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Infrastructure of audiovisual services – Communication procedures

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Gateway control protocol: Usage of the revised SDP offer/answer model with ITU-T H.248

Recommendation ITU-T H.248.80

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Recommendation ITU-T H.248.80

Gateway control protocol: Usage of the revised SDP offer/ answer model with ITU-T H.248

Summary

Recommendation ITU-T H.248.80 describes the interworking of the session description protocol (SDP) described by the "Revised SDP Offer/Answer (O/A) model with ITU-T H.248". This allows SDP capability negotiation and SDP media capabilities negotiation to be supported within ITU-T H.248.

History

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FOREWORD

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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/.

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Gateway control protocol: Usage of the revised SDP offer/ answer model with ITU-T H.248

1 Scope

Recommendation ITU-T H.248.80 describes the interworking of the SDP described by the "Revised SDP Offer/Answer (O/A) model" with ITU-T H.248. The "Revised SDP Offer/Answer model" is characterized by the following documents:

– SDP capability negotiation (SDPCapNeg) defined in [IETF RFC 5939]

– SDP media capabilities negotiation (MediaCapNeg) defined in [IETF RFC 6871]

NOTE – The support of miscellaneous capabilities negotiation in the Session Description document – [b-IETF RFC 7006] and Extension for PSTN bearers [b-IETF SDPCS] is for further study.

This Recommendation describes the relationship between the ITU-T H.248 group concept and the revised SDP offer/answer model concepts of actual and potential configurations. It provides guidelines for the inter-working between SDPCapNeg and normal ITU-T H.248.1 procedures. Rather than focussing on the SDPCapNeg procedures in the context of session handling, this Recommendation concentrates on mapping the between ITU-T H.248.1 and the SDP Capability negotiation framework SDP syntax. For interactions between the functions of SDPCapNeg and different SDP attributes, see [IETF RFC 5939] and associated IETF documents.

This Recommendation also discusses the support of [IETF RFC 6871] by ITU-T H.248.

In order to address several deficiencies in interworking between SDPCapNeg and [IETF RFC 6871] and ITU-T H.248 this Recommendation defines two packages that allow a more optimized support of the revised SDP offer/answer procedures on MGCs that also support ITU-T H.248.

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.248.39] Recommendation ITU-T H.248.39 (2006), *Gateway control protocol: H.248 SDP parameter identification and wildcarding*.

[ITU-T H.248.49] Recommendation ITU-T H.248.49 (2007), *Gateway control protocol: Session description protocol RFC and capabilities packages*.

[ITU-T H.248.63] Recommendation ITU-T H.248.63 (2009), *Gateway control protocol: Resource management packages.*

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

[IETF RFC 5939] IETF RFC 5939 (2010), *Session Description Protocol (SDP) Capability Negotiation.*

[IETF RFC 6871] IETF RFC 6871 (2013), *Session Description Protocol (SDP) Media Capabilities Negotiation*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 ***actual*** **configuration** [IETF RFC 6871]: An actual configuration specifies which combinations of SDP session parameters and media stream components can be used in the current offer/answer exchange and with what parameters. Use of an actual configuration does not require any further negotiation in the offer/answer exchange. See [IETF RFC 5939] for further details.

3.1.2 ***potential*** **configuration** [IETF RFC 6871]: A potential configuration indicates which combinations of capabilities can be used for the session and its associated media stream components. Potential configurations are not ready for use, however they are offered for potential use in the current offer/answer exchange. They provide an alternative that may be used instead of the actual configuration, subject to negotiation in the current offer/answer exchange. See [IETF RFC 5939] for further details.

3.1.3 ***latent*** **configuration** [IETF RFC 6871]: A latent configuration indicates which combinations of capabilities could be used in a future negotiation for the session and its associated media stream components. Latent configurations are neither ready for use, nor are they offered for actual or potential use in the current offer/answer exchange. Latent configurations merely inform the other side of possible configurations supported by the entity. Those latent configurations may be used to guide subsequent offer/answer exchanges, but they are not offered for use as part of the current offer/answer exchange.

NOTE – Latent configurations are beneficial for fast transitioning between different media configurations during active communication phases. Examples: IP emulation services for PSTN teleservices like "alternate speech-facsimile" or "text telephony" calls.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 **configuration**: A configuration relates to a set of capabilities, which may be indicated and negotiated via a signalling protocol, or provisioned via a management protocol.

NOTE – This definition is derived from [IETF RFC 5939], which itself does not provide an explicit definition of this term.

3.2.1.1 ***media*** **configuration**: A media configuration typically covers capabilities such as media type, media format, all media format attributes, media transport stack, media transport capacity and all associated parameter values.

NOTE 1 – The notion of 'media' originates from the concept of "IP media-path" (which relates to the ITU-T H.248 bearer-path), as opposed to the "IP signalling-path". The IP packet flow of the IP media-path carries the application data between IP application endpoints and the IP signalling-path carries the correspondent application control information.

NOTE 2 – A media configuration is specified within the SDP media description block. The relationship between the ITU-T H.248 "Media Descriptor" and SDP "Media Description" is illustrated in Figure 10 in [ITU-T H.248.1].

3.2.1.2 ***session*** **configuration**: Defines a *combination* of multiple media configurations.

NOTE – This definition is derived from [IETF RFC 6871], which itself does not provide an explicit definition of this term.

3.2.2 configuration (codec) list: The term *configuration list* represents a list of media configurations within the SDP *media description* block (in the case of SIP-embedded SDP).

3.2.3 SDP offer/answer protocol variants: The following names are applied in this Recommendation in order to distinguish different SDP Offer/Answer *protocol variants*. There are two models for the session description protocol (SDP) concerning the indication and negotiation of media and transport capabilities:

3.2.3.1 *legacy* SDP Offer/Answer: This name indicates SDP Offer/Answer according to [b-IETF RFC 3264].

3.2.3.2 *revised* SDP Offer/Answer: This name indicates SDP Offer/Answer according to [IETF RFC 5939] and [IETF RFC 6871].

NOTE – It is noted that the terms 'legacy' and 'revised' are not related to the SDP syntax as such, rather to the overall "application", i.e., the O/A negotiation protocol. It is not expected that the SDP syntax of [b-IETF RFC 3264] will be made obsolete by the revised SDP Offer/Answer RFCs. It is expected that both SDP O/A protocol variants will be used in parallel.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

DTMF	Dual Tone Multi Frequency
FoIP	Fax over Internet Protocol
FoUDPTL	Fax over User Datagram Protocol Transport Layer
IP	Internet Protocol
LD	Local Descriptor
MediaCapNeg	Media Capabilities Negotiation
MG	Media Gateway
MGC	Media Gateway Controller
MSRP	Message Session Relay Protocol
NTE	Named Telephone Events
O/A	Offer/Answer
PCMU	Pulse Code Modulated
PSTN	Public Switched Telephone Network
RD	Remote Descriptor
RTCP	RTP Control Protocol
RTP	Real-time Transport Protocol
SDP	Session Description Protocol
SDPCapNeg	SDP Capabilities Negotiation
SIP	Session Initiation Protocol
UDP	User Datagram Protocol
UDPTL	User Datagram Protocol Transport Layer
VBDoIP	Voice Band Date over Internet Protocol
VoIP	Voice over Internet Protocol

5 Conventions

Elements of the ITU-T H.248 protocol model, e.g., Context, Termination, Stream, Event are represented using the first letter capitalized. ITU-T H.248 Property, Event, Signal and Parameter identities are given in *italics*. When used in the main text SDP syntax is highlighted in bold, i.e., "**m=**".

