

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.248.39

(10/2014)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Communication
procedures

Gateway control protocol: ITU-T H.248 SDP parameter identification and wildcarding

Recommendation ITU-T H.248.39

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Recommendation ITU-T H.248.39

Gateway control protocol: ITU-T H.248 SDP parameter identification and wildcarding

Summary

Recommendation ITU-T H.248.39 describes the principles used to identify a single session description protocol (SDP) sub-field and how to apply wildcarding to that sub-field. The sub-field may be fully specified, wildcarded (CHOOSE "\$" or ALL "*") or not significant "-". Being able to identify a single sub-field is of use when requesting the media gateway (MG) to choose a parameter, specifying a range or for the purposes of auditing. Further specification of how SDP can be wildcarded will assist in interoperation between a media gateway controller (MGC) and an MG.

This revision incorporates guidelines for the wildcarding of source-specific media attributes. It also includes a package to indicate MG support for advanced wildcarding procedures that allow a MGC to request multiple SDP parameter values and/or multiple SDP lines to be returned in response to a CHOOSE request. Additionally, it allows the linking of multiple CHOOSE wildcards so that they return the same value. Furthermore, a new maintain value wildcard is introduced to allow the retention of a previously set value to avoid repetition of redundant information.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T H.248.39	2006-05-29	16	11.1002/1000/8819
2.0	ITU-T H.248.39	2014-10-14	16	11.1002/1000/12236

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

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Recommendation ITU-T H.248.39

Gateway control protocol: ITU-T H.248 SDP parameter identification and wildcarding

1 Scope

This Recommendation describes the principles to be used to identify a single session description protocol (SDP) sub-field and how to apply wildcarding to that sub-field. The sub-field may be fully specified, wildcarded (CHOOSE "\$" or ALL "**") or not significant "-" (see clause 5.2.2.2). Being able to identify a single sub-field is of use when requesting the MG to choose a parameter, specifying a range or for the purposes of auditing.

This Recommendation contains a package that allows a media gateway controller (MGC) to request multiple SDP parameter values and/or multiple SDP lines to be returned in response to a CHOOSE request. It also allows the linking of multiple CHOOSE wildcards so that they return the same value. A new "maintain value" wildcard, "~", is introduced, which is a short notation syntax (versus the fully specified SDP information) that allows performance optimization as well as the reduction of syntax errors (by avoiding the repetition of redundant information).

2 References

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

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

[ITU-T H.248.15] Recommendation ITU-T H.248.15 (2013), *Gateway control protocol: SDP H.248 package attribute*.

3 Definitions

3.1 Terms defined elsewhere

None.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ABNF	Augmented Backus–Naur Form
ATM	Asynchronous Transfer Mode
DTLS	Datagram Transport Layer Security
FFS	For further study
IP	Internet Protocol

LD	Local Descriptor
MG	Media Gateway
MGC	Media Gateway Controller
MIME	Multipurpose Internet Mail Extensions
RD	Remote Descriptor
RTCP	RTP Control Protocol
RTP	Real-time Transport Protocol
SDP	Session Description Protocol
SSRC	Synchronization Source
TLS	Transport Layer Security
UDP	User Datagram Protocol
VoATM	Voice over ATM
VoIP	Voice over IP

5 ITU-T H.248 wildcarding guiding principles

5.1 General ITU-T H.248 wildcarding principles

The overriding guidance provided by clause 7.1.8.1.1.1 of [ITU-T H.248.1] on the use of CHOOSE in the session description protocol (SDP) is: "the use of CHOOSE is allowed in place of a single parameter value".

Subsequent principles are:

- 1) In any SDP scheme each mandatory element SHALL therefore be represented by a single CHOOSE "\$".
- 2) Any part that contain text tokens (e.g., those in " ") that are mandatory SHALL also be included in the wildcard command.
- 3) Optional parts of an SDP scheme should not be included unless the wildcard or value applies to them.
- 4) When an item specifies a wildcard for a single sub-field, this applies to the nested augmented Backus–Naur form (ABNF) in that parameter.

5.2 Specific wildcarding principles for ITU-T H.248 embedded SDP

5.2.1 IETF SDP wildcards

The core SDP [b-IETF RFC 2327], as well as its successor [b-IETF RFC 4566], does *not* specify any wildcards. SDP lines are therefore always *fully specified*.

[b-ITU-T H.248.49] provides, *inter alia*, complementary information concerning relationship and usage of ITU-T H.248 and the various IETF RFCs on SDP.

5.2.2 SDP wildcards introduced by specifications other than ITU-T H.248.1

Wildcards are used (by the MGC) for *resource management* and/or the indication of particular *modes of operation* at the MG bearer level (aware versus agnostic). The scope of SDP wildcards in ITU-T H.248 messages is therefore limited to SDP media descriptions (see clause 7.1.8.1.1.2 of [ITU-T H.248.1]), within the Local Descriptor (LD) and the Remote Descriptor (RD).

5.2.2.1 Wildcard "-"

Wildcard "-", meaning "not significant" (or "agnostic", "unaware"), was introduced (in 2005) by the so-called "H.248 Ia profile version 1" (see clause 5.15 of [b-ETSI ES 283 018]), motivated by control needs in dedicated "IP-to-IP interworking modes" in border gateways (see clause G.2.2 of [b-ETSI TR 183 068]).

5.2.2.2 Wildcards "r", "l" and "[0-F]"

This Recommendation introduces the wildcarded value response "r", line response "l", interlinkage "[0-F]" and the maintain value "~" wildcards via the "Advanced SDP Wildcarding Package" (see clause 9).

6 Identification of single parameters

The clauses below define which parts of the SDP are classified as "single sub-fields (values)" for the purposes of ITU-T H.248.1 wildcarding. Each of these sub-fields may be fully specified, designated as CHOOSE "\$", designated as ALL "*", or designated as not significant "-". The sub-fields should not be partially wildcarded.

Each of the examples indicates what type of wildcarding is not valid. It also highlights some valid types of wildcarding and what should be returned.

NOTE 1 – For the purposes of the examples below, "?" is used to denote the potential wildcards:

- "\$" CHOOSE,
- "*" ALL,
- "-" "not significant". (See Note 2 below)

NOTE 2 – Not to be confused with clause B.2 of [ITU-T H.248.1] encoding for NULL Context (see also clause 5.2.2.2).

ABNF grammar, in subsequent clauses, is copied from Appendix A (SDP Grammar) of [b-IETF RFC 2327] and other IETF RFCs concerning SDP extensions.

NOTE 3 – Even though [b-IETF RFC 2327] is replaced by clause 9 of [b-IETF RFC 4566]), references to [b-IETF RFC 2327] have been used because [ITU-T H.248.1] specifies the use of this RFC for SDP.

