International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.248.95

(11/2015)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Communication procedures

Gateway control protocol: ITU-T H.248 support for RTP multiplexing

Recommendation ITU-T H.248.95

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Recommendation ITU-T H.248.95

Gateway control protocol: ITU-T H.248 support for RTP multiplexing

Summary

Recommendation ITU-T H.248.95 provides an overview of the types of real-time transport protocol (RTP) multiplexing and discusses how these may be implemented on ITU-T H.248 gateways.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T H.248.95	2015-11-29	16	11.1002/1000/12637

Keywords

ITU-T H.248, GCP, RTCP, RTP.

* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

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Gateway control protocol: ITU-T H.248 support for RTP multiplexing

1 Scope

Communication services utilizing the real-time transport protocol (RTP) as the application level framing protocol normally use a native IP-based transport mechanism [IETF RFC 3550], which results in using two separate user datagram protocol (UDP) ports for the RTP and RTP control protocol (RTCP) traffic components. ITU-T H.248 gateways provide a rich set of gateway services for such types of RTP traffic, as defined by [ITU-T H.248.48], [ITU-T H.248.58], [ITU-T H.248.71], [ITU-T H.248.77], [ITU-T H.248.87] and [ITU-T H.248.88].

In addition, multiple RTP-based traffic flow components could be multiplexed at multiple, different levels (from the perspective of a layered protocol architecture). The purpose of this Recommendation is to clarify how ITU-T H.248 gateways support such "multiplexing structures".

The scope of this Recommendation addresses the following subjects:

– Terminology: clarification of RTP related terms and definitions;
– Multiplexing methods: summary of existing multiplexing schemes in context of RTP-based communication services;
– ITU-T H.248 support: provides information on how dedicated multiplexing methods could be supported by ITU-T H.248 gateways inclusive of references to relevant signalling syntax; and
– Examples: provides some signalling examples as complementary information.

This Recommendation does not define any new ITU-T H.248 protocol extensions.

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

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

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

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

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

[ITU-T H.248.77] Recommendation ITU-T H.248.77 (2010), *Gateway control protocol: Secure real-time transport protocol (SRTP) package and procedures*.

[ITU-T H.248.87] Recommendation ITU-T H.248.87 (2014), *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*.

[ITU-T H.248.88] Recommendation ITU-T H.248.88 (2014), *Gateway control protocol: RTP topology dependent RTCP handling by ITU-T H.248 media gateways with IP terminations*.

[ITU-T H.248.93] Recommendation ITU-T H.248.93 (2014), *ITU-T H.248 support for control of transport security using the datagram transport layer security (DTLS) protocol*.

[ITU-T H.248.96] Recommendation ITU-T H.248.96 (2015), *Gateway control protocol: ITU-T H.248 Stream grouping and aggregation*.

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

[IETF RFC 5761] IETF RFC 5761 (2010), *Multiplexing RTP Data and Control Packets on a Single Port*.

[IETF RFC 5764] IETF RFC 5764 (2010), *Datagram Transport Layer Security (DTLS) Extension to Establish Keys for the Secure Real-time Transport Protocol (SRTP)*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 media (section 2.1 of [b-IETF RFC 7656]): A sequence of *synthetic* or *physical Stimuli* (sound waves, photons, key-strokes), represented in digital form. *Synthesized media* is typically generated directly in the digital domain.

3.1.2 media sink (section 2.1.31 of [b-IETF RFC 7656]): The media sink receives a source stream that contains, usually periodically, sampled media data together with associated synchronization information. Depending on application, this source stream then needs to be transformed into a raw stream that is conveyed to the media render, synchronized with the output from other media sinks.

3.1.3 media source (section 2.1.4 of [b-IETF RFC 7656]): The logical source of a reference clock synchronized, time progressing, digital media stream, called a source stream. This transformation takes one or more raw streams and provides a source stream as output. The output is synchronized with a reference clock, which can be as simple as a system local wall clock or as complex as NTP synchronized.

3.1.4 RTP endpoint (section 2.2.1 of [b-IETF RFC 7656]): A single addressable entity sending or receiving *RTP packets*. It may be decomposed into several functional blocks, but as long as it behaves as a single RTP stack entity it is classified as a single "endpoint".

NOTE – The self-contained notion of 'endpoint' is consistent with [b-ITU-T H-Sup.13].

3.1.5 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. An end system can act as one or more synchronization sources in a particular RTP session, but typically only one.

NOTE – The term is used and is important in context of "RTP topologies", see [ITU-T H.248.88]. The term is used as a synonym with "RTP endpoint" in [ITU-T H.248.88].

3.1.6 RTP session (section 2.2.2 of [b-IETF RFC 7656]): An *RTP session* is an association among a group of *Participants* communicating with RTP. It is a group communications channel which can potentially carry a number of *RTP streams*. Within an *RTP session*, every *Participant* can find metadata and control information (over RTCP) about all the *RTP streams* in the *RTP session*. The bandwidth of the RTCP control channel is shared between all Participants within an *RTP session*.

NOTE – Clause 3.1.3 of [ITU-T H.248.57] provides the following definition:

RTP session: An RTP session comprises a single RTP flow and an optional RTCP flow.

It could be concluded that the "*H.248.57 RTP session*" is a synonym to *RTP stream* in general.

3.1.7 RTP stream (section 2.1.10 of [b-IETF RFC 7656]): A *stream* of RTP packets containing *media data*, *source* or *redundant*. The *RTP stream* is identified by an SSRC belonging to a particular *RTP session*.