6 Interworking the Revised Offer/Answer SDP "SDPCapNeg" and ITU-T H.248.1

This clause describes the interworking between the Revised Offer/Answer "SDPCapNeg" SDP and ITU-T H.248. Primarily it describes the mapping with the "**a=acap:**", "**a=tcap:**", "**a=pcfg:**" and "**a=acfg:**" SDP attributes (plus any attribute defined as an extension to this framework) by using the ITU-T H.248.1 grouping concept. The "**a=csup:**" and "**a=creq:**" attributes are not described as they relate only to procedures for the SDPCapNeg framework. As this framework is not used between the MGC and MG they are not needed to be supported by ITU-T H.248.1.

An important difference between the Revised Offer/Answer SDP and ITU-T H.248.1 is the action the receiver takes when it does not understand or finds the SDP in error. The Revised Offer/Answer SDP negotiation typically ignores SDP lines it does not understand where ITU-T H.248.1 will generate an error reply. Therefore where interworking the two forms of SDP to minimise errors the MGC should perform the necessary checks (i.e., via auditing the MG or via provisioning) to ensure that the MG supports the syntax and capabilities requested.

However the mapping defined in this clause effectively provides the same capabilities as SDPCapNeg in ITU-T H.248.

6.1 Revised Offer/Answer SDP received by MGC

This clause assumes that the MGC has received a message containing SDP with the SDPCapNeg framework syntax and needs to communicate this information to the MG.

6.1.1 Relationship with the ITU-T H.248 Reserve Group concept

When the MGC detects the use of the revised Offer/Answer SDP procedures and requires that the information is sent to the MG, each of the potential configurations (as well as the actual configuration) are enumerated as a separate ITU-T H.248 Group. For more information regarding ITU-T H.248 Groups see clause 7.1.8 of [ITU-T H.248.1].

NOTE – The MGC may apply a policing function and limit the number of groups/capabilities based on internal policy. For the purposes of description this Recommendation assumes that all configurations are enumerated.

ITU-T H.248 groups are represented by providing a GroupID in the binary encoding or using multiple session descriptions (i.e., SDP) separated by v= lines. Thus each group effectively represents a "potential configuration".

The first group shall relate to the highest priority "potential configuration", i.e., the one with the lowest **a=pcfg:x** number. This group shall be followed by the next highest **a=pcfg:x** number. The final group shall be the "actual configuration".

Each group shall contain all properties/parameters to for a valid SDP description of the configuration. In the case of the text encoding using SDP this means that all SDPCapNeg attributes (and any extension attributes) related to the **a=pcfg** instance should be incorporated into a valid SDP session description.

[IETF RFC 5939] defines several modifiers that are related to the characteristics of a potential configuration: "-" (Delete), "[ ]" (Optional), "|" (Alternatives) and "+" (Mandatory). In incorporating SDPCapNeg attributes into a valid SDP session description these need to be taken into account.

The use of "-" is a means of indicating that the potential configuration doesn't contain attributes from the actual configuration. In mapping to ITU-T H.248 concepts there is no distinction between actual and preferred configurations. All the required properties/SDP are set for a particular ITU-T H.248 Group/Stream. Thus there is no need to indicate particular attributes are deleted from an ITU-T H.248 Group, they are simply omitted from the applicable ITU-T H.248 Descriptor.

The use of "[ ]" indicates that it is optional to support a particular capability. There is no equivalent ITU-T H.248 element. A MGC may either indicate that all ReserveGroups/Values should be supported (= True) or a single instance (=False) should be chosen.

The use of "+" indicates that it is mandatory to support a particular capability for a particular potential configuration. There is no ITU-T H.248 element to explicitly signal this however this behaviour can be inferred when a particular capability is added to an ITU-T H.248 Group.

The use of "|" indicates alternatives. See clause 6.1.2 for more information.

However no syntax described by SDPCapNeg shall be used in the groups otherwise an error response may be generated.

For example, given the following Revised Offer/Answer SDP:

```
v=0
o=- 25678 753849 IN IP4 192.0.2.1
s=
c=IN IP4 192.0.2.1
t=0 0
m=audio 53456 RTP/AVP 0 18
a=tcap:1 RTP/SAVP
a=acap:1 crypto:1 AES_CM_128_HMAC_SHA1_80
   inline:WVNfX19zZW1jdGwgKCkgewkyMjA7fQp9CnVubGVz|2^20|1:4
a=pcfg:1 t=1 a=1
```

To create a valid SDP for the first group (related to **a=pcfg:1**) the MGC would take RTP/AVP from the **m=audio** attribute and replace it with the RTP/SAVP from the **a=tcap:1** attribute. It would then delete the **a=tcap:1** line. It would then see that **a=acap:1** introduced the crypto attribute thus it would create a new **a=crypto** line containing the necessary information. It would then remove the **a=acap:1** line. The **a=pcfg:1** would then be removed. Thus the first group would be coded:

```
v=0
o=- 25678 753849 IN IP4 192.0.2.1
s=
c=IN IP4 192.0.2.1
t=0 0
m=audio 53456 RTP/SAVP 0 18
a=crypto:1 AES_CM_128_HMAC_SHA1_80
     inline: WVNfX19zZW1jdGwgKCkgewkyMjA7fQp9CnVubGVz|2^20|1:4
```

6.1.2 Relationship with the ITU-T H.248 Reserve Value concept

SDPCapNeg also allows the ability to specify alternatives (via the use of "|") in configuration lists. The MGC can also provide this functionality via the use of over specified property values (or SDP parameters as per [ITU-T H.248.39]). Over specification of properties is equivalent to providing alternatives which effectively is a "or" function in the same way as "|".

For example, given the following Revised Offer/Answer SDP:

```
v=0
o=- 25678 753849 IN IP4 192.0.2.1
s=
c=IN IP4 192.0.2.1
t=0 0
m=audio 53456 RTP/AVPF 0 18
```

```
a=tcap:1 RTP/AVPF RTP/AVP RTP/SAVP RTP/SAVPF
a=pcfg:1 t=2|1 a=1
```

The MGC would construct the following SDP for the first ITU-T H.248 Group:

```
v=0
o=- 25678 753849 IN IP4 192.0.2.1
s=
c=IN IP4 192.0.2.1
t=0 0
m=audio 53456 RTP/AVP RTP/AVPF 0 18
```

6.1.3 Relationship with the ITU-T H.248 Stream concept

SDPCapNeg allows a defined capability to be referenced by multiple media streams. For example: the **a=tcap:1** may be used to define two transports "RTP/SAVP" and "RTP /AVP". If an SDP Offer contains an audio and video stream the potential configuration for each of these media may reference the same transport capability (i.e., **t=1**). This is allowed because normal SDP allows multiple m= lines in a single session description.

ITU-T H.248 however limits SDP session descriptions to one "**m=**" line per session description. Each media type, i.e., audio/video is represented by its own ITU-T H.248 StreamID.

Therefore where the MGC receives an SDP Offer containing SDPCapNeg elements pertaining to multiple streams, a separate SDP session description is constructed for each media containing the capabilities detailed. Separate groups may need to be constructed (see clause 6.1.1).

