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Infrastructure of audiovisual services – Communication procedures

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Gateway control protocol: RTP topology dependent RTCP handling by ITU-T H.248 media gateways with IP terminations

Recommendation ITU-T H.248.88

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Recommendation ITU-T H.248.88

Gateway control protocol: RTP topology dependent RTCP handling by ITU-T H.248 media gateways with IP terminations

Summary

RTCP is the control protocol associated to RTP, which has various connection models called RTP topologies. The handling of RTCP information may be RTP topology dependent. ITU-T H.248 media gateways may support various types of RTP topologies, driven by network application scenarios. Recommendation ITU-T H.248.88 provides both general and detailed information about this topic, as well as explicit control means to enforce dedicated RTP topologies in such media gateways.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
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Gateway control protocol: RTP topology dependent RTCP handling by ITU-T H.248 media gateways with IP terminations

1 Scope

The scope of this Recommendation is related to RTP control protocol (RTCP) handling by ITU-T H.248 media gateways (MGs) [ITU-T H.248.1]. The required MG behaviour is fairly clear for the majority of use cases. However, there are some scenarios which benefit from or even require explicit signalling indication for an unambiguous control of MG RTCP (but also RTP) traffic handling behaviour.

This Recommendation covers:

– information on the history and motivation behind RTP topologies and RTCP handling and the available ITU-T H.248 tool landscape (clause 6);

– overview tables concerning RTP topology versus RTCP handling aspects and relevant ITU-T H.248 connection models (clause 7);

– RTCP service aspects (clause 8);

– scope and limitations of RTP topology control (clause 9);

– an ITU-T H.248 package for basic RTP topology control (clause 10); and

– package independent procedures for RTP topology control (clause 11).

This Recommendation may be useful in scenarios where an MG supports multiple RTP topologies and/or multiple RTP/RTCP services which may lead to ambiguous behaviour. In these scenarios an ITU-T H.248 profile specification may use the package in this Recommendation to alleviate this behaviour.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T G.729.1] Recommendation ITU-T G.729.1 (2006), *G.729-based embedded variable bit-rate coder: An 8-32 kbit/s scalable wideband coder bitstream interoperable with G.729*.

[ITU-T G.799.3] Recommendation ITU-T G.799.3 (2011), *Signal processing functionality and performance of an IP-to-IP voice gateway optimized for the transport of voice and voiceband data*.

[ITU-T H.248.1] Recommendation ITU-T H.248.1 (2013), *Gateway Control Protocol: Version 3*.

[ITU-T H.248.30] Recommendation ITU-T H.248.30 (2008), *Gateway control Protocol: RTCP extended performance metrics packages*.

[ITU-T H.248.48] Recommendation ITU-T H.248.48 (2012), *Gateway control Protocol: RTCP XR block reporting package*.

[ITU-T H.248.50] Recommendation ITU-T H.248.50 (2010), *Gateway control Protocol: NAT traversal toolkit packages*.

[ITU-T H.248.57] Recommendation ITU-T H.248.57 (2013), *Gateway control Protocol: RTP control protocol package*.

[ITU-T H.248.58] Recommendation ITU-T H.248.58 (2008), *Gateway control Protocol: Packages for application level H.248 statistics*.

[ITU-T H.248.71] Recommendation ITU-T H.248.71 (2010), *Gateway control Protocol: RTCP support packages*.

[ITU-T H.264] Recommendation ITU-T H.264 (2013), *Advanced video coding for generic audiovisual services*.

[ITU-T Q.9] Recommendation ITU-T Q.9 (1988), *Vocabulary of switching and signalling terms*.

[ITU-T T.411] Recommendation ITU-T T.411 (1993), *Information technology – Open Document Architecture (ODA) and interchange format: Introduction and general principles*.

[ITU-T V.152] Recommendation ITU-T V.152 (2010), *Procedures for supporting voice-band data over IP networks*.

[ITU-T Y.1221] Recommendation ITU-T Y.1221 (2010), *Traffic control and congestion control in IP-based networks*.

[IETF RFC 3550] IETF RFC 3550 (2003), *RTP: A Transport Protocol for Real-Time Applications*.

[IETF RFC 3551] IETF RFC 3551 (2003), *RTP Profile for Audio and Video Conferences with Minimal Control*.

[IETF RFC 3611] IETF RFC 3611 (2003), *RTP Control Protocol Extended Reports (RTCP XR)*.

[IETF RFC 3711] IETF RFC 3711 (2004), *The Secure Real-time Transport Protocol (SRTP)*.

[IETF RFC 4585] IETF RFC 4585 (2006), *Extended RTP Profile for Real-time Transport Control Protocol (RTCP)-Based Feedback (RTP/AVPF)*.

[IETF RFC 4588] IETF RFC 4588 (2006), *RTP Retransmission Payload Format*.

[IETF RFC 5124] IETF RFC 5124 (2008), *Extended Secure RTP Profile for Real-time Transport Control Protocol (RTCP)-Based Feedback (RTP/SAVPF)*.

[IETF RFC 5576] IETF RFC 5576 (2009), *Source-Specific Media Attributes in the Session Description Protocol (SDP)*.

[IETF RFC 5760] IETF RFC 5760 (2010), *RTP Control Protocol (RTCP) Extensions for Single-Source Multicast Sessions with Unicast Feedback*.

[IETF RFC 6051] IETF RFC 6051 (2010), *Rapid Synchronisation of RTP Flows*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 bit integrity [ITU-T Q.9]: Exists when the values of the bits in each octet of a digital bit stream at the output of a device or system are unchanged from those at the *input*.

NOTE – Digital processing devices such as A/µlaw converters, echo suppressors and digital pads must be disabled to provide bit integrity.

3.1.2 data integrity [ITU-T T.411]: The property that data has not been altered or destroyed.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 basic RTCP service: RTCP services based on RTCP packet types SR (200), RR (201), SDES (202) and BYE (203).

NOTE – A minimum RTP implementation must support at least [IETF RFC 3550]. The resulting basic RTCP service is thus considered to be the absolute minimum of any RTP implementation (because [IETF RFC 3550] delegates any service based on RTCP packet type APP (204) to other RT(C)P-related RFCs).

3.2.2 fully protocol unaware forwarding: This applies to transparent forwarding where the MG is unaware of the Lx protocol(s). The MG is thus not able to execute any kind of operation on the Lx-PDU.

NOTE – An example of "fully RTP protocol unaware forwarding" is when the ITU-T H.248 descriptor(s) does not contain any kind of signalling information (such as ITU-T H.248 events, properties, signals, statistics or SDP elements) related to the indication of RTP traffic. This would be a fully L4+ agnostic stream setting.

3.2.3 Lx-PDU integrity: In the context of packet processing, it is the basic property of data integrity. The MG must guarantee bit integrity for forwarded protocol data units (PDU) at layer Lx. Lower layer protocol control information (PCI) may be modified.

3.2.4 RTP domain: A network domain with RTP entities which share a common RTP/RTCP-related identifier space. An RTP domain is characterized therefore by a domain-wide (and temporal, see Note 2) uniqueness of such protocol identifiers, which typically constitute unambiguous RTP traffic flows (e.g., protocol elements SSRC, CNAME, PT).

NOTE 1 – Temporal horizon of identifier values: [b-IETF RFC 6222] differentiates the identifier lifetime in short-term persistent and long-term persistent identifier value assignments.

