- 5) The PD-PE sends a COPS DEC or ITU-T H.248 MODIFY message(s) to the PE-PE in order to install and modify the 'gates'.
- 6) PE-PE responds to the PD-PE with a COPS RPT or an ITU-T H.248 MODIFY reply message informing the outcome of the DEC or the MODIFY message, respectively.
- 7) PD-PE responds to the Diameter AAR command sent in step 2 with a Diameter AAA command.

#### 6.1.4 Resource de-activation

The flows are the same as for resource commitment, except that instead of activating the resources, these will be de-activated.

#### 6.1.5 Resource release

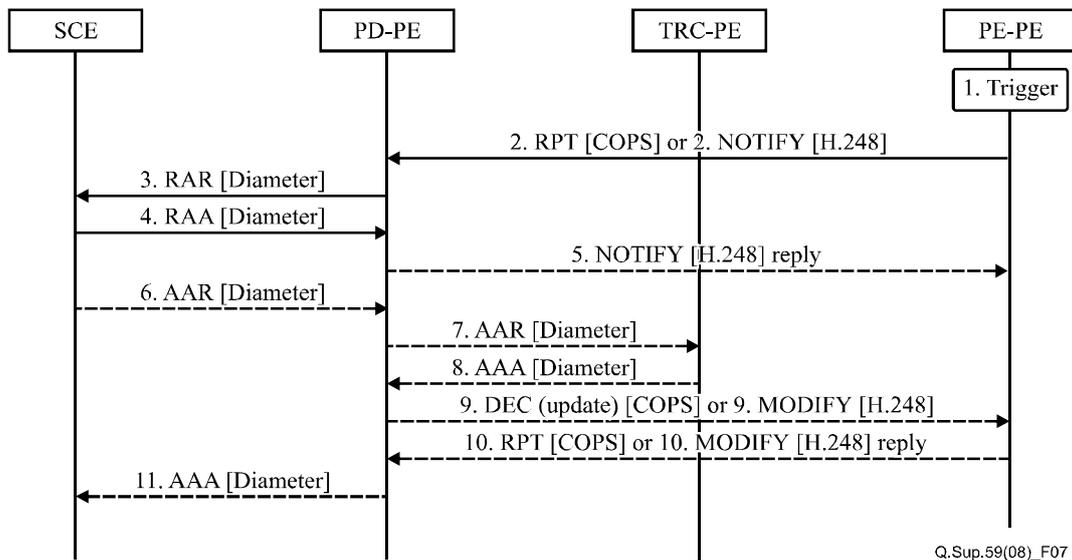


- 1) SCE receives a trigger for sending a resource release request towards PD-PE. This trigger could be a service termination request (e.g., SIP BYE) sent by UE.
- 2) SCE sends a Diameter STR command towards PD-PE. This command is used to release the resources previously allocated.
- 3) PD-PE sends a COPS DEC or an ITU-T H.248 SUBTRACT message towards PE-PE with a request to release the resources allocated to this particular SCE session media flow.
- 4) PE-PE responds to the PD-PE with a COPS RPT or an ITU-T H.248 SUBTRACT reply message informing the outcome of the DEC or the ITU-T H.248 SUBTRACT message, respectively.
- 5) PD-PE sends a Diameter STR command towards the TRC-PE. This command is used to inform the TRC-PE of the removal of the resources of this particular session.
- 6) TRC-PE responds by sending a Diameter STA command towards PD-PE.
- 7) PD-PE responds to the STR command sent in step 2 with an STA command.

## 6.1.6 Event notification

### 6.1.6.1 PE-PE indicated event notification – Stateful PD-PE case

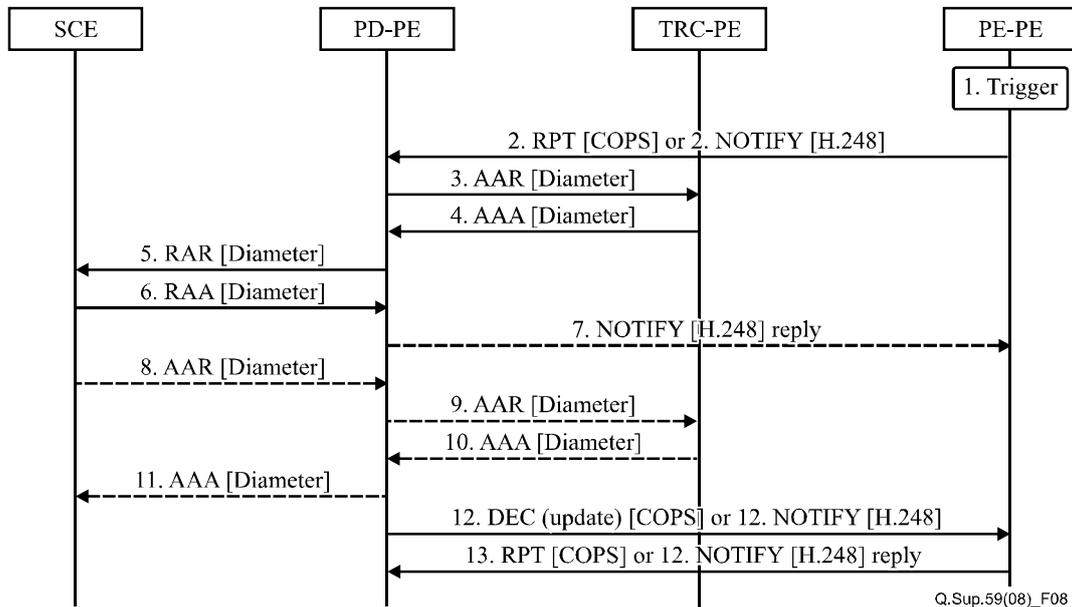
#### 6.1.6.1.1 Non-failure notification



- 1) PE-PE receives a trigger for sending a COPS RPT or an ITU-T H.248 NOTIFY (see Note) message towards PD-PE. This trigger could be a certain traffic condition which needs to be reported in accordance with a service previously requested by the PD-PE.  
NOTE – [ITU-T Q.3303.2] has not yet provided any detailed ITU-T H.248 command level procedure in clause 6.16.
- 2) PE-PE sends a COPS RPT or an ITU-T H.248 NOTIFY message towards PD-PE, informing the occurrence of the event.
- 3) PD-PE sends a Diameter RAR command notifying SCE about the event.
- 4) SCE responds to PD-PE with a Diameter RAA command.
- 5) If PD-PE received an ITU-T H.248 NOTIFY command in step 2, it sends an ITU-T H.248 NOTIFY reply message towards PE-PE.
- 6) SCE may optionally send a Diameter AAR command towards PD-PE.
- 7) PD-PE may optionally send a Diameter AAR command towards TRC-PE.
- 8) TRC-PE responds to the PD-PE with a Diameter AAA command.
- 9) PD-PE, on receiving the AAR, sends a COPS DEC (update) or an ITU-T H.248 MODIFY message towards PE-PE.
- 10) PE-PE responds to the PD-PE with a COPS RPT or an ITU-T H.248 MODIFY reply message informing the outcome of the DEC or the ITU-T H.248 MODIFY message, respectively.
- 11) PD-PE responds to the AAR command sent in step 6 by sending a Diameter AAA command.

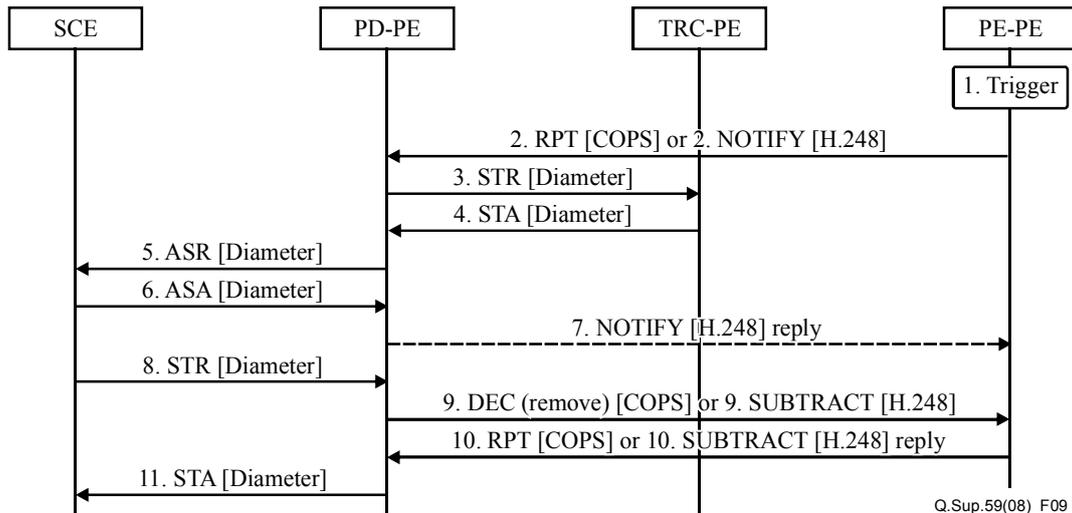
### 6.1.6.1.2 Failure notification

#### 6.1.6.1.2.1 Not all IP flows affected



- 1) PE-PE receives a trigger for sending a COPS RPT or an ITU-T H.248 NOTIFY (see Note) message towards PD-PE. This trigger could be a failure that affects an existing service (e.g., interface failure).  
NOTE – [ITU-T Q.3303.2] has not yet provided any detailed ITU-T H.248 command level procedure in clause 6.16.
- 2) PE-PE sends a COPS RPT or an ITU-T H.248 NOTIFY message towards PD-PE, informing the occurrence of the failure.
- 3) PD-PE sends a Diameter AAR command towards TRC-PE informing that the failure occurred.
- 4) TRC-PE responds to PD-PE with a Diameter AAA command.
- 5) PD-PE sends a Diameter RAR command notifying SCE about the failure.
- 6) SCE responds to PD-PE with Diameter RAA command.
- 7) If PD-PE received an ITU-T H.248 NOTIFY message in step 2, it sends an ITU-T H.248 NOTIFY reply message towards PE-PE.
- 8) SCE may optionally send a Diameter AAR command towards PD-PE.
- 9) PD-PE may optionally send a Diameter AAR command towards TRC-PE.
- 10) TRC-PE responds to PD-PE with a Diameter AAA command.
- 11) PD-PE responds to the AAR command by sending a Diameter AAA command.
- 12) PD-PE sends a COPS DEC (update) or an ITU-T H.248 NOTIFY message towards PE-PE.
- 13) PE-PE responds to the PD-PE with a COPS RPT or an ITU-T H.248 NOTIFY reply message informing the outcome of the DEC or NOTIFY message, respectively.