For example the MGC may receive the following SDP:

```
v=0
o=alice 2891092738 2891092738 IN IP4 lost.example.com
s=
t=0 0
c=IN IP4 lost.example.com
a=tcap:1 RTP/SAVP RTP/AVP
m=audio 59000 RTP/AVP 98
a=rtpmap:98 AMR/8000
a=pcfg:1 t=1
m=video 52000 RTP/AVP 31
a=rtpmap:31 H261/90000
a=pcfg:1 t=1
```

In order to express these capabilities to the MG the MGC would construct two SDPs each with two groups. The first would be set on an audio stream (e.g., StreamID=1):

```
v=0
o=alice 2891092738 2891092738 IN IP4 lost.example.com
s=
t=0 0
c=IN IP4 lost.example.com
m=audio 59000 RTP/SAVP 98
a=rtpmap:98 AMR/8000
v=0
o=alice 2891092738 2891092738 IN IP4 lost.example.com
s=
t=0 0
c=IN IP4 lost.example.com
m=audio 59000 RTP/AVP 98
a=rtpmap:98 AMR/8000
```

The second would be set on a video stream (e.g., StreamID=2):

```
v=0
o=alice 2891092738 2891092738 IN IP4 lost.example.com
s=
t=0 0
c=IN IP4 lost.example.com
m=video 52000 RTP/SAVP 31
a=rtpmap:31 H261/90000
a=pcfg:1 t=1
v=0
o=alice 2891092738 2891092738 IN IP4 lost.example.com
s=
t=0 0
c=IN IP4 lost.example.com
m=video 52000 RTP/AVP 31
a=rtpmap:31 H261/90000
```

6.1.4 MG action and response

The MG has no knowledge that the Revised Offer/Answer SDP negotiations mechanism is being used. The MG applies the normal ITU-T H.248 message processing rules. Depending on the setting of the ITU-T H.248 ReserveGroup property when processed by the MG the sets of ITU-T H.248 Groups (representing multiple configurations) it receives will either represent a single "actual configuration" (ReserveGroup=Off) or a set of "actual configurations" (ReserveGroup=On). The MG reserves the resources needed for the capabilities defined in the ITU-T H.248 group/s it selects. The MG will then respond to the MGC with what it actually supports. The MGC is then required to interwork the received ITU-T H.248 SDP to the Revised Offer/Answer SDP format/procedures. See clause 6.2 for more information.

6.1.5 Example mapping

The following example illustrates an ITU-T H.248 message interaction illustrating the mapping.

A MGC may receive the following Revised Offer/Answer SDP.

```
v=0
o=- 25678 753849 IN IP4 192.0.2.1
s=
c=IN IP4 192.0.2.1
t=0 0
m=audio 53456 RTP/AVP 0 18
a=tcap:1 RTP/SAVP
a=acap:1 crypto:1 AES_CM_128_HMAC_SHA1_80
   inline:WVNfX19zZW1jdGwgKCkgewkyMjA7fQp9CnVubGVz|2^20|1:4
a=pcfg:1 t=1 a=1
```

NOTE – For a description of the above example see clause 3.2 of [IETF RFC 5939].

According to SDPCapNeg the MGC should answer with the actual configuration. A MGC may send this information to a MG using ITU-T H.248.1 syntax today. It uses ReserveGroup=Off (default) and places a session description related to the secured transport under the first **v=0** as it is the preferred transport. Crypto is wildcarded in order for the MG to provide its key, likewise the IP address is also wildcarded. For example:

```
MGC to MG:
MEGACO/3 [123.123.123.4]:55555
Transaction = 10005 {
  Context = 2000 {
    Modify = A4445 {
       Media {
            Stream = 1 {
                Local {
```

```
v=0
o=- 25678 753849 IN IP4 $
s=
c=IN IP4 192.0.2.1
t=0 0
m=audio 53456 RTP/SAVP 0 18
a=crypto:1 AES_CM_128_HMAC_SHA1_80 inline:$
v=0
o=- 25678 753849 IN IP4 $
s=
c=IN IP4 $
t=0 0
m=audio 53456 RTP/AVP 0 18
}
            }
         }
      }
   }
}
```

As the MG has received multiple groups and ReserveGroup is set to off the MG will choose one group and reply with that SDP, i.e.:

```
MG to MGC:
MEGACO/3 [125.125.125.111]:55555
Reply = 10005 {
   Context = 2000 {
      Modify = A4445{
         Media {
            Stream = 1 {
                Local {
v=0
o=- 24351 621814 IN IP4 192.0.2.2
s=
c=IN IP4 192.0.2.2
t=0 0
m=audio 54568 RTP/SAVP 0 18
a=crypto:1 AES_CM_128_HMAC_SHA1_80
      inline:PS1uQCVeeCFCanVmcjkpPywjNWhcYD0mXXtxaVBR|2^20|1:4
             }
            }
         }
       }
   }
}
```

On reception of the reply the MGC then has to parse the received Local Descriptor information in order to determine if it matches any of the configurations according to the **a=pcfg:** it received in the SDP offer. If it has determined that the MG has accepted one of the configurations in the **a=pcfg:** attribute then it will construct a SDP Answer reply with the **a=acfg:** attribute set to the appropriate configuration as well as providing the correct SDP.

6.2 Revised Offer/Answer SDP initiated by MGC

This clause assumes that the MGC initiates an SDP Offer. In order to do this the MGC must be aware of the possible configurations in a MG. [ITU-T H.248.1] does not have specific procedures to determine possible configurations. This information would either need to be provisioned on the MGC or partly determined through an Auditing action.

7 Interworking the Revised Offer/Answer SDP "MediaCapNeg" and ITU-T H.248.1

The SDP Media Capabilities Negotiation document [IETF RFC 6871] is an extension to the SDP Capabilities Negotiation (SDPCapNeg) framework. It introduces five SDP attributes and three parameters to the configuration attributes. The SDP attributes are:

– A RTP media attribute ("a=rmcap") defines RTP media capabilities in the form of a subtype (e.g., "PCMU"), and its encoding parameters (e.g., "/8000/2").

– An "other" media attribute ("a=omcap") defines non-RTP (other) media capabilities in the form of a "format name". An attribute ("**a=mfcap**") specifies media format parameters associated with one or more media capabilities.

– An attribute ("**a=mscap**") that specifies media parameters associated with one or more media capabilities.

– An attribute ("**a=lcfg**") specifies latent media stream configurations when no corresponding media line ("m=") is offered.

– An attribute ("**a=sescap**") is used to specify an acceptable combination of simultaneous media streams as a list of potential and/or latent configurations.

The parameters are:

– A parameter type ("**m=**") permits specification of media capabilities (including their associated parameters) and combinations thereof for the configuration.

– A parameter type ("**pt=**") associates RTP payload types numbers with the referenced media capabilities.

– A parameter type ("**mt=**") is used to specify the media type for latent configurations.

In the context of interworking these syntax elements to ITU-T H.248 SDP the "**a=rmcap:**", "**a=omcap:**", "**a=mfcap:**" and "**a=mscap:**" attributes are treated in the same manner as the capabilities (e.g., **a=acap:**, **a=tcap:**) defined in clause 6. Likewise for the purposes of determining the contents of the ITU-T H.248 groups as explained in clause 6, the new "**m=**" and "**pt=**" parameters are treated in the same manner as parameters defined in the "**a=pcfg:**" and "**a=acfg:**" attributes in SDPCapNeg.

MediaCapNeg introduces the concept of "Latent Configurations". These configurations are ones that no resources are reserved for but may be used at some time in the future. ITU-T H.248.1 does not natively support the concept of "Latent Configurations". Thus the "**a=lcfg:**" attribute and the "**mt=**" parameter cannot be interworked to any [ITU-T H.248.1] syntax, however the MGC may provide interworking at the MGC level via provisioning information or some other method.

MediaCapNeg introduces the ability to specify acceptable combinations for simultaneous media streams. Whilst ITU-T H.248.1 allows the MGC to specify multiple sets of capabilities for multiple media streams to the MG, it lacks the capability to indicate the relationships between the sets. Thus the "**a=sescap:**" attribute cannot be interworked to any ITU-T H.248.1 syntax. However the MGC may prioritize and send a set of capabilities to the MG. If the MG doesn't support the set, the MGC may then send the next set, and so on until the MG supports a set of capabilities.

