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# SDP for the WebRTC
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Abstract

The Web Real-Time Communication [WebRTC] working group is charged to provide protocol support for direct interactive rich communication using audio, video and data between two peers' web browsers. With in the WebRTC framework, Session Description protocol (SDP) [RFC4566] is used for negotiating session capabilities between the peers. Such a negotiation happens based on the SDP Offer/Answer exchange mechanism described in [RFC3264].

This document provides an informational reference in describing the role of SDP and the Offer/Answer exchange mechanism for the most common WebRTC use-cases.

This SDP examples provided in this document is still a work in progress, but it aims to align closest to the evolving standards work.

Status of This Memo

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## 1. Introduction

Javascript Session Exchange Protocol(JSEP) [I-D.ietf-rtcweb-jsep] specifies a generic protocol needed to generate [RFC3264] Offers and Answers negotiated between the WebRTC peers for setting up, updating and tearing down a WebRTC session. For this purpose, SDP is used to construct [RFC3264] Offers/Answers for describing (media and non-media) streams as appropriate for the recipients of the session description to participate in the session.

The remainder of this document is organized as follows: Sections 3 and 4 provides an overview of SDP and the Offer/Answer exchange mechanism. Section 5 provides sample SDP generated for the most common WebRTC use-cases.

## 2. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

## 3. SDP and the WebRTC

The purpose of this section is to provide a general overview of SDP and its components. For a more in-depth understanding, the readers are advised to refer to [RFC4566].

The Session Description Protocol (SDP) [RFC4566] describes multimedia sessions, which can contain audio, video, whiteboard, fax, modem, and other streams. SDP provides a general purpose, standard representation to describe various aspects of multimedia session such as media capabilities, transport addresses and related metadata in a transport agnostic manner, for the purposes of session announcement, session invitation and parameter negotiation.

As of today SDP is widely used in the context of Session Initiation Protocol [RFC3261], Real-time Transport Protocol [RFC3550] and Real-time Streaming Protocol applications [RFC2326].

Below figure introduces high-level breakup of SDP into components that semantically describe a multimedia session, in our case, a WebRTC session [WebRTC]. It by no means captures everything about SDP and hence, should be used for informational purposes only.

