International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.248.66

(04/2016)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Communication procedures

Gateway control protocol: Packages for RTSP and ITU-T H.248 interworking

Recommendation ITU-T H.248.66

ITU-T H-SERIES RECOMMENDATIONS

AUDIOVISUAL AND MULTIMEDIA SYSTEMS

CHARACTERISTICS OF VISUAL TELEPHONE SYSTEMS	H.100–H.199
INFRASTRUCTURE OF AUDIOVISUAL SERVICES	
General	H.200–H.219
Transmission multiplexing and synchronization	H.220–H.229
Systems aspects	H.230–H.239
Communication procedures	**H.240–H.259**
Coding of moving video	H.260–H.279
Related systems aspects	H.280–H.299
Systems and terminal equipment for audiovisual services	H.300–H.349
Directory services architecture for audiovisual and multimedia services	H.350–H.359
Quality of service architecture for audiovisual and multimedia services	H.360–H.369
Telepresence	H.420–H.429
Supplementary services for multimedia	H.450–H.499
MOBILITY AND COLLABORATION PROCEDURES	
Overview of Mobility and Collaboration, definitions, protocols and procedures	H.500–H.509
Mobility for H-Series multimedia systems and services	H.510–H.519
Mobile multimedia collaboration applications and services	H.520–H.529
Security for mobile multimedia systems and services	H.530–H.539
Security for mobile multimedia collaboration applications and services	H.540–H.549
Mobility interworking procedures	H.550–H.559
Mobile multimedia collaboration inter-working procedures	H.560–H.569
BROADBAND, TRIPLE-PLAY AND ADVANCED MULTIMEDIA SERVICES	
Broadband multimedia services over VDSL	H.610–H.619
Advanced multimedia services and applications	H.620–H.629
Ubiquitous sensor network applications and Internet of Things	H.640–H.649
IPTV MULTIMEDIA SERVICES AND APPLICATIONS FOR IPTV	
General aspects	H.700–H.719
IPTV terminal devices	H.720–H.729
IPTV middleware	H.730–H.739
IPTV application event handling	H.740–H.749
IPTV metadata	H.750–H.759
IPTV multimedia application frameworks	H.760–H.769
IPTV service discovery up to consumption	H.770–H.779
Digital Signage	H.780–H.789
E-HEALTH MULTIMEDIA SERVICES AND APPLICATIONS	
Personal health systems	H.810–H.819
Interoperability compliance testing of personal health systems (HRN, PAN, LAN, TAN and WAN)	H.820–H.859
Multimedia e-health data exchange services	H.860–H.869

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

Recommendation ITU-T H.248.66

Gateway control protocol: Packages for RTSP and ITU-T H.248 interworking

Summary

Recommendation ITU-T H.248.66 provides guidance on mapping real time streaming protocol (RTSP) methods, error/status codes and header fields to ITU-T H.248 protocol information elements, packages and procedures. RTSP is used to control the playout of media resources. A media gateway controller (MGC) may be required to support the RTSP and request an ITU-T H.248-controlled media gateway (MG) to playout media resources and provide other associated functionality. Several packages are defined to enhance interoperability between RTSP and ITU-T H.248, however the functionalities defined in these packages may be used for other applications/services.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T H.248.66	2016-04-13	16	11.1002/1000/12634

Keywords

Interworking, media gateway protocols, MEGACO, package, real time streaming protocol, RTSP.

---

* 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.

FOREWORD

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

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

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

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

NOTE

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

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

INTELLECTUAL PROPERTY RIGHTS

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

As of the date of approval of this Recommendation, ITU had 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/.

Table of Contents

Recommendation ITU-T H.248.66

Gateway control protocol: Packages for RTSP and ITU-T H.248 interworking

1 Scope

This Recommendation provides guidance on mapping real time streaming protocol (RTSP) methods, error/status codes and header fields to ITU-T H.248 protocol information elements, packages and procedures. Several packages are defined to enhance interoperability between RTSP and ITU-T H.248, however the functionalities defined in these packages may be used for other applications/services.

RTSP operates between user equipment (UE) and a media server. This Recommendation assumes that the media server is functionally decomposed into a media control function (MCF) and a media delivery function (MDF). These functions can be realized in a media gateway controller (MGC) and a media gateway (MG). The Figure 1 illustrates the theoretical architecture in scope.

NOTE 1 – There may be other network entities between the UE and MGC (MCF), or the UE and the MG (MDF).

NOTE 2 – Alternative architectures are for further study.

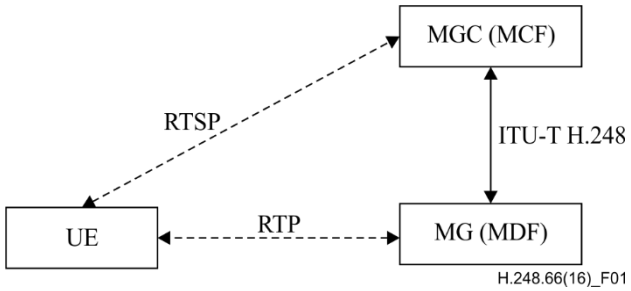


Figure 1 – RTSP and ITU-T H.248 interworking architecture

2 Reference

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

[ITU-T H.248.9] Recommendation ITU-T H.248.9 (2009), *Gateway control protocol: Advanced media server packages*.

[ITU-T H.248.10] Recommendation ITU-T H.248.10 (2001), *Gateway control protocol: Media gateway resource congestion handling package*.

[ITU-T H.248.11] Recommendation ITU-T H.248.11 (2013), *Gateway control protocol: Media gateway overload control package*.

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

[IETF RFC 2326] IETF RFC 2326 (1998), *Real Time Streaming Protocol (RTSP)*.

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

[IETF RFC 3986] IETF RFC 3986 (2005), *Uniform Resource Identifier (URI): Generic Syntax*.

[IETF RFC 3987] IETF RFC 3987 (2005), *Internationalized Resource Identifiers (IRIs)*.

[IETF RFC 4566] IETF RFC 4566 (2006), *SDP: Session Description Protocol*.

[IETF RFC 5234] IETF RFC 5234 (2008), *Augmented BNF for Syntax Specifications: ABNF*.

[IETF RFC 5322] IETF RFC 5322 (2008), *Internet Message Format*.

[IETF RFC 7826] IETF RFC 7826 (2016), *Real Time Streaming Protocol 2.0 (RTSP)*.

3 Definitions

3.1 Terms defined elsewhere

None.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 **Add.req**: ITU-T H.248.1 Add command request.

3.2.2 **AuditCapabilities.req**: ITU-T H.248.1 AuditCapabilities command request.

3.2.3 **AuditValue.req**: ITU-T H.248.1 AuditValue command request.

3.2.4 **Modify.req**: ITU-T H.248.1 Modify command request.

3.2.5 **Move.req**: ITU-T H.248.1 Move command request.

3.2.6 **Notify.req**: ITU-T H.248.1 Notify command request.

3.2.7 **Playback**: The process of delivering media, otherwise known as "media delivery" in RTSP.

3.2.8 **ServiceChange.req**: ITU-T H.248.1 internationalized resource identifier (IRI) command request.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ABNF Augmented Backus-Naur Form

BER Basic Encoding Rules

HTTP Hyper Text Transfer Protocol

IGMP Internet Group Management Protocol

IRI Internationalized Resource Identifier

MCF Media Control Function

MDF Media Delivery Function

MG Media Gateway

MGC Media Gateway Controller

NPT	Normal Play Time
PDU	Protocol Data Unit
RTP	Real-Time Transport Protocol
RTCP	RTP Control Protocol
RTSP	Real Time Streaming Protocol
SDP	Session Description Protocol
SMPTE	Society of Motion Picture and Television Engineers
TCP	Transmission Control Protocol
TLS	Transport Layer Security
TTL	Time To Live
UDP	User Datagram Protocol
UE	User Equipment
UTC	Coordinated Universal Time
URI	Universal Resource Identifier

5 Conventions

None.

6 RTSP and ITU-T H.248 interworking

6.1 Method interworking

6.1.1 OPTIONS

The MGC should be able to provide a response to an RTSP OPTIONS method based on the RTSP service capabilities. As the RTSP OPTIONS method may be used as a keep alive ,the MGC may issue an appropriate ITU-T H.248 command (e.g., an empty AuditValue.req) to the MG to maintain a keep alive with the MG for a particular termination.

6.1.2 DESCRIBE

On receipt of an RTSP DESCRIBE method the MGC may request the presentation/session description from the MG if it does not already have this information. The MGC should add a Termination to a Context using an Add.req and set the Media Resource Identifier Specification (*mri/spec*) property to the universal resource identifier (URI) received in the DESCRIBE. The MGC should also CHOOSE wildcard the LocalControl descriptor to determine the presentation/session description information for the media resource of interest.

6.1.3 SETUP

Using the information in the RTSP SETUP method the MGC can use an Add.req or Modify.req to set the remote address/port in the Remote Descriptor and request the server port from the Local Descriptor. The MGC shall ensure that the "Specification" property of the Media Resource Identifier package (*mri/spec*) is set for the particular stream/termination to ensure that the correct media resource is specified.

Session information can either be provided by the MGC or from the session description protocol (SDP) session information from the MG. If a session identifier is provided by the client then the MGC can use the ITU-T H.248 stream concept to bundle the session.

In the case that a SETUP contains multiple transport options these may be provided to the MG using multiple groups and allowing the MG to choose the applicable group. The MGC may also request the acceptable range formats by performing a CHOOSE wildcard on the Format Types (*rfs/ft*) property.

An RTSP SETUP method may result in the transport parameters being changed while a media resource is being played. In this case the MGC may need to reissue a new RTSP Play (*rtspp/play*) signal while CHOOSE wildcarding the Play Range (*pr*) parameter to determine the playout time at which the change in transport parameters occurred. In addition, the MGC may need to perform a CHOOSE wildcard on the real-time transport protocol (RTP) Information Synchronization Source (*rtpinfo/ssrc*), RTP Information Sequence Number (*rtpinfo/seq*) and RTP Information Timestamp (*rtpinfo/ts*) properties.

On RTSP SETUP failure or session timeout the MGC is responsible subtracting the applicable ITU-T H.248 terminations.

See section 13.3 of [IETF RFC 7826] for more information on SETUP procedures.

6.1.4 PLAY

The RTSP PLAY method relates directly to sending an ITU-T H.248 signal. The playout of a particular media resource may be achieved by issuing an RTSP Play (*rtspp/play*) signal in a Modify.req. The MG shall play the media resource indicated by the Media Resource Identifier (*mri*) parameter carried in the signal. If provided this overrides the *mri/spec* property.

The RTSP PLAY method may include time range information in the Range Header, if included this should be sent to the MG in the Play Range (*pr*) parameter.

The MGC may need to determine the time range formats that are supported by the MG for the particular media resource for use in an RTSP PLAY response, in this case the MGC shall CHOOSE wildcard the Range Format (*rf*) parameter.

The MGC may need to determine the time range information regarding the playout of the media resource used in an RTSP PLAY response, in this case the MGC shall CHOOSE wildcard the Play Range (*pr*) parameter.

If the RTSP PLAY method contains a Scale header the appropriate value should be included in the Play Scale (*ps*) parameter. If the RTSP PLAY method contains a Speed header the appropriate value/s should be included in the Data Speed (*ds*) parameter. If the RTSP PLAY method contains a Seek-Style header the appropriate value should be included in the Seek Behaviour (*sb*) parameter.

In addition, the MGC may need to perform a CHOOSE wildcard on the RTP Information Synchronization Source (*rtpinfo/ssrc*), RTP Information Sequence Number (*rtpinfo/seq*) and RTP Information Timestamp (*rtpinfo/ts*).