### 6.1.6.1.2.2 All IP flows affected



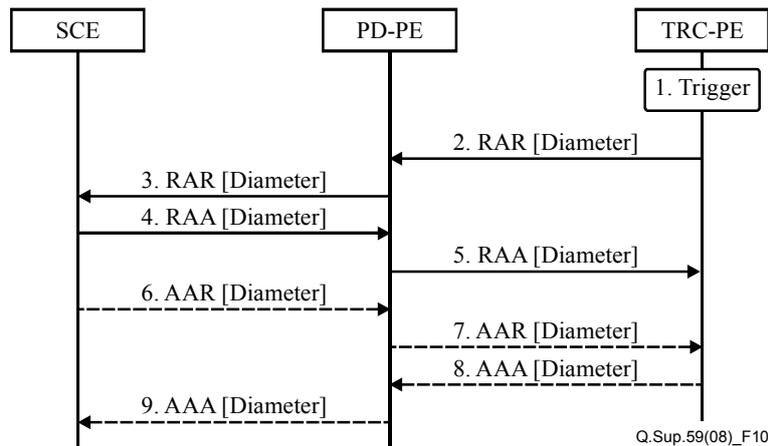
- 1) PE-PE receives a trigger for sending a COPS RPT or an ITU-T H.248 NOTIFY (see Note) message towards PD-PE. This trigger could be a failure that affects an existing service (e.g., interface failure).  
NOTE – [ITU-T Q.3303.2] has not yet provided any detailed ITU-T H.248 command level procedure in clause 6.16.
- 2) PE-PE sends a COPS RPT or an ITU-T H.248 NOTIFY message towards PD-PE, informing that the failure occurred.
- 3) PD-PE sends a Diameter STR command towards the TRC-PE informing that the failure occurred.
- 4) TRC-PE responds to the PD-PE with a Diameter STA command.
- 5) PD-PE sends a Diameter ASR command towards SCE, requesting SCE to abort the media session.
- 6) SCE responds to the PD-PE with a Diameter ASA command.
- 7) If PD-PE received an ITU-T H.248 NOTIFY message in step 2, it sends an ITU-T H.248 NOTIFY reply message towards PE-PE.
- 8) SCE sends a Diameter STR command towards PD-PE to request the termination of the session.
- 9) PD-PE sends a COPS DEC (remove) or an ITU-T H.248 SUBTRACT message towards PE-PE for releasing resources allocated to this particular media flow.
- 10) PE-PE responds to the PD-PE with a COPS RPT or an ITU-T H.248 SUBTRACT reply message informing the outcome of the DEC or SUBTRACT message, respectively.
- 11) PD-PE responds to the STR command sent in step 8 by sending a Diameter STA command towards SCE.

### 6.1.6.2 PE-PE indicated event notification – Stateless PD-PE case

For further study.

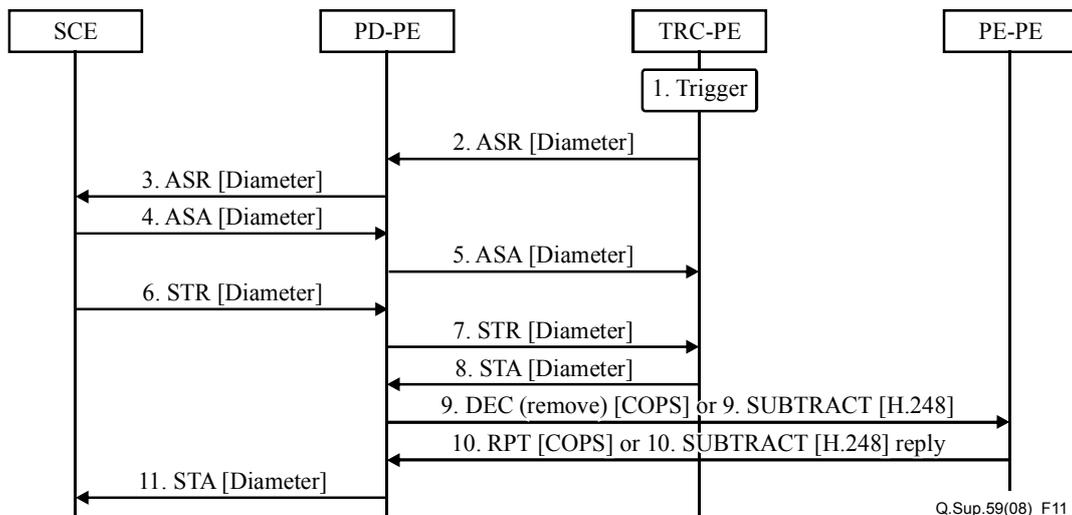
### 6.1.6.3 TRC-PE indicated event notification – Stateful PD-PE case

#### 6.1.6.3.1 Non-failure notification



- 1) TRC-PE receives a trigger for sending a Diameter RAR command towards PD-PE. This trigger could be a certain traffic condition which needs to be reported in accordance with a service previously requested by the PD-PE.
- 2) TRC-PE sends a Diameter RAR command towards PD-PE, informing of the occurred event.
- 3) PD-PE sends a Diameter RAR command notifying SCE about the occurred event.
- 4) SCE responds to the PD-PE with a Diameter RAA command.
- 5) PD-PE responds to the RAR received in step 2 by sending a Diameter RAA command towards TRC-PE.
- 6) SCE may optionally send a Diameter AAR command towards PD-PE.
- 7) PD-PE, on receiving the Diameter AAR command, sends a Diameter AAR command towards TRC-PE.
- 8) TRC-PE responds to PD-PE with a Diameter AAA command.
- 9) PD-PE responds to AAR command sent in step 6 by sending a Diameter AAA command towards SCE.

#### 6.1.6.3.2 Failure notification



- 1) TRC-PE receives a trigger for sending a Diameter ASR command towards PD-PE. This trigger could be a certain traffic failure which needs to be reported.
- 2) TRC-PE sends a Diameter ASR towards PD-PE informing it of the failure and requesting the termination of the Diameter session between PD-PE and TRC-PE.
- 3) PD-PE sends a Diameter ASR command informing SCE about the failure and requesting the termination of the session.
- 4) SCE responds to the ASR command by sending a Diameter ASA command towards PD-PE.
- 5) PD-PE responds to the ASR received in step 2 by sending a Diameter ASA command towards TRC-PE.
- 6) SCE sends a Diameter STR command towards PD-PE for terminating the Diameter session and releasing the allocated resources.
- 7) PD-PE sends a Diameter STR command towards TRC-PE informing of the occurred failure.
- 8) TRC-PE responds to the PD-PE with a Diameter STA command.
- 9) PD-PE, on receiving the Diameter STA, sends a COPS DEC (remove) or an ITU-T H.248 SUBTRACT message towards PE-PE for releasing the resources allocated to this particular media flow.
- 10) PE-PE responds to the PD-PE with a COPS RPT or an ITU-T H.248 SUBTRACT reply message informing the outcome of the DEC or SUBTRACT message, respectively.
- 11) PD-PE responds to the Diameter STR command sent in step 6 by sending a Diameter STA command.

#### 6.1.6.4 TRC-PE indicated event notification – Stateless PD-PE case

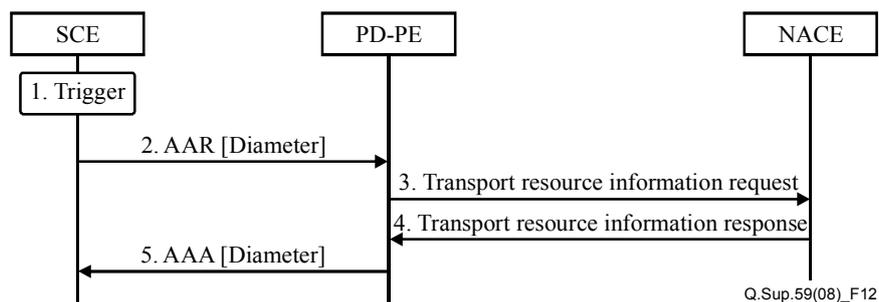
For further study.

## 6.2 Pull mode scenarios

Pull mode scenarios shall be applicable only for the path-coupled UEs. A single phase scheme of authorization, reservation and commitment is not applicable for pull mode.

NOTE – The three phase scheme is not discussed because it requires SDP extensions that are out of scope for NGN R1.

### 6.2.1 Resource authorization

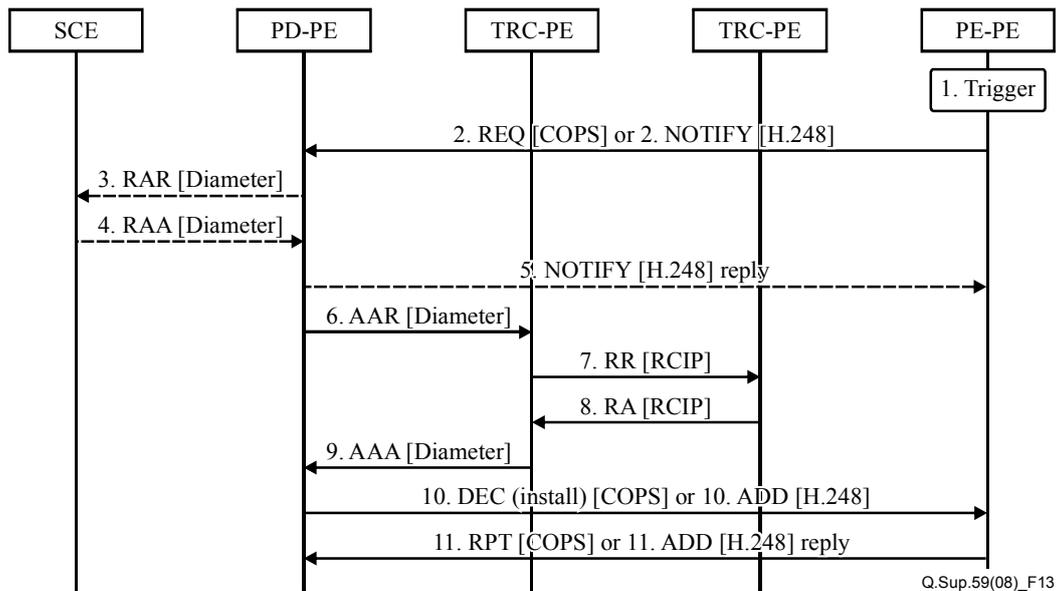


- 1) SCE receives a trigger for sending a resource authorization request towards PD-PE. This trigger could be a service request's provisional response (e.g., a provisional response to a SIP invite, such as 183 session progress containing SDP) sent by a terminating UE.
- 2) The SCE extracts or derives the service QoS requirement parameters (e.g., bandwidth) of the requested service, and then requests QoS resource authorization from the PD-PE by sending a Diameter AAR command which contains AVPs containing explicit QoS requirement parameters.

- 3) PD-PE sends transport resource information request message (stage 2 message) towards NACE for pulling the user's transport profile.
- 4) NACE responds with transport resource information response (stage 2 message) which contains the user's transport profile
- 5) The PD-PE authorizes every component negotiated for the session and generates an authorization token. PD-PE responds to the Diameter AAR command sent in step 2 by sending a Diameter AAA command, containing the generated authorization token, towards SCE.

## 6.2.2 Resource reservation and commitment

### 6.2.2.1 Stateful PD-PE case



- 1) PE-PE receives a trigger for sending a COPS REQ or an ITU-T H.248 NOTIFY (see Note) message. This trigger could be an UE-initiated explicit QoS request for resource reservation and commitment towards the PE-PE through dedicated path-coupled transport QoS signalling.

NOTE – [ITU-T Q.3303.2] has not yet provided any detailed ITU-T H.248 command level procedure in clause 6.16. The ITU-T H.248 command parameters for NOTIFY will be identified within the ITU-T H.248.55 pull mode package.

