Multiplexing Negotiation Using Session Description Protocol (SDP) Port Numbers
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Abstract

   This specification defines a new SDP Grouping Framework extension,
   "BUNDLE", that can be used with the Session Description Protocol
   (SDP) Offer/Answer mechanism to negotiate the usage of bundled media,
   which refers to the usage of a single 5-tuple for media associated
   with multiple SDP media descriptions ("m=" lines).

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1. Introduction

   In the IETF RTCWEB WG, a need to use a single 5-tuple for sending and
   receiving media associated with multiple SDP media descriptions ("m="
   lines) has been identified. This would e.g. allow the usage of a
   single set of Interactive Connectivity Establishment (ICE) [RFC5245]
   candidates for multiple media descriptions. Normally different media
   types (audio, video etc) will be described using different media
   descriptions.

   This specification defines a new SDP Grouping Framework [RFC5888]
   extension, "BUNDLE", that can be used with the Session Description
   Protocol (SDP) Offer/Answer mechanism [RFC3264] to negotiate the
   usage of bundled media, which refers to the usage of a single 5-tuple
   for media associated with multiple SDP media descriptions ("m="
   lines).

   The Offerer and Answerer [RFC3264] use the BUNDLE mechanism to
   negotiate a single BUNDLE address to be used for the bundled media
   associated with a BUNDLE group.

   The BUNDLE mechanism allows an SDP Offerer and SDP Answerer to assign
   identical addresses to multiple "m=" lines, if those "m=" lines are
   associated with a BUNDLE group. However, until it is known whether
   both the Offerer and Answerer support the BUNDLE mechanism, unique
   addresses are assigned to each "m=" line, including those associated
   with a BUNDLE group.

   NOTE: As defined in RFC 4566 [RFC4566], the semantics of multiple
   "m=" lines using the same port number value are undefined, and there

is no grouping defined by such means. Instead, an explicit grouping mechanism needs to be used to express the intended semantics. This specification provides such extension.

SDP Offers and SDP Answer can contain multiple BUNDLE groups. For each BUNDLE group, a BUNDLE address is negotiated. Multiple BUNDLE groups cannot share the same bundle address.

The default assumption is that all Real-Time Protocol (RTP) [RFC3550] based media flows within a BUNDLE group belongs to the same RTP Session [RFC3550]. Future extensions can change that assumption.

The BUNDLE mechanism is backward compatible. Endpoints that do not support the BUNDLE mechanism are expected to generate SDP Offers and SDP Answers without an SDP group:BUNDLE attribute, and are expected to assign unique addresses to each "m=" line, according to the procedures in [RFC4566] and [RFC3264]

2. Terminology

5-tuple: A collection of the following values: source address, source port, destination address, destination port and protocol.

Bundled media: Two or more RTP streams using a single 5-tuple. The RTCP streams associated with the RTP streams also use a single 5-tuple, which might be the same, but can also be different, as the one used by the RTP streams.

Unique address: This refers to an IP address and IP port combination, that can only be associated with a single "m=" line within an SDP Session.

BUNDLE address: This refers to an IP address and IP port combination, that is associated with each "m=" line within a BUNDLE group, within an SDP Session. The zero IP port value BUNDLE address MUST NOT be used in a BUNDLE address.

NOTE: "m=" lines that share a BUNDLE address MUST also share other parameters related to the media transport plane, e.g. ICE candidate information.

3. Conventions

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].

4. Applicability Statement

The mechanism in this specification only applies to the Session
Description Protocol (SDP) [RFC4566], when used together with the SDP
Offer/Answer mechanism [RFC3264].

5. SDP Grouping Framework BUNDLE Extension Semantics

This section defines a new SDP Grouping Framework extension, BUNDLE.

The BUNDLE extension can be indicated using an SDP session-level
'group' attribute. Each SDP Media Description ("m=" line) that is
grouped together, using SDP media-level mid attributes, belongs to a
given BUNDLE group.

6. SDP Offer/Answer Procedures

6.1. General

This section describes the usage of the SDP Offer/Answer mechanism
[RFC3264] to negotiate the usage of the BUNDLE mechanism, to
negotiate the BUNDLE address, and to add, remove and reject SDP Media
Descriptions ("m=" lines) [RFC4566] associated with a BUNDLE group.

The generic rules and procedures defined in [RFC3264] and [RFC5888]
apply when the SDP Offer/Answer mechanism is used with the BUNDLE
mechanism. For example, if an SDP Offer is rejected, the previously
negotiated SDP parameters and characteristics (including those
associated with BUNDLE groups) apply.

When an endpoint, acting as an Offerer or Answerer [RFC3264],
generates an SDP Offer, or an SDP Answer, the endpoint MUST assign an
SDP media-level mid value for each "m=" line in a BUNDLE group. In
addition, the endpoint MUST assign an SDP session-level group:BUNDLE
attribute for each BUNDLE group, and place each mid associated with
the SDP group:BUNDLE attribute mid list.

