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**Negotiating Media Multiplexing Using the Session Description Protocol  
(SDP)  
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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 sending and receiving media associated with multiple SDP media descriptions ("m=" lines).

This specification also updates sections [5.1](#), [8.1](#) and [8.2](#) of [RFC 3264](#), in order to allow an answerer to in an SDP answer assign a non-zero port value to an "m=" line, even if the offerer in the associated SDP offer had assigned a zero port value to the "m=" line.

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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 sending and receiving media associated with multiple SDP media descriptions ("m=" lines).

The offerer and answerer [[RFC3264](#)] use the BUNDLE mechanism to negotiate BUNDLE addresses, one for the offerer (offerer BUNDLE address) and one for the answerer (answerer BUNDLE address) to be used for the bundled media associated with a BUNDLE group.

Once the offerer and the answerer have negotiated a BUNDLE group, and the associated BUNDLE addresses, each endpoint can assign its BUNDLE address to each "m=" line within, and use the address to send and receive all media associated with, the BUNDLE group.

NOTE: As defined in [RFC 4566](#) [[RFC4566](#)], the semantics of assigning the same port value 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.

SDP bodies can contain multiple BUNDLE groups. Each BUNDLE group MUST use a unique 5-tuple. Any given "m=" line can only be associated with a single BUNDLE group.

The procedures in this specification apply independently to a given BUNDLE group.

All Real-time Transport Protocol (RTP) [[RFC3550](#)] based media flows associated with a single BUNDLE group belong to a single RTP session [[RFC3550](#)].

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 a unique address to each "m=" line within an SDP offer and SDP answer, according to the procedures in [RFC4566] and [RFC3264]

This specification also updates sections 5.1, 8.1 and 8.2 of [RFC3264], in order to allow an answerer to assign a non-zero port value to an "m=" line in an SDP answer, even if the offerer in the associated SDP offer had assigned a zero port value to the "m=" line.

## 2. Terminology

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

Unique address: An IP address and IP port combination that is assigned to a single "m=" line in an SDP offer or SDP answer.

Shared address: An IP address and IP port combination that is assigned to multiple "m=" lines in an SDP offer or SDP answer.

Offerer suggested BUNDLE mid: The first mid value in a given SDP 'group:BUNDLE' attribute mid list in an SDP offer.

Answerer selected BUNDLE mid: The first mid value in a given SDP 'group:BUNDLE' attribute mid list in an SDP answer.

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

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

BUNDLE group: A set of "m=" lines, created using an SDP offer/answer exchange, for which a single 5-tuple is used to send and receive media. Each endpoint uses its BUNDLE address, associated with the BUNDLE group, to send and receive the media.

Bundled "m=" line: An "m=" line, in an SDP offer or SDP answer, associated with a BUNDLE group.

Bundle-only "m=" line: An "m=" line, to which an SDP 'bundle-only' attribute has been assigned.

Bundled media: All media associated with a BUNDLE group.





Initial SDP offer: The first SDP offer, within an SDP session, in which the offerer indicates that it wants to create a given BUNDLE group.

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

### **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**

### **5.1. General**

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.

### **5.2. SDP Offer/Answer Procedures**

#### **5.2.1. General**

This section describes usage of the SDP offer/answer mechanism [[RFC3264](#)] for negotiating usage of the BUNDLE mechanism, for creating a BUNDLE group, for selecting the BUNDLE addresses (offerer BUNDLE address and answerer BUNDLE address), for adding an "m=" line to a BUNDLE group, for moving an "m=" line out of a BUNDLE group, and for disabling an "m=" line within a BUNDLE group.

The generic rules and procedures defined in [[RFC3264](#)] and [[RFC5888](#)] also apply to the BUNDLE mechanism. For example, if an SDP 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 SDP offer in which the



offerer wants to create a BUNDLE group, and the answerer rejects the SDP offer, the BUNDLE group is not created.

The procedures in this section are independent of the media type or transport protocol represented by a bundled "m=" line. [Section 8] defines additional considerations for RTP based media. [Section 6] defines additional considerations for the usage of the SDP 'bundle-only' attribute. [Section 9] defines additional considerations for the usage of Interactive Connectivity Establishment (ICE) mechanism [RFC5245].