- 2) PE-PE sends a COPS REQ or an ITU-T H.248 NOTIFY message to PD-PE to request resource reservation and commitment.
- 3) PD-PE may optionally send a Diameter RAR command towards SCE. This message will be sent if SCE had previously subscribed for this event through a Diameter AAR command.
- 4) SCE responds with a Diameter RAA command on receiving the RAR request.
- 5) If PD-PE received an ITU-T H.248 NOTIFY message in step 2, it sends an ITU-T H.248 NOTIFY reply message towards PE-PE.
- 6) PD-PE sends a Diameter AAR command towards TRC-PE for detecting and determining the requested QoS resources in the involved access network and core network, for media flows along the media flow path.
- 7) If there are multiple TRC-PE instances in the involved network, TRC-PE sends an RCIP RR command towards the interconnected TRC-PE, from edge to edge in the involved network, for resource availability check.

- 8) The TRC-PE which receives the RCIP RR command responds with an RCIP RA command, if the resource is available.
- 9) TRC-PE responds to the Diameter AAR command, sent in step 6, with a Diameter AAA command.
- 10) The PD-PE sends a COPS DEC or an ITU-T H.248 ADD message to the PE-PE to install and open the 'gates'.
- 11) PE-PE responds to the PD-PE with a COPS RPT or an ITU-T H.248 ADD reply message, informing the outcome of the DEC or the ADD message, respectively.

### 6.2.2.2 Stateless PD-PE case

For further study.

### 6.2.3 Resource modification

The flow for authorization is the same as the flow for resource authorization (except that the authorization token will not be generated and NACE may not be queried for transport resource information).

The flow for reservation and commitment is same as the flow for resource reservation and commitment, with the ITU-T H.248 ADD request/response message replaced with a MODIFY request/response message.

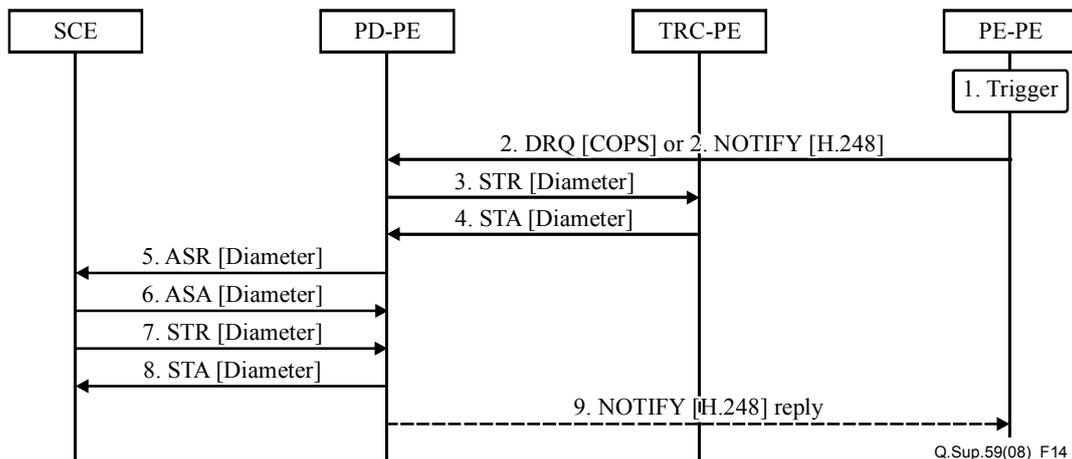
### 6.2.4 Resource de-activation

The flows are the same as for resource commitment, with the difference that instead of activating the resources, these will be de-activated.

### 6.2.5 Resource release

#### 6.2.5.1 UE requested

##### 6.2.5.1.1 Stateful PD-PE case



- 1) PE-PE receives a trigger for sending a COPS DRQ or an ITU-T H.248 NOTIFY (see Note) message towards PD-PE. This trigger could be an UE-initiated explicit QoS request for resource release towards the PE-PE through a dedicated path-coupled transport QoS signalling.

NOTE – [ITU-T Q.3303.2] has not yet provided any detailed ITU-T H.248 command level procedure in clause 6.16.

- 2) PE-PE sends a COPS DRQ or an ITU-T H.248 NOTIFY message towards PD-PE, informing of the resource release request.
- 3) PD-PE sends a Diameter STR command towards TRC-PE.

- 4) TRC-PE responds to the PD-PE with a Diameter STA command.
- 5) PD-PE sends a Diameter ASR command towards SCE, requesting SCE to abort the media session.
- 6) SCE responds to the PD-PE with a Diameter ASA command.
- 7) SCE sends a Diameter STR command towards PD-PE for terminating the session.
- 8) PD-PE responds to the STR command sent in step 7 by sending a Diameter STA command towards SCE.
- 9) If PD-PE received an ITU-T H.248 NOTIFY command in step 2, it sends an ITU-T H.248 NOTIFY reply towards PE-PE.

#### 6.2.5.1.2 Stateless PD-PE case

For further study.

#### 6.2.5.2 SCE requested

Same flow as for resource release for push mode.

### 6.2.6 Event notification

#### 6.2.6.1 PE-PE indicated event notification – Stateful PD-PE case

##### 6.2.6.1.1 Non-failure notification

Same as the corresponding flow for push mode.

##### 6.2.6.1.2 Failure notification

###### 6.2.6.1.2.1 Not all IP flows affected

Same as the corresponding flow for push mode.

###### 6.2.6.1.2.2 All IP flows affected

Same flow as for the UE-initiated resource release, except for the difference in the initial trigger, which in this case would be a failure instead of a specific resource release request sent from UE towards PE-PE.

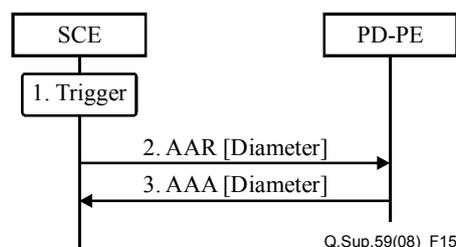
#### 6.2.6.2 PE-PE indicated event notification – Stateless PD-PE case

For further study.

#### 6.2.6.3 TRC-PE indicated event notification

Same as the corresponding flow for push mode.

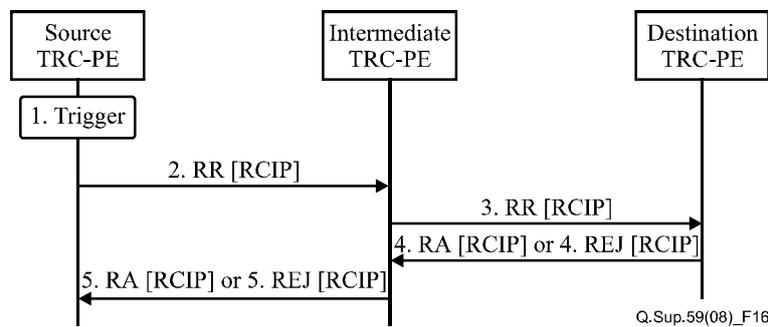
### 6.3 NAPT control and NAT traversal



- 1) SCE receives a trigger for sending a resource authorization and/or a reservation request towards PD-PE. This trigger could be a service request (e.g., SIP invite) sent by UE to request an application-specific service.
- 2) The SCE extracts the source and destination network addresses and port numbers from the signalling message body received from the UE. SCE sends a Diameter AAR command towards PD-PE, containing the extracted information, and requests the address binding information if a far-end NAT traversal is needed.
- 3) The PD-PE shall generate the address binding information of the selected PE-PE for the requested media flows. The PD-PE responds to the Diameter AAR command sent in step 2 by sending a Diameter AAA command containing network address binding information towards SCE.

## 6.4 TRC-PE to TRC-PE flows (Rp interface – rcp2)

### 6.4.1 Resource reservation

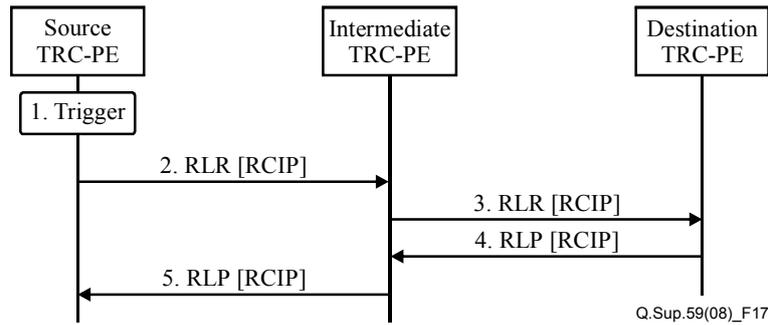


- 1) The source TRC-PE receives a trigger for sending a resource reservation request towards the next-hop TRC-PE (intermediate TRC-PE). This trigger could be a command sent by the PD-PE or via the previous-hop source seeking a TRC-PE for resource reservation. The destination IP address of the media flow is contained in the resource request.
- 2) The source TRC-PE sends an RCIP RR command towards the next-hop TRC-PE (intermediate TRC-PE).
- 3) The intermediate TRC-PE carries out resource computation, TRC-PE-route selection and admission control according to the topology and resource usage of the logic bearer network (see [ITU-T Y.2111]). The intermediate TRC-PE checks the availability of resources in its local domain and, if they are available and preliminary reserved, the RCIP RR command is transferred to the next TRC-PE towards the destination TRC-PE.
- 4) When the destination TRC-PE finds out that the destination IP address of the media flow belongs to the TRC-PE domain that is under its administration, and if the resource reservation in the destination TRC-PE is successful, the destination TRC-PE will send an RCIP RA command to the previous-hop TRC-PE (intermediate TRC-PE) through the same set of TRC-PEs in the reverse direction followed in step 3. If resource reservation in the destination TRC-PE fails, the destination TRC-PE will send an RCIP REJ command to the previous-hop TRC-PE (intermediate TRC-PE) through the same set of TRC-PEs in the reverse direction followed in step 3.
- 5) The intermediate TRC-PE sends an RCIP RA command or an RCIP REJ command towards the source TRC-PE through the same set of TRC-PEs in the reverse direction followed in step 2.

### 6.4.2 Resource modification

The flow for resource modification is the same as that for resource reservation, except that the RCIP RR message has a modify flag.

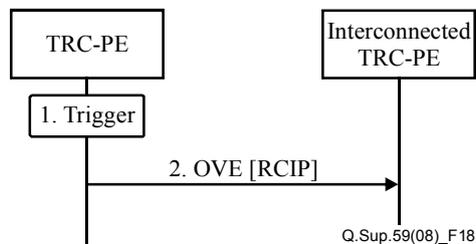
### 6.4.3 Resource release



- 1) The source TRC-PE receives a trigger for sending an RCIP RLR command towards the next-hop TRC-PE (intermediate TRC-PE). This trigger could be a command sent from PD-PE or via the previous-hop source seeking TRC-PE in order to inform the removal of the resources relative to a particular session.
- 2) The source TRC-PE sends an RCIP RLR command towards the intermediate TRC-PE to request the release of the RCIP resource connection.
- 3) The intermediate TRC-PE sends an RCIP RLR command towards the downstream TRC-PE until it arrives at the destination TRC-PE.
- 4) The destination TRC-PE releases the resources in the node and responds with an RLP command to the TRC-PE that sent the RLR.
- 5) The intermediate TRC-PE releases the resources in the node and responds with an RLP command to the TRC-PE that sent the RLR. The same operation is done until it arrives at the source TRC-PE.