6.1 Protocol version

Table 6-1 – Protocol version

SDP Specification:	
Definition: (Clause 6 of [b-IETF RFC 2327])	v= (protocol version)
ABNF: (Appendix A of [b-IETF RFC 2327])	proto-version = "v=" 1*DIGIT CRLF
ITU-T H.248/SDP encoding example with applied wildcarding:	Result:
v=?	Is valid. It would give v= 1*DIGIT The only parameter that may be wildcarded is 1*DIGIT.

6.2 Owner/Creator

Table 6-2 – Owner/Creator

SDP Specification:	
Definition: (Clause 6 of [b-IETF RFC 2327])	<code>o= (owner/creator and session identifier)</code>
ABNF: (Appendix A of [b-IETF RFC 2327])	<code>origin-field = "o=" username space sess-id space sess-version space nettype space addrtype space addr CRLF</code>
ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
<code>o=? o=? ? o=? ? ? o=? ? ? ? o=? ? ? ? ?</code>	Are all invalid. There are six mandatory parameters: "username", "sess-id", "sess-version", "nettype", "addrtype" and "addr".
<code>o=? ? ? ? ? ?</code>	Would return: <code>o=username sess-id sess-version nettype addrtype addr</code>

6.3 Session name

Table 6-3 – Session name

SDP Specification:	
Definition: (Clause 6 of [b-IETF RFC 2327])	<code>s= (session name)</code>
ABNF: (Appendix A of [b-IETF RFC 2327])	<code>session-name-field = "s=" text CRLF</code>
ITU-T H.248/SDP encoding example with applied wildcarding:	Result:
<code>s=?</code>	Is valid. It would give <code>s=text</code> The only parameter that may be wildcarded is "text".

6.4 URI of description

Table 6-4 – URI of Description

SDP Specification:	
Definition: (Clause 6 of [b-IETF RFC 2327])	u=* (URI of description)
ABNF: (Appendix A of [b-IETF RFC 2327])	uri-field = ["u=" uri CRLF] uri= ;defined in [b-IETF RFC 1630]
ITU-T H.248/SDP encoding example with applied wildcarding:	Result:
FFS.	—

6.5 Email address

Table 6-5 – Email address

SDP Specification:	
Definition: (Clause 6 of [b-IETF RFC 2327])	e=* (email address)
ABNF: (Appendix A of [b-IETF RFC 2327])	email-fields = *("e=" email-address CRLF) email-address = email email "(" email-safe ")" email-safe "<" email ">" email = ;defined in [b-IETF RFC 822]
ITU-T H.248/SDP encoding example with applied wildcarding:	Result:
FFS.	—

6.6 Phone number

Table 6-6 – Phone number

SDP Specification:	
Definition: (Clause 6 of [b-IETF RFC 2327])	p=* (phone number)
ABNF: (Appendix A of [b-IETF RFC 2327])	phone-fields = *("p=" phone-number CRLF) phone-number = phone phone "(" email-safe ")" email-safe "<" phone ">" phone = "+" POS-DIGIT 1*(space "-" DIGIT)
ITU-T H.248/SDP encoding example with applied wildcarding:	Result:
FFS.	—

6.7 Encryption key

Table 6-7 – Encryption key

SDP Specification:	
Definition: (Clause 6 of [b-IETF RFC 2327])	k=* (encryption key)
ABNF: (Appendix A of [b-IETF RFC 2327])	key-field = ["k=" key-type CRLF] key-type = "prompt" "clear:" key-data "base64:" key-data "uri:" uri key-data = email-safe "~" " There is one mandatory field "key-type".
ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
k=?	Would give k=key-type
k=?:?	Would give k=key-type:key-data where key-type is "clear" or "base64", k=key-type:uri where key-type is "uri".

6.8 Time description

Table 6-8 – Time description

SDP Specification:	
Definition: (Clause 6 of [b-IETF RFC 2327])	t= (time the session is active)
ABNF: (Appendix A of [b-IETF RFC 2327])	time-fields = 1*("t=" start-time space stop-time * (CRLF repeat-fields) CRLF) [zone-adjustments CRLF]
ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
t=?	Is invalid. There are two mandatory parameters "start-time" and "stop-time".
t=? ?	Would give t=start-time stop-time
NOTE – For repeat-fields and zone-adjustments see below.	

6.9 Repeat

Table 6-9 – Repeat

SDP Specification:	
Definition: (Clause 6 of [b-IETF RFC 2327])	r=* (zero or more repeat times)
ABNF: (Appendix A of [b-IETF RFC 2327])	repeat-fields = "r=" repeat-interval space typed-time 1*(space typed-time)
ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
r=?	Is invalid. There are two mandatory parameters "repeat-interval" and "typed-time".
r=? : ?	Would give r=repeat-interval typed-time
r=? ? ?	Would give r=repeat-interval typed-time typed-time

6.10 Time zone adjustments

Table 6-10 – Time zone adjustments

SDP Specification:	
Definition: (Clause 6 of [b-IETF RFC 2327])	z=* (time zone adjustments)
ABNF: (Appendix A of [b-IETF RFC 2327])	zone-adjustments = time space ["-"] typed-time *(space time space ["-"] typed-time)
ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
z=? z=? - z=-? z=? ? ?	Are invalid. There are two mandatory parameters "time" and "typed-time". These two parameters can be grouped multiple times thus an odd number of wildcards are invalid.
z=? ?	Would give z=time typed-time
z=? -?	Would give z=time -typed-time
z=? ? ? ?	Would give z=time typed-time time typed-time

6.11 Media description

Table 6-11 – Media description

SDP Specification:	
Definition: (Clause 6 of [b-IETF RFC 2327])	m= (media name and transport address)
ABNF: (Appendix A of [b-IETF RFC 2327])	media-field = "m=" media space port ["/" integer] space proto 1*(space fmt) CRLF
ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
m=? m=? ? m=? ?/? m=? /? m=? /? ?	Are invalid. There are four mandatory parameters "media", "port", "proto" and "fmt" and one optional parameter "integer" that may be wildcarded.
m=? ? ? ?	Would give m=media port proto fmt
m=? ?/? ? ?	Would give m=media port/integer proto fmt

Table 6-11 – Media description

SDP Specification:	
m=? ? ? ? ? ?	Would give m=media port proto fmt fmt This example is considering an "m=" line with multiple (here two) payload formats. See also clause 6.15.7
m=? ?/? ? ? ? ?	Would give m=media port/integer proto fmt fmt This example is considering an "m=" line with multiple (here two) payload formats. See also clause 6.15.7

6.12 Media title and session information

Table 6-12 – Media title and session information

SDP Specification:	
Definition: (Clause 6 of [b-IETF RFC 2327])	i=* (media title)
ABNF: (Appendix A of [b-IETF RFC 2327])	information-field = ["i=" text CRLF]
ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
i=?	Is valid. The only parameter that may be wildcarded is "text".
i=?	Would give z i=text

