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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Communication procedures

Gateway control protocol: Guidelines on the use of ITU-T H.248 capabilities for performance monitoring in RTP networks in ITU-T H.248 profiles

Recommendation ITU-T H.248.87

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Recommendation ITU-T H.248.87

Gateway control protocol: Guidelines on the use of ITU-T H.248 capabilities for performance monitoring in RTP networks in ITU-T H.248 profiles

Summary

Recommendation ITU-T H.248.87 provides guidelines on the use of performance monitoring tools for real-time transport protocol (RTP) traffic in ITU-T H.248 profiles. Such tools are related to RTP control protocol (RTCP) reports and the use of the ITU-T H.248-based gateway control interface for configuring measurement, filtering and reporting activities. These profile guidelines may be used by other standards developing organizations (SDOs) when defining their ITU-T H.248.1 profiles in support of ITU-T H.248 procedures and packages related to RTP bearer traffic with associated RTCP reports.

History

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FOREWORD

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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.

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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/.

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Recommendation ITU-T H.248.87

Gateway control protocol: Guidelines on the use of ITU-T H.248 capabilities for performance monitoring in RTP networks in ITU-T H.248 profiles

1 Scope

The scope of this Recommendation covers performance monitoring in RTP networks with the involvement of ITU-T H.248 entities. Performance monitoring as such is a network service across multiple network entities which are located in user, control and/or management planes. The scope of this Recommendation is limited to the user/control/management plane interfaces of ITU-T H.248 entities. The notion of performance monitoring is used to emphasize a call/session dependent service, which is basically in contrast to the legacy performance management capability, which is a pure management plane function (see [ITU-T M.3010] and [ITU-T M.60]).

Performance monitoring could be considered as a network overlay function.

This Recommendation provides:

- an overview of the existing "entire ITU-T H.248 toolkit" for RTCP extended report (XR) support, i.e., the set of available ITU-T H.248 packages in that area
- an overview of available ITU-T H.248 packages for non-XR related performance metrics, typically subject to RTCP basic report (SR, RR) capabilities
- example network use cases with different ITU-T H.248 MG types (primarily physical-to-RTP gateways, media-agnostic IP-to-IP gateways, RTP-topology-aware RTP-to-RTP gateways)
- a collection of functional requirements in order to motivate associated profile guidelines
- a classification of performance metrics (such as application-level versus transport-level metrics) in order to indicate applicability or not for ITU-T H.248 MGs
- the following principal ITU-T H.248 MG tasks:
  - measurement of RTP traffic
  - reporting of measurement data via RTCP XR reports
  - collection of RTCP XR carried measurement data
  - loopback of RTP (in order to relocate a measurement point)
  - filtering of RTCP XR reports
  - modification of RTCP XR reports and/or reporting of measurement data via ITU-T H.248 statistics to the MGC
  - control of such tasks via [ITU-T H.248] that could be addressed in an ITU-T H.248 profile, i.e.,
    - the identification of appropriate ITU-T H.248 packages
    - the detailed specification of package usage
    - the example call-dependent procedures
- the association to other related ITU-T H.248.x Recommendations such as [ITU-T H.248.71], [ITU-T H.248.79], [ITU-T H.248.85] and [b-ITU-T H.248.88]
- control of measurement methods (such as interval, cumulative and alert type of measurements)
- usage of ITU-T H.248.47-based conditional reporting [ITU-T H.248.47].

This Recommendation also discusses the purpose of performance monitoring (and therefore the possible motivation of a use case). For example:

– capture of grade-of-service (GoS) related data in order to evaluate network conditions
– capture of quality of service (QoS) and quality of experience (QoE) related data in order to evaluate service conditions (e.g., as part of service level agreements)
– capture of billing/charging related data
– capture of data as input for routing algorithms
– capture of data as input for network node selection algorithms
– capture of data as input for centralized servers as support of network operations
– capture of data as part of online tests.

1.1 Framework and layout of this Recommendation

The scope, purpose, structuring principle and framework of this Recommendation are summarized in Figure 1.

The primary audience of this Recommendation are authors of ITU-T H.248 profile specifications, which aim to support a particular network performance monitoring use case, and the consideration of a specific location and/or type of an ITU-T H.248 MG.

Performance monitoring support could affect three areas of an ITU-T H.248 profile:

1. basic protocol capabilities (such as connection model);
2. packages and their detailed usage; and/or
3. call-dependent procedures.

This Recommendation provides guidelines for these profile areas. Typically to define an ITU-T H.248 profile there are several steps that are followed, according to Figure 1, given by:

1. Requirements stage: selecting use case(s) and the identification of required MG behaviour in terms of measurements, reporting, filtering, etc. capabilities;
2. Protocol stage: addressing the necessary templates of the indicated profile areas and recommended input; and
3. Profile stage: incorporating "guidelines" in an actual profile specification and adapting the templates to the concrete specification setting.

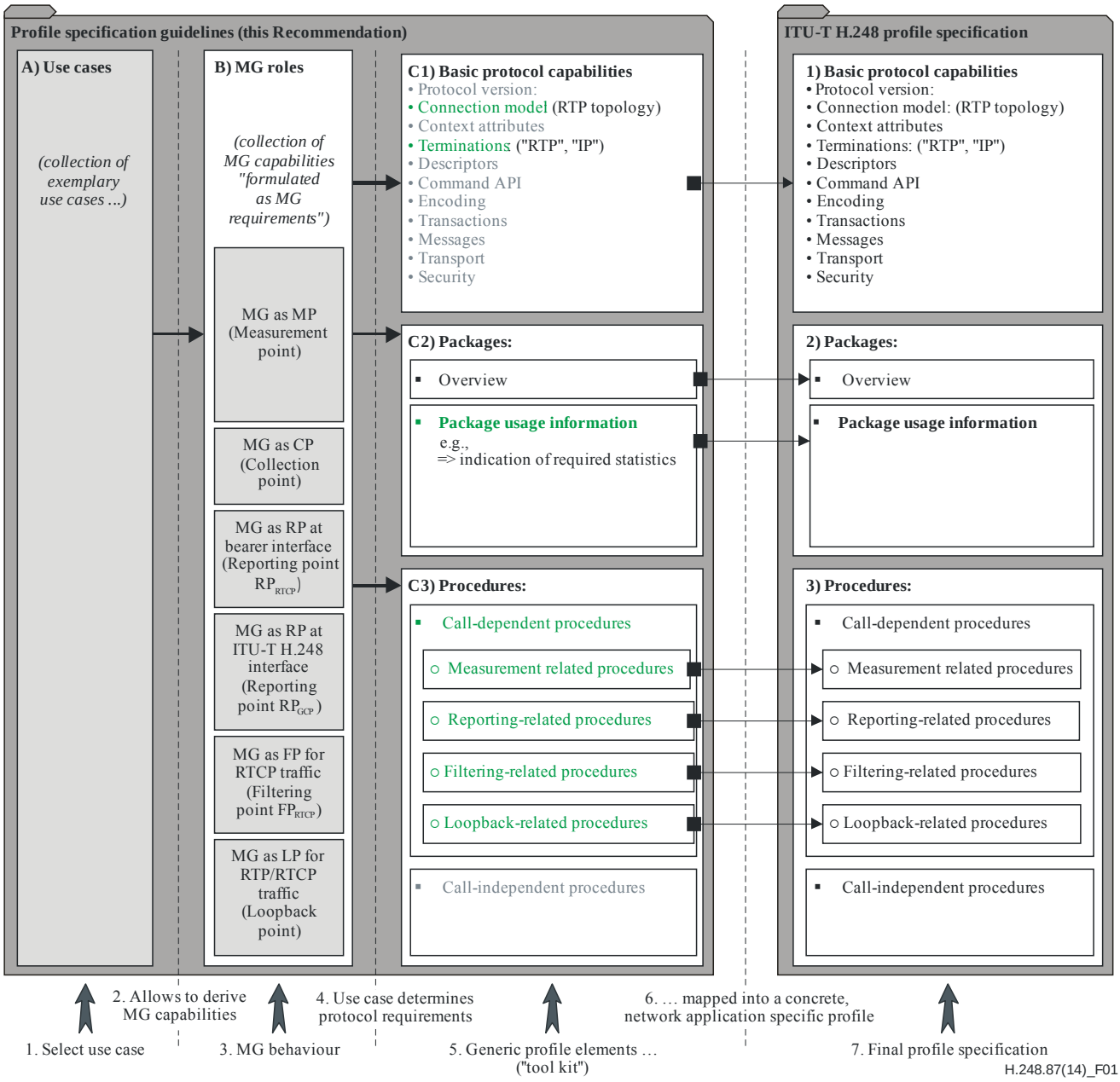


Figure 1 – Scope, structuring principle and framework of this Recommendation

This Recommendation is organized as follows:

– example use cases are collected in Appendix I;

– principal MG behaviour is defined in clause 8 by considering the set of requirements behind such MG roles (and the used prescriptive language for requirements is outlined in clause 5);

– a technology overview of existing ITU-T H.248 packages is in the scope of clause 6; and

– finally, guidelines for the three profile areas are the subject of clause 9 (which follows the profile structuring of the profile template according to [ITU-T H.248.1]).

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 (2013), *Gateway control protocol: Version 3*.

[ITU-T H.248.2] Recommendation ITU-T H.248.2 (2013), *Gateway control protocol: Facsimile, text conversation and call discrimination packages.*

[ITU-T H.248.8] Recommendation ITU-T H.248.8 (2013), *Gateway control protocol: Error code and service change reason description.*

[ITU-T H.248.30] Recommendation ITU-T H.248.30 (2007), *Gateway control protocol: RTCP extended performance metrics packages.*

[ITU-T H.248.47] Recommendation ITU-T H.248.47 (2008), *Gateway control protocol: Statistic conditional reporting package.*

[ITU-T H.248.48] Recommendation ITU-T H.248.48 (2012), *Gateway control protocol: RTCP XR block reporting 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.248.61] Recommendation ITU-T H.248.61 (2013), *Gateway control protocol: Packages for network level ITU-T H.248 statistics.*

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

[ITU-T H.248.76] Recommendation ITU-T H.248.76 (2010), *Gateway control protocol: Filter group package and guidelines.*

[ITU-T H.248.79] Recommendation ITU-T H.248.79 (2012), *Gateway control protocol: Guidelines for packet-based streams.*

[ITU-T H.248.85] Recommendation ITU-T H.248.85 (2013), *Gateway control protocol: Usage of loopback in ITU-T H.248.*

[ITU-T M.60] Recommendation ITU-T M.60 (1993), *Maintenance terminology and definitions.*

[ITU-T M.3010] Recommendation ITU-T M.3010 (2000), *Principles for a telecommunications management network.*

[ITU-T T.38] Recommendation ITU-T T.38 (2010), *Procedures for real-time Group 3 facsimile communication over IP networks.*

[IETF RFC 3550] IETF RFC 3550 (2003), *RTP: A Transport Protocol for Real-Time Applications.*
<http://www.ietf.org/rfc/rfc3550.txt>

[IETF RFC 3611] IETF RFC 3611 (2003), *RTP Control Protocol Extended Reports (RTCP XR).*
<https://tools.ietf.org/html/rfc3611>

[IETF RFC 6776] IETF RFC 6776 (2012), *Measurement Identity and Information Reporting Using a Source Description (SDES) Item and an RTCP Extended Report (XR) Block*.
<http://tools.ietf.org/html/rfc6776>

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 measurement point (MP) [ITU-T H.248.71]: 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.

3.1.2 reporting point (RP) [ITU-T H.248.71]: 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.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 application level metrics: A protocol stack-based classification of a performance metric. Such a performance metric uses protocol information elements from the application layer and possibly from lower layer protocols (Note 1). Some application level metrics are furthermore coupled to the termination of the application protocol (Note 2) and/or the location of user equipment (Note 3).

NOTE 1 – Example: an ITU-T H.248 IP-IP MG would typically be configured for a "media-aware" mode in order to have sufficient information about the carried application traffic with regards to the application level performance metric.

NOTE 2 – The termination of the application protocol correlates typically with RTP topology "RTP end system".

NOTE 3 – Example: the category of "QoE" based performance metrics as application level metrics.

3.2.2 collection point (CP) (adapted from clause 7.6.2 of [ITU-T H.248.71]): A CP is the physical or logical point which records/collects remote measurement data, as received via a user plane reporting interface (here via RTCP report packets).

3.2.3 filtering point (FP) (adapted from filter definition of [ITU-T H.248.76]): The location of a policy rule enforcement point for filtering information. Such specific policy rules are often simply termed "filter rules". In the context of this Recommendation, the filter rule conditions are primarily related to protocol control information elements related to RTP and RTCP header fields (e.g., payload/packet type, block type), but may also be based on carried measurement data; and the filter rule actions generally cover forwarding, blocking, counting or modification of data units at the levels of RTP/RTCP packets, and reports down to individual measurement data.

NOTE – The specification and syntax of such policy rules are outside the scope of this Recommendation.

3.2.4 loopback point (LP) (adapted from [ITU-T H.248.85]): The location of a loopback function. In the context of this Recommendation, a loopback function comprises a copy and forward operation at the level of protocol data information, with primary scope on IETF media loopback (according to clause 3.2.3 of [ITU-T H.248.85]).

NOTE – A loopback function is different in comparison to a redirect function, which does not copy any protocol data. The loopback function is called a loopback mirror in [b-IETF RFC 6849]. The ITU-T H.248 media loopback (see clause 3.2.2 of [ITU-T H.248.85]) does relate to a redirect function only in contrast to the IETF media loopback. Such a redirect function might be considered when used in performance monitoring solutions.

3.2.5 subject to profile specification: When used this term indicates that the ITU-T H.248 profile template section requires further specification via a profile specification.

3.2.6 transport level metrics: a protocol stack-based classification of a performance metric. Such a performance metric could be realized solely on protocol information elements from the transport layer and lower layer protocols.

NOTE – Example: an ITU-T H.248 IP-IP MG in media-agnostic, transport-aware mode could still support measurements for transport level metrics.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

2G-PLMN	Second-Generation Public Land Mobile Network
AMG	Access Media Gateway
APSI	(RTCP) Application-Specific Identifier (SDES item)
B2BRE	Back-to-Back RTP End system
BGW	Border Gateway
BT	Block Type (RTCP XR)
CP	Collection Point
DLSR	(RTP) Delay since Last SR
DS0	Digital Signal level 0
FP	Filtering Point
GoS	Grade of Service
GW	Gateway
IP	Internet Protocol
IPDV	IP packet Delay Variation
ISDN	Integrated Services Digital Network
LP	Loopback Point
LSR	(RTP) Last SR timestamp
Lx	Layer number
MG	Media Gateway
MGC	Media Gateway Controller
MOS	Mean Opinion Score
MP	Measurement Point
NE	Near-End
NGN	Next Generation Network
OP	Originating Point (source of RTP/RTCP traffic)

PCI Protocol Control Information
PSTN Public Switched Telephone Network
PT (RTP) Packet Type/Payload Type
QoE Quality of Experience
QoS Quality of Service
RMG Residential Media Gateway
RP Reporting Point
RR Receiver Report (RTCP)
RTCP RTP Control Protocol
RTP Real-time Transport Protocol
RTPE RTP End system
RTPMT RTP Media Translator
RTPTT RTP Transport Translator
SDES (RTCP) Source Description
SDP Session Description Protocol
SDU Service Data Unit
SIP Session Initiation Protocol
SR Sender Report (RTCP)
TDM Time Division Multiplexed
TGW Trunking Gateway
TS (RTP) Timestamp
UDP User Datagram Protocol
UE User Equipment
VoIP Voice over IP
XNQ (ITU-T H.248) Extended Network Quality (package)
XR Extended Report (RTCP)

4.1 Indices

…In	Incoming (traffic direction)
…H.248	ITU-T H.248 (control plane interface)
…L	Local
…Out	Outgoing (traffic direction)
…R	Remote
…RTCP	RTCP (user plane interface)
…SIP	SIP (control plane interface)

5 Conventions

5.1 Prescriptive language for requirements specification

This Recommendation provides a list of items (in clause 8), labelled as **R-x/y**, where *x* refers to the clause number and *y* a number within that clause. Such items use the following keywords with meanings as prescribed below:

– The keywords "is required to" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this document is to be claimed.