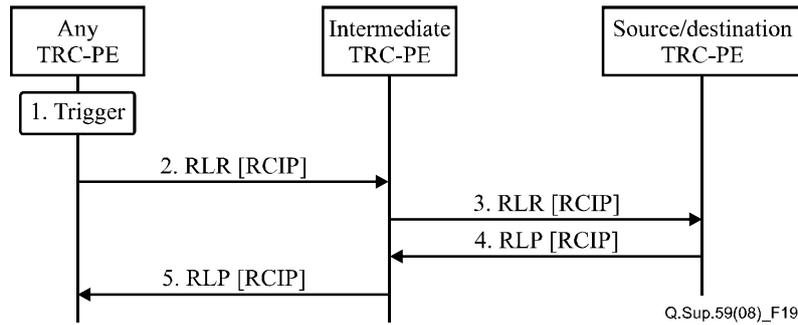
### 6.4.4 Event notification

#### 6.4.4.1 Non-failure notification



- 1) The TRC-PE receives a trigger for sending an RCIP OVE command towards the interconnected TRC-PE. This trigger could happen when the resource in the domain is in an overload condition or recovering from it.
- 2) The TRC-PE sends an RCIP OVE command towards every interconnected TRC-PE.

### 6.4.4.2 Failure notification



- 1) The TRC-PE receives a trigger for sending an RCIP RLR command towards the intermediate TRC-PE. This trigger could happen when any TRC-PE finds that the resources for a particular connection in the local domain are not available.
- 2) The TRC-PE sends an RCIP RLR command towards the intermediate TRC-PE (including upstream and downstream TRC-PEs) to inform of the release of the RCIP resource connection.
- 3) The downstream TRC-PE sends an RCIP RLR command towards its downstream TRC-PE until it arrives at the destination TRC-PE. The upstream TRC-PE sends an RCIP RLR command towards its upstream TRC-PE until it arrives at the source TRC-PE.
- 4) The source/destination TRC-PE releases the resources in the node and responds with an RLP command to the TRC-PE that sent the RLR.
- 5) The same operation is repeated until the RLP command arrives at the TRC-PE that sent the initial RLR.

## 6.5 PD-PE to PD-PE flows

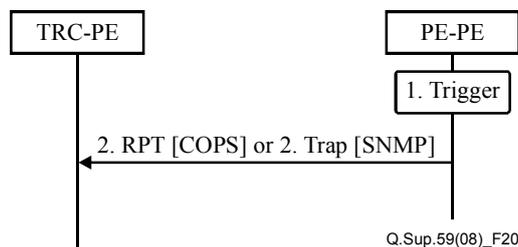
### 6.5.1 Intra-domain (Rd interface – rcp6)

For further study.

### 6.5.2 Inter-domain (Ri interface)

For further study.

## 6.6 PE-PE to TRC-PE unsolicited message flow (Rc interface – rcp4)



- 1) The PE-PE trigger could be activated on a specific event (such as establishment of a connection between PE-PE and TRC-PE) or at regular intervals based on a timer.
- 2) PE-PE sends a COPS RPT or an SNMP trap message, depending upon the type of protocol this interface supports, containing network topology and resource status information.

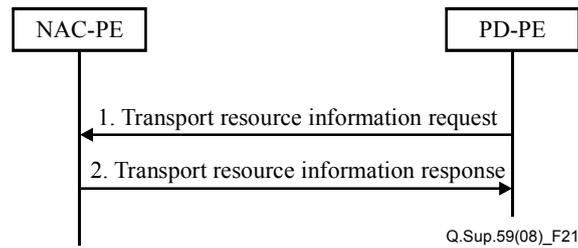
## 6.7 NAC-PE to PD-PE flows (Ru interface)

### 6.7.1 Pushing access transport network profile

For further study.

### 6.7.2 Pulling access transport network profile

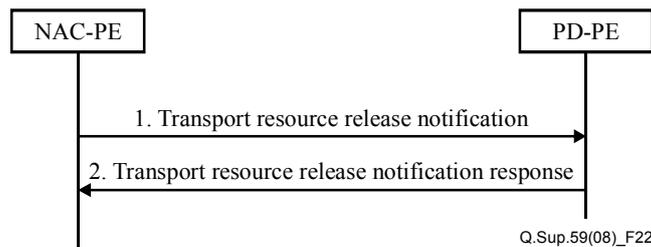
NOTE – This clause is only for information, and further description is for further study.



- 1) After receiving a service request from SCE, PD-PE will send a transport resource information request to NAC-PE to request the access transport network profile information (e.g., in the context of network failure recovery or data inconsistency prevention procedures).
- 2) NAC-PE will send the transport resource information response to PD-PE to provide the access transport network profile information. In the network failure recovery or data inconsistency prevention procedure, NAC-PE should send the profile information of each user to the PD-PE to guarantee data consistency with PD-PE.

### 6.7.3 Resource release notification

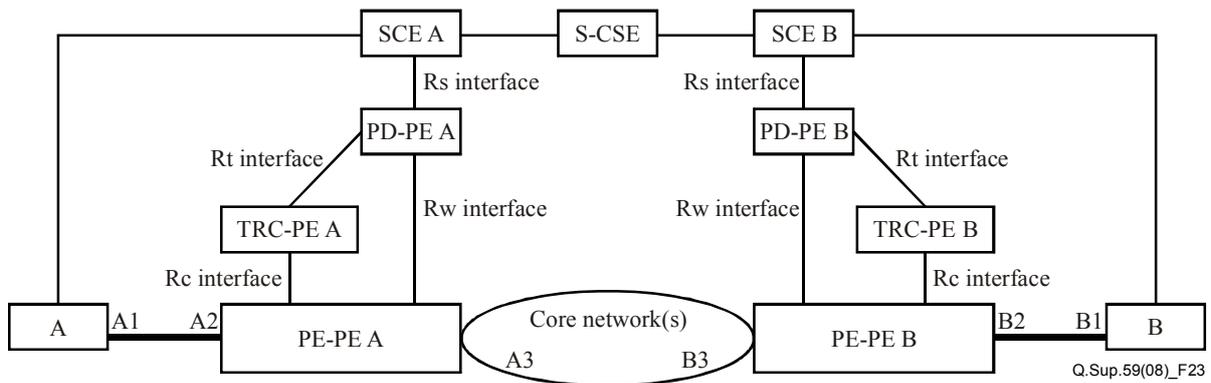
NOTE – This clause is only for information, and further description is for further study.



- 1) The transport resource release notification information flow is sent by NAC-PE to notify the PD-PE to remove the resource profile information from the local repository when the assigned IP address is released (e.g., DHCP leased timer expiry or a release of the access transport resources). In the context of synchronization and auditing, NAC-PE may notify PD-PE that all the user data for data consistency have been transmitted.
- 2) PD-PE will respond to NAC-PE after having received the transport resource release notification.

## 7 Parameter mapping

Parameter mapping is explained using the example network architecture shown in the following figure. In this example architecture, it is assumed that UE A (calling party) is establishing a SIP session with UE B (called party).



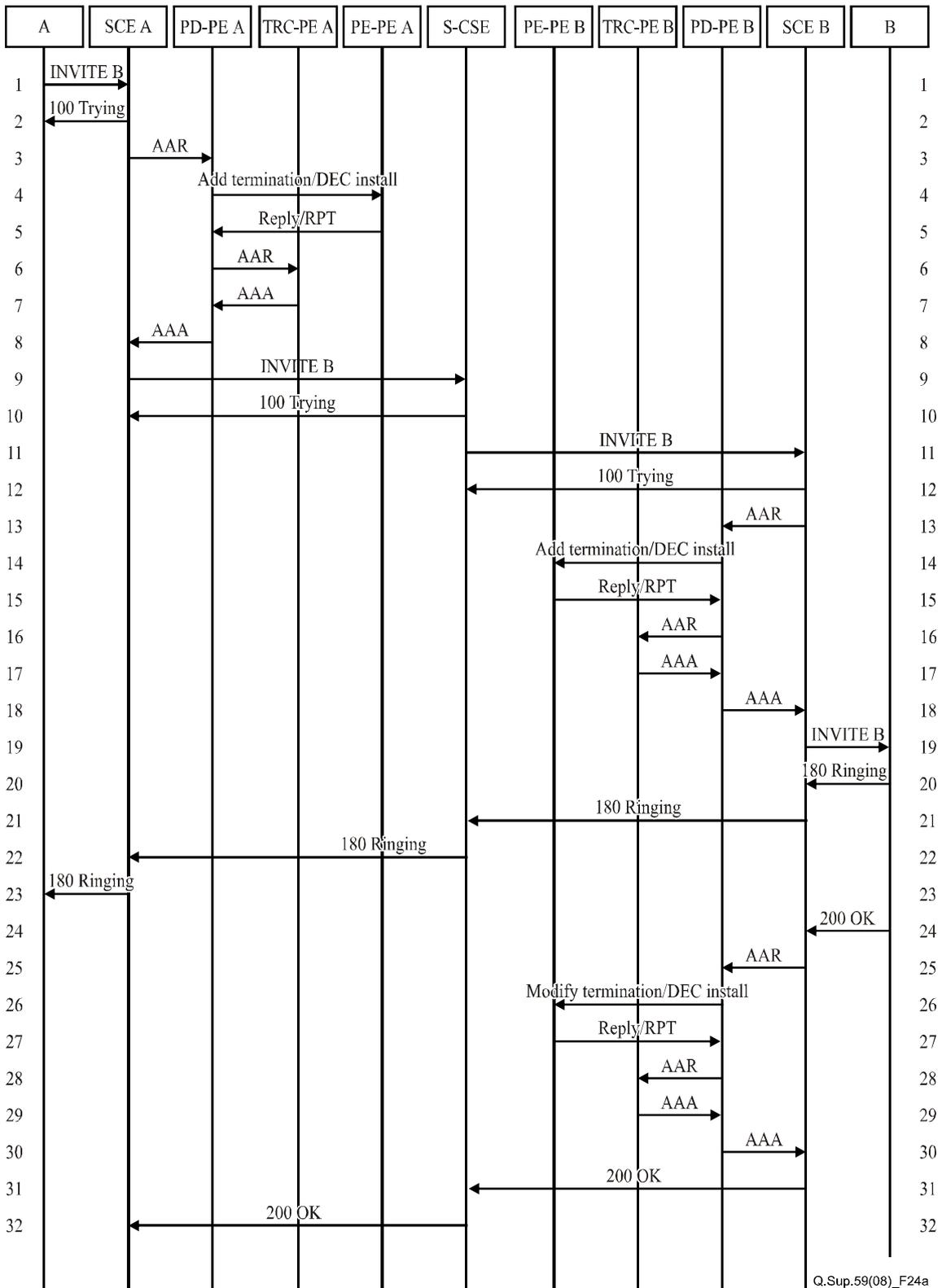
RTP should use an even destination port number and the corresponding RTCP stream should use the next higher (odd) destination port number. Therefore, the addresses and ports used in the example are as follows:

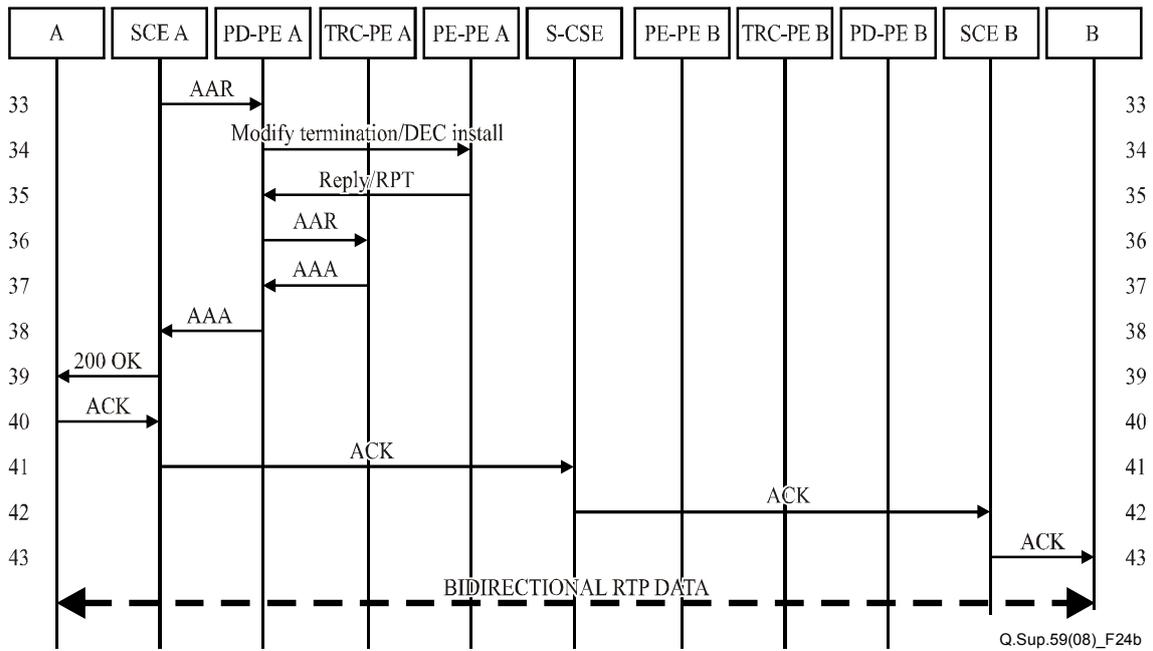
- A1 = 192.168.0.2:23942 for RTP and 192.168.0.2:23943 for RTCP.
- A2 = 192.168.0.1:4444 for RTP and 192.168.0.1:4445 for RTCP.
- A3 = 10.0.0.1:2222 for RTP and 10.0.0.1:2223 for RTCP.
- B1 = 192.168.1.2:29792 for RTP and 192.168.1.2:29793 for RTCP.
- B2 = 192.168.1.1:3332 for RTP and 192.168.1.1:3333 for RTCP.
- B3 = 10.0.0.2:1110 for RTP and 10.0.0.2:1111 for RTCP.

The RTP stream is assumed to consume 96 kbit/s, while the RTCP is assumed to use 8 kbit/s. 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.

## 7.1 Push mode scenarios

### 7.1.1 Session initiation





Step	Protocol	Interface	From	To	Message
<b>1</b>	<b>SIP</b>		<b>A</b>	<b>SCE A</b>	<b>INVITE B</b>
<pre> 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: &lt;sip:sce-a.example.com;lr&gt; From: User A &lt;sip:user_a@example.com&gt;;tag=372183 To: User B &lt;sip:user_b@example.com&gt; Call-ID: 398174293@phone-a.example.com CSeq: 1 INVITE Contact: &lt;sip:user_a@phone-a.example.com&gt; 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 </pre>					
<b>2</b>	<b>SIP</b>		<b>SCE A</b>	<b>A</b>	<b>100 Trying</b>
<pre> SIP/2.0 100 Trying Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03 From: User A &lt;sip:user_a@example.com&gt;;tag=372183 To: User B &lt;sip:user_b@example.com&gt; Call-ID: 398174293@phone-a.example.com CSeq: 1 INVITE Content-Length: 0 </pre>					
<b>3</b>	<b>DIAMETER</b>	<b>Rs</b>	<b>SCE A</b>	<b>PD-PE A</b>	<b>AA-Request</b>
<p>The SCE uses the IP address registered for signalling as the Globally-Unique-Address. The Rs protocol specification specifies 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 [ITU-T Q.3301.1] 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 [ITU-T Q.3301.1]. In clause C.2 of [ITU-T Q.3301.1], it is stated that both these numbers are to start at 1 for a given session. Following the rules defined in Annex B of [ITU-T Q.3301.1], the SCE translates the single codec indicated in the "m=" line to bandwidth using locally configured information on the mapping between codec and bandwidth and taking into consideration the packetization overhead (i.e., AVP/RTP 0 translates to PCMU/8000, which is 64 kbit/s, which becomes 96 kbit/s plus 8 kbit/s with packetization overhead).</p> <p>Given the reception of a=sendrecv in the SDP, the SCE issues a bidirectional reservation request to the PD-PE.</p>					
<pre> &lt;AA-Request&gt; ::= &lt; Diameter Header: 265, REQ, PXY &gt;   &lt; Session-Id = "sce-a.example.com;13815C;391" &gt;   { Auth-Application-Id = 16777235 (Rs) }   { Origin-Host = "sce-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 192.168.0.2 23942" ]       [ Flow-Description = "permit in 17 from any to any" ]     ]   ] </pre>					

```

    [ 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 ]
  ]
  [ 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 = 192.168.0.2 }
      { Port-Number = 23942 }
    ]
    [ V4-Transport-Address =
      { Framed-IP-Address = 192.168.0.2 }
      { Port-Number = 23943 }
    ]
  }
]
[ 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	ITU-T H.248	Rw	PD-PE A	PE-PE A	ADD terminations
<p>The default value of ITU-T H.248 StreamMode is "Inactive", the ITU-T H.248 streams are by default created as "Inactive". Hence, the mode descriptor is omitted in this message. The Diameter &lt;AA-Request&gt; for an RTP flow and an RTCP flow is translated here into an ITU-T H.248 termination/stream model by using the default RTP-specific behaviour of the BGF. Alternatively, the RTP and RTCP flows could be mapped on two separate ITU-T H.248 streams: (clause 6.16.1.1 of [ITU-T Q.3303.2]). The specific behaviour is controlled via property gm/rsb "RTP Specific Behaviour". This property is enabled by default; hence the gm/rsb descriptor is not included in the message.</p>					
<pre> MEGACO/3 [pd-pe-a.example.com]:55555 Transaction = 1 { Context = \${   Add = ip/1/if1/\$ { /* NOTE 1 */     Media {       Stream = 1 {         Remote {           v=0           m=-23942 --           c=IN IP4 192.168.0.2           b=AS:104         }       } /* Stream */     } /* Media */   } /* Add */   Add = ip/1/if2/\$ { </pre>					

```

Media {
  Stream = 1 {
    Local {
      v=0
      m=-$ --
      c=IN IP4 $
      b=AS:104
    }
  } /* Stream */
} /* Media */
} /* Add */
} /* Context */
} /* Transaction */

```

NOTE 1: the wildcard CHOOSE options are very limited, only "Id" may be wildcarded.

Step	Protocol	Interface	From	To	Message
5	ITU-T H.248	Rw	PE-PE A	PD-PE A	Reply (Add)

```

MEGACO/3 [abgf-a.example.com]:55555
Reply = 1 {
Context = 1 {
  Add = ip/1/if1/1 {
    Media {
      Stream = 1 {
        Remote {
          v=0
          m=-23942 --
          c=IN IP4 192.168.0.2
          b=AS:104
        }
      } /* Stream */
    } /* Media */
  } /* Add */
  Add = ip/1/if2/1 {
    Media {
      Stream = 1 {
        Local {
          v=0
          m=-2223 --
          c=IN IP4 10.0.0.1
          b=AS:104
        }
      } /* Stream */
    } /* Media */
  } /* Add */
} /* Context */
} /* Reply */

```

Step	Protocol	Interface	From	To	Message
6	DIAMETER	Rt	PD-PE A	TRC-PE A	AA-Request

The TRC-PE does not need the port numbers in this scenario since it does not interrogate any entity over Rc. However, these numbers are included anyway because that is the desired default behaviour. That is, the PD-PE 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 TRC-PE can determine the sources from the Globally-Unique-Address of the subscriber.

```

<AA-Request> ::= < Diameter Header: 265, REQ, PXY >
  < Session-Id = "pd-pe-a.example.com;429C3;412" >
  { Auth-Application-Id = 16777235 (Rs) }
  { Origin-Host = "pd-pe-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 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 ]
]
[ 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	Rt	TRC-PE A	PD-PE A	AA-Answer
<pre> &lt;AA-Answer&gt; ::= &lt; Diameter Header: 265, PXY &gt; &lt; Session-Id = "pd-pe-a.example.com;429C3;412" &gt; { Auth-Application-Id = 16777235 (Rs) } { Origin-Host = "trc-pe-a.example.com" } { Origin-Realm = "example.com" } [ Result-Code = DIAMETER_SUCCESS (2001) ] [ Authorization-Lifetime = 450 ] [ Auth-Grace-Period = 10 ] </pre>					
Step	Protocol	Interface	From	To	Message
8	DIAMETER	Rs	PD-PE A	SCE A	AA-Answer
<pre> &lt;AA-Answer&gt; ::= &lt; Diameter Header: 265, PXY &gt; &lt; Session-Id = "sce-a.example.com;13815C;391" &gt; { Auth-Application-Id = 16777235 (Rs) } { Origin-Host = "pd-pe-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 = 192.168.0.2 }       { Port-Number = 23943 }     ]   } ] [ Binding-Output-List =   [ V4-Transport-Address =     { Framed-IP-Address = 10.0.0.1 }     { Port-Number = 2222 }   ] ] </pre>					

```

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

```

Step	Protocol	Interface	From	To	Message
9	SIP		SCE A	S-CSCF	INVITE B
<pre> INVITE sip:user_b@example.com SIP/2.0 Via: SIP/2.0/UDP sce-a.example.com:5060;branch=z9hG4bKvp2yml Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03 Max-Forwards: 69 Record-Route: &lt;sip:sce-a.example.com;lr&gt; From: User A &lt;sip:user_a@example.com&gt;;tag=372183 To: User B &lt;sip:user_b@example.com&gt; Call-ID: 398174293@phone-a.example.com CSeq: 1 INVITE Contact: &lt;sip:user_a@phone-a.example.com&gt; 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 </pre>					
Step	Protocol	Interface	From	To	Message
10	SIP		S-CSCF	SCE A	100 Trying
<pre> SIP/2.0 100 Trying Via: SIP/2.0/UDP sce-a.example.com:5060;branch=z9hG4bKvp2yml Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03 From: User A &lt;sip:user_a@example.com&gt;;tag=372183 To: User B &lt;sip:user_b@example.com&gt; Call-ID: 398174293@phone-a.example.com CSeq: 1 INVITE Content-Length: 0 </pre>					
Step	Protocol	Interface	From	To	Message
11	SIP		S-CSCF	SCE B	INVITE B
<pre> INVITE sip:user_b@example.com SIP/2.0 Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKralar Via: SIP/2.0/UDP sce-a.example.com:5060;branch=z9hG4bKvp2yml Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03 Max-Forwards: 68 Record-Route: &lt;sip:s-cscf.example.com;lr&gt;,&lt;sip:sce-a.example.com;lr&gt; From: User A &lt;sip:user_a@example.com&gt;;tag=372183 To: User B &lt;sip:user_b@example.com&gt; Call-ID: 398174293@phone-a.example.com CSeq: 1 INVITE Contact: &lt;sip:user_a@phone-a.example.com&gt; Content-Type: application/sdp Content-Length: 125  v=0 </pre>					