NOTE 2 – An end-to-end RTP traffic flow could traverse multiple RTP domains, leading to the following observations:

– The end-to-end communication association would be comprised of multiple, concatenated RTP sessions.
– The edge of RTP domains is given by RTP entities with RTP topologies of type RTP End system or Back-to-Back RTP End system.

3.2.5 RTP packet integrity: Lx-PDU integrity for RTP packet PDU type [IETF RFC 3550]. RTP packet integrity implies RTCP packet integrity.

NOTE 1 – The embedded concept of bit integrity restricts this property to input-output related RTP topologies (e.g., the RTP end system topology would be excluded).

NOTE 2 – RTCP packet integrity is limited to end-to-end RTCP control flows, but not related to RTCP packets originating or terminating at the MG (such as possible RTCP XR packets).

3.2.6 RTP profile related RTCP service: The RTCP service given by a specific RTP profile.

3.2.7 RTP source translator: RTP topology related to the translation of RTP source specific parameters. This topology belongs to the high level category of RTP translator topology.

NOTE – This topology is not defined by [b-IETF RFC 5117].

3.2.8 RTCP service: An MG service tied to a particular RTCP packet type code point. The RTCP packet type (PT) value may be thus considered as RTCP service identifier.

NOTE 1 – This is the coarsest granularity of an RTCP service definition, but sufficient for this Recommendation. A finer grain RTCP service level could take into account further RTCP packet embedded identifiers such as the block type (BT) code point in the case of RTCP XR or the feedback message type (FMT) code point in the case of RTCP FB.

NOTE 2 – Another classification approach could derive generic (because usually PT-independent) RTCP service categories such as those related to performance monitoring, media encryption, codec rate control, congestion control, generic feedback, keeps alive, etc.

3.2.9 supplementary RTCP service: Any RTCP service in addition to basic RTCP services (clause 3.2.1) and/or RTP profile RTCP related services (clause 3.2.6).

3.2.10 transparent forwarding: MG packet forwarding behaviour with the characteristic of Lx-PDU integrity. This is a unidirectional characteristic of an Lx-PDU flow.

NOTE 1 – This is normally implicit, basic behaviour, where the RD settings on an ingress Termination match the LD settings on an egress Termination in the same Context: identical media descriptions imply transparent forwarding by the MG under the condition that the MG could derive the intended protocol layer Lx of transparent forwarding.

NOTE 2 – There would then be the characteristic of RTP packet integrity in the context of RTP transparent forwarding. The MG might be RTP aware; e.g., support of RTP related statistics or event detection would not violate transparent forwarding behaviour.

NOTE 3 – Delayed transparent forwarding is a variant of transparent forward from a temporal perspective, which is characterized by transparent forwarding, but Lx-PDUs might be intentionally delayed in the outgoing direction. The traffic characteristic of the Lx-PDU flow would be then modified. Examples:

– The application of IP traffic shaping (see clause 7.1.5 of [ITU-T Y.1221]) might be one example in the case of Lx equal to 'IP'.

– The application of RTP jitter elimination, reduction or adjustment (see [ITU-T G.799.3]) might be one example in the case of Lx equal to 'RTP'

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AGW	Access Gateway
APP	(RTCP) Application-defined packet type
AVP	(RTP) Audio Visual Profile
AVPF	(RTP) Audio Visual Profile with Feedback
B2BRE	Back-to-Back RTP End system
BGF	Border Gateway Function
BGW	Border Gateway
BR	(RTCP) Basic Report
BT	(RTCP) Block Type
CNAME	Canonical Name
CSRC	Contributing Source
DCCP	Datagram Congestion Control Protocol

FB	(RTCP) Feedback
FMT	(RTCP FB) Feedback Message Type
IP	Internet Protocol
LCD	Local Control Descriptor
LD	Local Descriptor
Lx	Layer x
MCU	Media Control Unit
MG	Media Gateway
MGC	Media Gateway Controller
MSRP	Message Session Relay Protocol
MUX	Multiplex
LD	Local Descriptor
NAPT	Network Address and Port Translation
NAT-T	NAT Traversal
PCI	Protocol Control Information
PDU	Protocol Data Unit
PP	Point to Point
PSTN	Public Switched Telephone Network
PT	(RTP) Payload Type; (RTCP) Packet Type
QoS	Quality of Service
RD	Remote Descriptor
RR	(RTCP) Receiver Report
RTCP	RTP Control Protocol
RTP	Real-time Transport Protocol
RTPASM	RTP Any Source Multicast
RTPASY	RTP Asymmetric Topologies
RTPE	RTP End system (or RTP endpoint)
RTPM	RTP Mixer
RTPMT	RTP Media Translator
RTPMU	RTP Multicast
RTPRTM	RTP RTCP-Terminating-MCU
RTPSSM	RTP Source Specific Multicast
RTPTF	RTP Transparent Forwarding
RTPTT	RTP Transport Translator
RTPVSM	RTP Video-Switch-MCU
SAVP	(RTP profile) Secure Audio Visual Profile
SAVPF	(RTP profile) Secure Audio Visual Profile with Feedback

SBG	Session Border Gateway
SDES	Source Description (RTCP Packet)
SDP	Session Description Protocol
SEP	Stream Endpoint
SN	Sequence Number
SR	(RTCP) Sender Report
SRTP	Secure RTP
SSRC	Synchronization Source
TCP	Transmission Control Protocol
TF	Transparent Forwarding
TLS	Transport Layer Security
TR	Translator
TrGW	(3GPP) Transition Gateway
TS	Time Stamp
UDP	User Datagram Protocol
UDPTL	UDP Transport Layer
VoIP	Voice over Internet Protocol
XR	(RTCP) Extension Report

NOTE – In this Recommendation, BGF is the same as Border Gateway and IP-to-IP Gateway.

5 Conventions

The following notation applies for ITU-T H.248 connection models.

– Notation (X_1, X_2, …) describes the ITU-T H.248 connection model in terms of number and type of terminations. The character X_i represents either a specific protocol (e.g., 'IP', 'RTP', 'TDM') or an umbrella term (e.g., 'physical', 'non-RTP'). The ITU-T H.248 connection model represents thus a single context with its X_i-enabled termination(s) or stream endpoint(s), but without any specification of the ITU-T H.248 topology.

6 Background to RTCP handling by ITU-T H.248 MGs

The handling of RTCP packets by ITU-T H.248 media gateways is often not straightforward, as MG behaviour is typically not discussed by the applicable IETF RFCs. RTCP handling in general is tightly coupled to the *RTP* topology model, which drives the processing of RTP/RTCP traffic of a particular ITU-T H.248 Context.

The aspect of RTP topologies is for many ITU-T H.248 MG types not really relevant because the handling is obvious. For example: for all ITU-T H.248 (IP, physical) connection models (as applied for VoIP MGs at the border towards circuit-switched networks). However, for ITU-T H.248 MGs with two or more IP terminations in a Context the situation is slightly different due to multiple RTP-enabled stream endpoint and which may result in multiple possible RTCP service behaviours. In this case new RTCP services have been defined that increase the possible interactions between RTP topology and these services. This has led to possible ambiguity in the RTCP handling behaviour in the MG.

The problem also has a historical dimension: [b-IETF RFC 1889] and [IETF RFC 3550] were too vague on RTP topology and RTCP handling, which was the motivation to clarify, in [b-IETF RFC 5117], RTP topology models at a more detailed level. [b-IETF RFC 5117] provides a finer grain topology classification and detailed topology description.