The MGC may also set a NotifyCompletion event in order to ascertain when the playout of the signal has ceased.

If an RTSP PLAY method is received for a media resource which is currently playing out, several alternatives exist. If the time range information in the RTSP PLAY method Range header has changed compared to the playing out signal then the MGC should reissue an *rtspp/play* signal with the update time information (and any other relevant parameters). This will have the effect of restarting the signal at a different time location. If the RTSP PLAY method contains changed "Speed" or "Scale" information then the MGC should issue the Data Delivery Speed Adjustment Speed (*ddsa/spd*) and/or Playback Relative Scale Adjustment Scale (*prsa/scl*) signal respectively.

In order to be backwards compatible to RTSP version 1 [IETF RFC 2326] an MGC can provide PLAY METHOD queuing as ITU-T H.248 provides a signal completion mechanism that can be used to indicate when a play request is finished. Signals lists can also be used to ensure sequenced playout.

See section 13.4 of [IETF RFC 7826] for more information on PLAY procedures.

6.1.5 PLAY_NOTIFY

The use of RTSP PLAY_NOTIFY is triggered by the notification of the different media play state events, which are defined in the RTSP Play package. The MGC can customize the events when sending an RTSP Play signal. Three types of PLAY_NOTIFY requests correspond to the notification of the three events: End-of-Stream Notification Event (*rtspp/eos*), Media Properties and Range Change Event (*rtspp/mprc*), Scale Change event (*rtspp/sc*).

See section 13.5 of [IETF RFC 7826] for more information on PLAY_NOTIFY procedures.

6.1.6 PAUSE

The RTSP PAUSE method is achieved through the use of the Signal Pause (*sp/pause*) signal. On receipt of an RTSP PAUSE method the MGC should issue the *sp/pause* signal with the applicable parameters. In order to determine the pause point information, the MGC should perform a CHOOSE wildcard on the Pause Range (*pr*) parameter. That MGC may specify the Time format to be used by setting the Range Format (*rf*) parameter.

On reception of the *sp/pause* signal the MG shall pause the relevant signals. To resume playout of the signal from the pause point the MGC shall remove the *sp/pause* signal from the Signals Descriptor. If the MGC wishes to resume playout from another time point then the procedures for the RTSP PLAY method should be followed.

See section 13.6 of [IETF RFC 7826] for more information on PAUSE procedures.

6.1.7 TEARDOWN

The RTSP TEARDOWN method can be directly mapped to:

– An ITU-T H.248 Subtract.req command where an entire session is removed;

– Removal of an ITU-T H.248 stream via an ITU-T H.248 Modify command where only a single media is to be removed;

– Stopping an RTSP Play signal (*rtspp/play*) through removal from a Signals descriptor will also result in resources being freed.

See section 13.7 of [IETF RFC 7826] for more information on TEARDOWN procedures.

6.1.8 GET_PARAMETER

The RTSP GET_PARAMETER method is mapped to the ITU-T H.248 AuditValue.req message in order to determine property values.

See section 13.8 of [IETF RFC 7826] for more information on GET_PARAMETER procedures.

6.1.9 SET_PARAMETER

The RTSP SET_PARAMETER method is mapped to a Modify.req command that modifies a property/parameter in an applicable ITU-T H.248 descriptor.

See section 13.9 of [IETF RFC 7826] for more information on SET_PARAMETER procedures.

6.1.10 REDIRECT

An RTSP REDIRECT method may be initiated by the MGC based on service information from an MG. This information may be as a result of overload indications such as those defined in [ITU-T H.248.10] and [ITU-T H.248.11] or as a result of ITU-T H.248 ServiceChange procedures.

6.1.11 Extension methods

Extension methods defined outside the core [IETF RFC 7826] specification may be supported by existing ITU-T H.248 procedures/code points. For example, the "Announce" method

[b-IETF RTSPANN] may use existing ITU-T H.248 NotifyCompletion mechanisms to indicate the end of a stream of media.

6.2 Embedded (interleaved) binary data

Routing media data through an MGC is not recommended for performance reasons; however, the use of ITU-T H.248 signals and events allow the tunnelling of data. If an MGC receives an indication that interleaving should be used then it should set the RTSP Interleaving Package Outgoing Data (*rtpint/od*) event on the MG with the channel number that should be used to encode the data block. The MGC shall then be ready to receive media data from the MG to forward to the RTSP client. If the MGC receives media data (e.g., RTCP reports) it shall forward this information to the MG via the RTSP Interleaving Incoming Data (*rtpint/id*) signal.

NOTE – The interleaving mechanism supported by [IETF RFC 7826] allows a maximum protocol data unit (PDU) size of 65535 bytes. If interleaving is used across ITU-T H.248, consideration should be given to the maximum PDU size of the underlying ITU-T H.248 transport. PDU fragmentation may be needed. This is out of scope of this Recommendation.

6.3 Status/error code interworking

[ITU-T H.248] has a full range of status codes which map to hyper text transfer protocol (HTTP) and RTSP status codes. These codes are defined in [ITU-T H.248.8]. Mappings to various status codes are discussed below.

6.3.1 Success 1xx

A success status code 1xx may be generated as a result of an ITU-T H.248 response message that does not contain an error.

6.3.2 Success 2xx

A success status code 2xx may be generated as a result of an ITU-T H.248 response message that does not contain an error.

6.3.3 Redirection 3xx

[ITU-T H.248] has ServiceChange messages and overload mechanisms that enable the MGC to determine MG (resource) availability in order to generate 3xx responses.

6.3.4 Client error 4xx

The following error codes should be handled at the MGC level: 400, 401, 402, 403, 404, 405, 406, 407, 408, 411, 413, 415, 451, 452, 454, 455, 456, 459, 460, 462, 463, 464, 465, 466, 470, 471 and 472.

The following error codes may be mapped to ITU T H.248 error codes in the following manner:

– 404 *Not Found*: May be issued as a result of ITU-T H.248 error codes related to the playout of an announcement i.e., 606, 611.

– 410 *Gone*: May be issued as a result of ITU-T H.248 error codes related to the playout of an announcement. There are several ITU-T H.248 error codes in the 600-611 series that relate errors with respect to segments related to URIs. However, there is no specific error code that is equivalent to the definition in section 17.4.10 of [IETF RFC 7826]. If the MGC is able to determine through another means that the resource is gone it may generate 410, otherwise 404 should be used as per section 17.4.10 of [IETF RFC 7826].

– 453 *Not Enough Bandwidth*: May be issued as a result of ITU-T H.248 error codes i.e., 526.

– 457 *Invalid Range*: May be handled by the MGC if it knows the values supported by the MG otherwise may be mapped from ITU-T H.248 error codes i.e., 449.

– 458 *Parameter Is Read-Only*: May be handled by the MGC if it knows the values supported by the MG otherwise may be mapped from ITU-T H.248 error codes i.e., 534.

– 461 *Unsupported Transport*: May be handled by the MGC if it knows the values supported by the MG otherwise may be mapped from ITU-T H.248 error codes i.e., 445, 461.

6.3.5 Server error 5xx

The MGC is typically able to issue 5xx status codes independent of the MG. However, a 5xx error may be generated due to a condition on an MG. For example: if an MG has indicated that it is overloaded through the use of [ITU-T H.248.10] or [ITU-T H.248.11] the MGC may respond with "503 Service Unavailable" as the underlying resources related to the RTSP request may not be available even though the MGC itself is not overloaded. Likewise, an MGC may respond with "551 Option Not Supported" or "501 Not Implemented" if an MG does not support the functionality associated with the request even though the MGC may support an RTSP protocol function or option.

6.4 Header field definitions

The mapping of the header fields to ITU-T H.248 information elements is dependent on the RTSP method with which they are associated. In some cases RTSP headers are not mapped to ITU-T H.248 information elements as they are used solely by the MGC.

6.4.1 Non-mapped headers

The headers listed in Table 1 can be considered to be used by the MGC only and do not have a direct mapping to ITU-T H.248 information elements.

Table 1 – Header fields without direct mapping to ITU-T H.248 information elements

Accept-Credentials	Content-Type	Proxy-Supported
Accept-Encoding	CSeq	Public
Accept-Language	Date	Referrer
Allow	From	Request-Status
Authentication-Info	If-Match	Require
Authorization	If-Modified-Since	Server
Cache-Control	If-None-Match	Session
Connection	Last-Modified	Supported
Connection-Credentials	Notify-Reason	Timestamp
Content-Base	Pipelined-Requests	User-Agent
Content-Encoding	Proxy-Authenticate	Via
Content-Language	Proxy-Authentication-Info	WWW-Authenticate
Content-Length	Proxy-Authorization	
Content-Location	Proxy-Require	

6.4.2 Mapped headers

The following RTSP headers may be mapped to [ITU-T H.248].

6.4.2.1 Accept

The MGC should know the content types that are acceptable for the RTSP method response. However, if the MGC is unaware of the content types it may alternatively perform an ITU-T H.248 AuditCapabilities.req on the MG to determine the allowable application types.

6.4.2.2 Accept-ranges

The Accept-Ranges information may be determined by performing a CHOOSE wildcard on the Range Format (*rf*) parameter in a RTSP Play (*rtspp/play*), Signal Pause (*sp/pause*), Data Delivery Speed Adjustment Speed (*ddsa/spd*), and/or Playback Relative Scale Adjustment Scale (*prsa/scl*) signals.

6.4.2.3 Bandwidth

The Bandwidth header may be mapped to "Bandwidth parameter (b=)" in SDP carried by [ITU-T H.248].

6.4.2.4 Blocksize

The block size header may be mapped to the Media Block Size (*mbs/size*) property.

6.4.2.5 Expires

If the MGC requires media resource expiry information it should set the URI of the applicable resource on the MG via the Media Resource Identifier (*mri/spec*) property. The MGC may either CHOOSE wildcard via Add.req or Modify.req or perform an AuditValue.req on the Media Resource Description Expiry Date and Time (*mrde/dt*) property.

6.4.2.6 Location

It is expected that the MGC will use this for any re-directs. As discussed in clause 6.1.10 this may be based on information provided by the MG.

6.4.2.7 Media-properties

The MGC may use this information to control the play state when issuing an RTSP play signal to the MG. The Media properties change, that the MG requires, can be acquired by the notification of the Media Properties (*mp*) parameter in RTSP Play package.

6.4.2.8 Media-range

It is expected that the MGC will use this for the indication of the available media ranges. See clause 12.2 for the detection of the change that the MG requires.

6.4.2.9 Mtag

If the MGC requires the information for populating the mtag header, then it should use "SDP a=mtag:?" in an ITU-T H.248 Add.req or Modify.req to determine the value from the MG.

6.4.2.10 Range

Range is supported in [ITU-T H.248] depending on the METHOD and functionality required. See text in clauses 12.3.1.1.4, 13.3.1.1.4, 14.3.1.1.4, and 15.3.1.1.4 on how range maps to the Play Range (*plyrng*), Pause Range (*pr*), and Range (*rng*) parameters.

6.4.2.11 Retry-after

The MGC may provide this information based on provisioned values and MG outage information from ITU-T H.248 ServiceChange.req commands or Notify.req commands with MG overload indications (e.g., through the use of [ITU-T H.248.10] or [ITU-T H.248.11]).

NOTE – The inclusion of a specific ServiceChange Outage Time is for further study and may be included in subsequent [ITU-T H.248.1] versions.

6.4.2.12 RTP-info

The ssrc, seq and rtptime values may be determined by performing a CHOOSE wildcard via an Add.req or Modify.req on the RTP Information Synchronization Source (*rtpinfo/ssrc*), RTP

Information Sequence Number (*rtpinfo/seq*) and RTP Information Timestamp (*rtpinfo/ts*) properties respectively.