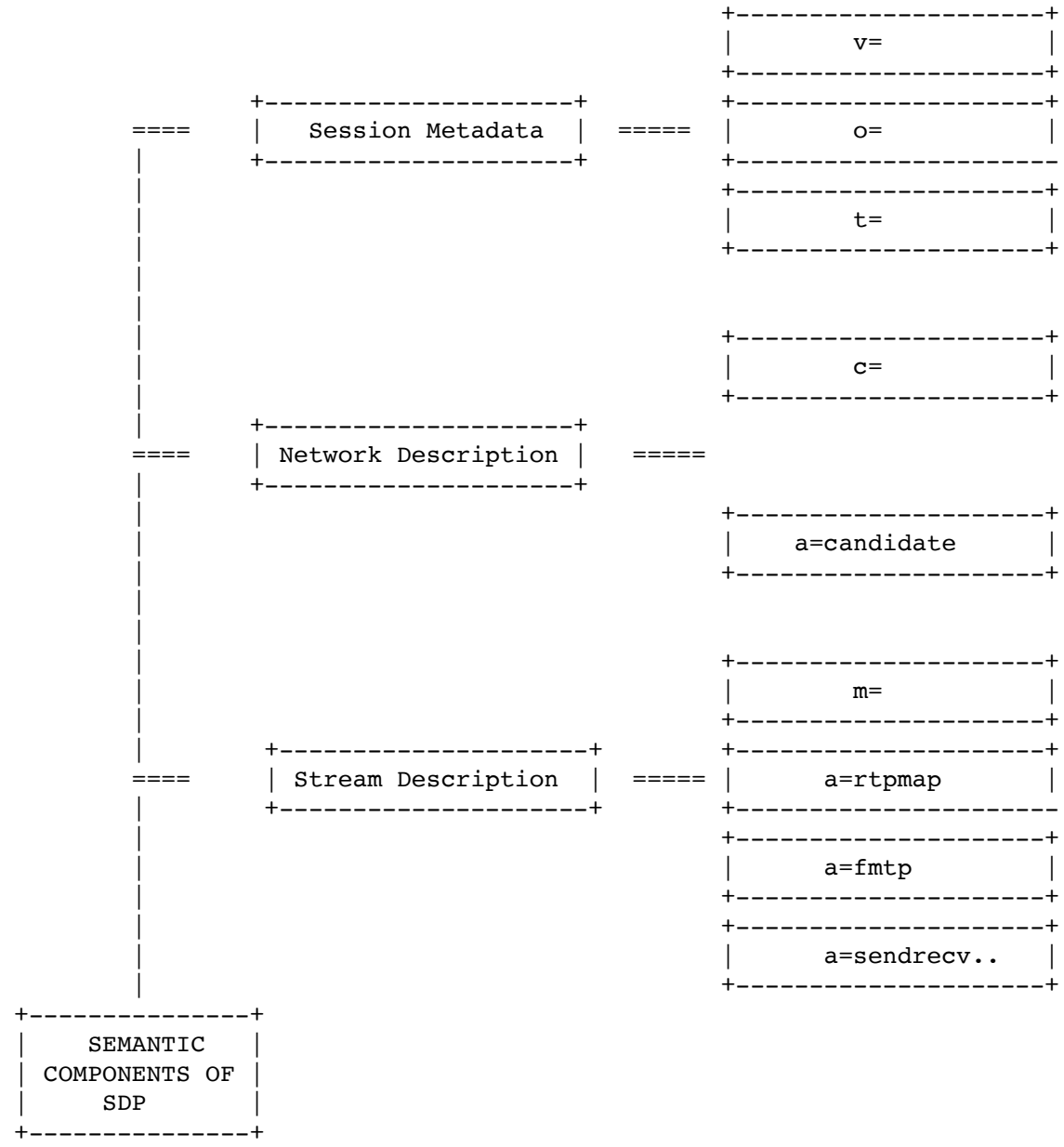



Figure 1: Semantic Components of SDP

[WebRTC] proposes JavaScript application to fully specify and control the signaling plane of a multimedia session as described in the JSEP specification [I-D.ietf-rtcweb-jsep]. JSEP provides mechanisms to create session characterization and media definition information to conduct the session based on SDP exchanges.

In this context, SDP serves two purposes:

1. Provide grammatical structure syntactically.

2. Semantically convey participant's intention and capabilities required to successfully negotiate a session.

## 4. Offer/Answer and the WebRTC

This section introduces SDP Offer/Answer Exchange mechanism mandated by WebRTC for negotiating session capabilities while setting up, updating and tearing down a WebRTC session. This section is intentionally brief in nature and interested readers are recommended to refer [RFC3264] for specific details on the protocol operation.

The Offer/Answer [RFC3264] model specifies rule for the bilateral exchange of Session Description Protocol (SDP) messages for creation of multimedia streams. It defines protocol with involved participants exchanging desired session characteristics from each others perspective constructed as SDP to negotiate the session between them.

In the most basic form,the protocol operation begins by one of the participants sending an initial SDP Offer describing its intent to start a multimedia communication session. The participant receiving the offer MAY generate an SDP Answer accepting the offer or it MAY reject the offer. If the session is accepted the Offer/Answer model guarantees a common view of the multimedia session between the participants.

At any time, either participant MAY generate a new SDP offer that updates the session in progress.

With in the context of WebRTC, the Offer/Answer model defines the state-machinery for WebRTC peers to negotiate session descriptions between them during the initial setup stages as well as for eventual session updates. Javascript Session Establishment Protocol specification [I-D.ietf-rtcweb-jsep] for WebRTC provides the mechanism for generating [RFC3264] SDP Offers and Answers in order for both sides of the session to agree upon details such as list of media formats to be sent/received, bandwidth information, crypto parameters, transport parameters, for example.

## 5. WebRTC Session Description Examples

A typical web based real-time multimedia communication session can be characterized as below:

- It has zero or more Audio only, Video only or Audio/Video RTP Sessions,
- MAY contain zero or more non-media data sessions,
- All the sessions are secured with DTLS-SRTP,

- Supports NAT traversal using ICE mechanism,
- Provides RTCP based feedback mechanisms,
- Sessions can be over IPv4-only, IPv6-only, dual-stack based clients.

Bundle?

## 5.1. Some Conventions

The examples given in this document follow the conventions listed below:

- In all the examples, Alice and Bob are assumed to be the WebRTC peers.
- It is assumed that for most of the examples, the support for [I-D.ietf-mmusic-sdp-bundle-negotiation] is established apriori either out-of-band or as a consequence of successful Offer/Answer negotiation between Alice and Bob, unless explicitly stated otherwise.

