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Negotiating Media Multiplexing Using the Session Description Protocol (SDP)
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Abstract

This specification defines a new Session Description Protocol (SDP) Grouping Framework extension, 'BUNDLE'. The extension can be used with the SDP Offer/Answer mechanism to negotiate the usage of a single address:port combination (BUNDLE address) for receiving media, referred to as bundled media, specified by multiple SDP media descriptions ("m=" lines).

To assist endpoints in negotiating the use of bundle this specification defines a new SDP attribute, 'bundle-only', which can be used to request that specific media is only used if bundled. The specification also updates RFC 3264, to allow usage of zero port values without meaning that media is rejected.

There are multiple ways to correlate the bundled RTP packets with the appropriate media descriptions. This specification defines a new Real-time Transport Protocol (RTP) source description (SDES) item and a new RTP header extension that provides an additional way to do this correlation by using them to carry a value that associates the RTP/RTCP packets with a specific media description.

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1. Introduction

When multimedia communications are established, each 5-tuple reserved for an individual media stream consume additional resources (especially when Interactive Connectivity Establishment (ICE) [RFC5245] is used). For this reason, it is attractive to use a 5-tuple for multiple media streams.

This specification defines a way to use a single address:port combination (BUNDLE address) for receiving media specified by multiple SDP media descriptions ("m=" lines).

This specification defines a new SDP Grouping Framework [RFC5888] extension called 'BUNDLE'. The extension can be used with the Session Description Protocol (SDP) Offer/Answer mechanism [RFC3264] to negotiate the usage of a BUNDLE group. Within the BUNDLE group, a BUNDLE address is used for receiving media specified by multiple "m=" lines. This is referred to as bundled media.

The offerer and answerer [RFC3264] use the BUNDLE extension to negotiate the BUNDLE addresses, one for the offerer (offerer BUNDLE address) and one for the answerer (answerer BUNDLE address), to be used for receiving the bundled media specified by a BUNDLE group. Once the offerer and the answerer have negotiated a BUNDLE group, they associate their respective BUNDLE address with each "m=" line in

the BUNDLE group. The BUNDLE addresses are used to receive all media specified by the BUNDLE group.

The use of a BUNDLE group and a BUNDLE address also allows the usage of a single set of Interactive Connectivity Establishment (ICE) [RFC5245] candidates for multiple "m=" lines.

This specification also defines a new SDP attribute, 'bundle-only', which can be used to request that specific media is only used if kept within a BUNDLE group. The specification also updates RFC 3264, to allow usage of zero port values without meaning that media is rejected.

As defined in RFC 4566 [RFC4566], the semantics of assigning the same transport address (IP address and port) to multiple "m=" lines 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 an extension.

This specification also updates sections 5.1, 8.1 and 8.2 of RFC 3264 [RFC3264]. The update allows an answerer to assign a non-zero port value to an "m=" line in an SDP answer, even if the "m=" line in the associated SDP offer contained a zero port value.

This specification also defines a new Real-time Transport Protocol (RTP) [RFC3550] source description (SDES) item, 'MID', and a new RTP SDES header extension that can be used to associate RTP streams with media descriptions.

SDP bodies can contain multiple BUNDLE groups. A given BUNDLE address MUST only be associated with a single BUNDLE group. The procedures in this specification apply independently to a given BUNDLE group. All RTP based media flows described by a single BUNDLE group belong to a single RTP session [RFC3550].

The BUNDLE extension is backward compatible. Endpoints that do not support the extension are expected to generate offers and answers without an SDP 'group:BUNDLE' attribute, and are expected to associate a unique address with each "m=" line within an offer and answer, according to the procedures in [RFC4566] and [RFC3264]

2. Terminology

"m=" line: SDP bodies contain one or more media descriptions. Each media description is identified by an SDP "m=" line.

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

Unique address: An IP address and port combination that is associated with only one "m=" line in an offer or answer.

Shared address: An IP address and port combination that is associated with multiple "m=" lines within an offer or answer.

Offerer BUNDLE-tag: The first identification-tag in a given SDP 'group:BUNDLE' attribute identification-tag list in an offer.

Answerer BUNDLE-tag: The first identification-tag in a given SDP 'group:BUNDLE' attribute identification-tag list in an answer.

Offerer BUNDLE address: Within a given BUNDLE group, an IP address and port combination used by an offerer to receive all media specified by each "m=" line within the BUNDLE group.

Answerer BUNDLE address: Within a given BUNDLE group, an IP address and port combination used by an answerer to receive all media specified by each "m=" line within the BUNDLE group.

BUNDLE group: A set of "m=" lines, created using an SDP Offer/Answer exchange, which uses the same BUNDLE address for receiving media.

Bundled "m=" line: An "m=" line, whose identification-tag is placed in an SDP 'group:BUNDLE' attribute identification-tag list in an offer or answer.

Bundle-only "m=" line: A bundled "m=" line with an associated SDP 'bundle-only' attribute.

Bundled media: All media specified by a given BUNDLE group.

Initial offer: The first offer, within an SDP session (e.g. a SIP dialog when the Session Initiation Protocol (SIP) [RFC3261] is used to carry SDP), in which the offerer indicates that it wants to create a given BUNDLE group.

Subsequent offer: An offer which contains a BUNDLE group that has been created as part of a previous offer/answer exchange.

Identification-tag: A unique token value that is used to identify an "m=" line. The SDP 'mid' attribute [RFC5888], associated with an "m=" line, carries an unique identification-tag. The session-level SDP 'group' attribute [RFC5888] carries a list of identification-

tags, identifying the "m=" lines associated with that particular 'group' attribute.

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]. Declarative usage of SDP is out of scope of this document, and is thus undefined.

5. SDP Grouping Framework BUNDLE Extension

This section defines a new SDP Grouping Framework extension [RFC5888], 'BUNDLE'. The BUNDLE extension can be used with the SDP Offer/Answer mechanism to negotiate the usage of a single address:port combination (BUNDLE address) for receiving bundled media.

A single address:port combination is also used for sending bundled media. The address:port combination used for sending bundled media MAY be the same as the BUNDLE address, used to receive bundled media, depending on whether symmetric RTP [RFC4961] is used.

All media associated with a BUNDLE group MUST be transport using the same transport-layer protocol (e.g., UDP or TCP).

The BUNDLE extension is indicated using an SDP 'group' attribute with a "BUNDLE" semantics value [RFC5888]. An identification-tag is associated with each bundled "m=" line, and each identification-tag is listed in the SDP 'group:BUNDLE' attribute identification-tag list. Each "m=" line whose identification-tag is listed in the identification-tag list is associated with a given BUNDLE group.

SDP bodies can contain multiple BUNDLE groups. Any given bundled "m=" line MUST NOT be associated with more than one BUNDLE group.

NOTE: The order of the "m=" lines listed in the SDP 'group:BUNDLE' attribute identification-tag list does not have to be the same as the order in which the "m=" lines occur in the SDP.

Section 8 defines the detailed SDP Offer/Answer procedures for the BUNDLE extension.

6. SDP 'bundle-only' Attribute

This section defines a new SDP media-level attribute [RFC4566], 'bundle-only'. 'bundle-only' is a property attribute [RFC4566], and hence has no value.

Name: bundle-only

Value: N/A

Usage Level: media

Charset Dependent: no

Example:

```
a=bundle-only
```

In order to ensure that an answerer that does not support the BUNDLE extension always rejects a bundled "m=" line, the offerer can assign a zero port value to the "m=" line. According to [RFC3264] an answerer will reject such "m=" line. By associating an SDP 'bundle-only' attribute with such "m=" line, the offerer can request that the answerer accepts the "m=" line if the answerer supports the Bundle extension, and if the answerer keeps the "m=" line within the associated BUNDLE group.

NOTE: Once the offerer BUNDLE address has been selected, the offerer does not need to include the 'bundle-only' attribute in subsequent offers. By associating the offerer BUNDLE address with an "m=" line of a subsequent offer, the offerer will ensure that the answerer will either keep the "m=" line within the BUNDLE group, or the answerer will have to reject the "m=" line.

The usage of the 'bundle-only' attribute is only defined for a bundled "m=" line with a zero port value, within an offer. Other usage is unspecified.

Section 8 defines the detailed SDP Offer/Answer procedures for the 'bundle-only' attribute.

7. SDP Information Considerations

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

7.1. Connection Data (c=)

The "c=" line nettype value [RFC4566] associated with a bundled "m=" line MUST be 'IN'.