6.13 Connection information

Table 6-13 – Connection information

SDP Specification:	
Definition: (Clause 6 of [b-IETF RFC 2327])	c=* (connection information - optional if included at session-level)
ABNF: (Appendix A of [b-IETF RFC 2327])	connection-field = ["c=" nettype space addrtype space connection-address CRLF]
ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
c=? c=? ?	Are invalid. There are three mandatory parameters "nettype", "addrtype" and "connection-address" which may be wildcarded.
c=? ? ?	Would give c=nettype addrtype connection-address

6.14 Bandwidth information

Table 6-14 – Bandwidth information

SDP Specification:	
Definition: (Clause 6 of [b-IETF RFC 2327])	b=* (bandwidth information)
ABNF: (Appendix A of [b-IETF RFC 2327])	bandwidth-fields = *("b=" bwtype ":" bandwidth CRLF)
ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
b=?	Is invalid, as ? is only for one parameter value. There are two mandatory values "bwtype" and "bandwidth" which may be wildcarded.
b=? : ?	Would give b=bwtype:bandwidth

6.15 Attributes

Table 6-15 – Attributes

SDP Specification:	
Definition: (Clause 6 of [b-IETF RFC 2327])	a=* (zero or more media attribute lines)
ABNF: (Appendix A of [b-IETF RFC 2327])	attribute-fields = *("a=" attribute CRLF) attribute = (att-field ":" att-value) att-field
ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
a=? : a=? ?	Is invalid. There is one mandatory parameter "att-field" and one optional parameter "att-value".
a=?	Would give a=att-field This will only wildcard a single "a=value", e.g., "a=recvonly" or "a=sendrecv" or "a=sendonly".
a=? : ?	Would give a=att-field:att-value Depending on the value of the first parameter it may not be valid to wildcard the second value. The "att-value" field shall return all the mandatory parameters and may return the optional parameters associated with attribute type.
a=rtpmap:?	Should at least give: a=rtpmap:payload encodingname/clockrate and may give: a=rtpmap:payload encodingname/clockrate encodingparameters

Where multiple attributes of the same type are sent by the MGC, it should fully specify at least one of the parameters to uniquely identify the instance of the attribute, for example, the payload type in the rtpmap attribute.

For a description of wildcarding various "att-value" parameters, see the clauses below.

6.15.1 RTP map

Table 6-15.1 – RTP map

SDP Specification:	
Definition: (Clause 6 of [b-IETF RFC 2327])	–
ABNF: (Appendix A of [b-IETF RFC 2327])	a=rtpmap:<payload type> <encoding name>/<clock rate>[/<encodingparameters>]
ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
a=rtpmap:? ? a=rtpmap:? ?/ a=rtpmap:? ? ? a=rtpmap:? ?//?	Are invalid. There are three mandatory parameters "payload type", "encoding name", "clock rate" and one optional parameter "encodingparameters".
a=rtpmap:? ?/?	Would give a=rtpmap:payloadtype encodingname/clockrate
a=rtpmap:? ?/?/?	Would give a=rtpmap:payloadtype encodingname/clockrate/encoding parameters

6.15.2 Packetization time

Table 6-15.2 – Packetization time

SDP Specification:	
Definition: (Clause 6 of [b-IETF RFC 2327])	–
ABNF: (Appendix A of [b-IETF RFC 2327])	a=ptime:<packet time> There is one mandatory parameter "packet time".
ITU-T H.248/SDP encoding example with applied wildcarding:	Result:
a=ptime:?	Would give a=ptime:packettime

6.15.3 Parameter format

Table 6-15.3 – Parameter format

SDP Specification:	
Definition: (Clause 6 of [b-IETF RFC 2327])	–
ABNF: (Appendix A of [b-IETF RFC 2327])	a=fmtp:<format> <format specific parameters>
ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
a=fmtp:?	Is invalid as there are two mandatory parameters "format" and "format specific parameters".
a=fmtp:? ?	Would give a=fmtp:format formatspecificparameters

6.15.4 Path

Table 6-15.4 – Path

SDP Specification:	
Definition: (Clause 6 of [b-IETF RFC 2327])	–
ABNF: (Appendix A of [b-IETF RFC 2327])	a=path:" MSRP-URL *(SP MSRP-URL) msrp-scheme"://"[userinfo "@"] hostport ["/" session-id] ";" transport
ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
a=path:msrp://?	Is invalid as "?" is only for one parameter value. There are two mandatory values "hostport" and "transport".
a=path:msrp://?;?	Would give a=path:msrp://hostport;transport
a=path:msrp://?@?;?	Would give a=path:msrp://userinfo@hostport; transport
a=path:msrp://?/?;?	Would give a=path:msrp://hostport/session-id; transport
a=path:msrp://?@?/?;?	Would give a=path:msrp://userinfo@hostport/ session-id;transport

6.15.5 SDP ITU-T H.248 package attribute

Table 6-15.5 – SDP ITU-T H.248 package attribute

SDP Specification:	
Definition: (ITU-T H.248.15))	–
ABNF: (ITU-T H.248.15))	a=h248item:<package name>/<property name> = <value>
ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
a=h248item:? a=h248item:? ? a=h248item:? ? ? a=h248item:~/ =? a=h248item:? ?=?	Are invalid. There are three mandatory parameters "package name", "property name" and "value".
a=h248item:~/?=?	Would give a=h248item:packagename/ propertyname=value

6.15.6 RTCP attribute

Table 6-15.6 – RTCP attribute

SDP Specification:	
Definition: ([b-IETF RFC 3605])	–
ABNF: (Clause 2.1 of [b-IETF RFC 3605])	rtcp-attribute = "a=rtcp:" port [nettype space addrtype space connection-address] CRLF
ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
a=rtcp:? ? a=rtcp:? ? ?	Are invalid. There is one mandatory parameter "port". There are three optional parameters "nettype", "addrtype" and "connection-address" but all three must be included.
a=rtcp:?	Would give a=rtcp:port
a=rtcp:? ? ? ?	Would give a=rtcp:port nettype addrtype connection-address

6.15.7 Silence suppression attribute

The "silenceSupp" attribute is defined in clause 5.6.3.2 of [b-IETF RFC 3108]. This attribute may be used for enabling and disabling of silence suppression mode for voice codec types without embedded silence suppression support (e.g., [b-ITU-T G.711] or [b-ITU-T G.726]). This attribute may be also used for non-ATM bearer types like real-time transport protocol (RTP)/UDP/IP.

The "silenceSupp" attribute provides five optional sub-fields for parameterization of the silence suppression function. Their usage may depend on the ephemeral ITU-T H.248 Termination type, e.g., voice over IP (VoIP) may only use the <silenceSuppEnable> sub-field, whereas voice over ATM (VoATM) may use additional sub-fields (see explicit statement in clause 5.6 of [b-IETF RFC 3108]).

