

I n t e r n a t i o n a l T e l e c o m m u n i c a t i o n U n i o n

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.248.71

(02/2010)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS
Infrastructure of audiovisual services – Communication
procedures

**Gateway control protocol: RTCP support
packages**

Recommendation ITU-T H.248.71



ITU-T H-SERIES RECOMMENDATIONS
AUDIOVISUAL AND MULTIMEDIA SYSTEMS

CHARACTERISTICS OF VISUAL TELEPHONE SYSTEMS	H.100–H.199
INFRASTRUCTURE OF AUDIOVISUAL SERVICES	
General	H.200–H.219
Transmission multiplexing and synchronization	H.220–H.229
Systems aspects	H.230–H.239
Communication procedures	H.240–H.259
Coding of moving video	H.260–H.279
Related systems aspects	H.280–H.299
Systems and terminal equipment for audiovisual services	H.300–H.349
Directory services architecture for audiovisual and multimedia services	H.350–H.359
Quality of service architecture for audiovisual and multimedia services	H.360–H.369
Supplementary services for multimedia	H.450–H.499
MOBILITY AND COLLABORATION PROCEDURES	
Overview of Mobility and Collaboration, definitions, protocols and procedures	H.500–H.509
Mobility for H-Series multimedia systems and services	H.510–H.519
Mobile multimedia collaboration applications and services	H.520–H.529
Security for mobile multimedia systems and services	H.530–H.539
Security for mobile multimedia collaboration applications and services	H.540–H.549
Mobility interworking procedures	H.550–H.559
Mobile multimedia collaboration inter-working procedures	H.560–H.569
BROADBAND, TRIPLE-PLAY AND ADVANCED MULTIMEDIA SERVICES	
Broadband multimedia services over VDSL	H.610–H.619
Advanced multimedia services and applications	H.620–H.629
IPTV MULTIMEDIA SERVICES AND APPLICATIONS FOR IPTV	
General aspects	H.700–H.719
IPTV terminal devices	H.720–H.729
IPTV middleware	H.730–H.739
IPTV application event handling	H.740–H.749
IPTV metadata	H.750–H.759
IPTV multimedia application frameworks	H.760–H.769
IPTV service discovery up to consumption	H.770–H.779

For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T H.248.71

Gateway control protocol: RTCP support packages

Summary

Recommendation ITU-T H.248.71 defines three ITU-T H.248 packages that relate to the real-time control protocol (RTCP). The RTCP Source Description package, the Received RTCP package, and the RTCP Feedback Message package allow the media gateway controller (MGC) to monitor and control RTCP flows that are terminated by (or that pass through) a media gateway (MG).

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T H.248.71	2010-02-13	16

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at <http://www.itu.int/ITU-T/ipr/>.

© ITU 2010

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

CONTENTS

	Page
1 Scope	1
2 References.....	1
3 Definitions	1
3.1 Terms defined elsewhere.....	1
3.2 Terms defined in this Recommendation.....	2
4 Abbreviations and acronyms	2
5 Conventions	3
6 RTCP source description package	3
6.1 Properties.....	3
6.2 Events	3
6.3 Signals	3
6.4 Statistics.....	3
6.5 Error codes.....	4
6.6 Procedures	5
7 Received RTCP package	6
7.1 Properties.....	6
7.2 Events	6
7.3 Signals	6
7.4 Statistics.....	6
7.5 Error codes.....	8
7.6 Procedures	8
8 RTCP feedback message package	12
8.1 Properties.....	12
8.2 Events	12
8.3 Signals	14
8.4 Statistics.....	15
8.5 Error codes.....	15
8.6 Procedures	15

Recommendation ITU-T H.248.71

Gateway control protocol: RTCP support packages

1 Scope

This Recommendation defines several ITU-T H.248 packages that relate to RTCP flows that terminate at or pass through the MG.

The *RTCP Source Description* package maps information appearing in sent and received RTCP Source Description (SDS) packets into ITU-T H.248 statistics. Auditing these statistics allows the MGC to gain a better understanding of the RTP end-systems and intermediate systems that participate in an RTP session.

The *Received RTCP* package maps information appearing in received RTCP Sender Report and Receiver Report packets into ITU-T H.248 statistics. By auditing these statistics, the MGC can collect performance and QoS metrics, measured by the remote participants of the RTP session.

The *RTCP Feedback Message* package allows the MGC to be notified when the MG receives RTCP feedback messages, and to instruct the MG to send such messages. RTCP feedback messages are used by RTP Audio Visual Profiles with feedback extensions (see [IETF RFC 4585]).