The "c=" line addrtype value [RFC4566] associated with a bundled "m=" line MUST be 'IP4' or 'IP6'. The same value MUST be associated with each "m=" line.

NOTE: Extensions to this specification can specify usage of the BUNDLE mechanism for other nettype and addrtype values than the ones listed above.

7.2. Bandwidth (b=)

An offerer and answerer MUST use the rules and restrictions defined in [I-D.ietf-mmusic-sdp-mux-attributes] for associating the SDP bandwidth (b=) line with bundled "m=" lines.

7.3. Attributes (a=)

An offerer and answerer MUST use the rules and restrictions defined in [I-D.ietf-mmusic-sdp-mux-attributes] for associating SDP attributes with bundled "m=" lines.

8. SDP Offer/Answer Procedures

This section describes the SDP Offer/Answer [RFC3264] procedures for:

- Negotiating and creating a BUNDLE group; and
- Selecting the BUNDLE addresses (offerer BUNDLE address and answerer BUNDLE address); and
- Adding an "m=" line to a BUNDLE group; and
- Moving an "m=" line out of a BUNDLE group; and
- Disabling an "m=" line within a BUNDLE group.

The generic rules and procedures defined in [RFC3264] and [RFC5888] also apply to the BUNDLE extension. For example, if an offer is rejected by the answerer, the previously negotiated SDP parameters and characteristics (including those associated with a BUNDLE group) apply. Hence, if an offerer generates an offer in which the offerer wants to create a BUNDLE group, and the answerer rejects the offer, the BUNDLE group is not created.

The procedures in this section are independent of the media type or "m=" line proto value represented by a bundled "m=" line. Section 10 defines additional considerations for RTP based media. Section 6 defines additional considerations for the usage of the SDP 'bundle-only' attribute. Section 11 defines additional considerations for the usage of Interactive Connectivity Establishment (ICE) [I-D.ietf-ice-rfc5245bis] mechanism.

SDP offers and answers can contain multiple BUNDLE groups. The procedures in this section apply independently to a given BUNDLE group.

8.1. Mux Category Considerations

When an offerer associates SDP attributes with a bundled "m=" line associated with a shared address, IDENTICAL and TRANSPORT mux category SDP attributes [I-D.ietf-mmusic-sdp-mux-attributes] are associated with the "m=" line only if the "m=" line is also associated with the offerer BUNDLE-tag. Otherwise the offerer MUST NOT associate such SDP attributes with the "m=" line.

When an answerer associates SDP attributes with a bundled "m=" line, IDENTICAL and TRANSPORT mux category SDP attributes are associated with the "m=" line only if the "m=" line is also associated with the answerer BUNDLE-tag. Otherwise the answerer MUST NOT associated such SDP attributes with the "m=" line.

NOTE: As bundled "m=" lines associated with a shared address will share the same IDENTICAL and TRANSPORT mux category SDP attributes, and attribute values, there is no need to associate such SDP attributes with each "m=" line. The attributes and attribute values are implicitly applied to each "m=" line associated with the shared address.

8.2. Generating the Initial SDP Offer

When an offerer generates an initial offer, in order to create a BUNDLE group, it MUST:

- Assign a unique address to each "m=" line within the offer, following the procedures in [RFC3264], unless the media line is a 'bundle-only' "m=" line (see below); and

- Add an SDP 'group:BUNDLE' attribute to the offer; and

- Place the identification-tag of each bundled "m=" line in the SDP 'group:BUNDLE' attribute identification-tag list; and

- Indicate which unique address the offerer suggests as the offerer BUNDLE address [Section 8.2.1].

If the offerer wants to request that the answerer accepts a given bundled "m=" line only if the answerer keeps the "m=" line within the BUNDLE group, the offerer MUST:

- Associate an SDP 'bundle-only' attribute [Section 8.2.1] with the "m=" line; and

- Assign a zero port value to the "m=" line.

NOTE: If the offerer assigns a zero port value to an "m=" line, but does not also associate an SDP 'bundle-only' attribute with the "m=" line, it is an indication that the offerer wants to disable the "m=" line [Section 8.5.4].

[Section 17.1] shows an example of an initial offer.

8.2.1. Suggesting the offerer BUNDLE address

In the offer, the address associated with the "m=" line associated with the offerer BUNDLE-tag indicates the address that the offerer suggests as the offerer BUNDLE address.

The "m=" line associated with the offerer BUNDLE-tag MUST NOT contain a zero port value or an SDP 'bundle-only' attribute.

8.2.2. Example: Initial SDP Offer

The example shows an initial SDP offer. The offer includes two "m=" lines in the SDP, and suggests that both are included in a BUNDLE group. The audio "m=" line is associated with the offerer BUNDLE-tag (placed first in the SDP group:BUNDLE attribute identificatoin-id list).

SDP Offer

```
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
b=AS:200
a=mid:foo
a=rtcp-mux
a=rtpmap:0 PCMU/8000
a=rtpmap:8 PCMA/8000
a=rtpmap:97 iLBC/8000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
m=video 10002 RTP/AVP 31 32
b=AS:1000
a=mid:bar
a=rtcp-mux
a=rtpmap:31 H261/90000
a=rtpmap:32 MPV/90000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
```

8.3. Generating the SDP Answer

When an answerer generates an answer that contains a BUNDLE group, the following general SDP grouping framework restrictions, defined in [RFC5888], also apply to the BUNDLE group:

- The answerer MUST NOT include a BUNDLE group in the answer, unless the offerer requested the BUNDLE group to be created in the corresponding offer; and

- The answerer MUST NOT include an "m=" line within a BUNDLE group, unless the offerer requested the "m=" line to be within that BUNDLE group in the corresponding offer.

If the answer contains a BUNDLE group, the answerer MUST:

- Select an Offerer BUNDLE Address [Section 8.3.1]; and

- Select an Answerer BUNDLE Address [Section 8.3.2];

The answerer is allowed to select a new Answerer BUNDLE address each time it generates an answer to an offer.

If the answerer does not want to keep an "m=" line within a BUNDLE group, it MUST:

- Move the "m=" line out of the BUNDLE group [Section 8.3.3]; or
- Reject the "m=" line [Section 8.3.4];

If the answerer keeps a bundle-only "m=" line within the BUNDLE group, it follows the procedures (associates the answerer BUNDLE address with the "m=" line etc) for any other "m=" line kept within the BUNDLE group.

If the answerer does not want to keep a bundle-only "m=" line within the BUNDLE group, it MUST reject the "m=" line [Section 8.3.4].

The answerer MUST NOT associate an SDP 'bundle-only' attribute with any "m=" line in an answer.

NOTE: If a bundled "m=" line in an offer contains a zero port value, but the "m=" line does not contain an SDP 'bundle-only' attribute, it is an indication that the offerer wants to disable the "m=" line [Section 8.5.4].

8.3.1. Answerer Selection of Offerer Bundle Address

In an offer, the address (unique or shared) associated with the bundled "m=" line associated with the offerer BUNDLE-tag indicates the address that the offerer suggests as the offerer BUNDLE address [Section 8.2.1]. The answerer MUST check whether that "m=" line fulfils the following criteria:

- The answerer will not move the "m=" line out of the BUNDLE group [Section 8.3.3]; and
- The answerer will not reject the "m=" line [Section 8.3.4]; and
- The "m=" line does not contain a zero port value.

If all of the criteria above are fulfilled, the answerer MUST select the address associated with the "m=" line as the offerer BUNDLE address. In the answer, the answerer BUNDLE-tag represents the "m=" line, and the address associated with the "m=" line in the offer becomes the offerer BUNDLE address.

If one or more of the criteria are not fulfilled, the answerer MUST select the next identification-tag in the identification-tag list, and perform the same criteria check for the "m=" line associated with that identification-tag. If there are no more identification-tags in

the identification-tag list, the answerer MUST NOT create the BUNDLE group. In addition, unless the answerer rejects the whole offer, the answerer MUST apply the answerer procedures for moving an "m=" line out of a BUNDLE group [Section 8.3.3] to each bundled "m=" line in the offer when creating the answer.

[Section 17.1] shows an example of an offerer BUNDLE address selection.

8.3.2. Answerer Selection of Answerer BUNDLE Address

When the answerer selects a BUNDLE address for itself, referred to as the answerer BUNDLE address, it MUST associate that address with each bundled "m=" line within the created BUNDLE group in the answer.

The answerer MUST NOT associate the answerer BUNDLE address with an "m=" line that is not within the BUNDLE group, or to an "m=" line that is within another BUNDLE group.