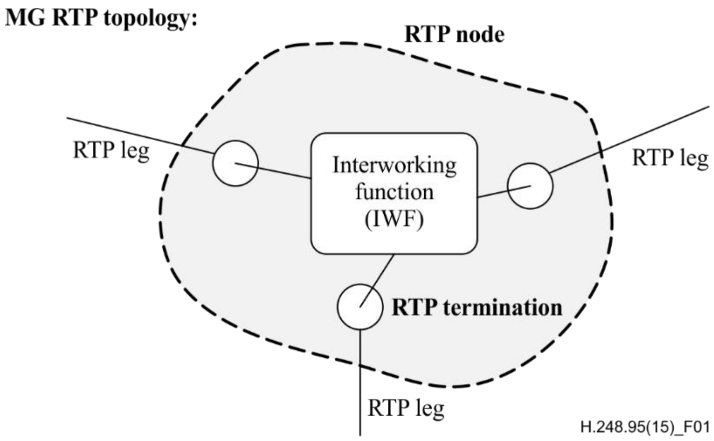
3.1.8 stream (H.248 media) (clause 3.2.9 of [ITU-T H.248.1]): Bidirectional media or control flow received/sent by a media gateway as part of a call or conference.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 media gateway (MG) RTP topology: The configuration of *RTP termination(s)* (Note 1) for an individual *RTP session* with a single *RTP stream* within an *RTP node*. There are multiple RTP terminations in general besides the single case. The RTP terminations are meshed for the "multiple case" and interconnected via an interworking function (IWF). There are a number of protocol layer related IWFs, at the RTP layer itself and at lower or upper layers. A particular RTP topology is characterized by a specific IWF.

Important MG RTP topologies are designated by a name.



NOTE – Example with three *RTP terminations*
The three RTP legs belonging the the same *RTP session*.

Figure 1 – Illustration of "MG RTP topology"

NOTE 1 – ITU-T H.248 terminology: an RTP-enabled ITU-T H.248 termination or stream endpoint.

NOTE 2 – Figure 1 illustrates the key aspects of the "MG RTP topology" concept. The term "RTP leg" is undefined but not decisive due to the relation to "RTP session".

3.2.2 media format: A particular pair of associated *media encoder* (section 2.1.6 of [b-IETF RFC 7656]) and *media decoder* (section 2.1.29 of [b-IETF RFC 7656]) entities.

3.2.3 media type: A categorization concept for the classification of similar media formats (e.g., 'audio', 'video').

3.2.4 RTP media multiplexing: A single IP transport layer 4 (L4) port for multiple RTP sources. There is a single unique SSRC per RTP source.

3.2.5 RTP node: Generic term used to designate a physical or logical network element with processing of RTP traffic, such as an IP host, terminal device, user equipment, gateway, media server, conference server, etc.

3.2.6 RTP source: A media packetizer (section 2.1.9 of [b-IETF RFC 7656]) which produces RTP packets, i.e., a source RTP stream plus optional associated redundant RTP stream(s). An RTP source uses as primary identifier the SSRC parameter.

3.2.7 RTP/RTCP transport multiplexing (briefly "RTP transport multiplexing"): A single IP transport (L4) port for RTP and RTCP packets.

3.2.8 UDP payload multiplexing: A single IP transport (L4) port for multiple, UDP-based application (upper layer) protocols. The first octet of the UDP payload is used for multiplexing. The application protocols are used in their native syntax, which limits UDP payload multiplexing only on scenarios which could guarantee unambiguity.

NOTE – Example: [IETF RFC 5764] defines UDP payload multiplexing for the three UDP packet based applications: RTP, STUN and DTLS.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

CSRC	Contributing Source
DTLS	Datagram Transport Layer Security
ICE	Interactive Connectivity Establishment
IMS	IP Multimedia Subsystem
IP	Internet Protocol
IWF	Interworking Function
L4	Layer 4
MG	Media Gateway
MGC	Media Gateway Controller
NAT	Network Address Translation
NGN	Next Generation Network
NTP	Network Time Protocol
PDU	Packet Data Unit
PT	Payload Type
RTCP	RTP Control Protocol
RTP	Real-time Transport Protocol
SDP	Session Description Protocol
SIP	Session Initiation Protocol
SRTCP	Secure RTP Control Protocol
SRTP	Secure Real-time Transport Protocol
SSRC	Sending Source
STUN	Session Traversal Utilities for NAT
UDP	User Datagram Protocol

WebRTC	Real-Time Communication in WEB-browsers (as work item in W3C)

5 Conventions

None.

6 Overview of RTP multiplexing

6.1 Introduction

Multiple, RTP-based traffic flow components may be multiplexed at multiple, different levels (from the perspective of a layered protocol architecture).

An RTP-based traffic flow is given by a packet flow with a common identifier (also known as flow identifier or traffic descriptor). A particular multiplexing method uses specific information elements of such a traffic descriptor, which are mandatory for de-multiplexing again. Figure 1 summarizes the three major multiplexing techniques for RTP traffic, as well as the used header elements.

