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Multiplexing Negotiation Using Session Description Protocol (SDP) Port
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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-mux-attributes]. It might not be 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. General

When an Offerer generates an Offer, it assigns an address to each "m=" line, according to the procedures in [RFC3264]. To each "m=" line within a BUNDLE group the Offerer assigns either an address that is unique to that "m=" line, or a shared address that is also assigned to other "m=" lines within the BUNDLE group. Such shared address can be, but does not have to be, a previously selected BUNDLE address Section 6.5.1.

OPEN ISSUE (Q6): There is a discussion on whether assigning a shared address to multiple "m=" lines shall be allowed until the Answerer has indicated support of BUNDLE.

- o (<http://www.ietf.org/mail-archive/web/mmusic/current/msg12245.html>)

The Offerer MUST NOT assign an address (unique or shared), that it has assigned to an "m=" line within a BUNDLE group, to an "m=" line outside the BUNDLE group.

The Offerer MUST, for a BUNDLE group, on the SDP session level [RFC4566], insert an SDP group:BUNDLE attribute associated with the BUNDLE group. The Offerer MUST assign an SDP 'mid' attribute [RFC5888] to each "m=" line within the BUNDLE group, and place the mid value in the group:BUNDLE attribute mid list.

The Offerer MAY assign an SDP 'bundle-only' attribute [ref-to-be-added] to one or more "m=" lines within a BUNDLE group.

OPEN ISSUE (Q8): It still needs to be decided whether a zero port value can be assigned to a 'bundle-only' "m=" line.

- o (<http://www.ietf.org/mail-archive/web/mmusic/current/msg12075.html>)
- o (<http://www.ietf.org/mail-archive/web/mmusic/current/msg12226.html>)
- o (<http://www.ietf.org/mail-archive/web/mmusic/current/msg12339.html>)

6.4.2. Request BUNDLE address selection

When an Offerer generates an Offer, it MUST indicate which address (unique or shared) within a BUNDLE group it wishes the Answerer to select as the Offerer's BUNDLE address for the BUNDLE group Section 6.5.1. The Offerer MUST do this even if the Answerer has, in a previous Answer within the dialog, already selected the Offerer's BUNDLE address.

In order to request an address (unique or shared) to be selected as the Offerer's BUNDLE address for a BUNDLE group, the Offerer places the mid value, associated with the "m=" line representing the requested address, first in the SDP group:BUNDLE attribute mid list associated with the BUNDLE group.

Section 10.1 shows an example of a Bundle Address Request.

6.4.3. Bundle Address Synchronization (BAS)

When an Offerer receives an Answer, in which an offered BUNDLE group is accepted, if the Offerer in the associated Offer assigned an address (unique or shared), that does not represent the BUNDLE address selected for the Offerer, to an "m=" line within the BUNDLE group, the Offerer MUST send a subsequent Offer, in which it assigns the BUNDLE address selected for the Offerer to each "m=" line within the BUNDLE group. This procedure is referred to as Bundle Address Synchronization (BAS), and the Offer is referred to as a BAS Offer.

The Offerer MAY modify any SDP parameter in a BAS Offer.

NOTE: It is important that the BAS Offer 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 BAS Offer. Removing "m=" lines, or reducing the number of codecs, in the BAS Offer used for the is considered to have a low risk of being rejected.

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

Section 10.1 shows an example of an BAS Offer.

6.4.4. Adding a media description to a BUNDLE group

When an Offerer generates an Offer, in which it adds an "m=" line to a BUNDLE group, the Offerer assigns an address (unique or shared) to

the "m=" line, assigns an SDP 'mid' attribute to the "m=" line, and places the mid value in the group:BUNDLE attribute mid list associated with the BUNDLE group, according to the procedures in Section 6.4.2. If the Offerer wishes the Answerer to select the address assigned to the added "m=" as the Offerer's BUNDLE address, the mid value associated with the "m=" line is placed first in the list, according to the procedures in Section 6.4.2.

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

6.4.5. Moving A Media Description Out Of A BUNDLE Group

When an Offerer generates an Offer, in which an "m=" line is moved out of a BUNDLE group, the Offerer MUST assign a unique address to the moved "m=" line. In addition, the Offerer MUST NOT anymore include a mid value, representing the "m=" line, in the SDP group:BUNDLE attribute mid list associated with the BUNDLE group.

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

6.4.6. Disabling A Media Description In A BUNDLE Group

When an Offerer generates an Offer, in which an "m=" line associated with a BUNDLE group is disabled, the Offerer MUST assign an address with a zero port value [RFC4566] to the disabled "m=" line. In addition, the Offerer MUST NOT anymore include a mid value, representing the "m=" line, in the SDP group:BUNDLE attribute mid list associated with the BUNDLE group.

OPEN ISSUE (Q8): It still needs to be decided whether a zero port value can be assigned to a 'bundle-only' "m=" line.

- o (<http://www.ietf.org/mail-archive/web/mmusic/current/msg12075.html>)
- o (<http://www.ietf.org/mail-archive/web/mmusic/current/msg12226.html>)
- o (<http://www.ietf.org/mail-archive/web/mmusic/current/msg12339.html>)

Section 10.5 shows an example of an Offer used to disable an "m=" line in a BUNDLE group.