6.2. Bundled SDP Information

6.2.1. General

This section describes restrictions associated with the usage of SDP
parameters and extensions within a BUNDLE group. It also describes,
when parameter and attribute values have been assigned to each "m="
line in the BUNDLE group, how to calculate a value for the whole
BUNDLE group.

6.2.2. Bandwidth (b=)

The total proposed bandwidth is the sum of the proposed bandwidth for
each "m=" line associated with a negotiated BUNDLE group.

6.2.3. rtcp-mux Attribute

For each "m=" line in a BUNDLE group, an Offerer and Answerer MUST
assign an SDP rtcp-mux attribute [RFC5761].

6.2.4. rtcp Attribute

When used, for each RTP media "m=" line in a BUNDLE group, an Offerer
and Answerer MUST assign an SDP rtcp attribute [RFC3605] with an
identical attribute value.

6.2.5. DTLS-SRTP fingerprint Attribute

When DTLS-SRTP is used, for each RTP media "m=" line in a BUNDLE
group, an Offerer and Answerer MUST assign an SDP DTLS-SRTP
fingerprint attribute with identical attribute values.

6.2.6. SDES crypto Attribute

When SDES is used, for each RTP media "m=" line in a BUNDLE group, an
Offerer and Answerer MUST assign an SDP crypto attribute, with unique
attribute values.

6.2.7. Other Attributes (a=)

There are also special rules for handling many different attributes
as defined in [I-D.nandakumar-mmusic-sdp-attributes]. It might not
possible to use bundle with some attributes.

6.3. RFC 5888 restrictions

Based on the rules and procedures in [RFC5888], the following
restrictions also apply to BUNDLE groups in SDP Answers:

o 1) A BUNDLE group must not be added to an SDP Answer, unless the
   same BUNDLE group was included in the associated SDP Offer; and

o 2) An SDP "m=" line must not be added to a BUNDLE group in the SDP
   Answer, unless it was in the same BUNDLE group in the associated
   SDP Offer.

6.4. SDP Offerer Procedures

6.4.1. SDP Offerer Bundle Address Request and Usage

An Offerer can assign a BUNDLE address to multiple "m=" lines in a
BUNDLE group, once the Answerer has selected the BUNDLE address for
the Offerer. An Offerer MUST NOT assign a BUNDLE address to multiple
"m=" lines until the Answerer has selected the BUNDLE address.

OPEN ISSUE: Should it be allowed to assign a new BUNDLE address to
multiple "m=" lines in a BUNDLE group, before the Answerer has
selected the BUNDLE address?

In order to negotiate (or, to re-negotiate) the BUNDLE address
associated with a BUNDLE group, the Offerer, in the SDP Offer,
assigns a unique address to each "m=" line in the BUNDLE group. In
addition, the Offerer indicates which unique address it wishes the
Answerer to select as the Offerer's BUNDLE address. The Offerer
places the mid, associated with the unique address requested to be
selected as the BUNDLE address, first in the SDP group:BUNDLE
attribute mid list. The Answerer will then select the BUNDLE address
for the Offerer ([ref-to-be-added]).

If the Offerer, in a subsequent SDP Offer, wants to re-negotiate the
BUNDLE address associated with a BUNDLE group, it MAY assign the
previously negotiated BUNDLE address as a unique address to one of
the "m=" lines in the BUNDLE group.

If the Offerer assigns the previously selected BUNDLE address to more
than one "m=" line in a BUNDLE group, the first mid in the SDP
group:BUNDLE attribute mid list MUST represent an "m=" line to which
the BUNDLE address is assigned. Hence, in order to re-negotiate the
BUNDLE address, the Offerer needs to assign a unique address to each
"m=" line in the BUNDLE group, as described above.

An Offerer MUST NOT assign a BUNDLE address to an "m=" line that is
not associated with a BUNDLE group. An Offerer MUST NOT assign a
BUNDLE address, that has been negotiated for a BUNDLE group, to an
"m=" line that is associated with another BUNDLE group.

Section 10.1 shows an example of a Bundle Address Request.

6.4.2. Bundle Address Synchronization (BAS)

When an Offerer has requested the Answerer to select the Offerer's
BUNDLE address, and the Offerer did not assign the requested BUNDLE
address to each "m=" line in the BUNDLE group of the SDP Offer used
to request the BUNDLE address, when the associated SDP Answer is
received the Offerer MUST send a subsequent SDP Offer. In the
subsequent SDP Offer the Offerer MUST assign the selected BUNDLE

address to each "m=" line in the BUNDLE group. This procedure is
referred to as Bundle Address Synchronization (BAS).