Don't you always offer Bundle and negotiate?

- Call-flow diagrams that accompany the use-cases capture only the prominent aspects of the system behavior and intentionally is not detailed to improve readability.
- Eventhough the call-flow diagrams shows SDP being exchanged between the parties, it doesn't represent the only way an WebRTC setup is expected to work. Other approaches may involve WebRTC applications to exchange the media setup information via non-SDP mechanisms as long as they confirm to the [I-D.ietf-rtcweb-jsep] API specification.

ORTC or how w/o SDP?

- The SDP examples deviate from actual on-the-wire SDP notation in several ways. This is done to facilitate readability and to conform to the restrictions imposed by the RFC formatting rules.
  - Visual markers/Empty lines in any SDP example are inserted to make functional divisions in the SDP clearer, and are not actually part of the SDP syntax.
  - Any SDP line that is indented (compared to the initial line in the SDP block) is a continuation of the preceding line. The line break and indent are to be interpreted as a single space character.
  - Excepting the above two conventions, line endings are to be interpreted as <CR><LF> pairs (that is, an ASCII 13 followed by an ASCII 10).

- Against each SDP line, pointers to the appropriate RFCs are provided for further informational reference. Also an attempt has been made to provide explanatory notes to enable better understanding of the SDP usage, wherever appropriate.

- Following SDP details are common across all the use-cases defined in this document unless mentioned otherwise.

  * DTLS fingerprint for SRTP (a=fingerprint)

  * RTP/RTCP Multiplexing (a=rtcp-mux)

  * RTCP Feedback support (a=rtcp-fb)

  * Host and server-reflexive candidate lines (a=candidate)

  * SRTP Setup framework parameters (a=setup)

  * RTCP attribute (a=rtcp)

  * RTP header extension indicating audio-levels from client to the mixer

  For specific details, readers must refer to [I-D.ietf-rtcweb-jsep] specification.

- The term "Session" is used rather loosely in this document to refer to either a "Communication Session" or a "RTP Session" or a "RTP Stream" depending on the context.

- Payload type 109 is usually used for OPUS, 0 for PCMU, 8 for PCMA, 99 for H.264 and 120 for VP8 in most of the examples to maintain uniformity.

- The IP Address:Port combinations '192.168.1.4:61665' (host) and '24.23.204.141:54609' (Server Reflexive) is typically used for Alice.

- The IP Address:Port combinations '192.168.1.7:51556' (host) and '98.248.92.77:49203' (Server Reflexive) is typically used for Bob.

- In the actual use the values that represent SSRCs, ICE candidate foundations, WebRTC Mediastream and MediaStreamTrack Ids shall be much larger and/or random than the ones shown in the examples.

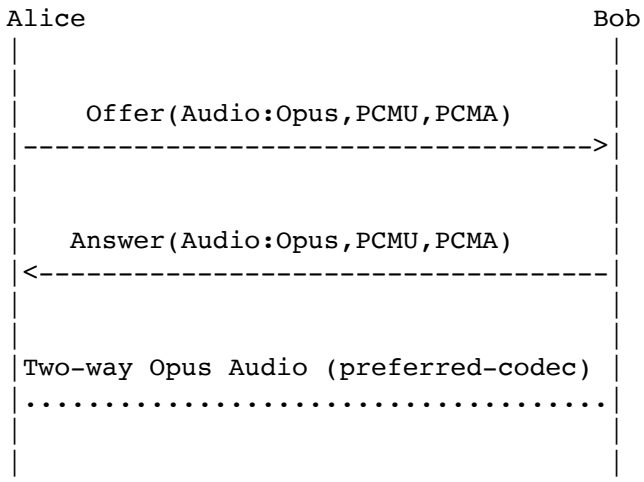
DTLS-ID's!

## 5.2. Basic Examples

### 5.2.1. Audio Only Session

This common scenario shows SDP for secure two-way audio session with Alice offering Opus, PCMU, PCMA and Bob accepting all the offered audio codecs.