– The keywords "is prohibited from" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this document is to be claimed.

– The keywords "is recommended" indicate a requirement which is recommended but which is not absolutely required. Thus this requirement need not be present to claim conformance.

– The keywords "can optionally" indicate an optional requirement which is permissible, without implying any sense of being recommended. This term is not intended to imply that the vendor's implementation must provide the option and the feature can be optionally enabled by the network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with the specification.

6 Relation to other ITU-T H.248.x-series Recommendations

The purpose of this clause is to identify possible relations (or not) to other Recommendations and past work on ITU-T H.248 profiles. Overview and background information is provided in Appendix IV. Below is the description of the two in force ITU-T H.248 Recommendations that support RTCP extension reports, and of an expired work item for additional background information.

6.1 [ITU-T H.248.30]: RTCP extended performance metrics packages

This Recommendation is tightly coupled to [IETF RFC 3611]. The RTCP performance metrics are directly mapped on ITU-T H.248 statistics. Near- and far-end measurements are supported.

6.2 [ITU-T H.248.48]: RTCP XR block reporting package

This Recommendation addresses the issues regarding [ITU-T H.248.30] and the work on the extended network quality package [b-ITU-T H.248.xnq]. The use of [ITU-T H.248.48] represents a comprehensive measurement concept and makes superfluous both ITU-T H.248.30 and the ITU-T H.248.xnq work.

6.3 Expired proposal ITU-T H.248.xnq: Gateway control protocol: Extended network quality metrics packages for next generation networks (NGNs).

This expired work (see Appendix II) was developed in order to address the limitations of the measurement framework defined in [ITU-T H.248.30], as well as the IETF work on additional RTCP performance metrics. The work on the ITU-T H.248 packages was completed, but the draft was discontinued in favour of a design change for a solution that was future proof and decoupled from the IETF standardization development.

7 Classification of performance metrics

Performance metrics for RTP traffic could be structured in several categories. The following classification characteristics are useful for this Recommendation:

– protocol stack based (metrics based on protocol information elements);

– traffic direction based (metrics based on the bidirectional information of an RTP session or on the unidirectional information only); and

– network route based (metrics based on network topology and RTP/RTCP traffic routes such as metrics related to round trips, one-ways, loopbacks, etc.).

The various categories are relevant concerning possible MG behaviour (see clause 8). Figure 2 illustrates the protocol stack-based classification scheme.

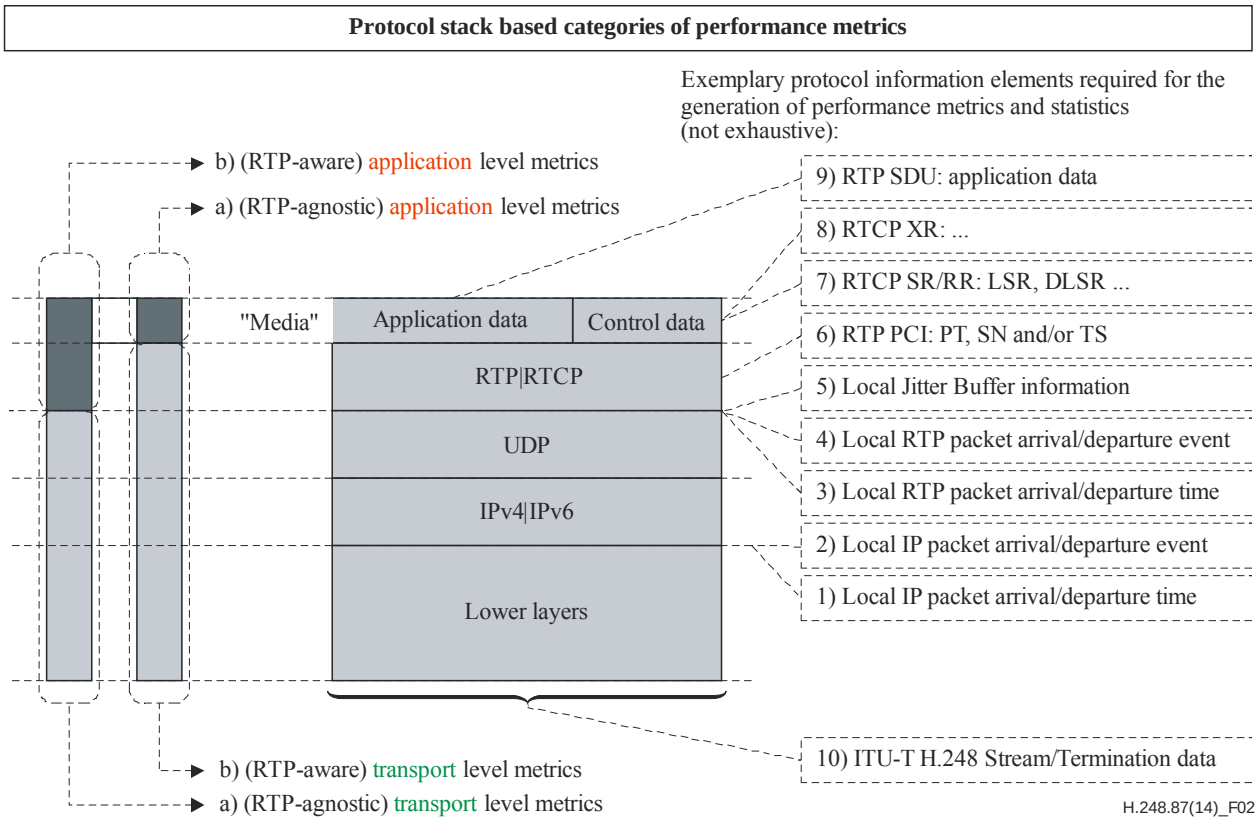


Figure 2 – Protocol stack based categories of performance metrics

Appendix III provides some examples for each category. For instance, the ITU-T H.248 statistics of the RTP application data package [ITU-T H.248.58] belong to the category of RTP-agnostic application level metrics because their calculation does not require any information from the RTP header, but their scope is for application data as carried in the payload of an RTP packet.

8 Roles provided by MG

The overall network service of performance monitoring may be structured in a set of capabilities, which could be individually or assigned in combinations to an ITU-T H.248 MG. The various roles of an MG may be illustrated by a gateway model concerning the processing of incoming RTP and RTCP packets (see Figure 3). The purpose of this clause is the characterization of such roles and the specification of associated requirements.

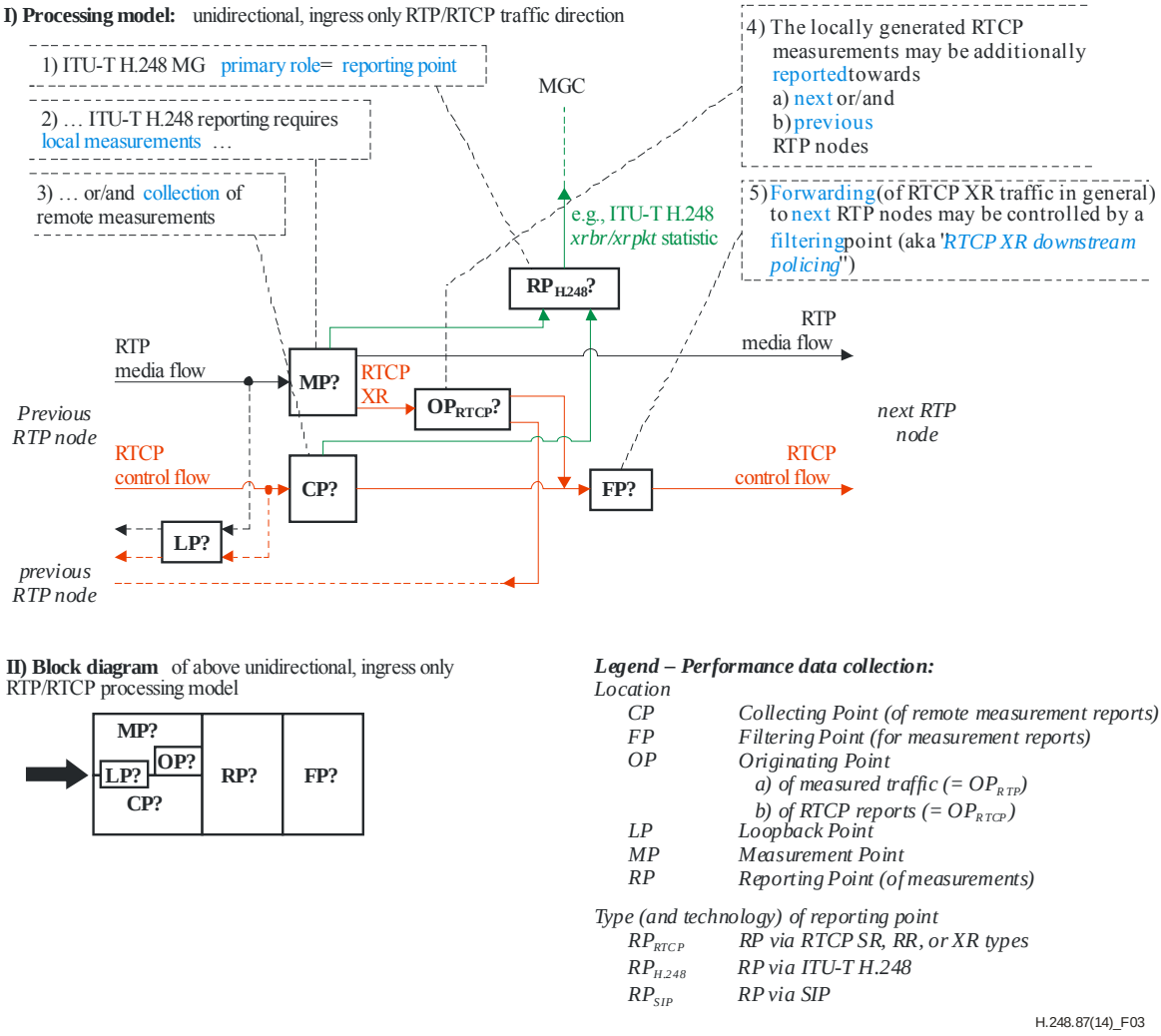


Figure 3 – RTCP-based performance measurements – ITU-T H.248 IP-to-IP border gateway/router – Unidirectional, ingress only RTP/RTCP processing model

The following separate functions are identified for an MG with an (IP, IP) connection model (see Figure 3):

– Generation of local measurements (MP_L);

– Reporting of local measurements ($RP_{L,H.248}$) via ITU-T H.248 towards MGC;

– Reporting of local measurements ($RP_{L,RTCP}$) via RTCP towards remote terminals, remote ITU-T H.248 MGs, remote RTP end systems, or other RTP entities;

– Collection of remote measurements ($CP_{R,H.248}$);

– Reporting of remote measurements ($RP_{R,H.248}$) towards MGC;

– Loopback of incoming RTP/RTCP traffic (LP_{RTP}) back to a remote RTP end system. The remote RTP end system may then provide a local measurement point of a remote sink, i.e., loopback allows to relocate MPs;

– Filtering of remote measurements (FP_{Out}) in an outgoing direction, from provider A towards B (which are transported via RTCP reports); and

– Filtering of remote measurements (FP_{In}) in ingress direction, from provider B (which are transported via RTCP reports).

8.1 ITU-T H.248 MG as general measurement point (MP)

MG capability related requirements:

R-8.1/1: The MG is required to support local performance measurements.

Technology-dependent requirements related to metric types which are particularly defined for RTP traffic:

NOTE 1 – Subsequent requirements consider grouped performance metrics at the top-level of ITU-T H.248 packages or IETF RFC documents.

R-8.1/2: The MG is required to execute measurements for the performance metrics as defined by the RTP package [ITU-T H.248.1].

R-8.1/3: The MG is required to execute measurements for the performance metrics as defined by the *RTP application data* package [ITU-T H.248.58].

R-8.1/4: The MG is required to execute measurements for the performance metrics as defined by the received *RTCP* package [ITU-T H.248.71].

R-8.1/5: The MG is required to execute measurements for the performance metrics as defined by RTCP XR block types 1 to 7 [IETF RFC 3611].

NOTE 2 – There are two reporting options via ITU-T H.248 ($RP_{H.248}$): [ITU-T H.248.30] or [ITU-T H.248.48], see clause 8.5.

R-8.1/6: The MG is required to execute measurements for the performance metrics as defined by RTCP XR block type 8 [b-IETF RFC 5093].

R-8.1/7: The MG is required to execute measurements for the performance metrics as defined by other RTCP XR block types.

8.2 ITU-T H.248 MG as location-dependent measurement point (MP)

There are two location specific aspects:

– a performance metric itself could be associated to the source, destination or interim node of an end-to-end RTP session (such as RTP packet rate at RTP sender side, or audio signal level at RTP receiver side or RTP packet delay variation observed at an interim RTP mixer); and

– the particular location of an ITU-T H.248 MG within the (RTP) IP network topology.

8.2.1 Location-independent requirements

The following principal requirements are derived:

R-8.2.1/1: The MG is required to support at least transport level measurements.

NOTE – This is the very minimum requirement, applicable for almost all MG scenarios (related to RTP topologies, related to metric types according to clause 3.2.6).

R-8.2.1/2: The MG is required to support transport level metrics, independent of the supported ITU-T H.248 connection model ("all IP" or "IP-to-non-IP") and independent of RTP topologies.

8.2.2 Location and metric type specific restrictions

Some performance metrics are only applicable for particular locations in a network topology. Especially application level metrics are tied to the source/sink of application level traffic, and the location of the final consumer of the service (e.g., the type of metrics related to quality of experience).

R-8.2.2/1: The MG is prohibited from supporting application level metrics in network locations where the support of the measurement is nonsensical due to possible violation of the metrics semantic.

NOTE – This requirement is consistent with [b-IETF RFC 6792], see clause 3.2 of [b-IETF RFC 6792], Location of Monitors.