6.4.2.13 Scale

The Scale header maps to the on the Playback Scale (ps) parameter in a RTSP Play (*rtspp/play*) and or a Playback Scale (*ps*) parameter in the Playback Relative Scale Adjustment Scale (*prsa/scl*) signal. See clauses 12.6 and 15.6 for procedural information.

6.4.2.14 Seek-style

The Seek-Style header maps to the Seek Behaviour (*sb*) parameter in a RTSP Play (*rtspp/play*) signal. See clause 12.6 for procedural information.

6.4.2.15 Speed

The Speed header maps to the Data Speed (*ds*) parameter in a RTSP Play (*rtspp/play*) and or the Data Speed (*ds*) parameter in the Data Delivery Speed Adjustment Speed (*ddsa/spd*) signal. See clauses 12.6 and 14.6 for procedural information.

6.4.2.16 Terminate-Reason

Typically, the MGC may provide the information in the header to a user without MG involvement. However, the "time" parameter may be populated as a result of the MGC receiving a ServiceChange command with a "Graceful" ServiceChangeDelay parameter.

6.4.2.17 Transport

The MGC may interact with the MG via Add, Modify and Move commands to determine/set the transport parameters in the Local and Remote descriptors. [ITU-T H.248] supports over specification to allow for preferential lists of parameters.

General parameters

Unicast | multicast: The MGC may provide this to the MG via SDP in ITU-T H.248 Add.req, Modify.req or Move.req. An IPv4 address range 224.0.0.0 to 239.255.255.255 or an IPv6 address starting with FF indicates a multicast address. If a multicast address is used it is the responsibility of the MG to allocate a unicast IP address and join the multicast group through an applicable protocol, e.g., Internet group management protocol (IGMP). Likewise, at subtraction it is the responsibility of the MG to remove the unicast address from the multicast group.

If the MG is unable to allocate an IP address, error code 445 "Unsupported or Unknown Property" is returned.

Layers: Multicast layers are supported by the SDP c=line (for an IP multicast address).

Destination: The MGC may provide this to the MG via SDP in ITU-T H.248 Add.req, Modify.req or Move.req.

Source: It is expected that the MGC will provide this to the MG via SDP in ITU-T H.248 Add.req, Modify.req or Move.req.

Mode: It is expected that the MGC will be able to map a mode to the relevant ITU-T H.248 request.

Multimedia Internet keying (MIKEY): [ITU-T H.248.77] discusses the use of secure RTP in split MGC/MGs.

Interleaved: Interleaving is supported by the RTSP Interleaving (rtspint) package.

Ttl: Multicast time to live (TTL) is supported by the SDP c= line.

RTP parameters

The synchronization source may be specified through the use of Synchronization Source Property in clause 16.1.1. RTCP-mux may be specified via an SDP attribute in the ITU-T H.248 Local and Remote descriptors.

Connection oriented transport parameters

The values associated with parameters "setup" and "connection" have no direct information element in the ITU-T H.248 protocol. However, the MGC may provide an equivalent interworking. For example: for "connection" the MGC may utilise an existing ITU-T H.248 stream rather than assigning a new one with a new connection address.

6.4.2.18 Unsupported

It is expected the MGC will handle this. There may be some interaction with the MG via the ITU-T H.248 error codes i.e., 440, 443-446.

7 Media resource identification package

Package name: Media Resource Identification

Package ID: mri (0x00d5)

Description: This package allows the MGC to identify a Media Resource that is operated on by the current or subsequent command.

Version: 1

Extends: None

7.1 Properties

7.1.1 Specification

Property name: Specification

Property ID: spec (0x0001)

Description: This property allows the MGC to specify a Media Resource which it currently or subsequently performs an operation on.

Type: String

Possible values: As per **`RTSPMediaResourceSpec`** of RTSP Media Resource Syntax (*mrs*) package.

Optionally **`AnnouncementSpec`** in clause 6.2.5 of [ITU-T H.248.9] may be supported in addition.

Default: None

Defined in: TerminationState or LocalControl

Characteristics: ReadWrite

7.2 Events

None.

7.3 Signals

None.

7.4 Statistics

None.

7.5 Error codes

None.

7.6 Procedures

An MGC may determine the Media Resource syntax that is supported by an MG/Termination through auditing packages. If the RTSP Media Resource Syntax (*mrs*) package is supported by the MG, the MGC can assume that the RTSP URI/internationalized resource identifier (IRI) syntax may be used to describe a Media Resource. If the Basic Announcement Syntax (*bannsyx*) package is supported, the announcement syntax may be also used to describe a Media Resource.

However, the MGC through auditing packages is unable to determine the individual properties of a Media Resource. If the MGC requires additional information (e.g., range, expiry) or wants to adjust detailed parameters (e.g., scale, speed) of a particular Media Resource, it shall firstly set the Specification property of the Media Resource Identification package (*mri/spec*) to the Media Resource that will be used in its subsequent operating instruction to the MG regarding that Media Resource.

When the MGC performs an operation on a particular Media Resource via sending an Add, Modify or Move command request, it shall set the *mri/spec* property in this command request to identify the Media Resource. The MG shall then associate the Media Resource Identifier indicated by this property with that Media Resource, and respond with information about the Media Resource to the MGC via a corresponding command reply.

Subsequently, the MGC may use additional packages/properties with above Media Resource Identifier to determine information or adjust parameters regarding that particular Media Resource. While the Media Resource Identifier is provided a non-"None" value by the MGC in a request, then all responses from the MG for that request shall pertain to the Media Resource identified by that value.

The *mri/spec* property may be set on a Stream (of a Termination) level, an Individual Termination level or the Root Termination level. This allows the operation regarding the Media Resource to be scoped according to usage. If the *mri/spec* property is set on the Termination/Stream level, any subsequent operation should also pertain to the instance of this property on the Termination/Stream level.

If the *mri/spec* property is set on the higher (e.g., Root Termination) level and subsequent operation pertains to the instance of this property on lower (e.g., Individual Termination) level, the MG should process it based on the setting of the property on the lower level.

8 Range format support package

Package name: Range Format Support

Package ID: rfs (0x00d6)

Description: This package allows the MGC and the MG to exchange which range format/s they respectively support for the particular media resources that have range information associated with them.

Version: 1

Extends: None

8.1 Properties

8.1.1 Format types

Property name: Format Types

Property ID: ft (0x0001)

Description: This property describes the range formats that may be supported.

Type: Sub-list of String

Possible values:

NPT	Normal play time (NPT) format is supported
SMPTE	Society of motion picture and television engineers (SMPTE) format with the default (29.97 fps) frame rate is supported
SMPTE-30	SMPTE format with the 30 fps frame rate is supported
SMPTE-25	SMPTE format with the 25 fps frame rate is supported
UTC	Coordinated universal time (UTC) clock format is supported
Frame	Frame number format is supported
Byte	Byte number format is supported
Bit	Bit number format is supported
Word	Word number format is supported
Sentence	Sentence number format is supported
Paragraph	Paragraph number format is supported
None	No range information is associated with the Media Resource

NOTE – The use of type String allows the use of extension tokens without the need to open the package.

Default: Provisioned

Defined in: TerminationState or LocalControl

Characteristics: ReadWrite

8.2 Events

None.

8.3 Signals

None.

8.4 Statistics

None.

8.5 Error codes

None.

8.6 Procedures

Media resources may have range information associated with them. This range information may be in formats such as: NPT, SMPTE with typical frame rate, UTC, Frame, Byte, Bit, Word, Sentence and Paragraph.

– NPT indicates the stream absolute position relative to the beginning of the presentation (see section 4.4.2 of [IETF RFC 7826]);

– SMTPE expresses time relative to the start of the clip for frame-level access accuracy (see section 4.4.1 of [IETF RFC 7826]);

– UTC (clock) is used to express an absolute time (see section 4.4.3 of [IETF RFC 7826]);

– Frame, Byte and Bit indicate the position respectively in frame, byte and bit number of the presentation/clip;

– Word, Sentence and Paragraph indicate the position respectively in word, sentence and paragraph units of the text/script.

When the MGC wishes to exchange the range format support capabilities about a particular media resource with the MG, it shall set the Format Type property of the Range Format Support package (*rfs/ft*) in the Add, Move or Modify command request regarding to that media resource. The MGC shall set the value of the *rfs/ft* property to a list of the range formats it requests (i.e., it supports). The MG shall then determine the list of range formats to be used by the media resource, and respond via the *rfs/ft* property in the corresponding command reply to the MGC. The MG may determine the range format support by determining the intersection between the one requested by the MGC and the one supported by the MG itself.

When the MGC wishes to know what range format a particular media resource supports from the MG, it shall either set the *rfs/ft* property with "CHOOSE ($)" wildcard value in the Add, Move or Modify command request, or perform an AuditCapabilities command request of the *rfs/ft* property regarding to that media resource. The MG shall then respond with the *rfs/ft* property containing a list of range formats supported by the media resource in the corresponding command reply to the MGC.

Where an MGC wishes to exchange or know the range format support capabilities about a particular instance of media resource, it shall set the Specification property of the Media Resource Identifier package (*mri/spec*) with the *rfs/ft* property in the above Add, Modify or Move command request.

9 Media resource description expiry package

Package name: Media Resource Description Expiry

Package ID: mrde (0x00d7)

Description: This package allows the MGC to determine when the description of a particular media resource should be considered stale.

Version: 1

Extends: None

9.1 Properties

9.1.1 Date and time

Property name: Date and Time

Property ID: dt (0x0001)

Description: This property indicates the date and time of the expiry of the media resource description.

Type:	String
Possible values:	The format is a full date and time as defined by section 3.3 of [IETF RFC 5322]. See section 18.22 of [IETF RFC 7826] for more details.
Default:	Provisioned
Defined in:	TerminationState or LocalControl
Characteristics:	ReadOnly

9.2 Events

None.

9.3 Signals

None.

9.4 Statistics

None.

9.5 Error codes

None.

9.6 Procedures

Media resources may be described through the use of a "presentation" description which may be sent to (and through) various network entities. These "presentation" descriptions commonly use SDP [IETF RFC 4566] as a means to describe the characteristics of the media resource. When these "presentation" descriptions pass through the network they may be cached by intermediate network entities or the endpoint. However, the descriptions of the media resources may change with time due to changes of provisioning or dynamic changes of low-level information and thus the original "presentation" description becomes stale. By indicating the expiry information associated with the "presentation" description, it allows the network entities to be aware for how long the media resource description is valid. See section 18.22 of [IETF RFC 7826] for more information how an expiry information may be used.

As it is the MG that contains the media resources, the MGC may not be aware of the expiry information associated with a particular media resource.

When the MGC wishes to know the expiry information associated with a particular media resource from the MG, it shall either set the Date and Time property of the Media Resource Description Expiry package (*mrde/dt*) property with "CHOOSE ($)" wildcard value in the Add, Move or Modify command request, or perform AuditValue command request of the *mrde/dt* property regarding to that media resource. The MG shall then respond via the *mrde/dt* property with the expiry information related to that media resource in the corresponding command reply to the MGC.

When an MGC wishes to know the expiry information associated with a particular instance of media resource, it shall synchronously set the Specification property of the Media Resource Identifier package (*mri/spec*) with the *mrde/dt* property in the above Add, Modify or Move command request.

If the *mrde/dt* property is set on a Termination/Stream without the Media Resource Identifier and there are multiple Media Resources on the Termination/Stream, the MG shall respond with error code 472 "Required Information Missing".

10 Media block size package

Package name: Media Block Size

Package ID: mbs (0x00d8)

Description: This package allows the MGC to request the MG to use a particular media packet size when delivering media from a Termination/Stream.