Table 6-15.7 – Silence suppression attribute

SDP Specification:	
Definition: (Clause 5.6.3.2 of [b-IETF RFC 3108])	–
ABNF: (Clause 5.6.3.2 of [b-IETF RFC 3108])	a=silenceSupp: <silenceSuppEnable> <silenceTimer> <suppPref> <sidUse> <fxnslevel>
ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
a=silenceSupp:? a=silenceSupp:? ? a=silenceSupp:? ? ? a=silenceSupp:? ? ? ?	Are invalid. There are five mandatory parameters "silenceSuppEnable", "silenceTimer", "suppPref", "sidUse" and "fxnslevel".
a=silenceSupp:? ? ? ? ?	Would give a=silenceSupp:silenceSuppEnable silenceTimer suppPref sidUse fxnslevel That means that the ITU-T H.248 MG would reply with the default value for "silenceSuppEnable". That default value may, for instance, be defined within an ITU-T H.248 Profile specification.

6.15.8 Media description with multiple payload types and multiple attribute lines

Clause 6.11 shows a wildcarding example with multiple list entries in <fmt list> in the "m=" line.

The fourth "m=" line parameter, <fmt list>, is a list of one or more payload formats. This clause is considering another wildcarding example with multiple list entries in <fmt list>.

The unambiguous resource selection by the MG may require correspondent "a=" lines in case of wildcarding in the list of formats in the "m=" line. This is reflected in clause 7.1.8 of [ITU-T H.248.1].

NOTE 1 – To avoid ambiguity when requesting the MG to reserve and commit resources, the MGC should supply as much information as needed when using under-specification (i.e., CHOOSE) so that the MG can make an unambiguous selection. For example, when using CHOOSE without specifying the required application type (e.g., "media name" in case of SDP encoding), further information may be needed (e.g., attribute lines in case of SDP encoding).

Such a wildcarding configuration must therefore consider the combination of a single "m=" and multiple "a=" lines.

NOTE 2 – Clause 6.11 shows examples with scope on "m=" line only.

Table 6-15.8 – Examples

ITU-T H.248/SDP encoding example with applied wildcarding:	Result:
ITU-T H.248 request: Local{ v=0 c=IN IP4 \$ m=audio\$ RTP/AVP \$ \$ a=rtpmap:\$ G729D/8000 a=rtpmap:\$ G726-16/8000 a=ptime:10 }	ITU-T H.248 reply: Local{ v=0 c=IN IP4 11.9.19.65 m=audio 5000 RTP/AVP 98 99 a=rtpmap:98 G729D/8000 a=rtpmap:99 G726-16/8000 a=ptime:10 }

In this example the MGC specifies the encoding name for the two RTP payload types. Thus the MG cannot choose a different encoding name. If the MGC does not send the "a=" line, the MG could choose the encoding name as well. This latter option is not preferred.

6.15.9 Source-specific media attributes

Source-specific media attributes are defined in [b-IETF RFC 5576]. These attributes may be used to describe *RTP media sources* in SDP, associate attributes with these sources, and express relationships among such traffic sources. [b-IETF RFC 5576] also defines several source-level attributes that can be used to describe properties of media sources.

Structure of [b-IETF RFC 5576] SDP attributes:

- media attributes:
 - "ssrc" media attribute (see clause 6.15.9.1)
 - "ssrc-group" media attribute (see clause 6.15.9.2).
- source attributes:
 - "cname" source attribute (see clause 6.15.9.1.2)
 - "previous-ssrc" source attribute (see clause 6.15.9.1.3)
 - "fntp" source attribute (see clause 6.15.9.1.4).

6.15.9.1 The "ssrc" media attribute

6.15.9.1.1 ABNF structure

See Table 6-15.9.1.1.

Table 6-15.9.1.1 – Media attribute "ssrc"

SDP Specification:	
Definition: (Clause 4.1 of [b-IETF RFC 5576])	–
ABNF: (Clause 10 of [b-IETF RFC 5576])	a=ssrc:<ssrc-id> <attribute> a=ssrc:<ssrc-id> <attribute>:<value> Formal: ssrc-attr = "ssrc:" ssrc-id SP attribute ; The base definition of "attribute" is in [b-IETF RFC 4566]. ; (It is the content of "a=" lines.) ssrc-id = integer ; 0 .. 2**32 - 1 attribute =/ ssrc-attr

The media attribute "a=ssrc:" must contain an additional source attribute (see next subclauses). The SDP wildcarding is also demonstrated in these clauses.

6.15.9.1.2 Wildcarding with source attribute "cname"

See Table 6-15.9.1.2.

Table 6-15.9.1.2 – Source-specific attribute "cname"

SDP Specification:	
Definition: (Clause 6.1 of [b-IETF RFC 5576])	–
ABNF: (Clause 10 of [b-IETF RFC 5576])	a=ssrc:<ssrc-id> cname:<cname> Formal: cname-attr = "cname:" cname cname = byte-string ; Following the syntax conventions for CNAME as defined in [b-IETF RFC 3550]. ; The definition of "byte-string" is in [b-IETF RFC 4566]. attribute =/ cname-attr
ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
a=ssrc:<ssrc-id> cname:?	Would give a=ssrc:ssrc-id cname:cname i.e., MG used CNAME value (typically at the level of root), which is either provisioned or locally generated, based on [b-IETF RFC 6222].

6.15.9.1.3 Wildcarding with source attribute "previous-ssrc"

See Table 6-15.9.1.3.

Table 6-15.9.1.3 – Source-specific attribute "previous-ssrc"

SDP Specification:	
Definition: (Clause 6.2 of [b-IETF RFC 5576])	–
ABNF: (Clause 10 of [b-IETF RFC 5576])	a=ssrc:<ssrc-id> previous-ssrc:<ssrc-id> ... Formal: previous-ssrc-attr = "previous-ssrc:" ssrc-id *(SP ssrc-id) attribute =/ previous-ssrc-attr
ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
a=ssrc:?	Is invalid.
a=ssrc:? previous-ssrc:?	Would give a= ssrc: ssrc-id1 previous-ssrc: ssrc-id2, ssrc-id3 ... ssrc-idn The use of a multiple value response wildcard is required to return a list of previous- ssrcs.

NOTE – The example above illustrates wildcarding a previous-ssrc value. The use of the previous-ssrc attribute is dependent on SSRC identifier collision leading to an allocation of a new SSRC identifier. The conditions leading to such an occurrence are not in scope of this Recommendation, however, the information below details consideration when using such wildcarding:

Such a use case would involve further procedures. For example:

- 1) The MG notifies the MGC that SSRC collision was detected, e.g., using a new ITU-T H.248 event.
- 2) The MGC requests the MG to allocate a new local SSRC and includes a wildcarded a=ssrc attribute:
a=ssrc:\$ previous-ssrc:\$
- 3) The MG replies with a new SSRC and with an old SSRC:
a=ssrc:<new-ssrc-id> previous-ssrc:<old-ssrc-id>
- 4) The MGC uses the MG's reply to generate a new **SDP offer** containing the MG replied attribute line:
a=ssrc:<new-ssrc-id> previous-ssrc:<old-ssrc-id>

Variant of step (2):

- 2) The MGC requests the MG to allocate a new local SSRC and includes a **partially** wildcarded a=ssrc attribute:
a=ssrc:\$ previous-ssrc:<old-ssrc-id> (If the MGC stored <old-ssrc-id>)

6.15.9.1.4 Wildcarding with source attribute "fmtmp"

See Table 6-15.9.1.4.