NOTE 1 – It may be noted that the problem is not specific to ITU-T H.248, it also concerns other gateway/policy control protocols, which are applied to IP-IP gateways or policy enforcement points. For example, [ITU-T H.248.48] considers different RTCP processing functions (e.g., local generation of RTCP reports, forwarding/filtering of RTCP reports). [ITU-T H.248.48] is applicable for multiple RTP topologies and could be categorized as a supplementary RTCP service (see clause 8.3.3). These interaction issues required consideration.

Generally RTP topology and RTCP handling may be summarized as follows:

1. Local *RTCP* handling by an ITU-T H.248 MG is basically linked to the applied RTP topology, and the RTP topology is given by the Terminations/Streams in an ITU-T H.248 Context.
2. Without this Recommendation there are no explicit ITU-T H.248 means defined to control RTP topology. Thus, ITU-T H.248 profiles that do not utilize this Recommendation assume implicit behaviour (which may lead to misinterpretations).
3. Existing ITU-T H.248 protocol elements for RTP/RTCP control are for other, different purposes, i.e.:
   a. [ITU-T H.248.1] Annex E.12 RTP Package: event and statistics
   b. [ITU-T H.248.30], RTCP extended performance metrics packages:
      – RTCP XR Base Package,
      – RTCP XR Burst Metrics Package
   c. [ITU-T H.248.48], RTCP XR Block Reporting Package: statistics
   d. [ITU-T H.248.50], RTP Keep Alive Request Package: RTP signals

      NOTE 2 – Discussion: ITU-T H.248.50 signal parameter "Keep Alive Packet Type" (from the signal "Send keepalive packet") indicates some RTP/RTCP related packet types, which represent the semantic of the RTP topology RTP end system (sender only). A controversial situation might then result if the ITU-T H.248 Stream endpoint were enabled with a signal e.g., kar/skap/kapt/cn (indicating topology RTP end system) and also part of an overall RTP transport translator (given by a property setting of "*rtpt/rtptopo* = TR").
   e. [ITU-T H.248.57], RTCP HandlingPackage: L4 port allocation control
   f. [ITU-T H.248.58], RTP Application Data Package: statistics
   g. [ITU-T H.248.71], RTCP support packages:
      – RTCP Source Description Package,
      – Received RTCP Package,
      – RTCP Feedback Message Package

The topic of correct RTCP handling by ITU-T H.248 MGs, is important in order not to jeopardize end-to-end RTP-based services.

7 RTP topologies versus RTCP handling in ITU-T H.248 MGs

This clause compares the structure RTP Topologies versus RTCP handling versus H.248 MG Context configurations. The functions related to RTCP handling are labelled with F-x according to clause 7.6. The RTP topologies are classified according to ITU-T H.248 connection models which are determined by the number of terminations per Context, see clauses 7.1 to 7.4.

7.1 Single ITU-T H.248 IP Termination per Context

See Table 1.

Table 1 – RTP topologies vs RTCP handling vs H.248 MG models – Single ITU-T H.248 IP Termination per Context

No.	RTP topology	RTCP handling	ITU-T H.248 connection model	Example
I.1	**RTP end system** (RTPE) (also known as RTP endpoint)	F-1, F-2, F-3, F-6	(RTP, non-RTP)	VoIP Residential, Access or Trunking MG

7.2 Two ITU-T H.248 IP Terminations per Context

7.2.1 RTP topologies according to IETF RFC 5117

RTP topologies RFC [b-IETF RFC 5117], clause 3, Topologies, provides definitions and refinements of RTP topologies introduced by [IETF RFC 3550]. Table 2 discusses the respective models with two IP terminations.

NOTE – Some media-level functions may be achieved by more than one RTP topology. For example, audio transcoding may be done in B2BRE or RTPMT topologies. However, there would be different RTCP handling functions.

Table 2 – RTP Topologies vs RTCP handling vs ITU-T H.248 MG models – Two ITU-T H.248 IP Terminations per Context

No.	RTP topology	RTCP handling	ITU-T H.248 connection model	Example
II.1	Back-to-back RTP end system (B2BRE)	F-1, F-2, F-3, F-5, F-6, F-7	(RTP, RTP)	IP-to-IP MG located at the border between two RTP domains (e.g., SRTP-to-RTP interworking)
II.2	RTP transport translator (RTPTT)	F-1, F-4, F-6, F-7 (Note 1) F-2 if F-6	(RTP, RTP)	IP-to-IP MG located within a single RTP domain, without any media processing
II.3	RTP media translator (RTPMT) in general (Note 2)	F-1, F-3, F-4, F-5, F-6, F-7 F-2 if F-6	(RTP, RTP)	IP-to-IP MG located within a single RTP domain, with processing of the RTP payload
II.3.1	RTP media translator without media format change (RTPMTlight)	F-1, F-3, F-4, F-5, F-6, F-7 F-2 if F-6	(RTP, RTP)	Trans-packetization (changing packetization times), jitter reduction between two IP networks
II.3.2	RTP Media Translator with media format change (RTPMTfull)	F-1, F-3, F-4, F-5, F-6, F-7 F-2 if F-6	(RTP, RTP)	Audio transcoding

Table 2 – RTP Topologies vs RTCP handling vs ITU-T H.248 MG models – Two ITU-T H.248 IP Terminations per Context

NOTE 1 – Function F-7 (RTCP packet filtering) is classified as a supplementary RTCP service (see clause 9), therefore applicable for this RTP topology. This note is also relevant for some other RTP topologies. NOTE 2 – The RTPMT topology is sometimes further sub-classified here with II.3.1 and II.3.2 (see e.g., [b-IETF RFC 6679]).

7.2.2 Other RTP topologies

The high-level RTP topology models according to [b-IETF RFC 5117] have evolved since the publication of this RFC (in 2008) in terms of more detailed information (e.g., semantic clarifications), evaluation of whether the number of existing models can be reduced and the identification of new RTP topology models (see also [b-IETF rtp-topo]). This clause provides descriptions of such new/extended models.

7.2.2.1 RTP source translator topology

RTP source translators (RTPST) do not modify the media stream itself, but are concerned with RTP source parameters. RTP source parameters comprise the following:

– RTP source identifier (parameter SSRC)
– RTP source/end-point persistent identifier (parameter CNAME)
– RTP source sequence number space (parameters SN, OSN)
– RTP source time space (parameter TS).

RTP source translators could modify one or multiple RTP source related parameters. Concrete RTCP handling depends on the specific RTPST type, but would typically cover at least F-1, F-3 and F-5 (from clause 7.6).

7.3 More than two ITU-T H.248 IP Terminations per Context

See Table 3.

Table 3 – RTP topologies versus RTCP handling versus ITU-T H.248 MG models – More than two ITU-T H.248 IP Terminations per Context

No.	RTP topology	RTCP handling	ITU-T H.248 connection model	Example
III.1	RTP mixer (RTPM)	F-1, F-2, F-3, F-5, F-6, F-7	(RTP, RTP, … RTP)	Media server
III.2	RTP video-switch-MCU (RTPVSM)	F-1, F-2, F-3, F-5, F-6, F-7	(RTP, RTP, … RTP)	Media server
III.3	RTP RTCP-terminating-MCU (RTPRTM)	F-1, F-2, F-3, F-5, F-6, F-7	(RTP, RTP, … RTP)	Media server where each ITU-T H.248 RTP Termination relates to the RTP End system topology
III.4	RTP multicast (RTPMU)	For further study	For further study	
III.4.1	RTP source specific Multicast (RTPSSM)	For further study	For further study	
III.4.2	RTP any source Multicast (RTPASM)	For further study	For further study	

7.4 Other topologies

See Table 4.