Version: 1

Extends: None

10.1 Properties

10.1.1 Size

Property name: Size

Property ID: size (0x0001)

Description: This property allows the MGC to request a particular media packet size. The media packet size does not include lower-layer headers such as IP, user datagram protocol (UDP), or RTP.

Type: Integer

Possible values: Any positive number of Octets

Default: Provisioned dependent on media format/type

Defined in: TerminationState or LocalControl

Characteristics: ReadWrite

10.2 Events

None.

10.3 Signals

None.

10.4 Statistics

None.

10.5 Error codes

None.

10.6 Procedures

An MGC may be requested by a client entity to provide a particular media packet size. The media packet size shall be provided to the MG via the use of the Size property of the Media Block Size (*mbs/size*) package. The MG may freely use a media packet size which is lower than the one requested. The MG may truncate this media packet size to the closest multiple of the minimum, media-specific block size, or override it with a media-specific size if necessary. No ITU-T H.248 error response is returned if the value is overridden. Then the MG shall return the actual media packet size it uses to the MGC. See section 18.10 of [IETF RFC 7826] for further information.

When an MGC requests that all media on a particular Termination use a specific media packet size the *mbs/size* property should be provided in the TerminationState descriptor. Where only a particular

stream should use a specific media packet size the *mbs/size* property should be provided in the LocalControl descriptor.

If an MGC performs a "CHOOSE ($)" wildcard on the *mbs/size* property, the MG should provide the media packet size value. However, if it is unable to do so due to the media description (i.e., Local and Remote) being insufficient, error code 472 "Required Information Missing" should be returned.

11 RTSP media resource syntax package

Package name: RTSP Media Resource Syntax

Package ID: mrs (0x00d9)

Description: This package exists only to indicate that the MG is capable of processing the RTSP URI syntax described herein. An MGC learns that the capability is supported by auditing the packages supported by the Termination on which RTSP playout is to be performed and verifying that this package is listed.

NOTE – The syntax of "RTSPMediaResourceSpec" described below is aligned with the [ITU-T H.248.9] "Basic Announcement Syntax" package syntax for provisioned segments described by "announcementSpec". This is in order that generic packages such as the "Signal Pause" package may have applicability to various Media Resource syntaxes.

Version: 1

Extends: None

11.1 Properties

None.

11.2 Events

None.

11.3 Signals

None.

11.4 Statistics

None.

11.5 Error codes

None.

11.6 Procedures

11.6.1 General structure

An RTSP Media Resource is identified through the use of an URI that whose syntax is restricted as compared to [IETF RFC 3986]. Section 3.2 of [IETF RFC 3986] describes the use of URIs and IRIs with respect to RTSP. The clauses below describe the encoding of the RTSP URIs and IRIs which respect to ITU-T H.248 signal parameters and properties. IRIs can be mapped to URI using the procedures defined in section 3 of [IETF RFC 3987].

11.6.1.1 ASN.1 encoding

In the ASN.1 encoding, the general signal parameter syntax is ultimately constrained by the VALUE production of Annex A of [ITU-T H.248.1]. Parameter values are double-wrapped with an inner basic encoding rules (BER) applied first to aid interpretation of the parameter, followed by an outer BER encoding as an OCTET STRING. The general structure of the basic RTSP media resource specification syntax for purposes of the inner encoding is expressed as follows:

```
RTSPMediaResourceSpec ::= IA5String
```

The details of the string structure are as specified in the remainder of clause 11.6; they are equally applicable to text and ASN.1 encoding.

11.6.1.2 Text encoding

In the text encoding, the detailed signal parameter syntax is ultimately constrained by the VALUE production of Annex B of [ITU-T H.248.1]. The augmented Backus-Naur form (ABNF) [IETF RFC 5234] description of the gross structure of an announcement specification is as follows:

```
RTSPMediaResourceSpec = DQUOTE segSpec DQUOTE
  ; DQUOTE and COMMA are as defined in Annex B/H.248.1.

segSpec = keyword "=" "<" spec ">" ; angle brackets as delimiters

keyword = "sid"           ; provisioned segment identifier

spec    = provSegSpec     ; provisioned segment identifier
```

The quotedString form of VALUE is required for RTSPMediaResourceSpec because a segSpec can contain restricted characters (e.g., =, <, > as shown above), and because successive segSpecs are comma-separated. However, the VALUE production requires escapes for the following:

– All control characters (%x00-%x1F and %x7F) except TAB (%x09);

– The DQUOTE character (%x22).

Escaping within URIs must be performed as "percent-encoding" described in [IETF RFC 3986]. Escaping within stand-alone voice variable specifications uses the same mechanism as [IETF RFC 3986], but applies only to the characters listed above, the percent sign "%" (which is used as an escape character), and the closing angle bracket ">" (which terminates a variable value). (This is currently a non-issue, since neither "%" as a non-escape character nor ">" will be found within any variable value defined in this Recommendation.)

Keywords in the text-encoded syntax are case-insensitive. Case sensitivity within URIs is defined by the applicable standards.

11.6.2 Provisioned segment specifications

A provisioned segment specification consists of a URI formed under the rules of [IETF RFC 3986]. This Recommendation supports three URI schemes:

– 1) the rtsp scheme, 2) the rtsps scheme, 3) the rtspu scheme:

  The rtsp schemes are used to indicate resources for the primary purpose of streaming delivery of the resource to a client. The differences of these schemes are with regards to the RTSP protocol itself, i.e., "rtsps" relates to its transport of transport layer security (TLS), "rtspu" relates to its transport over UDP and "rtsp" relates to its transport over transmission control protocol (TCP).

In accordance with [IETF RFC 3986], the following characters must be escaped within all URIs:

– Reserved characters within the individual URI schemes;

– The space character;
– Characters used as delimiters or for escaping: "<", ">", "#", "%", and <">;
– Characters subject to unwanted transformations or subject to misinterpretation: "{", "}", "|", "\", "^", "[", "]", and "`".

11.6.2.1 Text encoding

This clause provides a detailed description of the provSegSpec production which is referred to in clause 6.2.5.1.2 of [ITU-T H.248.9].

```
provSegSpec = rtspurl

rtspurl = RTSP-URI
     ; See clause 20.2.1/[IETF RFC 7826] for the
     ; syntax related to URIs using the rtsp, rtsps and rtspu schemes.
```

12 RTSP play package

Package name: RTSP Play

Package ID: rtspp (0x00da)

Description: This package is used to playout a particular media resource with the specified parameters.

Version: 1

Extends: None

12.1 Properties

None.

12.2 Events

12.2.1 End-of-stream notification event

Event name: End-of-Stream Notification

Event ID: eos (0x0001)

Description: This event enables the MGC to be notified when the playout of a media resource has ended or is nearing completion.

12.2.1.1 EventsDescriptor parameters

None.

12.2.1.2 ObservedEventsDescriptor parameters

12.2.1.2.1 End range

Parameter name: End Range

Parameter ID: er (0x0001)

Description: This parameter indicates the point in the stream or streams where delivery is/are ending with the timescale that has been used by the client in the PLAY request being fulfilled.

Type: String

Optional: No

Possible values: `Range = ranges-spec`

The ABNF syntax is defined in section 20.2.3 of [IETF RFC 7826].

NOTE – The above syntax omits **`"Range" HCOLON`** as it is unnecessary for ITU-T H.248 encoding. The syntax also allows the use of a "Quoted String" form. If this is used the double quote character should be represented by \%x22.

Default: None

12.2.1.2.2 RTP synchronization source

Parameter name: RTP Synchronization Source

Parameter ID: ssrc (0x0002)

Description: This property allows the MGC to receive the synchronization source information if RTP is used as media transport. See section 13.5.1 of [IETF RFC 7826].

Type: String

Optional: Yes

Possible values: `ssrc = 8 * HEXDIG`

Encoded as per Annex B.2 of [ITU-T H.248.1].

Default: None

12.2.1.2.3 RTP sequence number

Parameter name: RTP Sequence Number

Parameter ID: seq (0x0003)

Description: This property allows the MGC to receive the last sequence number that applies to the RTP stream. See section 13.5.1 of [IETF RFC 7826].

Type: Integer

Optional: Yes

Possible values: 0 to 65535

Default: None

12.2.1.2.4 RTP timestamp

Parameter name: RTP Timestamp

Parameter ID: ts (0x0004)

Description: This property allows the MGC to receive the RTP timestamp value corresponding to the end time that applies to the RTP stream. See section 13.5.1 of [IETF RFC 7826].

Type: String

Optional: Yes

Possible values: Unsigned Integer

Default: None

12.2.1.2.5 Media resource identifier

Parameter name: Media Resource Identifier

Parameter ID: mri (0x0005)

Description: The identifier of the media resource that is streaming.

Type: String

Optional: Yes

Possible values: As per **`RTSPMediaResourceSpec`** of RTSP Media Resource Syntax (*rmrs*) package.

Default: None

12.2.1.2.6 Request ID

Parameter name: Request ID

Parameter ID: rid (0x0006)

Description: This parameter indicates to which play request the event is associated. See clause 7.1.11 of [ITU-T H.248.1].

Type: Integer

Optional: Yes

Possible values: 1-4294967295

Default: None

12.2.2 Media properties and range change event

Event name: Media Properties and Range Change

Event ID: mprc (0x0002)

Description: This event enables the MGC to be notified when the media properties (see section 18.29 of [IETF RFC 7826]) or the media range (see section 18.30 of [IETF RFC 7826]) requires change.

12.2.2.1 EventsDescriptor parameters

12.2.2.1.1 Time progressing interval

Parameter name: Time Progressing Interval

Parameter ID: tpi (0x0001)

Description: Specifies the time interval for *mprc* event notifications in the case of time progressing media. See section 13.5.2 of [IETF RFC 7826].

Type: Integer

Optional: Yes

Possible values: 0 upwards in seconds.

Default: 300 seconds.

12.2.2.2 ObservedEventsDescriptor parameters

12.2.2.2.1 Media properties

Parameter name: Media Properties

Parameter ID: mp (0x0001)

Description: Indicates the media properties change that the MG requires.

Type: String

Optional: No

Possible values: As per **`media-prop-list`** in section 20.2.3 of [IETF RFC 7826]

Default: None

12.2.2.2.2 Media range

Parameter name: Media Range

Parameter ID: mr (0x0002)

Description: This parameter indicates the media range change that the MG requires.

Type: String

Optional: Yes

Possible values: As per **`ranges-list`** in section 20.2.3 of [IETF RFC 7826]

Default: None

12.2.2.2.3 Media resource identifier

Parameter name: Media Resource Identifier

Parameter ID: mri (0x0003)

Description: The identifier of the media resource that is streaming.

Type: String

Optional: Yes

Possible values: As per **`RTSPMediaResourceSpec`** of RTSP Media Resource Syntax (*rmrs*) package.

Default: None

12.2.2.2.4 Request ID

Parameter name: Request ID

Parameter ID: rid (0x0004)

Description: This parameter indicates to which play request the event is associated. See clause 7.1.11 of [ITU-T H.248.1].

Type: Integer

Optional: Yes

Possible values: 1-4294967295

Default: None

12.2.3 Scale Change Event

Event name: Scale Change

Event ID: sc (0x0003)

Description: This event enables the MGC to be notified when the MG detects that it will be unable to continue to provide content at the current scale. See section 13.5.3 of [IETF RFC 7826].

12.2.3.1 EventsDescriptor parameters

12.2.3.1.1 Enable scale change

Parameter name: Enable Scale Change

Parameter ID: esc (0x0001)

Description: This parameter enables or disables the autonomous scale change capability when scale adjustment is desired.

Type: Boolean

Optional: Yes

Possible values: OFF (0x0000): Autonomous scale change is not allowed
ON (0x0001): Autonomous scale change is enabled

Default: OFF

12.2.3.1.2 Media resource identifier

Parameter name: Media Resource Identifier

Parameter ID: mri (0x0002)

Description: The identifier of the media resource that is streaming.