[ITU-T H.248.63] defines the "Resource Management Configuration" Package. This package allows a MGC to describe which resources are expected to be used in a Context. This allows the MG to allocate resources in an efficient manner when an actual configuration is specified. This Package effectively allows the MGC to specify to a MG that there are "latent configurations" that may be used in the future. In order to provide interworking the MGC maps MediaCapNeg SDP defined by the "latent configuration" to the *rmc/rd* property. As the *rmc/rd* property is based on the ITU-T H.248 connection model it lacks the conciseness of the SDPCapNeg framework as described in clause 6. The use of [ITU-T H.248.63] also does not allow the MG to be requested for a set of "latent configurations" in the case that the MGC initiates the revised SDP offer.

8 Enhanced Revised Offer/Answer SDP support in ITU-T H.248

As shown in clauses 6 and 7 it is possible to perform basic interworking between the Revised Offer/Answer model and ITU-T H.248.1. The main difference is in the actual mechanism (syntax) that is used. As can be seen in the above examples, in ITU-T H.248 each separate configuration must appear as a separate ITU-T H.248 group. In the case of SDP this results in a significant increase in message size. It is also implies a parsing function to map between ITU-T H.248.1 SDP and potential (and actual) SDPCapNeg configurations.

Also shown in clause 6 is that there is no mechanism for the MGC to request from a ITU-T H.248 Termination the possible configurations. This clearly presents problems for a MGC which wants to support SDPCapNeg.

Clause 7 shows that the "Latent Configuration" and "Session Configuration" are not well supported by [ITU-T H.248.1].

This Recommendation defines the "Enhanced Revised Offer/Answer SDP Support Package" and the "Enhanced SDP Media Capabilities Negotiation Support Package" which allows the support of parts of the SDPCapNeg (and MediaCapNeg) syntax in ITU-T H.248 messages in order to address the above deficiencies.

9 Enhanced Revised Offer/Answer SDP Support package

Package name: Enhanced Revised Offer/Answer SDP Support

Package ID: eroas (0x0109)

Description: This package allows the support of the SDP Capability Negotiation syntax between an MGC and MG.

Version: 1

Extends: None

9.1 Properties

9.1.1 SDPCapNeg Extensions

Property name: SDPCapNeg Extensions

Property ID: sdpe (0x0001)

Description: This property allows the MGC to determine which SDPCapNeg extensions are supported on the gateway/Termination/Stream.

Type: Sub-list of String

Possible values: As per the IANA registry. See clause 6.2 of [IETF RFC 5939].

Default: "cap-v0"

Defined in: TerminationState, LocalControl

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 Determining the enhanced ITU-T H.248 support of the SDP capability negotiation framework

Before interworking SDPCapNeg SDP syntax with ITU-T H.248 the MGC should audit the MG to determine if the "Enhanced Revised Offer/Answer SDP Support" (*eroas*) package is supported. If the package is supported then the MGC may audit the "SDPNegCap Extensions" (*eroas/sdpe*) Property to determine which SDP Capability negotiation framework extensions are supported by the MG. If the audit occurs on a *eroas/sdpe* Property in the TerminationState Descriptor on the Root Termination the MG shall respond with the superset of all the supported extensions on the MG.

NOTE 1 – The "Session Description Protocol Capabilities Package" (*sdpc*) [ITU-T H.248.49] allows the MGC to audit which SDP elements are supported. However this does not contain a property for capability extensions. The *sdpe* property has been defined in this package to allow the support of revised offer/answer SDP without the need for support of [ITU-T H.248.49].

Where the MGC requires the MG to return the list of supported extensions for a particular media type (i.e., audio, video) the MGC should use the *eroas/sdpe* Property at the LocalControl level. In order to provide a list per media type the MGC should provide an indication in the Stream of the media type (e.g., through the use of local and remote descriptors). This will return the list of supported extensions for a particular stream.

The MGC may also determine the list of supported extensions by wildcarding CHOOSE the *eroas/sdpe* property on the Termination/Stream on an individual Termination/Stream.

The MGC may then use these extensions in ITU-T H.248 messages to/from the MG.

NOTE 2 – The SDP Capability Negotiation framework provides the ability to set the supported (**a=csupp:**) and required (**a=creq:**) capability attributes on a session and/or a media stream level.

The MG is not required to return the "**cap-v0**" tag (see clause 6.2 of [IETF RFC 5939] in response to an audit as supported is implied due to the support of the *eroas* package.

9.6.2 Usage of SDP Capability Negotiation framework attributes

The support of the *eroas* package by the MG allows the MGC and MG to use the "**a=acap:**", "**a=tcap:**", "**a=pcfg:**" and "**a=acfg:**" attributes in ITU-T H.248 messaging between them. Therefore if the MGC uses revised Offer/Answer SDP at the session level it does not have to perform the mapping to ITU-T H.248 groups as described in clause 6.1. Different configurations may be specified through the use of the "**a=acap:**", "**a=tcap:**", "**a=pcfg:**" attributes. The MGC must also provide an actual configuration. Due to the ITU-T H.248 connection model and the separation of multiple media into streams the MGC shall provide the required SDPCapNeg attributes in each Stream. This is effectively the same procedure as described in clause 6.1.3 except that SDPCapNeg syntax may also be used.

The MGC may also use any additional attributes related to capabilities supported by the *eroas/sdpe* attribute.

NOTE 1 – Typically media level SDPCapNeg attributes may be supported by ITU-T H.248 in the Local and Remote Descriptor. However some session level attributes may not be supported because they apply to multiple streams. As ITU-T H.248 separates stream descriptions these attributes may be more appropriate at a Termination level. In this case the definition of a package (see clause 10) is desirable.

The use of Reserve Group and Reserve Value is valid for SDPCapNeg attributes. However the need for SDP Groups is diminished due to the support of the configuration attributes. As per the ITU-T H.248 grouping concept if the Reserve Group and Reserve Value flag is "off" the MG shall choose one of the configurations (the preferred or actual) specified. The chosen configuration is included in the response. The response shall contain the appropriate SDPCapNeg (or valid extension) attributes. If Reserve Group is "On" and "Reserve Value" is "off" the MG shall choose a configuration in the group. If "Reserve Value" is "on" then the MG shall only remove configurations than it cannot support. Likewise for "Reserve Group" equal to "on".

The use of this package means that mapping of the "-", "[ ]", "|" and "+" modifiers related to the characteristics of a potential configuration to ITU-T H.248 concepts (Reserve Group and Reserve Value, etc.) is not required. Furthermore as the modifiers affect only configurations other than the actual configuration there is no need to map it directly to ITU-T H.248. Thus it is valid to use "-"", "[ ]", "|" and "+" syntax when this package is used.

Rather than fully specifying the SDPCapNeg attributes the MGC may wildcard CHOOSE the "**a=pcfg:**" attribute. The MG should then provide any alternative preferred configurations in addition to the "actual configuration" in the reply. Even if the MGC does not wildcard CHOOSE associated attributes (e.g., "**a=tcap:**" and "**a=acap:**") these may be provided in the response.

NOTE 2 – This is in keeping with ITU-T H.248.1 behaviour that allows an MG to include extra SDP lines in a response.

If the MGC sends an SDPCapNeg extension that is not supported by the MG, like any unknown SDP the MG shall send an error reply.

10 Enhanced SDP Media Capabilities Negotiation Support package

Package name: Enhanced SDP Media Capabilities Negotiation Support

Package ID: smcn (0x010A)

Description: This package allows the support of the indication of "Session Configurations" and "Latent Configurations" (as per "a=sescap:" and "a=lcfg:" defined in [IETF RFC 6871]) between the MGC and MG.