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 H.248.1] | Recommendation ITU-T H.248.1 (2005), <i>Gateway control protocol: Version 3</i> , including its Amendment 2 (2009). |
| [ITU-T M.2301] | Recommendation ITU-T M.2301 (2002), <i>Performance objectives and procedures for provisioning and maintenance of IP-based networks</i> . |
| [IETF RFC 3550] | IETF RFC 3550 (2003), <i>RTP: A Transport Protocol for Real-Time Applications</i> . |
| [IETF RFC 3629] | IETF RFC 3629 (2003), <i>UTF-8, a transformation format of ISO 10646</i> . |
| [IETF RFC 4585] | IETF RFC 4585 (2006), <i>Extended RTP Profile for Real-time Transport Control Protocol (RTCP)-Based Feedback (RTP/AVPF)</i> . |
| [IETF RFC 5104] | IETF RFC 5104 (2008), <i>Codec Control Messages in the RTP Audio-Visual Profile with Feedback (AVPF)</i> . |

3 Definitions

3.1 Terms defined elsewhere

3.1.1 RTP end-system [IETF RFC 3550]: An application that generates the content to be sent in RTP packets and/or consumes the content of received RTP packets.

3.1.2 RTP mixer [IETF RFC 3550]: An intermediate system that receives RTP packets from one or more sources, possibly changes the data format, combines the packets in some manner and then forwards a new RTP packet. All RTP packets originating from a mixer are identified as having the mixer as their synchronization source.

3.1.3 RTP translator [IETF RFC 3550]: An intermediate system that forwards RTP packets with their synchronization source identifier intact. Examples of translators include devices that convert encodings without mixing, replicators from multicast to unicast, and application-level filters in firewalls.

NOTE – The RTP translator concept is further refined in [b-IETF RFC 5117] into "RTP transport translator" and "RTP media translator". For the purposes of this Recommendation, there is no difference between the two.

3.2 Terms defined in this Recommendation

3.2.1 measurement point (MP) (adapted from [ITU-T M.2301]): An MP is the physical or logical point at which measurements can be made and to which the data obtained is related. In the context of RTP and RTCP, any source of RTCP packets is a measurement point. Its measurement data is based on the RTP and RTCP traffic sent and received at that element.

3.2.2 reporting point (RP): This is the point at which the measurement data is reported to another network element. In the context of RTP and RTCP, any source of RTCP packets is a reporting point, where the measurement data is reported through RTCP. In addition, any ITU-T H.248 MG is a reporting point, when reporting various measurement data through ITU-T H.248 statistics.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ABNF	Augmented Backus-Naur Form
AVPF	Audio Visual Profile with Feedback
CNAME	Canonical Name
FB	Feedback
FCI	Feedback Control Information
FMT	Feedback Message Type
IANA	Internet Addressing and Numbers Authority
IP	Internet Protocol
LSB	Least Significant Bit
MG	Media Gateway
MGC	Media Gateway Controller
MP	Measurement Point
NAT	Network Address Translation
PLI	Picture Loss Indication
PSFB	Payload Specific Feedback
PT	RTCP control Packet Type
RP	Reporting Point

QoS	Quality of Service
RR	RTCP Receiver Report
RTP	Real-time Transport Protocol
RTCP	RTP Control Protocol
RTPFB	Transport layer (RTP) Feedback
SDES	Source Description
SDP	Session Description Protocol
SR	RTCP Sender Report
SSRC	Synchronization Source
TMMBR	Temporary Maximum Media stream Bit-rate Request

5 Conventions

None.

6 RTCP source description package

Package name: RTCP Source Description Package

Package ID: rtcpsdes (0x0104)

Description: This package defines statistics regarding the information appearing in source description (SDES) RTCP packets, as defined in [IETF RFC 3550]. The statistics detail both information generated locally at the MG and information learnt from remote systems participating in the RTP session.

Version: 1

Extends: None.

6.1 Properties

None.

6.2 Events

None.

6.3 Signals

None.

6.4 Statistics

6.4.1 Local synchronization source

Statistic name: Local Synchronization Source

Statistic ID: lssrc (0x0001)

Description: The RTP synchronization source (SSRC) used by the MG in the RTP and RTCP packets it sends.

Type: Unsigned Integer

Possible values: Any

Level: Stream

6.4.2 Remote synchronization source

Statistic name: Remote Synchronization Source

Statistic ID: rsrc (0x0002)

Description: The RTP synchronization source (SSRC) appearing in RTCP packets received from remote RTP systems (end-systems, mixers or translators). Note that a single RTP session may have more than one remote system (e.g., in multicast sessions).

Type: Sub-list of Unsigned Integer. Each element in the sub-list represents the SSRC of one remote system.

Possible values: Any. If the MG does not yet know the SSRC of any remote system (e.g., because no RTCP packets were yet received), this statistic shall include a single element that is set to zero.

Level: Stream

6.4.3 Local canonical name

Statistic name: Local Canonical Name

Statistic ID: lname (0x0003)

Description: The canonical name (CNAME) appearing in RTCP SDES packets generated by the MG.

Type: String

Possible values: Any. See clause 6.6.4 for the text encoding of special octets.

Level: Stream

6.4.4 Remote canonical name

Statistic name: Remote Canonical Name

Statistic ID: rcname (0x0004)

Description: The canonical name (CNAME) appearing in SDES packets received from remote RTP systems (end-systems, mixers or translators).

Type: Sub-list of String. Each element in the Sub-list encodes the CNAME of one remote system. The order of the *rcname* elements shall match the order of the *rsrc* elements. Therefore the *i*-th elements of the *rcname* and *rsrc* statistics contain, respectively, the CNAME and SSRC of one remote system.