## **5.2.2. SDP Information Considerations**

### **5.2.2.1. General**

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 assigned to each bundled "m=" line, how to calculate a value for the whole BUNDLE group.

#### **5.2.2.2. Connection Data (c=)**

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

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

#### **5.2.2.3. Bandwidth (b=)**

The total proposed bandwidth is the sum of the proposed bandwidth for each bundled "m=" line.

#### **5.2.2.4. Attributes (a=)**

[I-D.nandakumar-mmusic-sdp-mux-attributes] defines rules and restrictions for assigning different types of SDP attributes to a bundled "m=" line.



### **[5.2.3.](#) Generating the Initial SDP Offer**

#### **[5.2.3.1.](#) General**

When an offerer generates an initial SDP offer, in order to create a BUNDLE group, the offerer MUST in the SDP offer assign a unique address to each "m=" line with a non-zero port value, following the procedures in [[RFC3264](#)].

The offerer MUST in the SDP offer insert an SDP session level 'group:BUNDLE' attribute, associated with the BUNDLE group, and assign an SDP 'mid' attribute [[RFC5888](#)] to each "m=" line that the offerer wants to be within the BUNDLE group, and place the 'mid' attribute value in the 'group:BUNDLE' attribute mid list.

[[Section 12.1](#)] shows an example of an initial SDP offer.

#### **[5.2.3.2.](#) Request offerer BUNDLE address selection**

When an offerer generates an initial SDP offer, in order to create a BUNDLE group, the offerer MUST in the SDP offer indicate which unique address, associated with one of the "m=" lines that the offerer wants to be within the BUNDLE group, that the offerer wants the answerer to select as the offerer BUNDLE address [[Section 5.2.4.2](#)]. In the SDP offer, the offerer BUNDLE mid value represents that address.

### **[5.2.4.](#) Generating the SDP Answer**

#### **[5.2.4.1.](#) [RFC 5888](#) restrictions**

When an answerer generates an SDP answer, the following restrictions, defined in [[RFC5888](#)], also apply a BUNDLE group:

- o 1) The answerer MUST NOT in the SDP answer include a BUNDLE group, unless the offerer in the associated SDP offer requested the BUNDLE group to be created; and
- o 2) The answerer MUST NOT in the SDP answer include an "m=" line within a BUNDLE group, unless the offerer in the associated SDP offer requested the "m=" line to be within the BUNDLE group.

#### **[5.2.4.2.](#) Answerer Selection of Offerer Bundle Address**

When an answerer generates an SDP answer, it MUST select a BUNDLE address for the offerer, referred to as the offerer BUNDLE address. The answerer MUST select an address which the offerer in the associated SDP offer requested to be within the BUNDLE group.



In the SDP offer, the offerer suggested BUNDLE mid represents the "m=" line to which the offerer in the SDP offer has assigned the address that it wants the answerer to select as the offerer BUNDLE address [[Section 5.2.3.2](#)]. The answerer MUST first select the "m=" line associated with the offerer suggested BUNDLE mid, and check whether it fulfils the following criteria:

- o The answerer will in the SDP answer create the BUNDLE group;
- o The answerer will not in the SDP answer move the "m=" line out of the BUNDLE group [[Section 5.2.4.4](#)];
- o The answerer will not in the SDP answer reject the "m=" line [[Section 5.2.4.5](#)]; and
- o The offerer did not in the associated SDP offer assign a zero port value to the "m=" line.

If all of the criteria above is fulfilled, the answerer MUST select the address associated with the "m=" line as the offerer BUNDLE address.

If all of the criteria is not fulfilled, the answerer MUST select the next mid value in the mid list, and perform the same criteria check for the "m=" line associated with the mid value.

In the SDP answer, the answerer selected BUNDLE mid value represents the "m=" line which address (in the associated SDP offer) the answerer has selected as the offerer BUNDLE address.

[[Section 12.1](#)] shows an example of an offerer BUNDLE address selection.

#### **[5.2.4.3](#). Answerer Selection of Answerer BUNDLE Address**

When an answerer generates an SDP answer, the answerer MUST select a BUNDLE address for itself, referred to as the answerer BUNDLE address, and in the SDP answer assign the answerer BUNDLE address to each "m=" line within the created BUNDLE group.

The answerer MUST NOT in the SDP answer assign the answerer BUNDLE address to an "m=" line that is not associated with the BUNDLE group, or to an "m=" line that is associated with another BUNDLE group.