When the Offerer performs a BAS, the Offerer MAY modify SDP
parameters in the same SDP Offer.

NOTE: It is important that the SDP Offer used for the BAS gets
accepted by the Answerer, so the Offerer needs to consider the
necessity to modify SDP parameters that could get the Answerer to
reject the SDP Offer. Removing "m=" lines, or reducing the number of
codecs, in the SDP Offer used for the BAS is considered to have a low
risk of being rejected.

NOTE: The main purpose of the BAS is to make sure that
intermediaries, that might not support the BUNDLE mechanism, have
correct information regarding which IP address and port is going to
be used for the bundled media.

Section 10.1 shows an example of an SDP Offer used to perform a BAS.

6.4.3. Adding a media description to a BUNDLE group

When an Offerer adds an "m=" line to a BUNDLE group, the Offerer MUST
assign either a unique address, or the BUNDLE address associated with
the BUNDLE group, to the added "m=" line. In addition, the Offerer
MUST assign a mid value to the "m=" line, and place the mid in the
SDP group:BUNDLE attribute mid list associated with the BUNDLE group,
in order to group the "m=" line to the BUNDLE group.

NOTE: If the Offerer assigns a unique address to the added "m=" line,
it allows the Answerer to move the "m=" line out of the BUNDLE group
without having to reject the "m=" line ([ref-to-be-added]).

To the previously added "m=" lines in the BUNDLE group, the Offerer
assigns either unique addresses or the BUNDLE address associated with
the BUNDLE group, according to the procedures in Section 6.4.1.

Section 10.3 shows an example of an SDP Offer used to add an "m="
line to a BUNDLE group.

6.4.4. Moving A Media Description Out Of A BUNDLE Group

When an Offerer moves an "m=" line out of a BUNDLE group, the Offerer
MUST assign a unique address to the moved "m=" line. In addition,
the Offerer MUST NOT anymore use a mid value to group the "m=" line
with the BUNDLE group.

To the remaining "m=" lines in the BUNDLE group, the Offerer assigns
either unique addresses or the BUNDLE address associated with the
BUNDLE group, according to the procedures in Section 6.4.1.

Section 10.4 shows an example of an SDP Offer used to move an "m="
line out of a BUNDLE group.

6.4.5. Disabling A Media Description In A BUNDLE Group

When an Offerer disables an "m=" line in a BUNDLE group, the Offerer
MUST assign a zero port value [RFC3264] to the disabled "m=" line.
In addition, the Offerer MUST NOT anymore use a mid value to group
the "m=" line with the BUNDLE group.

To the remaining "m=" lines in the BUNDLE group, the Offerer assigns
either unique addresses or the BUNDLE address associated with the
BUNDLE group, according to the procedures in Section 6.4.1.

Section 10.5 shows an example of an SDP Offer used to move an "m="
line out of a BUNDLE group.

6.5. SDP Answerer Procedures

6.5.1. Answerer Bundle Address Selection and Usage

6.5.1.1. Offerer Bundle Address Selection

If the Offerer, in an SDP Offer, assigned a unique address to each
"m=" line in a BUNDLE group, it means that the Offerer has requested
the Answerer to select a BUNDLE address for the Offerer. The first
mid in the SDP group:BUNDLE attribute mid list of the SDP Offer
represents the unique address which the Offerer requests the Answer
to select as the Offerer's BUNDLE address.

The Answerer SHOULD select the unique address associated with the
first mid to become the Offerer's BUNDLE address, unless the Answerer
in the SDP Answer will move the "m=" line represented by the mid out
of the BUNDLE group, or if there is some other reason why the
Answerer can not select the unique address associated with the mid.
In that case, the Answerer MUST try the next mid in the list.

In the SDP Answer, the Answerer MUST place the mid associated with
the selected BUNDLE address first in the SDP group:BUNDLE attribute
mid list associated with the BUNDLE group.

Section 10.1 shows an example of an Offerer's BUNDLE address
selection.

6.5.1.2. Anwerer Bundle Address Selection

The Answerer MUST select a local BUNDLE address, and in the SDP
Answer assign it to each "m=" line associated with the BUNDLE group.

The Answerer is allowed to change its BUNDLE address in any SDP
Answer.

The Answerer MUST NOT assign a BUNDLE address to an "m=" line that is
not associated with a BUNDLE group. The Answerer MUST NOT assign a
BUNDLE address, associated with a BUNDLE group, to an "m=" line
associated with another BUNDLE group.

Section 10.1 shows an example of an Answerer's local BUNDLE address
selection.

6.5.2. Moving A Media Description Out Of A BUNDLE Group

When an Answerer moves an "m=" line out of a BUNDLE group, the
Answerer MUST assign a unique address to the moved "m=" line. In
addition, the Answerer MUST NOT anymore use a mid value to group the
"m=" line with the BUNDLE group.