Table 4 – RTP topologies vs RTCP handling vs H.248 MG models – Other topologies

No.	RTP topology	RTCP handling	ITU-T H.248 connection model	Example
IV.1	Asymmetric topologies (RTPASY)	For further study	(RTP, MUX, RTP … RTP)	ITU-T H.248 Contexts with internal ITU-T H.248 MUX terminations
IV.2	Topology combinations	For further study	For further study	Cascaded ITU-T H.248 Contexts

7.5 Notes to the ITU-T H.248 Connection model

Names of terminations (TerminationID) may be arbitrarily chosen (see clause 6.2.2 of [ITU-T H.248.1]), but termination naming schemes are usually given by ITU-T H.248 profile specifications. Such ITU-T H.248 profiles typically use the notation of "IP" for IP-based ephemeral terminations (e.g., in order not to exclude any possible IP applications, which might be concluded by a transport protocol or application protocol specific notation). This Recommendation uses "RTP" instead because there may be a difference between the following connection models:

– **(RTP, RTP)**
  - ○ MG is RTP-aware, which enforces a transport-protocol aware mode of operation;
  - ○ MG may be media aware or media agnostic.

– **(IP, IP)**
  - ○ MG may be RTP-agnostic, i.e., aware of the transport protocol (UDP), but unaware of higher protocol layers, thus RTP packets may transparently go through such an ITU-T H.248 Context.

It should be noted that the termination name could carry an implicit semantic concerning configured RTP topologies and/or RTCP handling behaviour of a Context. However, this practice is not recommended. This Recommendation therefore recommends that the ITU-T H.248.TerminationID should not be used to indicate a particular RTP topology.

7.6 Classes of RTCP related functions

The MG may be requested to support the following RTCP packets or RTCP related functions:

F-1: RTP node identifier: usage (or not) of MG-local CNAMEs (e.g., per MG or per termination);

F-2: RTP source identifier: allocation (or not) of MG-local SSRCs per RTP session;

F-3: RTCP protocol endpoint for basic services: origination/termination of RTCP packets (reports);

F-4: RTCP packet forwarding: unmodified forwarding of RTCP packets (reports);

F-5: RTCP packet modification: rewrite of RTCP packets;

F-6: RTCP protocol endpoint for supplementary services: local generation of RTCP reports (such as for RTCP XR based applications);

F-7: RTCP packet filtering: filtering of RTCP reports (e.g., either entire RTCP packet or just an individual RTCP report within a compound packet is filtered).

NOTE 1 – The listed function labels (F-1 to F-7) are used in Tables 1 to 4.

NOTE 2 – Additional functions may be defined in the future.

7.7 Relation to modes of operations of IP-to-IP media gateways

The subject of RTP topologies affects all kinds of ITU-T H.248 MGs, which are involved in RTP traffic processing, from PSTN residential/access/trunking MGs to media servers for large conferencing systems. Of particular interest are ITU-T H.248 IP-to-IP media gateways (also known as border gateways, at the access/edge, core or interconnect/peering network level) due to RTP traffic processing related to NAPT, NAT-T, QoS support, policy control and/or media conversion functions, based on RTP topologies according to clause 7.2.

The basic packet processing behaviour by such MGs is called mode of operation, leading to the aspect of possible interactions between RTP topologies and such modes of operations as defined for IP-to-IP media gateways.

There are already a number of such modes identified for IP-to-IP media gateways, e.g., media-format agnostic, transport protocol type aware, etc. For instance, [b-ETSI TR 183 068] provides an established categorization which could be summarized according to Figure 1.

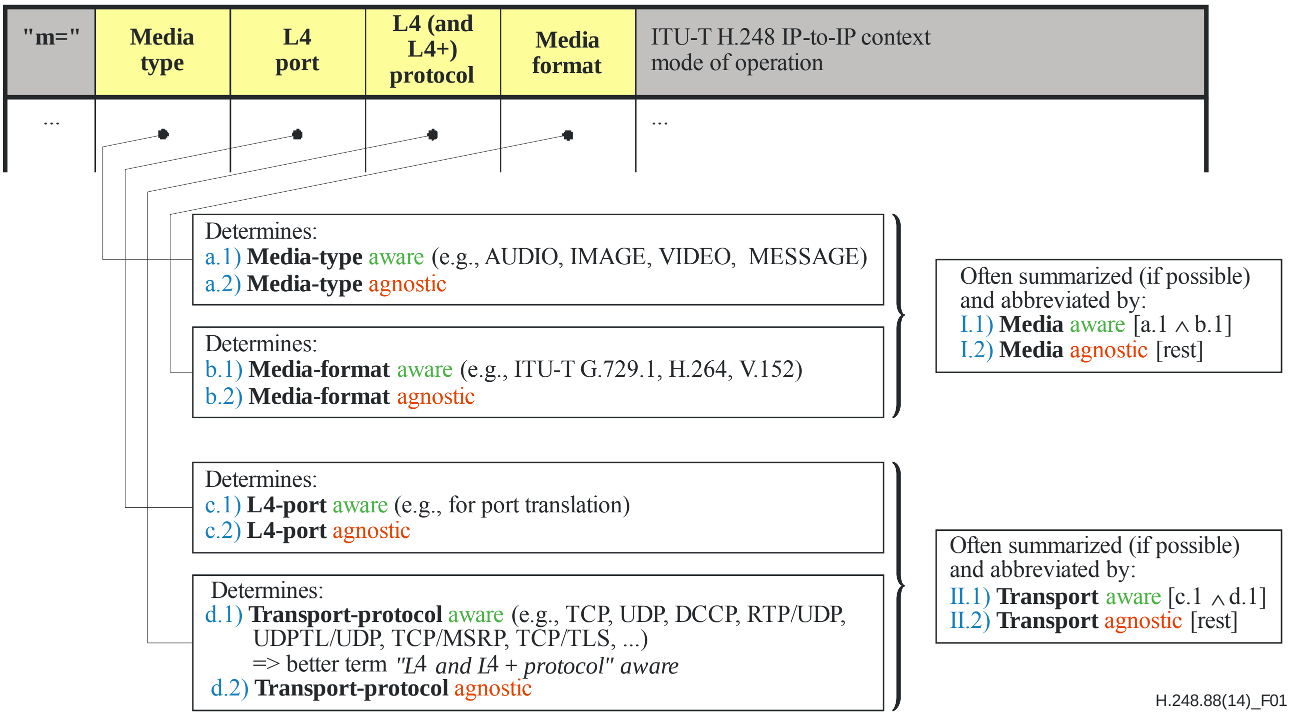

Figure 1 – BGF modes – ITU-T H.248 Local and Remote Descriptor: SDP "m="-line specification combinations (copy of Fig. G.3 of [b-ETSI TR 183 068])

The modes of operation are related to the media description in the local and remote descriptors. The classification in Figure 1 is based on the SDP "m="-line only.

7.8 Recommendations for ITU-T H.248 profiles for IP-to-IP gateways

A particular profile may explicitly require support of a number of RTP topologies and a number of different modes of operation. This is the case in the following two situations:

– There are no further specification actions required in the case of semantic unambiguity (e.g., no interactions are identified). The correct RTP/RTCP processing behaviour could be clearly concluded by the MG from Context specifications, without explicit RTP topology control.

