Abstract

SDP has been extended with a capability negotiation mechanism framework that allows the endpoints to negotiate transport protocols and attributes. This framework has been extended with a Media capabilities negotiation mechanism that allows endpoints to negotiate additional media-related capabilities. This negotiation is embedded into the widely-used SDP offer/answer procedures.

This memo extends the SDP capability negotiation framework to allow endpoints to negotiate a number of miscellaneous SDP capabilities. In particular, this memo provides a mechanism to negotiate media titles ("i=" line for each media), connection data ("c=" line), and media bandwidth ("b=" line).

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# Table of Contents

1. Introduction ............................................. 4  
2. Conventions Used in This Document ......................... 4  
3. Protocol Description ...................................... 5  
   3.1. Extensions to SDP ................................... 5  
      3.1.1. Bandwidth Capability .............................. 6  
      3.1.2. Connection Data Capability ....................... 8  
      3.1.3. Information Capability ......................... 10  
   3.2. Session Level versus Media Level .................. 13  
4. Field Replacement Rules .................................. 13  
5. IANA Considerations ...................................... 14  
   5.1. New SDP Attributes ................................. 14  
   5.2. New Option Tags .................................. 14  
   5.3. New SDP Capability Negotiation Configuration Parameters 15  
6. Security Considerations .................................. 15  
7. Acknowledgments .......................................... 15  
8. References ............................................... 15  
   8.1. Normative References ............................... 15  
   8.2. Informative References ............................. 16  
Authors’ Addresses ........................................ 16
1. Introduction

The Session Description Protocol (SDP) [RFC4566] is intended for describing multimedia sessions for the purposes of session announcement, session invitation, and other forms of multimedia session initiation. SDP has been extended with a capability negotiation mechanism framework [I-D.ietf-mmusic-sdp-capability-negotiation] that allows the endpoints to negotiate capabilities, such as support for Realtime Transport Protocol (RTP) [RFC3550] and Secure Realtime Transport Protocol (SRTP) [RFC3711]. The SDP media capabilities [I-D.ietf-mmusic-sdp-media-capabilities] provides negotiation capabilities to media lines as well.

This negotiation is embedded into the widely used SDP offer/answer procedures [RFC3264]. This memo provides the means to negotiate further capabilities than those specified in the SDP capability negotiation mechanism framework [I-D.ietf-mmusic-sdp-capability-negotiation] and the SDP media capabilities [I-D.ietf-mmusic-sdp-media-capabilities]. In particular, this memo provides a mechanism to negotiate media titles ("i="), connection data ("c="), and media bandwidth ("b="). It would have been possible to define a mechanism to negotiate media encryption keys ("k="). However, the usage of the media encryption keys ("k=") is highly discouraged in favour of other existing more sophisticated mechanisms. Therefore, we are not providing a mechanism to provide capabilities for media encryption keys ("k=") at this stage.

Since the three added capabilities are highly unconnected, it is not expected that implementations will support all three at the same time. Instead, it is expected that applications will choose their needed capability for their specific purpose. Due to this, we are writing the normative part pertaining to each capability in a self-contained section. In particular, Section 3.1.1 describes the bandwidth capability extension, Section 3.1.2 describes the connection data capability extension, and Section 3.1.3 describes the information capability extension. Separate option tags are defined for each capability.

2. Conventions Used in This Document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14, RFC 2119 [RFC2119] and indicate requirement levels for compliant implementations.
3. Protocol Description

3.1. Extensions to SDP

The SDP Capability Negotiation Framework [I-D.ietf-mmusic-sdp-capability-negotiation] and the SDP media capabilities [I-D.ietf-mmusic-sdp-media-capabilities] specify attributes for negotiating SDP capabilities. These documents specify new attributes (e.g., 'acap', 'tcap', 'mcap') for achieving their purpose. In this document we define a number of new additional capability attributes for SDP lines of the the general form:

\[ \text{type} = \text{value} \]

for types "i", "c", and "b". The corresponding capability attributes are defined as "icap", "ccap", and "bcap", respectively.

From the sub-rules of "a=" line in SDP [RFC4566], SDP attributes are of the form:

\[ \text{attribute} = (\text{att-field} \, " : " \, \text{att-value}) / \text{att-field} \]
\[ \text{att-field} = \text{token} \]
\[ \text{att-value} = \text{byte-string} \]

Capability attributes use only the 'att-field:att-value' form.