[Section 17.1] shows an example of an answerer BUNDLE address selection.

8.3.3. Moving A Media Description Out Of A BUNDLE Group

When an answerer wants to move an "m=" line out of a BUNDLE group, it MUST first check the following criteria:

- In the corresponding offer, the "m=" line is associated with a shared address (e.g. a previously selected offerer BUNDLE address); or

- In the corresponding offer, an SDP 'bundle-only' attribute is associated with the "m=" line, and the "m=" line contains a zero port value.

If either criteria above is fulfilled, the answerer MUST reject the "m=" line [Section 8.3.4].

Otherwise, if in the corresponding offer the "m=" line is associated with a unique address, the answerer MUST associate a unique address with the "m=" line in the answer (the answerer does not reject the "m=" line).

In addition, in either case above, the answerer MUST NOT place the identification-tag, associated with the moved "m=" line, in the SDP 'group' attribute identification-tag list associated with the BUNDLE group.

8.3.4. Rejecting A Media Description In A BUNDLE Group

When an answerer rejects an "m=" line, it MUST associate an address with a zero port value with the "m=" line in the answer, according to the procedures in [RFC3264].

In addition, the answerer MUST NOT place the identification-tag, associated with the rejected "m=" line, in the SDP 'group' attribute identification-tag list associated with the BUNDLE group.

8.3.5. Example: SDP Answer

The example shows an SDP answer, based on the SDP offer in [Section 8.2.2]. The answers acceppts both "m=" lines in the BUNDLE group.

SDP Answer

```
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
b=AS:200
a=mid:foo
a=rtcp-mux
a=rtpmap:0 PCMU/8000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
m=video 20000 RTP/AVP 32
b=AS:1000
a=mid:bar
a=rtcp-mux
a=rtpmap:32 MPV/90000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
```

8.4. Offerer Processing of the SDP Answer

When an offerer receives an answer, if the answer contains a BUNDLE group, the offerer MUST check that any bundled "m=" line in the answer was indicated as bundled in the corresponding offer. If there is no mismatch, the offerer MUST use the offerer BUNDLE address, selected by the answerer [Section 8.3.1], as the address for each bundled "m=" line.

NOTE: As the answerer might reject one or more bundled "m=" lines, or move a bundled "m=" line out of a BUNDLE group, each bundled "m=" line in the offer might not be indicated as bundled in the answer.

If the answer does not contain a BUNDLE group, the offerer MUST process the answer as a normal answer.

8.5. Modifying the Session

When an offerer generates a subsequent offer, it MUST associate the previously selected offerer BUNDLE address [Section 8.3.1] with each bundled "m=" line (including any bundle-only "m=" line), except if:

- The offerer suggests a new offerer BUNDLE address [Section 8.5.1]; or
- The offerer wants to add a bundled "m=" line to the BUNDLE group [Section 8.5.2]; or
- The offerer wants to move a bundled "m=" line out of the BUNDLE group [Section 8.5.3]; or
- The offerer wants to disable the bundled "m=" line [Section 8.5.4].

In addition, the offerer MUST select an offerer BUNDLE-tag [Section 8.2.1] associated with the previously selected offerer BUNDLE address, unless the offerer suggests a new offerer BUNDLE address.

8.5.1. Suggesting a new offerer BUNDLE address

When an offerer generates an offer, in which it suggests a new offerer BUNDLE address [Section 8.2.1], the offerer MUST:

- Assign the address (shared address) to each "m=" line within the BUNDLE group; or
- Assign the address (unique address) to one bundled "m=" line.

In addition, the offerer MUST indicate that the address is the new suggested offerer BUNDLE address [Section 8.2.1].

NOTE: Unless the offerer associates the new suggested offerer BUNDLE address with each bundled "m=" line, it can associate unique addresses with any number of bundled "m=" lines (and the previously selected offerer BUNDLE address to any remaining bundled "m=" line)

if it wants to suggest multiple alternatives for the new offerer BUNDLE address.

8.5.2. Adding a media description to a BUNDLE group

When an offerer generates an offer, in which it wants to add a bundled "m=" line to a BUNDLE group, the offerer MUST:

- Assign a unique address to the added "m=" line; or
- Assign the previously selected offerer BUNDLE address to the added "m=" line; or
- If the offerer associates a new (shared address) suggested offerer BUNDLE address with each bundled "m=" line [Section 8.5.1], also associate that address with the added "m=" line.

In addition, the offerer MUST add the identification-tag associated with the added "m=" line to the SDP 'group:BUNDLE' attribute identification-tag list with the BUNDLE group [Section 8.2.1].

NOTE: Assigning a unique address to the "m=" line allows the answerer to move the "m=" line out of the BUNDLE group [Section 8.3.3], without having to reject the "m=" line.

If the offerer associates a unique address with the added "m=" line, and if the offerer suggests that address as the new offerer BUNDLE address [Section 8.5.1], the offerer BUNDLE-tag MUST represent the added "m=" line [Section 8.2.1].

If the offerer associates a new suggested offerer BUNDLE address with each bundled "m=" line [Section 8.5.1], including the added "m=" line, the offerer BUNDLE-tag MAY represent the added "m=" line [Section 8.2.1].

[Section 17.3] shows an example where an offerer sends an offer in order to add a bundled "m=" line to a BUNDLE group.

8.5.3. Moving A Media Description Out Of A BUNDLE Group

When an offerer generates an offer, in which it wants to move a bundled "m=" line out of a BUNDLE group it was added to in a previous offer/answer transaction, the offerer:

- MUST associate a unique address with the "m=" line; and

- MUST NOT place the identification-tag associated with the "m=" line in the SDP 'group:BUNDLE' attribute identification-tag list associated with the BUNDLE group.

NOTE: If the removed "m=" line is associated with the previously selected BUNDLE-tag, the offerer needs to suggest a new BUNDLE-tag [Section 8.2.1].

NOTE: If an "m=" line, when being moved out of a BUNDLE group, is added to another BUNDLE group, the offerer applies the procedures in [Section 8.5.2] to the "m=" line.

[Section 17.4] shows an example of an offer for moving an "m=" line out of a BUNDLE group.

8.5.4. Disabling A Media Description In A BUNDLE Group

When an offerer generates an offer, in which it wants to disable a bundled "m=" line (added to the BUNDLE group in a previous offer/answer transaction), the offerer:

- MUST associate an address with a zero port value with the "m=" line, following the procedures in [RFC4566]; and

- MUST NOT place the identification-tag associated with the "m=" line in the SDP 'group:BUNDLE' attribute identification-tag list associated with the BUNDLE group.

[Section 17.5] shows an example of an offer for disabling an "m=" line within a BUNDLE group.

9. Protocol Identification

Each "m=" line within a BUNDLE group MUST use the same transport-layer protocol. If bundled "m=" lines use different protocols on top of the transport-layer protocol, there MUST exist a publicly available specification which describes a mechanism, for this particular protocol combination, how to associate received data with the correct protocol.

In addition, if received data can be associated with more than one bundled "m=" line, there MUST exist a publicly available specification which describes a mechanism for associating the received data with the correct "m=" line.

This document describes a mechanism to identify the protocol of received data among the STUN, DTLS and SRTP protocols (in any combination), when UDP is used as transport-layer protocol, but does

not describe how to identify different protocols transported on DTLS. While the mechanism is generally applicable to other protocols and transport-layer protocols, any such use requires further specification around how to multiplex multiple protocols on a given transport-layer protocol, and how to associate received data with the correct protocols.

9.1. STUN, DTLS, SRTP

Section 5.1.2 of [RFC5764] describes a mechanism to identify the protocol of a received packet among the STUN, Datagram Transport Layer Security (DTLS) and SRTP protocols (in any combination). If an offer or answer includes bundled "m=" lines that represent these protocols, the offerer or answerer MUST support the mechanism described in [RFC5764], and no explicit negotiation is required in order to indicate support and usage of the mechanism.

[RFC5764] does not describe how to identify different protocols transported on DTLS, only how to identify the DTLS protocol itself. If multiple protocols are transported on DTLS, there MUST exist a specification describing a mechanism for identifying each individual protocol. In addition, if a received DTLS packet can be associated with more than one "m=" line, there MUST exist a specification which describes a mechanism for associating the received DTLS packet with the correct "m=" line.

[Section 10.2] describes how to associate the packets in a received SRTP stream with the correct "m=" line.

10. RTP Considerations

10.1. Single RTP Session

All RTP-based media within a single BUNDLE group belong to a single RTP session [RFC3550].

