ETSI TS 183 048 V2.2.1 (2009-08)

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

Reference

RTS/TISPAN-03200-NGN-R2

Keywords

protocol, signalling, 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.

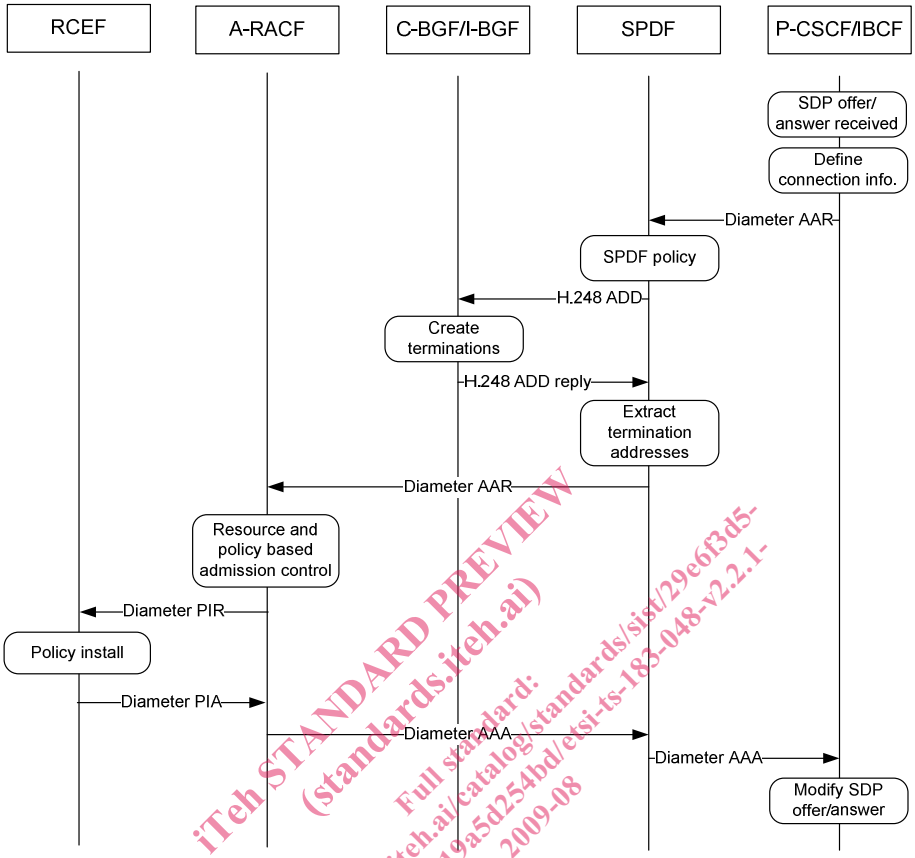

Figure 4.1: RACS, RCEF, BGF and P-CSCF/IBCF interactions (alternative 1)

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.

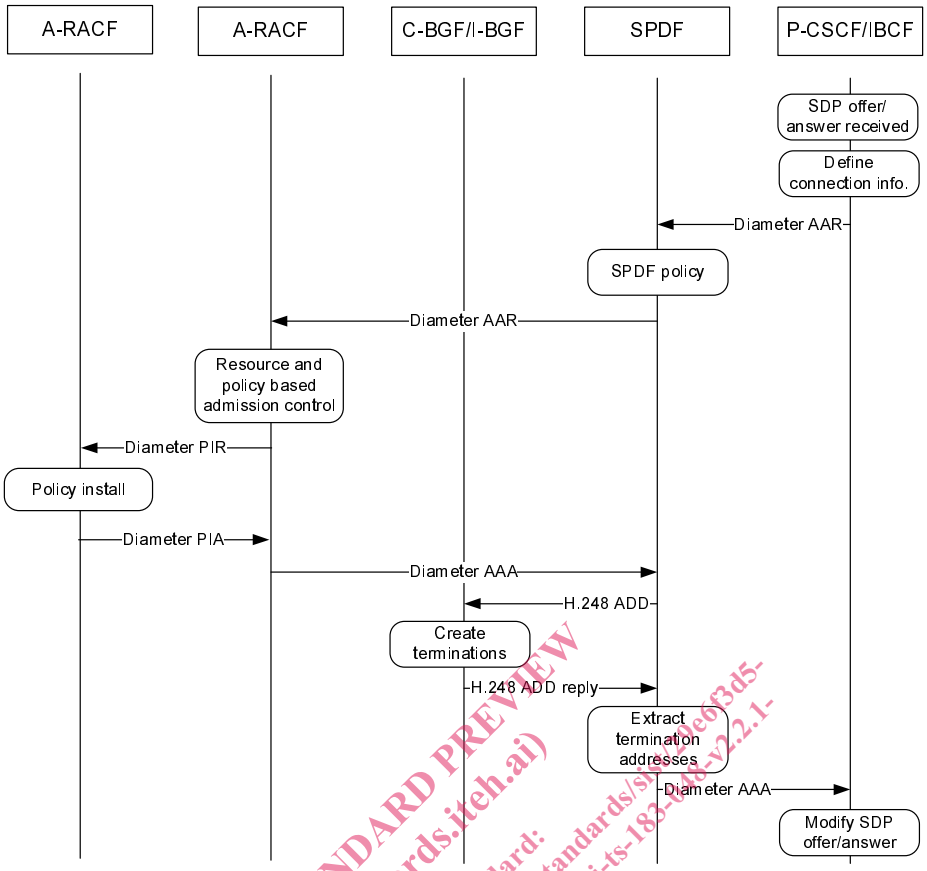

Figure 4.2: RACS, RCEF, BGF and P-CSCF/IBCF interactions (alternative 2)

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.

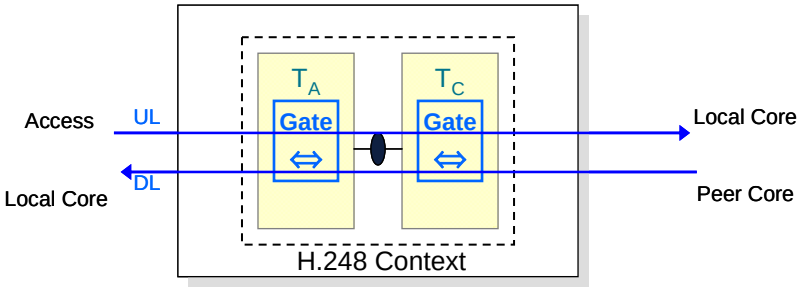

Figure 5.2.1.2.1: BGF connection and flow model representation

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".