The new attributes may be referenced in potential configurations ("a=pcfg") or in latent configurations ("a=lcfg"), as productions conforming to the extension-config-list as defined in [I-D.ietf-mmusic-sdp-capability-negotiation].

\[ \text{extension-config-list} = ["+" \, \text{ext-cap-name} \, "=" \, \text{ext-cap-list}] \]
\[ \text{ext-cap-name} = 1*(\text{ALPHA} / \text{DIGIT}) \]
\[ \text{ext-cap-list} = 1*\text{VCHAR} \quad \text{; defined in} \quad [\text{RFC4234}] \]

The optional "+" is used to indicate that the entire configuration, not just the parameter, must be ignored if the parameter is not supported. The attributes may be referenced in actual configurations as productions conforming to the sel-extension-config defined in [I-D.ietf-mmusic-sdp-capability-negotiation].

\[ \text{sel-extension-config} = \text{ext-cap-name} \, "=" \, 1*\text{VCHAR} \]

The specific parameters are defined in the individual description of each capability, below.

It is not the intention of this work to negotiate these new
capabilities at the session level, rather only at the media level. Therefore, capabilities referenced by any configuration attribute MUST appear at the media level when a configuration is "converted" to a corresponding media block. For this reason, the "icap" attribute is called the "media information capability". Specific values for each new attribute are described below.

3.1.1. Bandwidth Capability

According to RFC 4566 [RFC4566] the bandwidth field denotes the proposed bandwidth to be used by the session or media. For what it concerns this memo, we focus on the bandwidth at the media level. This bandwidth field is specified in RFC 4566 [RFC4566] according to the following syntax:

\[ \text{b=<bwtype>:<bandwidth}> \]

where \(<\text{bwtype}>\) is an alphanumeric modifier giving the meaning of the \(<\text{bandwidth}>\) figure.

In this document, we define a new capability attribute: the bandwidth capability attribute "bcap". This attribute lists bandwidth as capabilities according to the following definition:

\[ "\text{a=}\text{bcap:} \text{ bw-cap-num 1*WSP bwtype ":" bandwidth CRLF} \]

where \(<\text{bw-cap-num}>\) is a unique ordinal identifier of the bandwidth capability, and the other elements are as defined for the "b=" field in [RFC4566].

This format satisfies the general attribute production rules in RFC4566 according to the following Augmented Backus-Naur Form (ABNF) [RFC5234] syntax:

\[
\begin{align*}
\text{att-field} & = \text{"bcap"} \\
\text{att-value} & = \text{bw-cap-num 1*WSP bwtype ":" bandwidth} \\
\text{bw-cap-num} & = 1*DIGIT \ ; \text{integer between 1 and 2^31-1, inclusive}
\end{align*}
\]

Negotiation of bandwidth per media stream can be useful when negotiating media encoding capabilities with different bandwidths.

3.1.1.1. Configuration Parameters

The SDP Capability Negotiation Framework [I-D.ietf-mmusic-sdp-capability-negotiation] provides for the existence of the "pcfg" and "acfg" attributes, which can carry one or more potential configurations to be negotiated. The concept is extended by the the Media Capabilities Negotiation
In this document we extend the <extension-config-list> field to be able to convey lists of bandwidth capabilities in latent or potential configurations, according to the following Augmented Backus-Naur Form (ABNF) [RFC5234] syntax:

```
extension-config-list = bandwidth-config-list

bandwidth-config-list = ["+"] "b=" bw-cap-list *(BAR b-cap-list)
bw-cap-list = bw-cap-num *"," b-cap-num
bw-cap-num = 1*DIGIT ; 1 to 2^32-1 inclusive
```

Figure 1: Syntax of the bandwidth parameter in lcfg and pcfg attributes

Each bandwidth capability configuration is a comma-separated list of bandwidth capability attribute numbers where 'b-cap-num' refers to the bw-cap-num bandwidth capability numbers defined explicitly earlier in this document, and hence must be between 1 and 2^31-1 (both included). Alternative bandwidth configurations are separated by a vertical bar ("|").