Since a single RTP session is used for each bundle group, all "m=" lines representing RTP-based media in a bundle group will share a single SSRC numbering space [RFC3550].

The following rules and restrictions apply for a single RTP session:

- A specific payload type value can be used in multiple bundled "m=" lines only if each codec associated with the payload type number shares an identical codec configuration [Section 10.1.1].

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

- The RTP MID header extension MUST be enabled, by associating an SDP 'extmap' attribute [RFC5285], with a 'urn:ietf:params:rtp-hdrext:sdes:mid' URI value, with each bundled RTP-based "m=" line in every offer and answer.

- A given SSRC MUST NOT transmit RTP packets using payload types that originate from different bundled "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 fail to function. Even if done in proper sequence this causes RTP Timestamp rate switching issues [RFC7160]. However, once an SSRC has left the RTP session (by sending an RTCP BYE packet), that SSRC can be reused by another source (possibly associated with a different bundled "m=" line) after a delay of 5 RTCP reporting intervals (the delay is to ensure the SSRC has timed out, in case the RTCP BYE packet was lost [RFC3550]).

10.1.1. Payload Type (PT) Value Reuse

Multiple bundled "m=" lines might represent RTP based media. As all RTP based media specified by a BUNDLE group belong to the same RTP session, in order for a given payload type value to be used inside more than one bundled "m=" line, all codecs associated with the payload type number MUST share an identical codec configuration. This means that the codecs MUST share the same media type, encoding name, clock rate and any parameter that can affect the codec configuration and packetization.
[I-D.ietf-mmusic-sdp-mux-attributes] lists SDP attributes, whose attribute values must be identical for all codecs that use the same payload type value.

10.2. Associating RTP/RTCP Streams With Correct SDP Media Description

As described in [RFC3550], RTP/RTCP packets are associated with RTP streams [RFC7656]. Each RTP stream is identified by an SSRC value, and each RTP/RTCP packet carries an SSRC value that is used to associate the packet with the correct RTP stream (an RTCP packet can carry multiple SSRC values, and might therefore be associated with multiple RTP streams).

In order to be able to process received RTP/RTCP packets correctly it must be possible to associate an RTP stream with the correct "m=" line, as the "m=" line and SDP attributes associated with the "m=" line contain information needed to process the packets.

As all RTP streams associated with a BUNDLE group are using the same address:port combination for sending and receiving RTP/RTCP packets,

the local address:port combination cannot be used to associate an RTP stream with the correct "m=" line. In addition, multiple RTP streams might be associated with the same "m=" line.

Also, as described in [Section 10.1.1], the same payload type value might be used by multiple RTP streams, in which case the payload type value cannot be used to associate an RTP stream with the correct "m=" line.

An offerer and answerer can inform each other which SSRC values they will use for an RTP stream by using the SDP 'ssrc' attribute [RFC5576]. However, an offerer will not know which SSRC values the answerer will use until the offerer has received the answer providing that information. Due to this, before the offerer has received the answer, the offerer will not be able to associate an RTP stream with the correct "m=" line using the SSRC value associated with the RTP stream. In addition, the offerer and answerer may start using new SSRC values mid-session, without informing each other using the SDP 'ssrc' attribute.

In order for an offerer and answerer to always be able to associate an RTP stream with the correct "m=" line, the offerer and answerer using the BUNDLE extension MUST support the mechanism defined in Section 14, where the offerer and answerer insert the identification-tag (provided by the remote peer) associated with an "m=" line in RTP and RTCP packets associated with a BUNDLE group.

The mapping from an SSRC to an identification-tag is carried in RTCP SDES packets or in RTP header extensions (Section 14). Since a compound RTCP packet can contain multiple RTCP SDES packets, and each RTCP SDES packet can contain multiple chunks, an RTCP packet can contain several SSRC to identification-tag mappings. The offerer and answerer maintain tables mapping RTP streams identified by SSRC, to a€œm=a€œ lines identified by the identification-tag. These tables are updated each time an RTP/RTCP packet containing one or more mappings from SSRC to identification-tag is received. Note that the mapping from SSRC to identification-tag can change at any time during an RTP session. Once an offerer or answerer recieve an RTP/RTCP packet carrying an identification-tag and an SSRC value (an RTCP packet might carry multiple identification-tags and SSRC values), it creates a mapping between the SSRC value and the identification-tag, in order to associate the RTP stream with the "m=" line associated with the identification-tag. Note that the mapping might change mid-session if, for a given SSRC value, a different identification-tag is provided in an RTP/RTCP packet.

If an offerer and answerer is not able to associate an RTP stream with an "m=" line (using the mechanisms described in this section, or using other appropriate mechanism, e.g, based on the payload type value if it is unique to a single "m=" line), it MUST either drop the RTP/RTCP packets associated with the RTP stream, or process them in an application specific manner, once non-stream specific processing (e.g., related to congestion control) of the packets have occurred. Note that RTCP packets can report on multiple RTP streams.

10.3. RTP/RTCP Multiplexing

Within a BUNDLE group, the offerer and answerer MUST enable RTP/RTCP multiplexing [RFC5761] for the RTP-based media specified by the BUNDLE group.

When RTP/RTCP multiplexing is enabled, the same address:port combination will be used for sending all RTP packets and the RTCP packets associated with the BUNDLE group. Each endpoint will send the packets towards the BUNDLE address of the other endpoint. The same address:port combination MAY be used for receiving RTP packets and RTCP packets.

10.3.1. SDP Offer/Answer Procedures

This section describes how an offerer and answerer use the SDP 'rtcp-mux' attribute [RFC5761] and the SDP 'rtcp-mux-only' attribute [I-D.ietf-mmusic-mux-exclusive] to negotiate usage of RTP/RTCP multiplexing for RTP-based media specified by a BUNDLE group.

The procedures in this section only apply to RTP-based "m=" lines.

10.3.1.1. Generating the Initial SDP Offer

When an offerer generates an initial offer, the offerer MUST associate an SDP 'rtcp-mux' attribute [RFC5761] with each bundled RTP-based "m=" line in the offer, including a bundle-only "m=" line. In addition, the offerer MUST associate an SDP 'rtcp-mux-only' attribute [I-D.ietf-mmusic-mux-exclusive] with each RTP-based bundle-only "m=" line, and MAY associated an SDP 'rtcp-mux-only' attribute with other bundled RTP-based "m=" lines.

NOTE: Whether the offerer associates an SDP 'rtcp-mux-only' attribute with a bundled "m=" line or not depends on whether the offerer supports fallback to usage of a separate port for RTCP in case the answerer does not include the "m=" line in the BUNDLE group.

NOTE: If the offerer associates an SDP 'rtcp-mux' attribute with a bundled "m=" line, but does not associate an SDP 'rtcp-mux-only'

attribute with the "m=" line, the offerer can also associate an SDP 'rtcp' attribute [RFC3605] with the "m=" line in order to provide a fallback port for RTCP, as described in [RFC5761]. However, the fallback port will only be used in case the answerer does not include the "m=" line in the BUNDLE group.

In the initial offer, the address:port combination for RTCP MUST be unique in each bundled RTP-based "m=" line (excluding a bundle-only "m=" line), similar to RTP.

10.3.1.2. Generating the SDP Answer

When an answerer generates an answer, if the answerer accepts one or more RTP-based "m=" lines within a BUNDLE group, the answerer MUST enable usage of RTP/RTCP multiplexing. The answerer MUST associate an SDP "rtcp-mux" attribute with each RTP-based "m=" line in the answer. In addition, if an "m=" line in the corresponding offer contained an SDP "rtcp-mux-only" attribute, the answerer MUST associate an SDP "rtcp-mux-only" attribute with the "m=" line in the answer.

If an RTP-based "m=" line in the corresponding offer did not contain an SDP 'rtcp-mux' attribute, the answerer MUST NOT include the "m=" line within a BUNDLE group in the answer.

If an RTP-based "m=" line in the corresponding offer contained an SDP "rtcp-mux-only" attribute, and if the answerer moves the "m=" line out of the BUNDLE group in the answer Section 8.3.3, the answerer MUST still either enable RTP/RTCP multiplexing for the media associated with the "m=" line, or reject the "m=" line Section 8.3.4.

The answerer MUST NOT associate an SDP 'rtcp' attribute with any bundled "m=" line in the answer. The answerer will use the port value of the selected offerer BUNDLE address for sending RTP and RTCP packets associated with each RTP-based bundled "m=" line towards the offerer.