To the remaining "m=" lines in the BUNDLE group, the Answerer assigns
the Answerer's BUNDLE address.

An Answerer MUST NOT move an "m=" line out of a BUNDLE group, unless:

o 1) The Offerer assigned a unique address to the "m=" line in the
   associated SDP Offer; or

o 2) The Answerer also rejects the "m=" line Section 6.5.3.

6.5.3. Rejecting A Media Description In A BUNDLE Group

When an Answerer rejects an "m=" line in a BUNDLE group, the Answerer
MUST assign a zero port value to the rejected "m=" line. In
addition, the Answerer MUST NOT anymore use a mid value to group the
"m=" line with the BUNDLE group.

To the remaining "m=" lines in the BUNDLE group, the Answerer assigns
the Answerer's BUNDLE address.

7. Single vs Multiple RTP Sessions

7.1. General

By default, all RTP based media flows within a given BUNDLE group belong to a single RTP session [RFC3550]. Multiple BUNDLE groups will form multiple RTP Sessions.

The usage of multiple RTP Sessions within a given BUNDLE group, or the usage of a single RTP Session that spans over multiple BUNDLE groups, is outside the scope of this specification. Other specification needs to extend the BUNDLE mechanism in order to allow such usages.

7.2. Single RTP Session

When a single RTP Session is used, media associated with all "m=" lines part of a bundle group share a single SSRC [RFC3550] numbering space.

In addition, the following rules and restrictions apply for a single RTP Session:

o - The dynamic payload type values used in the "m=" lines MUST NOT overlap.

o - The "proto" value in each "m=" line MUST be identical (e.g. RTP/AVPF).

o - A given SSRC SHOULD NOT transmit RTP packets using payload types that originates from different "m=" lines.

NOTE: The last bullet above is to avoid sending multiple media types from the same SSRC. If transmission of multiple media types are done with time overlap RTP and RTCP fails to function. Even if done in proper sequence this causes RTP Timestamp rate switching issues [ref to draft-ietf-avtext-multiple-clock-rates].

8. Usage With ICE

8.1. General

This section describes how to use the BUNDLE grouping extension together with the Interactive Connectivity Establishment (ICE) mechanism [RFC5245].

8.2. Candidates

When an ICE-enabled endpoint generates an SDP Offer, which contains a
BUNDLE group, the SDP Offerer MUST include ICE candidates for each
"m=" line associated with a "BUNDLE" group, except for any "m=" line
with a zero port number value. If the "m=" lines associated with the
BUNDLE group contain different port number values, the SDP Offerer
MUST also insert different candidate values in each "m=" line
associated with the BUNDLE group. If the "m=" lines associated with
the BUNDLE group contain an identical port number value, the
candidate values MUST also be identical.

When an ICE-enabled endpoint generates and SDP Answer, which contains
a BUNDLE group, the Answerer MUST include ICE candidates for each
"m=" line associated with the "BUNDLE" group, except for any "m="
line where the port number value is set to zero. The Answerer MUST
insert identical candidate values in each "m=" line associated with
the BUNDLE group.

8.3. Candidates

Once it is known that both endpoints support, and accept to use, the
BUNDLE grouping extension, ICE connectivity checks and keep-alives
only needs to be performed for the whole BUNDLE group, instead of for
each individual "m=" line associated with the group.

9. Security Considerations

This specification does not significantly change the security
considerations of SDP which can be found in Section X of TBD.

TODO: Think carefully about security analysis of reuse of same SDES
key on multiple "m=" lines when the far end does not use BUNDLE and
warn developers of any risks.

10. Examples

10.1. Example: Bundle Address Selection

The example below shows:

o 1. An SDP Offer, in which the Offerer assigns unique addresses to
    each "m=" line in the BUNDLE group, and requests the Answerer to
    select the Offerer's BUNDLE address.

o 2. An SDP Answer, in which the Answerer selects the BUNDLE
    address for the Offerer, and assigns its own local BUNDLE address
    to each "m=" line in the BUNDLE group.

    o 3. A subsequent SDP Offer, which is used to perform a Bundle
       Address Synchronization (BAS).