The answerer is allowed to select a new answerer BUNDLE address in every SDP answer that the answerer generates.





[[Section 12.1](#)] shows an example of an answerer BUNDLE address selection.

#### **5.2.4.4. Moving A Media Description Out Of A BUNDLE Group**

When an answerer generates an SDP answer, in which the answerer moves a bundled "m=" line out a BUNDLE group, the answerer assigns an address to the moved "m=" line based on the type of address that the offerer in the associated SDP offer assigned to the "m=" line.

- o If the offerer in the SDP offer has assigned a shared address (e.g. a previously selected offerer BUNDLE address) to the "m=" line, the answerer MUST in the SDP answer reject the moved "m=" line, according to the procedures in [[Section 5.2.4.5](#)].
- o If the offerer in the SDP offer assigned an SDP 'bundle-only' attribute to the "m=" line, the answerer MUST in the SDP answer reject the moved "m=" line, according to the procedures in [[Section 5.2.4.5](#)].
- o If the offerer in the SDP offer assigned a unique address to the "m=" line, the answerer MUST in the SDP answer assign a unique address to the moved "m=" line.

In addition, in either case above, the answerer MUST NOT in the SDP answer include a mid value, associated with the moved "m=" line, in the SDP 'group:BUNDLE' attribute mid list associated with the BUNDLE group.

#### **5.2.4.5. Rejecting A Media Description In A BUNDLE Group**

When an answerer generates an SDP answer, in which the answerer rejects an "m=" line, the answerer MUST in the SDP answer 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 in the SDP answer include a mid value, associated with the rejected "m=" line, in the SDP 'group:BUNDLE' attribute mid list associated with the BUNDLE group.

### **5.2.5. Offerer Processing of the SDP Answer**

#### **5.2.5.1. General**

When an offerer receives an SDP answer, the offerer MUST apply the selected offerer BUNDLE address to each bundled "m=" line. If the offerer generates a subsequent SDP offer, the offerer MUST in the SDP



offer assign the offerer BUNDLE address to each bundled "m=" line (including any 'bundle-only' "m=" line) [[Section 5.2.6](#)].

If the SDP answer does not contain a BUNDLE group, the offerer MUST cease to use any procedure associated with the BUNDLE mechanism.

#### **[5.2.5.2](#). Bundle Address Synchronization (BAS)**

If the selected offerer BUNDLE address is different than the address that the offerer in the associated SDP offer assigned to a bundled "m=" line (including an "m=" line that the offerer in the SDP offer added to an existing BUNDLE group [[Section 5.2.6.2](#)]), and the bundled "m=" line was not rejected [[Section 5.2.4.5](#)], or moved out of the BUNDLE group [[Section 5.2.4.4](#)] by the answerer, the offerer SHOULD as soon as possible generate a subsequent SDP offer, in which the offerer assigns the offerer BUNDLE address to each bundled "m=" line. This procedure is referred to as Bundle Address Synchronization (BAS), and the SDP offer is referred to as a BAS Offer.

The offerer MAY in the BAS offer modify any SDP parameter.

NOTE: It is important that the BAS offer gets accepted by the answerer. For that reason the offerer needs to consider the necessity to in the BAS offer modify SDP parameters that could get the answerer to reject the BAS offer. Disabling "m=" lines, or reducing the number of codecs, in a BAS offer is considered to have a low risk of being rejected.

NOTE: The main purpose of the BAS offer is to ensure that intermediaries, that might not support the BUNDLE mechanism, have correct information regarding the address is going to be used to transport the bundled media.

[[Section 12.1](#)] shows an example where an offerer sends a BAS offer.

### **[5.2.6](#). Modifying the Session**

#### **[5.2.6.1](#). General**

When an offerer generates a subsequent SDP offer, the offerer MUST in the SDP offer assign the previously selected offerer BUNDLE address [[Section 5.2.4.2](#)] to each bundled "m=" line (including any bundle-only "m=" line), unless the offerer in the SDP offer moves the "m=" line out of the BUNDLE group [[Section 5.2.6.3](#)], or disables the "m=" line [[Section 5.2.6.4](#)].



If the SDP offerer in the SDP offer adds an "m=" line to the BUNDLE group [[Section 5.2.6.2](#)], the offerer MAY assign the previously selected offerer BUNDLE address to the added "m=" line.