If the usage of RTP/RTCP multiplexing within a BUNDLE group has been negotiated in a previous offer/answer transaction, the answerer MUST associate an SDP 'rtcp-mux' attribute with each bundled RTP-based "m=" line in the answer.

10.3.1.3. Offerer Processing of the SDP Answer

When an offerer receives an answer, if the answerer has accepted the usage of RTP/RTCP multiplexing (see Section 10.3.1.2), the answerer follows the procedures for RTP/RTCP multiplexing defined in [RFC5761]. The offerer will use the port value associated with the

answerer BUNDLE address for sending RTP and RTCP packets associated with each RTP-based bundled "m=" line towards the answerer.

NOTE: It is considered a protocol error if the answerer has not accepted the usage of RTP/RTCP multiplexing for RTP-based "m=" lines that the answerer included in the BUNDLE group.

10.3.1.4. Modifying the Session

When an offerer generates a subsequent offer, for each RTP-based "m=" line that was previously added to the BUNDLE group the offerer MUST associate an SDP 'rtcp-mux' attribute and an SDP 'rtcp-mux-only' attribute with the "m=" line in the same way it was previously done, unless the offerer wants to disable or remove the "m=" line from the BUNDLE group.

If the offerer wants to add a bundled RTP-based "m=" line to the BUNDLE group, it associates an SDP 'rtcp-mux' attribute and an SDP 'rtcp-mux-only' attribute with the "m=" line using the procedures in [Section 10.3.1.1].

11. ICE Considerations

This section describes how to use the BUNDLE grouping extension together with the Interactive Connectivity Establishment (ICE) mechanism [I-D.ietf-ice-rfc5245bis].

The generic procedures for negotiating usage of ICE using SDP, defined in [I-D.ietf-mmusic-ice-sip-sdp], also apply to usage of ICE with BUNDLE, with the following exceptions:

- When BUNDLE addresses for a BUNDLE group have been selected for both endpoints, ICE connectivity checks and keep-alives only need to be performed for the whole BUNDLE group, instead of per bundled "m=" line.

- Among bundled "m=" lines with which the offerer has associated a shared address, the offerer only associates ICE-related media-level SDP attributes with the "m=" line associated with the offerer BUNDLE-tag.

- Among bundled "m=" lines with which the answerer has associated a shared address, the answerer only associates ICE-related media-level SDP attributes with the "m=" line associated with the answerer BUNDLE-tag.

Support and usage of ICE mechanism together with the BUNDLE extension is OPTIONAL.

11.1. SDP Offer/Answer Procedures

When an offerer associates a unique address with a bundled "m=" line (excluding any bundle-only "m=" line), the offerer MUST associate SDP 'candidate' attributes (and other applicable ICE-related media-level SDP attributes), containing unique ICE properties (candidates etc), with the "m=" line, according to the procedures in [I-D.ietf-mmusic-ice-sip-sdp].

When an offerer associates a shared address with a bundled "m=" line, if the "m=" line is associated with the offerer BUNDLE-tag, the offerer MUST associate SDP 'candidate' attributes (and other applicable ICE-related media-level SDP attributes), containing shared ICE properties, with the "m=" line. If the "m=" line is not associated with the offerer BUNDLE-tag, the offerer MUST NOT associate ICE-related SDP attributes with the "m=" line.

When an answerer associates a shared address with a bundled "m=" line, if the "m=" line is associated with the answerer BUNDLE-tag, the answerer MUST associate SDP 'candidate' attributes (and other applicable ICE-related media-level SDP attributes), containing shared ICE properties, with the "m=" line. If the "m=" line is not associated with the answerer BUNDLE-tag, the answerer MUST NOT associate ICE-related SDP attributes with the "m=" line.

NOTE: As most ICE-related media-level SDP attributes belong to the TRANSPORT mux category [I-D.ietf-mmusic-sdp-mux-attributes], the offerer and answerer follow the rules in Section 8.1. However, in the case of ICE-related media-level attributes, the rules apply to all attributes (see note below), even if they belong to a different mux category.

NOTE: The following ICE-related media-level SDP attributes are defined in [I-D.ietf-mmusic-ice-sip-sdp]: 'candidiate', 'remote-candidates', 'ice-mismatch', 'ice-ufrag', 'ice-pwd', and 'ice-pacing'.

11.1.1. Generating the Initial SDP Offer

When an offerer generates an initial offer, the offerer MUST associate ICE-related media-level SDP attributes with each bundled "m=" line, according to [Section 11.1].

11.1.2. Generating the SDP Answer

When an answerer generates an answer that contains a BUNDLE group, the answerer MUST associate ICE-related SDP attributes with the "m="

line associated with the answerer BUNDLE-tag, according to [Section 11.1].

11.1.3. Offerer Processing of the SDP Answer

When an offerer receives an answer, if the answerer supports and uses the ICE mechanism and the BUNDLE extension, the offerer MUST associate the ICE properties associated with the offerer BUNDLE address, selected by the answerer [Section 8.3.1], with each bundled "m=" line.

11.1.4. Modifying the Session

When an offerer generates a subsequent offer, it MUST associate unique or shared ICE properties to one or more bundled "m=" lines, according to [Section 11.1].

12. DTLS Considerations

One or more media streams within a BUNDLE group might use the Datagram Transport Layer Security (DTLS) protocol [RFC6347] in order to encrypt the data, or to negotiate encryption keys if another encryption mechanism is used to encrypt media.

When DTLS is used within a BUNDLE group, the following rules apply:

- There can only be one DTLS association [RFC6347] associated with the BUNDLE group; and
- Each usage of the DTLS association within the BUNDLE group MUST use the same mechanism for determining which endpoints (the offerer or answerer) become DTLS client and DTLS server; and
- Each usage of the DTLS association within the Bundle group MUST use the same mechanism for determining whether an offer or answer will trigger the establishment of a new DTLS association, or whether an existing DTLS association will be used; and
- If the DTLS client supports DTLS-SRTP [RFC5764] it MUST include the 'use_srtp' extension [RFC5764] in the DTLS ClientHello message [RFC5764], The client MUST include the extension even if the usage of DTLS-SRTP is not negotiated as part of the multimedia session (e.g., SIP session [RFC3261].

NOTE: The inclusion of the 'use_srtp' extension during the initial DTLS handshake ensures that a DTLS renegotiation will not be required in order to include the extension, in case DTLS-SRTP encrypted media is added to the BUNDLE group later during the multimedia session.

13. Update to RFC 3264

This section replaces the text of the following sections of RFC 3264:

- Section 5.1 (Unicast Streams).
- Section 8.2 (Removing a Media Stream).
- Section 8.4 (Putting a Unicast Media Stream on Hold).

13.1. Original text of section 5.1 (2nd paragraph) of RFC 3264

For recvonly and sendrecv streams, the port number and address in the offer indicate where the offerer would like to receive the media stream. For sendonly RTP streams, the address and port number indirectly indicate where the offerer wants to receive RTCP reports. Unless there is an explicit indication otherwise, reports are sent to the port number one higher than the number indicated. The IP address and port present in the offer indicate nothing about the source IP address and source port of RTP and RTCP packets that will be sent by the offerer. A port number of zero in the offer indicates that the stream is offered but MUST NOT be used. This has no useful semantics in an initial offer, but is allowed for reasons of completeness, since the answer can contain a zero port indicating a rejected stream (Section 6). Furthermore, existing streams can be terminated by setting the port to zero (Section 8). In general, a port number of zero indicates that the media stream is not wanted.

13.2. New text replacing section 5.1 (2nd paragraph) of RFC 3264

For recvonly and sendrecv streams, the port number and address in the offer indicate where the offerer would like to receive the media stream. For sendonly RTP streams, the address and port number indirectly indicate where the offerer wants to receive RTCP reports. Unless there is an explicit indication otherwise, reports are sent to the port number one higher than the number indicated. The IP address and port present in the offer indicate nothing about the source IP address and source port of RTP and RTCP packets that will be sent by the offerer. A port number of zero in the offer by default indicates that the stream is offered but MUST NOT be used, but an extension mechanism might specify different semantics for the usage of a zero port value. Furthermore, existing streams can be terminated by setting the port to zero (Section 8). In general, a port number of zero by default indicates that the media stream is not wanted.

13.3. Original text of section 8.2 (2nd paragraph) of RFC 3264

A stream that is offered with a port of zero MUST be marked with port zero in the answer. Like the offer, the answer MAY omit all attributes present previously, and MAY list just a single media format from amongst those in the offer.