Version: 1

Extends: eroas version 1 (0x0109)

10.1 Properties

10.1.1 Session Configurations

Property name: Session Configurations

Property ID: sconf (0x0002)

Description: This property allows the MGC to indicate the valid sets of configurations for a Termination based on the MediaCapNeg "Session Capability" Attribute. It also allows the MGC to request the MG to provide the valid Configuration sets.

Type: Sub-list of String

Possible values: Each instance of String is defined as type "sescap" according to the following ABNF:

```
sescap = session-num 1*WSP list-of-configs
```

As per clause 3.3.8 of [IETF RFC 6871]. The values relate to the potential and latent configurations defined in each stream. The MGC and MG shall ensure the potential and latent configuration numbers are unique across all streams on the Termination.

Default: None.

Defined in: TerminationState

Characteristics: Read/Write

10.1.2 Latent Configurations

Property name: Latent Configurations

Property ID: lconf (0x0003)

Description: This property allows the MGC to determine if additional latent configurations are supported on the Termination. A latent configuration represents an additional media stream to the one already specified on the Termination.

According to clause 3.3.5 of [IETF RFC 6871] the latent configuration must contain the media type and transport protocol, and in most cases must include the media configuration. As such this property also allows the specification of the transport capabilities and media configurations.

Type: Sub-list of String

Possible values: Each instance of String is defined as type "lcfg", "rmcap", "omcap", "tcap" or "acap" according to the following ABNF:

```
lcfg = "lcfg:" config-number 1*WSP lcfg-config-list
; For further definitions see clause 3.3.5/
; [IETF RFC 6871]

tcap = "tcap:" trpr-cap-num 1*WSP proto-list
; For further definition see [IETF RFC 5939]

rmcap = "rmcap:" media-cap-num-list
                1*WSP encoding-name "/" clock-rate
                ["/" encoding-parms]

; For further definitions see clause 3.3.1/
; [IETF RFC 6871]

omcap = "omcap:" media-cap-num-list 1*WSP format-name
; For further definitions see clause 3.3.1/
; [IETF RFC 6871]

acap = "acap:" att-cap-num 1*WSP att-par
; For further definitions see clause 3.4.1/
; [IETF RFC 5939]
```

Default: None.

Defined in: TerminationState

Characteristics: Read/Write

10.2 Events

None.

10.3 Signals

None.

10.4 Statistics

None.

10.5 Error codes

None.

10.6 Procedures

10.6.1 General

The support of this package implies that the media capabilities negotiation defined in [IETF RFC 6871] is supported by the MG. Therefore the MG shall include the "med-v0" option tag in a response to either an audit or CHOOSE wildcard of the *eroas/sdpe* property.

As a result the MGC may use the "**a=rmcap:**", **"a=omcap"**, "**a=mfcap:**" and "**a=mscap:**" media level attributes, the associated "**m=**" and "**pt=**" parameters and the enhanced potential configuration attribute (see clause 3.3 of [IETF RFC 6871] in SDP in ITU-T H.248 Local and Remote Descriptors.

As the "Session Configurations" and "Latent Configurations" properties are set in Termination state they are unaffected by the setting of Reserve Group/Value.

10.6.2 Session configurations

In order to use the Session Configuration functionality rather than supplying the "**a=sescap:**" attribute the MGC shall supply the "Session Configuration" (*smcn/scap*) property to the MG. If session configuration functionality is required the MGC shall include this functionality when specifying multiple configurations (especially when multiple streams are used) so the MG can choose the appropriate related configurations.

If the MGC requires the MG to provide the session capabilities in addition to wildcarding the preferred configurations (as described in clause 9.6.2) the MGC shall wildcard CHOOSE the *smcn/sconf* property.

10.6.3 Latent configurations

In order to use the Latent Configuration functionality rather than supplying the "**a=lcfg:**" attribute the MGC shall use the "Latent Configurations" (*smcn/lconf*) property. It shall also include any related **acap, tcap, rmcap** and **omcap** attributes. If the MGC requires the MG to supply the additional configurations that it can support without assigning resources the MGC shall wildcard CHOOSE the *smcn/lconf* property.

The MGC may also set the *smcn/lconf* with multiple latent configurations and send these to the MG. If the MG does not support a specified configuration is shall send a reply with that **lcfg** and any associated **tcap, rmcap** and/or **omcap** instance removed.

11 Examples

This clause provides example of Enhanced Revised Offer/Answer SDP support in ITU-T H.248.

11.1 Audit of SDPCapNeg extensions

The MGC may perform an audit of the Packages Descriptor to determine if a MG supports the SDP Capability Negotiation framework. Once the MGC has determined that the MG supports the eroas package, it may perform an AuditValue to determine which extensions are supported (see Table 1).

The MG supports the base capability negotiation framework and media capability framework (see Table 2).

Table 1 – Example command encoding – MGC request

ITU-T H.248 encoding (shortened command)	Comments

MEGACO/3 [123.123.123.4]:55555
Transaction = 4000 {
  Context = – {
  AuditValue = Root {
  Audit {
  TerminationState {eroas/sdpe}
  }
  }
  }
}
	The MGC sends an audit request, using the *SDPCapNeg Extensions* (sdpe) property (see clause 9.1.1).

Table 2 – Example command encoding – MG reply

ITU-T H.248 encoding (shortened command)	Comments

MEGACO/3 [124.124.124.222]:55555
Reply = 4000 {
  Context = – {
  AuditValue = Root {
  TerminationState {
  eroas/sdpe = "med-v0"
  }
  }
  }
}
	The value "med-v0" relates to the SDP capabilities according to [IETF RFC 6871].

NOTE – The value "cap-v0" is not required as usage is implied due to the support of the package.	

11.2 Example usage of SDP Capability Negotiation framework attributes

Clause 4.1 of [IETF RFC 5939] provides the example in Table 3 of how to indicate multiple transport protocols. It is assumed that an MGC receives a revised SDP offer (via SIP).

Table 3 – Example command encoding – (SIP) SDP Offer

(SIP) SDP encoding	Comments
v=0 o=- 25678 753849 IN IP4 192.0.2.1 s= c=IN IP4 192.0.2.1 t=0 0 m=audio 53456 RTP/AVP 0 18 a=tcap:1 RTP/SAVPF RTP/SAVP RTP/AVPF a=acap:1 crypto:1 AES_CM_128_HMAC_SHA1_80 inline:WVNfX19zZW1jdGwgKCkgewkyMjA7fQp9CnVubGVz|2^2	The SDP Offer includes plain RTP (RTP/AVP), RTP with RTCP-based feedback (RTP/AVPF), Secure RTP (RTP/SAVP), and Secure RTP with RTCP-based feedback (RTP/SAVPF) as alternatives. RTP is the default, with

Table 3 – Example command encoding – (SIP) SDP Offer

(SIP) SDP encoding	Comments
0|1:4 FEC_ORDER=FEC_SRTP a=acap:2 rtcp-fb:0 nack a=pcfg:1 t=1 a=1,[2] a=pcfg:2 t=2 a=1 a=pcfg:3 t=3 a=[2]	RTP/SAVPF, RTP/SAVP, and RTP/AVPF as the alternatives and preferred in the order listed. The "m=" line indicates use of plain RTP with PCMU or ITU-T G.729. The capabilities are provided by the "a=tcap:" and "a=acap:" attributes.

Given the interdependencies between the configurations in order to send this information to the MG, it would be required to send the information using multiple groups. However, as a previous audit has determined that the SDPCapNeg framework is supported, it constructs the command shown in Table 4. ReserveValue is set to "ON" because the MG which capabilities are supported it is not required to choose one. ReserveGroup is not used as the grouping concept is not needed.