Type: String

Optional: Yes

Possible values: As per **`RTSPMediaResourceSpec`** of RTSP Media Resource Syntax (*rmrs*) package.

Default: None

12.2.3.1.3 Request ID

Parameter name: Request ID

Parameter ID: rid (0x0003)

Description: This parameter indicates to which play request the event is associated. See clause 7.1.11 of [ITU-T H.248.1].

Type: Integer

Optional: Yes

Possible values: 1-4294967295

Default: None

12.2.3.2 ObservedEventsDescriptor parameters

12.2.3.2.1 Scale change

Parameter name: Scale Change

Parameter ID: sc (0x0001)

Description: If the Enable Scale Change (*esc*) parameter is set to ON, this parameter indicates the scale that the MG has adopted after the change; if the *esc* parameter is set to OFF, it indicates the scale that the MG wants to change to.

Type: String

Optional: Yes

Possible values:

```
Scale Change = FLOAT
POS-FLOAT    = 1*12DIGIT ["." 1*9DIGIT]
FLOAT        = ["-"] POS-FLOAT
```

The ABNF syntax is defined in section 20.2.3 of [IETF RFC 7826].

Default: 1

12.2.3.2.2 Scale range

Parameter name: Scale Range

Parameter ID: sr (0x0002)

Description: This parameter indicates the media time at which the change took effect with the timescale that has been used by the client in the play request being fulfilled.

Type: String

Optional: Yes

Possible values:

```
Range = ranges-spec
```

The ABNF syntax is defined in section 20.2.3 of [IETF RFC 7826].

NOTE – The above syntax omits **"Range" HCOLON** as it is unnecessary for ITU-T H.248 encoding. The syntax also allows the use of a "Quoted String" form. If this is used the double quote character should be represented by \%x22.

Default: None

12.2.3.2.3 RTP synchronization source

Parameter name: RTP Synchronization Source

Parameter ID: ssrc (0x0003)

Description: This property allows the MGC to receive the synchronization source information if RTP is used as media transport. See section 13.5.1 of [IETF RFC 7826].

Type: String

Optional: Yes

Possible values:

```
ssrc = 8 * HEXDIG
```

Encoded as per Annex B.2 of [ITU-T H.248.1].

Default: None

12.2.3.2.4 RTP sequence number

Parameter name: RTP Sequence Number

Parameter ID: seq (0x0004)

Description: This property allows the MGC to receive the sequence number corresponding to the point of change that applies to the RTP stream. See section 13.5.1 of [IETF RFC 7826].

Type: Integer

Optional: Yes

Possible values: 0 to 65535

Default: None

12.2.3.2.5 RTP timestamp

Parameter name: RTP Timestamp

Parameter ID: ts (0x0005)

Description: This property allows the MGC to receive the RTP timestamp value corresponding to the point of change that applies to the RTP stream. See section 13.5.1 of [IETF RFC 7826].

Type: String

Optional: Yes

Possible values: Unsigned Integer

Default: None

12.2.3.2.6 Media resource identifier

Parameter name: Media Resource Identifier

Parameter ID: mri (0x0006)

Description: The identifier of the media resource that is to be streamed.

Type: String

Optional: Yes

Possible values: As per **`RTSPMediaResourceSpec`** of RTSP Media Resource Syntax (*rmrs*) package.

Default: None

12.2.3.2.7 Request ID

Parameter name: Request ID

Parameter ID: rid (0x0007)

Description: This parameter indicates to which play request the event is associated. See clause 7.1.11 of [ITU-T H.248.1].

Type: Integer

Optional: Yes

Possible values: 1-4294967295

Default: None

12.3 Signals

12.3.1 Play

Signal name: Play

Signal ID: play (0x0001)

Description: Plays an RTSP Media Resource.

SignalType: Brief

Duration: Not applicable to Brief signals

12.3.1.1 Additional parameters

12.3.1.1.1 Media Resource identifier

Parameter name: Media Resource Identifier

Parameter ID: mri (0x0001)

Description: The identifier of the media resource that is to be streamed.

Type: String

Optional: Yes

Possible values: As per **`RTSPMediaResourceSpec`** of RTSP Media Resource Syntax (*rmrs*) package.

Default: None

12.3.1.1.2 Playback scale

Parameter name: Playback Scale

Parameter ID: ps (0x0002)

Description: The playback relative scale of media resource specifiable as a positive (faster) or negative (slower) variation from the normal playback speed.

For more information on playback scale see section 18.44 of [IETF RFC 7826].

NOTE – The functionality of the Playback Scale parameter is otherwise known as "play speed".

Type: String

Optional: Yes

Possible values:

```
Playback Scale = FLOAT
POS-FLOAT      = 1*12DIGIT ["." 1*9DIGIT]
FLOAT          = ["-"] POS-FLOAT
```

The ABNF syntax is defined in section 20.2.3 of [IETF RFC 7826].

Default: 1

12.3.1.1.3 Direction

Parameter name: Direction

Parameter ID: di (0x0003)

Description: The direction parameter can be used to indicate the direction that the RTSP media stream is to be sent.

Type: Enumeration

Optional: Yes

NOTE – The implementation of this parameter is optional in ITU-T ITU-T H.248.1v3 implementations as signal direction is supported as part of the core protocol.

Possible values: Ext (0x01): indicates that the RTSP media stream is sent from the MG to an external point

Int (0x02): indicates that the RTSP media stream is played into the MG to the other terminations

Both (0x03): indicates internal and external behaviour

Default: *Ext (0x01)*

12.3.1.1.4 Play range

Parameter name: Play Range

Parameter ID: pr (0x0004)

Description: This parameter is used to indicate the playout range information of the media resource associated with the signal.

Type: String

Optional: Yes

Possible values: **`Range = ranges-spec`**

The ABNF syntax is defined in section 20.2.3 of [IETF RFC 7826].

NOTE – The above syntax omits **`"Range" HCOLON`** as it is unnecessary for ITU-T H.248 encoding. The syntax also allows the use of a "Quoted String" form. If this is used the double quote character should be represented by \%x22.

Default: None

12.3.1.1.5 Range format

Parameter name: Range Format

Parameter ID: rf (0x0005)

Description: This parameter is used to indicate the range format used in the range information related to the URI parameter in this signal.

Type: String

Optional: Yes

Possible values: As per the Format Type property of the Range Format Support package (*rfs/ft*).

NOTE – The use of type String allows the use of extension tokens without the need to open the package.

Default: NPT

12.3.1.1.6 Data speed

Parameter name: Data Speed

Parameter ID: ds (0x0006)

Description: This parameter allows the MGC to instruct the MG to deliver the media resource at a specified data speed. The bandwidth required to deliver the media resource may need to be altered. For more information on data delivery speed see section 18.50 of [IETF RFC 7826].

Type: String

Optional: Yes

Possible values: **`Speed = lower-bound MINUS upper-bound`**

The ABNF syntax is defined in section 20.2.3 of [IETF RFC 7826].

NOTE – The above syntax omits **"Range" HCOLON** as it is unnecessary for ITU-T H.248 encoding.

Default: 1-1

12.3.1.1.7 Media properties

Parameter name: Media Properties

Parameter ID: mp (0x0007)

Description: Indicates the media properties that the MGC requires. May be used with wildcard CHOOSE in order to determine the media properties from the MG.

Type: String

Optional: No

Possible values: As per **media-prop-list** in section 20.2.3 of [IETF RFC 7826]

Default: None

12.3.1.1.8 Seek behaviour

Parameter name: Seek Behaviour

Parameter ID: sb (0x0008)

Description: This parameter can be used to indicate the seek preference of where to start the media stream when performing a random access. See more details of seek behaviours in section 18.47 of [IETF RFC 7826].

Type: Enumeration

Optional: Yes

Possible values:

RAP (0x0001)	indicates to the MG to locate and start play from the closest previous random access point of the media stream
FP (0x0002)	indicates to the MG to start delivery with the media unit that has a playout time first prior to the requested time
Next (0x0003)	indicates to the MG to start from the next media unit after the provided start time
CoRap (0x0004)	is a variant of the RAP behaviour. See section 18.45 of [IETF RFC 7826] for a definition of the behaviour

Default: RAP (0x0001)

12.4 Statistics

None.

12.5 Error codes

None.

12.6 Procedures

The MGC invokes the Play signal of the RTSP Play package (*rtspp/play*) with at least the Media Resource Identifier (*mri*) parameter set to playout the specified RTSP media resource. RTSP media resource playout is subject to termination by Events or new Signals descriptor settings in the normal way. The MGC can use the standard signal NotifyCompletion capability to determine when and why playout has ended.

The MGC may also specify the range of the RTSP media resource that should be played through the use of the Play Range (*pr*) parameter. The MG shall then play the content indicated by the *pr* parameter from the MGC, and return the actual range of the RTSP media resource it is playing via the *pr* parameter to the MGC. The MGC or the MG may use the Range Format (*rf*) parameter to indicate the format of the information in the *pr* parameter. When the MGC sends a Play signal with the Play Range (*pr*) parameter to perform a random access to the media, the MGC may use the Seek Behaviour (*sb*) parameter to specify the access and seek preference of where to start media delivery. If the MGC requires a specific seek style, then it shall send on one seek value. If the MGC has a preference for a certain style it should send a list of values with the preferred value in the first list position. Where a list is provided the MG shall return the actual seek policy of the media it adopted to the MGC.

The MGC may set an initial playback relative scale and/or data delivery speed through the use of the Playback Scale (*ps*) and Data Speed (*ds*) respectively. In order to control the media play state, the MGC may also specify (or request) the Media Properties (*mp*) parameter to indicate the Media properties, including the Random Access, Retention, and Content Modifications of the media resource. See section 18.29 of [IETF RFC 7826] for the detailed properties.

If the MGC needs the range information associated with the RTSP media resource, it should "CHOOSE ($)" wildcard the *pr* parameter. The MG shall then return the range of the RTSP media resource via the *pr* parameter. If the MGC requires specified range format, it shall use the *rf* parameter.

The MGC indicates the related events on the MG to detect the changes of the media play state, when the change is detected, the MG would notify the event to the MGC. There are three types of events specified:

1) The End-of-Stream Notification Event (*eos*) is used to notify the MGC that the media has ended or will be complete in the near future. The Signal Completion Event can be used to indicate the termination of the play signal, but the *eos* event may occur before the end of the media to enable the MGC to acquire associated parameters, including the End Range of the media and the RTP related information if RTP is used.

2) The MGC orders the Media Properties and Range Change Event to acquire the changes of the media properties and media range that the MG requires, which is carried by the Media Properties (*mp*) and Media Range (*mr*) parameters. The Time Progressing Interval (*tpi*) parameter provides the time interval of the notification. Based on the reported *mprc* Event, the MGC may issue an update play signal to specify the new properties.

3) The Scale Change Event enables the MGC to be notified when the MG detects that a scale adjustment is needed. The MGC may use the Media Resource Identifier (*mri*) and Request ID (*rid*) parameters to specify the instance that the event applies. When setting this event on the MG, the MGC may enable the autonomous scale change capability via Enable Scale Change (*esc*) parameter. If the *esc* parameter is set to 'ON', the MG changes the scale value autonomously and notifies the new scale value and media range time where the change took effect to the MGC. If the *esc* parameter is set to 'OFF', the MG cannot make the change without the MGC's indication. The MG should notify the MGC of the scale value that it wants to change to, which may then specify the adjusted scale value via an update RTSP play signal.

In both of the above two cases, RTP-related parameters should also be notified if RTP is used.