Possible values: Any. If the CNAME of a certain system is not yet known, the appropriate sub-list element shall be encoded as a string containing a single minus character (i.e., "-"). See clause 6.6.4 for the text encoding of special octets.

Level: Stream

6.5 Error codes

None.

6.6 Procedures

6.6.1 Locally generated values

Some of the statistics of this package (*lssrc* and *lcname*) contain RTCP field values generated by the MG. These statistics shall be available even if the MG is not sending RTCP traffic (e.g., due to other ITU-T H.248 parameters or local configuration). In such a case, the statistics shall include the values that would have been used had the MG sent RTCP traffic.

6.6.2 Received values

If the *rssrc* and the *rcname* statistics are set on the MG, it populates the statistics relating to remote end-systems and translators based on RTCP packets it receives. Specifically:

- 1) When the MG receives an RTCP packet, it shall ensure that the SSRC of the packet's sender (i.e., the SSRC appearing in the RTCP header) appears *in the rssrc* statistic, adding it if necessary.
- 2) When the MG receives an SDES RTCP packet, it examines each of that packet's chunks. If the chunk relates to the system that sent the RTCP packet (i.e., if the SSRC appearing in the chunk is identical to the SSRC of the sender), the MG will use that chunk's CNAME item to update the *rcname* statistic.

This procedure ensures that, in the case of a mixer, the MG will record only the CNAME of the mixer itself, and not the CNAMEs of any of the contributing sources.

NOTE – It is possible for the MGC to set only one of these statistics on a stream. However such a configuration is of questionable usefulness.

6.6.2.1 Indicating missing values

Before the MG receives any RTCP packets from a remote system, the values of the *rssrc* and *rcname* statistics are [0] and ["-"] respectively. The MGC shall interpret this specific combination of values as indicating that no information is available regarding any remote system.

6.6.3 Pruning stale values

The MG should make sure that values that no longer represent the state of the RTP session are cleared from the statistics. For example:

- 1) When the MG detects that another system has changed its SSRC, it should remove the values relating to the old SSRC from the statistics. How the MG detects such SSRC changes is implementation-dependent.
- 2) When the MG decides that an SSRC has timed out (e.g., according to the procedures of clause 6.3.5 of [IETF RFC 3550]), it should remove the values relating to that SSRC from the statistics.
- 3) When the MG receives a BYE RTCP packet, it should wait for some interval and then remove the values relating to the packet's SSRC from the statistics. Waiting for a time interval before removing the values is required in order to prevent a race condition where, at the end of a call, the statistics are cleared just before the ITU-T H.248 termination is subtracted (and the statistics are audited).

6.6.4 Encoding UTF-8 strings into ITU-T H.248 strings

CNAME items appearing in RTCP SDES packets are encoded as a UTF-8 string, according to [IETF RFC 3629]. The *lcname* and *rcname* statistics report such CNAME values, using String as the statistics' type.

According to clause 12.1.5 of [ITU-T H.248.1], the String statistic type uses the UTF-8 encoding. Therefore, the octets of the CNAME item can be directly copied from the RTCP packet into the statistics. A problem arises, however, when the ITU-T H.248 protocol is using text encoding, as several octet values that are legal in UTF-8 cannot appear in the quotedString ABNF form that is used for the String type (see clause B.2 of [ITU-T H.248.1]).

The hexadecimal octet values that cannot appear in the quotedString form are listed below:

00-08
0b-0c
0e-1f
22
7f

Each of these octets represents a single character from the US-ASCII range of UTF-8. Only octet 22 represents a printable character (double-quotes); therefore this is the only octet that can reasonably appear within a CNAME.

When an MG needs to encode such an octet within one of this package's statistics, it shall convert it to the following octet triplet:

%xx

where xx are the hexadecimal digits representing the octet. Note that such an encoding introduces an ambiguity when the "%" character (hexadecimal 25) needs to be encoded. Therefore this character shall also be encoded using the following octet triplet:

%25

7 Received RTCP package

Package name: Received RTCP Package

Package ID: recrtcp (0x00f5)

Description: This package defines statistics that detail information received from the remote systems of an RTCP flow.

Version: 1

Extends: None.

7.1 Properties

None.

7.2 Events

None.

7.3 Signals

None.

7.4 Statistics

7.4.1 Remote packets sent

Statistic name: Remote Packets Sent

Statistic ID: rps (0x0001)

Description: The total number of RTP data packets transmitted by the remote systems since starting transmission; calculated based on the Sender's Packet Count field of received SRs.

Type: Sub-list of Double

Possible values: Any non-negative value.

Level: Termination or Stream

7.4.2 Remote octets sent

Statistic name: Remote Octets Sent

Statistic ID: ros (0x0002)

Description: The total number of payload octets (i.e., not including RTP header or padding) transmitted in RTP data packets by the remote systems since starting transmission; calculated based on the Sender's Octet Count field of received SRs.

Type: Sub-list of Double

Possible values: Any non-negative value.