–	In the case of possible interactions, semantic ambiguity and/or explicit RTP topology related behaviour, it is then recommended to consider explicit RTP topology control according to clause 10.

NOTE – The profile may also need to provide further clarification on the derived MG behaviour in the above instance.

## 8	RTCP services

The purpose of this clause is to describe the handling of RTCP packets, dependent on the RTP topology and RTCP services employed.

### 8.1	RTCP packet structure

Figure 2 illustrates the basic RTCP packet structure using an example of a compound RTCP packet.

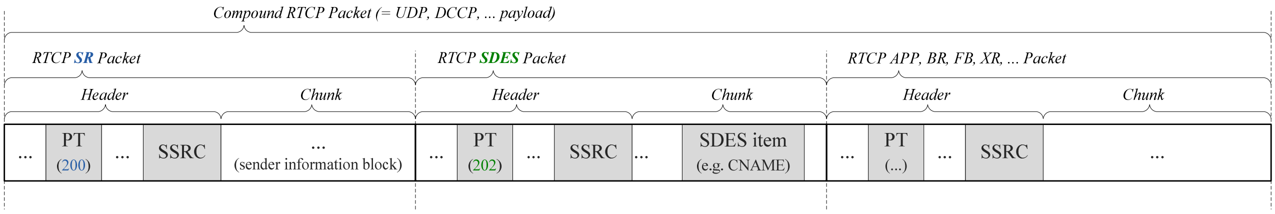

Figure 2 – RTCP packet structure (compound RTCP packet)

The RTCP packet structures need to be considered to identify key information elements (see next clause).

### 8.2	Important RTCP information elements (from ITU-T H.248 MG perspective)

Not every information element in RTCP packets is relevant from an ITU-T H.248 perspective. However, there are some elements which demand careful consideration when processing RTP/RTCP traffic via ITU-T H.248 MGs.

#### 8.2.1	Information elements related to the identification of an RTP entity

There are primarily three information element types:

–	SSRC (per originating RTP source),

–	CSRC (for contributing RTP source), and

–	SDES.

These elements define the spatial horizon of RTP media and RTCP control flows, i.e., the end-to-end significance of RTCP services. See for instance the detailed evaluation of example ITU-T H.248 measurement architectures in [ITU-T H.248.48] and IETF monitoring architectures for RTP in [b-IETF RFC 6792].

#### 8.2.2	Other relevant information elements

For instance, the BYE packet type provides general information on the end of the RTP session lifetime

NOTE – The ITU-T H.248 termination/stream endpoint could still continue to exist.

8.3 RTCP service levels

8.3.1 Basic RTCP services

There are RTP sessions with or without RTCP (see also clause 1.1 of [ITU-T H.248.57]). Every RTP implementation must be compliant to [IETF RFC 3550] and thus basically support all the RTCP services defined by this RFC (for RTP sessions with RTCP). They may be called basic RTCP services and cover the four RTCP packet types of SR (200), RR (201), SDES (202) and BYE (203).

NOTE – The code-point for application defined RTCP packet types APP (204) is also introduced by this RFC, but the definition of application specific services is delegated to subsequent RFCs.

Basic RTCP services are indicated to the MG by an implicit (e.g., via SDP "m=" line) or explicit request for RTCP port allocation (see [ITU-T H.248.57]) which leads to processing RTCP control flow traffic by an ITU-T H.248 context.

8.3.2 RTP profile dependent RTCP services

RTP profiles may add additional RTCP services such as e.g., the RTP profiles RTP/AVPF and RTP/SAVPF.

The use of RTP profile dependent RTCP services is typically indicated to the MG by the protocol field value in the SDP "m=" line, as part of the LD-/RD-embedded SDP media description.

8.3.3 Supplementary RTCP services

RTP sessions may be supplemented by further RTCP-based services. [b-IETF RFC 5968] defines the generic extension principles for RTCP. Such supplementary services include for instance the RTCP extension report (XR) based capabilities, as defined for measurement and monitoring architectures.

Supplementary RTCP services are indicated to the MG by, for example, RTCP report/packet type specific signalling elements e.g., ITU-T H.248 packages [ITU-T H.248.30] and [ITU-T H.248.48], or correspondent SDP attributes as part of the LD-/RD-embedded SDP media description.

9 Scope of RTP topology control

There is a relation between RTP topology and RTCP services. However, the scope of RTP topology control needs to be limited due to the plethora of RTCP services and in order to handle complexity. Figure 3 summarizes again the main RTCP service categories (from clause 8).

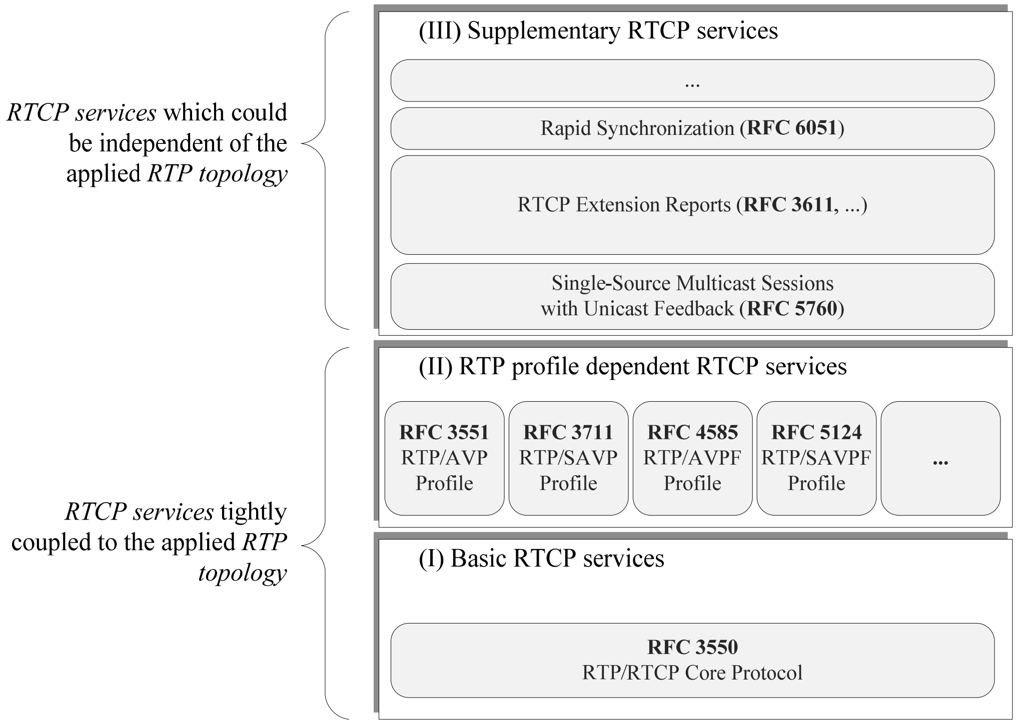

Figure 3 – Level of RTCP services

The scope of RTP topology control, – based on the ITU-T H.248 rtpt package defined by this Recommendation -, is limited to basic (I) and *RTP* profile dependent (II) RTCP services.

Example:

The ITU-T H.248 RTP stream in an ITU-T H.248 IP-IP MG could be configured for the RTP topology Topo-Translator, which implies RTCP services such as

– no allocation of local SSRC values,

– no generation of RTCP RR reports, and

– forwarding of RTCP BYE packets.