2-Way Audio Only Session




| Offer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20518 0 IN IP4 0.0.0.0 | [RFC4566] - Session Origin Information |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| a=identity:eyJpZHAiOnsiZG9tYWluIjoibmlpZi5odSIsInByb3RvY29sIjoiaWRwLmh0bWwifSwiYXNzZXJ0a W9uIjoiZXlKaGJHY2lPaUpTVXpJMU5pSXNJbl I1Y0NJNklrcFhVeUo5LmV5SmpiMjUwWlc1MGN5STZl eUptYVc1b lpYSndjbWx1ZENJNlczc2lZV3huYjNKc GRHaHRJam9pYzJoaExUSTFOaUlzSW1ScFoyVnpkQ0k 2SWprek9rTXdPa kl6T2pKR09rRXlPakF3T2pBd09q QkVPalV4T2tGRE9rUXlPalUwT2pZMU9rWTBPak5DT2 pkRU9qa3lPa1JET2pnN E9qTXpPalV4T2pJek9qUXd | Section 5.6 of [I-D.ietf-rtcweb-security-arch] |

| | |
|---|---|
| PamN5T2preE9qZ3pPalZDT2pBeE9qSkdPalV3T2pjN<br>E9qTkdJbjFkZlN3aWFXUmxib lJwZEhraU9pSnRhWE<br>5wUUc1cGFXWXVhSFVpZlEuSTVQdGhKNFFDT05TOFVX<br>d25OOUh3MEdaTDl3d0RBVGRrTWtFW llmdlNVTTJ6U<br>md5R09WSGgzRmpnc2FPZklkRnFsNUx6azBFbndVOTN<br>QOUlCQ0xZOWtia3V1c0V1S25YRGVNLTNIN WFmdTJv<br>Zl9CTlZjUnB3MmdBdlNBbVR6SlltcEpqMFEtdmV0Tm<br>tVT1huZE9HLUIzT3ZGb3QwZVNENlZSNUdhb2wyc Gd<br>uS3FSTktOd3dacEZ1eUZZbFRodHJIdGNiT19WV3o4Q<br>nZpTThKS25OdExWd1JxNUhMX2ZLTlRCNzFDYkoyWmh<br>5W XU1UEdwWDhXcXJMWC1ybm5YSFY3RnhoTTh5OHdr<br>LWd5cnRZazVnbFlZeUFrcTVqZklSXzRzWER5d19Qc1<br>BWTW1aZ XltenVGV3BQTzVFWlJYR0ZpRjFET0o4Q0Q<br>3Z3Zta2dUdlBXSWpkemtBIn0= | |
| ****** Audio m=line ********* | ********** ********* |
| m=audio 54609 UDP/TLS/RTP/SAVPF 109 0 8 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:audio | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendrecv | [RFC3264] - Alice can send and recv audio |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] - Opus Codec 48khz, 2 channels |
| a=rtpmap:0 PCMU/8000 | [RFC3551] PCMU Audio Codec |
| a=rtpmap:8 PCMA/8000 | [RFC3551] PCMA Audio Codec |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] - ICE user fragment |
| a=ice-pwd:a28a397a4c3f31747d1ee3474af08a068 | [RFC5245] - ICE password |
| a=fingerprint:sha-256 19:E2:1C:3B:4B:9F:81 :E6:B8:5C:F4:A5:A8:D8:73:04 :BB:05:2F:70:9F:04:A9:0E:05:E9:26:33:E8:70:88:A2 | [RFC5245] - DTLS Fingerprint for SRTP |
| a=setup:actpass | [RFC4145] - Alice can perform DTLS before Answer arrives |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |

This should be RFC5763



Alice can act as DTLS client or server

| | |
|---|---|
| a=rtcp-mux | [RFC5761] - Alice can perform RTP/RTCP Muxing |
| a=rtcp:60065 IN IP4 24.23.204.141 | [RFC3605] |
| a=rtcp-rsize | [RFC5506] - Alice intends to use reduced size RTCP for this session |
| a=rtcp-fb:109 nack | [RFC5104] - Indicates NACK RTCP feedback support |
| a=extmap:1 urn:ietf:params:rtp-hdrext :ssrc-audio-level | [RFC6464] Alice supports RTP header extension to indicate audio levels |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2122194687 192.168.1.4 61665 typ host | [RFC5245] - RTP Host Candidate |
| a=candidate:1 1 UDP 1685987071 24.23.204.141 54609 typ srflx raddr 192.168.1.4 rport 61665 | [RFC5245] - RTP Server Reflexive ICE Candidate |
| a=candidate:0 2 UDP 2122194687 192.168.1.4 61667 typ host | [RFC5245] - RTCP Host Candidate |
| a=candidate:1 2 UDP 1685987071 24.23.204.141 60065 typ srflx raddr 192.168.1.4 rport 61667 | [RFC5245] - RTCP Server Reflexive ICE Candidate |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |

NACK for Opus?