Level: Termination or Stream

7.4.3 Remote packet loss

Statistic name: Remote Packet Loss

Statistic ID: rpl (0x0003)

Description: The fraction of RTP data packets that each remote system lost between sending the one-before-last and the last SR or RR; as reported in the Fraction Lost field of received SRs/RRs. The fraction is expressed as a percentage value, using a fixed-point notation; a 32-bit whole part and a 32-bit fraction (see also clause E.12.4.3 of [ITU-T H.248.1]). If the loss is negative due to duplicates, the remote packet loss is set to zero.

NOTE 1 – This statistic is not cumulative, and represents only the loss measured by each remote system between the times when it has sent its last two SRs/RRs. The MGC may periodically audit this statistic, either by issuing AuditValue commands or through the procedures of the Statistic Conditional Reporting package (see [b-ITU-T H.248.47]).

NOTE 2 – In SR and RR reports, the Fraction Lost field is expressed as an 8-bit fixed point fraction with no whole part. Converting this value to the encoding of the *rpl* statistic amounts to multiplying the value appearing in the SR/RR by a factor of 100×2^{24} .

Type: Sub-list of Double.

Possible values: A 32-bit whole number and a 32-bit fraction, so that the resulting number is in the range of 0-100.

Level: Termination or Stream.

7.4.4 Remote cumulative packet loss

Statistic name: Remote Cumulative Packet Loss

Statistic ID: rcpl (0x0004)

Description: The total number of RTP data packets that each remote system lost since the beginning of reception; calculated based on the Cumulative Number of Packets Lost field of received SRs/RRs. This number is defined to be the number of packets expected less the number of packets actually received, where the number of packets received includes any which are late or duplicates. Thus, packets that arrive late are not counted as lost, and the loss may be negative if there are duplicates. If the loss is negative the remote cumulative packet loss is set to zero.

Type: Sub-list of Double

Possible values: Any non-negative value.

Level: Termination or Stream

7.4.5 Remote jitter

Statistic name: Remote Jitter

Statistic ID: rjit (0x0005)

Description: An estimate of the statistical variance of the RTP data packet inter-arrival time measured by each remote system; as reported in received SRs/RRs. The inter-arrival jitter is measured in the units of the RTP timestamp and defined to be the mean deviation (smoothed absolute value) of the difference in packet spacing at the receiver compared to the sender for a pair of packets (see also clause A.8 of [IETF RFC 3550]).

NOTE – This statistic is not cumulative, and represents only the momentary jitter measured by each remote system at the time that it has sent its last SR/RR. The MGC may periodically audit this statistic, either by issuing AuditValue commands or through the procedures of the Statistic Conditional Reporting package (see [b-ITU-T H.248.47]).

Type: Unsigned Integer

Possible values: Any

Level: Termination or Stream

7.5 Error codes

None.

7.6 Procedures

7.6.1 Principle of operation

The Received RTCP package can only be implemented by ITU-T H.248 streams that contain an incoming RTCP flow. Such a stream could be, for example, a stream representing the combination of an RTP flow and its RTCP flow; or a stream representing the RTCP flow only.

An overview of the principle behind the package is given in Figure 1.

A measurement point exists at the remote end of an RTP session, where performance and QoS metrics are maintained regarding the sent and received RTP and RTCP traffic. These metrics are then relayed to the MG through an RTCP reporting point.

The MG collects the metrics relayed through RTCP, and reports them to the MGC through the statistics of the Received RTCP package.