    SDP Offer (1)

       v=0
       o=alice 2890844526 2890844526 IN IP4 host.atlanta.com
       s=
       c=IN IP4 host.atlanta.com
       t=0 0
       a=group:BUNDLE foo bar
       m=audio 10000 RTP/AVP 0 8 97
       a=mid:foo
       b=AS:200
       a=rtpmap:0 PCMU/8000
       a=rtpmap:8 PCMA/8000
       a=rtpmap:97 iLBC/8000
       m=video 10002 RTP/AVP 31 32
       a=mid:bar
       b=AS:1000
       a=rtpmap:31 H261/90000
       a=rtpmap:32 MPV/90000

    SDP Answer (2)

       v=0
       o=bob 2808844564 2808844564 IN IP4 host.biloxi.com
       s=
       c=IN IP4 host.biloxi.com
       t=0 0
       a=group:BUNDLE foo bar
       m=audio 20000 RTP/AVP 0
       a=mid:foo
       b=AS:200
       a=rtpmap:0 PCMU/8000
       m=video 20000 RTP/AVP 32
       a=mid:bar
       b=AS:1000
       a=rtpmap:32 MPV/90000

    SDP Offer (3)

       v=0
       o=alice 2890844526 2890844526 IN IP4 host.atlanta.com
       s=

```
c=IN IP4 host.atlanta.com
t=0 0
a=group:BUNDLE foo bar
m=audio 10000 RTP/AVP 0 8 97
a=mid:foo
b=AS:200
a=rtpmap:0 PCMU/8000
a=rtpmap:8 PCMA/8000
a=rtpmap:97 iLBC/8000
m=video 10000 RTP/AVP 31 32
a=mid:bar
b=AS:1000
a=rtpmap:31 H261/90000
a=rtpmap:32 MPV/90000
```

10.2. Example: Bundle Mechanism Rejected

The example below shows:

o 1. An SDP Offer, in which the Offerer assigns unique addresses to
    each "m=" line in the BUNDLE group, and requests the Answerer to
    select the Offerer's BUNDLE address.

o 2. An SDP Answer, in which the Answerer rejects the BUNDLE group,
    and assigns unique addresses to each "m=" line.

SDP Offer (1)

```
v=0
o=alice 2890844526 2890844526 IN IP4 host.atlanta.com
s=
c=IN IP4 host.atlanta.com
t=0 0
a=group:BUNDLE foo bar
m=audio 10000 RTP/AVP 0 8 97
a=mid:foo
b=AS:200
a=rtpmap:0 PCMU/8000
a=rtpmap:8 PCMA/8000
a=rtpmap:97 iLBC/8000
m=video 10002 RTP/AVP 31 32
a=mid:bar
b=AS:1000
a=rtpmap:31 H261/90000
a=rtpmap:32 MPV/90000
```

   SDP Answer (2)

```
   v=0
   o=bob 2808844564 2808844564 IN IP4 host.biloxi.com
   s=
   c=IN IP4 host.biloxi.com
   t=0 0
   m=audio 20000 RTP/AVP 0
   b=AS:200
   a=rtpmap:0 PCMU/8000
   m=video 30000 RTP/AVP 32
   b=AS:1000
   a=rtpmap:32 MPV/90000
```

10.3. Example: Offerer Adds A Media Description To A BUNDLE Group

   The example below shows:

   o 1. An SDP Offer, in which the Offerer adds an "m=" line,
      represented by the "zen" mid value, to a previously negotiated
      BUNDLE group, assigns a unique address to the added "m=" line, and
      assigns the previously negotiated BUNDLE address to the previously
      added "m=" lines in the BUNDLE group.

   o 2. An SDP Answer, in which the Answerer assigns its own local
      BUNDLE address to each "m=" line (including the added "m=" line)
      in the BUNDLE group.

   o 3. A subsequent SDP Offer, which is used to perform a Bundle
      Address Synchronization (BAS).

   SDP Offer (1)

```
   v=0
   o=alice 2890844526 2890844526 IN IP4 host.atlanta.com
   s=
   c=IN IP4 host.atlanta.com
   t=0 0
   a=group:BUNDLE foo bar zen
   m=audio 10000 RTP/AVP 0 8 97
   a=mid:foo
   b=AS:200
   a=rtpmap:0 PCMU/8000
   a=rtpmap:8 PCMA/8000
```

```
        a=rtpmap:97 iLBC/8000
        m=video 10000 RTP/AVP 31 32
        a=mid:bar
        b=AS:1000
        a=rtpmap:31 H261/90000
        a=rtpmap:32 MPV/90000
        m=video 20000 RTP/AVP 66
        a=mid:zen
        b=AS:1000
        a=rtpmap:66 H261/90000


   SDP Answer (2)

        v=0
        o=bob 2808844564 2808844564 IN IP4 host.biloxi.com
        s=
        c=IN IP4 host.biloxi.com
        t=0 0
        a=group:BUNDLE foo bar zen
        m=audio 20000 RTP/AVP 0
        a=mid:foo
        b=AS:200
        a=rtpmap:0 PCMU/8000
        m=video 20000 RTP/AVP 32
        a=mid:bar
        b=AS:1000
        a=rtpmap:32 MPV/90000
        m=video 20000 RTP/AVP 66
        a=mid:zen
        b=AS:1000
        a=rtpmap:66 H261/90000


   SDP Offer (3)

        v=0
        o=alice 2890844526 2890844526 IN IP4 host.atlanta.com
        s=
        c=IN IP4 host.atlanta.com
        t=0 0
        a=group:BUNDLE foo bar zen
        m=audio 10000 RTP/AVP 0 8 97
        a=mid:foo
        b=AS:200
        a=rtpmap:0 PCMU/8000
        a=rtpmap:8 PCMA/8000
        a=rtpmap:97 iLBC/8000
```

```
          m=video 10000 RTP/AVP 31 32
          a=mid:bar
          b=AS:1000
          a=rtpmap:31 H261/90000
          a=rtpmap:32 MPV/90000
          m=video 10000 RTP/AVP 66
          a=mid:zen
          b=AS:1000
          a=rtpmap:66 H261/90000
```