Table 6-15.9.1.4 – Source-specific attribute "fmtmp"

SDP Specification:	
Definition: (Clause 6.3 of [b-IETF RFC 5576])	–
ABNF: (Clause 10 of [b-IETF RFC 5576])	a=ssrc:<ssrc> fmtmp:<format> <format specific parameters> Formal: Not part of [b-IETF RFC 5576]
ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
a=ssrc:? fmtmp:? ?	This syntax is valid; however the results would be uncertain. The usage in the following row is preferred.
a=ssrc:? fmtmp:<format> <format specific parameters>	Would give a=ssrc:ssrc-id fmtmp:<format> <format specific parameters>

6.15.9.2 The "ssrc-group" media attribute

See Table 6-15.9.2.

Table 6-15.9.2 – Media attribute "ssrc-group"

SDP Specification:	
Definition: (Clause 4.2 of [b-IETF RFC 5576])	–
ABNF: (Clause 10 of [b-IETF RFC 5576])	a=ssrc-group:<semantics> <ssrc-id> ... Formal: ssrc-group-attr = "ssrc-group:" semantics *(SP ssrc-id) semantics = "FEC" / "FID" / token ; Matches [b-IETF RFC 5888] definition and

Table 6-15.9.2 – Media attribute "ssrc-group"

SDP Specification:	
	; IANA registration rules in this doc. token = <as defined in [b-IETF RFC 4566] attribute =/ ssrc-group-attr
ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
a=ssrc-group:? ? a=ssrc-group:? ?R	Are invalid. This is because there are semantic limitations concerning the <i>group semantics</i> according to clause 4.2 of [b-IETF RFC 5576]. For example meaningful tokens are "FEC" and "FID", but other tokens such as "LS", "SFR", "ANAT" or "CS" are normally not applicable in this service context.
a=ssrc-group:token ?R (Note)	Would give a=ssrc-group:token <i>list of ssrc-ids</i>
NOTE – This SDP attribute is interlinked with the SDP "ssrc" media attribute (see clause 6.15.9.1). Thus, unambiguous SDP wildcarding requires the usage of the advanced wildcarding capabilities according to clause 9. In particular: the application of wildcarding interlinkage (see clause 9.6.4).	

The wildcarding of "a=ssrc-group" must also consider the relationship to any wildcarding performed on "a=ssrc". An "ssrc" chosen as a result of a CHOOSE wildcard on one attribute may need to be used on another attribute. The wildcarding interlinkage wildcard is used to link the CHOOSE instances. See clause 9.6.4 for more information.

Example

Wildcarding a=ssrc-group using wildcarding interlinkage in conjunction with [b-IETF RFC 4588] specified multipurpose Internet mail extensions (MIME) subtype *rtx* is as follows:

```

a=ssrc-group:FID $1 $2
a=ssrc:$1 cname:$
a=ssrc:$2 cname:$

```

Where the MG then allocates one "original stream SSRC" and one "retransmission stream SSRC" and where it returns the "original stream SSRC" in the first a=ssrc attribute lines and the "retransmission stream SSRC" in the second a=ssrc attribute line, for example:

Replied Local Descriptor:

```

...
a=ssrc-group:FID <original-stream-SSRC> <retransmission-stream-SSRC>
a=ssrc:<original-stream-SSRC> cname:<MG-CNAME>
a=ssrc:<retransmission-stream-SSRC> cname:<MG-CNAME>

```

See also the example in clause 9.6.4.

6.15.10 Fingerprint attribute

The fingerprint attribute is defined by [b-IETF RFC 4572] and is used for transport security protocols such as transport layer security (TLS) and datagram transport layer security (DTLS).

Table 6-15.10 – Attribute "fingerprint"

SDP Specification:	
Definition: (Clause 5 of [b-IETF RFC 4572])	–
ABNF: (Clause 5 of [b-IETF RFC 4572])	a=fingerprint:<hash-func> <fingerprint>
ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
a=fingerprint:?	Is invalid. This is because both the mandatory 2-tuple of "name of hash function" and "hash value itself need to be individually wildcarded.
a=fingerprint:? ?	Would give a=fingerprint:hash-func fingerprint

6.15.10.1 Examples

See Table 6-15.10.1.

Table 6-15.10.1 – Examples for attribute "fingerprint"

ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
Example 1: MGC: a=fingerprint:\$ \$	The MG chooses a hash function and hash value ('fingerprint'), and replies to the MGC, e.g.: a=fingerprint: sha-384 fingerprint
Example 2: MGC: a=fingerprint:md5 \$	The MG chooses a hash value for <i>md5</i> algorithm and replies to the MGC, e.g.: a=fingerprint:md5 fingerprint

7 Use for wildcarding (CHOOSE or ALL)

The MGC should fully specify as many of the SDP parameters as possible when specifying an SDP line in ITU-T H.248. As indicated above, the MGC shall provide: a fully specified value, wildcard (CHOOSE "\$" or ALL "*") or not significant value, "-", for each parameter.

For example (see Table 7-1): The MGC requests that the port be selected and issues the transaction below.

NOTE – The full SDP is omitted for brevity.

Table 7-1 – Examples

ITU-T H.248/SDP encoding example with applied wildcarding:	Result:
ITU-T H.248 request: Transaction = 10 { Context = 20 { Modify = 30 { Media { Stream = 1 { Local { m=audio \$ RTP/AVP 4 } } } } } }	ITU-T H.248 reply (the port is returned): Reply = 10 { Context = 20 { Modify = 30 { Media { Stream = 1 { Local { m=audio 1111 RTP/AVP 4 } } } } } }

8 Use in auditing

8.1 Audit value

Individual auditing of Local and Remote SDPs was introduced in [ITU-T H.248.1] Version 3.

For use in auditing, the MGC should fully specify as many of the parameters in the SDP line as possible, to minimize the number of combinations that are returned. The actual parameters that the MGC requests to be returned should be designated with the ALL, "*", wildcard. The parameters for which the MGC has no knowledge and whose values are not required to be returned shall be designated with "-" (i.e., not significant). In the reply from the MG, these parameters will be marked as "-". Examples follow in Table 8-1.