Table 4 – Example command encoding – MGC request

ITU-T H.248 encoding (shortened command)	Comments

MGC to MG:
MEGACO/3 [123.123.123.4]:55555
Transaction = 50000 {
Context = $ {
Add = $ {Media {
Stream = 1 {
LocalControl {
ReservedValue = ON
},
Local {
v=0
c=IN IP4 $
m=audio $ RTP/AVP 0 18
a=tcap:1 RTP/SAVPF RTP/SAVP RTP/AVPF
a=acap:1 crypto:1 AES_CM_128_HMAC_SHA1_80
inline:WVNfX19zZW1jdGwgKCkgewkyMjA7fQp9CnVubGVz|2^20|1:4
FEC_ORDER=FEC_SRTP
a=acap:2 rtcp-fb:0 nack
a=pcfg:1 t=1 a=1,[2]
a=pcfg:2 t=2 a=1
a=pcfg:3 t=3 a=[2]
},
Remote {
v=0
o=- 25678 753849 IN IP4 192.0.2.1
s=
c=IN IP4 192.0.2.1
t=0 0
m=audio 53456 RTP/AVP 0 18
a=tcap:1 RTP/SAVPF RTP/SAVP RTP/AVPF
a=acap:1 crypto:1 AES_CM_128_HMAC_SHA1_80
inline:WVNfX19zZW1jdGwgKCkgewkyMjA7fQp9CnVubGVz|2^20|1:4
FEC_ORDER=FEC_SRTP
	The SDP Offer from the incoming SIP messages is mapped on the LD and RD in the ITU-T H.248 ADD.req command.
	SDP mapping details:
	– The IP transport connection endpoint is wildcarded in the LD.
	– The SDP media description itself is 1:1 mapped, i.e., without any change of the preferred order (e.g., due to a local policy).
	The LD follows the RD, leading to a) a symmetric RTP profile and b) a symmetric media format in both traffic directions.

Table 4 – Example command encoding – MGC request

ITU-T H.248 encoding (shortened command)	Comments
a=acap:2 rtcp-fb:0 nack a=pcfg:1 t=1 a=1,[2] a=pcfg:2 t=2 a=1 a=pcfg:3 t=3 a=[2] } } } } }	

As per the example in clause 4.1 of [IETF RFC 5939], secure RTP profiles are not supported by the MG. Plain RTP with RTCP feedback and SDP Capability Negotiation extensions are. The reply sent by the MG is shown in Table 5.

Table 5 – Example command encoding – MG reply

ITU-T H.248 encoding (shortened command)	Comments

MG to MGC:
MEGACO/3 [125.125.125.111]:55555
Reply = 50000 {
Context = 5000 {
Add = A5556{
Media {
Stream = 1 {
Local {
v=0
o=- 24351 621814 IN IP4 192.0.2.2
s=
c=IN IP4 192.0.2.2
t=0 0
m=audio 54568 RTP/AVPF 0 18
a=rtcp-fb:0 nack
a=acfg:1 t=3 a=[2]
},
Remote {
v=0
o=- 25678 753849 IN IP4 192.0.2.1
s=
c=IN IP4 192.0.2.1
t=0 0
m=audio 53456 RTP/AVP 0 18
a=rtcp-fb:0 nack
a=acfg:1 t=3 a=[2]
}
}
}
}
}
	The selected and confirmed media configuration is indicated as the "actual configuration" back to the MGC.

At this stage, the MGC may then construct (at SIP level) a revised SDP Answer utilizing the SDP Capability Negotiation framework.

11.3 Example usage of enhanced SDP Media Capabilities Negotiation Support

Clause 4.3 of [IETF RFC 6871] provides an example for latent configurations. It considers the following (SIP) SDP Offer (Table 6).

Table 6 – Example command encoding – (SIP) SDP Offer

(SIP) SDP encoding	Comments
v=0 o=- 25678 753849 IN IP4 192.0.2.1 s= c=IN IP4 192.0.2.1 t=0 0 a=creq:med-v0 m=audio 23456 RTP/AVP 0 a=rtpmap:0 PCMU/8000 a=rmcap:1 PCMU/8000 a=rmcap:2 G729/8000 a=rmcap:3 telephone-event/8000 a=mfcap:3 0-11 a=pcfg:1 m=1,3|2,3 pt=1:0,2:18,3:100 a=lcfg:10 mt=video t=1 m=10|11 a=rmcap:10 H263-1998/90000 a=rmcap:11 H264/90000 a=tcap:1 RTP/AVP a=lcfg:3 mt=message t=2 m=20 a=tcap:2 TCP/MSRP a=omcap:20 *	It is an example case in which the Offerer can support either ITU-T G.711 [b-ITU-T G.711] µ-law, or ITU-T G.729B [b-ITU-T G.729], along with DTMF telephony events for the 12 common touchtone signals, but is willing to support simple G.711 µ-law audio as a last resort. In addition, the Offerer wishes to announce its ability to support video and/or MSRP in the future, but does not wish to offer a video or an MSRP stream at present.

In order for the MGC to convey this information to the MG, it constructs the command in Table 7. As the latent configurations are not yet related to any ITU-T H.248 media stream it uses the "lconf" property.

Table 7 – Example command encoding – MGC request

ITU-T H.248 encoding (shortened command)	Comments

MGC to MG:
MEGACO/3 [123.123.123.4]:55555
Transaction = 60000 {
Context = $ {
Add = $ {Media {
TerminationState {
smcn/lconf = ["tcap:1 RTP/AVP
rmcap:10 H263-1998/90000",
"rmcap:11 H264/90000",
"lcfg:10 mt=video t=1 m=10|11}",
"lcfg:3 mt=message t=2 m=20",
"tcap:2 TCP/MSRP",
"omcap:20 *"
]}
 	
Stream = 1 {
LocalControl {
ReservedValue = ON
},
 	
Local {
v=0
c=IN IP4 $
a=creq:med-v0
m=audio $ RTP/AVP 0
a=rtpmap:0 PCMU/8000
	The *latent configuration* is indicated on TerminationState level, using the *lconf* property from the *smcn* package.
	The Offerer indicates the options of three possible latent configurations: ITU-T H.263 or ITU-T H.264 video formats or a MSRP stream.
	The *preferred configurations* are mapped into the LD/RD of the Stream Descriptor.

Table 7 – Example command encoding – MGC request

ITU-T H.248 encoding (shortened command)	Comments

a=rmcap:1 PCMU/8000
a=rmcap:2 G729/8000
a=rmcap:3 telephone-event/8000
a=mfcap:3 0-11
a=pcfg:1 m=1,3|2,3 pt=1:0,2:18,3:100
},
Remote {
v=0
o=- 25678 753849 IN IP4 192.0.2.1
s=
c=IN IP4 192.0.2.1
t=0 0
a=creq:med-v0
m=audio 23456 RTP/AVP 0
a=rtpmap:0 PCMU/8000
a=rmcap:1 PCMU/8000
a=rmcap:2 G729/8000
a=rmcap:3 telephone-event/8000
a=mfcap:3 0-11
a=pcfg:1 m=1,3|2,3 pt=1:0,2:18,3:100
}
}
}
}
}	

As per clause 4.3 of [IETF RFC 6871], the MG is able to support all the potential configurations and ITU-T H.263 video [b-ITU-T H.263], but not ITU-T H.264 video [b-ITU-T H.264]. Its reply is shown in Table 8.