R-8.2.2/2: The MG is required to notify the MGC of such a violation, if enforced by the MGC for such kind of measurements, by e.g., an error code.

8.3 ITU-T H.248 MG as collection point (CP)

The collection function is based on incoming RTCP data.

R-8.3/1: The MG is required to collect remote measurement data via incoming RTCP reports.

R-8.3/2: The MG is required to identify remote RTP nodes (via the ITU-T H.248 RTCP source description package according to [ITU-T H.248.71]) in the bearer path.

8.4 ITU-T H.248 MG as reporting point at IP bearer interface (RP_{RTCP})

This interface is used for the exchange of measurement data and information for the production of measurements via RTCP reports.

8.4.1 Measurement data

R-8.4.1/1: The MG is required to send RTCP basic reports (SR and/or RR).

R-8.4.1/2: The MG is required to receive RTCP basic reports (SR and/or RR).

R-8.4.1/3: The MG is recommended to send RTCP extension reports (XR; see Note).

R-8.4.1/4: The MG is recommended to receive RTCP extension reports (XR; see Note).

NOTE – This requirement could be further detailed to the block type (BT) level or below the BT level down to individual metrics.

8.4.2 Measurement configuration

R-8.4.2/1: The MG is recommended to send the measurement identity related SDES item (such as the application-specific identifier (APSI) according to clause 3.1 of [IETF RFC 6776]).

R-8.4.2/2: The MG is recommended to receive the measurement identity related SDES item (such as the application-specific identifier (APSI) according to clause 3.1 of [IETF RFC 6776]).

R-8.4.2/3: The MG is recommended to send measurement information according to XR block type 14 (clause 4 of [IETF RFC 6776]).

R-8.4.2/4: The MG is recommended to send measurement information according to XR block type 14 (clause 4 of [IETF RFC 6776]).

8.5 ITU-T H.248 MG as reporting point at an ITU-T H.248 interface ($RP_{H.248}$)

8.5.1 Reporting content

This reporting capability is tightly coupled to the ITU-T H.248 signalling capability according to individual ITU-T H.248 packages:

R-8.5.1/1: The MG is required to support ITU-T H.248 statistics according to the RTP package [ITU-T H.248.1].

R-8.5.1/2: The MG is required to support ITU-T H.248 statistics according to the RTCP extended performance metrics package [ITU-T H.248.30].

R-8.5.1/3: The MG is required to support ITU-T H.248 statistics according to the RTCP XR block reporting package [ITU-T H.248.48].

R-8.5.1/4: The MG is required to support ITU-T H.248 statistics according to the RTP application data package [ITU-T H.248.58].

R-8.5.1/5: The MG is required to support ITU-T H.248 statistics according to the received RTCP package [ITU-T H.248.71].

8.5.2 Reporting control

The principal ITU-T H.248 control capabilities for statistics reporting are summarized in Appendix IV of [ITU-T H.248.1]. The following three major practices may be considered from the ITU-T H.248 command perspective:

R-8.5.2/1: The MG is required to support ITU-T H.248 statistics reporting at the end of communication phases only (i.e., related to SUBTRACT command).

R-8.5.2/2: The MG is required to support ITU-T H.248 statistics reporting during active communication phases on request by the MGC (i.e., related to AUDITVALUE command).

R-8.5.2/3: The MG is required to support ITU-T H.248 statistics reporting during active communication phases dependent on configured reporting conditions (i.e., related to [ITU-T H.248.47] and NOTIFY command).

8.6 ITU-T H.248 MG as filtering point (FP) (for RTCP traffic)

Example scenarios with filtering support are illustrated in Appendix I; see use cases 2, 3, 4, 6 and 7. The specific filter capabilities are basically given by the particular filter rule conditions and filter rule actions (see clause 3.2.3). The level of conditions and actions is useful for the derivation of filter requirements.

Identification requirements, hierarchically ordered:

R-8.6/1: The MG is required to support filter rule conditions related to the identification of RTP/RTCP traffic as such (e.g., related to the usual 5-tuple for an RTCP control flow (under the condition of separate IP transport connections for RTP and RTCP)).

R-8.6/2: The MG is required to support filter rule conditions related to the identification of RTCP packets based on the RTCP packet type (PT) codepoint.

R-8.6/3: The MG is required to support filter rule conditions related to the identification of RTCP report block structures based on the RTCP block type (BT) codepoint.

R-8.6/4: The MG is required to support filter rule conditions related to the identification of an individual metric within an RTCP report block, based on the report block structure.

Action execution requirements for various action types:

a) Forwarding

R-8.6/5: The MG is required to support unmodified forwarding of information entities according to requirements R-8.6/1-4, as the default action.

b) Blocking

R-8.6/6: The MG is required to support blocking of the entire RTCP traffic.

NOTE 1 – This action may be the subject of abnormal traffic handling, but may violate end-to-end RTCP protocol applications.

R-8.6/7: The MG is required to support blocking of specific RTCP packet types.

NOTE 2 – This action may relate to the discard of an entire RTCP packet or the removal of an individual RTCP packet unit in case of a compound RTCP packet.

R-8.6/8: The MG is required to support blocking of specific RTCP block types.

NOTE 3 – The identified RTCP block would be entirely removed from an RTCP XR packet.

c) Modification

R-8.6/9: The MG is required to support the modification of an individual measurement value, i.e., the carried value of a specific metric type in an RTCP packet. Any concrete modification operation (such as a default value setting, value resetting, setting of a specific value) is outside of the scope of this Recommendation.

NOTE 4 – Such an action is typically requested by a network operator, which does not want to disclose its own measurement results to peering partners.

All the above actions should be executed in a correct protocol manner, i.e., any modified RTP/L4/IP packet should be syntactically correct, which may imply the adaptation of length, padding and/or recalculation of checksum information.

8.7 ITU-T H.248 MG as loopback point (LP) (for RTP/RTCP traffic)

There are multiple loopback options:

R-8.7/1: The MG is required to support an LP in native ITU-T H.248 mode, i.e., due to a StreamMode property value LoopBack setting.

R-8.7/2: The MG is required to support an LP according to [b-IETF RFC 6849] in encapsulated packet loopback mode.

R-8.7/3: The MG is required to support an LP according to [b-IETF RFC 6849] in direct loopback mode.

R-8.7/4: The MG is required to support an LP according to [b-IETF RFC 6849] in media loopback mode.

8.8 Support of specific RTP topologies

The relation between RTCP services and RTP topologies in ITU-T H.248 entities is described in [b-ITU-T H.248.88]. Performance monitoring based of RTCP XR belongs to supplementary RTCP services, which are basically an overlay function and hence are independent of RTP topologies. On the other hand, performance monitoring using RTCP basic reports (such as SR, RR) would depend on RTP topologies.

R-8.8/1: The MG is recommended to support the RTP topology, RTP end system (e.g., in use case 1 (see clause I.2)).

R-8.8/2: The MG is recommended to support the RTP topology, Back-to-back RTP end system (e.g., in use case 6 (see clause I.7) with implicit filtering of RTCP measurement reports).

R-8.8/3: The MG is recommended to support the RTP topology, RTP transport translator (e.g., in use case 2 (see clause I.3) with support of RTP-aware transport level metrics according RTCP basic reports).

R-8.8/4: The MG is recommended to support the RTP topology, RTP media translator (e.g., in case of audio transcoding within an end-to-end RTP session).

9 ITU-T H.248 profile specification guidelines

This clause provides guidelines for ITU-T H.248 profile specifications. The structure follows the profile template according to Appendix III of [ITU-T H.248.1].

The template elements, which are not applicable in this Recommendation, are indicated by: subject to profile specification.

Any profile guidelines are primarily dependent on the concerned network configuration and use case (see examples in Appendix I). The guidelines in this clause are therefore basically conditional. Two exemplary use cases are considered (as described in Appendix V), termed as capability set CS_A and CS_B. Capability set 'A' (CS_A) is a trunking gateway performance monitoring scenario according to use case 1 (clause I.2); and Capability set 'B' (CS_B) is a border gateway performance monitoring scenario according use case 6 (clause I.7).

9.1 Profile identification

Subject to profile specification.

9.2 Summary

Subject to profile specification.

Examples:

IF CS_A THEN no specific ITU-T H.248.1 version required.

IF CS_B THEN ITU-T H.248.1 V3 required due to support of stream-level statistics.

9.3 Gateway control protocol version

Subject to profile specification.

9.4 Connection model

Maximum number of contexts	Subject to profile specification.
Maximum number of terminations per context	Subject to profile specification. Examples: IF CS_A THEN "2" (TGW). IF CS_B THEN "2" (BGW).
Allowed termination type combinations in a context	Context (one or more IP terminations). Examples: IF CS_A THEN "(IP, phy) connection model". IF CS_B THEN "(IP, IP) connection model".

NOTE – The scope of this Recommendation is only applicable to ITU-T H.248 gateways in IP networks.

9.5 Context attributes

Subject to profile specification.

9.6 Terminations

Subject to profile specification.

Examples:

IF CS_A THEN RTP termination (for the ephemeral termination).

IF CS_B THEN IP terminations.

9.7 Descriptors

9.7.1 TerminationState Descriptor

Subject to profile specification.

9.7.2 Stream Descriptor

Subject to profile specification.

NOTE – ITU-T H.248-based performance monitoring functions at RTP stream/terminations does not have implications on this descriptor.

Examples:

IF CS_A THEN single, RTP-based stream only.

IF CS_B THEN one or multiple streams.

9.7.3 Events Descriptor

Subject to profile specification.

NOTE – ITU-T H.248-based performance monitoring functions at RTP stream/terminations does normally not have implications on this descriptor (example exceptions are the conditional reporting capability according to [ITU-T H.248.47] and the detection capability of specific RTCP messages according to [ITU-T H.248.71]).

9.7.4 EventBuffer Descriptor

Subject to profile specification.

NOTE – ITU-T H.248-based performance monitoring functions at RTP stream/terminations does not have implications on this descriptor.

9.7.5 Signals Descriptor

Subject to profile specification.

NOTE – ITU-T H.248-based performance monitoring functions at RTP stream/terminations does not have implications on this descriptor.

9.7.6 DigitMap Descriptor

Subject to profile specification.

9.7.7 Statistics Descriptor

NOTE – ITU-T H.248-based performance monitoring functions at RTP stream/terminations may demand for support of statistics in case of an $RP_{H.248}$ requirement.

Examples:

Are statistics supported on terminations, streams or both?

Statistics supported on	Examples: IF CS_A THEN termination-level statistics only. IF CS_B THEN both.

Are statistics to be reported?

Statistics reported on subtract	IF CS_A OR CS_B THEN "YES".	
If yes	**StatisticIDs reported**	IF CS_A OR CS_B THEN ALL (according package usage details by clause 9.14.3).

9.7.8 ObservedEvents Descriptor

Subject to profile specification.

NOTE – ITU-T H.248-based performance monitoring functions at RTP stream/terminations does not have implications on this descriptor.

9.7.9 Topology Descriptor

Subject to profile specification.

NOTE – ITU-T H.248-based performance monitoring functions at RTP stream/terminations does not have implications on this descriptor.

9.7.10 Error Descriptor

Which ITU-T H.248.8 and package defined error codes are supported?

Error codes sent by the MGC:

Supported ITU-T H.248.8 error codes	Subject to profile specification.
Supported error codes defined in packages	Subject to profile specification.

Error codes sent by the MG:

Supported ITU-T H.248.8 error codes	Subject to profile specification.
Supported error codes defined in packages	Subject to profile specification. Examples: IF CS_A OR CS_B THEN (additional) support of error codes 485, 486 and 487 (see clause 6.5 of [ITU-T H.248.48]).

9.8 Command API

NOTE – It is assumed that an Error Descriptor may be returned in any command reply.

9.8.1 Add

Subject to profile specification.

NOTE – ITU-T H.248-based performance monitoring functions: usage of this ITU-T H.248 command in principal operations on statistics is illustrated in Appendix IV of [ITU-T H.248.1].

9.8.2 Modify

Subject to profile specification.

NOTE – ITU-T H.248-based performance monitoring functions: usage of this ITU-T H.248 command in principal operations on statistics is illustrated in Appendix IV of [ITU-T H.248.1].

9.8.3 Subtract

Subject to profile specification.

NOTE – ITU-T H.248-based performance monitoring functions: usage of this ITU-T H.248 command in principal operations on statistics is illustrated in Appendix IV of [ITU-T H.248.1].

9.8.4 Move

Subject to profile specification.

9.8.5 AuditValue

Subject to profile specification.

NOTE – ITU-T H.248-based performance monitoring functions: usage of this ITU-T H.248 command in principal operations on statistics is illustrated in Appendix IV of [ITU-T H.248.1].

9.8.6 AuditCapabilities

Subject to profile specification.

9.8.7 Notify

Subject to profile specification.

NOTE – ITU-T H.248-based performance monitoring functions: usage of this ITU-T H.248 command in principal operations on statistics is illustrated in Appendix IV of [ITU-T H.248.1].

9.8.8 ServiceChange

Subject to profile specification.

9.8.9 Manipulating and auditing context attributes

Subject to profile specification.

9.9 Generic command syntax and encoding

Subject to profile specification.

NOTE – There is no impact on encoding.

9.10 Transactions

Subject to profile specification.

NOTE – There is no impact on transactions.

9.11 Messages

Subject to profile specification.

NOTE – There is no impact on the number of transactions per message.

9.12 Transport

Subject to profile specification.

NOTE – No requirement on any particular ITU-T H.248 transport modes. However, given the nature of these services, profile specifications could consider the use of a transport that provides large message size handling (i.e., dependent on the amount of ITU-T H.248 statistics).

9.13 Security

Subject to profile specification.

NOTE – There is no impact on ITU-T H.248 transport security. However, encryption of ITU-T H.248 messages may be considered due to the sensitivity of measurement data.

9.14 Packages

Although this Recommendation does not mandate any ITU-T H.248 package for profile specifications, there may be some useful packages for supporting ITU-T H.248-based performance monitoring of RTP networks. The following is a non-exhaustive list of available ITU-T H.248 capabilities:

– ITU-T H.248 controlled MPs (inclusive RP capability):
  - Annex E.12.4 of [ITU-T H.248.1] for some basic RTP performance metrics according to [IETF RFC 3550];
  - [ITU-T H.248.30] for support of [IETF RFC 3611] in specific use cases (see clauses 6.1 and IV.2);
  - [ITU-T H.248.48] as generic tool for all kinds of RTCP XR defined performance metrics;
  - [ITU-T H.248.58] for support of RTP application data related metrics (see also clause III.3.1);

- ○ [ITU-T H.248.61] for support of RTP-agnostic transport level metrics (see also clause III.2.1);

– ITU-T H.248 specific remote MPs (inclusive RP capability):
  - ○ [ITU-T H.248.71], clause 7 for collection and reporting for remote measurements of some basic RTP performance metrics according [IETF RFC 3550];

– ITU-T H.248 advanced RP:
  - ○ [ITU-T H.248.47] as generic tool for reporting control;

– ITU-T H.248 controlled LP:
  - ○ [ITU-T H.248.85]

NOTE – The above Recommendations contain many different properties, signals and events; however, as they are optional to simplify the definition of this profile specification guideline, these impacts are not listed.