6.5. SDP Answerer Procedures

6.5.1. Offerer Bundle Address Selection

When an Answerer generates an Answer that contains a BUNDLE group, the Answerer MUST select the Offerer's BUNDLE address. The first mid value in the SDP group:BUNDLE attribute mid list of the Offer represents the address which the Offerer wishes the Answer to select as the Offerer's BUNDLE address Section 6.4.2.

The Answerer SHOULD select the address represented by the first mid value, unless the Answerer in the associated Answer will reject the "m=" line associated with the mid value, or remove the "m=" line from the BUNDLE group. In such case the Answerer MUST select an address associated with the first unrejected mid value that remains in the SDP group:BUNDLE attribute mid list of the Offer.

In the SDP Answer, the Answerer MUST place the mid value associated with the selected Offerer's 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.

6.5.2. Answerer Bundle Address Selection

When an Answerer creates an Answer that contains a BUNDLE group, the Answerer MUST assign a local shared address, the Answerer's BUNDLE address, to each "m=" line within the BUNDLE group.

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

The Answerer MUST NOT assign a shared address, that it has assigned to an "m=" line within a BUNDLE group, to an "m=" line outside the BUNDLE group.

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

6.5.3. Moving A Media Description Out Of A BUNDLE Group

When an Answerer generates an Answer, in which an "m=" line is moved out of a BUNDLE group, the Answerer assigns an address to the moved "m=" line based on the type of address that the Offerer assigned to the associated "m=" line in the associated Offer, as described below.

If the Offerer assigned a shared address to the "m=" line, the answerer MUST reject the moved "m=" line, according to the procedures in Section 6.5.4.

If the Offerer assigned an SDP 'bundle-only' attribute to the "m=" line, the Answerer MUST reject the moved "m=" line, according to the procedures in Section 6.5.4.

If the Offerer assigned a unique address to the "m=" line, the Answerer MUST assign a unique address to the moved "m=" line.

In addition, in either case above, the Answerer MUST NOT anymore include a mid value, representing the "m=" line, in the SDP group:BUNDLE attribute list associated with the BUNDLE group.

6.5.4. Rejecting A Media Description In A BUNDLE Group

When an Answerer generates an Answer, in which an "m=" line associated with a BUNDLE group is rejected, the Answerer MUST assign an address with a zero port value to the rejected "m=" line, according to the procedures in [RFC4566]. In addition, the Answerer MUST NOT anymore include a mid value, representing the "m=" line, in the SDP group:BUNDLE attribute midlist associated with the BUNDLE group.

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 an 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 atlanta.example.com
s=
c=IN IP4 atlanta.example.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 biloxi.example.com
s=
c=IN IP4 biloxi.example.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 atlanta.example.com
s=
c=IN IP4 atlanta.example.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 atlanta.example.com
s=
c=IN IP4 atlanta.example.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 biloxi.example.com
s=
c=IN IP4 biloxi.example.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 atlanta.example.com
s=
c=IN IP4 atlanta.example.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 biloxi.example.com
s=
c=IN IP4 biloxi.example.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 atlanta.example.com
s=
c=IN IP4 atlanta.example.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 atlanta.example.com
s=
c=IN IP4 atlanta.example.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 biloxi.example.com
s=
c=IN IP4 biloxi.example.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 atlanta.example.com
s=
c=IN IP4 atlanta.example.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 biloxi.example.com
s=
c=IN IP4 biloxi.example.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-04

- o Updated Offerer procedures (<http://www.ietf.org/mail-archive/web/mmusic/current/msg12293.html>).
- o Updated Answerer procedures (<http://www.ietf.org/mail-archive/web/mmusic/current/msg12333.html>).
- o Usage of SDP 'bundle-only' attribute added.

- o Reference to Trickle ICE document added.

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

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- [RFC3264] Rosenberg, J. and H. Schulzrinne, "An Offer/Answer Model with Session Description Protocol (SDP)", RFC 3264, June 2002.
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[RFC5888] Camarillo, G. and H. Schulzrinne, "The Session Description Protocol (SDP) Grouping Framework", RFC 5888, June 2010.

[I-D.nandakumar-mmusic-sdp-mux-attributes]
Nandakumar, S. and C. Jennings, "A Framework for SDP Attributes when Multiplexing ", draft-nandakumar-mmusic-sdp-mux-attributes-04 (work in progress), September 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 2010.

[I-D.ietf-mmusic-trickle-ice]
Ivov, E., Rescorla, E., and J. Uberti, "Trickle ICE: Incremental Provisioning of Candidates for the Interactive Connectivity Establishment (ICE) Protocol ", draft-ietf-mmusic-trickle-ice-00 (work in progress), October 2013.

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 atlanta.example.com
s=
c=IN IP4 atlanta.example.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 biloxi.example.com
s=
c=IN IP4 biloxi.example.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 atlanta.example.com
s=
c=IN IP4 atlanta.example.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 atlanta.example.com
s=
c=IN IP4 atlanta.example.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 [I-D.ietf-mmusic-trickle-ice] 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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