The bandwidth parameter to the actual configuration attribute ("a=acfg") is formulated as a sel-extension-config with

```
ext-cap-name = "b"
```

hence

```
 sel-extension-config = sel-bandwidth-config
sel-bandwidth-config = "b=" bw-cap-list ; bw-cap-list as above.
```

Figure 2: Syntax of the bandwidth parameter in acfg attributes

### 3.1.1.2. Option tag

The SDP Capability Negotiation Framework [I-D.ietf-mmusic-sdp-capability-negotiation] solution allows for capability negotiation extensions to be defined. Associated with each such extension is an option tag that identifies the extension in question. Hereby, we define a new option tag of "bcap-v0" that identifies support for the bandwidth capability. This option tag
SHOULD be added to other existing option tags present in the "csup" and "creq" attributes in SDP, according to the procedures defined in the SDP Capability Negotiation Framework [I-D.ietf-mmusic-sdp-capability-negotiation].

3.1.2. Connection Data Capability

According to SDP [RFC4566], the connection data field in SDP contains the connection data, and it has the following syntax:

```
c=<nettype> <addrtype> <connection-address>
```

where `<nettype>` indicates the network type, `<addrtype>` indicates the address type, and the `<connection-address>` is the connection address, which is dependent on the address type. For internet (IN) network type transport addresses, the port number (`<port>`) which appears in the media line is also required to complete the address.

The address types "IP4" and "IP6" indicate the type of IP addresses.

[I-D.ietf-mmusic-sdp-cs] defines a circuit-switched (CS) network type intended primarily to identify an alternative media path in case IN connectivity is overloaded or unavailable. This use requires the SDP Capability Negotiation ([I-D.ietf-mmusic-sdp-capability-negotiation]) framework, as illustrated below.

SDP [RFC4566] permits specification of connection data at the session or at the media level. In order to permit negotiation of connection data at the media level, we define the connection data capability attribute ("a=ccap") in the form:

```
"a=ccap:" conn-cap-num 1*WSP nettype SP addrtype SP connection-address SP port ["/" integer] CRLF
```

where `<conn-cap-num>` is a unique ordinal identifier of the connection data capability, and the other elements are as defined in [RFC4566].

This format corresponds to the [RFC4566] attribute production rules according to the following Augmented Backus-Naur Form (ABNF) [RFC5234] syntax:

```
att-field = "ccap"
att-value = conn-cap-num 1*WSP nettype SP addrtype SP connection-address SP port ["/" integer]
conn-cap-num = 1*DIGIT ; integer between 1 and 2^31-1, inclusive
```

The ccap attribute contains a port number, which is required for the media line when converting a potential or latent configuration into a
conventional media description. The ccap attribute is a media-level-only attribute. When a potential configuration references a ccap attribute, and that configuration is converted to an equivalent media description, the resulting configuration will contain a media-level connection ("c=") line derived from the ccap information.

A potential or latent configuration may invoke no more than one ccap attribute at a time (see below).

The connection information capability can be used to negotiate the use of IPv4 or IPv6 addresses without resort to Interactive Connectivity Establishment (ICE) [I-D.ietf-mmusic-ice]. Note, however, that ICE provides for real-time reachability testing of multiple addresses, whereas use of the connection capability forces an early choice of connection address.

[I-D.boucadair-mmusic-altc] describes a simple method of specifying alternative network addresses when the transport protocol (<proto>) is the same.

3.1.2.1. Configuration Parameters

The SDP Capability Negotiation Framework [I-D.ietf-mmusic-sdp-capability-negotiation] provides for the existence of the "pcfg" and "acfg" attributes, which can carry one or more potential configurations to be negotiated. The concept is extended by the Media Capabilities Negotiation [I-D.ietf-mmusic-sdp-media-capabilities] with an "lcfg" attribute that conveys latent configurations.

In this document we define a <connection-config> parameter to be used to specify a connection data capability in a potential or latent configuration attribute. The parameter follows the form of an extension-config-list, with

\[
\text{ext-cap-name} = \text{"c"} \\
\text{ext-cap-list} = \text{conn-cap-list}
\]

where, according to the following Augmented Backus-Naur Form (ABNF) [RFC5234] syntax:

\[
\text{extension-config-list} = \text{conn-config-list} \\
\text{conn-config-list} = \text{"c=" conn-cap-list} \\
\text{conn-cap-list} = \text{conn-cap-num *(BAR conn-cap-num)} \\
\text{conn-cap-num} = \text{1*DIGIT} ; 1 \text{ to } 2^{32}-1 \text{ inclusive}
\]

Figure 3: Syntax of the connection data parameter in lcfg and pcfg
attributes

Each capability configuration alternative contains a single connection data capability attribute number and refers to the conn-cap-num capability number defined explicitly earlier in this document, and hence must be between 1 and $2^{31}-1$ (both included). The connection data capability allows the expression of only a single capability in each alternative, rather than a list of capabilities, since no more than a single connection data field is permitted per media block. Nevertheless, it is still allowed to express alternative potential connection configurations separated by a vertical bar ("|").