In the case that the MGC uses multiple RTSP play signals on the termination it should use a Signal RequestID. If used the MG shall return the RequestID with the event to indicate the signal request that is associated. Unlike SignalCompletion the signal id is not needed because it will always be linked to the play RTSP signal.

13 Signal pause package

Package name: Signal Pause

Package ID: sp (0x00db)

Description: This package allows the MGC to request the MG to pause the playout of a particular signal. This generic package may be applied to a diverse range of signals.

Version: 1

Extends: None

13.1 Properties

None.

13.2 Events

None.

13.3 Signals

13.3.1 Pause

Signal name: Pause

Signal ID: pause (0x0001)

Description: This signal allows the MGC to request an MG to pause the playout of signals.

SignalType: On/Off

Duration: Not applicable to On/Off signals

13.3.1.1 Additional parameters

13.3.1.1.1 Signal identity

Parameter name: Signal Identity

Parameter ID: sigid (0x0001)

Description: The Signal Identity parameter allows an MGC to pause the playout of a Signal with the indicated signal identity.

Type: Octet String

Optional: Yes

Possible values: For *text encoding* a Package Name / Signal ID encoded as per **`pkgdName`** in Annex B.2 of [ITU-T H.248.1]

For *binary encoding* a Package Name / Signal ID encoded as per **`SignalName`** in Annex A.2 of [ITU-T H.248.1]

Default: None

13.3.1.1.2 Signal list identity

Parameter name: Signal List Identity

Parameter ID: listid (0x0002)

Description: The Signal List Identity parameter allows an MGC to pause the playout of a Signal List with the indicated signal list identity.

Type: Integer

Optional: Yes

Possible values: 0 to 65535

Default: None

13.3.1.1.3 Media resource identifier

Parameter name: Media Resource Identifier

Parameter ID: mri (0x0003)

Description: The Media Resource Identifier parameter allows the MGC to indicate the media resource that a pause should be applied to.

Type: String

Optional: Yes

Possible values: As per **`RTSPMediaResourceSpec`** of RTSP Media Resource Syntax (*mrs*) package.

Optionally **`AnnouncementSpec`** in clause 6.2.5 of [ITU-T H.248.9] may be supported in addition.

Default: None

13.3.1.1.4 Pause range

Parameter name: Pause Range

Parameter ID: pr (0x0004)

Description: This parameter allows the MGC to request the MG to return the point at which the playout of a signal was interrupted and what part of the signal remains unplayed.

Type: String

Optional: Yes

Possible values: **`Range = ranges-spec`**

The ABNF syntax is defined in section 20.2.3 of [IETF RFC 7826].

NOTE – The above syntax omits **`"Range" HCOLON`** as it is unnecessary for ITU-T H.248 encoding. The syntax also allows the use of a "Quoted String" form. If this is used the double quote character should be represented by \%x22.

Default: None

13.3.1.1.5 Range format

Parameter name: Range Format

Parameter ID: rf (0x0005)

Description: This parameter indicates the range information format that shall be used with this signal.

Type: String

Optional: Yes

Possible values: As per the Format Type property of the Range Format Support package (*rfs/ft*).

NOTE – The use of type String allows the use of extension tokens without the need to open the package.

Default: NPT

13.4 Statistics

None.

13.5 Error codes

13.5.1 Unable to pause the playout of the signal

Error Code #: 475

Name: Unable to pause the playout of the signal

Definition: The MG has been unable to pause the playout of the signal referenced by the Pause signal of the Signal Pause package.

Error Text in the Error Descriptor: The signal identity of the applicable signal encoded as per clause 13.3.1.1.1.

Comment: The signal referenced by the Pause signal continues to playout.

13.6 Procedures

13.6.1 Pausing signal playout

An MGC may be requested by a client entity to halt the delivery of a media component in such a way that the media is paused at a particular point in order for the media delivery to start again from that point at some time in the future.

The use of Stream mode set to "RecvOnly" fulfils the objective of stopping media flow but does not maintain this playout state information. Stopping a signal by turning a signal off or replacing the Signals descriptor has the effect of stopping the media flow but does not maintain the playout state information either.

In order to halt media delivery (which was started as an result of the operating of a certain Signal) and maintain the pause point information, the MGC shall send the Pause signal of the Signal Pause Package (*sp/pause*) to the MG. The MGC shall include existing Signals/SignalLists as well as the *sp/pause* signal in the Signal Descriptor in order to maintain the playout (albeit paused) of the Signal. This makes use of the ITU-T H.248 capability where multiple Signals are played simultaneously (see clause 7.1.11 of [ITU-T H.248.1]).

If the *sp/pause* signal is set by the MGC at a Termination or Stream level without the Signal Identity (*sigid*), Signal List Identity (*listid*) or Media Resource Identifier (*mri*) parameter then the MG shall pause the playout of all signals on that Termination or Stream.

If the *sp/pause* signal is set by the MGC at a Termination or Stream level with the *sigid* or *listid* parameter then the MG shall pause the playout of the signal indicated by the *sigid* parameter or the entire signal list indicated by the *listid* parameter on that Termination or Stream.

If the *sp/pause* signal is set by the MGC with the *mri* parameter then the MG shall pause the playout of the signal(s) associated with the media resource.

If the *sp/pause* signal is set by the MGC with the *mri* parameter and the *sigid* or *listid* parameter then the MG shall pause the playout of the signal(s) associated with the media resource and indicated by the *sigid* or *listid* parameter.

If the MG detects a mismatch between the *sigid*/*listid* parameter and the Signal/SignalList playout on that Termination/Stream or associated with the media resource indicated by the *mri* parameter then it should return error code 473 "Conflicting Property Values".

NOTE 1 – In some cases there may be more than one instance of a Signal Identity or Signal List Identity for a Termination/Stream in these cases the MGC should use the *mri* parameter to uniquely identify the signal instance.

NOTE 2 – An MGC may determine the Media Resource Resource syntax that is supported by an MG/Termination through auditing packages. If the RTSP Media Resource Syntax (*mrs*) package is supported the MG can assume that the RTSP URI/IRI syntax may be used to describe a media resource. If the Basic Announcement Syntax (*bannsyx*) package is supported announcement syntax may be also used to describe a media resource.

The MG should not release media resources associated with the signal(s) that are paused. However, the MGC may stop the playing Signal(s) if it determines it is necessary. In this case the MGC should remove the playing Signal(s) as well as the *sp/pause* signal.

If the MG is unable to pause the signal(s) indicated by the *sp/pause* signal, then it should respond with error code 475 "Unable to pause the playout of the signal". The referenced signal(s) should continue to playout.

13.6.2 Requesting pause information

An MGC may be requested to provide information associated with the pause point and the range regarding the media yet to playout. This information can then be used in later communication to restart the playout from the pause point or at a point later in the remaining media range. To request the pause information, the MGC should do a "CHOOSE ($)" wildcard on the Pause Range (*pr*) parameter. The MG shall then return the range information in the format indicated by the Range Format (*rf*) parameter. See section 13.6 of [IETF RFC 7826] for an example use of Pause Point information. If multiple media resources/streams are in use, this may need to multiple pause point information being returned. If the *sp/pause* signal affects multiple media resources and the *pr* parameter is requested, then the MG should return the common range information for all the media resources. If the MG is unable to determine which pr parameter values should be returned, it should issue error code 473 "Conflicting Property Values".

13.6.3 Restarting after a pause

When the MGC wants resume the playout of the signal(s) from the pause point it should remove the relevant instance of the *sp/pause* signal from the Signal Descriptor. The MG shall then continue to play the signal(s) related to the removed *sp/pause* signal from the saved pause point.

The MGC may also request that playout should resume from another point, in this case the MGC should remove the *sp/pause* signal and the signal(s) related to the removed *sp/pause* signal and re-issue the signal(s) with new range information.

14 Data delivery speed adjustment package

Package name: Data Delivery Speed Adjustment

Package ID: ddsa (0x00dc)

Description: This package allows the MGC to request the MG to alter the data delivery speed of a particular signal. This is a generic package that may be applied to a diverse range of signals related to media playout.

Version: 1

Extends: None

14.1 Properties

None.

14.2 Events

None.

14.3 Signals

14.3.1 Speed

Signal name: Speed

Signal ID: spd (0x0001)

Description: This signal allows the MGC to alter the data delivery speed of a particular signal.

SignalType: On/Off

Duration: Not applicable to On/Off signals

14.3.1.1 Additional parameters

14.3.1.1.1 Signal identity

Parameter name: Signal Identity

Parameter ID: sigid (0x0001)

Description: The Signal Identity parameter allows an MGC to alter the data delivery speed to the playout of a Signal with the indicated signal identity.

Type: Octet String

Optional: Yes

Possible values: For text encoding a Package Name / Signal ID encoded as per **`pkgdName`** in Annex B.2 of [ITU-T H.248.1].

For binary encoding a Package Name / Signal ID encoded as per **`SignalName`** in Annex A.2 of [ITU-T H.248.1].

Default: None

14.3.1.1.2 Signal list identity

Parameter name: Signal List Identity

Parameter ID: listid (0x0002)

Description: The Signal List Identity parameter allows an MGC to alter the data delivery speed to the playout of a Signal List with the indicated identity.

Type: Integer

Optional: Yes

Possible values: 0 to 65535

Default: None

14.3.1.1.3 Media resource identifier

Parameter name: Media Resource Identifier

Parameter ID: mri (0x0003)

Description: The Media Resource Identifier parameter allows the MGC to indicate the media resource whose data delivery speed should be altered.

Type: String

Optional: Yes

Possible values: As per **`RTSPMediaResourceSpec`** of RTSP Media Resource Syntax (*mrs*) package.

Optionally **`AnnouncementSpec`** in clause 6.2.5 of [ITU-T H.248.9] may be supported in addition.

Default: None

14.3.1.1.4 Range

Parameter name: Range

Parameter ID: rng (0x0004)

Description: This parameter is used to indicate the adjusting range information of the media resource associated with the signal.

Type: String

Optional: Yes

Possible values: **`Range = ranges-spec`**

The ABNF syntax is defined in section 20.2.3 of [IETF RFC 7826].

NOTE – The above syntax omits **`"Range" HCOLON`** as it is unnecessary for ITU-T H.248 encoding. The syntax also allows the use of a "Quoted String" form. If this is used the double quote character should be represented by \%x22.

Default: None

14.3.1.1.5 Range format

Parameter name: Range Format

Parameter ID: rf (0x0005)

Description: This parameter indicates the range information format that shall be used with this signal.

Type: String

Optional: Yes

Possible values: As per the Format Type property of the Range Format Support package (*rfs/ft*).

NOTE – The use of type String allows the use of extension tokens without the need to open the package.

Default: NPT

14.3.1.1.6 Data speed

Parameter name: Data Speed

Parameter ID: ds (0x0006)

Description: This parameter allows the MGC to instruct the MG to deliver the media resource at an adjusted data speed. The bandwidth required to deliver the media resource may need to be altered. For more information on data delivery speed see section 18.50 of [IETF RFC 7826].

Type: String

Optional: Yes

Possible values: **`Speed = lower-bound MINUS upper-bound`**

The ABNF syntax is defined in section 20.2.3 of [IETF RFC 7826].

NOTE – The above syntax omits **`"Range" HCOLON`** as it is unnecessary for ITU-T H.248 encoding.

Default: 1-1

14.4 Statistics

None.

14.5 Error codes

14.5.1 Unable to adjust the data delivery speed of the signal

Error Code #: 476

Name: Unable to adjust the data delivery speed of the signal

Definition: The MG has been unable to adjust the data delivery speed of the signal referenced by the Speed signal of the Data Delivery Speed Adjustment package.

Error Text in the Error Descriptor: The signal identity of the applicable signal encoded as per clause 14.3.1.1.1.