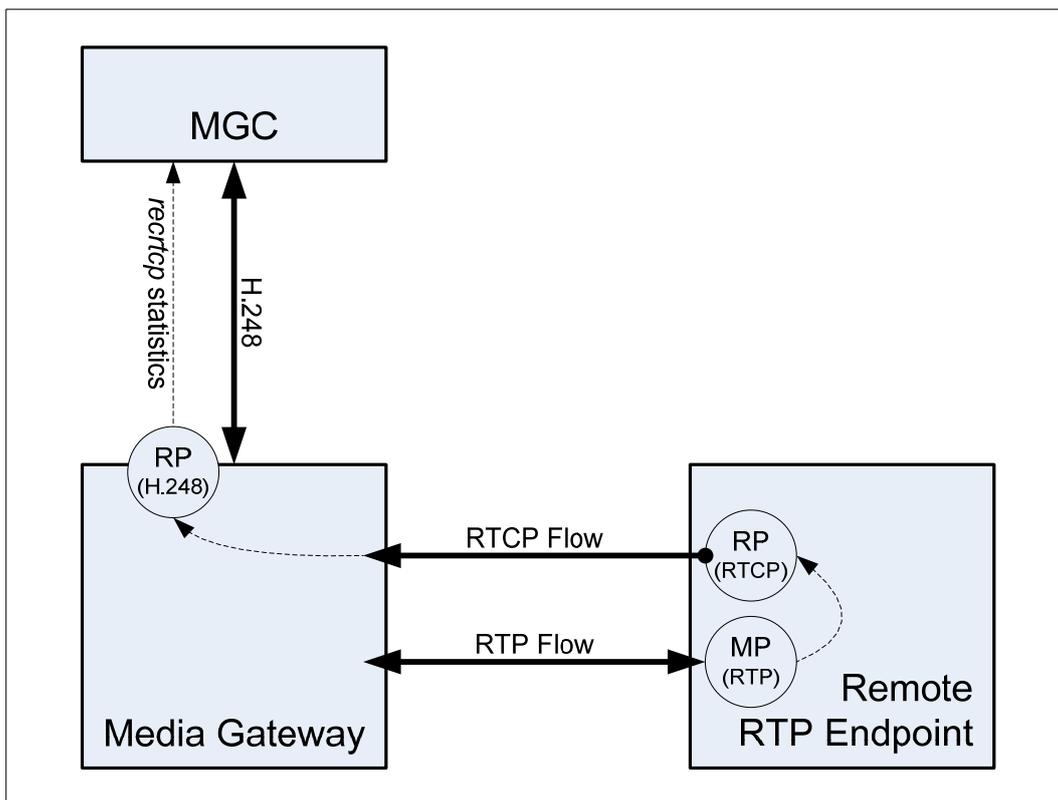


Figure 1 – An overview of the Received RTCP package's operation

Note that the Received RTCP package does not assume that the MG is the originator of the RTP flow, nor does it assume that it is the final destination of the RTCP flow. In many cases (for example, an IP-to-IP MG providing NAT services), the MG simply relays the RTP/RTCP traffic, while the RTP source is a different network device lying "behind" the MG.

7.6.1.1 Correspondence with the RTP and network packages

There is a strong correspondence between the statistics of the Received RTCP package and the statistics of the RTP and Network packages (see [ITU-T H.248.1]). The difference is that the Received RTCP package reports metrics that are measured by remote systems and relayed to the MG through RTCP, while the RTP and Network packages report metrics measured locally at the MG.

The measurement point and reporting point involved in the statistics of the RTP and Network packages are highlighted in Figure 2.

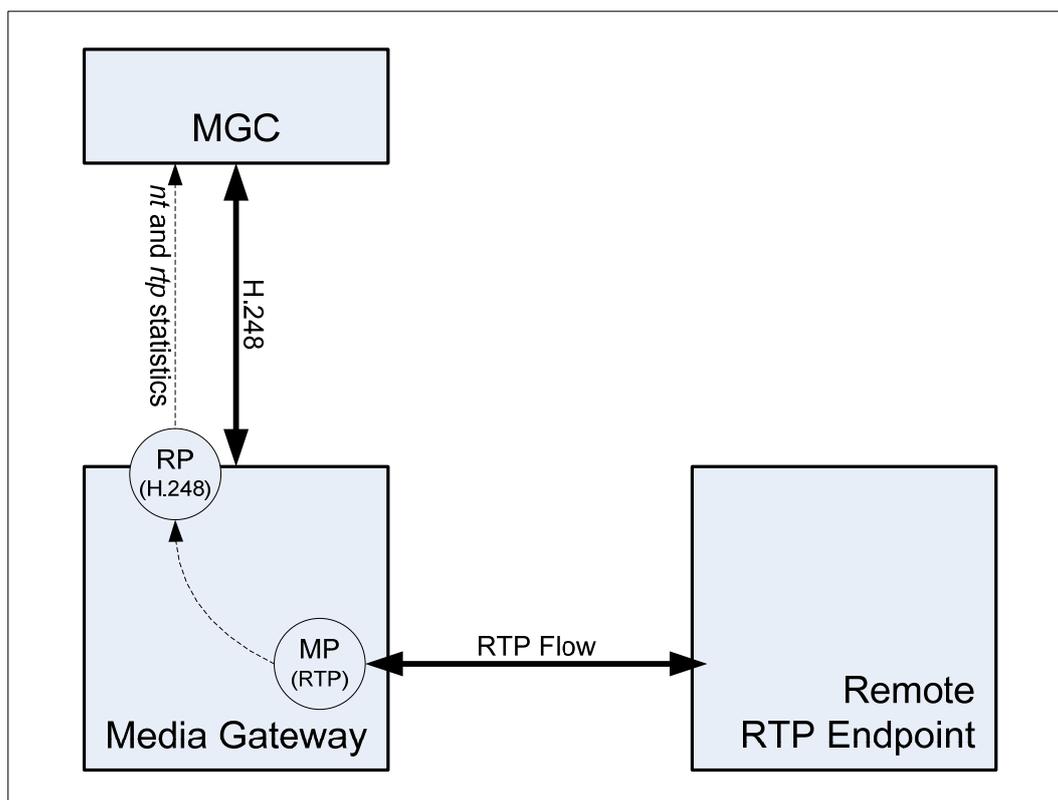


Figure 2 – The operation of statistics of the RTP and Network packages

To highlight this similarity, the statistics of the Received RTCP package use the same names as the corresponding statistics of the RTP and Network packages. A "Remote" prefix is added to each statistic of the Received RTCP package, to emphasize that the measurement point is at the remote system.