The same ITU-T H.248 RTP stream could additionally be used for ITU-T H.248.48 type performance monitoring capabilities, which could lead to RTCP services such as

– allocation of local SSRC values for measurement points, or/and

– generation of RTCP XR reports.

The ITU-T H.248.48 related supplementary RTCP services are not in contradiction to the RTP topology associated services.

10 RTP Topology Package

Package name: RTP Topology Package

Package ID: rtpt (0x0114)

Description: The package allows a MGC to indicate to a MG which particular RTP topology an RTP stream is operating under. The RTP Topologies are fundamentally defined by [b-IETF RFC 5117] and complemented by this Recommendation. A single ITU-T H.248 Stream allows the definition of two RTP streams thus the topology is defined at a Local and Remote Descriptor level.

Version: 1

Extends: None.

10.1 Properties

10.1.1 RTP Topology

Property name: RTP Topology

Property ID: rtptopo (0x0001)

Description: This property indicates which RTP topology (as primarily defined by [b-IETF RFC 5117]) that an RTP Stream is acting under.

Type: Enumeration

Possible values: MG (0x0000): MG Determined

PP (0x0001): Topo-Point-to-Point (NOTE 1)

MC (0x0002): Topo-Multicast

TR (0x0003): Topo-Translator

MX (0x0004): Topo-Mixer

VS (0x0005): Topo-Video-Switch-MCU

RT (0x0006): Topo-RTCP-terminating-MCU

TA (0x0007): Topo-Asymmetric

TF (0x0008): Topo-Transparent-Forwarding (NOTE 2)

NOTE 1 – A pair of two connected Stream endpoints (between two RTP terminations within a context) and PP topology is synonymous with a Back-to-Back RTP End system (B2BRE) topology from the perspective of an end-to-end RTP session.

NOTE 2 – An ITU-T H.248 IP-IP MG will enforce transparent forwarding (see clause 3.2.10) behaviour.

Default: MG

Defined in: Local / Remote

Characteristics: Read/Write

10.2 Events

None.

10.3 Signals

None.

10.4 Statistics

None.

10.5 Error codes

None.

10.6 Procedures

10.6.1 General

This package allows the MGC to indicate to the MG which particular RTP topology that an RTP stream is acting under. The type of RTP topology may have impacts on various bearer level functions. It may have an impact on RTCP handling procedures.

In most cases a MG is able to determine itself the RTP topology that is used due to the ITU-T H.248 Connection Model (i.e., the combination of Terminations/Streams and associated properties in a Context). For example: it can determine the difference between a point-to-point topology (i.e., a two Termination Context) versus a mixer (i.e., three or more Termination Context). Thus the MGC does not need to signal the RTP Topology (rtpt/topo*)* property.

However in some cases the MG is unable to distinguish between topologies. For example: in some network scenarios it may not be able to distinguish between point-to-point and translator topologies. This package may be used in scenarios where a more deterministic method is needed to indicate what the RTP topology of a RTP Stream is.

It is expected that packages extending this package or profiles utilising this package specify what the function specific impact of the RTP Topology property would be.

10.6.2 MGC level information for RTP topology control

RTP topology control (at MGC level) could be based on

– call/session control signalling or/and

– local policies.

10.6.3 Topology dependent procedures

"MG Determined" indicates the MG shall determine RTP topology and subsequent RTCP handling based on the implicit information derived from the applicable ITU-T H.248 descriptors. This behaviour may also be subject to profile specification.

10.6.3.1 Point-to-Point topology

The MG shall provide a specific, local CNAME.

The MG shall allocate local SSRC values per RTP session endpoint (which corresponds to an ITU-T H.248 flow pair of RTP media and RTCP control traffic; often identical to the ITU-T H.248 Stream endpoint (SEP)).

The MG shall originate/terminate RTCP packets of type:

– at least: SDES, SR, BR and BYE

– possibly: APP (because application specific RTCP service)

10.6.3.2 Multicast topology

Procedures are not yet described in package version 1. For further study.

10.6.3.3 Translator topology

The MG may provide a specific, local CNAME.

The MG shall not allocate local SSRC values for RTP traffic under this topology.

The MG may allocate local SSRC values for supplementary RTCP services.

The MG shall not originate/terminate RTCP packets of type:

– at least: "SR, BR and BYE

The MG may originate/terminate RTCP packets of type:

– e.g., XR

10.6.3.4 Mixer topology

Procedures are not yet described in package version 1. For further study.

10.6.3.5 Video-Switch-MCU topology

Procedures are not yet described in package version 1. For further study.

10.6.3.6 RTCP-terminating-MCU topology

Procedures are not yet described in package version 1. For further study.

10.6.3.7 Asymmetric topology

Procedures are not yet described in package version 1. For further study.

10.6.3.8 Transparent Forwarding topology

10.6.3.8.1 Background to Transparent Forwarding

There are basically two ITU-T H.248 signalling options to achieve an MG behaviour of RTP transparent forwarding:

a) Implicit signalling

Existing ITU-T H.248 signalling using LD/RD settings with identical media descriptions (see examples in Appendix I). There are two terminations (and two associated stream endpoints), which implies synchronized settings between all four local and remote descriptors (in the case of a bidirectional RTP session). The MG would provide a transparent forwarding behaviour (according to clause 3.2.10) for all cases of unambiguous ITU-T H.248 signalling.

b) Explicit signalling

Explicit indication is done via rtpt/rtptopo property (see clause 10.6.3.8.2).

10.6.3.8.2 Usage of rtpt/rtptopo property

The ITU-T H.248 Stream Descriptor could contain RTP/RTCP related information (such as LD-/RD-embedded SDP media descriptions or other ITU-T H.248 signalling elements related to RTP/RTCP; or LCD level information). Other descriptors could also contain RTP/RTCP related information (e.g., related to events, signals or statistics). This kind of ITU-T H.248 information could lead to the activation of RTP/RTCP processing functions in the MG or/and ambiguity concerning the targeted RTP topology behaviour.

The property value TF of (rtpt/topo) property shall then be used when the MG shall transparently forward RTP packets in order to guarantee deterministic traffic processing. The MG behaviour of RTP transparent forwarding (RTPTF) includes transparent forwarding (clause 3.2.10), but not fully protocol unaware forwarding (clause 3.2.2) due to basic RTP awareness (at least by usage of rtptopo property).

11 Package-independent procedures for RTP topology control

11.1 RTP source translator topology

This RTP topology refers to clause 7.2.2.1.

11.1.1 Via SDP attribute "a=ssrc:"

The MGC shall use the SDP attribute "a=ssrc:" (see [IETF RFC 5576]) for the RTP source translator assignment of a particular Stream endpoint. Table 5 defines the allowed roles (i.e., SDP "a=ssrc:" value settings), given by the 4-tuple {Ta(LD), Ta(RD), Tb(LD), Tb(RD)}.

Table 5 – Indication of topology "RTP source translator"

ITU-T H.248 SEP		SDP attribute	RTP source translator
Ta	LD	a= ssrc:	wildcarded "CHOOSE" (Note 1)
	RD	a= ssrc:	not sent (Note 2)
Tb	LD	a= ssrc:	not sent (Note 2)
	RD	a= ssrc:	not sent (Note 2)

NOTE 1 – The translated information relates actually to the "local source" connection endpoint, which is in scope of the ITU-T H.248 Local Descriptor (see clause 5.2.2 of [ITU-T H.248.1]).