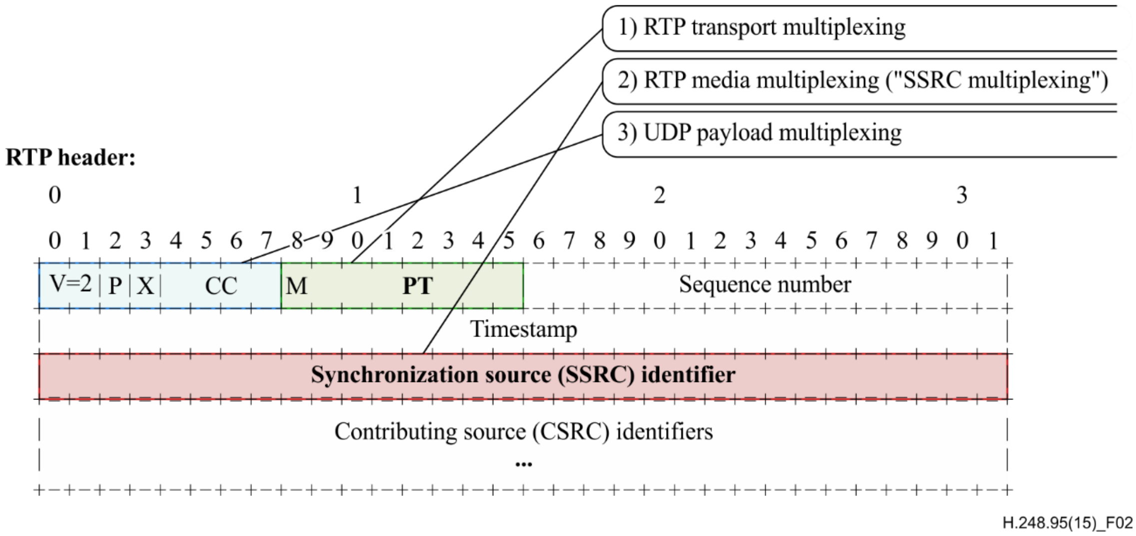


Figure 2 – Different multiplexing methods for RTP traffic and their used RTP header fields

In more detail:

1) **RTP transport multiplexing** (see clause 6.3) uses the 8th-bit field of marker bit (M) and 7-bit payload type (PT), which together comprise the 8-bit packet type;

2) **RTP media multiplexing** (see clause 6.4) uses the 32-bit sending source (SSRC);

3) **UDP payload multiplexing** (see clause 6.5) is based on the first octet of the user datagram protocol (UDP) payload, which relates to the RTP header field indicated in Figure 2.

6.2 Protocol history: multiplexing framework defined for original RTP

Section 5.2 of [IETF RFC 3550] "*Multiplexing RTP Sessions*" describes the general multiplexing principles for RTP.

6.3 RTP transport multiplexing

RTP transport multiplexing represents the case when an RTP media flow and its associated RTP control protocol (RTCP) control flow share a common IP transport address endpoint. In a normal, non-multiplexed scenario, RTP and RTCP use different endpoint identifiers on layer 4 (L4) (e.g., UDP ports in case of RTP-over-UDP transport).

Enabling of RTP transport multiplexing is achieved by the allocation of the same L4 port for RTCP as allocated for RTP.

Port allocation rules for RTCP at ITU-T H.248 interfaces are subject of [ITU-T H.248.57], which covers both, the transport un-multiplexed and multiplexed cases.

RTP transport multiplexing is an extension to [IETF RFC 3550], motivated and defined by [IETF RFC 5761].

6.3.1 Limitations of RTP transport multiplexing

Sections 4 and 5 in [IETF RFC 5761] describe a number of constraints, interactions and conditions to be considered when applying RTP transport multiplexing.

6.3.2 Control of RTP transport multiplexing

Control of RTP transport multiplexing:

1) using session description protocol (SDP): via SDP attribute "a=rtcp-mux" (see section 8 of [IETF RFC 5761]);
2) the usage of this SDP element at the H.248 interfaces is defined by [ITU-T H.248.57].

6.3.3 Relation to (RTP, non-RTP media) multiplexing in general

RTP transport multiplexing is orthogonal to other kinds of multiplexing mechanisms (such as application-specific media-level multiplexing options).

RTP transport multiplexing is basically (RTP) application agnostic, only driven by network address translation (NAT) traversal aspects.

6.4 RTP media multiplexing

RTP media multiplexing represents the case when multiple *RTP streams* of different *RTP sources* share a common IP transport address endpoint. In a normal, non-multiplexed scenario, individual RTP sources use different endpoint identifiers on L4 (e.g., UDP ports in case of RTP-over-UDP transport).

Enabling of RTP media multiplexing is achieved at session initiation protocol (SIP)-based call control level via the SDP method "bundling" (see [b-IETF BUNDLE]). Bundling is enabled in ITU-T H.248 via stream grouping [ITU-T H.248.96].

6.5 UDP payload multiplexing

UDP payload multiplexing represents the following case:

1) a single UDP connection is used; plus
2) UDP as transport protocol for RTP and RTCP; plus
3) secure RTP (secure real-time transport protocol (SRTP) and secure RTP control protocol (SRTCP)); plus
4) datagram transport layer security (DTLS)-based SRTP key exchange between the SRTP endpoints; plus
5) interactive connectivity establishment (ICE)/session traversal utilities for NAT (STUN)-based NAT traversal support for the UDP connection.

The case referred to as "DTLS-SRTP" is defined by [IETF RFC 5764]. A single UDP connection is then used as the multiplexing structure for the three traffic flow components related to L4+ protocols: SRTP, DTLS and STUN. The de-multiplexing method is defined in section 5.1.2 of [IETF RFC 5764], using the leading byte of the UDP packet payload.