7.6.2 Collection of received RTCP statistics

ITU-T H.248 terminations where the statistics defined in this package are set shall record the values appearing in certain fields of RTCP Sender Reports and Receiver Reports received from remote end-systems intermediate-systems (i.e., mixers and translators). These values are then used to calculate the statistics of this package. The MG shall ensure that the value of cumulative statistics (i.e., *rps*, *ros* and *rcpl*) will remain correct even if the corresponding RTCP field has wrapped around (due to the limited number of bits in the RTCP packet). For example, if the remote system has sent $2^{32}+x$ octets, the Sender Octet's Count field of the RTCP SR will wrap-around to x , however the value of the *Remote Octets Sent* statistic would still represent the true number of sent octets (i.e., $2^{32}+x$).

NOTE – For the MG to be able to calculate the correct value of the statistics, it must assume that several RTCP reports are received between any two consecutive wrap-around events. The MG cannot be aware (and therefore cannot maintain the correct statistic value) if multiple wrap-around events of a single field happened between two consecutive reports. A sample algorithm for detecting wrap-around events (through the RTP sequence number) is given in clause A.1 of [IETF RFC 3550].

If no appropriate RTCP report was yet received, the value of each statistic shall be set to zero.

7.6.3 RTP flows with a single remote system

Simple RTP sessions are unicast ones, involving only two RTP end-systems or mixers. In use cases involving such sessions, the Received RTCP package can be used on its own. Each statistic then includes only a single value (i.e., a sub-list of length one), representing the metric reported by the

remote-end of the RTP session. The MG updates this value following any RTCP SR/RR received from that remote-end.

7.6.4 RTP flows with multiple remote systems

Some RTP sessions involve more than one remote RTP system. Two examples for such sessions are multicast RTP sessions and RTP sessions that involve quality monitoring RTP translators. In such scenarios, the MG will receive RTCP Sender and/or Receiver Reports from each of these remote systems. In addition, these reports may include report-blocks concerning the RTP packets sent by other senders in the session.

When the session includes multiple remote systems, the Received RTCP package must be used in conjunction with the RTCP Source Description Package (*rtcpsdes*). *Rtcpsdes Remote Synchronization Source (rtcpsdes/rssrc)* statistic shall be set on any stream that collects any *recrtcp* statistic. Trying to set a *recrtcp* statistic without setting *rtcpsdes/rssrc* shall be rejected using error #472 (Required information missing).

Each of this package's statistic shall include a list of values, where the *i*-th position in the list corresponds to reports sent by the system represented by the *i* position of the *rtcpsdes/rssrc* statistic. When calculating the statistics of this package, the MG shall only use report blocks concerning RTP packets sent by the MG (i.e., report blocks whose SSRC matches the SSRC used by the MG). Any other report blocks must be ignored.

As an example, consider an RTP session with three end-systems:

- 1) The MG, which is a sender and uses SSRC 123.
- 2) Sender A, which uses SSRC 456.
- 3) Receiver B, which uses SSRC 789.

The MG's *Remote End-System's Synchronization Source* will include the SSRCs of both remote end-systems:

```
rtcpsdes/rssrc = [456, 789]
```

Each of these package's statistics will also have two values, for example:

```
recrtcp/rcpl = [293, 19]
```

The first value (293) is based on the Sender Reports sent by A. The second value (19) is based on the Receiver Reports sent by B.

Each Receiver Report sent by B will include two report-blocks (because there are two senders in the session): one having an SSRC of 123 (dealing with the MG's RTP packets) and one having an SSRC of 456 (dealing with A's RTP packets). The statistics of this package will be based only on the report block dealing with the MG's packets.

7.6.5 Sender-only statistics

Two statistics of this package, the *Remote Packets Sent (rps)* and *Remote Octets Sent (ros)* are based on Sender Report packets. If no SRs were received from a remote system for the complete duration of the RTP session, these statistics shall be set to zero. If, however, a remote system alternates between sending Sender Reports and Receiver Reports, the reception of an RR shall not reset these statistics to zero. Instead, their value calculated based on the last SR received shall be maintained.

NOTE – A zero value of the *rps* and *ros* statistics can be used by the MGC to detect remote systems that never send RTP packets (e.g., "pure" receiver end-systems or quality-monitoring RTP translators).

7.6.6 Termination level statistics

The statistics of this package can be collected both at the stream level and at the termination level. When collected at the termination level, the statistic contains a single value representing the aggregate over all ITU-T H.248 streams and all remote systems.

Most of these package's statistics are cumulative (see clause 7.1.15 of [ITU-T H.248.1]), and shall be aggregated by summing them. The aggregation of the non-cumulative statistics (*Remote Packet Loss* and *Remote Jitter*) is for future study, and outside the scope of this Recommendation. Some possibilities are to use the average value, a weighted average value or the maximal value among all the remote systems.

8 RTCP feedback message package

Package name: RTCP Feedback Package

Package ID: rtcpfb (0x00f6)

Description: This package allows the MGC and MG to coordinate the reception and sending of RTCP Feedback messages. The RTCP Feedback mechanism is defined in [IETF RFC 4585], which defines several types of messages and allows further extension by other specifications (e.g., [IETF RFC 5104]).

This package contains signals and events that allow a MGC to request an MG to notify it when a particular RTCP feedback message is detected. It also allows the MGC to trigger the MG to send a particular feedback message.