NOTE 2 – The semantic of "not sent" means that the MGC shall not include this SDP attribute in the ITU-T H.248 Descriptor, despite the fact whether it is used on call signalling level.

The *RTP* source translator function is requested to translate the RTP source value with following semantic:

– direction Ta to Tb: not any translation of RTP source parameter values;

– direction Tb to Ta: the received SSRC value in any kind of RTP packets is replaced by the locally used SSRC value for this ITU-T H.248 SEP;

Figure 4 illustrates the RTP source translator topology.

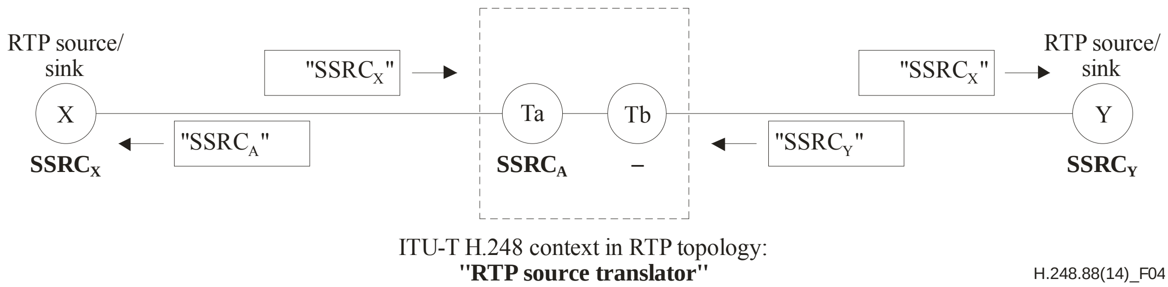

Figure 4 – Semantic of the RTP source translator

Description of Figure 4:

– Ta assigns value $SSRC_A$ (due to wildcard $ in the LD);

– Tb does not allocate any SSRC identifier.

This results in the following translation function:

– the SSRC values are unchanged in RTP/RTCP packets from X to Y (i.e., contain value $SSRC_X$); and

– RTP/RTCP packets sent from Y to X are modified from value $SSRC_Y$ to $SSRC_A$.

The MG shall reply with error code 449 in case of incorrect StreamDescriptor settings that violate Table 5.

11.1.2 Via MIME subtype rtx in SDP attributes

The MIME subtype rtx is defined in [IETF RFC 4588]. The MGC may use this element in SDP attributes for triggering an RTP source translator function with regards to the translation of sequence number spaces.

However, this particular RTP source translator function is conditional, only required when the MG would provide parallel RTP interworking functions which are dependent on sequence number values (such as SRTP to non-SRTP interworking).

The RTP source translator function sequence number translation would be then enforced by correspondent ITU-T H.248 descriptor information.

Appendix I

Examples of transparent forwarding

(This appendix does not form an integral part of this Recommendation.)

I.1 Introduction

The MG behaviour of RTP transparent forwarding may be enforced by either implicit or explicit ITU-T H.248 signalling (see clause 10.6.3.8.1). The explicit method is semantically straightforward, whereas implicit signalling is often conditional. Some examples shall illustrate the uncontroversial and controversial usage of implicit signalling.

There is an (IP, IP) connection model in all examples. The signalling of a single stream endpoint is shown.

I.2 Convention

The examples use an abstracted command notation, see Table I.1. There are three key areas of interest in such ITU-T H.248 commands:

Table I.1 –Implicit signalling – abstracted ITU-T H.248 command format with principal areas related to RTP

ITU-T H.248 encoding (shortened command)	Comments

`Add = ip/$ ; Termination` **`Ta`**`, SEP` **`S1`**
`… Stream = 1 {`
`LocalControl {<"`*`RTP impacting elements Y/N?`*`">}`
`Local {…`
`m=…`
`a=…`
`},`
`Remote {`
`m=…`
`a=…`
`}`
`other Descriptors``{<"`*`RTP impacting elements Y/N?`*`">}`
`…},`
`Add = ip/$ ; Termination` **`Tb`**`, SEP` **`S1`**
`… Stream = 1 {`
`LocalControl {<"`*` RTP impacting elements Y/N?`*`">}`
`Local {…`
`m=…`
`a=…`
`},`
`Remote {`
`m=…`
`a=…`
`}`
`other Descriptors``{<"`*`RTP impacting elements Y/N?`*`">}`
`…}`
	There are basically three areas in ITU-T H.248 commands which could contain information indicating the existence of RTP bearer traffic:
	1. SDP media descriptions embedded in LD/RD as part of the Stream Descriptor; relevant information would be primarily subject of the "m=" and "a=" lines;
	2. ITU-T H.248 properties in the LCD (again embedded in Stream Descriptor);
	3. ITU-T H.248 properties in other descriptors (e.g., Events Descriptor, Statistics Descriptor).

I.3 Examples for implicit signalling

The method of implicit signalling is described in clause 10.6.3.8.1 as option (a).

I.3.1 Example 1: UDP payload transparent forwarding

Table I.2 illustrates UDP payload transparent forwarding:

Table I.2 – Example 1: UDP payload transparent forwarding

ITU-T H.248 encoding (shortened command)	Comments

`MGC to MG:`
`MEGACO/…`
`Transaction = … {`
`    Context = … {`
`       Add  = ip/$  ; Termination Ta, SEP S1`
`         {Media {`
`            Stream = 1 {`
`             LocalControl {`
`              ...    ; NOTE 1`
`             } ...`
`             Local {`
`              v=0`
`              c=IN IP4 <IP_addr>`
`              m=- <port> udp -`
`             },`
`             Remote {`
`              v=0`
`              c=IN IP4 <IP_addr>`
`              m=- <port> udp -`
`           }…},`
`       Add  = ip/$  ; Termination Tb, SEP S1`
`         {Media {`
`            Stream = 1 {`
`             LocalControl {`
`              ...`
`             } ...`
`             Local {`
`              v=0`
`              c=IN IP4 <IP_addr>`
`              m=- <port> udp -`
`             },`
`             Remote {`
`              v=0`
`              c=IN IP4 <IP_addr>`
`              m=- <port> udp -`
`           }…},`
…
	The RTP session shall be configured for transparent forwarding for both traffic directions.
	Prerequisites:
	– All four "m=" lines SHALL be identical.
	Example here:
	– Transport 'UDP' is indicated, which implies RTP agnostic to the MG.
	– The MG could be requested for local NAPT, which is a L4-dependent function (thus UDP indication).
	Conclusions:
	– This setting does not provide UDP transparent forwarding (which was also not requested) due to UDP checksum updates.
	– It leads rather to UDP payload transparent forwarding …
	– … which could be RTP transparent forwarding in the case of RTP-over-UDP bearer traffic

Discussion/conclusions of example 1:

– requested and actual forwarding mode (UDP payload transparent forwarding) are identical;

– implicit signalling is thus unambiguous.