[10.4](#). Example: Offerer Moves A Media Description Out Of A BUNDLE Group

The example below shows:

o 1. An SDP Offer, in which the Offerer moves an "m=" line out of a
    previously negotiated BUNDLE group, assigns a unique address to
    the moved "m=" line, and assigns the previously negotiated BUNDLE
    address to the remaining "m=" lines in the BUNDLE group.

o 2. An SDP Answer, in which the Answerer moves the corresponding
    "m=" line out of the BUNDLE group, and assigns unique address to
    the moved "m=" line, and assigns the previously negotiated BUNDLE
    address to the remaining "m=" lines in the BUNDLE group.

SDP Offer (1)

```
    v=0
    o=alice 2890844526 2890844526 IN IP4 host.atlanta.com
    s=
    c=IN IP4 host.atlanta.com
    t=0 0
    a=group:BUNDLE foo bar
    m=audio 10000 RTP/AVP 0 8 97
    a=mid:foo
    b=AS:200
    a=rtpmap:0 PCMU/8000
    a=rtpmap:8 PCMA/8000
    a=rtpmap:97 iLBC/8000
    m=video 10000 RTP/AVP 31 32
    a=mid:bar
    b=AS:1000
    a=rtpmap:31 H261/90000
    a=rtpmap:32 MPV/90000
    m=video 50000 RTP/AVP 66
```

```
    b=AS:1000
    a=rtpmap:66 H261/90000
```

SDP Answer (2)

```
    v=0
    o=bob 2808844564 2808844564 IN IP4 host.biloxi.com
    s=
    c=IN IP4 host.biloxi.com
    t=0 0
    a=group:BUNDLE foo bar
    m=audio 20000 RTP/AVP 0
    a=mid:foo
    b=AS:200
    a=rtpmap:0 PCMU/8000
    m=video 20000 RTP/AVP 32
    a=mid:bar
    b=AS:1000
    a=rtpmap:32 MPV/90000
    m=video 60000 RTP/AVP 66
    b=AS:1000
    a=rtpmap:66 H261/90000
```

10.5. Example: Offerer Disables A Media Description In A BUNDLE Group

The example below shows:

o 1. An SDP Offer, in which the Offerer moves an "m=" line out of a
       previously negotiated BUNDLE group, assigns a zero port number the
       moved "m=" line in order to disable it, and assigns the previously
       negotiated BUNDLE address to the remaining "m=" lines in the
       BUNDLE group.

o 2. An SDP Answer, in which the Answerer moves the corresponding
       "m=" line out of the BUNDLE group, and assigns a zero port value
       to the moved "m=" line in order to disable it, and assigns the
       previously negotiated BUNDLE address to the remaining "m=" lines
       in the BUNDLE group.

SDP Offer (1)

```
    v=0
    o=alice 2890844526 2890844526 IN IP4 host.atlanta.com
```

```
     s=
     c=IN IP4 host.atlanta.com
     t=0 0
     a=group:BUNDLE foo bar
     m=audio 10000 RTP/AVP 0 8 97
     a=mid:foo
     b=AS:200
     a=rtpmap:0 PCMU/8000
     a=rtpmap:8 PCMA/8000
     a=rtpmap:97 iLBC/8000
     m=video 10000 RTP/AVP 31 32
     a=mid:bar
     b=AS:1000
     a=rtpmap:31 H261/90000
     a=rtpmap:32 MPV/90000
     m=video 0 RTP/AVP 66
     a=rtpmap:66 H261/90000
```

   SDP Answer (2)

```
     v=0
     o=bob 2808844564 2808844564 IN IP4 host.biloxi.com
     s=
     c=IN IP4 host.biloxi.com
     t=0 0
     a=group:BUNDLE foo bar
     m=audio 20000 RTP/AVP 0
     a=mid:foo
     b=AS:200
     a=rtpmap:0 PCMU/8000
     m=video 20000 RTP/AVP 32
     a=mid:bar
     b=AS:1000
     a=rtpmap:32 MPV/90000
     m=video 0 RTP/AVP 66
     a=rtpmap:66 H261/90000
```

11. IANA Considerations

   This document requests IANA to register the new SDP Grouping semantic
   extension called BUNDLE.