In addition, the offerer MUST in the SDP offer indicate which address (unique or previously selected offerer BUNDLE address) it wants the answerer to select as the offerer BUNDLE address, following the procedures in [[Section 5.2.3.2](#)]. The offerer MUST do this even if the offerer in the SDP offer assigns a previously selected offerer BUNDLE address to each bundled "m=" line.

#### **[5.2.6.2](#). Adding a media description to a BUNDLE group**

When an offerer generates an SDP offer, in which the offerer wants to add an "m=" line to a BUNDLE group, the offerer assigns in the SDP offer an address (unique or previously selected offerer BUNDLE address) to the "m=" line, assigns an SDP 'mid' attribute to the "m=" line, and places the mid value in the SDP 'group:BUNDLE' attribute mid list associated with the BUNDLE group [[Section 5.2.3.2](#)].

NOTE: If the offerer wants the answerer to select the address associated with the added "m=" as the offerer BUNDLE address, the offerer suggested BUNDLE mid MUST represent the added "m=" line [[Section 5.2.3.2](#)].

[[Section 12.3](#)] shows an example where an offerer sends an SDP offer in order to add an "m=" line to a BUNDLE group.

#### **[5.2.6.3](#). Moving A Media Description Out Of A BUNDLE Group**

When an offerer generates an SDP offer, in which the offerer wants to move a bundled "m=" line out of a BUNDLE group, the offerer MUST assign a unique address to the "m=" line. In addition, the offerer MUST NOT place a mid value associated with the "m=" line in the SDP 'group:BUNDLE' attribute mid list associated with the BUNDLE group.

NOTE: The offerer MAY keep a previously assigned SDP 'mid' attribute in an "m=" line that it wants to move out of a BUNDLE group, e.g. if the mid value is used for some other SDP grouping extension than BUNDLE.

[[Section 12.4](#)] shows an example where an offerer sends an SDP offer in order to move an "m=" line out of a BUNDLE group.



#### **5.2.6.4. Disabling A Media Description In A BUNDLE Group**

When an offerer generates an SDP offer, in which the offerer wants to disable a bundled "m=" line, the offerer **MUST** assign an address with a zero port value to the "m=" line, following the procedures in [\[RFC4566\]](#). In addition, the offerer **MUST NOT** place a mid value associated with the "m=" line in the SDP 'group:BUNDLE' attribute mid list associated with the BUNDLE group.

NOTE: The offerer **MAY** assign an SDP 'mid' attribute to an "m=" line that it wants to disable, e.g. if the mid value is used for some other SDP grouping extension than BUNDLE.

[\[Section 12.5\]](#) shows an example where an offerer sends an SDP offer in order to disable an "m=" line within a BUNDLE group.

### **6. SDP 'bundle-only' Attribute**

#### **6.1. General**

This section defines a new SDP media-level attribute [\[RFC4566\]](#), 'bundle-only'. An offerer can in an SDP offer assign a 'bundle-only' "m=" line to a bundled "m=" line (including an "m=" line that the offerer wants to add to the BUNDLE group [\[Section 5.2.6.2\]](#)), in order to ensure that the answerer only accepts the "m=" line if the answerer supports the BUNDLE mechanism, and if the answerer in the SDP answer keeps the "m=" line within the BUNDLE group.

#### **6.2. SDP Offer/Answer Procedures**

##### **6.2.1. Generating the Initial SDP Offer**

When an offerer generates an initial SDP offer, in order to create a BUNDLE group, the offerer can in the SDP offer assign an SDP 'bundle-only' attribute to an "m=" line that the offerer wants to be within the BUNDLE group.

The offerer **MUST** in the SDP offer assign a zero port value to the bundle-only "m=" line.

##### **6.2.2. Generating the SDP Answer**

When the answerer selects the offerer BUNDLE address [\[Section 5.2.4.2\]](#), the answerer **MUST** also take a bundle-only "m=" line with a non-zero port value into consideration.

If the offerer in the SDP offer has assigned a zero port value to a bundle-only "m=" line, and if the answerer accepts the "m=" line, the





answerer will treat the "m=" line as any other bundle "m=" line when the answerer generates the SDP answer [[Section 5.2.4](#)].