Comment: The signal referenced by the Speed signal continues to playout.

14.6 Procedures

14.6.1 Adjusting data delivery speed

An MGC may be requested by a client entity to adjust the data delivery speed (i.e., delivery bandwidth) of a playing media resource associated with a particular signal.

The MGC may audit packages to determine if data delivery speed adjustment is supported by the MG.

If the MGC initiates the playout of a new signal with an altered data delivery speed, it shall use an appropriate Play signal (e.g., *rtspp/play*) that contains a Data Speed parameter. Likewise if the MGC requires a range change and a data delivery speed adjustment is shall use an appropriate Play signal.

An MGC shall use the Data Delivery Speed Adjustment (*ddsa*) package when it wants to adjust the data delivery speed of a now playing signal.

In order to change the data delivery speed of a certain Signal, the MGC shall send the Speed signal of Data Delivery Speed Adjustment package (*ddsa/spd*) to the MG. The MGC shall include existing Signals/SignalLists as well as the *ddsa/spd* signal in the Signal Descriptor in order to maintain the playout (albeit with an altered data delivery speed) of the Signal. This makes use of the ITU-T H.248 capability where multiple Signals are played simultaneously (see clause 7.1.11 of [ITU-T H.248.1]).

If the *ddsa/spd* signal is set by the MGC at a Termination or Stream level without Signal Identity (*sigid*), Signal List Identity (*listid*) or Media Resource Identifier (*mri*) parameter then the MG shall alter the data delivery speed of all signals on that Termination or Stream.

If the *ddsa/spd* signal is set by the MGC at a Termination or Stream level with the *sigid* or *listid* parameter then the MG shall alter the data delivery speed of the signal indicated by the *sigid* parameter or the entire signal list indicated by the *listid* parameter on that Termination or Stream.

If the *ddsa/spd* signal is set by the MGC with the *mri* parameter then the MG shall alter the data delivery speed of the signal identified or the signal(s) associated with the media resource.

If the *ddsa/spd* signal is set by the MGC with the *mri* parameter and the *sigid* or *listid* parameter then the MG shall alter the data delivery speed of the signal(s) associated with the media resource and indicated by the *sigid* or *listid* parameter.

If the MG detects a mismatch between the *sigid*/*listid* parameter and the Signal/SignalList playout on that Termination/Stream or associated with the media resource indicated by the *mri* parameter then it should return error code 473 "Conflicting Property Values".

NOTE 1 – In some cases there may be more than one instance of a Signal Identity or Signal List Identity for a Termination/Stream in these cases the MGC should use the *mri* parameter to uniquely identify the signal instance.

NOTE 2 – An MGC may determine the Media Resource Resource syntax that is supported by an MG/Termination through auditing packages. If the RTSP Media Resource Syntax (*mrs*) package is supported the MG can assume that the RTSP URI/IRI syntax may be used to describe a media resource. If the Basic Announcement Syntax (*bannsyx*) package is supported announcement syntax may be also used to describe a media resource.

The MG shall alter the data delivery speed according to the Data Speed (*ds*) parameter from the MGC, and may respond with the actual data delivery speed it is using via the *ds* parameter to the MGC. See section 18.50 of [IETF RFC 7826] for an example of how Speed adjustment is used. If the MG is unable to support the *ds* parameter value provided by the MGC, it may return error code 449 "Unsupported or Unknown Parameter or Property Value" or in the case the MG supports an alternate value it may return this value via the *ds* parameter in the response.

The MGC may overwrite the *ddsa/spd* signal with an updated *ds* parameter in which case the MG shall apply the new data delivery speed.

If the MG is unable to adjust the data delivery speed indicated by the *ddsa/spd* signal then it should respond with error code 476 "Unable to adjust the data delivery speed of signal". The referenced signal should continue to playout in a current manner.

14.6.2 Requesting range information

An MGC may be requested to provide range information associated with the data speed adjusted signal playout. To request the range information, the MGC should do a "CHOOSE ($)" wildcard on the Range (*rng*) parameter. The MG shall then return the time range information in the format indicated by the Range Format (*rf*) parameter. See section 13.4 of [IETF RFC 7826] for an example use of range information. If multiple media resources/streams are in use, this may lead to multiple range information being returned. If the *ddsa/spd* signal affects multiple media resources and the *rng* parameter is requested, then the MG should return the common range information for all the media resource. If the MG is unable to determine which *rng* parameter values should be returned, it should issue error code 473 "Conflicting Property Values".

14.6.3 Normal data delivery

When the MGC wants to revert back to the normal data delivery speed, it should remove the relevant instance of the *ddsa/spd* signal from the Signal Descriptor. The MG shall then continue to play the signal(s) related to the removed *ddsa/spd* at a normal data delivery speed.

15 Playback relative scale adjustment package

Package name: Playback Relative Scale Adjustment

Package ID: prsa (0x00dd)

Description: This package allows the MGC to request the MG to alter the playback relative scale of a particular signal. "Relative Scale" is otherwise known as "play speed". This is a generic package that may be applied to a diverse range of signals related to media playout.

Version: 1

Extends: None

15.1 Properties

None.

15.2 Events

None.

15.3 Signals

15.3.1 Scale

Signal name: Scale

Signal ID: scl (0x0001)

Description: This signal allows the MGC to alter the playback relative scale of a particular signal.

SignalType: On / Off

Duration: Not applicable to on / off signals

15.3.1.1 Additional parameters

15.3.1.1.1 Signal identity

Parameter name: Signal Identity

Parameter ID: sigid (0x0001)

Description: The Signal Identity parameter allows an MGC to alter the playback relative scale of a Signal with the indicated signal identity.

Type: Octet String

Optional: Yes

Possible values: For text encoding a Package Name / Signal ID encoded as per **`pkgdName`** in Annex B.2 of [ITU-T H.248.1].

For binary encoding a Package Name / Signal ID encoded as per **`SignalName`** in Annex A.2 of [ITU-T H.248.1].

Default: None

15.3.1.1.2 Signal list identity

Parameter name: Signal List Identity

Parameter ID: listid (0x0002)

Description: The Signal List Identity parameter allows an MGC to alter the playback relative scale of a Signal List with the indicated identity.

Type: Integer

Optional: Yes

Possible values: 0 to 65535

Default: None

15.3.1.1.3 Media resource identifier

Parameter name: Media Resource Identifier

Parameter ID: mri (0x0003)

Description: The Media Resource Identifier parameter allows the MGC to indicate the media resource whose playback relative scale should be altered.

Type: String

Optional: Yes

Possible values: As per **`RTSPMediaResourceSpec`** of RTSP Media Resource Syntax (*mrs*) package.

Optionally **`AnnouncementSpec`** in clause 6.2.5 of [ITU-T H.248.9] may be supported in addition.

Default: None

15.3.1.1.4 Range

Parameter name: Range

Parameter ID: rng (0x0004)

Description: This parameter is used to indicate the adjusting range information of the media resource associated with the signal.

Type: String

Optional: Yes

Possible values: **`Range = ranges-spec`**

The ABNF syntax is defined in section 20.2.3 of [IETF RFC 7826].

NOTE – The above syntax omits **`"Range" HCOLON`** as it is unnecessary for ITU-T H.248 encoding. The syntax also allows the use of a "Quoted String" form. If this is used the double quote character should be represented by \%x22.

Default: None

15.3.1.1.5 Range format

Parameter name: Range Format

Parameter ID: rf (0x0005)

Description: This parameter indicates the range information format that shall be used with this signal.

Type: String

Optional: Yes

Possible values: As per the Format Type property of the Range Format Support package (*rfs/ft*).

NOTE – The use of type String allows the use of extension tokens without the need to open the package.

Default: NPT

15.3.1.1.6 Playback scale

Parameter name: Playback Scale

Parameter ID: ps (0x0006)

Description: This parameter allows the MGC to instruct the MG to deliver the media resource at an adjusted playback relative scale.

The playback relative scale of a signal is specifiable as a positive (faster) or negative (slower) variation from the normal playback speed.

For more information on playback scale see section 18.44 of [IETF RFC 7826].

Type: String

Optional: Yes

Possible values:

```
Playback Scale = FLOAT
POS-FLOAT      = 1*12DIGIT ["." 1*9DIGIT]
FLOAT          = ["-"] POS-FLOAT
```

The ABNF syntax is defined in section 20.2.3 of [IETF RFC 7826]. A ratio of the normal playback speed.

Default: 1

15.3.1.1.7 Playback scale delta

Parameter name: Playback Scale Delta

Parameter ID: psd (0x0007)

Description: As per the Playback Scale parameter this parameters allows the MGC to instruct the MG to deliver the media resource at an adjusted playback relative scale. The scale delta provided by this parameter is relative to the current playback speed.

Type: String

Optional: Yes

Possible values:

```
Playback Scale = FLOAT
POS-FLOAT      = 1*12DIGIT ["." 1*9DIGIT]
FLOAT          = ["-"] POS-FLOAT
```

The ABNF syntax is defined in section 20.2.3 of [IETF RFC 7826].

A ratio of the current playback speed.

Default: 1

15.3.1.1.8 Restart

Parameter name: Restart

Parameter ID: rs (0x0008)

Description: This parameter can be used to indicate the behaviour when the playout of a rewind operation reaches the beginning of the media or a fast forward operation reaches the end of the media.

Type: Enumeration

Optional: Yes

Possible values: ST (0x01): indicates to the MG to stop playing media. This will result in Scale signal completion.

RS (0x02): indicates to the MG to play the media from the beginning

LB (0x03): indicates to the MG to loop back to the end of the media and to start rewinding; or, in the case of fast forward, to loop back to the start of the media and start fast forwarding.

Default: ST (0x01)

15.4 Statistics

None.

15.5 Error codes

15.5.1 Unable to adjust the playback relative scale of the signal

Error Code #: 477

Name: Unable to adjust the playback relative scale of the signal

Definition: The MG has been unable to adjust the playback relative scale of the signal referenced by the Scale signal of the Playback Relative Scale Adjustment package.

Error Text in the Error Descriptor: The signal identity of the applicable signal encoded as per clause 15.3.1.1.1.

Comment: The signal referenced by the Scale signal continues to playout.

15.6 Procedures

15.6.1 Adjust playback relative scale

An MGC may be requested by a client entity to adjust the playback relative scale (i.e., play speed) of a playing media resource associated with a particular signal.

The MGC may audit packages to determine if playback relative scale adjustment is supported by the MG.

If the MGC initiates the playout of a new signal with an altered playback relative scale, it shall use an appropriate Play signal (e.g., *rtspp/play*) that contains a Playback Scale parameter. Likewise if the MGC requires a range change and a playback relative scale adjustment is shall use an appropriate Play signal.

An MGC shall use the Playback Relative Scale Adjustment (*prsa*) package when it wants to adjust the playback relative scale of a now playing signal.

In order to change the playback relative scale of a certain Signal the MGC shall send the Scale signal of the Playback Relative Scale Adjustment Scale package (*prsa/scl*) to the MG. The MGC shall include existing Signals/SignalLists as well as the *prsa/scl* signal in the Signal Descriptor in order to maintain the playout (albeit with an altered playback relative scale) of the Signal. This makes use of the ITU-T H.248 capability where multiple Signals are played simultaneously (see clause 7.1.11 of [ITU-T H.248.1]).

If the *prsa/scl* signal is set by the MGC at a Termination or Stream level without Signal Identity (*sigid*), Signal List Identity (*listid*) or Media Resource Identifier (*mri*) parameter then the MG shall alter the playback relative scale of all signals on that Termination or Stream.

If the *prsa/scl* signal is set by the MGC at a Termination or Stream level with the *sigid* or *listid* parameter then the MG shall alter the playback relative scale of the signal indicated by the *sigid* parameter or the entire signal list indicated by the *listid* parameter on that Termination or Stream.