9.14.1 Mandatory packages

Mandatory: specifies the packages that shall be supported in this profile.

Mandatory packages			
Package name	**PackageID**	**Version**	**Termination types supported**
<name>	<xxxx (0x00xx)>	<1, 2, 3, …>	<Describe>
Examples: IF CS_A THEN RTP application data package [ITU-T H.248.58] RTCP XR block reporting package [ITU-T H.248.48]	 rtpad (0x00cb) xrbr (0x00af)	 v1 v1	 RTP RTP
Examples: IF CS_B THEN RTP package [ITU-T H.248.1] Statistic conditional reporting package. [ITU-T H.248.47] RTCP XR block reporting package [ITU-T H.248.48] Received RTCP package [ITU-T H.248.71]	 rtp (0x000c) scr (0x00ae) xrbr (0x00af) recrtcp (0x00f5)	 v2 v2 v1 v1	 IP IP IP IP

9.14.2 Optional packages

Subject to profile specification.

9.14.3 Package usage information

The following is a non-exhaustive list of package usage indications.

9.14.3.1 RTP Package

(If [ITU-T H.248.1], Annex E.12 approach)

Examples:

IF CS_B THEN "usage details for the five statistics":

…				
Statistics	**Mandatory/ Optional**	**Used in command**	**Supported values**	**Termination/Stream types supported**
ps (0x0004)	M	ADD, MOD, SUBTRACT, NOTIFY	ALL	IP
pr (0x0005)	M		ALL	IP
pl (0x0006)	M		ALL	IP
jit (0x0007)	Not required (Note)		–	–
delay (0x0008)	M		ALL	IP
Error codes	…			
NOTE – Assumption: support of RTCP XR *packet delay variation* metrics according to [b-IETF RFC 6798], as part of the xrbr package (see clause 9.14.3.7).				

9.14.3.2 Received RTCP Package

(If [ITU-T H.248.71] approach)

Examples:

IF CS_B THEN usage details for the five statistics:

…				
Statistics	**Mandatory/ Optional**	**Used in command**	**Supported values**	**Termination/Stream types supported**
rps (0x0001)	M (Note)	ADD, MOD, SUBTRACT, NOTIFY	ALL	IP
ros (0x0002)			ALL	IP
rpl (0x0003)			ALL	IP
rcpl (0x0004)			ALL	IP
rjit (0x0005)			ALL	IP
Error codes	…			
NOTE – Assumption: there may be two types of UE in IP network domain X_d (see Figure I.6): a) UE with support of RTCP basic report related performance metrics only, and b) UE with additional support of RTCP extension report defined performance metrics. The statistics of the *recrtcp* package are only used for terminals of type (a).				

9.14.3.3 RTCP XR Base Package

(If [ITU-T H.248.30] approach)

9.14.3.4 RTCP XR Burst Metrics Package

(If [ITU-T H.248.30] approach)

9.14.3.5 Received RTCP XR Package

(If [ITU-T H.248.30] approach)

9.14.3.6 Received RTCP XR Burst Metrics Package

(If [ITU-T H.248.30] approach)

9.14.3.7 RTCP XR Block Reporting Package

(If [ITU-T H.248.48] approach)

Examples:

IF CS_B THEN usage detail for the five statistics:

Properties	**Mandatory/ Optional**	**Used in command**	**Supported values**	**Provisioned value**	**Termination/ Stream types supported**
scpo (0x0001)	M (Note 1)	ADD MOD	ALL	"N"	IP
sfpo (0x0002)	M (Note 2)	ADD MOD	ALL	"N"	IP
srb (0x0003)	M (Note 3)	ADD MOD	ALL	"N"	IP
Signals	**Mandatory/ Optional**	**Used in command**		**Duration provisioned value**	
None	–	–		–	
Events	**Mandatory/ Optional**	**Used in command**			
None	–	–			
Statistics	**Mandatory/ Optional**	**Used in command**	**Supported values**		**Termination/ Stream types supported**
xrpkt (0x0001)	M	a) ADD & MOD (Note 4) b) SUBTRACT NOTIFY c) Not used in: MOVE AUDITVALUE& AUDITCAP	ALL		IP
Error codes	**Mandatory/Optional**				
#485	M				
#486	M				
#487	M				

NOTE 1 – Required for reporting control of remote measurements by UE_A.

NOTE 2 – Required for FP configuration at both terminations.

NOTE 3 – Required for reporting control and configuration of local measurements.

NOTE 4 – Required if all operations on statistics (as described by Appendix IV of [ITU-T H.248.1]) would be supported (e.g., inclusive enable/disable and initialization/reset).

9.14.3.8 RTCP Source Description Package

NOTE – The use of ITU-T H.248.71's **rtcpsdes** package is normally coupled with the performance monitoring mechanism defined in [ITU-T H.248.48].

Examples:

IF CS_B THEN "usage detail according to the following table …":

Properties	**Mandatory/ Optional**	**Used in command**	**Supported values**	**Provisioned value**	**Termination/ Stream types supported**
None	–	–	–	–	–
Signals	**Mandatory/ Optional**	**Used in command**		**Duration provisioned value**	
None	–	–		–	
Events	**Mandatory/ Optional**	**Used in command**			
None	–	–			
Statistics	**Mandatory/ Optional**	**Used in command:**	**Supported values:**		**Termination/ Stream types supported:**
lssrc (0x0001)	O (Note)	Same as clause 9.14.3.7	ALL		IP
rssrc (0x0002)	M	Same as clause 9.14.3.7	ALL		IP
lcname (0x0003)	M	Same as clause 9.14.3.7	ALL		IP
rcname (0x0004)	M	Same as clause 9.14.3.7	ALL		IP
Error codes	**Mandatory/Optional**				
None	–				
NOTE – Local SSRC usage is conditional on the applied RTP topology (see Table V.2).					

9.14.3.9 Further performance monitoring-related packages

Subject to profile specification.

9.15 Mandatory support of SDP and ITU-T H.248.1 Annex C information elements

Subject to profile specification.

Examples:

IF CS_A OR CS_B THEN support of RTCP XR THEN support of XR related SDP:

Supported Annex C and SDP information elements		
Information element	**Annex C support**	**SDP support**
"a=rtcp-xr:"	Not supported (in this example)	Supported values for attribute parameter <xr-format> are dependent on the concrete supported RTCP XR defined performance metrics. (Note 1)
NOTE – Usage of this SDP attribute is defined in clause 6.6 of [ITU-T H.248.48].		

9.16 Optional support of SDP and ITU-T H.248.1 Annex C information elements

Subject to profile specification.

9.17 Procedures

9.17.1 Measurement-related procedures

9.17.1.1 Enabling of MPs

Subject to profile specification.

Examples:

IF CS_A OR CS_B

THEN measurements should always start immediately with creation of the termination or stream end-point

THEN enabling of MPs should conceptually follow the procedures of clauses IV.2.1, IV.2.2 or IV.2.3 in [ITU-T H.248.1].

9.17.1.2 Disabling of MPs

Subject to profile specification.

Examples:

IF CS_A OR CS_B

THEN the deactivation of measurements should be supported

THEN deactivation of MPs should conceptually follow the procedures of clauses IV.3.3 or IV.3.5 in [ITU-T H.248.1].

9.17.2 Reporting-related procedures

9.17.2.1 Reporting point at gateway control interface (ITU-T H.248 statistics)

9.17.2.1.1 Reporting/reading of statistics ($RP_{H.248}$)

Subject to profile specification.

9.17.2.1.2 Resetting of statistics ($RP_{H.248}$)

Subject to profile specification.

NOTE – The conceptual procedure is described in clause IV.4 of [ITU-T H.248.1].

9.17.2.1.3 Configuration of conditional reporting

Subject to profile specification.

9.17.2.2 Reporting point at IP bearer interface (RTCP reports)

Subject to profile specification.

9.17.3 Filtering-related procedures

Subject to profile specification.

9.17.4 Loopback-related procedures

Subject to profile specification.

Appendix I

Example use cases for ITU-T H.248-based performance monitoring in RTP networks

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

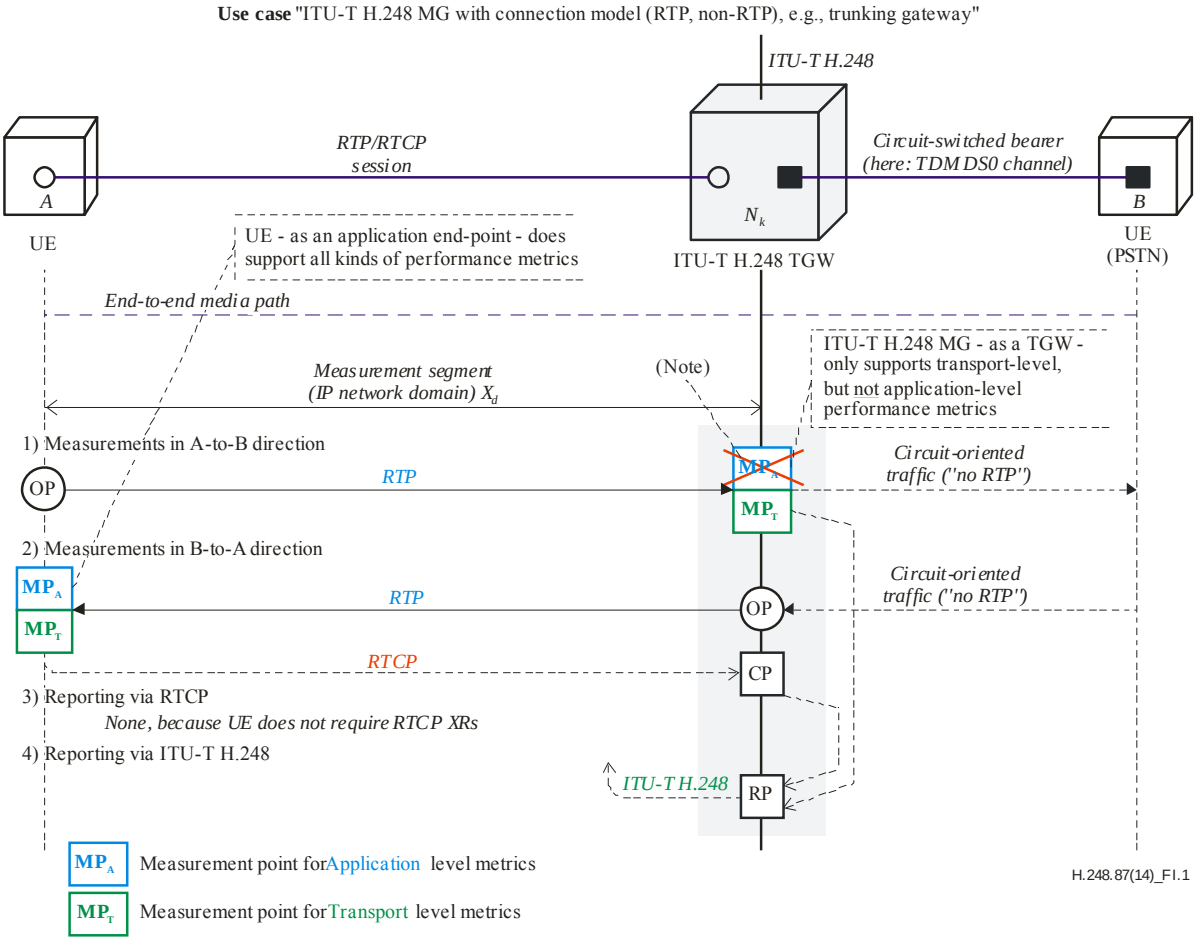
I.1 Overview

This appendix studies a number of example use cases which demonstrate all type of conceivable requirements behaviour and capabilities that may be requested from ITU-T H.248 MGs involved in performance monitoring of RTP traffic. Each use case is illustrated by a diagram and the set of considered capabilities is structured in multiple steps (like measurement reporting and/or filtering points; per traffic direction) in order to point out the specific aspects.

The use cases are ordered according to increasing functionality from the perspective of ITU-T H.248-based performance monitoring in RTP networks.

I.2 Use case 1: ITU-T H.248 MG with connection model (RTP non-RTP) e.g., trunking gateway

Figure I.1 illustrates an end-to-end media/bearer path between user equipment (UE) in a PSTN and VoIP network domain.



NOTE – This measurement limitation is not a capability restriction of the ITU-T H.248 entity, it is rather due to the semantic of the performance metric.

Figure I.1 – Use case 1: ITU-T H.248 MG with connection model (RTP non-RTP)

The interworking of the two different user plane protocol stacks is provided by an ITU-T H.248 physical-to-RTP media gateway (such as a trunking gateway (TGW) in this example). It may be noted that the TGW is located at the edge of the RTP domain hence providing the RTP end system topology (according to [b-IETF RFC 5117]). However the RTP end system is located at the core network level far away from the real user location (the remote PSTN terminal UE B). This observation is important concerning performance measurements with respect to user specific metrics (such as of type QoE).

The measurement segment (i.e., IP network domain X_d) is bounded by UE A and ITU-T H.248 MG N_k. Measurements for RTP traffic are provided by the sink location i.e., there are MPs at the TGW in A-to-B direction (1) and the UE *A* in reverse direction (2).

Observation I.1.a

The set of supported performance metrics are different in the two MPs. The ITU-T H.248 MG is limited to transport level metrics only. The MG should thus provide correspondent feedback (e.g., by an error code) to an MGC which tries to enforce the measurement of application level metrics.

The performance monitoring network is engineered in such a way that the reporting of measurement results towards the control plane is solely under the responsibility of ITU-T H.248 MGs (and not of VoIP terminal equipment). There is consequently an ITU-T H.248-based reporting point ($RP_{H.248}$). UE A therefore has to transfer the measurements of MP_T and MP_A via RTCP (the RP_{RTCP} of UE *A*) back to the ITU-T H.248 MG which collects the data (via CP) and reports them typically at a later point in time (e.g., when the call is terminated) via $RP_{H.248}$ as ITU-T H.248 statistics.

Observation I.1.b

No RP_{RTCP} support is required by the ITU-T H.248 MG because there is no usage of correspondent RTCP data by UE A.

Again it may be further recalled that circuit-oriented UE (like PSTN or ISDN terminals) do not support the generation of measurements for user plane traffic and their reporting (hence there is no MP and RP provided by UE B in Figure I.1).

I.3 Use case 2: IP-IP H.248 MG and remote SIP UE – Single control plane RP by MG

The end-to-end media/bearer path is now continuously RTP based (Figure I.2). The H.248 MG provides the role of a so-called border gateway (BGW) characterized by an ITU-T H.248 (IP-IP) connection model.

Observation I.2.a

There is a single ITU-T H.248 connection model (IP-IP) but a variety of different possible RTP topologies concerning the interconnection of RTP traffic between UE A and B (see [b-ITU-T H.248.88]). The various RTP modes of operations as assigned to the BGW may impact measurements filtering and/or reporting capabilities.