Enabling of UDP payload multiplexing is achieved at the SIP-based call control level via the indication of "DTLS-SRTP" in RTP related SDP media descriptions (see section 8 of [IETF RFC 5764]). H.248 gateway control signalling indicates the application of UDP payload multiplexing at a particular ITU-T H.248 Termination/Stream implicitly, via the signalling of the SRTP key management scheme [ITU-T H.248.77], usage of ICE/STUN [ITU-T H.248.50] and DTLS related bearer control [ITU-T H.248.93].

7 Use cases with RTP multiplexing

7.1 General note

There are theoretically at least the following three reasons for the application of RTP multiplexing:

1) to maximize the likelihood of successful NAT traversal by minimizing the number of "pinholes" (i.e., number of IP transport connections);
2) to minimize the call establishment delay in case of ICE-based NAT traversal procedures by minimizing the number of IP transport connections, because every candidate IP transport connection must first be tested for end-to-end connectivity before; or/and
3) to "piggy back" the DTLS and STUN packet flows on the same RTP-over-UDP connection in case of DTLS-SRTP.

Reason (3) is already applicable for a single RTP stream ("monomedia call"), but all other multiplexing schemes only take effect for communication services with multiple RTP streams ("multimedia call").

The dominant use cases are driven by NAT traversal (1, 2) for multimedia communication services. This clause focuses on such scenarios.

7.2 Use case "multimedia call in NGN/IMS"

When multiplexing is used in a legacy next generation network (NGN)/IP multimedia subsystem (IMS) call, then RTP transport multiplexing is used in order to save L4 ports.

7.3 Use case "Web real-time communication"

[b-ITU-T H.248.94] defines an ITU-T H.248 real-time communication in WEB-browsers (WebRTC) gateway, which is required to support RTP multiplexing as an inherent defined capability of this service. See [b-ITU-T H.248.94], e.g., clause 8.3 ("Requirements related to bearer traffic multiplexing ") and clause 8.4.3 ("RTP multiplexing").

8 ITU-T H.248 control of RTP multiplexing

8.1 General principle

Multiplexing of multiple ITU-T H.248 Streams onto one multiplexed Stream is primarily indicated by setting the same address/port information on the applicable ITU-T H.248 Streams.

8.2 RTP media multiplexing

In order to multiplex several RTP streams the media gateway controller (MGC) may set the "association" (*mgroup/groupse*) property indicating which ITU-T H.248 Streams on a Termination are associated together for the purposes of multiplexing, with the grouping type of "BUNDLE".

[ITU-T H.248.96] describes these methods.

8.3 RTP transport multiplexing

Solely controlled via [ITU-T H.248.57], any kind of ITU-T H.248 Stream grouping [ITU-T H.248.95] is not required. It is not possible due to the lack of a correspondent grouping semantic.

9 RTP multiplexing examples

There are three basic RTP multiplexing methods:

1) RTP/RTCP transport multiplexing (see clause 6.3);
2) RTP media multiplexing (see clause 6.4); and
3) UDP payload multiplexing (see clause 6.5).

[ITU-T H.248.57] provides tables on the use of ITU-T H.248 properties and SDP attributes to enable RTP/RTCP transport multiplexing. No further examples are detailed in this Recommendation.

The examples in clauses 9.1 and 9.2 show RTP media multiplexing.

These clauses provide example use cases of RTP multiplexing. In each of the examples, Terminations (T1) and (T2) have five streams. StreamIDs (1) and (2) are audio streams. StreamIDs (3), (4) and (5) are video streams. These RTP and ITU-T H.248 Streams are bi-directional. The MGC indicates stream multiplexing by setting the same address/port information on the streams to be multiplexed and by setting the "BUNDLE" grouping semantic tying the Streams together.

9.1 Video stream multiplexing

In this example the video streams are multiplexed together on Termination (T1) using the “BUNDLE” grouping semantic. The scenario is illustrated in Figure 3.

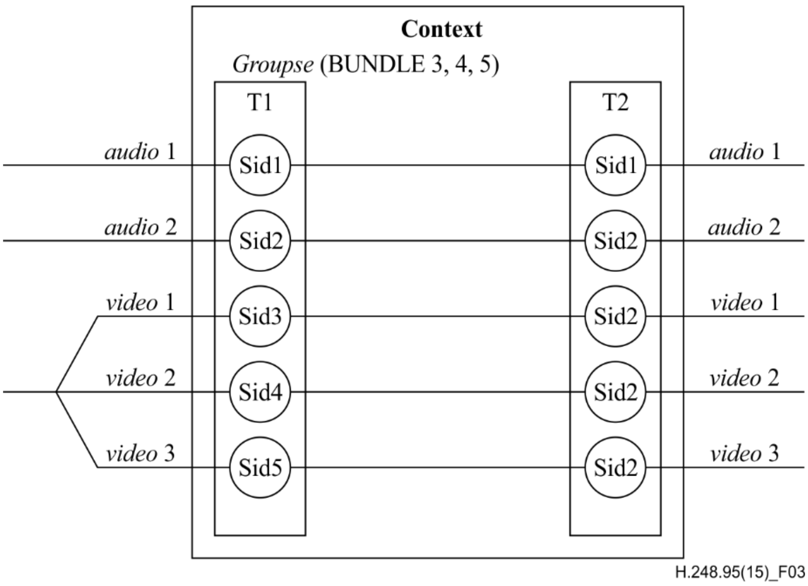


Figure 3 – Example: Video stream multiplexing connection model

Tables 1 and 2 provide an example ITU-T H.248 command request and response establishing the connection on Termination T1 as illustrated in Figure 3.