<pre> 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 </pre>					
Step	Protocol	Interface	From	To	Message
12	SIP		SCE-B	S-CSE	100 Trying
<pre> SIP/2.0 100 Trying Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKralar Via: SIP/2.0/UDP sce-a.example.com:5060;branch=z9hG4bKvp2yml Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03 From: User A &lt;sip:user_a@example.com&gt;;tag=372183 To: User B &lt;sip:user_b@example.com&gt; Call-ID: 398174293@phone-a.example.com CSeq: 1 INVITE Content-Length: 0 </pre>					
Step	Protocol	Interface	From	To	Message
13	DIAMETER	Rs	SCE B	PD-PE B	AA-Request
<p>It should be noted that the IP address registered for signalling, which is the same 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 B may be the same source IP address used for media.</p>					
<pre> &lt;AA-Request&gt; ::= &lt; Diameter Header: 265, REQ, PXY &gt;   &lt; Session-Id = "sce-b.example.com;481C43;583" &gt;   { Auth-Application-Id = 16777235 (Rs) }   { Origin-Host = "sce-b.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 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) ] ] [ Binding-Information =   { Binding-Input-List =     [ V4-Transport-Address =       { Framed-IP-Address = 10.0.0.1 }       { Port-Number = 2222 }     ]   ]   [ V4-Transport-Address = </pre>					

```

        { 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	ITU-T H.248	Rw	PD-PE B	PE-PE B	Add terminations
<pre> MEGACO/3 [pd-pe-b.example.com]:43924 Transaction = 1 { Context = \$ {   Add = ip/1/if1/\$ {     Media {       Stream = 1 {         Local {           v=0           m=-\$ --           c=IN IP4 \$           b=AS:104         }       } /* Stream */     } /* Media */   } /* Add */   Add = ip/1/if2/\$ {     Media {       Stream = 1 {         Remote {           v=0           m=-2222 - -           c=IN IP4 10.0.0.1           b=AS:104         }       } /* Stream */     } /* Media */   } /* Add */ } /* Context */ } /* Transaction */ </pre>					
Step	Protocol	Interface	From	To	Message
15	ITU-T H.248	Rw	PE-PE B	PD-PE B	Reply (Add)
<pre> MEGACO/3 [abgf-b.example.com]:43924 Reply = 1 { Context = 1 {   Add = ip/1/if1/1{     Media {       Stream = 1 {         Local {           v=0           m=-3332 -           c=IN IP4 192.168.1.1           b=AS:104         }       } /* Stream */     } /* Media */   } /* Add */   Add = ip/1/if2/1{     Media { </pre>					

```

Stream = 1 {
  Remote {
    v=0
    m=-2222--
    c=IN IP4 10.0.0.1
    b=AS:104
  }
} /* Stream */
} /* Media */
} /* Add */
} /* Context */
} /* Reply */

```

Step	Protocol	Interface	From	To	Message
16	DIAMETER	Rt	PD-PE B	TRC-PE B	AA-Request

The TRC-PE 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 = "pd-pe-b.example.com;41295;512" >
  { Auth-Application-Id = 16777235 (Rs) }
  { Origin-Host = "pd-pe-b.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 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	Rt	TRC-PE B	PD-PE B	AA-Answer
<pre>&lt;AA-Answer&gt; ::= &lt; Diameter Header: 265, PXY &gt;   &lt; Session-Id = "pd-pe-b.example.com;41295;512" &gt;   { Auth-Application-Id = 16777235 (Rs) }   { Origin-Host = "trc-pe-b.example.com" }   { Origin-Realm = "example.com" }   [ Result-Code = DIAMETER_SUCCESS (2001) ]   [ Authorization-Lifetime = 450 ]   [ Auth-Grace-Period = 10 ]</pre>					
Step	Protocol	Interface	From	To	Message
18	DIAMETER	Rs	PD-PE B	SCE B	AA-Answer
<pre>&lt;AA-Answer&gt; ::= &lt; Diameter Header: 265, PXY &gt;   &lt; Session-Id = "sce-b.example.com;481C43;583" &gt;   { Auth-Application-Id = 16777235 (Rs) }   { Origin-Host = "pd-pe-b.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 = 10.0.0.1 }         { Port-Number = 2223 }       ]     }   [ Binding-Output-List =     [ V4-Transport-Address =       { Framed-IP-Address = 192.168.1.1 }       { Port-Number = 3332 }     ]     [ V4-Transport-Address =       { Framed-IP-Address = 192.168.1.1 }       { Port-Number = 3333 }     ]   ]   [ Authorization-Lifetime = 450 ]   [ Auth-Grace-Period = 10 ]</pre>					
Step	Protocol	Interface	From	To	Message
19	SIP		SCE B	B	INVITE B
<pre>INVITE sip:user_b@example.com SIP/2.0 Via: SIP/2.0/UDP sce-b.example.com:5060;branch=z9hG4bKs1pp0 Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKralar Via: SIP/2.0/UDP sce-a.example.com:5060;branch=z9hG4bKvp2yml Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03 Max-Forwards: 67 Record-Route: &lt;sip:sce-b.example.com;lr&gt;, &lt;sip:s-cscf.example.com;lr&gt;, &lt;sip:sce-a.example.com;lr&gt; From: User A &lt;sip:user_a@example.com&gt;;tag=372183 To: User B &lt;sip:user_b@example.com&gt; Call-ID: 398174293@phone-a.example.com CSeq: 1 INVITE Contact: &lt;sip:user_a@phone-a.example.com&gt; Content-Type: application/sdp Content-Length: 128</pre>					

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		B	SCE B	180 Ringing
SIP/2.0 180 Ringing Via: SIP/2.0/UDP sce-b.example.com:5060;branch=z9hG4bKs1pp0 Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKralar Via: SIP/2.0/UDP sce-a.example.com:5060;branch=z9hG4bKvp2yml Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03 Record-Route: <sip:sce-b.example.com;lr>, <sip:s-cscf.example.com;lr>, <sip:sce-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		SCE B	S-CSCF	180 Ringing
SIP/2.0 180 Ringing Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKralar Via: SIP/2.0/UDP sce-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:sce-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	SCE A	180 Ringing
SIP/2.0 180 Ringing Via: SIP/2.0/UDP sce-a.example.com:5060;branch=z9hG4bKvp2yml Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03 Record-Route: <sip:sce-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		SCE A	A	180 Ringing
SIP/2.0 180 Ringing Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03 Record-Route: <sip:sce-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
24	SIP		B	SCE B	200 OK (SDP)
SIP/2.0 200 OK Via: SIP/2.0/UDP SCE-b.example.com:5060;branch=z9hG4bKs1pp0 Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKralar Via: SIP/2.0/UDP SCE-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					
Step	Protocol	Interface	From	To	Message
25	DIAMETER	Rs	SCE B	PD-PE B	AA-Request (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 to be redundant information (as the in Flow-Description AVP and the Max-Requested-Bandwidth-UL have already been provided to RACF) the Rs specification does not explicitly allow any of those AVPs to be omitted. Hence, they are all included.					
<pre> &lt;AA-Request&gt; ::= &lt; Diameter Header: 265, REQ, PXY &gt;   &lt; Session-Id = "SCE-b.example.com;481C43;583" &gt;   { Auth-Application-Id = 16777235 (Rs) }   { Origin-Host = "sce-b.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 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) ] </pre>					

```

[ Flow-Status = ENABLED ]
[ Reservation-Priority = DEFAULT (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 = 192.168.1.2 }
      { Port-Number = 29793 }
    ]
  }
]
[ 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
26	ITU-T H.248	Rw	PD-PE B	PE-PE B	Modify terminations
<pre> MEGACO/3 [pd-pe-b.example.com]:43924 Transaction = 2 { Context = 1 {   Modify = ip/1/if1/1 {     Media {       Stream = 1 {         LocalControl {           Mode=SendRecv         }         Local {           v=0           m=-3332 --           c=IN IP4 192.168.1.1           b=AS:104         }         Remote {           v=0           m=-29792 --           c=IN IP4 192.168.1.2           b=AS:104         }       } /* Stream */     } /* Media */   } /* Modify */   Modify = ip/1/if2/1 {     Media {       Stream = 1 {         LocalControl {           Mode=SendRecv         }         Local {           v=0           m=-\$ --           c=IN IP4 \$           b=AS:104         }         Remote {           v=0           m=- 2222 - - </pre>					

<pre> c=IN IP4 10.0.0.1 b=AS:104     }   } /* Stream */ } /* Media */ } /* Modify */ } /* Context */ } /* Transaction */ </pre>					
Step	Protocol	Interface	From	To	Message
27	ITU-T H.248	Rw	PE-PE B	PD-PE B	Reply (Modify)
<pre> MEGACO/3 [abgf-b.example.com] : 43924 Reply = 2 { Context = 1 {   Modify = ip/1/if1/1 {     Media {       Stream = 1 {         Local {           v=0           m=-3332 --           c=IN IP4 192.168.1.1           b=AS:104         }         Remote {           v=0           m=-29792 --           c=IN IP4 192.168.1.2           b=AS:104         }       } /* Stream */     } /* Media */   } /* Modify */   Modify = ip/1/if2/1 {     Media {       Stream = 1 {         Local {           v=0           m=-1110 --           c=IN IP4 10.0.0.2           b=AS:104         }         Remote {           v=0           m=- 2222 - -           c=IN IP4 10.0.0.1           b=AS:104         }       } /* Stream */     } /* Media */   } /* Modify */ } /* Context */ } /* Reply */ </pre>					
Step	Protocol	Interface	From	To	Message
28	DIAMETER	Rt	PD-PE B	TRC-PE B	AA-Request (Modify)
<pre> &lt;AA-Request&gt; ::= &lt; Diameter Header: 265, REQ, PXY &gt; &lt; Session-Id = "pd-pe-b.example.com;41295;512" &gt; { Auth-Application-Id = 16777235 (Rs) } { Origin-Host = "pd-pe-b.example.com" } { Origin-Realm = "example.com" } { Destination-Realm = "example.com" } [ Media-Component-Description =   { Media-Component-Number = 1 } </pre>					

```

[ 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-UL = 96000 ]
  [ Max-Requested-Bandwidth-DL = 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-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
29	DIAMETER	Rt	TRC-PE B	PD-PE B	AA-Answer (Modify)