13.4. New text replacing section 8.2 (2nd paragraph) of RFC 3264

A stream that is offered with a port of zero MUST by default be marked with port zero in the answer, unless an extension mechanism, which specifies semantics for the usage of a non-zero port value, is used. If the stream is marked with port zero in the answer, the answer MAY omit all attributes present previously, and MAY list just a single media format from amongst those in the offer."

13.5. Original text of section 8.4 (6th paragraph) of RFC 3264

RFC 2543 [10] specified that placing a user on hold was accomplished by setting the connection address to 0.0.0.0. Its usage for putting a call on hold is no longer recommended, since it doesn't allow for RTCP to be used with held streams, doesn't work with IPv6, and breaks with connection oriented media. However, it can be useful in an initial offer when the offerer knows it wants to use a particular set of media streams and formats, but doesn't know the addresses and ports at the time of the offer. Of course, when used, the port number MUST NOT be zero, which would specify that the stream has been disabled. An agent MUST be capable of receiving SDP with a connection address of 0.0.0.0, in which case it means that neither RTP nor RTCP should be sent to the peer.

13.6. New text replacing section 8.4 (6th paragraph) of RFC 3264

RFC 2543 [10] specified that placing a user on hold was accomplished by setting the connection address to 0.0.0.0. Its usage for putting a call on hold is no longer recommended, since it doesn't allow for RTCP to be used with held streams, doesn't work with IPv6, and breaks with connection oriented media. However, it can be useful in an initial offer when the offerer knows it wants to use a particular set of media streams and formats, but doesn't know the addresses and ports at the time of the offer. Of course, when used, the port number MUST NOT be zero, if it would specify that the stream has been disabled. However, an extension mechanism might specify different semantics of the zero port number usage. An agent MUST be capable of receiving SDP with a connection address of 0.0.0.0, in which case it means that neither RTP nor RTCP should be sent to the peer.

14. RTP/RTCP extensions for identification-tag transport

SDP Offerers and Answerers [RFC3264] can associate identification-tags with "m=" lines within SDP Offers and Answers, using the procedures in [RFC5888]. Each identification-tag uniquely represents an "m=" line.

This section defines a new RTCP SDES item [RFC3550], 'MID', which is used to carry identification-tags within RTCP SDES packets. This section also defines a new RTP SDES header extension [RFC7941], which is used to carry the 'MID' RTCP SDES item in RTP packets.

The SDES item and RTP SDES header extension make it possible for a receiver to associate each RTP stream with with a specific "m=" line, with which the receiver has associated an identification-tag, even if those "m=" lines are part of the same RTP session. The RTP SDES header extension also ensures that the media recipient gets the identification-tag upon receipt of the first decodable media and is able to associate the media with the correct application.

A media recipient informs the media sender about the identification-tag associated with an "m=" line through the use of an 'mid' attribute [RFC5888]. The media sender then inserts the identification-tag in RTCP and RTP packets sent to the media recipient.

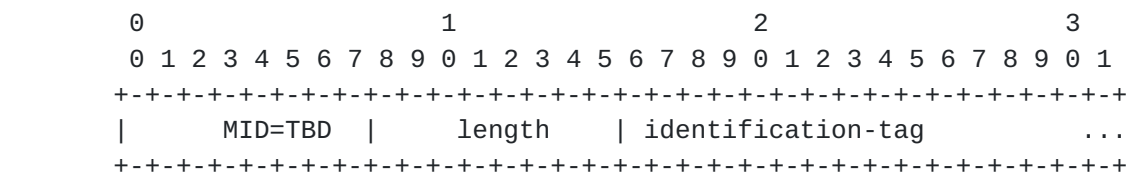
NOTE: This text above defines how identification-tags are carried in SDP Offers and Answers. The usage of other signalling protocols for carrying identification-tags is not prevented, but the usage of such protocols is outside the scope of this document.

[RFC3550] defines general procedures regarding the RTCP transmission interval. The RTCP MID SDES item SHOULD be sent in the first few RTCP packets sent after joining the session, and SHOULD be sent regularly thereafter. The exact number of RTCP packets in which this SDES item is sent is intentionally not specified here, as it will depend on the expected packet loss rate, the RTCP reporting interval, and the allowable overhead.

The RTP SDES header extension for carrying the 'MID' RTCP SDES SHOULD be included in some RTP packets at the start of the session and whenever the SSRC changes. It might also be useful to include the header extension in RTP packets that comprise access points in the media (e.g., with video I-frames). The exact number of RTP packets in which this header extension is sent is intentionally not specified here, as it will depend on expected packet loss rate and loss patterns, the overhead the application can tolerate, and the importance of immediate receipt of the identification-tag.

For robustness purpose, endpoints need to be prepared for situations where the reception of the identification-tag is delayed, and SHOULD NOT terminate sessions in such cases, as the identification-tag is likely to arrive soon.

14.1. RTCP MID SDES Item



The identification-tag payload is UTF-8 encoded, as in SDP.

The identification-tag is not zero terminated.

[RFC EDITOR NOTE: Please replace TBD with the assigned SDES identifier value.]

14.2. RTP SDES Header Extension For MID

The payload, containing the identification-tag, of the RTP SDES header extension element can be encoded using either the one-byte or two-byte header [RFC7941]. The identification-tag payload is UTF-8 encoded, as in SDP.

The identification-tag is not zero terminated. Note, that the set of header extensions included in the packet needs to be padded to the next 32-bit boundary using zero bytes [RFC5285].

As the identification-tag is included in either an RTCP SDES item or an RTP SDES header extension, or both, there should be some consideration about the packet expansion caused by the identification-tag. To avoid Maximum Transmission Unit (MTU) issues for the RTP packets, the header extension's size needs to be taken into account when encoding the media.

It is recommended that the identification-tag is kept short. Due to the properties of the RTP header extension mechanism, when using the one-byte header, a tag that is 1-3 bytes will result in a minimal number of 32-bit words used for the RTP SDES header extension, in case no other header extensions are included at the same time. Note, do take into account that some single characters when UTF-8 encoded will result in multiple octets. The identification-tag MUST NOT contain any user information, and applications SHALL avoid generating

the identification-tag using a pattern that enables application identification.

15. IANA Considerations

15.1. New SDES item

[RFC EDITOR NOTE: Please replace RFCXXXX with the RFC number of this document.]

[RFC EDITOR NOTE: Please replace TBD with the assigned SDES identifier value.]

This document adds the MID SDES item to the IANA "RTP SDES item types" registry as follows:

```
Value:     TBD
Abbrev.:   MID
Name:      Media Identification
Reference: RFCXXXX
```

15.2. New RTP SDES Header Extension URI

[RFC EDITOR NOTE: Please replace RFCXXXX with the RFC number of this document.]

This document defines a new extension URI in the RTP SDES Compact Header Extensions sub-registry of the RTP Compact Header Extensions registry sub-registry, according to the following data:

```
Extension URI: urn:ietf:params:rtp-hdrext:sdes:mid
Description:   Media identification
Contact:       christer.holmberg@ericsson.com
Reference:     RFCXXXX
```

The SDES item does not reveal privacy information about the users. It is simply used to associate RTP-based media with the correct SDP media description (m- line) in the SDP used to negotiate the media.

The purpose of the extension is for the offerer to be able to associate received multiplexed RTP-based media before the offerer receives the associated SDP answer.

15.3. New SDP Attribute

[RFC EDITOR NOTE: Please replace RFCXXXX with the RFC number of this document.]

This document defines a new SDP media-level attribute, 'bundle-only', according to the following data:

```
  Attribute name:     bundle-only
  Type of attribute:  media
  Subject to charset: No
  Purpose:            Request a media description to be accepted
                      in the answer only if kept within a BUNDLE
                      group by the answerer.
  Appropriate values: N/A
  Contact name:       Christer Holmberg
  Contact e-mail:     christer.holmberg@ericsson.com
  Reference:          RFCXXXX
  Mux category:       NORMAL
```

15.4. New SDP Group Semantics

[RFC EDITOR NOTE: Please replace RFCXXXX with the RFC number of this document.]

This document registers the following semantics with IANA in the "Semantics for the "group" SDP Attribute" subregistry (under the "Session Description Protocol (SDP) Parameters" registry:

Semantics	Token	Reference
Media bundling	BUNDLE	[RFCXXXX]

16. Security Considerations

The security considerations defined in [RFC3264] and [RFC5888] apply to the BUNDLE extension. Bundle does not change which information flows over the network but only changes which addresses and ports that information is flowing on and thus has very little impact on the security of the RTP sessions.