Table 1 – Example ITU-T H.248 command request for multiplexed streams

<table>
<tr><th>H.248 encoding</th><th>Comments</th></tr>
<tr><td><pre>
MEGACO/3 [123.123.123.4]:55555
Transaction = 10004 {
    Context = 1 {
       Add = T1 {
          Media {
             TermationState { mgroup/groupse =
["BUNDLE 3 4 5"]},
             Stream = 1 {
                Local {
                   v=0
                   c=IN IP4 $
                   m=audio $ RTP/AVP 32
                }
                Remote {
                   v=0
                   c=IN IP4 193.193.193.193
                   m=audio 30000 RTP/AVP 32
                }
             }
             Stream = 2 {
                Local {
                   v=0
                   c=IN IP4 $
                   m=audio $ RTP/AVP 8
                }
                Remote {
                   v=0
                   c=IN IP4 193.193.193.193
                   m=audio 30002 RTP/AVP 8
                }
             }
             Stream = 3 {
                Local {
                   v=0
                   c=IN IP4 $
                   m=video $ RTP/AVP 32
                }
                Remote {
                   v=0
                   c=IN IP4 193.193.193.193
                   m=video 30004 RTP/AVP 32
                }
             }
             Stream = 4 {
                Local {
                   v=0
                   c=IN IP4 $
                   m=video $ RTP/AVP 33
                }
                Remote {
                   v=0
                   c=IN IP4 193.193.193.193
                   m=video 30004 RTP/AVP 33
                }
             }
             Stream = 5 {
                Local {
                   v=0
                   c=IN IP4 $
</pre></td><td>Termination (T1) is added with the two audio streams and three video streams. The "BUNDLE2 grouping semantic is used to indicate that Streams 3, 4 and 5 are multiplexed together.</td></tr>
</table>

Table 1 – Example ITU-T H.248 command request for multiplexed streams

<table>
<tr><th>H.248 encoding</th><th>Comments</th></tr>
<tr><td><pre>
                    m=video $ RTP/AVP 34
                 }
                 Remote {
                    v=0
                    c=IN IP4 193.193.193.193
                    m=video 30004 RTP/AVP 34
                 }
              }   }
        }
     }
}
</pre></td><td></td></tr>
</table>

The media gateway (MG) reply to the command request for multiplexed streams in Table 1 is shown in Table 2.

Table 2 – Example reply to a ITU-T H.248 command request for multiplexed streams

<table>
<tr><th>H.248 encoding</th><th>Comments</th></tr>
<tr><td><pre>
MEGACO/3 [124.124.124.222]:55555
Reply = 10004 {
   Context = 1 {
      Add=T1 {
         Media {
            Stream = 1 {
                Local {
                   v=0
                   c=IN IP4 200.200.200.200
                   m=audio 50000 RTP/AVP 32
                }
                Remote {
                   v=0
                   c=IN IP4 193.193.193.193
                   m=audio 30000 RTP/AVP 32
                }
             }
             Stream = 2 {
                Local {
                   v=0
                   c=IN IP4 200.200.200.200
                   m=audio 50002 RTP/AVP 8
                }
                Remote {
                   v=0
                   c=IN IP4 193.193.193.193
                   m=audio 30002 RTP/AVP 8
                }
             }
             Stream = 3 {
                Local {
                   v=0
                   c=IN IP4 200.200.200.200
                   m=video 50004 RTP/AVP 32
                }
                Remote {
                   v=0
</pre></td><td></td></tr>
</table>

Table 2 – Example reply to a ITU-T H.248 command request for multiplexed streams

H.248 encoding	Comments

<pre>   c=IN IP4 193.193.193.193
                  m=video 30004 RTP/AVP 32
               }
            }
            Stream = 4 {
               Local {
                  v=0
                  c=IN IP4 200.200.200.200
                  m=video 50004 RTP/AVP 33
               }
               Remote {
                  v=0
                  c=IN IP4 193.193.193.193
                  m=video 30004 RTP/AVP 33
               }
            }
            Stream = 5 {
               Local {
                  v=0
                  c=IN IP4 200.200.200.200
                  m=video 50004 RTP/AVP 34
               }
               Remote {
                  v=0
                  c=IN IP4 193.193.193.193
                  m=video 30004 RTP/AVP 34
               }
            }   }
      }
   }
}</pre>	

9.2 Audio and video stream in separate multiplexes

In this example video streams are multiplexed over a transport connection and the audio streams are multiplexed over a separate transport connection on Termination (T1) using the "BUNDLE2 grouping semantic. The scenario is illustrated in Figure 4.