NOTE: If the offerer in the SDP offer has assigned a zero port value to a bundled "m=" line, but the offerer has not assigned a 'bundle-only' SDP attribute to the "m=" line, it is an indication that the offerer wants to disable the "m=" line [[Section 5.2.6.4](#)].

If the answerer in the SDP answer does not keep the bundle-only "m=" line within the BUNDLE group, the answerer MUST in the SDP answer reject the "m=" line [[Section 5.2.4.5](#)].

The answerer MUST NOT in the SDP answer assign an SDP 'bundle-only' attribute to an "m=" line (even if the offerer in the associated SDP offer has assigned a 'bundle-only' attribute to the "m="line).

### **[6.2.3](#). Offerer Processing of the SDP Answer**

When the offerer receives an SDP answer, the offerer follows the procedures in [[Section 5.2.5](#)]. If the offerer in the associated SDP offer assigned an SDP 'bundle-only' attribute to an "m=" line, and the "m=" line was accepted (and was kept within the BUNDLE group) by the answerer, the selected offerer BUNDLE address also applies to the "m=" line.

### **[6.2.4](#). Modifying the Session**

When an offerer creates a subsequent SDP offer, the offerer follows the procedures in [[Section 5.2.6](#)]. If the offerer in the SDP offer assigns an SDP 'bundle-only' attribute to a bundled "m=" line, in order to ensure that the answerer accepts the "m=" line only if the answerer keeps the "m=" line within the BUNDLE group, the offerer MUST NOT assign a zero port value to the "m=" line. Instead, the offerer MUST in the SDP offer assign the offerer BUNDLE address or, if the "m=" line is added to the BUNDLE group [[Section 5.2.6.2](#)], either the offerer BUNDLE address or a unique address, to the "m=" line.

NOTE: The offerer can in a subsequent SDP offer assign an SDP 'bundle-only' attribute to a bundled "m=" line even if the offerer did not assign a 'bundle-only' attribute to the "m=" line in a previous SDP offer.

If the offerer in the SDP offer wants to move a bundled "m=" line out of a BUNDLE group [[Section 5.2.6.3](#)], the offerer MUST NOT in the SDP offer assign a 'bundle-only' attribute to the "m=" line.



If the offerer in the SDP offer wants to disable a bundled "m=" line [[Section 5.2.6.4](#)], the offerer MUST NOT in the SDP offer assign a 'bundle-only' attribute to the "m=" line.

## **[7.](#) Protocol Identification**

### **[7.1.](#) General**

If bundled "m=" lines represent different transport protocols, there MUST exist a specification which describes a mechanism, for this specific transport protocol combination, how to associate a received packet with the correct transport protocol.

In addition, if a received packet can be associated with more than one bundled "m=" line, there MUST exist a specification which describes a mechanism how to associated the received packet with the correct "m=" line.

### **[7.2.](#) STUN, DTLS, SRTP**

[Section 5.1.2 of \[RFC5764\]](#) describes a mechanism how to identify the protocol among the STUN, DTLS and SRTP protocols (in any combination). If an offer or answerer in SDP offers or answers include 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 how to identify 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 how to associate the received DTLS packet with the correct "m=" line.

[[Section 8.2](#)] describes how to associate a received (S)RTP packet with the correct "m=" line.

## **[8.](#) RTP Considerations**

### **[8.1.](#) Single RTP Session**



### **8.1.1. General**

All RTP-based media within a single BUNDLE group belong to a single RTP session [[RFC3550](#)]. Disjoint BUNDLE groups will form multiple RTP sessions, one per BUNDLE group.

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:

- o A specific payload type value can be used in multiple bundled "m=" lines if each codec associated with the payload type number shares an identical codec configuration [[Section 8.1.2](#)].
- o The "proto" value in each bundled "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 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 fails to function. Even if done in proper sequence this causes RTP Timestamp rate switching issues [ref to [draft-ietf-avtext-multiple-clock-rates](#)].

### **8.1.2. Payload Type (PT) Value Re-usage**

Multiple bundled "m=" lines might represent RTP based media. As all RTP based media associated with 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 numbers 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.nandakumar-mmusic-sdp-mux-attributes](#)] lists SDP attributes, which attribute values must be identical for all codecs that use the same payload type value.