The evaluation of RTP topology dependencies is outside the scope of this example. The ITU-T H.248 MG provides MPs in A-to-B (1) and B-to-A (2.1) direction. The two MPs in B-to-A direction (2.1) and (2.2) are necessary in order to estimate the impact of incoming RTP traffic from domain X_{d+1} on domain X_d.

Observation I.2.b

The number of MPs in a unidirectional traffic path may differ between the two traffic directions from the perspective of a particular network operator and from the perspective of the MG location in the end-to-end RTP path.

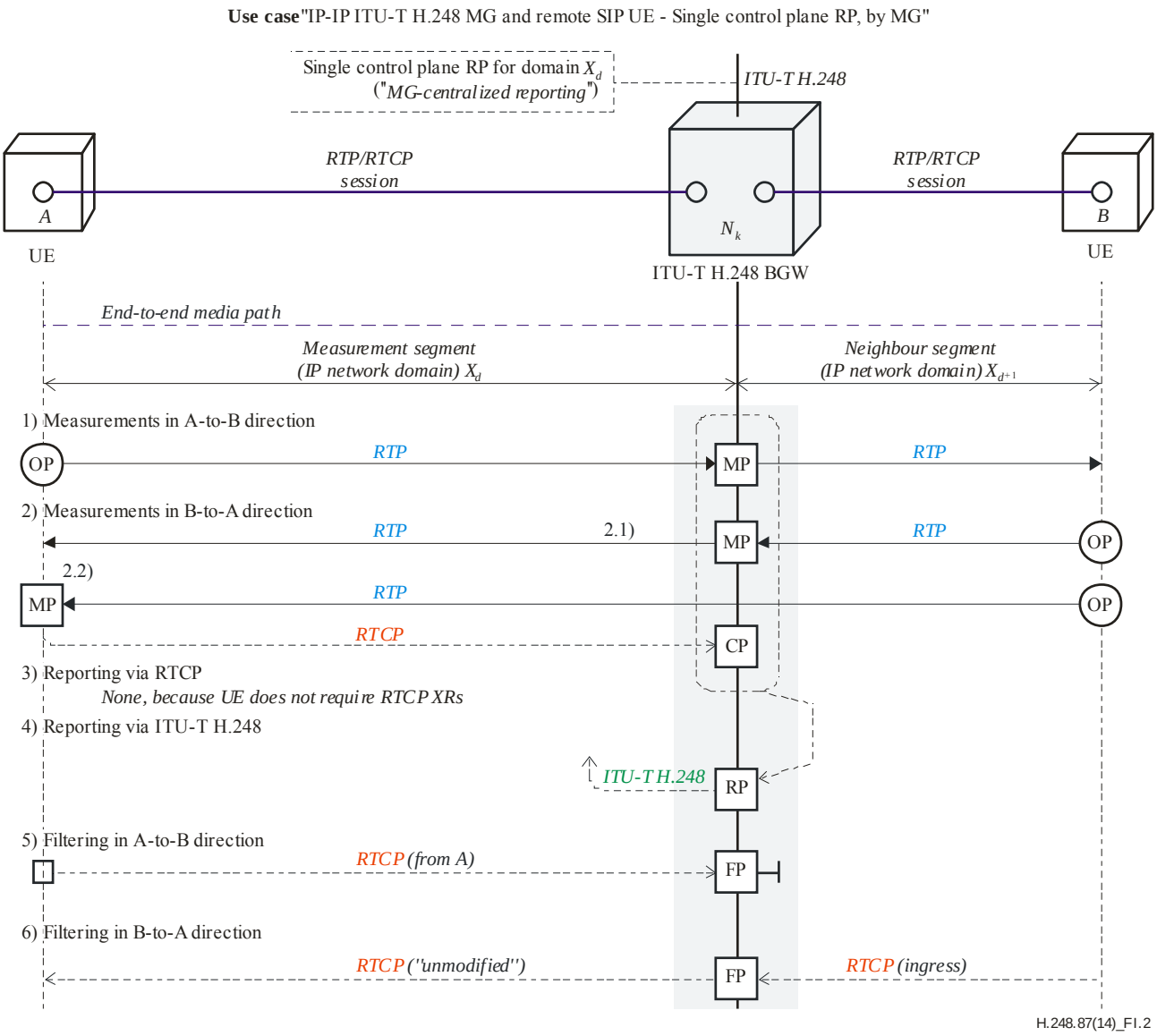


Figure I.2 – Use case 2: IP-IP ITU-T H.248 MG and remote SIP UE – Single control plane RP by MG

The reporting framework – in the user and control plane – is identical to that in use case 1. Additional filtering capabilities:

– Network operator X_d wants to avoid the distribution of RTCP transferred measurement data outside its network. There is thus a FP in A-to-B direction located at the MG (5).

– There may be incoming RTCP reports from peering partner X_{d+1} which could be filtered by the MG (6). Multiple filtering options can be imagined: e.g., transparent forwarding blocking of entire RTCP reports or early selected deletion of unwanted measurement data.

There are many conceivable variations of this use case. For example, FP (6) could be augmented or replaced by a CP and $RP_{H.248}$ to capture all incoming RTCP data already at the border of domain X_d.

I.4 Use case 3: IP-IP ITU-T H.248 MG and remote SIP UE – Single control plane RP by UE

The network configuration in the example of Figure I.3 is identical to the previous use case 2, however the control plane reporting points are removed from the ITU-T H.248 MGs towards the

SIP-based UE. This is a feasible network option when there are other control plane protocols with adequate reporting capabilities.

NOTE – SIP is such an example which provides at least initial support, but which does not provide as complete and powerful capabilities in comparison to ITU-T H.248.

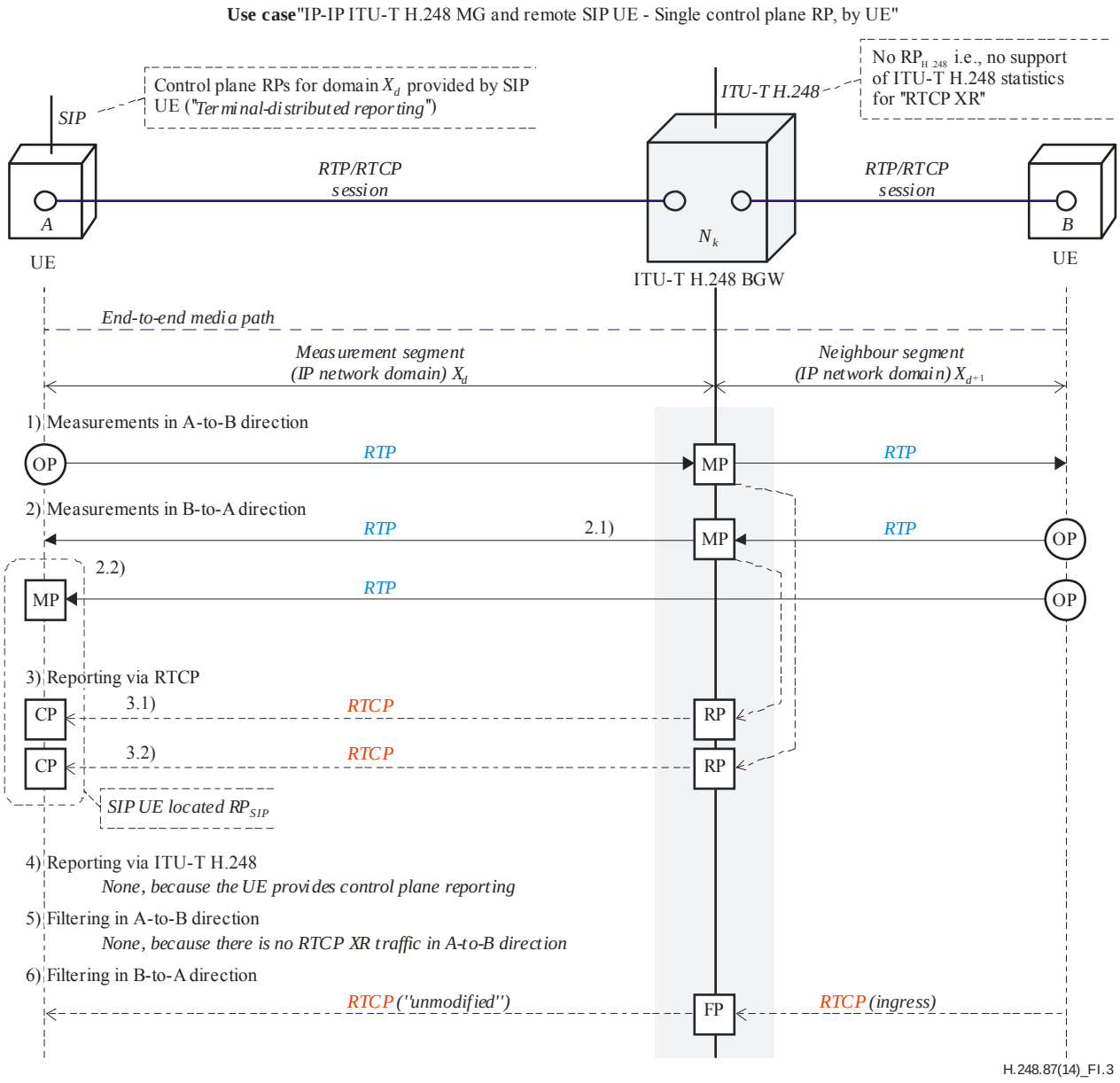


Figure I.3 – Use case 3: IP-IP ITU-H.248 MG and remote SIP UE – Single control plane RP by UE

Observation I.3.a

The two control plane reporting concepts – network centralized RPs located in ITU-T H.248 MGs (use cases 1 and 2) versus terminal-distributed RPs as provided, e.g., by SIP UE – are not mutually exclusive design alternatives. There are pros and cons (such as cost factors protocol support implementation status, etc.) behind each network engineering and operation approach; their evaluation is outside the scope of this Recommendation.

The ITU-T H.248 MG is now requested to support RTCP-based reporting see RP_{RTCP} (3.1) and (3.2). The SIP UE collects the data and provides SIP-based reporting (together with the UE-local measurements (2.2)).

No ITU-T H.248 statistics are requested from the ITU-T H.248 MG; the $RP_{H.248}$ is hence lacking in this example. Additional filtering capabilities:

– Any FP in egress direction is not required (5) because the SIP UE could already suppress the distribution of RTCP measurement reports.

– The ingress situation is similar as in previous use case 3.

I.5 Use case 4: IP-IP ITU-T H.248 MG and remote SIP UE – Single location of MPs ("LP by MG")

The MP is normally at the same location as the projected observation point (as in previous examples). However the MP could be geographically relocated from the observation point in the case of an available transport means for transferring the concerned traffic data from the observation point to a remote location. Loopbacking is such a capability: the traffic is redirected at the loopback point (LP) in the reverse direction.

Observation I.4.a

Loopbacking permits the geographical relocation of the MP anywhere in the loopback path. It may be noted that the relocated MP does not have to be at the location of the originating point (OP); it may also be in between the LP and OP section.

[b-IETF RFC 6849] defines a media loopback capability which could be supported by ITU-T H.248 entities (see [ITU-T H.248.85]). The notion of media is primarily related to all kinds of application data carried via RTP. Figure I.4 depicts a use case with an enabled media loopback at the ITU-T H.248 BGW.

The ITU-T H.248 BGW provides a loopback point (LP) for RTP traffic originating from UE A. The IETF loopback source and loopback mirror roles are assigned to UE A and BGW, respectively, in this example. The motivation for using an LP instead of a local MP at an ITU-T H.248 MG is elaborated in more detail in clause I.9.

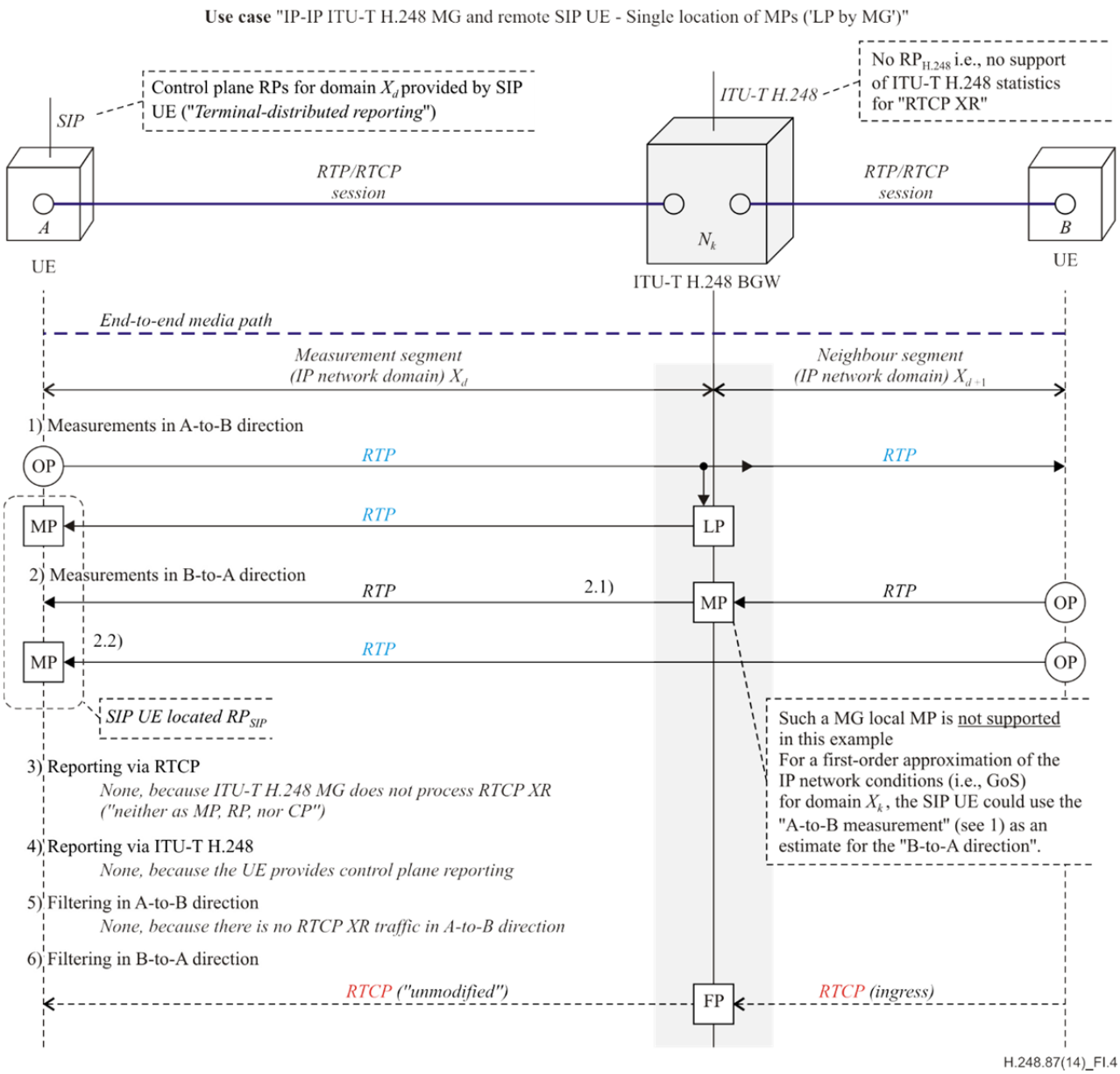


Figure I.4 – Use case 4: IP-IPITU-T H.248 MG and remote SIP UE – Single location of MPs ("LP by MG")

I.6 Use case 5: Distributed control plane reporting with near-end measurements only (at the example of a trunking gateway)

This is a variation of use cases 1 and 3 whereby control plane reporting is distributed between two RTP nodes (Figure I.5). The MPs are identical to use case 1 but each RTP node reports their own measurements also known as near-end measurements (see also [ITU-T H.248.71]).