12. Acknowledgements

The usage of the SDP grouping extension for negotiating bundled media is based on a similar alternatives proposed by Harald Alvestrand and Cullen Jennings. The BUNDLE mechanism described in this document is based on the different alternative proposals, and text (e.g. SDP examples) have been borrowed (and, in some cases, modified) from those alternative proposals.

The SDP examples are also modified versions from the ones in the Alvestrand proposal.

Thanks to Paul Kyzivat and Martin Thompson for taking the the time to read the text along the way, and providing useful feedback.

13. Change Log

[RFC EDITOR NOTE: Please remove this section when publishing]

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-02

o Mechanism modified, to be based on usage of SDP Offers with both different and identical port number values, depending on whether it is known if the remote endpoint supports the extension.

o Cullen Jennings added as co-author.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-01

o No changes. New version due to expiration.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-00

o No changes. New version due to expiration.

Changes from draft-holmberg-mmusic-sdp-multiplex-negotiation-00

o Draft name changed.

o Harald Alvestrand added as co-author.

o "Multiplex" terminology changed to "bundle".

o Added text about single versus multiple RTP Sessions.

o Added reference to RFC 3550.

14. References

14.1. Normative References

[RFC2119]   Bradner, S., "Key words for use in RFCs to Indicate
            Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC3264]   Rosenberg, J. and H. Schulzrinne, "An Offer/Answer Model
            with Session Description Protocol (SDP)", RFC 3264, June
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[RFC4566]   Handley, M., Jacobson, V., and C. Perkins, "SDP: Session
            Description Protocol", RFC 4566, July 2006.

[RFC5761]   Perkins, C. and M. Westerlund, "Multiplexing RTP Data and
            Control Packets on a Single Port", RFC 5761, April 2010.

[RFC5888]   Camarillo, G. and H. Schulzrinne, "The Session Description
            Protocol (SDP) Grouping Framework", RFC 5888, June 2010.

[I-D.nandakumar-mmusic-sdp-attributes]
            Nandakumar, S. and C. Jennings, "A Framework for SDP
            Attributes when Multiplexing", draft-nandakumar-mmusic-
            sdp-attributes-00 (work in progress), February 2013.

14.2. Informative References

[RFC3550]   Schulzrinne, H., Casner, S., Frederick, R., and V.
            Jacobson, "RTP: A Transport Protocol for Real-Time
            Applications", STD 64, RFC 3550, July 2003.

[RFC3605]   Huitema, C., "Real Time Control Protocol (RTCP) attribute
            in Session Description Protocol (SDP)", RFC 3605, October
            2003.

[RFC5245]   Rosenberg, J., "Interactive Connectivity Establishment
            (ICE): A Protocol for Network Address Translator (NAT)
            Traversal for Offer/Answer Protocols", RFC 5245, April
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Appendix A. Design Considerations

A.1. General

One of the main issues regarding the BUNDLE grouping extensions has
been whether, in SDP Offers and SDP Answers, the same port number
value should be inserted in "m=" lines associated with a BUNDLE
group, as the purpose of the extension is to negotiate the usage of a
single 5-tuple for media associated with the "m=" lines. Issues with
both approaches, discussed in the Appendix have been raised. The

   outcome was to specify a mechanism which uses SDP Offers with both
   different and identical port number values.

   Below are the primary issues that have been considered when defining
   the "BUNDLE" grouping extension:

   o 1) Interoperability with existing UAs.

   o 2) Interoperability with intermediary B2BUA- and proxy entities.

   o 3) Time to gather, and the number of, ICE candidates.

   o 4) Different error scenarios, and when they occur.

   o 5) SDP Offer/Answer impacts, including usage of port number value
      zero.

   NOTE: Before this document is published as an RFC, this
   Appendix might be removed.

[A.2](#). UA Interoperability

   Consider the following SDP Offer/Answer exchange, where Alice sends
   an SDP Offer to Bob:

   SDP Offer

       v=0
       o=alice 2890844526 2890844526 IN IP4 host.atlanta.com
       s=
       c=IN IP4 host.atlanta.com
       t=0 0
       m=audio 10000 RTP/AVP 97
       a=rtpmap:97 iLBC/8000
       m=video 10002 RTP/AVP 97
       a=rtpmap:97 H261/90000

   SDP Answer

       v=0
       o=bob 2808844564 2808844564 IN IP4 host.biloxi.com
       s=
       c=IN IP4 host.biloxi.com

```
    t=0 0
    m=audio 20000 RTP/AVP 97
    a=rtpmap:97 iLBC/8000
    m=video 20002 RTP/AVP 97
    a=rtpmap:97 H261/90000
```