## **8.2. Associating RTP Packets With Correct SDP Media Description**

In general, there are multiple mechanisms that can be used by an endpoint in order to associate received RTP packets with the bundled "m=" line representing the RTP packets. Such mechanisms include using the local address:port combination on which the RTP packets are received, the payload type value carried inside the RTP packets, the



SSRC values carried inside the RTP packets, and other "m=" line specific information carried inside the RTP packets.

As all RTP packets associated with a BUNDLE group are sent and received using the same 5-tuple, the local address:port combination cannot be used to associate received RTP packets with the correct "m=" line.

As described in [[Section 8.1.2](#)], the same payload type value might be used inside RTP packets described by multiple "m=" lines. In such cases, the payload type value cannot be used to associate received RTP packets with the correct "m=" line.

An offerer and answerer can in an SDP offer and answer inform each other which SSRC values they will use inside sent RTP packets by, by assigning an SDP 'ssrc' attribute [[RFC5576](#)] to each bundled "m=" line which contains a payload type value that is also used inside another bundled "m=" line. As the SSRC values will be carried inside the RTP packets, the offerer and answerer can then use that information to associate received RTP packets with the correct "m=" line. However, an offerer will not know which SSRC values the answerer will use until it has received the SDP answer providing that information. Due to this, before the offerer has received the SDP answer, the offerer will not be able to associate received RTP packets with the correct "m=" line using the SSRC values.

In order for an offerer and answerer to always be able to associate received RTP packets with the correct "m=" line, the offerer and answerer MUST in an SDP offer and answer assign an SDP "receiver-id" attribute [receiver-id-reference-to-be-added] to each bundled "m=" line which contains a payload type value that is also used inside another bundled "m=" line. If an answerer accepts such "m=" line, and keeps it within the BUNDLE group, the answerer MUST insert the 'receiver-id' attribute value in RTP packets, associated with the "m=" line, sent towards the offerer.

OPEN ISSUE: We need a mechanism that implements the 'receiver-id' mechanism and the associated SDP attribute.

### **[8.3.](#) RTP/RTCP Multiplexing**

#### **[8.3.1.](#) General**

When a BUNDLE group, which contains RTP based media, is created, the offerer and answerer MUST negotiate whether to enable RTP/RTCP multiplexing for the RTP based media associated with the BUNDLE group [[RFC5761](#)].





If RTP/RTCP multiplexing is not enabled, separate 5-tuples will be used for sending and receiving the RTP packets and the RTCP packets.

### **8.3.2. SDP Offer/Answer Procedures**

#### **8.3.2.1. General**

This section describes how an offerer and answerer can use the SDP 'rtcp-mux' attribute [[RFC5761](#)] and the SDP 'rtcp' attribute [[RFC3605](#)] to negotiate usage of RTP/RTCP multiplexing for RTP based associated with a BUNDLE group.

#### **8.3.2.2. Generating the Initial SDP Offer**

When an offerer generates an initial SDP offer, if the offerer wants to negotiate usage of RTP/RTCP multiplexing within a BUNDLE group, the offerer MUST in the SDP offer assign an SDP 'rtcp-mux' attribute [[RFC5761](#)] to each bundled "m=" line (including any bundle-only "m=" line). In addition, the offerer MUST in the SDP offer assign an SDP 'rtcp' attribute [[RFC3605](#)] to each bundled "m=" line (including any bundle-only "m=" line), with an attribute value that is identical to the port value assigned to the "m=" line itself.

If the offerer does not want to negotiate usage of RTP/RTCP multiplexing, the offerer MUST NOT assign the SDP attributes above to any bundled "m=" line.

#### **8.3.2.3. Generating the SDP Answer**

##### **8.3.2.3.1. Generating the SDP Answer to an Initial SDP Offer**

When the answerer generates an SDP answer to an initial SDP offer, if the offerer in the associated SDP offer indicated support of RTP/RTCP multiplexing [[RFC5761](#)] within a BUNDLE group, the answerer MUST in the SDP answer either accept or reject usage of RTP/RTCP multiplexing.

If the answerer accepts usage of RTP/RTCP multiplexing within the BUNDLE group, the answerer MUST in the SDP answer assign an SDP 'rtcp-mux' attribute to each bundled "m=" line. The answerer MUST NOT in the SDP answer assign an SDP 'rtcp' attribute to any bundled "m=" line.