I.3.2 Example 2: Fully RTP protocol unaware forwarding

Signalling according to Table I.3 should lead to a MG behaviour of fully RTP protocol unaware forwarding:

Table I.3 – Example 2: Fully RTP protocol unaware forwarding

ITU-T H.248 encoding (shortened command)	Comments

`Add = ip/$ ; Termination` **`Ta`**`, SEP` **`S1`**
`… Stream = 1 {`
`LocalControl {<"`*`RTP impacting elements Y/N?`*`">}`
`Local {…`
`m=- - - -`
`},`
`Remote {`
`m=- - - -`
`}`
`other Descriptors``{<"`*`RTP impacting elements Y/N?`*`">}`
`…},`
`Add = ip/$ ; Termination` **`Tb`**`, SEP` **`S1`**
`… Stream = 1 {`
`LocalControl {<"`*` RTP impacting elements Y/N?`*`">}`
`Local {…`
`m=- - - -`
`},`
`Remote {`
`m=- - - -`
`}`
`other Descriptors``{<"`*`RTP impacting elements Y/N?`*`">}`
`…}`
	The so called BGW mode of operation (in TISPAN BGF, 3GPP IMS-AGW, 3GPP TrGW, MSF SBG) with the characteristic of:
	– media type agnostic
	– media format agnostic
	– transport protocol type agnostic and
	– L4 port agnostic.
	The "-" notation was introduced by TISPAN in border gateway profiles.

Discussion/conclusions of example 2:

– The MG would implicitly provide fully RTP protocol unaware forwarding if there would be not any other signalling elements related to RTP.

– The MGC knows whether the implicit signalling would be unambiguous or not (due to the indicated condition). The MGC may therefore provide an additional explicit indication in case of guaranteed transparent forwarding service requirements.

I.3.3 Example 3: Additional RTCP awareness

Example 3: same as example 2, but with additional property rtcph/rsb = ON (see [ITU-T H.248.57]) in the LocalControl Descriptor (LCD)

Discussion/conclusions of example 3:

– There's an explicit indication of RTP bearer traffic, the MG becomes RTP aware.

– However, there are basically three meaningful RTP translator options (PP, TR and TF) with different impact on RTP packets, thus pure implicit signalling would be controversial.

– Unambiguous behaviour might be achieved by explicit assignment of PP or TR topology (with different RTCP handling, but common SSRC/CSRC modifications) in case of non-transparent forwarding.

– Transparent forwarding however could not be achieved via implicit signalling, requires rather the explicit assignment of the TF topology.

I.3.4 Example 4: Fully specified SDP media description

Example 4: same semantic aimed as with example 2, but fully specified SDP media description, rather than the "-" option, see Table I.4:

Table I.4 – Example 4: Fully specified SDP media description

ITU-T H.248 encoding (shortened command)	Comments

Add = ip/$; Termination **Ta**, SEP **S1**
… Stream = 1 {
LocalControl {<"*RTP impacting elements Y/N?*">}
Local {…
m=audio <port> rtp/avp x1 x2
a=rtpmap:x1 …
a=ptime: …
},
Remote {
m=audio <port> rtp/avp x1 x2
a=rtpmap:x1 …
a=ptime: …
}
other Descriptors{<"*RTP impacting elements Y/N?*">}
…},
Add = ip/$; Termination **Tb**, SEP **S1**
… Stream = 1 {
LocalControl {<" *RTP impacting elements Y/N?*">}
Local {…
m=audio <port> rtp/avp x1 x2
a=rtpmap:x1 …
a=ptime: …
},
Remote {
m=audio <port> rtp/avp x1 x2
a=rtpmap:x1 …
a=ptime: …
}
other Descriptors{<"*RTP impacting elements Y/N?*">}
…}
	This option was added by 3GPP profiles (in comparison to TISPAN BGF).
	The MG has to compare all four SDP media descriptions, and if fully identical then to conclude a correspondent RTP topology behaviour. But which one exactly?

Discussion/conclusions of example 4:

– This example should be functionally identical as example 2, i.e., leading to the same MG behaviour, but there are subtle difference between examples 2 and 4 when considering the dynamics of ITU-T H.248 signalling.

– Problem: the final establishment of the ITU-T H.248 stream might be subject of multiple signalling cycles (ADD, MOD, …). The MG normally already becomes RTP aware (even media aware) with the very first ITU-T H.248 command request. But which topology? B2BRE, media translator, transport translator or transparent forwarding?

– The MG could of course wait till the stream is finally established, but that would be an unsatisfying situation for performance optimized implementations, which may want to achieve e.g., the minimization of call and bearer establishment delays.

– The explicit indication of the required RTP topology (MG, PP, TR or TF) in the first command request could solve the ambiguity.

I.3.5 Example 5: Transport protocol translation for RTP bearer traffic

Table I.5 illustrates the example RTP-over-UDP to RTP-over-TCP interworking (but could be also RTP-over-UDP to RTP-over-DCCP, etc.).

Table I.5 – Example 5: Transport protocol translation for RTP bearer traffic

ITU-T H.248 encoding (shortened command)	Comments

Add = ip/$; Termination **Ta**, SEP **S1**
… Stream = 1 {
LocalControl {<"*RTP impacting elements Y/N?*">}
Local {…
m=- <port> UDP -
},
Remote {
m=- <port> UDP -
}
other Descriptors{<"*RTP impacting elements Y/N?*">}
…},
Add = ip/$; Termination **Tb**, SEP **S1**
… Stream = 1 {
LocalControl {<" *RTP impacting elements Y/N?*">}
Local {…
m=- <port> TCP/RTP/AVP -
},
Remote {
m=- <port> TCP/RTP/AVP -
}
other Descriptors{<"*RTP impacting elements Y/N?*">}
…}
	Stream endpoint SEP Ta/S1 is L4+ agnostic, the MG would be RTP unaware.
	However, SEP Tb/S1 indicates RTP as L4+ protocol.
	The complete settings lead to the conclusion of transport protocol translation for RTP bearer traffic.

Discussion/conclusions of example 5:

– That is a different signalling variant, but similar concerning conclusions as example 3.

– The MG would exclude the PP topology (because PP would be based on value "RTP/AVP" instead of "UDP" at Ta/S1 side.

– However, there are still two meaningful RTP translator options (TR and TF), thus, not unambiguous.

– Thus, guaranteed transparent forwarding would require rather the explicit assignment of the TF topology.

I.3.6 Example 6: Transparent forwarding of encrypted RTP traffic

This use case relates to so-called end-to-end media security scenarios where an IP-IP MG is located in the middle of the end-to-end SRTP-enabled RTP session. There are ITU-T H.248 profiles which use the "m=" line transport code-point RTP/SAVP for the indication of SRTP traffic to the MG, see Table I.6:

Table I.6 – Example 6: Transparent forwarding of encrypted RTP traffic

ITU-T H.248 encoding (shortened command)	Comments

Add = ip/$; Termination **Ta**, SEP **S1**
… Stream = 1 {
LocalControl {<"*RTP impacting elements Y/N?*">}
Local {…
m=- <port> RTP/SAVP -
},
Remote {
m=- <port> RTP/SAVP -
}
other Descriptors{<"*RTP impacting elements Y/N?*">}
…},
Add = ip/$; Termination **Tb**, SEP **S1**
… Stream = 1 {
LocalControl {<" *RTP impacting elements Y/N?*">}
Local {…
m=- <port> RTP/SAVP -
},
Remote {
m=- <port> RTP/SAVP -
}
other Descriptors{<"*RTP impacting elements Y/N?*">}
…}
	SRTP traffic is indicated by the "m=" line, in a media agnostic manner.
	The complete settings lead to the conclusion of transparent forwarding of SRTP bearer traffic.

Discussion/conclusions of example 6:

– There could be an ambiguous situation without explicit RTP topology indication (e.g., MG could conclude B2BRE (= PP)), which would be controversial.

– Required would be a transparent forwarding behaviour, which would be satisfied by RTPTT and TF topologies.

– Solution: unambiguous semantic by explicit indication of rtpt/rtptopo = *TF*.

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