Table 8-1 – Examples

ITU-T H.248/SDP encoding examples with applied wildcarding:	Results:
<p>The MGC requests that all the attributes be returned with transaction:</p> <pre>Transaction = 10 { Context = 20 { AuditValue = 30{ Audit{ Media{ Local{ a=*. * } } } } } }</pre>	<p>This could potentially return a long list of all the attributes on the MG.</p>
<p>Whereas transaction:</p> <pre>Transaction = 10 { Context = 20 { AuditValue = 30{ Audit{ Media{ Local{ a=ptime: * } } } } } }</pre>	<p>This would only return the value of the ptime attribute.</p>
<p>If the MGC audits a line with multiple parameters (for example "c=") and it only wants to know the type of network, it would issue the following transaction:</p> <pre>Transaction = 10 { Context = 20 { AuditValue = 30{ Audit{ Media{ Local{ c=- * - } } } } } }</pre>	<p>It would return the connection line:</p> <pre>c=- IP4 -</pre>

8.2 Audit capability

Wildcarding of SDP elements for audit capabilities is for further study.

9 Advanced SDP Wildcarding Package

Package name: Advanced SDP Wildcarding Package

Package ID: aswp (0x011c)

Description: This package allows the MG to indicate whether it supports advanced SDP wildcarding procedures: multiple value response, multiple line response, wildcarding interlinkage and maintain value. An MGC may use this information to determine which procedures and syntax to use.

Version: 1

Extends: None.

9.1 Properties

9.1.1 Advanced Wildcarding Support

Property name: Advanced Wildcarding Support

Property ID:	aws (0x0001)
Description:	This property indicates whether advanced SDP wildcarding procedures: multiple value response, multiple line response, wildcarding interlinkage and maintain value (as described by clause 9.6) are supported.
Type:	Sub-list of enumeration
Possible values:	MVR multiple value response MLR multiple line response WI wildcard interlinkage MV maintain value
Default:	None (unless provisioned otherwise)
Defined in:	TerminationState (Root Termination only)
Characteristics:	Read/Write

9.2 Events

None.

9.3 Signals

None.

9.4 Statistics

None.

9.5 Error codes

None.

9.6 Procedures

9.6.1 General

The support of the Advanced Wildcarding Support Package (*awsp*) indicates that an MG supports procedures that allow the following wildcards:

- multiple value response: In response to a multiple value wildcard request the MG will return (if applicable) multiple values for the wildcarded parameter. The response uses a single SDP line for the response.
- multiple line response: In response to a multiple line wildcard request the MG will return (if applicable) multiple values for the wildcarded parameter. The response uses multiple SDP lines for the response, one value per SDP line.
- wildcarding interlinkage: This allows the MGC to indicate to the MG that a response to one wildcard is used for subsequent wildcards in a particular command.
- maintain value: This allows the MGC to indicate to the MG that a particular value shall remain unchanged from a previously signalled, wildcarded or provisioned value.

An MGC should perform a packages audit (see clause 7.2.5 of [ITU-T H.248.1]) on the Root Termination to determine if an MG supports the "Advanced Wildcarding Support" package. If the MGC requires the use of advanced wildcards it shall set the "Advanced Wildcarding Support" property (*awsp/aws*) to the wildcards types it requires unless it has already been set via provisioning.

The Advanced Wildcarding Support Package is only for the ITU-T H.248.1 encoding of the SDP, either when the SDP is used natively in ITU-T H.248 text encoding mode or with the use of the SDP equivalent ITU-T H.248 properties (clause C.11 of [ITU-T H.248.1]) in binary encoding mode. It does not relate to the use of CHOOSE wildcards for TerminationIDs or StreamIDs.

If the MGC attempts to use advanced wildcarding procedures toward an MG that does not support this package, the error code 403 "Syntax error in transaction request" is likely to be returned.

9.6.2 Wildcarded value response

An MGC may indicate that it requires a wildcarded multiple value response by appending the character "R" or "r" to a CHOOSE wildcard, i.e., "\$R" or "\$r". It may be used where the SDP ABNF definition allows a multiplicity of values, e.g., the ABNF "*" (SP value)". The MGC may use this when it does not know how many values will be returned.

In response to a wildcard multiple value request, an MG will return multiple values (if applicable) of the SDP parameter where the wildcard was issued using a single SDP line.

For example: Utilising the "ssrc-group" as defined in clause 6.15.9.2 an ITU-T H.248 command containing:

```
a=ssrc-group:FID $R
```

would return:

```
a=ssrc-group:FID <ssrc1> <sssrc2> <sssrc3> etc.
```

9.6.3 Wildcarded line response

An MGC may indicate that it requires a wildcarded multiple line response by appending the character "L" or "l" to a CHOOSE wildcard, i.e., "\$L" or "\$l". This is used where the SDP response may require additional SDP lines, but the MGC does not know how many lines will be returned.

In response to a wildcard multiple value request, an MG will return multiple lines (if applicable) of the SDP parameter where the wildcard was issued using a single SDP line.

Only one wildcarded line response request is allowed in an SDP description. If there are other CHOOSE wildcards in the SDP line, then they shall be executed independently per line response.

For example, an ITU-T H.248 command using "ssrc" as defined in clause 6.15.9.2:

```
a=ssrc:$L cname:$
```

would return:

```
a=ssrc:<ssrc2>  cname:<cnameA>
a=ssrc:<ssrc1>  cname:<cnameB>
a=ssrc:<ssrc3>  cname:<cnameC>
etc.
```

9.6.4 Wildcarding interlinkage

An MGC may indicate that multiple CHOOSE wildcard instances are related by appending a HEX digit (which represents a wildcard label) to a CHOOSE wildcard, i.e., "\$[0-F]" or "\$[0-f]". This allows an MGC to indicate that the resulting value of one CHOOSE should be used for the result of another CHOOSE. This is only used when an identical SDP parameter (semantically and syntactically) is used across SDP lines. Only one wildcard label may be used per wildcard; however, several wildcard labels may be used per SDP line and SDP description. CHOOSE wildcards with the same wildcard label may be used across SDP lines. The MG will use the value in response to the first CHOOSE wildcard for the results of the CHOOSE wildcards with the same label on subsequent lines.

For example, using the "ssrc" and "ssrc-group" attributes as defined in clause 6.15.9.2 an ITU-T H.248 command containing:

```
a=ssrc:$1 cname:$  
a=ssrc:$2 cname:$  
a=ssrc-group:FID $1 $2
```

would return:

```
a=ssrc:<ssrca> cname:<cnameA>  
a=ssrc:<ssrcb> cname:<cnameB>  
a=ssrc-group:FID <ssrca> <ssrcb>
```

9.6.5 Maintain value

The purpose of this wildcard is to allow the MGC to request the preservation of previously set SDP values. The maintain value wildcard, "~", maintains the following unchanged values:

- a) signalled attribute values, or
- b) previously wildcarded attribute values, or
- c) provisioned attribute values.

Not using this wildcard implies the complete replication of all SDP information (i.e., fully specified SDP lines) by the MGC, in order not to release previously requested resources at the MG. The MG must process entirely such SDP data and compare it with previously received SDPs. This process may be avoided through the use of this wildcard.