UE A provides a SIP-based reporting interface (RP_{SIP} e.g., based on [b-IETF RFC 6035]). The ITU-T H.248 MG (here a TGW but may also be a BGW) reports its near-end (NE) measurements (via $RP_{H.248}$) in the form of ITU-T H.248 statistics.

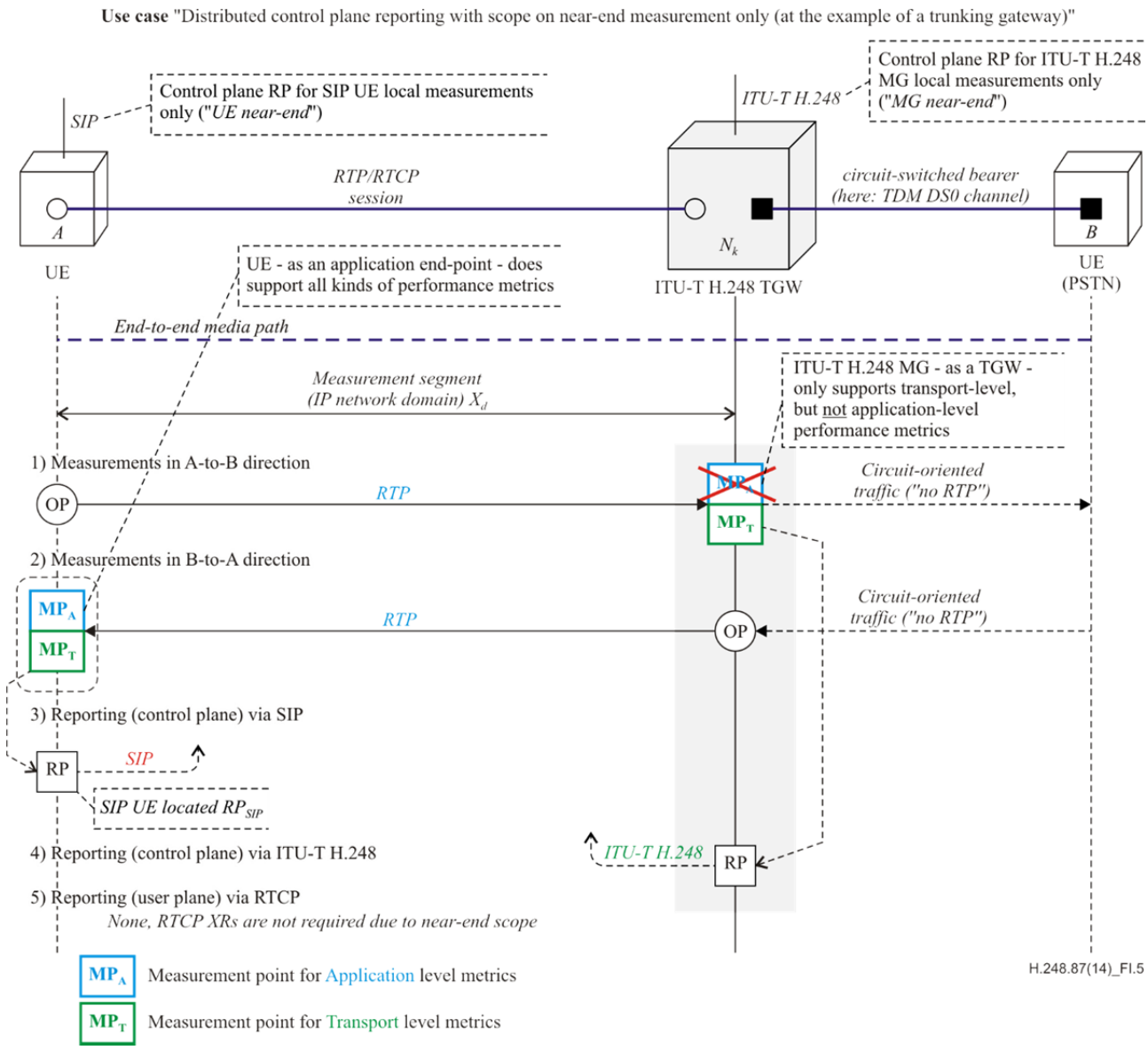


Figure I.5 – Use case 5: Distributed control plane reporting covering near-end measurements only (at the example of a trunking gateway)

This use case could be advantageous when:

– RTCP XR based reporting is to be avoided (i.e., there is no RP_{RTCP}); or/and

– measurement and/or reporting capabilities of different RTP node implementations (here UE and MG) follow different roadmaps (i.e., the local scope on NE-only MPs/RPs allows to decouple implementations).

It may be noted that the various control plane reporting capabilities besides ITU-T H.248 (such as SIP [b-IETF RFC 3261], ITU-T H.323 [b-ITU-T H.323], MGCP [b-IETF RFC 3435], etc.) do not provide adequate support with regards to RTCP XR defined performance metrics and measurement configurations.

I.7 Use case 6: IP-IP ITU-T H.248 MG as peering node

Network peering is the scenario invoked when an end-to-end media/bearer path traverses the border between two network operators, service providers, etc. Figure I.6 depicts a typical peering architecture: the last network element at the border could be an ITU-T H.248 BGW (in this case, node N_k for provider domain X_d and node N_{k+1} for provider domain X_{d+2}). There is sometimes an interim domain X_{d+1} (also known as neutral zone or demilitarized zone) e.g., realized simply as point-to-point L2 link or L3 route.

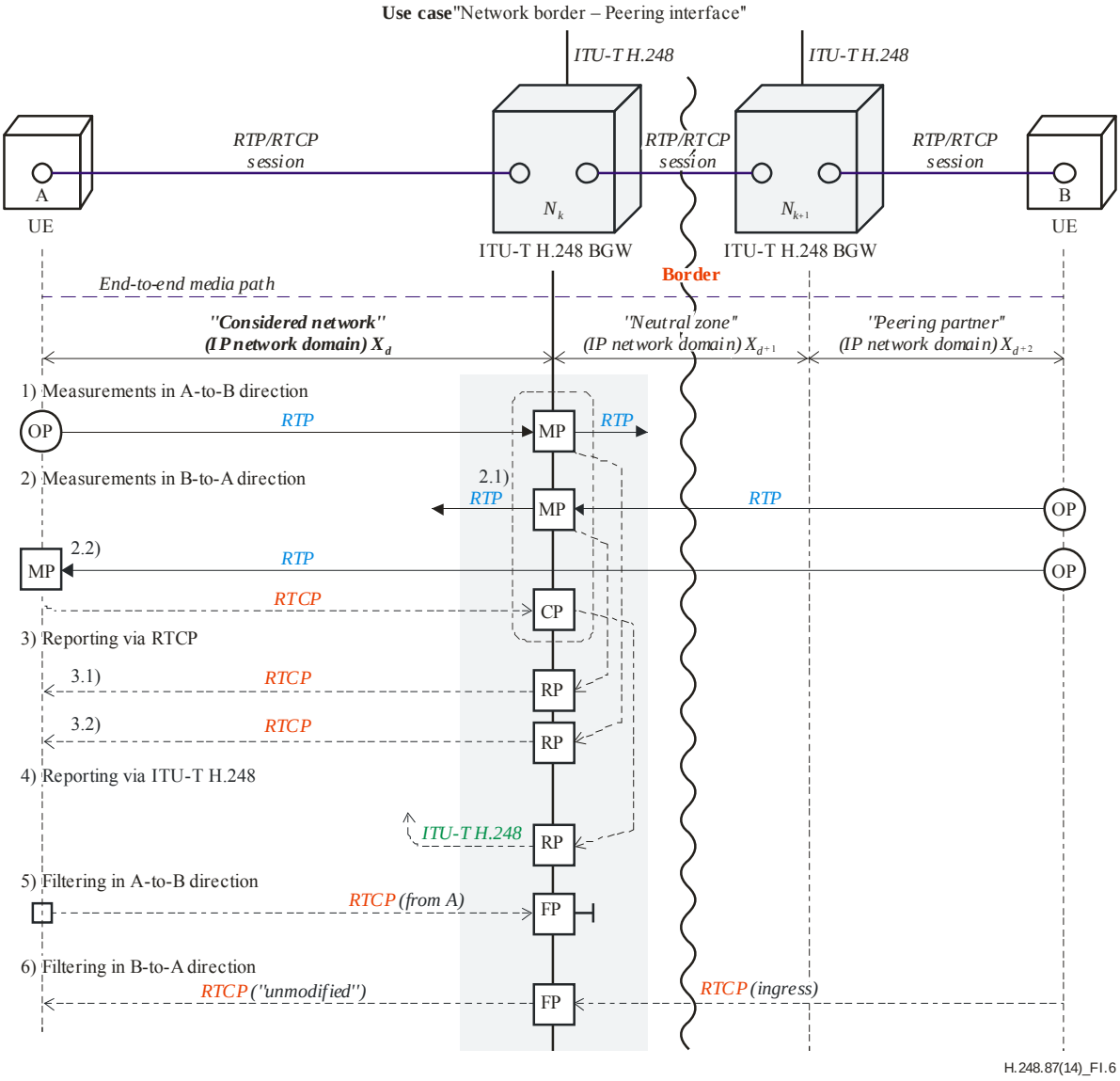


Figure I.6 – Use case 6: IP-IP ITU-T H.248 MG as peering node

Provider domain X_d and the selected control plane reporting point in ITU-T H.248 BGW (N_k) is of interest in use case 6. Measurement reporting and filtering is similar to the previous use cases. The ITU-T H.248 BGW (N_k) additionally provides the RP_{RTCP} capability (3.1) and (3.2) for the reporting of MG-local measurements (1) and (2.1), respectively. UE A therefore also has all measurements results available: they could be used by the UE-embedded application control logic.

I.8 Use case 7: Multiple IP network domains – Segment-based measurements

Multiple IP network domains may be interconnected by ITU-T H.248 BGWs (Figure I.7). Each network domain relates basically to a measurement segment from the perspective of an end-to-end

media/bearer path. The primary scope of this use case is an ITU-T H.248 BGW node N_k and provider domain X_d.

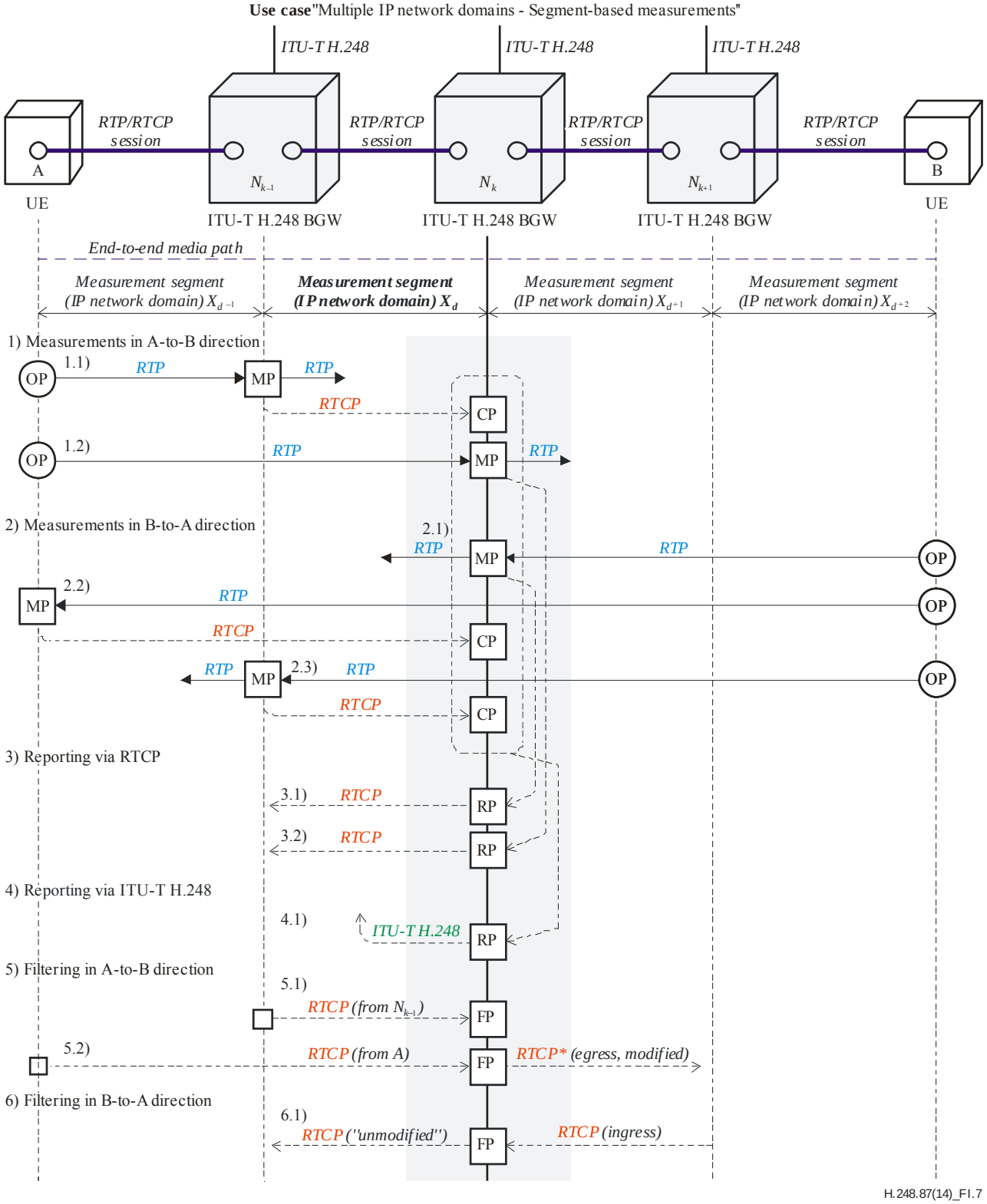


Figure I.7 – Use case 7: Multiple IP network domains – Segment-based measurements

The fundamental challenge of this use case is the assumption that there are different network conditions in each segment, i.e., the grade of service (GoS) for IP traffic (RTP packets in this case) varies per network domain X_i. Each provider is interested in trying to figure out the GoS of their

peering partners besides the measurement of its own GoS values. This is in order to estimate the impact on the end-to-end QoS like the QoE conditions for users A and B.

Such an analysis is basically feasible when the measurement segments are bounded by ITU-T H.248 BGWs, the usage of RTCP XR and the ITU-T H.248.48-based performance monitoring suite (e.g., plus ITU-T H.248.71) in order to configure MPs, CPs, RPs, LPs and/or FPs.