Table 8 – Example command encoding – MG reply

ITU-T H.248 encoding (shortened command)	Comments

MG to MGC:
MEGACO/3 [125.125.125.111]:55555
Reply = 50000 {
Context = 6000 {
Add = A5556 {Media {
TerminationState {
smcn/lconf = [
"lcfg:2 mt=video t=1 m=10"]
}
Stream = 1 {
LocalControl {
ReservedValue = ON
},
Local {
v=0
o=- 24351 621814 IN IP4 192.0.2.2
s=
c=IN IP4 192.0.2.2
t=0 0
a=csup:med-v0
m=audio 54322 RTP/AVP 0 100
a=rtpmap:0 PCMU/8000
a=rtpmap:100 telephone-event/8000
a=fmtp:100 0-11
	The MG supports the ITU-T H.263 but not the ITU-T H.264 video format. The MG therefore confirms the requested ITU-T H.263 video configuration as a latent configuration.

Table 8 – Example command encoding – MG reply

ITU-T H.248 encoding (shortened command)	Comments

a=acfg:1 m=1,3 pt=1:0,3:100
a=pcfg:1 m=2,3 pt=2:18,3:100
},
Remote {
v=0
o=- 25678 753849 IN IP4 192.0.2.1
s=
c=IN IP4 192.0.2.1
t=0 0
a=csup:med-v0
m=audio 23456 RTP/AVP 0
a=rtpmap:0 PCMU/8000
a=rtpmap:100 telephone-event/8000
a=fmtp:100 0-11
a=acfg:1 m=1,3 pt=1:0,3:100
a=pcfg:1 m=2,3 pt=2:18,3:100
}
}
}
}
}	

11.4 Further example with respect to session configurations

Clause D.2.4.2.4 of [ITU-T T.38] provides an example with four possible session configurations. It considers the (SIP) SDP Offer shown in Table 9.

Table 9 – Copy of Table D.9 of [ITU-T T.38]

SDP encoding (shortened SDP description)	Comments
1) **OFFER** (embedded in SIP INVITE): ; SESSION CONFIGURATIONs a=sescap:1 1 ; VoIP = G.729, VBDoIP = V.152 (G.711) a=sescap:2 2 ; VoIP = G.711, VBDoIP = V.152 (G.711) a=sescap:3 3,5 ; VoIP = G.729, FoIP = T.38 UDPTL/UDP a=sescap:4 4,5 ; VoIP = G.711, FoIP = T.38 UDPTL/UDP ; LATENT CONFIGURATION for T.38 a=tcap:2 udptl ; T.38 FoUDPTL/UDP transport variant a=omcap:5 t38 ; T.38 FoIP codec (subtype = 't38') a=acap:11 T38FaxVersion:4 a=acap:12 T38FaxRateManagement:transferredTCF a=acap:13 T38FaxUdpEC:t38UDPRedundancy a=acap:14 (… additional T.38 attributes may be incl.) a=lcfg:5 mt=image t=2 m=5 a=11,12,13,14,… ; ACTUAL CONFIGURATION (due to backward compatibility) … ommitted … ; ; POTENTIAL CONFIGURATIONs a=tcap:1 RTP/AVP ; transport for VoIP & VBDoIP a=rmcap:1 G729/8000 ; audio codec 1 a=rmcap:2,3 PCMU/8000 ; audio codec 2 & VBD codec a=mscap:3 gpmd vbd=yes ; for V.152 PCMU a=pcfg:1 t=1 a=-ms m=1,3 pt=1:18,3:99 a=pcfg:2 t=1 a=-ms m=2,3 pt=2:0,3:99 a=pcfg:3 t=1 a=-ms m=1 pt=1:18 a=pcfg:4 t=1 a=-ms m=2 pt=2:0	Offered (4) potential configurations (as session configurations due to 'voice' and 'facsimile'): – Preference 1: Audio (ITU-T G.729), VBD (ITU-T V.152 PCMU) and NTE (RFC 4733) – Preference 2: Audio (PCMU), VBD (ITU-T V.152 PCMU) and NTE (RFC 4733) – Preference 3: Audio (ITU-T G.729) and Fax Relay (ITU-T T.38 FoUDPTL/UDP) – Preference 4: Audio (PCMU) and Fax Relay (ITU-T T.38 FoUDPTL/UDP)
2) **ANSWER** (embedded in SIP 200 OK): … a=sescap:4	The *Answerer* prefers the 4th session configuration.

The MGC maps the SDP Offer to an ITU-T H.248 command request. An example mapping is shown in Table 10.

Table 10 – Example command encoding – MGC request

ITU-T H.248 encoding (shortened command)	Comments

MGC to MG:
MEGACO/3 [123.123.123.4]:55555
Transaction = 60000 {
Context = $ {
Add = $ {Media {
TerminationState {
smcn/sconf = ["1 1", "2 2", "3 3,5",
"4 4,5"],
smcn/lconf = ["tcap:2 udptl",
"omcap:5 t38",
"acap:11 T38FaxVersion:4",
"acap:12 T38FaxRateManagement:transferredTCF",
"acap:13 T38FaxUdpEC:t38UDPRedundancy",
"lcfg:5 mt=image t=2 m=5 a=11,12,13"]
},
Stream = 1 {
LocalControl {
ReservedValue = ON
},
Local {
v=0
c=IN IP4 $
a=creq:med-v0
m=audio $ RTP/AVP 18
a=rtpmap:18 G729/8000
a=tcap:1 RTP/AVP
a=rmcap:1 G729/8000
a=rmcap:2,3 PCMU/8000
a=mscap:3 gpmd vbd=yes
a=pcfg:1 t=1 a=-ms m=1,3 pt=1:18,3:99
a=pcfg:2 t=1 a=-ms m=2,3 pt=2:0,3:99
a=pcfg:3 t=1 a=-ms m=1 pt=1:18
a=pcfg:4 t=1 a=-ms m=2 pt=2:0
}
}
}
}
}
	In Table 9 above, as the image/t38 based media description is not offered as a potential configuration but only communicated as latent configuration, the MGC neither adds an image/t38 based session description as separate group to the Stream 1 LD nor does it add a second image/t38 based ITU-T H.248 stream. Potential future usage of ITU-T T.38 would require a subsequent SDP offer/answer negotiation procedure, which then would typically trigger corresponding ITU-T H.248 procedures to modify the created stream endpoint to an image/t38 based session and media description.

It is assumed that the MG does not support ITU-T G.729 [b-ITU-T G.729] and that it therefore only supports session configurations 2 (Audio (PCMU), VBD (V.152 PCMU)) and 4 (Audio (PCMU) and Fax Relay (ITU-T T.38 FoUDPTL/UDP)). An example MG reply is shown in Table 11.

Table 11 – Example command encoding – MG reply

ITU-T H.248 encoding (shortened command)	Comments

MG to MGC:
MEGACO/3 [125.125.125.111]:55555
Reply = 60000 {
  Context = 6000 {
  Add = A5678 {
  Media {
  TerminationState {
  smcn/sconf = ["2 2", "4 4,5"],
  smcn/lconf = [
  "tcap:2 udptl",
  "omcap:5 t38",
  "acap:11 T38FaxVersion:4",
  "acap:12 T38FaxRateManagement:transferredTCF",
  "acap:13 T38FaxUdpEC:t38UDPRedundancy",
  …, // Further acap attributes
  "lcfg:5 mt=image t=2 m=5 a=11,12,13,…"]
  },
  Stream = 1 {
  Local {
v=0
o=- 24351 621814 IN IP4 192.0.2.2
s=
c=IN IP4 192.0.2.2
t=0 0
a=creq:med-v0
m=audio 53456 RTP/AVP 18
a=rtpmap:18 G729/8000
a=tcap:1 RTP/AVP
a=rmcap:2,3 PCMU/8000
a=mscap:3 gpmd vbd=yes
a=pcfg:2 t=1 a=-ms m=2,3 pt=2:0,3:99
a=pcfg:4 t=1 a=-ms m=2 pt=2:0
  }
  }
  }
  }
  }
}
	The TerminationState Descriptor and the *smcn/sconf* property are added to the MG's reply because the MG only supports two of the MGC requested four session configurations.