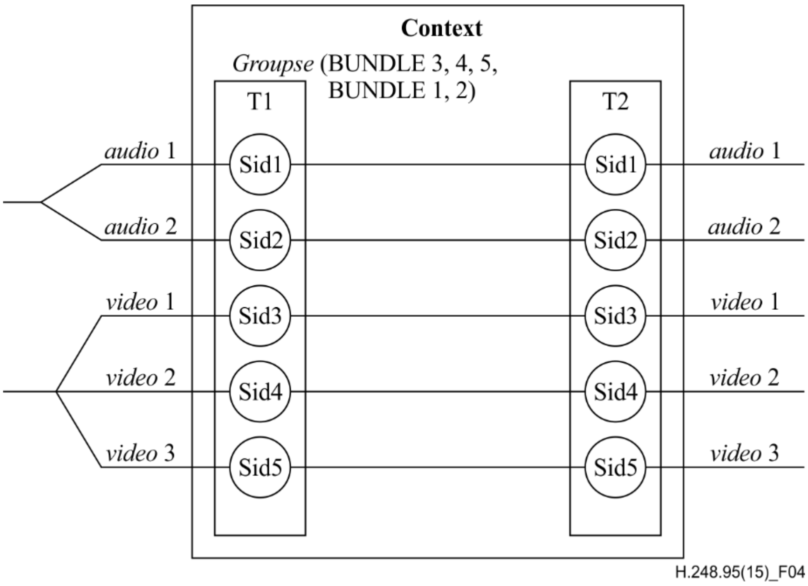


Figure 4 – Example: Video stream multiplexing connection model

Tables 3 and 4 provide an example ITU-T H.248 command request and response establishing the connection illustrated in Figure 4.

Table 3 – Example ITU-T H.248 command request for multiple multiplexed streams

ITU-T H.248 encoding	Comments

`MEGACO/3 [123.123.123.4]:55555`
`Transaction = 10004 {`
`    Context = 1 {`
`       Add = T1 {`
`           Media {`
`              TermationState { mgroup/groupse =`
`["BUNDLE 1 2", "BUNDLE 3 4 5"]},`
`              Stream = 1 {`
`                 Local {`
`                    v=0`
`                    c=IN IP4 $`
`                    m=audio $ RTP/AVP 32`
`                 }`
`                 Remote {`
`                    v=0`
`                    c=IN IP4 193.193.193.193`
`                    m=audio 30000 RTP/AVP 32`
`                 }`
`              }`
`              Stream = 2 {`
`                 Local {`
`                    v=0`
`                    c=IN IP4 $`
`                    m=audio $ RTP/AVP 8`
`                 }`
`                 Remote {`
`                    v=0`
`                    c=IN IP4 193.193.193.193`
`                    m=audio 30000 RTP/AVP 8`
`                 }`
`              }`
	Termination (T1) is added with the two audio streams and three video streams. The "BUNDLE2 grouping semantic is used to indicate that Streams 3, 4 and 5 are multiplexed together and that Streams 2 and 3 are multiplexed together.

Table 3 – Example ITU-T H.248 command request for multiple multiplexed streams

ITU-T H.248 encoding	Comments

`Stream = 3 {`
`Local {`
`v=0`
`c=IN IP4 $`
`m=video $ RTP/AVP 32`
`}`
`Remote {`
`v=0`
`c=IN IP4 193.193.193.193`
`m=video 30002 RTP/AVP 32`
`}`
`}`
`Stream = 4 {`
`Local {`
`v=0`
`c=IN IP4 $`
`m=video $ RTP/AVP 33`
`}`
`Remote {`
`v=0`
`c=IN IP4 193.193.193.193`
`m=video 30002 RTP/AVP 33`
`}`
`}`
`Stream = 5 {`
`Local {`
`v=0`
`c=IN IP4 $`
`m=video $ RTP/AVP 34`
`}`
`Remote {`
`v=0`
`c=IN IP4 193.193.193.193`
`m=video 30002 RTP/AVP 34`
`}`
`} }`
`} }`
`}`	

The MG reply is described in Table 4.

Table 4 – Example reply to a ITU-T H.248 command request for multiple multiplexed streams

ITU-T H.248 encoding	Comments

`MEGACO/3 [124.124.124.222]:55555`
`Reply = 10004 {`
`Context = 1 {`
`Add=T1{`
`Media {`
`Stream = 1 {`
`Local {`
`v=0`
`c=IN IP4 200.200.200.200`
`m=audio 50000 RTP/AVP 32`	

Table 4 – Example reply to a ITU-T H.248 command request for multiple multiplexed streams

<table>
<tr><th>ITU-T H.248 encoding</th><th>Comments</th></tr>
<tr><td><pre>
            }
            Remote {
               v=0
               c=IN IP4 193.193.193.193
               m=audio 30000 RTP/AVP 32
            }
         }
         Stream = 2 {
            Local {
               v=0
               c=IN IP4 200.200.200.200
               m=audio 50000 RTP/AVP 8
            }
            Remote {
               v=0
               c=IN IP4 193.193.193.193
               m=audio 30000 RTP/AVP 8
            }
         }
         Stream = 3 {
            Local {
               v=0
               c=IN IP4 200.200.200.200
               m=video 50002 RTP/AVP 32
            }
            Remote {
               v=0
               c=IN IP4 193.193.193.193
               m=video 30002 RTP/AVP 32
            }
         }
         Stream = 4 {
            Local {
               v=0
               c=IN IP4 200.200.200.200
               m=video 50002 RTP/AVP 33
            }
            Remote {
               v=0
               c=IN IP4 193.193.193.193
               m=video 30002 RTP/AVP 33
            }
         }
         Stream = 5 {
            Local {
               v=0
               c=IN IP4 200.200.200.200
               m=video 50002 RTP/AVP 34
            }
            Remote {
               v=0
               c=IN IP4 193.193.193.193
               m=video 30002 RTP/AVP 34
            }
         }
     }
  }
</pre></td><td></td></tr>
</table>

Table 4 – Example reply to a ITU-T H.248 command request for multiple multiplexed streams

ITU-T H.248 encoding	Comments
} }	

Appendix I

Existing ITU-T H.248 support for RTP multiplexing

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

I.1 3GPP-defined multiplexing for IP bearers with 3GPP framing protocol

Reference: see clause 6.4 of [b-ETSI TS 129 414].