```

<AA-Answer> ::= < Diameter Header: 265, PXY >
  < Session-Id = "pd-pe-b.example.com;41295;512" >
  { Auth-Application-Id = 16777235 (Rs) }
  { Origin-Host = "trc-pe-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
30	DIAMETER	Rs	PD-PE B	SCE B	AA-Answer (Modify)

```

<AA-Answer> ::= < Diameter Header: 265, PXY >
  < Session-Id = "sce-b.example.com;481C43;583" >
  { Auth-Application-Id = 16777235 (Rs) }
  { Origin-Host = "pd-pe-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 = 192.168.1.2 }
        { Port-Number = 29793 }
      ]
    }
  ]
  [ Binding-Output-List = 10.0.0.2
    [ V4-Transport-Address =
      { Framed-IP-Address = 10.0.0.2 }
      { Port-Number = 1110 }
    ]
  ]

```

<pre> [ V4-Transport-Address =   { Framed-IP-Address = 10.0.0.2 }   { Port-Number = 1111 } ] ] [ Authorization-Lifetime = 450 ] [ Auth-Grace-Period = 10 ] </pre>					
Step	Protocol	Interface	From	To	Message
31	SIP		SCE B	S-CSCF	200 OK (SDP)
<pre> SIP/2.0 200 OK Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKra1ar Via: SIP/2.0/UDP sce-a.example.com:5060;branch=z9hG4bKvp2yml Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03 Max-Forwards: 69 From: User A &lt;sip:user_a@example.com&gt;;tag=372183 To: User B &lt;sip:user_b@example.com&gt; Call-ID: 398174293@phone-a.example.com CSeq: 1 INVITE Contact: &lt;sip:user_b@phone-b.example.com&gt; 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 </pre>					
Step	Protocol	Interface	From	To	Message
32	SIP		S-CSCF	SCE A	200 OK (SDP)
<pre> SIP/2.0 200 OK Via: SIP/2.0/UDP sce-a.example.com:5060;branch=z9hG4bKvp2yml Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03 Max-Forwards: 68 From: User A &lt;sip:user_a@example.com&gt;;tag=372183 To: User B &lt;sip:user_b@example.com&gt; Call-ID: 398174293@phone-a.example.com CSeq: 1 INVITE Contact: &lt;sip:user_b@phone-b.example.com&gt; 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 </pre>					
Step	Protocol	Interface	From	To	Message
33	DIAMETER	Rs	SCE A	PD-PE A	AA-Request (Modify)
<pre> &lt;AA-Request&gt; ::= &lt; Diameter Header: 265, REQ, PXY &gt;   &lt; Session-Id = "sce-a.example.com;13815C;391" &gt;   { Auth-Application-Id = 16777235 (Rs) }   { Origin-Host = "sce-a.example.com" }   { Origin-Realm = "example.com" }   { Destination-Realm = "example.com" } </pre>					

```

[ 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) ]
]
[ Binding-Information =
  { Binding-Input-List =
    [ V4-Transport-Address =
      { Framed-IP-Address = 10.0.0.2 }
      { Port-Number = 1110 }
    ]
    [ V4-Transport-Address =
      { Framed-IP-Address = 10.0.0.2 }
      { Port-Number = 1111 }
    ]
  }
]
[ Reservation-Priority = DEFAULT (0) ]
[ Globally-Unique-Address =
  [ Framed-IP-Address = 192.168.0.2 ]
  [ Address-Realm = "example.com" ]
]
[ Authorization-Lifetime = 450 ]

```

Step	Protocol	Interface	From	To	Message
34	ITU-T H.248	Rw	PD-PE A	PE-PE A	Add terminations A (A to B)
<pre> MEGACO/3 [pd-pe-a.example.com]:55555 Transaction = 2 { Context = 1 {   Add = ip/1/if1/1 {     Media {       Stream = 1 {         LocalControl {           Mode=SendRecv         }         Local {           v=0           m=-\$ --           c=IN IP4 \$           b=AS:104         }         Remote {           v=0           m=-23942 --           c=IN IP4 192.168.0.2         }       }     }   } } </pre>					

```

        b=AS:104
    }
} /* Stream */
} /* Media */
} /* Add */
Add = ip/1/1/if2/1 {
    Media {
        Stream = 1 {
            LocalControl {
                Mode=SendRecv
            }
            Local {
                v=0
                m=-2222 --
                c=IN IP4 10.0.0.1
                b=AS:104
            }
            Remote {
                v=0
                m=-1110 --
                c=IN IP4 10.0.0.2
                b=AS:104
            }
        }
    } /* Stream */
} /* Media */
} /* Add */
} /* Context */
} /* Transaction */

```

Step	Protocol	Interface	From	To	Message
35	ITU-T H.248	Rw	PE-PE A	PD-PE A	Reply (Add)
<pre> MEGACO/3 [abgf-a.example.com]:55555 Reply = 2 { Context = 1 {     Add = ip/1/1/if1/1 {         Media {             Stream = 1 {                 Local {                     v=0                     m=-4444 --                     c=IN IP4 192.168.0.1                     b=AS:104                 }                 Remote {                     v=0                     m=-23942 --                     c=IN IP4 192.168.0.2                     b=AS:104                 }             }         } /* Stream */     } /* Media */ } /* Add */ Add = ip/1/1/if2/1 {     Media {         Stream = 1 {             Local {                 v=0                 m=-2222 --                 c=IN IP4 10.0.0.1                 b=AS:104             }             Remote {                 v=0 </pre>					

```

m=-1110 --
c=IN IP4 10.0.0.2
b=AS:104
    }
  } /* Stream */
} /* Media */
} /* Add */
} /* Context */
} /* Reply */

```

Step	Protocol	Interface	From	To	Message
36	DIAMETER	Rt	PD-PE A	TRC-PE A	AA-Request (Modify)

```

<AA-Request> ::= < Diameter Header: 265, REQ, PXY >
< Session-Id = "pd-pe-a.example.com;429C3;412" >
{ Auth-Application-Id = 16777235 (Rs) }
{ Origin-Host = "pd-pe-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 192.168.0.2 23942" ]
    [ Flow-Description = "permit in 17 from any 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 any to 192.168.0.2 23943" ]
    [ Flow-Description = "permit in 17 from any 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 = 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
37	DIAMETER	Rt	TRC-PE A	PD-PE A	AA-Answer (Modify)