Performance monitoring from operator X_d (and ITU-T H.248 BGW node N_k) perspective:

– capture measurements of RTP traffic entering and leaving domain X_d; i.e.,
  ○ MPs between X_d and X_{d-1} (1.1) and (2.3) and
  ○ MPs between X_d and X_{d+1} (1.2) and (2.1) and
– capture measurements of RTP traffic entering at their source and sink; i.e.,
  ○ MPs at UE A (2.2) and UE B (not shown in Figure I.6);
– collect remote measurements via RTCP (1.1) (2.2) (2.3) …;
– distribute local measurements via RTCP (3.1) (3.2) …;
– report ITU-T H.248 statistics (4.1); and
– filtering options such as (5.1) (5.2) and (6.1).

I.9 Use case 8: MP relocation by loopbacking

The relocation of an MG-local MP to the remote RTP source end-point might be beneficial under certain conditions (see also clause I.5). Such an MP relocation could principally be achieved by enabling a loopback point (LP), see Figure I.8.

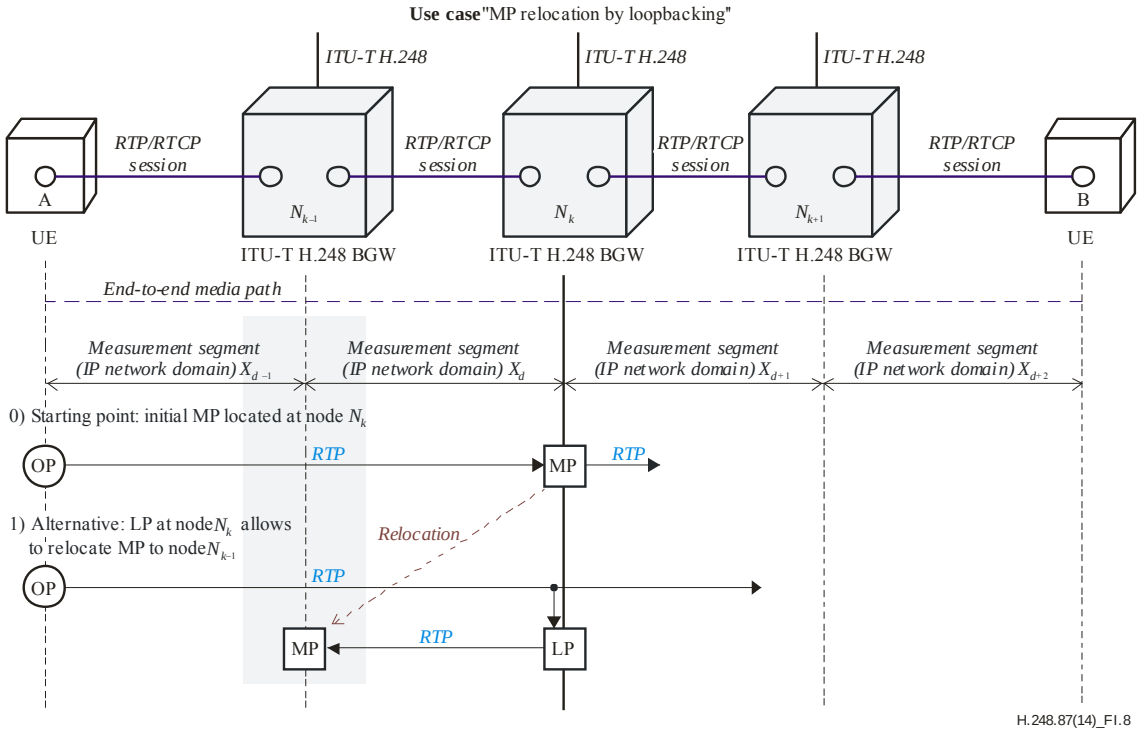


Figure I.8 – Use case 8: MP relocation by loopbacking

This use case is even more advanced than the one of clause I.5 because the MP is relocated to a previous MG (here BGW node N_{k-1}) instead of the actual loopback source (i.e., OP of UE_A here).

A general discussion and evaluation of loopbacking in the context of performance monitoring is provided in the following:

1. Prerequisites for loopbacking
   - The loopbacked media[1] must contain all necessary information as required by the performance metric(s). This requirement may be denoted as location-independent measurement parity.

     Here the measurement results (of the MPs) at locations N_{k-1} (with loopback) and N_k (without loopbacking) must be identical.
   - This condition may be fulfilled for some metrics but not the plethora of all envisioned RTCP XR defined metrics. The specific measurement algorithm of a performance metric determines the principal applicability (of MP relocation) or not.
2. Drawbacks of loopbacking
   - There is essentially a doubling of transport capacity at the loopback path.
3. Motivation for MP relocation by loopbacking
   - Cost factor of MG-local MP (i.e., too expensive for node N_k); see also clause 8 of [ITU-T H.248.79];
   - Congestion factor e.g., temporary unavailability of sufficient measurement capacity;
   - Implementation factor e.g., still lacking measurement capability;
   - RTCP factor e.g., a missing RTCP XR interface would prevent the reporting of local measurements whereas loopbacking just requires the usual RTP interface (LP in favour of RP_{RTCP}).
4. Consider MP relocation to previous RTP node (here node N_{k-1}), instead of RTP source end-point (here: UE_A)
   - Background: The relocated MP could be somewhere in the loopback path. There are thus two principal options in this use case (node N_{k-1} or UE_A).
   - The option of node N_{k-1} is actually outside the scope of [b-IETF RFC 6849] but feasible in network scenarios with interim ITU-T H.248 IP-IP gateways (as illustrated above);
   - The node N_{k-1} option provides the following advantages:
     - mitigates the basic drawback of increased network transport capacity and/or of the lack of measurement capability in the UE;
     - the loopback service may not at all be visible to the UE when node N_{k-1} acts as a virtual loopback source in the above scenario.

Thus as an overall conclusion: MP relocation by loopbacking is not a scalable option at network level (see also [b-IETF RFC 6849]), but might be beneficial and justified under specific conditions.

[1] The loopbacked media information is primarily the subject of the enforced loopback mode. [b-IETF RFC 6849] supports the three basic loopback modes: encapsulated packet loopback, direct loopback and media loopback. These are distinguished by the treatment of incoming RTP packets at the loopback mirror.

Appendix II

Design of the expired extended network quality base (XNQ) package

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

II.1 Introduction

The extended network quality base package is technically stable and a proven technology in the market. However the publication was stopped in 2005 in favour of a more future-safe solution, which is now available via [ITU-T H.248.48]. Use of the extended network quality base [b-ITU-T H.248.xnq] is therefore deprecated.

The package usage detailed template is provided in the next clause due to the fact of existing ITU-T H.248 profiles which might replace that package in an up-versioned profile.

II.2 Extended network quality base package

(If [b-ITU-T H.248.xnq] approach)

The extended network quality base package is detailed in Tables II.1 II.2 and II.3.

Table II.1 – Properties for the extended network quality base (XNQ) package

Properties	**Mandatory/ Optional**	**Used in command**	**Supported values**	**Provisioned value**	**Termination/Stream types supported**
Measurement period (mp 0x0002)	<M/O>	<ADD MOD MOVE AUDITVALUE AUDITCAP>	<Values / ALL >	<Value / Not applicable>	<Describe>
Severe degradation threshold (splt 0x0003)	<M/O>	<ADD MOD MOVE AUDITVALUE AUDITCAP>	<Values / ALL >	<Value / Not applicable>	<Describe>
Signals	**Mandatory/ Optional**	**Used in command**		**Duration provisioned value**	
None	<M/O>	<ADD MOD MOVE AUDITVALUE AUDITCAP>		<Value / Not applicable>	
	Signal parameters	**Mandatory/ Optional**	**Supported values**	**Provisioned value**	
	<name and Identity>	<M/O>	<Values / ALL>	<Value / Not applicable>	
Events	**Mandatory/ Optional**	**Used in command**			
None	<M/O>	<ADD MOD MOVE NOTIFY AUDITVALUE AUDITCAP>			
	Event parameters	**Mandatory/ Optional**	**Supported values**	**Provisioned value**	
	<name and Identity>	<M/O>	<Values / ALL>	<Value / Not applicable>	
	ObservedEvent parameters	**Mandatory/ Optional**	**Supported values**	**Provisioned value**	
	<name and Identity>	<M/O>	<Values / ALL>	<Value / Not applicable>	

Table II.2 – Statistics for the extended network quality base (XNQ) package

Statistics	Mandatory/ Optional	Used in command	Supported values	Termination/Stream types supported
Near-end statistics				
Time degraded by network problems (ntdegnet 0x0001)	<M/O>	<ADD MOD MOVE SUBTRACT AUDITVALUE AUDITCAP>	<Values / ALL >	<Describe>
Time degraded by jitter buffer adaptations (ntdegjit 0x0002)				
Network degraded seconds count (nes 0x0003)				
Network severely degraded seconds count (nses 0x0004)				
Maximum IPDV range within RTCP cycle (nvmaxdiff 0x0005)				
Global maximum IPDV range (nvrange 0x0006)				
IPDV sum (nvsum 0x0007)				
IPDV cycles (nvcyc 0x0008)				
Jitter buffer adaptation events (njbevents 0x0009)				

Table II.2 – Statistics for the extended network quality base (XNQ) package

Statistics	Mandatory/ Optional	Used in command	Supported values	Termination/Stream types supported
RTP cumulative packet loss (ncumpl 0x000a)				
Far-end statistics				
Time degraded by network problems (ftdegnet 0x000b)				
Time degraded by jitter buffer adaptations (ftdegjit 0x000c)				
Network degraded seconds count (fes 0x000d)				
Network severely degraded seconds count (fses 0x000e)				
Maximum IPDV range within RTCP cycle (fvmaxdiff 0x000f)				
Global maximum IPDV range (fvrange 0x0010)				
IPDV sum (fvsum 0x0011)				
IPDV cycles (fvcyc 0x0012)				

Table II.2 – Statistics for the extended network quality base (XNQ) package

Statistics	Mandatory/ Optional	Used in command	Supported values	Termination/Stream types supported
Jitter buffer adaptation events (fjbevents 0x0013)				
RTP cumulative packet loss (fcumpl 0x0014)				
Round-trip delay statistics				
Minimum round trip delay (rtdmin 0x0015)				
Maximum round trip delay (rtdmax 0x0016)				
Last round trip delay (rtdnow 0x0017)				

Table II.3 – Error codes for the extended network quality base (XNQ) package

Error codes	Mandatory/Optional
None	<M/O>

Appendix III

Example performance metric types

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

III.1 Background

Possible classification schemas for performance metrics for RTP traffic are described in clause 7. The protocol stack based method uses the terms application and transport level metrics (see clauses 3.2.1 and 3.2.6). This appendix provides some typical examples for each category.

There are examples which may only be metrics generated MG-locally and reported via ITU-T H.248 metrics, which may be reported via RTCP and examples for both reporting options.

III.2 Transport level metrics

III.2.1 RTP-agnostic transport level metrics

Example metrics:

– All four statistics according to [ITU-T H.248.61] concerning octet and packet-based IP traffic volume (for RTP sessions)

– Packet delay variation [b-IETF RFC 6798].

ITU-T H.248 network package:

– Statistics *os* and/or see clause E.11.4 of [ITU-T H.248.1].

III.2.2 RTP-aware transport level metrics

These kinds of transport level metrics are RTP-aware due to consideration of RTP header information TS SN and/or RTCP data.

Example metrics:

– Jitter buffer nominal delay [b-IETF RFC 7005]

– Jitter buffer maximum delay [b-IETF RFC 7005]

– Jitter buffer high water mark and jitter buffer low water mark [b-IETF RFC 7005]

– Sum of burst durations [b-IETF RFC 6958]

– Packets lost in bursts [b-IETF RFC 6958]

– Total packets expected in bursts [b-IETF RFC 6958]

– Number of bursts [b-IETF RFC 6958]

– Sum of squares of burst durations [b-IETF RFC 6958]

– Round trip delay [IETF RFC 3611]

– Network round trip delay [b-IETF RFC 6843]

– Discard count [b-IETF RFC 6843]

– Packets discarded in bursts [b-IETF RFC 7003]

– Total packets expected in bursts [b-IETF RFC 7003]

– Burst/gap loss summary statistics [b-IETF RFC 7004]

– Burst/gap discard summary statistics [b-IETF RFC 7004].

ITU-T H.248 RTP package:

– All six statistics (*ps*, *pr*, *pl*, *jit*, *delay* and *cpl*); see clause E.12.4 of [ITU-T H.248.1].

ITU-T H.248 received RTCP package:

– All five statistics (*rps*, *ros*, *rpl*, *rcpl* and *rjit*); see clause 7.4 of [ITU-T H.248.71].

III.3 Application level metrics

III.3.1 RTP-agnostic application level metrics

Example metrics:

These examples are based on the pure application data stream at receiver side:

– Unimpaired seconds [b-IETF rtcp-xr-conc]

– Concealed seconds [b-IETF rtcp-xr-conc]

– Severely concealed seconds [b-IETF rtcp-xr-conc]

– Unimpaired seconds [b-IETF rtcp-xr-conc]

– Frame impairment statistics summary [b-IETF RFC 7004].

The following example relates to FAX-over-IP using [ITU-T T.38] in T.38-over-RTP transport mode and an ITU-T H.248 IP termination enabled with the IP FAX package [ITU-T H.248.2]:

– Pages transferred defined by ITU-T H.248 statistic *ipfax/pagestrans*; is an application level metric due to data object 'page' and RTP-agnostic due to independence of RTP header information.

Statistics of RTP application data package [ITU-T H.248.58] (again due to RTP payload relation only (application data) but independence of RTP header information):

– RTP payload octets sent and

– RTP payload octets received.

III.3.2 RTP-aware application level metrics

For these metrics the measurement function must be media format aware based on the RTP payload type codepoint in contrast to the examples of clause III.3.1.

Example metrics:

– MOS value (attributed by MOS type and calculation method) [b-IETF rtcp-xr-qoe]

– Signal level [IETF RFC 3611]

– Noise level [IETF RFC 3611]

– Residual echo return loss [IETF RFC 3611]

– R factor [IETF RFC 3611]

– External R factor [IETF RFC 3611]

– End system delay [b-IETF RFC 6843] (virtual internal round-trip delay in topology RTP end system; it is an application level metric due to inclusion of encoding/decoding delays).

Appendix IV

Relationship between IETF RTCP XR documents and ITU-T H.248.x items and Recommendations

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

IV.1 Background

There were three major steps in the ITU-T concerning the support of RTCP XR-based measurements and reporting. Figure IV.1 recalls the timeline and evolution of ITU-T H.248.x capabilities for support of RTCP XR.

Figure IV.1 indicates the basic relationship between ITU-T and IETF documents. However, the overall situation needs the consideration of other documents as well; see Figure IV.2.