Motivation: transport capacity reductions ("bandwidth efficiency").

Multiplexing method: multiple RTP packets mapped into a single packet data unit (PDU) augmented by a (3GPP defined) multiplex header "“similar to IETF SHIM approach").

ITU-T H.248 control: no signalling support, thus a pure provisioning-based approach.

Appendix II

Functional processing model for RTP streams

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

II.1 Reference

The model provided by this appendix is based on and aligned with the part models according to Figures 1 to 13 of [b-IETF RFC 7656]. The various part models highlight specific aspects of RTP services and protocol functions.

II.2 Purpose

The functional model uses the structure of a processing pipeline, considering the entire end-to-end media chain from communication source to communication sink. Such a model illustrates firstly the relationship between many terms. Secondly, ITU-T H.248 media gateways are typically involved only in a subset of the processing pipeline (i.e., an ITU-T H.248 Context, Termination, Stream Endpoint) covering only a few of the processing stages.

II.3 Functional processing model for RTP streams

Figure II.1 illustrates an example model with coverage of media source mixing, scalable media encoding, RTP packet redundancy decomposed media transport.

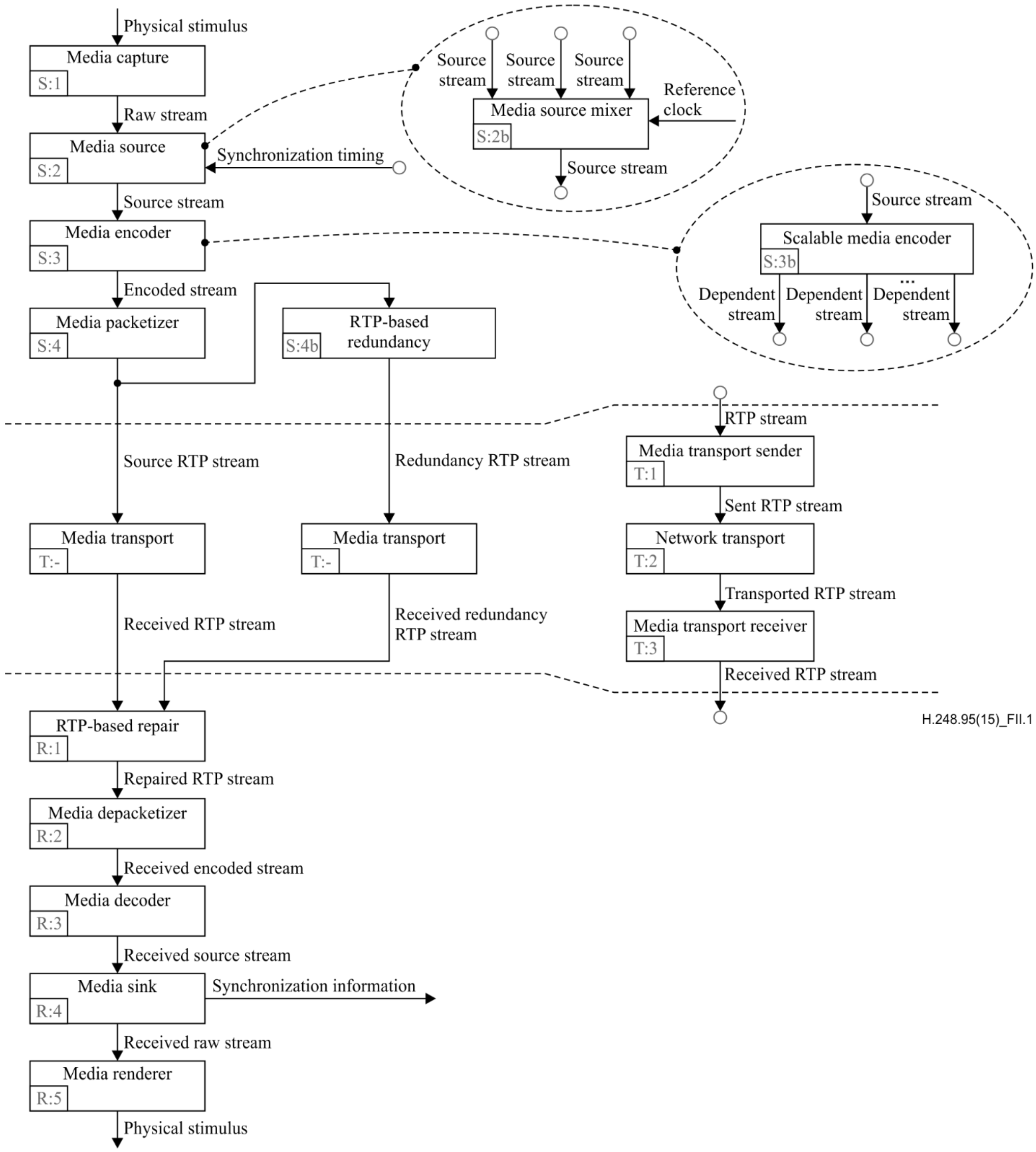


Figure II.1 – Functional processing model for RTP streams – Example with coverage of media source mixing, scalable media encoding, RTP packet redundancy decomposed media transport