When the BUNDLE extension is used, a single set of security credentials might be used for all media streams specified by a BUNDLE group.

When the BUNDLE extension is used, the number of SSRC values within a single RTP session increases, which increases the risk of SSRC collision. [RFC4568] describes how SSRC collision may weaken SRTP and SRTCP encryption in certain situations.

17. Examples

17.1. Example: Bundle Address Selection

The example below shows:

- An offer, in which the offerer associates a unique address with each bundled "m=" line within the BUNDLE group.

- An answer, in which the answerer selects the offerer BUNDLE address, and then selects its own BUNDLE address (the answerer BUNDLE address) and associates it with each bundled "m=" line within 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
b=AS:200
a=mid:foo
a=rtcp-mux
a=rtpmap:0 PCMU/8000
a=rtpmap:8 PCMA/8000
a=rtpmap:97 iLBC/8000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
m=video 10002 RTP/AVP 31 32
b=AS:1000
a=mid:bar
a=rtcp-mux
a=rtpmap:31 H261/90000
a=rtpmap:32 MPV/90000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
```

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
b=AS:200
a=mid:foo
a=rtcp-mux
a=rtpmap:0 PCMU/8000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
m=video 20000 RTP/AVP 32
b=AS:1000
a=mid:bar
a=rtcp-mux
a=rtpmap:32 MPV/90000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
```

17.2. Example: BUNDLE Extension Rejected

The example below shows:

- An offer, in which the offerer associates a unique address with each bundled "m=" line within the BUNDLE group.

- An answer, in which the answerer rejects the offered BUNDLE group, and associates a unique address with each "m=" line (following normal RFC 3264 procedures).

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
b=AS:200
a=mid:foo
a=rtcp-mux
a=rtpmap:0 PCMU/8000
a=rtpmap:8 PCMA/8000
a=rtpmap:97 iLBC/8000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
m=video 10002 RTP/AVP 31 32
b=AS:1000
a=mid:bar
a=rtcp-mux
a=rtpmap:31 H261/90000
a=rtpmap:32 MPV/90000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
```

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=rtcp-mux
a=rtpmap:0 PCMU/8000
m=video 30000 RTP/AVP 32
b=AS:1000
a=rtcp-mux
a=rtpmap:32 MPV/90000
```

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

The example below shows:

- A subsequent offer (the BUNDLE group has been created as part of a previous offer/answer exchange), in which the offerer adds a new "m=" line, represented by the "zen" identification-tag, to a previously negotiated BUNDLE group, associates a unique address with the added "m=" line, and associates the previously selected offerer BUNDLE address with each of the other bundled "m=" lines within the BUNDLE group.

- An answer, in which the answerer associates the answerer BUNDLE address with each bundled "m=" line (including the newly added "m=" line) within 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 zen
m=audio 10000 RTP/AVP 0 8 97
b=AS:200
a=mid:foo
a=rtcp-mux
a=rtpmap:0 PCMU/8000
a=rtpmap:8 PCMA/8000
a=rtpmap:97 iLBC/8000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
m=video 10000 RTP/AVP 31 32
b=AS:1000
a=mid:bar
a=rtcp-mux
a=rtpmap:31 H261/90000
a=rtpmap:32 MPV/90000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
m=video 20000 RTP/AVP 66
b=AS:1000
a=mid:zen
a=rtcp-mux
a=rtpmap:66 H261/90000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
```

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
b=AS:200
a=mid:foo
a=rtcp-mux
a=rtpmap:0 PCMU/8000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
m=video 20000 RTP/AVP 32
b=AS:1000
a=mid:bar
a=rtcp-mux
a=rtpmap:32 MPV/90000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
m=video 20000 RTP/AVP 66
b=AS:1000
a=mid:zen
a=rtcp-mux
a=rtpmap:66 H261/90000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
```

17.4. Example: Offerer Moves A Media Description Out Of A BUNDLE Group

The example below shows:

- A subsequent offer (the BUNDLE group has been created as part of a previous offer/answer transaction), in which the offerer moves a bundled "m=" line out of a BUNDLE group, associates a unique address with the moved "m=" line, and associates the offerer BUNDLE address with each other bundled "m=" line within the BUNDLE group.

- An answer, in which the answerer moves the "m=" line out of the BUNDLE group, associates a unique address with the moved "m=" line, and associates the answerer BUNDLE address with each of the remaining bundled "m=" line within 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
b=AS:200
a=mid:foo
a=rtcp-mux
a=rtpmap:0 PCMU/8000
a=rtpmap:8 PCMA/8000
a=rtpmap:97 iLBC/8000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
m=video 10000 RTP/AVP 31 32
b=AS:1000
a=mid:bar
a=rtcp-mux
a=rtpmap:31 H261/90000
a=rtpmap:32 MPV/90000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
m=video 50000 RTP/AVP 66
b=AS:1000
a=mid:zen
a=rtcp-mux
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
b=AS:200
a=mid:foo
a=rtcp-mux
a=rtpmap:0 PCMU/8000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
m=video 20000 RTP/AVP 32
b=AS:1000
a=mid:bar
a=rtcp-mux
a=rtpmap:32 MPV/90000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
m=video 60000 RTP/AVP 66
b=AS:1000
a=mid:zen
a=rtcp-mux
```

```
a=rtpmap:66 H261/90000
```

17.5. Example: Offerer Disables A Media Description Within A BUNDLE Group

The example below shows:

- A subsequent offer (the BUNDLE group has been created as part of a previous offer/answer transaction), in which the offerer disables a bundled "m=" line within a BUNDLE group, assigns a zero port number to the disabled "m=" line, and associates the offerer BUNDLE address with each of the other bundled "m=" lines within the BUNDLE group.

- An answer, in which the answerer moves the disabled "m=" line out of the BUNDLE group, assigns a zero port value to the disabled "m=" line, and associates the answerer BUNDLE address with each of the remaining bundled "m=" line within 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
b=AS:200
a=mid:foo
a=rtcp-mux
a=rtpmap:0 PCMU/8000
a=rtpmap:8 PCMA/8000
a=rtpmap:97 iLBC/8000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
m=video 10000 RTP/AVP 31 32
b=AS:1000
a=mid:bar
a=rtcp-mux
a=rtpmap:31 H261/90000
a=rtpmap:32 MPV/90000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
m=video 0 RTP/AVP 66
a=mid:zen
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
b=AS:200
a=mid:foo
a=rtcp-mux
a=rtpmap:0 PCMU/8000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
m=video 20000 RTP/AVP 32
b=AS:1000
a=mid:bar
a=rtcp-mux
a=rtpmap:32 MPV/90000
a=extmap 1 urn:ietf:params:rtp-hdrext:sdes:mid
m=video 0 RTP/AVP 66
a=mid:zen
a=rtpmap:66 H261/90000
```

18. 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 extension 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, Martin Thomson, Flemming Andreasen, Thomas Stach, Ari Keranen, Adam Roach, Christian Groves, Roman Shpount, Suhas Nandakumar, Nils Ohlmeier, Jens Guballa, Raju Makaraju and Justin Uberti for reading the text, and providing useful feedback.

Thanks to Magnus Westerlund, Colin Perkins and Jonathan Lennox for providing help and text on the RTP/RTCP procedures.

Thanks to Spotify for providing music for the countless hours of document editing.

19. Change Log

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

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-35

- Editorial changes on RTP streaming mapping section based on comments from Colin Perkins.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-34

- RTP streams, instead of RTP packets, are associated with m- lines.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-33

- Editorial changes based on comments from Eric Rescorla and Cullen Jennings:
- - Changes regarding usage of RTP/RTCP multiplexing attributes.
- - Additional text regarding associating RTP/RTCP packets with SDP m- lines.
- - Reference correction.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-32

- Editorial changes based on comments from Eric Rescorla and Cullen Jennings:
- - Justification for mechanism added to Introduction.
- - Clarify that the order of m- lines in the group:BUNDLE attribute does not have to be the same as the order in which the m- lines are listed in the SDP.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-31

- Editorial changes based on GitHub Pull requests by Martin Thomson:
- - https://github.com/cdh4u/draft-sdp-bundle/pull/2
- - https://github.com/cdh4u/draft-sdp-bundle/pull/1
- Editorial change based on comment from Diederick Huijbers (9th July 2016).