The connection data parameter to the actual configuration attribute ("a=acfg") is formulated as a sel-extension-config with

```plaintext
   ext-cap-name = "c"

hence

   sel-extension-config = sel-connection-config
   sel-connection-config = "c=" conn-cap-num ; as defined above.
```

Figure 4: Syntax of the connection data parameter in acfg attributes

3.1.2.2. Option tag

The SDP Capability Negotiation Framework [I-D.ietf-mmusic-sdp-capability-negotiation] solution allows for capability negotiation extensions to be defined. Associated with each such extension is an option tag that identifies the extension in question. Hereby, we define a new option tag of "ccap-v0" that identifies support for the connection data capability. This option tag SHOULD be added to other existing option tags present in the "csup" and "creq" attributes in SDP, according to the procedures defined in the SDP Capability Negotiation Framework [I-D.ietf-mmusic-sdp-capability-negotiation].

3.1.3. Information Capability

RFC 4566 [RFC4566] provides for the existence of an information field expressed in the format of the "i=" line, which can appear either at the session level or at the media level. An "i=" line that is present at the session level is known as the "session name", and its purpose is to convey a human-readable textual information about the session. We don’t see much usage of capabilities related to the "i=" line at the session level.
The "i=" line in SDP can also appear at the media level, in which case it is used to provide human-readable information about the media stream to which it is related, e.g., it may indicate the purpose of the media stream. The information field is not to be confused with the label attribute ("a=label:...), [RFC4574]) which provides a machine-readable tag. It is foreseen that applications declaring capabilities related to different configurations of a media stream may need to provide different identifying information for each of those configurations. That is, a party might offer alternative media configurations for a stream, each of which represents a different presentation of the same or similar information. For example, an audio stream might offer English or Spanish configurations, or a video stream might offer a choice of video source such as speaker camera, group camera, or document viewer. The information capability is needed to inform the answering user in order to select the proper choice, and the label is used to inform the offering machine which choice the answerer has selected. Hence, there is value in defining a mechanism to provide information of media streams as capabilities.

According to SDP [RFC4566], the media label has the following syntax:

"i="text

where "text" represents a human-readable text indicating the purpose of the media stream.

In this document we define a new capability attribute: the information media capability, "icap". This attribute lists information media labels as capabilities, according to the following definition:

"a=icap:" info-cap-num 1*WSP text

where <info-cap-num> is the ordinal identifier of the particular media information capability and <text> is a human-readable text that indicates the purpose of the media stream it is supposed to characterize.

As an example, one might use:

a=icap:1 Document Camera

to represent a purpose of a media stream identified with the capability number 1.

The media information capability attribute satisfies the general attribute production rules in [RFC4566] according to the following Augmented Backus-Naur Form (ABNF) [RFC5234] syntax:
3.1.3.1. Configuration Parameters

The SDP Capability Negotiation Framework
[I-D.ietf-mmusic-sdp-capability-negotiation] provides for the
existence of the "pcfg" and "acfg" attributes, which can carry one or
more potential configurations to be negotiated. The concept is
extended by the the Media Capabilities Negotiation
[I-D.ietf-mmusic-sdp-media-capabilities] with an "lcfg" attribute
that conveys latent configurations.