OPEN ISSUE: Do we want to include the SDP 'rtcp' attribute also in the SDP answer, even though it is not needed?



If the answerer rejects usage of RTP/RTCP multiplexing within the BUNDLE group, the answerer MUST NOT in the SDP answer assign an SDP 'rtcp-mux' or SDP 'rtcp' attribute to any bundled "m=" line.

#### **8.3.2.3.2. Generating the SDP Answer to a Subsequent SDP Offer**

When the answerer generates an SDP answer to a subsequent SDP offer, if the offerer in the associated SDP offer indicated support of RTP/RTCP multiplexing [[RFC5761](#)] within a BUNDLE group, the answerer MUST in the SDP answer assign an SDP 'rtcp-mux' attribute and SDP 'rtcp' attribute to each bundled "m=" line.

NOTE: The BUNDLE mechanism does not allow the answerer to, in a subsequent SDP answer, disable usage of RTP/RTCP multiplexing, if the offerer in the associated SDP offer indicates that it wants to continue using RTP/RTCP multiplexing.

#### **8.3.2.4. Offerer Processing of the SDP Answer**

When the offerer receives an SDP answer, it follows the procedures defined in [[RFC5245](#)].

#### **8.3.2.5. Modifying the Session**

When an offerer generates a subsequent SDP offer, if the offerer wants to negotiate usage of RTP/RTCP multiplexing within a BUNDLE group, or if the offerer wants to continue usage of previously negotiated RTP/RTCP multiplexing within the BUNDLE group, the offerer MUST in the SDP offer assign 'rtcp-mux' and 'rtcp' attributes to each bundled "m=" line (including bundle-only "m=" lines), unless the "m=" line is disabled or removed from the BUNDLE group.

If the offerer does not want to negotiate usage of RTP/RTCP multiplexing within the BUNDLE group, or if the offerer wants to disable previously negotiated usage of RTP/RTCP multiplexing within a BUNDLE group, the offerer MUST NOT in the SDP offer assign 'rtcp-mux' and 'rtcp' attributes to any bundled "m=" line.

NOTE: It is RECOMMENDED that, once usage of RTP/RTCP multiplexing has been negotiated within a BUNDLE group, that the usage of not disabled. Disabling RTP/RTCP multiplexing means that the offerer and answerer need to reserve new IP ports, to be used for sending and receiving RTCP packets.



## **9. ICE Considerations**

### **9.1. General**

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

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

### **9.2. SDP Offer/Answer Procedures**

#### **9.2.1. Generating the Initial SDP Offer**

When an offerer generates an initial SDP offer, which contains a BUNDLE group, the offerer MUST assign ICE candidates [[RFC5245](#)] to each bundled "m=" line, except to an "m=" line to which the offerer assigns a zero port value (e.g. a bundle-only "m=" line). The offerer MUST assign unique ICE candidate values to each "m=" line.

#### **9.2.2. Generating the SDP Answer**

When an answerer generates an SDP Answer, which contains a BUNDLE group, the answerer MUST assign ICE candidates to each bundled "m=" line. The answerer MUST assign identical ICE candidate values to each bundled "m=" line.

#### **9.2.3. Offerer Processing of the SDP Answer**

When the offerer receives an SDP answer, it follows the procedures defined in [[RFC5245](#)].

#### **9.2.4. Modifying the Session**

When an offerer generates a subsequent SDP offer, for each bundled "m=" line to which the offerer assigns its BUNDLE address, the offerer MUST assign identical ICE candidate values. The offerer MUST assign the ICE candidate values associated with the "m=" line that was used by the answerer to select the offerer BUNDLE address [ref-to-be-added].

#### **9.2.5. Keep-alives**

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 bundled "m=" line.