11.5 Further example with respect to multiple latent configurations

Clause D.2.4.2.5 of [ITU-T T.38] provides an example with multiple latent configurations. It considers the (SIP) SDP Offer described in Table 12.

Table 12 – Copy of Table D.10 of [ITU-T T.38]

SDP encoding (shortened SDP description)	Comments
1) **OFFER** (embedded in SIP INVITE): ; SESSION CONFIGURATIONs a=sescap:1 1,3 ; VoIP = G.729, FoIP = T.38 UDPTL/UDP with packet red a=sescap:2 1,4 ; VoIP = G.729, FoIP = T.38 UDPTL/UDP with NoEC a=sescap:3 1,5 ; VoIP = G.729, FoIP = T.38 UDPTL/UDP with FEC ; LATENT CONFIGURATION for T.38 a=tcap:2 udptl ; T.38 FoUDPTL/UDP transport variant a=omcap:5 t38 ; T.38 FoIP codec (subtype = 't38') a=acap:11 T38FaxVersion:4 a=acap:12 T38MaxBitRate:14400 ; NOTE – the exclusion of attributes "T38FaxFillBitRemoval", "T38FaxTranscodingMMR" and "T38FaxTranscodingJBIG" means value "FALSE" (see [IETF RFC 4612]). a=acap:16 T38FaxRateManagement:transferredTCF a=acap:17 T38FaxMaxBuffer:1800 a=acap:18 T38FaxMaxDatagram:150 a=acap:19 T38ModemType:t38G3FaxOnly a=acap:21 T38FaxUdpEC:t38UDPRedundancy ; error correction scheme 1 a=acap:22 T38FaxUdpEC:t38UDPNoEC ; error correction scheme 2 a=acap:23 T38FaxUdpEC:t38UDPFEC ; error correction scheme 3 a=lcfg:3 mt=image t=2 m=5 a=11,12,16,17,18,19,21 ; T.38 configuration #1 a=lcfg:4 mt=image t=2 m=5 a=11,12,16,17,18,19,22 ; T.38 configuration #2 a=lcfg:5 mt=image t=2 m=5 a=11,12,16,17,18,19,23 ; T.38 configuration #3 ; ACTUAL CONFIGURATION (due to backward compatibility) … ommitted … ; ; POTENTIAL CONFIGURATIONs a=tcap:1 RTP/AVP ; transport for VoIP a=acap:1 ptime:10 ; for G.711 a=rmcap:1 G729/8000 ; audio codec 1 a=pcfg:1 t=1 a=-ms:1 m=1 pt=1:18	Offered (4) potential configurations (as session configurations due to 'voice' and 'facsimile'): – Preference 1: Audio (ITU-T G.729) and Fax Relay (ITU-T T.38 FoUDPTL/UDP with error correction method "t38UDPRedundancy"), i.e., ITU-T T.38 using packet redundancy as error correction. – Preference 2: Audio (ITU-T G729) and Fax Relay (ITU-T T.38 FoUDPTL/UDP with error correction method "t38UDPNoEC"), i.e., ITU-T T.38 without any error correction. – Preference 3: Audio (ITU-T G.729) and Fax Relay (ITU-T T.38 FoUDPTL/UDP with error correction method "t38UDPFEC"), i.e., ITU-T T.38 using Forward Error Correction as error correction.
2) **ANSWER** (embedded in SIP 200 OK): … a=sescap:1	The *Answerer* prefers the 1st session configuration.

The MGC maps the SDP Offer in Table 12 to an ITU-T H.248 command request. An example mapping is shown in Table 13.

Table 13 – Example command encoding – MGC request

ITU-T H.248 encoding (shortened command)	Comments

MGC to MG:
MEGACO/3 [123.123.123.4]:55555
Transaction = 60000 {
  Context = $ {
  Add = $ {
  Media {
  TerminationState {
  smcn/sconf = ["1 1,3", "2 1,4", "3 1,5"],
  smcn/lconf = [
  "tcap:2 udptl",
  "omcap:5 t38",
  "acap:11 T38FaxVersion:4",
  "acap:12 T38MaxBitRate:14400",
  "acap:16 T38FaxRateManagement:transferredTCF",
  "acap:17 T38FaxMaxBuffer:1800",
  "acap:18 T38FaxMaxDatagram:150",
  "acap:19 T38ModemType:t38G3FaxOnly",
  "acap:21 T38FaxUdpEC:t38UDPRedundancy",
  "acap:22 T38FaxUdpEC:t38UDPNoEC",
  "acap:23 T38FaxUdpEC:t38UDPFEC",
  "lcfg:3 mt=image t=2 m=5 a=11,12,16,17,18,19,21",
  "lcfg:4 mt=image t=2 m=5 a=11,12,16,17,18,19,22",
  "lcfg:5 mt=image t=2 m=5 a=11,12,16,17,18,19,23"]
  },
  Stream = 1 {
  LocalControl {
  ReservedGroup = off,
  ReservedValue = off
  },
  Local {
v=0
c=IN IP4 $
a=creq:med-v0
m=audio $ RTP/AVP 18
a=rtpmap:18 G729/8000
a=tcap:1 RTP/AVP ; transport for VoIP
a=acap:1 ptime:10 ; for G.711
a=rmcap:1 G729/8000 ; audio codec 1
a=pcfg:1 t=1 a=-ms:1 m=1 pt=1:18
  }
  }
  }
  }
  }
}	

Here it is assumed that the MG only supports error correction methods "t38UDPRedundancy" and "t38UDPNoEC". An example MG reply is shown in Table 14.

Table 14 – Example command encoding – MG reply

ITU-T H.248 encoding (shortened command)	Comments

MG to MGC:
MEGACO/3 [125.125.125.111]:55555
Reply = 60000 {
  Context = 6000 {
  Add = A5678 {
  Media {
  TerminationState {
  smcn/sconf = ["1 1,3", "2 1,4"],
  smcn/lconf = [
  "tcap:2 udptl",
  "omcap:5 t38",
  "acap:11 T38FaxVersion:4",
  "acap:12 T38MaxBitRate:14400",
  "acap:16 T38FaxRateManagement:transferredTCF",
  "acap:17 T38FaxMaxBuffer:1800",
  "acap:18 T38FaxMaxDatagram:150",
  "acap:19 T38ModemType:t38G3FaxOnly",
  "acap:21 T38FaxUdpEC:t38UDPRedundancy",
  "acap:22 T38FaxUdpEC:t38UDPNoEC",
  "lcfg:3 mt=image t=2 m=5 a=11,12,16,17,18,19,21",
  "lcfg:4 mt=image t=2 m=5 a=11,12,16,17,18,19,22",
  },
  Stream = 1 {
  Local {
v=0
o=- 24351 621814 IN IP4 192.0.2.2
s=
c=IN IP4 192.0.2.2
t=0 0
a=creq:med-v0
m=audio 53456 RTP/AVP 18
a=rtpmap:18 G729/8000
a=tcap:1 RTP/AVP ; transport for VoIP
a=acap:1 ptime:10 ; for G.711
a=rmcap:1 G729/8000 ; audio codec 1
a=pcfg:1 t=1 a=-ms:1 m=1 pt=1:18
  }
  }
  }
  }
  }
}	

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