```

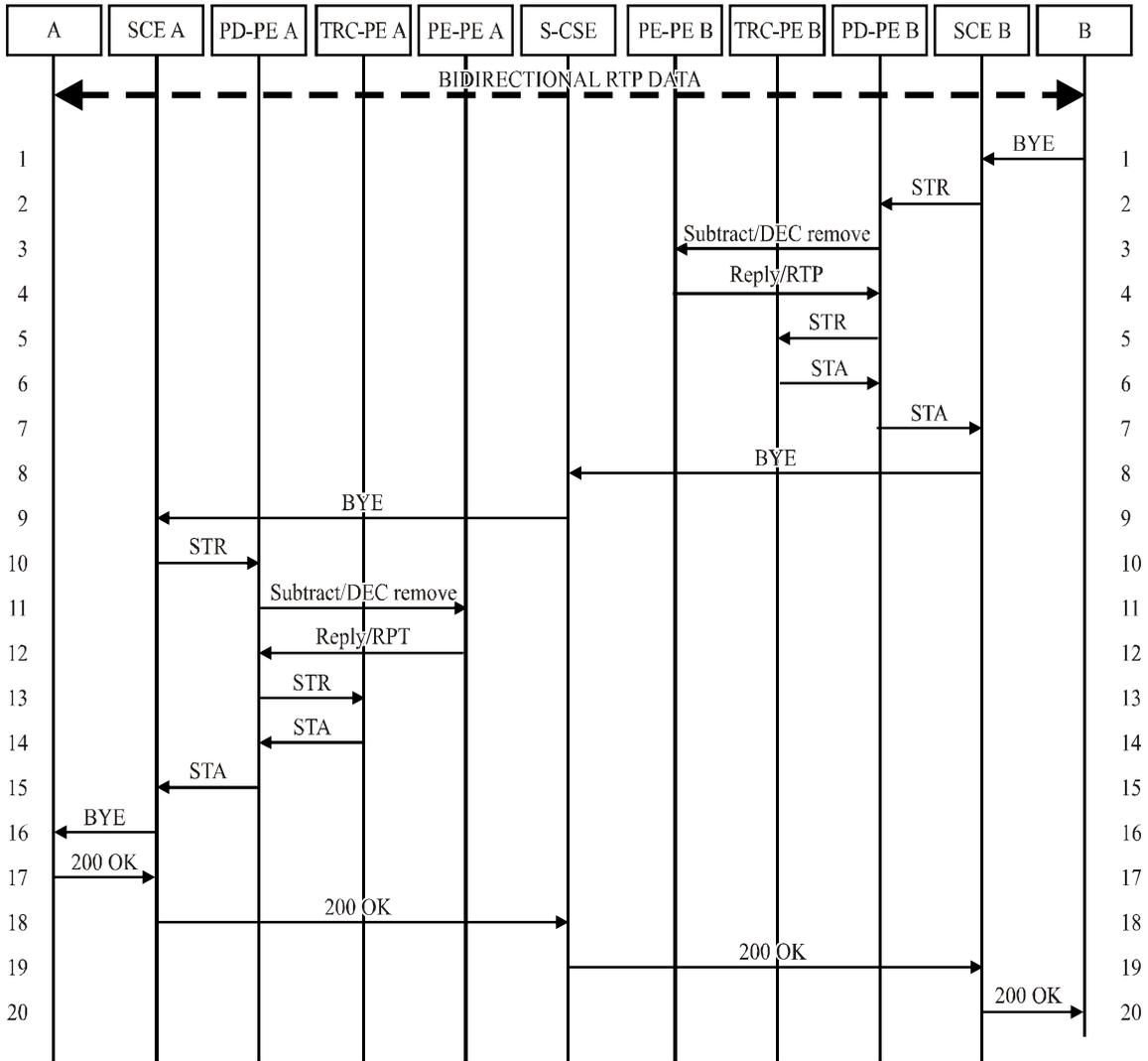
<AA-Answer> ::= < Diameter Header: 265, PXY >
< Session-Id = "pd-pe-a.example.com;429C3;412" >
{ Auth-Application-Id = 16777235 (Rs) }
{ Origin-Host = "trc-pe-a.example.com" }
{ Origin-Realm = "example.com" }
[ Result-Code = DIAMETER_SUCCESS (2001) ]
[ Authorization-Lifetime = 450 ]
[ Auth-Grace-Period = 10 ]

```

Step	Protocol	Interface	From	To	Message
38	DIAMETER	Rs	PD-PE A	SCE A	AA-Answer (Modify)
<pre> &lt;AA-Answer&gt; ::= &lt; Diameter Header: 265, PXY &gt;   &lt; Session-Id = "sce-a.example.com;13815C;391" &gt;   { Auth-Application-Id = 16777235 (Rs) }   { Origin-Host = "pd-pe-a.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 = 10.0.0.2 }         { Port-Number = 1111 }       ]     }     [ Binding-Output-List =       [ V4-Transport-Address =         { Framed-IP-Address = 192.168.0.1 }         { Port-Number = 4444 }       ]       [ V4-Transport-Address =         { Framed-IP-Address = 192.168.0.1 }         { Port-Number = 4445 }       ]     ]   ]   [ Authorization-Lifetime = 450 ]   { Auth-Grace-Period = 10 } </pre>					
Step	Protocol	Interface	From	To	Message
39	SIP		SCE A	A	200 OK (SDP)
<pre> SIP/2.0 200 OK Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03 Max-Forwards: 67 From: User A &lt;sip:user_a@example.com&gt;;tag=372183 To: User B &lt;sip:user_b@example.com&gt; Call-ID: 398174293@phone-a.example.com CSeq: 1 INVITE Contact: &lt;sip:user_b@phone-b.example.com&gt; 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 </pre>					

Step	Protocol	Interface	From	To	Message
40	SIP		A	SCE 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:sce-a.example.com;lr>, <sip:s-cscf.example.com;lr>, <sip:SCE-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					
41	SIP		SCE A	S-CSCF	ACK
ACK sip:user_b@example.com SIP/2.0 Via: SIP/2.0/UDP sce-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:SCE-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					
42	SIP		S-CSCF	SCE B	ACK
ACK sip:user_b@example.com SIP/2.0 Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKralar Via: SIP/2.0/UDP sce-a.example.com:5060;branch=z9hG4bKvp2yml Via: SIP/2.0/UDP phone-a.example.com:5060;branch=z9hG4bK74b03 Max-Forwards: 68 Route: <sip:sce-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					
43	SIP		SCE B	B	ACK
ACK sip:user_b@example.com SIP/2.0 Via: SIP/2.0/UDP sce-b.example.com:5060;branch=z9hG4bKs1pp0 Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKralar Via: SIP/2.0/UDP sce-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					

### 7.1.2 Session termination



Q.Sup.59(08)\_F25

Step	Protocol	Interface	From	To	Message
1	SIP		B	SCE B	BYE
<pre> 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: &lt;sip:sce-b.example.com;lr&gt;, &lt;sip:s-cscf.example.com;lr&gt;, &lt;sip:sce-a.example.com;lr&gt; From: User B &lt;sip:user_b@example.com&gt;;tag=4fxdce12ls To: User A &lt;sip:user_a@example.com&gt; Call-ID: 398174293@phone-a.example.com CSeq: 1 BYE Content-Length: 0                     </pre>					

Step	Protocol	Interface	From	To	Message
2	DIAMETER	Rs	SCE B	PD-PE B	STR
<pre>&lt;ST-Request&gt; ::= &lt; Diameter Header: 275, REQ, PXY &gt;   &lt; Session-Id = "sce-b.example.com;481C43;583" &gt;   { Origin-Host = "sce-b.example.com" }   { Origin-Realm = "example.com" }   { Destination-Realm = "example.com" }   { Auth-Application-Id = 16777235 (Rs) }</pre>					
Step	Protocol	Interface	From	To	Message
3	ITU-T H.248	Rw	PD-PE B	PE-PE B	Subtract termination B
<pre>MEGACO/3 [pd-pe-b.example.com]:43924 Transaction = 3 { Context = 1 {   Subtract = ip/1/1f1/1 {     Audit{       Statistics     }   }   Subtract = ip/1/1f2/1 {     Audit{       Statistics     }   } } /* Context */ } /* Transaction */</pre>					
Step	Protocol	Interface	From	To	Message
4	ITU-T H.248	Rw	PE-PE B	PD-PE B	Reply
<pre>MEGACO/3 [abgf-b.example.com]:43924 Reply = 3 { Context = 1 {   Subtract = ip/1/1f1/1 {     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/1/1f2/1 {     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 */</pre>					

Step	Protocol	Interface	From	To	Message
5	DIAMETER	Rt	PD-PE B	TRC-PE B	STR
<pre>&lt;ST-Request&gt; ::= &lt; Diameter Header: 275, REQ, PXY &gt;   &lt; Session-Id = "pd-pe-b.example.com;41295;512" &gt;   { Origin-Host = "pd-pe-b.example.com" }   { Origin-Realm = "example.com" }   { Destination-Realm = "example.com" }   { Auth-Application-Id = 16777235 (Rs) }</pre>					
6	DIAMETER	Rt	TRC-PE B	PD-PE B	STA
<pre>&lt;ST-Answer&gt; ::= &lt; Diameter Header: 275, PXY &gt;   &lt; Session-Id = "pd-pe-b.example.com;41295;512" &gt;   { Origin-Host = "trc-pe-b.example.com" }   { Origin-Realm = "example.com" }   { Destination-Realm = "example.com" }   { Auth-Application-Id = 16777235 (Rs) }   [ Result-Code = DIAMETER_SUCCESS (2001) ]</pre>					
7	DIAMETER	Rs	PD-PE B	SCE B	STA
<pre>&lt;ST-Answer&gt; ::= &lt; Diameter Header: 275, PXY &gt;   &lt; Session-Id = "sce-b.example.com;481C43;583" &gt;   { Origin-Host = "pd-pe-b.example.com" }   { Origin-Realm = "example.com" }   { Destination-Realm = "example.com" }   { Auth-Application-Id = 16777235 (Rs) }   [ Result-Code = DIAMETER_SUCCESS (2001) ]</pre>					
8	SIP		SCE B	S-CSCF	BYE
<pre>BYE sip:user_a@example.com SIP/2.0 Via: SIP/2.0/UDP sce-b.example.com:5060;branch=z9hG4bKs1pp0 Via: SIP/2.0/UDP phone-b.example.com:5060;branch=z9hG4bKjwafcb9 Max-Forwards: 69 Route: &lt;sip:s-cscf.example.com;lr&gt;, &lt;sip:sce-a.example.com;lr&gt; From: User B &lt;sip:user_b@example.com&gt;;tag=4fxdce12ls To: User A &lt;sip:user_a@example.com&gt; Call-ID: 398174293@phone-a.example.com CSeq: 1 BYE Content-Length: 0</pre>					
9	SIP		S-CSCF	SCE A	BYE
<pre>BYE sip:user_a@example.com SIP/2.0 Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKralar Via: SIP/2.0/UDP sce-b.example.com:5060;branch=z9hG4bKs1pp0 Via: SIP/2.0/UDP phone-b.example.com:5060;branch=z9hG4bKjwafcb9 Max-Forwards: 68 Route: &lt;sip:sce-a.example.com;lr&gt; From: User B &lt;sip:user_b@example.com&gt;;tag=4fxdce12ls To: User A &lt;sip:user_a@example.com&gt; Call-ID: 398174293@phone-a.example.com CSeq: 1 BYE Content-Length: 0</pre>					

Step	Protocol	Interface	From	To	Message
10	DIAMETER	Rs	SCE A	PD-PE A	STR
<pre>&lt;ST-Request&gt; ::= &lt; Diameter Header: 275, REQ, PXY &gt;   &lt; Session-Id = "sce-a.example.com;13815C;391" &gt;   { Origin-Host = "sce-a.example.com" }   { Origin-Realm = "example.com" }   { Destination-Realm = "example.com" }   { Auth-Application-Id = 16777235 (Rs) }</pre>					
Step	Protocol	Interface	From	To	Message
11	ITU-T H.248	Rw	PD-PE A	PE-PE A	Subtract termination A
<pre>MEGACO/3 [pd-pe-a.example.com]:5555 Transaction = 3 { Context = 1 {   Subtract = ip/1/1f1/1 {     Audit{       Statistics     }   }   Subtract = ip/1/1f2/1 {     Audit{       Statistics     }   } } /* Context */ } /* Transaction */</pre>					
Step	Protocol	Interface	From	To	Message
12	ITU-T H.248	Rw	PE-PE A	PD-PE A	Reply
<pre>MEGACO/3 [abgf-a.example.com]:21398 Reply = 3 { Context = 1 {   Subtract = ip/1/1f1/1 {     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/1/1f1/2 {     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 */</pre>					
Step	Protocol	Interface	From	To	Message
13	DIAMETER	Rt	PD-PE A	TRC-PE A	STR
<pre>&lt;ST-Request&gt; ::= &lt; Diameter Header: 275, REQ, PXY &gt;   &lt; Session-Id = "pd-pe-a.example.com;429C3;412" &gt;   { Origin-Host = "pd-pe-a.example.com" }   { Origin-Realm = "example.com" }   { Destination-Realm = "example.com" }   { Auth-Application-Id = 16777235 (Rs) }</pre>					

Step	Protocol	Interface	From	To	Message
14	DIAMETER	Rt	TRC-PE A	PD-PE A	STA
<pre>&lt;ST-Answer&gt; ::= &lt; Diameter Header: 275, PXY &gt;   &lt; Session-Id = "pd-pe-a.example.com;429C3;412" &gt;   { Origin-Host = "trc-pe-a.example.com" }   { Origin-Realm = "example.com" }   { Destination-Realm = "example.com" }   { Auth-Application-Id = 16777235 (Rs) }   [ Result-Code = DIAMETER_SUCCESS (2001) ]</pre>					
15	DIAMETER	Rs	PD-PE A	SCE A	STA
<pre>&lt;ST-Answer&gt; ::= &lt; Diameter Header: 275, PXY &gt;   &lt; Session-Id = "sce-a.example.com;13815C;391" &gt;   { Origin-Host = "pd-pe-a.example.com" }   { Origin-Realm = "example.com" }   { Destination-Realm = "example.com" }   { Auth-Application-Id = 16777235 (Rs) }   [ Result-Code = DIAMETER_SUCCESS (2001) ]</pre>					
16	SIP		SCE A	A	BYE
<pre>BYE sip:user_a@example.com SIP/2.0 Via: SIP/2.0/UDP sce-a.example.com:5060;branch=z9hG4bKs1pp0 Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKralar Via: SIP/2.0/UDP sce-b.example.com:5060;branch=z9hG4bKs1pp0 Via: SIP/2.0/UDP phone-b.example.com:5060;branch=z9hG4bKjwafcb9 Max-Forwards: 67 From: User B &lt;sip:user_b@example.com&gt;;tag=4fxdce12ls To: User A &lt;sip:user_a@example.com&gt; Call-ID: 398174293@phone-a.example.com CSeq: 1 BYE Content-Length: 0</pre>					
17	SIP		A	SCE A	200 OK BYE
<pre>SIP/2.0 200 OK Via: SIP/2.0/UDP sce-a.example.com:5060;branch=z9hG4bKs1pp0 Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKralar Via: SIP/2.0/UDP sce-b.example.com:5060;branch=z9hG4bKs1pp0 Via: SIP/2.0/UDP phone-b.example.com:5060;branch=z9hG4bKjwafcb9 Max-Forwards: 70 From: User B &lt;sip:user_b@example.com&gt;;tag=4fxdce12ls To: User A &lt;sip:user_a@example.com&gt; Call-ID: 398174293@phone-a.example.com CSeq: 1 BYE Content-Length: 0</pre>					

Step	Protocol	Interface	From	To	Message
<b>18</b>	<b>SIP</b>		<b>SCE A</b>	<b>S-CSCF</b>	<b>200 OK BYE</b>
SIP/2.0 200 OK Via: SIP/2.0/UDP s-cscf.example.com:5060;branch=z9hG4bKralar Via: SIP/2.0/UDP sce-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					
<b>19</b>	<b>SIP</b>		<b>S-CSCF</b>	<b>SCE B</b>	<b>200 OK BYE</b>
SIP/2.0 200 OK Via: SIP/2.0/UDP sce-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					
<b>20</b>	<b>SIP</b>		<b>SCE B</b>	<b>B</b>	<b>200 OK BYE</b>
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					

## 7.2 Pull mode scenarios

For further study.





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