## **10.** Update to [RFC 3264](#)

### **10.1.** General

This section replaces the text of the following sections of [RFC 3264](#):

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

### **10.2.** 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.

### **10.3.** 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.





**10.4. 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.

**10.5. 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.

**10.6. 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.

**10.7. 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.



## **11. 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.

## **12. Examples**

### **12.1. Example: Bundle Address Selection**

The example below shows:

- o 1. An SDP offer, in which the offerer assigns a unique address to each bundled "m=" line within the BUNDLE group.
- o 2. An SDP answer, in which the answerer selects the offerer BUNDLE address, and in which selects its own BUNDLE address (the answerer BUNDLE address) and assigns it each bundled "m=" line within the BUNDLE group.
- o 3. A subsequent SDP offer (BAS 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
```

**12.2. Example: Bundle Mechanism Rejected**

The example below shows:

- o 1. An SDP offer, in which the offerer assigns a unique address to each bundled "m=" line within the BUNDLE group.



- o 2. An SDP answer, in which the answerer rejects the offered BUNDLE group, and assigns a unique addresses to 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
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
```

### **[12.3.](#) Example: Offerer Adds A Media Description To A BUNDLE Group**

The example below shows:

- o 1. An SDP offer, in which the offerer adds a new "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 selected offerer BUNDLE address to each of the other bundled "m=" lines within the BUNDLE group.

- o 2. An SDP answer, in which the answerer assigns the answerer BUNDLE address to each bundled "m=" line (including the newly added "m=" line) within the BUNDLE group.
- o 3. A subsequent SDP offer (BAS 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
```

### [12.4.](#) 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 a bundled "m=" line out of a BUNDLE group, assigns a unique address to the moved "m=" line, and assigns the offerer BUNDLE address to each other bundled "m=" line within the BUNDLE group.
- o 2. An SDP answer, in which the answerer moves the "m=" line out of the BUNDLE group, assigns unique address to the moved "m="



line, and assigns the answerer BUNDLE address to each other 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
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
```





### **12.5. Example: Offerer Disables A Media Description Within A BUNDLE Group**

The example below shows:

- o 1. An SDP offer, in which the offerer disables a bundled "m=" line within BUNDLE group, assigns a zero port number the disabled "m=" line, and assigns the offerer BUNDLE address to each of the other bundled "m=" lines within the BUNDLE group.
- o 2. An SDP 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 assigns the answerer BUNDLE address to each of the other bundled "m=" lines 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
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
```



### **13. IANA Considerations**

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

### **14. 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.

### **15. Change Log**

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

Changes from [draft-ietf-mmusic-sdp-bundle-negotiation-06](#)

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

Changes from [draft-ietf-mmusic-sdp-bundle-negotiation-05](#)

- o Major re-structure of SDP Offer/Answer sections, to align with [RFC 3264](#) structure.
- o Additional definitions added.
- o - Shared address.



- o - Bundled "m=" line.
- o - Bundle-only "m=" line.
- o - Offerer suggested BUNDLE mid.
- o - Answerer selected BUNDLE mid.
- o 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 mechanism.
- o Q8 Closed (IETF#88): An Offerer can, before it knows whether the Answerer supports the BUNDLE mechanism, assign a zero port value to a 'bundle-only' "m=" line.
- o SDP 'bundle-only' attribute section added.
- o Connection data nettype/addrtype restrictions added.
- o [RFC 3264](#) update section added.
- o 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](#)

- 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](#).

## **16. References**

### **16.1. Normative References**

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
- [RFC3264] Rosenberg, J. and H. Schulzrinne, "An Offer/Answer Model with Session Description Protocol (SDP)", [RFC 3264](#), June 2002.
- [RFC4566] Handley, M., Jacobson, V., and C. Perkins, "SDP: Session Description Protocol", [RFC 4566](#), July 2006.
- [RFC5761] Perkins, C. and M. Westerlund, "Multiplexing RTP Data and Control Packets on a Single Port", [RFC 5761](#), April 2010.
- [RFC5888] Camarillo, G. and H. Schulzrinne, "The Session Description Protocol (SDP) Grouping Framework", [RFC 5888](#), June 2010.
- [I-D.nandakumar-mmusic-sdp-mux-attributes]  
Nandakumar, S., "A Framework for SDP Attributes when Multiplexing", [draft-ietf-mmusic-sdp-mux-attributes-01](#) (work in progress), February 2014.

### **16.2. 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.
- [RFC5576] Lennox, J., Ott, J., and T. Schierl, "Source-Specific Media Attributes in the Session Description Protocol (SDP)", [RFC 5576](#), June 2009.
- [RFC5764] McGrew, D. and E. Rescorla, "Datagram Transport Layer Security (DTLS) Extension to Establish Keys for the Secure Real-time Transport Protocol (SRTP)", [RFC 5764](#), May 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-01](#) (work in progress), February 2014.

## [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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