In this document, we define an <info-config-list> parameter to be
used to convey information capabilities in a potential or latent
configuration. This parameter is defined as an <extension-config-
list> with the following associations:

```
ext-cap-name = "i"

ext-cap-list = info-cap-list
```

This leads to the following definition for the information capability
parameter:

```
extension-config-list = info-config-list
info-config-list      = "i=" info-cap-list
info-cap-list         = info-cap-num *(BAR info-cap-num)
info-cap-num          = 1*DIGIT   ; integer between 1 and 2^31-1
```

Figure 5: Syntax of the information capability parameter in lcfg and
pcfg attributes

Each potential capability configuration contains a single information
capability attribute number where ‘info-cap-num’ is the information
capability number defined explicitly earlier in this document, and
hence must be between 1 and 2^31-1 (both included). The information
capability allows the expression of only a single capability in each
alternative, since no more than a single information field is
permitted per media block. Nevertheless, it is still allowed to
express alternative potential information configurations separated by
a vertical bar ("|").
3.1.3.2. Option Tag

At present, it is difficult to envision a scenario in which the 'icap' attribute must be supported or the offer must be rejected. In most cases, if the icap attribute or its contents were to be ignored, an offered configuration could still be chosen based on other criteria such as configuration numbering. However, one might imagine an SDP offer that contained English and Spanish potential configurations for an audio stream. The session might be unintelligible if the choice is based on configuration numbering, rather than informed user selection. Based on such considerations, it may well prove useful to announce the ability to use the icap attribute and its contents to select media configurations, or to inform the user about the selected configuration(s). Therefore, we define a new option tag of "icap-v0" that identifies support for the media information capability. This option tag SHOULD be added to other existing option tags present in the "csup" and/or "creq" attributes in SDP, according to the procedures defined in the SDP Capability Negotiation Framework [I-D.ietf-mmusic-sdp-capability-negotiation]. The discussion above suggests that "icap-v0" will typically appear in a "csup" attribute, but rarely in a "creq" attribute.

3.2. Session Level versus Media Level

The icap, ccap, and bcap attributes can appear at the session level and/or at the media level, but MUST be interpreted as a media-level capability. To avoid confusion, the <type-attr-num> for each line must be unique across all capability attributes of the same type within the entire session description. As described below, these capability attributes may be referenced by acfg, pcfg and/or lcfg attributes.

4. Field Replacement Rules

To simplify the construction of SDP records, given the need to include fields at the base level for endpoints that do not support capabilities negotiation, we define some simple field-replacement rules for those fields invoked by potential or latent configurations. In particular, any i-field or c-field invoked by a configuration MUST replace the corresponding field, if present at the base media level. Any b-field invoked by a configuration MUST replace any b-field of the same bandwidth type at the media level.
5. IANA Considerations

5.1. New SDP Attributes

IANA is hereby requested to register the following new SDP attributes:

- **Attribute name:** icap
  - **Long form name:** Information Capability
  - **Type of attribute:** Media-level
  - **Subject to charset:** Yes
  - **Purpose:** Negotiate human-readable media information
  - **Appropriate values:** See Section 3.1.3

- **Attribute name:** ccap
  - **Long form name:** Connection Data Capability
  - **Type of attribute:** Media-level
  - **Subject to charset:** No
  - **Purpose:** Negotiate media-level connection data
  - **Appropriate values:** See Section 3.1.2

- **Attribute name:** bcap
  - **Long form name:** Bandwidth Capability
  - **Type of attribute:** Media-level
  - **Subject to charset:** No
  - **Purpose:** Negotiate media-level bandwidths
  - **Appropriate values:** See Section 3.1.1

5.2. New Option Tags

IANA is hereby requested to add the new option tags "ccap-v0", "icap-v0", and "bcap-v0", defined herein, to the SDP Capability Negotiation Option Tag Registry.
5.3. New SDP Capability Negotiation Configuration Parameters

6. Security Considerations

This document provides an extension on top of RFC 4566 [RFC4566], RFC 3264 [RFC3264], SDP Capability Negotiation Framework [I-D.ietf-mmusic-sdp-capability-negotiation], and SDP Media Capabilities Negotiation [I-D.ietf-mmusic-sdp-media-capabilities]. As such, the security considerations of those documents apply.

7. Acknowledgments

Thanks to Christer Holmberg, Alf Heidermark, and Ingemar Johansson for arguing for the existence of this document and early reviewing it.

8. References

8.1. Normative References

[I-D.boucadair-mmusic-altc]

[I-D.ietf-mmusic-sdp-capability-negotiation]

[I-D.ietf-mmusic-sdp-cs]

[I-D.ietf-mmusic-sdp-media-capabilities]


8.2. Informative References


Authors’ Addresses

Miguel A. Garcia-Martin
Ericsson
Calle Via de los Poblados 13
Madrid, 28033
Spain

Phone: +34 91 339 1000
Email: miguel.a.garcia@ericsson.com