- Changes based on comments from Flemming Andreasen (21st June 2016):
- - Mux category for SDP bundle-only attribute added.
- - Mux category considerations editorial clarification.
- - Editorial changes.
- RTP SDES extension according to draft-ietf-avtext-sdes-hdr-ext.
- Note whether Design Considerations appendix is to be kept removed:
- - Appendix is kept within document.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-30

- Indicating in the Abstract and Introduction that the document updates RFC 3264.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-29

- Change based on WGLC comment from Colin Perkins.
- - Clarify that SSRC can be reused by another source after a delay of 5 RTCP reporting intervals.
- Change based on WGLC comment from Alissa Cooper.
- - IANA registry name fix.
- - Additional IANA registration information added.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-28

- - Alignment with exclusive mux procedures.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-27

- - Yet another terminology change.
- - Mux category considerations added.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-26

- - ICE considerations modified: ICE-related SDP attributes only added to the bundled m- line representing the selected BUNDLE address.

- - Reference to draft-ietf-mmusic-ice-sip-sdp added.
- - Reference to RFC 5245 replaced with reference to draft-ietf-ice-rfc5245bis.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-25

- - RTP/RTCP mux procedures updated with exclusive RTP/RTCP mux considerations.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-24

- - Reference and procedures associated with exclusive RTP/RTCP mux added

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-23

- - RTCP-MUX mandatory for bundled RTP m- lines
- - Editorial fixes based on comments from Flemming Andreasen

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-22

- - Correction of Ari's family name
- - Editorial fixes based on comments from Thomas Stach
- - RTP/RTCP correction based on comment from Magnus Westerlund
- -- http://www.ietf.org/mail-archive/web/mmusic/current/msg14861.html

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-21

- - Correct based on comment from Paul Kyzivat
- -- 'received packets' replaced with 'received data'

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-20

- - Clarification based on comment from James Guballa
- - Clarification based on comment from Flemming Andreasen

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-19

- - DTLS Considerations section added.

- - BUNDLE semantics added to the IANA Considerations
- - Changes based on WGLC comments from Adam Roach
- -- http://www.ietf.org/mail-archive/web/mmusic/current/msg14673.html

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-18

- - Changes based on agreements at IETF#92
- -- BAS Offer removed, based on agreement at IETF#92.
- -- Procedures regarding usage of SDP "b=" line is replaced with a reference to to draft-ietf-mmusic-sdp-mux-attributes.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-17

- - Editorial changes based on comments from Magnus Westerlund.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-16

- - Modification of RTP/RTCP multiplexing section, based on comments from Magnus Westerlund.
- - Reference updates.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-15

- - Editorial fix.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-14

- - Editorial changes.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-13

- Changes to allow a new suggested offerer BUNDLE address to be assigned to each bundled m- line.
- Changes based on WGLC comments from Paul Kyzivat
- - Editorial fixes

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-12

- Usage of SDP 'extmap' attribute added

- SDP 'bundle-only' attribute scoped with "m=" lines with a zero port value
- Changes based on WGLC comments from Thomas Stach
- - ICE candidates not assigned to bundle-only m- lines with a zero port value
- - Editorial changes
- Changes based on WGLC comments from Colin Perkins
- - Editorial changes:
- -- "RTP SDES item" -> "RTCP SDES item"
- -- "RTP MID SDES item" -> "RTCP MID SDES item"
- - Changes in section 10.1.1:
- -- "SHOULD NOT" -> "MUST NOT"
- -- Additional text added to the Note
- - Change to section 13.2:
- -- Clarify that mid value is not zero terminated
- - Change to section 13.3:
- -- Clarify that mid value is not zero terminated
- -- Clarify padding
- Changes based on WGLC comments from Paul Kyzivat
- - Editorial changes:
- Changes based on WGLC comments from Jonathan Lennox
- - Editorial changes:
- - Defintion of SDP bundle-only attribute alligned with structure in 4566bis draft

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-11

- Editorial corrections based on comments from Harald Alvestrand.

- Editorial corrections based on comments from Cullen Jennings.
- Reference update (RFC 7160).
- Clarification about RTCP packet sending when RTP/RTCP multiplexing is not used (http://www.ietf.org/mail-archive/web/mmusic/current/msg13765.html).
- Additional text added to the Security Considerations.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-10

- SDP bundle-only attribute added to IANA Considerations.
- SDES item and RTP header extension added to Abstract and Introduction.
- Modification to text updating section 8.2 of RFC 3264.
- Reference corrections.
- Editorial corrections.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-09

- Terminology change: "bundle-only attribute assigned to m= line" to "bundle-only attribute associated with m= line".
- Editorial corrections.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-08

- Editorial corrections.
- - "of"->"if" (8.3.2.5).
- - "optional"->"OPTIONAL" (9.1).
- - Syntax/ABNF for 'bundle-only' attribute added.
- - SDP Offer/Answer sections merged.
- - 'Request new offerer BUNDLE address' section added

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-07

- OPEN ISSUE regarding Receiver-ID closed.

- - RTP MID SDES Item.
- - RTP MID Header Extension.
- OPEN ISSUE regarding insertion of SDP 'rtcp' attribute in answers closed.
- - Indicating that, when rtcp-mux is used, the answerer MUST NOT include an 'rtcp' attribute in the answer, based on the procedures in section 5.1.3 of RFC 5761.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-06

- Draft title changed.
- Added "SDP" to section names containing "Offer" or "Answer".
- Editorial fixes based on comments from Paul Kyzivat (http://www.ietf.org/mail-archive/web/mmusic/current/msg13314.html).
- Editorial fixed based on comments from Colin Perkins (http://www.ietf.org/mail-archive/web/mmusic/current/msg13318.html).
- - Removed text about extending BUNDLE to allow multiple RTP sessions within a BUNDLE group.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-05

- Major re-structure of SDP Offer/Answer sections, to align with RFC 3264 structure.
- Additional definitions added.
- - Shared address.
- - Bundled "m=" line.
- - Bundle-only "m=" line.
- - Offerer suggested BUNDLE mid.
- - Answerer selected BUNDLE mid.
- Q6 Closed (IETF#88): An Offerer MUST NOT assign a shared address to multiple "m=" lines until it has received an SDP Answer indicating support of the BUNDLE extension.

- Q8 Closed (IETF#88): An Offerer can, before it knows whether the Answerer supports the BUNDLE extension, assign a zero port value to a 'bundle-only' "m=" line.

- SDP 'bundle-only' attribute section added.

- Connection data nettype/addrtype restrictions added.

- RFC 3264 update section added.

- Indicating that a specific payload type value can be used in multiple "m=" lines, if the value represents the same codec configuration in each "m=" line.

Changes from draft-ietf-mmusic-sdp-bundle-negotiation-04

- Updated Offerer procedures (http://www.ietf.org/mail-archive/web/mmusic/current/msg12293.html).

- Updated Answerer procedures (http://www.ietf.org/mail-archive/web/mmusic/current/msg12333.html).

- Usage of SDP 'bundle-only' attribute added.

- Reference to Trickle ICE document added.

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

- 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.

- Cullen Jennings added as co-author.

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

- No changes. New version due to expiration.

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

- No changes. New version due to expiration.

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

- Draft name changed.

- Harald Alvestrand added as co-author.

- "Multiplex" terminology changed to "bundle".
- Added text about single versus multiple RTP Sessions.
- Added reference to RFC 3550.

20. References

20.1. Normative References

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Appendix A. Design Considerations

One of the main issues regarding the BUNDLE grouping extensions has been whether, in SDP Offers and SDP Answers, the same port 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 address:port combination for media specified by 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 values.

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

- 1) Interoperability with existing UAs.
- 2) Interoperability with intermediary B2BUA- and proxy entities.
- 3) Time to gather, and the number of, ICE candidates.
- 4) Different error scenarios, and when they occur.
- 5) SDP Offer/Answer impacts, including usage of port number value zero.

A.1. 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 knows 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.2. Usage of port number value zero

In an SDP Offer or SDP Answer, the media specified by 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 values, and one of those port values would be used for a BUNDLE address associated with the BUNDLE group, problems would occur if an endpoint wants to disable/reject the "m=" line associated with that port, by setting the port value to zero. After that, no "m=" line would contain the port value which is used for the BUNDLE address. In addition, it is unclear what would happen to the ICE candidates associated with the "m=" line, as they are also used for the BUNDLE address.

A.3. 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 B2BUA still generates that SDP attribute in the Offer for the outgoing call leg. Consider a 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 case, 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, a B2BUA 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.3.1. 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.3.2. 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 specified by all "m=" lines try to use that bandwidth. That may either simply lead to bad user experience, or to termination of the call.

A.4. Candidate Gathering

When using ICE, a 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 for exampe a web-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 allocations 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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