This is particularly useful in interworking scenarios where a MG bearer level indication must be mapped to a MGC control level indication. One such interworking scenario is between the ITU-T H.245 messages sent by a [b-ITU-T H.324] terminal and the corresponding RTCP messages used by terminals at an RTP-based network.

Version: 1

Extends: None.

8.1 Properties

None.

8.2 Events

8.2.1 RTCP feedback message detection

Event name: RTCP Feedback Message Detection

Event ID: det (0x0001)

Description: This event is used to receive RTCP Feedback information regarding a media stream.

8.2.1.1 EventsDescriptor parameters

8.2.1.1.1 Feedback message type

Parameter name: Feedback Message Type

Parameter ID: type (0x0001)

Description: This parameter specifies which RTCP feedback message types are to be detected by the MG and reported to the MGC. This is achieved by indicating the control packet type (PT) and the feedback message type (FMT). The control packet type can either be transport layer feedback (RTPFB) or payload specific feedback (PSFB).

Type: Sub-list of String

Optional: No

Possible values: The sub-list contains one or several bit pattern(s) each with two bytes, encoded as a hexadecimal value. Bit 0 is the most significant bit.

Bits 0-7 represent the FMT.

Bits 8-15 represent the PT. A value of 205 indicates a transport layer FB message. A value of 206 indicates a payload-specific FB message.

See the IANA registry for PT values and FMT values for both the RTPFB and PSFB control packet types, <http://www.iana.org/assignments/rtp-parameters>.

For example, to detect the payload specific (payload type value 206) AVPF Picture Loss Indication (PLI) (FMT=1) feedback message, hexadecimal value 0x01CE is used.

For example, to detect the transport specific (payload type value 205) AVPF Temporary Maximum Media stream Bit-rate Request (TMMBR) (FMT=3) feedback message, hexadecimal value 0x03CD is used.

Default: None.

8.2.1.2 ObservedEventsDescriptor parameters

NOTE – Whilst the RTCP Feedback mechanism supports various types of messages, only those messages and information that are deemed relevant to a MGC are specified below.

8.2.1.2.1 Update picture

Parameter name: Update Picture

Parameter ID: upic (0x0001)

Description: This is used to indicate that a picture loss indication (i.e., indicated by a PLI RTCP Feedback message) has been received from the remote end and that the picture may need to be updated.

Type: Enumeration

Optional: Yes

Possible values: "PLI"
(0x0001) Picture Loss Indication

Default: None.

8.2.1.2.2 Max bitrate

Parameter name: Max Bitrate

Parameter ID: mbr (0x0002)

Description: This is used to indicate that the MG has received a maximum media stream bit rate (i.e., as indicated by a TMMBR RTCP Feedback message) from the remote end. The bandwidth is calculated by the MG based on the bandwidth as indicated in the RTCP TMMBR message excluding any overhead indicated in the RTCP TMMBR message.

The MG shall issue a *rtcpfb/det* notification with a *mbr* parameter only if the received RTCP TMMBR message contains a FCI related to the SSRC used by the MG. Only the bandwidth appearing in that FCI is reported.

Type: Double
Optional: Yes
Possible values: 0 upwards in units of bits per second
Default: None.

8.3 Signals

8.3.1 Feedback message sending

Signal name: Feedback Message Sending
Signal ID: fbmessend (0x0001)
Description: This signal allows the MGC to provide feedback information to the MG that is relevant to a particular media session. Based on the information a MG will send an appropriate RTCP feedback message to the remote end.
Signal type: Brief
Duration: Not applicable

8.3.1.1 Additional parameters

NOTE – Whilst the RTCP feedback mechanism supports various types of messages, only those messages and information that are deemed relevant to a MGC are specified below.

8.3.1.1.1 Update picture

Parameter name: Update Picture
Parameter ID: upic (0x0001)
Description: This is used by the MGC to indicate to the MG that it shall send an indication to the remote end that a picture update is needed (i.e., the MG shall send a PLI RTCP Feedback message).
Type: Enumeration
Optional: Yes
Possible values: "PLI" (0x0001): Picture Loss Indication
Default: None.

8.3.1.1.2 Max bitrate

Parameter name: Max Bitrate
Parameter ID: mbr (0x0002)

Description:	This is used by the MGC to indicate to the MG that it shall send an indication to the remote end with a maximum bit rate for the media stream (i.e., the MG shall send a TMMBR RTCP feedback message using indicated rate to calculate the contents of the feedback message).
Type:	Double
Optional:	Yes
Possible values:	0 upwards in units of bits per second
Default:	None.

8.4 Statistics

None.

8.5 Error codes

None.

8.6 Procedures

8.6.1 General

Media gateways may be required to support RTCP feedback messages. The support of RTCP-based feedback messages is signalled through the SDP protocol field indicating the support of the "Extended RTP Profile with RTCP based Feedback (RTP/AVPF)". Furthermore, which feedback messages are supported is indicated through the SDP attribute "RTCP Feedback parameter (rtcpfb)". See [IETF RFC 4585] for more information regarding their usage.