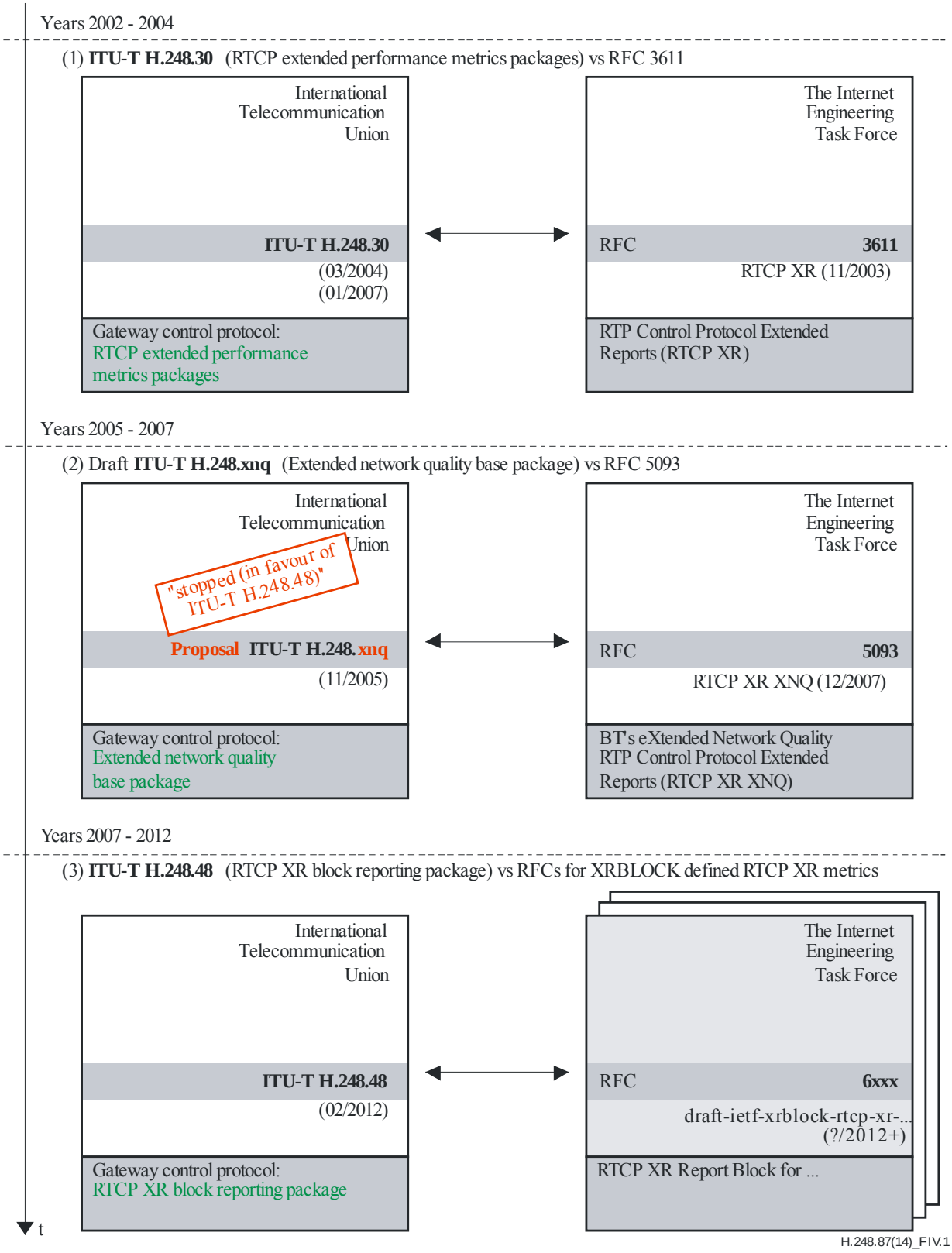


Figure IV.1 – Timeline and evolution of ITU-T H.248.x capabilities for support of RTCP XR

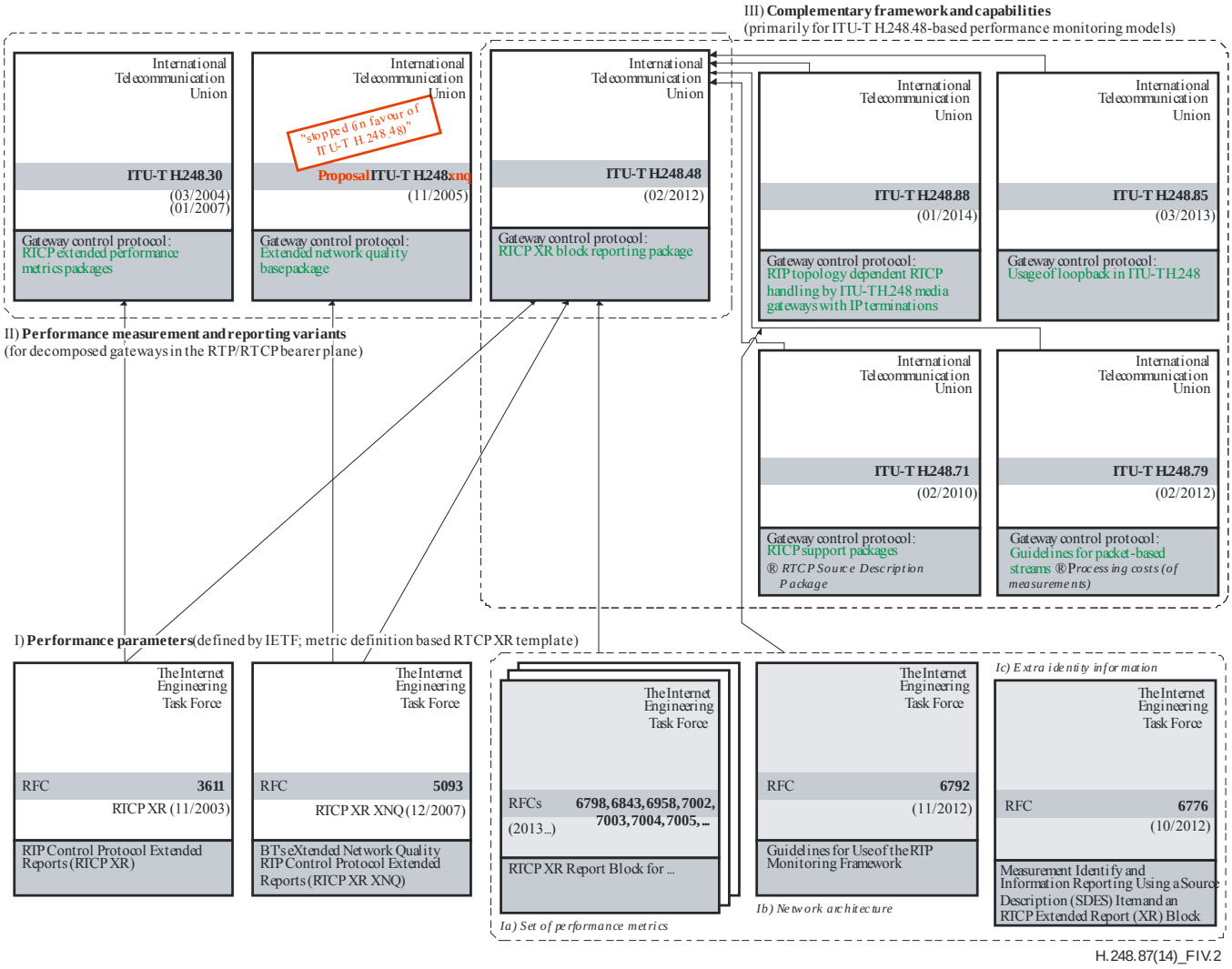


Figure IV.2 – Link between IETF RTCP XR documents and ITU-T H.248.x work items and Recommendations

Figure IV.2 indicates three major areas:

I. **Performance parameters** (solely defined by IETF; metric definition based RTCP XR template)

II. **Performance measurement and reporting variants** (for decomposed gateways in the RTP/RTCP bearer plane; defined by [ITU-T H.248.30], [b-ITU-T H.248.xnq] and [ITU-T H.248.48])

III. **Complementary framework and capabilities** (primarily for ITU-T H.248.48-based performance monitoring models, such as [ITU-T H.248.71], [ITU-T H.248.79], [ITU-T H.248.85] and [b-ITU-T H.248.88]).

Figure IV.2 indicates the difficulties for service providers, network operators or manufactures in identifying the right technology for a particular deployment scenario (which is finally given by an ITU-T H.248 profile specification). For instance, it is not evident that there are self-contained ITU-T H.248.48 solutions or whether a combination together with the ITU-T H.248.71 **rtcpsdes** package would always be required.

The next clause discusses typical capabilities within the scope of ITU-T H.248-based performance monitoring in RTP networks.

IV.2 Capabilities versus ITU-T H.248.x packages support

This clause compares the different approaches of [ITU-T H.248.30], [b-ITU-T H.248.xnq] and [ITU-T H.248.48], their purposes and characteristics but also principal limitations. The different ITU-T H.248.x solutions satisfy different sets of requirements (or support different capability sets). The capabilities may be structured in multiple areas. Table IV.1 indicates the main categories:

Table IV.1 – RTCP XR-based performance monitoring: Differences in ITU-T H.248.30 vs ITU-T H.248.xnq vs ITU-T H.248.48 – Part 1

Capability		(1) ITU-T H.248.30	(2) ITU-T H.248.xnq	(3) ITU-T H.248.48	Comments
A) Supported RTCP XR metric types		BT = 1 – 7 (limited)	BT = 8 (limited)	BT = "All" (NOTE)	A block type (BT) combines multiple performance metrics
B) Supported RTP topologies?					See also [b-ITU-T H.248.88]
B.1	RTP end system (RTPE)	Yes	Yes	Yes	
B.2	Back-to-back RTP end system (B2BRE)	Yes	Yes	Yes	
B.3	RTP translators (RTPTT RTPMT)	No	No	Yes	RTP translator topology required for e.g., network peering
B.4	RTP mixer	Yes	Yes	Yes	
C) ITU-T H.248 MG as reporting point (RP)					Via ITU-T H.248 statistics
C.1	Only near-end?	Yes	Yes	Yes	
C.2	Centralized RP for both directions?	No	No	Yes	"No" means that two MGs must be used, one for each direction
D) ITU-T H.248 MG as filtering point (FP)		No	No	Yes	"No" because "not applicable"
E) ITU-T H.248 MG types (connection model)					
E.1	Physical-to-RTP (e.g., ITU-T H.248 RMG AMG TMG)	Yes	Yes	Yes	
E.2	IP-to-IP (incl. RTP-to-RTP)	No	No	Yes	
NOTE – All RTCP XR block types as registered with IANA see [b-IANA RTCP XR].					

The content of Table IV.1 reflects the network evolution path of the past decade from a network architecture initially dominated by ITU-T H.248 MGs at the border between an IP network and circuit-oriented networks (such as PSTN ISDN 2G-PLMN) towards the direction of all-IP networks with its ITU-T H.248 MGs as IP-IP gateway/router entities.

Table IV.2 provides some categories concerning technology status and profile availability.

Table IV.2 – RTCP XR-based performance monitoring: Differences in ITU-T H.248.30 vs ITU-T H.248.xnq vs ITU-T H.248.48 – Part 2

Capability		(1) ITU-T H.248.30	(2) ITU-T H.248.xnq	(3) ITU-T H.248.48	Comments
F) Part of ITU-T H.248 profile?					
F.1	Standardized profile?	No	No	Not yet	[ITU-T H.248.48] is on the agenda for border GWs
F.2	Other profiles?	–	–	–	Outside the scope of this Recommendation
G) Non- ITU-T H.248 reporting?					Reporting of RTCP XR block types
G.1	SIP	Yes	No	Planned	
G.2	ITU-T H.323	Yes	No	Open	
G.3	MGCP	Yes	No	Open	
G.4	Diameter	No	No	Open	

Appendix V

Use case specific capability sets – Two examples

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

V.1 Overview

Profile content is mainly use case dependent as outlined in clause 1.1. In order to demonstrate profile specification guidelines in clause 9 this Recommendation considers two example use cases:

Capability set 'A' (CS_A): a trunking gateway performance monitoring scenario according to use case 1 (clause I.2); and

Capability set 'B' (CS_B): a border gateway performance monitoring scenario according to use case 6 (clause I.7).

Tables V.I and V.2 illustrate sets of requirements (based on clause 8) for profiling the two gateway types.

The performance monitoring scope of the BGW example (Table V.2) is limited to local measurements for network GoS only – i.e., typical RTP-agnostic transport level metrics as well as round-trip delay (as RTP-aware transport level metric) – plus the reporting of all performance measurements by remote UE_A.

Table V.1 – TGW example for capability set 'A' (CS_A)

Functional area	Capabilities
ITU-T H.248 MG as general measurement point (MP):	R-8.1/1 R-8.1/3 R-8.1/7
ITU-T H.248 MG as location-dependent measurement point (MP):	R-8.2.1/1 R-8.2.2/1 R-8.2.2/2
ITU-T H.248 MG as collection point (CP):	R-8.3/1
ITU-T H.248 MG as reporting point at IP bearer interface (RP_{RTCP}):	R-8.4.1/4
ITU-T H.248 MG as reporting point at ITU-T H.248 interface ($RP_{H.248}$):	Data: R-8.5.1/3 R-8.5.1/4 Control: R-8.5.2/1
ITU-T H.248 MG as filtering point (FP) (for RTCP traffic):	– (Note 1)
ITU-T H.248 MG as loopback point (LP) (for RTP/RTCP traffic):	–
Support of specific RTP topologies	R-8.8/1 (Note 2)
Others	–
NOTE 1 – TGW terminates any RTCP traffic. NOTE 2 – TGW represents inherently (in any case) the RTP end system topology.	

Table V.2 – BGW example for capability set 'B' (CS_B)

Functional area	Capabilities
ITU-T H.248 MG as general measurement point (MP):	R-8.1/1 R-8.1/2 R-8.1/4 R-8.1/7
ITU-T H.248 MG as location-dependent measurement point (MP):	R-8.2.1/1 R-8.2.2/1 R-8.2.2/2
ITU-T H.248 MG as collection point (CP):	R-8.3/1 R-8.3/2
ITU-T H.248 MG as reporting point at IP bearer interface (RP_{RTCP}):	R-8.4.1/1 R-8.4.1/2 R-8.4.1/3 R-8.4.1/4
ITU-T H.248 MG as reporting point at ITU-T H.248 interface ($RP_{H.248}$):	Data: R-8.5.1/1 R-8.5.1/3 R-8.5.1/5 Control: R-8.5.2/1 R-8.5.2/3
ITU-T H.248 MG as filtering point (FP) (for RTCP traffic) :	R-8.6/1 R-8.6/2 R-8.6/3 R-8.6/4 R-8.6/8
ITU-T H.248 MG as loopback point (LP) (for RTP/RTCP traffic):	–
Support of specific RTP topologies:	R-8.8/2 OR R-8.8/3 (Note)
Others:	–
NOTE – Conditional dependent on the demanded round-trip delay (RTD) metric. E.g., the RTD UE_A to N_k to UE_A would require topology back-to-back RTP end system and the RTD UE_A to UE_B to UE_A e.g., topology RTP transport translator.	

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