Use cases for a) and b):

- the wildcard is used in ITU-T H.248 command replies (when SDP information is replied).
- the wildcard is typically used in subsequent ITU-T H.248 command requests, i.e., this wildcard is not used in the first ITU-T H.248 command request, when initially creating a stream endpoint or termination.

Use case for c):

- the wildcard could be used in the first ITU-T H.248 command request, under the condition that corresponding values are already prepared via management actions (at the MGC and the MG level).

Wildcard "~" shall not be used in case of ambiguous SDP media descriptions (e.g., when multiple SDP lines would be linked via an identifier, which is wildcarded).

9.6.6 Interactions

9.6.6.1 Interactions between wildcarding qualifiers "value response", "line response" and "interlinkage"

The scope of the wildcarding interlinkage label is limited to the Command, Termination/Stream and Group where the wildcard is issued. For example:

ITU-T H.248 encoding	Comments
<pre> MEGACO/3 [123.123.123.4]:55555 Transaction = 10004 { Context = 1 { Add = T1 { Media { Stream = 1 { Local { v=0 c=IN IP4 \$ m=audio \$1 RTP/AVP 32 } } Stream = 2 { Local { v=0 c=IN IP4 \$ m=audio \$1 RTP/AVP 8 } } } } } } </pre>	<p>Even though Stream 1 and Stream 2 both use an interlinked wildcard label \$1 it does not mean that the MG should use the same value for Stream 2.</p>

An MGC shall not use both the wildcard value response "R" and wildcard line response "L" in the same wildcard, e.g., "\$LR" is not valid.

An MGC may use a wildcard label with a multiple value response (e.g., \$1R or \$R1) or with a multiple line response request (e.g., \$1L or \$L1) in combination with wildcarding interlinkage. An MGC may use the same wildcard label for either multiple values or multiple line response requests. This indicates that multiple values from one SDP line should be used to populate a value on multiple SDP lines and vice-versa.

The use of a multiple values response request and a multiple line response request on one SDP line is valid.

The following example illustrates the use of a multiple value and multiple line response request in an SDP description:

```

a=ssrc-group:FID $1R
a=ssrc:$1L cname:$

```

The wildcard interlinkage element "1" indicates that the "R" and the "L" wildcards are related. Therefore the MG uses the results of the "R" CHOOSE wildcard to populate multiple instances of a= lines for the response, e.g.:

```

a=ssrc-group:FID <ssrc2> <ssrc1> <ssrc3>
a=ssrc:<ssrc2> cname:<cnameA>
a=ssrc:<ssrc1> cname:<cnameB>
a=ssrc:<ssrc3> cname:<cnameC>

```


9.6.6.2 Additional interactions with wildcarding qualifier "maintain value"

The combined usage of multiple wildcarding qualifiers in combination with the "maintain value" is principally feasible, but conditional, dependent on particular SDP elements and/or associated SDP lines.

It is not recommended to use the wildcarding qualifier "maintain value" with the other wildcarding qualifiers per SDP line.

Appendix I

Example signalling scenarios for the maintain value wildcard "~"

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

I.1 Purpose

The benefit of the maintain value wildcard, "~", is illustrated with two examples: one without wildcarding (clause I.2) and one with wildcarding (clause I.3). The value of this wildcard is primarily motivated by the "size of SDP information", e.g., in the context of large SDP objects (also known as "SDP blobs")¹ that are used in signalling SDP media descriptions for:

- multi-media types/formats/parameters/etc. configurations,
- key material as part of cryptographic information,
- fingerprints as part of cryptographic information.

I.2 Signalling without the maintain value wildcard "~"

The usage of the maintain value wildcard, "~", is illustrated with an example of the SDP attribute "a=fingerprint". This SDP element is an example representation of an SDP element that may have a large value size. An ADD.request command example without wildcard usage is used as a starting point as shown in Table I.1.

A possible example MG reply is shown in Table I.2.

The stream endpoint is modified in a subsequent command cycle, e.g., by the MODify.request command shown in Table I.3.

A possible example MG reply is shown in Table I.4.

Table I.1 – Example command encoding – MGC Add request

ITU-T H.248 encoding (shortened command)	Comments
<pre>MGC to MG: MEGACO/3 [11.9.19.65]:55555 Transaction = 1 { Context = \$ { Add = ip/\$/\$/\$ { Media { Stream = 1 { LocalControl { ... }, Local { v=0 c=IN IP4 \$ m=audio \$ UDP/TLS/RTP/SAVP - b=AS:7 a=setup:passive a=fingerprint: sha-256 0E:CB:C3:2A:EF:E8:3F:6A:FD:19:07:20:10:80:69:B4:17:E2:3E :3B:2C:89:41:FB:06:85:E6:71:26:A2:19:51 }, Remote { v=0</pre>	<p>The SDP attribute "a=fingerprint" is contained in both the LD and RD. The value is fully specified in the request command in the MGC-to-MG direction.</p>

¹ Blob: binary or basic large object, relates to a collection of data stored as a single entity.

Table I.1 – Example command encoding – MGC Add request

ITU-T H.248 encoding (shortened command)	Comments
<pre> c=IN IP4 135.117.113.26 m=audio 56376 UDP/TLS/RTP/SAVP - a=fingerprint:sha-256 8F:AA:57:46:7C:C1:D3:50:74:8D:22:C9:10:12:BE:AD:F0:13:9C :4F:D1:4F:B7:F3:96:5B:C3:70:FC:C5:AA:AE } ... } </pre>	

Table I.2 – Example command encoding– MG Add reply

ITU-T H.248 encoding (shortened command)	Comments
<pre> MG to MGC: MEGACO/3 [125.125.125.111]:55555 Reply = 1 { Context = <C1> { Add = <IP_A> { Media { Stream = 1 { Local { v=0 c=IN IP4 172.40.7.1 b=AS:7 m=audio 23914 UDP/TLS/RTP/SAVP - a=setup:passive a=fingerprint:sha-256 0E:CB:C3:2A:EF:E8:3F:6A:FD:19:07:20:10:80:69:B4:17:E2:3E :3B:2C:89:41:FB:06:85:E6:71:26:A2:19:51 ... }, Remote { v=0 c=IN IP4 135.117.113.26 m=audio 56376 UDP/TLS/RTP/SAVP - a=fingerprint:sha-256 8F:AA:57:46:7C:C1:D3:50:74:8D:22:C9:10:12:BE:AD:F0:13:9C :4F:D1:4F:B7:F3:96:5B:C3:70:FC:C5:AA:AE } } } } } } </pre>	<p>The entire SDP value is replied by the MG. Next, the MGC should validate that information by comparing the sent and received data.</p>