As such, this package does not itself indicate support of a particular RTP profile or RTCP feedback message set. This must be done through the Local and Remote descriptors.

This package allows the MGC to request to be notified of the reception of certain RTCP feedback messages and allows the MGC to request certain RTCP feedback messages to be sent.

8.6.2 Feedback message reception and notification

For an MGC to be notified of a particular feedback message, it shall set the *RTCP Feedback Message Detection (rtcpfb/det)* event on an applicable termination/stream on the MG. The event should be set at a stream level in order to uniquely identify the media stream to which the RTCP feedback message belongs. The MGC shall indicate the payload type and feedback message type of the RTCP Feedback messages for which it requires to be notified.

Once the event is set, when the MG receives a RTCP feedback message that matches one of those indicated in the event, a Notify request command is sent to the MGC. This Notify message shall contain an ObservedEvent parameter related to the RTCP feedback message information that was detected. If a compound RTCP message is received with multiple RTCP feedback messages, an ObservedEvent notification is generated for each one.

On reception of the Notify message, the MGC may then use the ObservedEvent parameters to determine what further action needs to be taken.

8.6.3 Feedback message sending

Certain information may be received by the MGC that may be relevant to a media stream. As a result, the MGC may require information to be sent to a receiver through the bearer path (i.e., via RTCP feedback messages). In order to achieve this, the MGC shall use the *Feedback Message Sending (rtcpfb/fbmesssend)* signal on the applicable Termination/Stream. The signal should be sent at a stream level to unambiguously identify the correct media stream. The MGC shall use the

appropriate signal parameter (e.g., Update Picture or Max Bit Rate) to indicate the information that needs to be sent. The MG shall derive from this information which RTCP Feedback message type needs to be sent.

On reception of the *rtcpfb/fbmesssend* signal, the MG shall use the signal parameters to construct a valid RTCP feedback message according to [IETF RFC 4585] or an appropriate extension RFC. If the MG is unable to construct or send the RTCP feedback message, it shall return error code #513 (Media gateway unequipped to generate requested signals).

8.6.4 Example

The *rtcpfb* package may be used by MGC/MGs in scenarios for interworking between H.324/H.324 Annex C ("H.324M") and RTP-based packet switched networks. In this case, an MGC would initiate/terminate ITU-T H.245 signalling and the MG would initiate/terminate RTCP signalling. As the MGC is the master, it is assumed that it determines what information will be interworked between ITU-T H.245 and RTCP.

As such, it determines that the [b-ITU-T H.245] videoFastUpdatePicture and Flow Control Commands will need to be interworked with RTCP. The equivalent RTCP feedback messages are Picture Loss Indication (PLI, see [IETF RFC 4585]) and Temporary Maximum Media Stream Bit Rate Request (TMMBR, see [IETF RFC 5104]), respectively.

An MGC will receive the ITU-T H.245 messages directly, however it will need to receive the information from the RTCP feedback messages from the MG. In order for it to receive the messages, it sends the following:

```
MGC to MG1:
MEGACO/3 [123.123.123.4]:55555
Transaction = 9999 {
  Context = 1 {
    Modify = A4444 {
      Events = 2222 {rtcpfb/det {ST=2,type=[0x001CE,0x03CD]}}
    }
  }
}
```

If the MG then receives a PLI RTCP feedback message, it shall generate a notification to the MGC using the following command:

```
MG1 to MGC:
MEGACO/3 [124.124.124.222]:55555
Transaction = 10000 {
  Context = 1 {
    Notify = A4444 {ObservedEvents =2222 {
      19990729T22000000:rtcpfb/det{ST=2,upic="PLI"}}}
  }
}
```

On reception of the Notify command, the MGC may generate an ITU-T H.245 videoFastUpdatePicture command.

Bibliography

- [b-ITU-T H.245] Recommendation ITU-T H.245 (2008), *Control protocol for multimedia communication*.
- [b-ITU-T H.248.47] Recommendation ITU-T H.248.47 (2007), *Gateway control protocol: Statistic conditional reporting package*.
- [b-ITU-T H.324] Recommendation ITU-T H.324 (2009), *Terminal for low bit-rate multimedia communication*.
- [b-IETF RFC 5117] IETF RFC 5117 (2008), *RTP Topologies*.

SERIES OF ITU-T RECOMMENDATIONS

Series A	Organization of the work of ITU-T
Series D	General tariff principles
Series E	Overall network operation, telephone service, service operation and human factors
Series F	Non-telephone telecommunication services
Series G	Transmission systems and media, digital systems and networks
Series H	Audiovisual and multimedia systems
Series I	Integrated services digital network
Series J	Cable networks and transmission of television, sound programme and other multimedia signals
Series K	Protection against interference
Series L	Construction, installation and protection of cables and other elements of outside plant
Series M	Telecommunication management, including TMN and network maintenance
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Terminals and subjective and objective assessment methods
Series Q	Switching and signalling
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminals for telematic services
Series U	Telegraph switching
Series V	Data communication over the telephone network
Series X	Data networks, open system communications and security
Series Y	Global information infrastructure, Internet protocol aspects and next-generation networks
Series Z	Languages and general software aspects for telecommunication systems