RFC 4961 specifies a way of doing symmetric RTP but that is an a
later invention to RTP and Bob can not assume that Alice supports RFC
4961. This means that Alice may be sending RTP from a different port
than 10000 or 10002 - some implementation simply send the RTP from an
ephemeral port. When Bob's endpoint receives an RTP packet, the only
way that Bob know if it should be passed to the video or audio codec
is by looking at the port it was received on. This lead some SDP
implementations to use the fact that each "m=" line had a different
port number to use that port number as an index to find the correct m
line in the SDP. As a result, some implementations that do support
symmetric RTP and ICE still use a SDP data structure where SDP with
"m=" lines with the same port such as:

SDP Offer

```
    v=0
    o=alice 2890844526 2890844526 IN IP4 host.atlanta.com
    s=
    c=IN IP4 host.atlanta.com
    t=0 0
    m=audio 10000 RTP/AVP 97
    a=rtpmap:97 iLBC/8000
    m=video 10000 RTP/AVP 98
    a=rtpmap:98 H261/90000
```

will result in the second "m=" line being considered an SDP error
because it has the same port as the first line.

A.3. Usage of port number value zero

In an SDP Offer or SDP Answer, the media associated with an "m=" line
can be disabled/rejected by setting the port number value to zero.
This is different from e.g. using the SDP direction attributes, where
RTCP traffic will continue even if the SDP "inactive" attribute is
indicated for the associated "m=" line.

If each "m=" line associated with a BUNDLE group would contain
different port number values, and one of those port would be used for
the 5-tuple, problems would occur if an endpoint wants to disable/
reject the "m=" line associated with that port, by setting the port
number value to zero. After that, no "m=" line would contain the
port number value which is used for the 5-tuple. In addition, it is
unclear what would happen to the ICE candidates associated with the
"m=" line, as they are also used for the 5-tuple.

A.4. B2BUA And Proxy Interoperability

Some back to back user agents may be configured in a mode where if
the incoming call leg contains an SDP attribute the B2BUA does not
understand, the B2BUS still generates that SDP attribute in the Offer
for the outgoing call leg. Consider an B2BUA that did not understand
the SDP "rtcp" attribute, defined in RFC 3605, yet acted this way.
Further assume that the B2BUA was configured to tear down any call
where it did not see any RTCP for 5 minutes. In this cases, if the
B2BUA received an Offer like:

SDP Offer

    v=0
    o=alice 2890844526 2890844526 IN IP4 host.atlanta.com
    s=
    c=IN IP4 host.atlanta.com
    t=0 0
    m=audio 49170 RTP/AVP 0
    a=rtcp:53020

It would be looking for RTCP on port 49172 but would not see any
because the RTCP would be on port 53020 and after five minutes, it
would tear down the call. Similarly, an SBC that did not understand
BUNDLE yet put BUNDLE in it's offer may be looking for media on the
wrong port and tear down the call. It is worth noting that a B2BUA
that generated an Offer with capabilities it does not understand is
not compliant with the specifications.

A.4.1. Traffic Policing

Sometimes intermediaries do not act as B2BUA, in the sense that they
don't modify SDP bodies, nor do they terminate SIP dialogs. Still,
however, they may use SDP information (e.g. IP address and port) in
order to control traffic gating functions, and to set traffic

policing rules. There might be rules which will trigger a session to
be terminated in case media is not sent or received on the ports
retrieved from the SDP. This typically occurs once the session is
already established and ongoing.

A.4.2. Bandwidth Allocation

Sometimes intermediaries do not act as B2BUA, in the sense that they
don't modify SDP bodies, nor do they terminate SIP dialogs. Still,
however, they may use SDP information (e.g. codecs and media types)
in order to control bandwidth allocation functions. The bandwidth
allocation is done per "m=" line, which means that it might not be
enough if media associated with all "m=" lines try to use that
bandwidth. That may either simply lead to bad user experience, or to
termination of the call.

A.5. Candidate Gathering

When using ICE, an candidate needs to be gathered for each port.
This takes approximately 20 ms extra for each extra "m=" line due to
the NAT pacing requirements. All of this gather can be overlapped
with other things while the page is loading to minimize the impact.
If the client only wants to generate TURN or STUN ICE candidates for
one of the "m=" lines and then use trickle ICE [TODO REF] to get the
non host ICE candidates for the rest of the "m=" lines, it MAY do
that and will not need any additional gathering time.

Some people have suggested a TURN extension to get a bunch of TURN
allocation at once. This would only provide a single STUN result so
in cases where the other end did not support BUNDLE, may cause more
use of the TURN server but would be quick in the cases where both
sides supported BUNDLE and would fall back to a successful call in
the other cases.

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