Table I.3 – Example command encoding – MGC Modify request

ITU-T H.248 encoding (shortened command)	Comments
<pre> MGC to MG: MEGACO/3 [11.9.19.65]:55555 Transaction = 2 { Context = <C1> { Modify = <IP_A> { Media { Stream = 1 { LocalControl { ... }, Local { v=0 c=IN IP4 172.40.7.1 b=AS:7 m=audio 23914 UDP/TLS/RTP/SAVP - a=setup:passive a=fingerprint:sha-256 0E:CB:C3:2A:EF:E8:3F:6A:FD:19:07:20:10:80:69:B4:17:E2:3E :3B:2C:89:41:FB:06:85:E6:71:26:A2:19:51 a=rtcp-mux }, Remote { v=0 c=IN IP4 135.117.113.26 m=audio 56376 UDP/TLS/RTP/SAVP - a=fingerprint:sha-256 8F:AA:57:46:7C:C1:D3:50:74:8D:22:C9:10:12:BE:AD:F0:13:9C :4F:D1:4F:B7:F3:96:5B:C3:70:FC:C5:AA:AE a=rtcp-mux } } } } } } </pre>	<p>The MGC has to provide the full specification of the SDP attribute again.</p> <p>The MG has to validate this information by comparing (and possibly updating) the information received in the previous command request (Table I.1). This is a cumbersome and unnecessary task when the value itself was not changed (as shown here).</p>

Table I.4 – Example command encoding– MG Modify reply

ITU-T H.248 encoding (shortened command)	Comments
<pre> MG to MGC: MEGACO/3 [125.125.125.111]:55555 Reply = 2 { Context = <C1> { Modify = <IP_A> { Media { Stream = 1 { Local { v=0 c=IN IP4 172.40.7.1 b=AS:7 m=audio 23914 UDP/TLS/RTP/SAVP - a=setup:passive a=fingerprint:sha-256 0E:CB:C3:2A:EF:E8:3F:6A:FD:19:07:20:10:80:69:B4:17:E2:3E :3B:2C:89:41:FB:06:85:E6:71:26:A2:19:51 a=rtcp-mux } Remote { v=0 c=IN IP4 135.117.113.26 m=audio 56376 UDP/TLS/RTP/SAVP - a=fingerprint:sha-256 8F:AA:57:46:7C:C1:D3:50:74:8D:22:C9:10:12:BE:AD:F0:13:9C :4F:D1:4F:B7:F3:96:5B:C3:70:FC:C5:AA:AE a=rtcp-mux } } } } } } </pre>	<p>Same comment as in Table I.2. Now, the MGC might be loaded with an unnecessary task again.</p>

I.3 Signalling using the maintain value wildcard "~"

The same signalling example, with two command request/reply cycles, is now used with wildcard "~". The wildcard, as such, is applicable due to unchanged parameter values. Table I.5 provides the starting point. A possible example MG reply is indicated in Table I.6.

Table I.7 illustrates the MODify.request command and a possible example MG reply is indicated in Table I.8.

Table I.5 – Example command encoding – MGC Add request

ITU-T H.248 encoding (shortened command)	Comments
<pre> MGC to MG: MEGACO/3 [11.9.19.65]:55555 Transaction = 1 { Context = \$ { Add = ip/\$/\$/\$ { Media { Stream = 1 { LocalControl { ... }, Local { v=0 c=IN IP4 \$ m=audio \$ UDP/TLS/RTP/SAVP - b=AS:7 a=setup:passive a=fingerprint: sha-256 0E:CB:C3:2A:EF:E8:3F:6A:FD:19:07:20:10:80:69:B4:17:E2:3E :3B:2C:89:41:FB:06:85:E6:71:26:A2:19:51 }, Remote { v=0 c=IN IP4 135.117.113.26 m=audio 56376 UDP/TLS/RTP/SAVP - a=fingerprint:sha-256 8F:AA:57:46:7C:C1:D3:50:74:8D:22:C9:10:12:BE:AD:F0:13:9C :4F:D1:4F:B7:F3:96:5B:C3:70:FC:C5:AA:AE } } } } } } </pre>	<p>This is identical to Table I.1, i.e., a fully specified SDP value (because such cryptographic information is normally out of scope of any provisioning).</p>

Table I.6 – Example command encoding– MG Add reply

ITU-T H.248 encoding (shortened command)	Comments
<pre> MG to MGC: MEGACO/3 [125.125.125.111]:55555 Reply = 1 { Context = <C1> { Add = <IP_A> { Media { Stream = 1 { Local { v=0 c=IN IP4 172.40.7.1 b=AS:7 m=audio 23914 UDP/TLS/RTP/SAVP - a=setup:passive a=fingerprint::~ ~ ... }, Remote { v=0 </pre>	<p>The two SDP attribute parameter values could be both wildcarded "~".</p> <p>Thus, the MG acknowledges that it has accepted values sent by the MGC.</p>

Table I.6 – Example command encoding– MG Add reply

ITU-T H.248 encoding (shortened command)	Comments
<pre> c=IN IP4 135.117.113.26 m=audio 56376 UDP/TLS/RTP/SAVP - a=fingerprint:~ ~ } ... } </pre>	

Table I.7 – Example command encoding – MGC Modify request

ITU-T H.248 encoding (shortened command)	Comments
<pre> MGC to MG: MEGACO/3 [11.9.19.65]:55555 Transaction = 2 { Context = <C1> { Modify = <IP_A> { Media { Stream = 1 { LocalControl { ... }, Local { v=0 c=IN IP4 172.40.7.1 b=AS:7 m=audio 23914 UDP/TLS/RTP/SAVP - a=setup:passive a=fingerprint: ~ ~ a=rtcp-mux }, Remote { v=0 c=IN IP4 135.117.113.26 m=audio 56376 UDP/TLS/RTP/SAVP - a=fingerprint:~ ~ a=rtcp-mux } } } } } } ... } </pre>	<p>The MGC could use "~" wildcarding again. This simplifies processing at the MGC and MG side.</p>

Table I.8 – Example command encoding– MG Modify reply

ITU-T H.248 encoding (shortened command)	Comments
<pre> MG to MGC: MEGACO/3 [125.125.125.111]:55555 Reply = 2 { Context = <C1> { Modify = <IP_A> { Media { Stream = 1 { Local { v=0 c=IN IP4 172.40.7.1 b=AS:7 m=audio 23914 UDP/TLS/RTP/SAVP - a=setup:passive a=fingerprint:~ ~ a=rtcp-mux ... }, Remote { v=0 c=IN IP4 135.117.113.26 m=audio 56376 UDP/TLS/RTP/SAVP - a=fingerprint:~ ~ a=rtcp-mux } } } } } </pre>	<p>The MG could also use "~" wildcarding again. This simplifies processing at the MG and MGC side.</p>

I.4 Evaluation of the examples

The maintain value wildcard, "~", could be applied in three out of four commands in the examples shown in clause I.3 versus I.2. It could also be demonstrated that wildcard "~" is used in command replies (see Tables I.6 and I.8) besides the usage in the MODify command request (see Table I.5).

Furthermore, it should be emphasized that the processing savings are not only related to the sending ITU-T H.248 entity, but rather that both ITU-T H.248 entities (MGC and MG) benefit from wildcarding.

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