If the *prsa/scl* signal is set by the MGC with the *mri* parameter then the MG shall alter the playback relative scale of the signal identified or the signal(s) associated with the media resource.

If the *prsa/scl* signal is set by the MGC with the *mri* parameter and the *sigid* or *listid* parameter then the MG shall alter the playback relative scale of the signal(s) associated with the media resource and indicated by the *sigid* or *listid* parameter.

If the MG detects a mismatch between the *sigid*/*listid* parameter and the Signal/SignalList playout on that Termination/Stream or associated with the media resource indicated by the *mri* parameter then it should return error code 473 "Conflicting Property Values".

NOTE 1 – In some cases there may be more than one instance of a Signal Identity or Signal List Identity for a Termination/Stream in these cases the MGC should use the *mri* parameter to uniquely identify the signal instance.

NOTE 2 – An MGC may determine that Media Resource Resource syntax that is supported by an MG/Termination through auditing packages. If the RTSP Media Resource Syntax (*mrs*) package is supported the MG can assume that the RTSP URI/IRI syntax may be used to describe a media resource. If the Basic Announcement Syntax (*bannsyx*) package is supported announcement syntax may be also used to describe a media resource.

The MG shall alter the playback relative scale according to the Playback Scale (*ps*) or the Playback Scale Delta (*psd*) parameter from the MGC, and may respond with the actual playback relative scale it is using via the *ps* or *psd* parameter to the MGC. The MGC shall not use both parameters in a signal. See section 18.46 of [IETF RFC 7826] for an example of how Scale adjustment is used. If the MG is unable to support the *ps* parameter value provided by the MGC, it may return error code 449 "Unsupported or Unknown Parameter or Property Value" or in the case the MG supports an alternate value it may return this value via the *ps* parameter in the response.

When the MGC instructs the MG to perform a rewind or fast forward operation it may send the Restart (*rs*) parameter to specify the restart behaviour. If the playback reaches the very beginning or end of the media stream, the MG will deal with the media stream depending on the indication of the *rs* parameter.

NOTE 3 – A rewind operation is indicated by sending the Scale signal with a negative value for the Playback Scale (*ps*) or Playback Scale Delta (*psd*) parameter.

The MGC may overwrite the *prsa/scl* signal with an updated *ps* parameter in which case the MG shall apply the new playback relative scale.

If the MG is unable to adjust the playback relative scale indicated by the *prsa/scl* signal, then it should respond with error code 477 "Unable to adjust the playback relative scale of the signal". The referenced signal should continue to playout in the current manner.

15.6.2 Requesting range information

The procedures of clause 14.6.2 apply with *ddsa/spd* changed to *prsa/scl*.

15.6.3 Normal data delivery

The procedures of clause 14.6.3 apply with *ddsa/spd* changed to *prsa/scl*.

16 RTP information package

Package name: RTP Information

Package ID: rtpinfo (0x00de)

Description: This package allows the MGC to request information regarding an RTP stream from an MG.

Version: 1

Extends: None

16.1 Properties

16.1.1 Synchronization source

Property name: Synchronization Source

Property ID: ssrc (0x0001)

Description: This property allows the MGC to request the synchronization source that applies to the RTP stream. See "Synchronization Source" section 5.1 of [IETF RFC 3550].

Type: String

Possible values: `ssrc = 8 * HEXDIG`

Encoded as per Annex B.2 of [ITU-T H.248.1].

Default: None

Defined in: LocalControl

Characteristics: ReadOnly

16.1.2 Sequence number

Property name: Sequence Number

Property ID: seq (0x0002)

Description: This property allows the MGC to request the sequence number of the first packet that applies to the RTP stream. See "Sequence Number" section 5.1 of [IETF RFC 3550] for more information.

Type: Integer

Possible values: 0 to 65535

Default: None

Defined in: LocalControl

Characteristics: ReadOnly

16.1.3 RTP timestamp

Property name: RTP Timestamp

Property ID: ts (0x0003)

Description: This property allows the MGC to request the RTP timestamp value corresponding to the start time that applies to the RTP stream. See "Timestamp" section 5.1 of [IETF RFC 3550] for more information.

Type: String

Possible values: Unsigned Integer

Default: None

Defined in: LocalControl

Characteristics: ReadOnly

16.2 Events

None.

16.3 Signals

None.

16.4 Statistics

None.

16.5 Error codes

None.

16.6 Procedures

An MGC may be required to provide RTP related information regarding a particular media stream to a client. An MGC may request the following information by issuing a "CHOOSE ($)" wildcard on the relevant property on the relevant stream:

– RTP Information Synchronization Source (*rtpinfo/ssrc*);

– RTP Information Sequence Number (*rtpinfo/seq*);

– RTP Information Timestamp (*rtpinfo/ts*).

The information returned by the MG as a result is as per section 18.45 of [IETF RFC 7826]. If the MG does not have sufficient information regarding the details of the stream (i.e., lacking information in the Local and Remote descriptors), the MG may return error code 472 "Required Information Missing".

If the MGC requires that the RTP information be scoped against a particular media resource (e.g., URI) then it should set the Specification property of the Media Resource Identifier package (*mri/spec*) to that particular media resource. The MG shall then use this media resource as an input to provide the relevant RTP information.

17 RTP interleaving package

Package name: RTP Interleaving

Package ID: rtpint (0x00df)

Description: This package allows the MGC to request that media stream packets be routed through the MGC instead of being transported directly between the MG and a remote endpoint of a particular media connection.

Version: 1

Extends: None

17.1 Properties

None.

17.2 Events

17.2.1 Outgoing data

Event name: Outgoing Data

Event ID: od (0x0001)

Description: This event indicates to the MG that outgoing media stream packets should be sent to the MGC rather than sent directly to the remote endpoint of a particular media connection.

17.2.1.1 EventsDescriptor parameters

17.2.1.1.1 Channel number

Parameter name: Channel Number

Parameter ID: cn (0x0001)

Description: This parameter indicates the Channel Number/s that should be used when generating the interleaved data blocks. See "Interleaved" in section 18.54 of [IETF RFC 7826].

Type: String

Optional: No

Possible values: cn = channel ["-" channel]

channel = 1*3DIGIT; 0 to 255

Default: None

17.2.1.2 ObservedEventsDescriptor parameters

17.2.1.2.1 Data block

Parameter name: Data Block

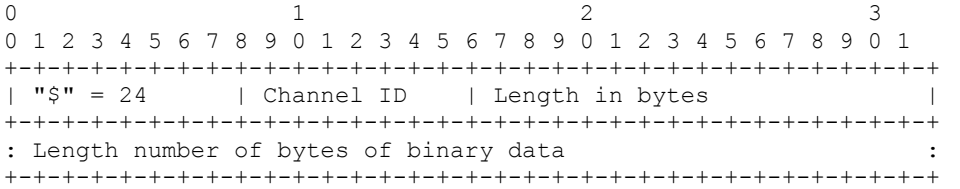
Parameter ID: db (0x0001)

Description: This parameter contains the data block sent from the MG to the MGC.

Type: Octet String

Optional: No

Possible values: The octet string is first encoded as per section 14 of [IETF RFC 7826], i.e.,



For text-encoded ITU-T H.248, clause B.3 of [ITU-T H.248.1] is then applied.

Default: None

17.2.1.2.2 Channel number

Parameter name: Channel Number

Parameter ID: cn (0x0002)

Description: This parameter indicates the Channel Number/s that actually be used when generating the interleaved data blocks. See "Interleaved" in section 18.54 of [IETF RFC 7826].

Type: String

Optional: Yes

Possible values: cn = channel ["-" channel]

channel = 1*3DIGIT; 0 to 255

Default: None

17.3 Signals

17.3.1 Incoming data

Signal name: Incoming Data

Signal ID: id (0x0001)

Description: This signal indicates to the MG that incoming media stream packets should be received via the MGC rather than received directly from the local endpoint of a particular media connection.

Signal Type: Brief

Duration: Not applicable to Brief signals

17.3.1.1 Additional parameters

17.3.1.1.1 Data block

Parameter name: Data Block

Parameter ID: db (0x0001)

Description: This parameter contains the data block received via the MGC to the MG.

Type: Octet String

Optional: No

Possible values: The octet string is first encoded as per section 14 of [IETF RFC 7826]. See clause 17.2.1.2.1 for an example. For text-encoded ITU-T H.248, clause B.3 of [ITU-T H.248.1] is then applied.

Default: None

17.3.1.1.2 Channel number

Parameter name: Channel Number

Parameter ID: cn (0x0002)

Description:	This parameter indicates the Channel Number/s that should be used when parsing the interleaved data blocks. See "Interleaved" in section 18.54 of [IETF RFC 7826].
Type:	String
Optional:	No
Possible values:	cn = channel ["-" channel] channel = 1*3DIGIT; 0 to 255
Default:	None

17.4 Statistics

None.

17.5 Error codes

None.

17.6 Procedures

Using ITU-T H.248 to transport Media Stream Data via an MGC with the peer endpoint of a media connection incurs considerable processing overhead. Therefore, it is not recommended that this method be used. An MGC may audit packages in order to determine if an MG supports this functionality.

When the MGC needs to indicate to the MG that a media stream (e.g., RTP data) should be embedded into the control stream (i.e., ITU-T H.248 message) for transport, it shall set the Outgoing Data event of the RTP Interleaving package (*rtpint/od*) and the Incoming Data signal of the RTP Interleaving package (*rtpint/id*) respectively for the media stream data outgoing from and incoming to the MG.

When the MGC has determined that media stream data outgoing from a Termination of the MG should be sent to the MGC rather than sent directly to the remote end of the media connection, it shall set the *rtpint/od* event on the Termination. If there are multiple streams associated with the Termination, the MGC shall set the event with the StreamID of the stream that the embedding applies to. The MGC shall also set the Channel Number (*cn*) parameter to indicate the channels number that should be used by the MG in the generating/encoding the interleaved data block.

On reception of the *rtpint/od* event the MG shall send all related outgoing media stream data (i.e., RTP and RTCP packets) to the MGC via the ObservedEvent instead of sending it directly to the remote endpoint of a particular media connection. The MG shall generate/encode the related outgoing media stream data into the Data Block (*db*) parameter using the Channel Number indicated by the *cn* parameter from the MGC according to section 14 of [IETF RFC 7826]. The MG shall also return the actual used Channel Number via *cn* parameter to the MGC if it is different to the one requested by the MGC.

If the *rtpint/od* event is removed, then media stream data sending reverts back to normal.

When the MGC has determined that media stream data incoming to a Termination of the MG should be received via the MGC rather than received directly from the local endpoint of a particular media connection, it should send the *rtpint/id* signal to the Termination. Where there are multiple streams associated with the Termination, the MGC shall set the signal with the StreamID of the stream that the embedding applies to. The MGC shall use the Data Block (*db*) parameter to contain the related incoming media stream data, and (if necessary) the Channel Number (*cn*) parameter to indicate the channels number should be used by the MG in the parsing/decoding the interleaved data block. The MG shall then parse/decode the related incoming media stream data with the Channel Number indicated by the *cn* parameter form the MGC according to section 14 of [IETF RFC 7826].

If the *rtpint/id* signal is removed, then media data reception reverts back to normal.

Normally both the incoming and the outgoing media stream data are embedded into the control stream to transport or not. However, there may be some exceptions.

Bibliography

[b-IETF RTSPANN] IETF draft-ietf-mmusic-rtsp-announce-01 (2005), *RTSP Announce Method*. <https://datatracker.ietf.org/doc/draft-ietf-mmusic-rtsp-announce/>

SERIES OF ITU-T RECOMMENDATIONS

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

Printed in Switzerland
Geneva, 2016