Stages *Media capture* (S:1) and *Media renderer* (R:5) are normally subject of terminal equipment, thus typically not located in ITU-T H.248 MG entities. These stages are also not used in cases of ITU-T H.248 RTP-to-RTP media gateways enforcing RTP topologies "RTP Media Translator" and "Back-to-Back RTP End system" (see [ITU-T H.248.88]). For instance, such an RTP topology might be required due to media format translation (e.g., audio transcoding): the ITU-T H.248 MG would then support processing stages from/up to the *Media encoder* (S:3) and *Media decoder* (R:3), or even the additional stages of *Media source* (S:2) and *Media sink* (R:4) in case of synchronization timing aspects.

The above example model is not exhaustive concerning all possible RTP protocol functions and capabilities (e.g., security is missing).

II.4 Functional processing model with scope on RTP multiplexing

Figure II.2 focuses on RTP multiplexing at the sender side. The figure shows *RTP media multiplexing* for audio and video inclusive *RTP transport multiplexing* for the associated RTCP control flows.

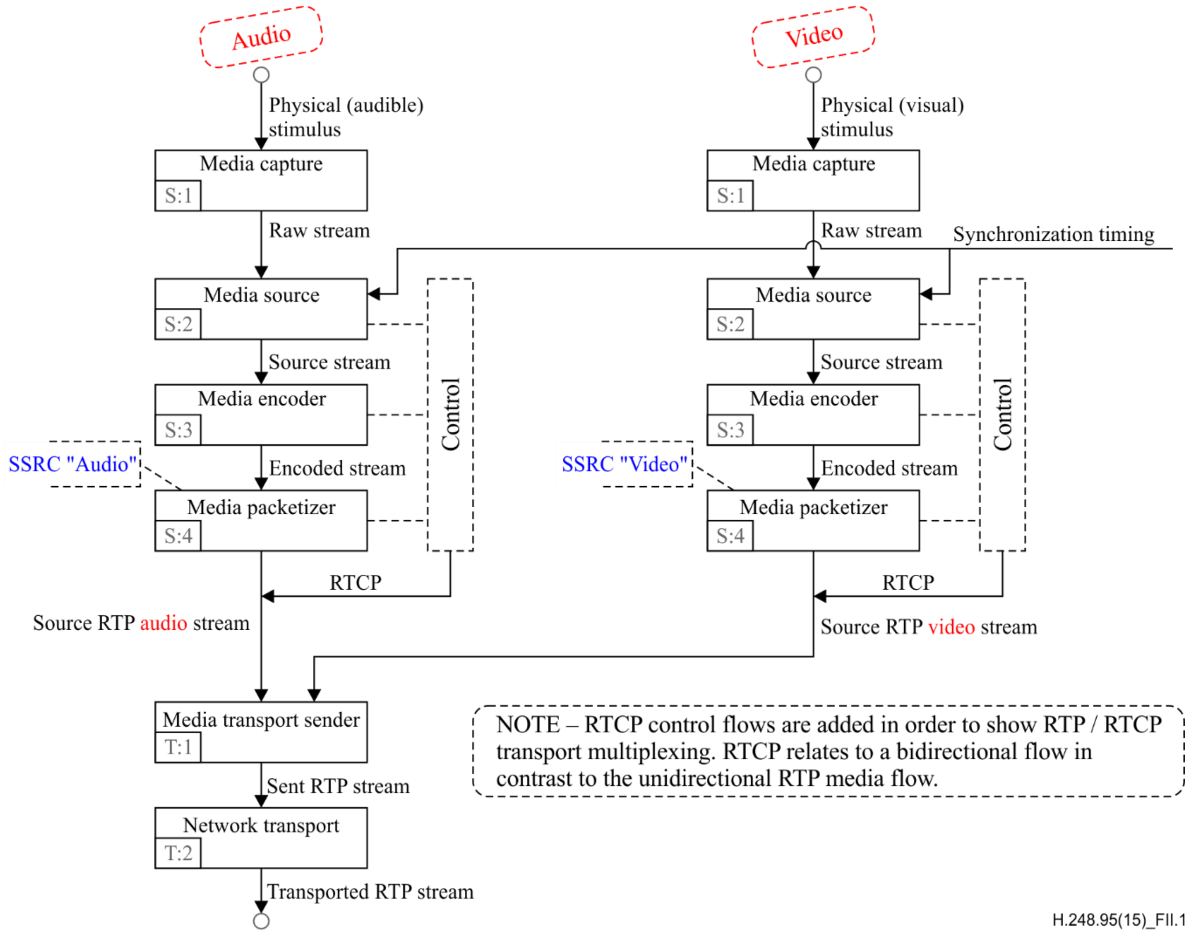


Figure II.2 – Functional processing model with scope on RTP multiplexing at sender side

Stage "*Media transport sender*" (T:1) provides effectively the multiplexing point for *RTP transport multiplexing*, *RTP media multiplexing* and *UDP payload multiplexing*. The present definition of "Media Transport" in [b-IETF RFC 7656] covers therefore un-multiplexed and multiplexed transport.

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Printed in Switzerland
Geneva, 2016