Trickle with EOC?

Table 1: 5.2.1 SDP Offer

| Answer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 16833 0 IN IP4 0.0.0.0 | [RFC4566] - Session Origin Information |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| a=identity:ew0KICAiaWRwIjp7DQogICAgImRvbW | Section 5.6 of [I-D.i |

| | |
|---|---|
| FpbiI6ICJjaXNjb3NwYXJrLmNvbSIsDQogICAg In Byb3RvY29sIjogImRlZmF1bHQiDQogICJ hc3NlcnRpb24iOiAibEp3WkVocmFVOXBTblJo V0U 1d1VVYzFjR0ZYV1hWaFNGVnBabEV1U1RWUWRHaEtO RkZEVDA1VE9GVlhkMjVPT1VoM01FZGFURGwz ZDBS QlZHUnJUV3RGVw0KICAgICAgICAgICAgICBsbG1kb E5WVFRKNlVtZDVSMDlXU0dnelJtcG5jMkZQ Wmtsa 1JuRnNOVXg2YXpCRmJuZFZPVE5RT1VsQ1EweFpPV3 RpYTNWMWMwVjFTMjVZUkdWTkxUTklODQog ICAgIC AgICAgICAgIFdGbWRUSnZabDlDVGxaalVuQjNNbWR CZGxOQmJWUjZTbGx0Y0VwcU1GRXRkbVYw VG10VlQ xaHVaRTlITFVJelQzWkdiM1F3WlZORU5sWlNOVWRo YjJ3eWMNCiAgICAgICAgICAgICAgR2R1 UzNGU1Rr dE9kM2RhY0VaMWVVWlpiRlJvZEhKSWRHTmlUMTlXV jNvNFFuWnBUVGhLUzI1T2RFeFdkMUp4 TlVoTVgyWkxUbFJDTnpGRFlrb3lXbWg1VyINCn0= | etf-rtcweb-security-arch] |
| ****** Audio m=line ********* | ********** ******** |
| m=audio 49203 UDP/TLS/RTP/SAVPF 109 0 8 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:audio | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendrecv | [RFC3264] - Bob can send and recv audio |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] Opus Codec |
| a=rtpmap:0 PCMU/8000 | [RFC3551] PCMU Audio Codec |
| a=rtpmap:8 PCMA/8000 | [RFC3551] PCMA Audio Codec |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:05067423 | [RFC5245] - ICE user fragment |
| a=ice-pwd:1747d1ee3474a28a397a4c3f3af08a068 | [RFC5245] - ICE password parameter |
| a=fingerprint:sha-256 6B:8B:F0:65:5F:78:E2:51:3B:AC:6F:F3:3F:46:1B:35 :DC:B8:5F:64:1A:24:C2:43:F0:A1:58:D0:A1:2C:19:08 | [RFC5245] - DTLS Fingerprint for SRTP |
| a=setup:active | [RFC4145] - Bob carries out DTLS Handshake in parallel |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] - Bob can |

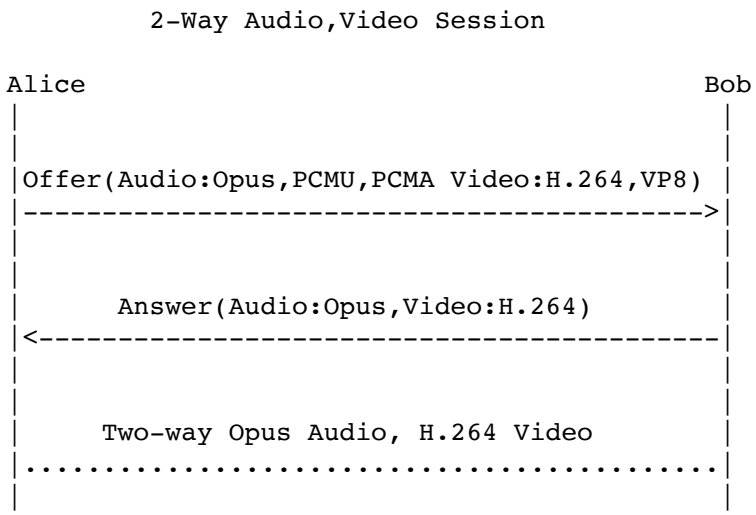
Bob is the DTLS client

| | |
|---|---|
| | perform RTP/RTCP Muxing on port 49203 |
| a=rtcp-rsize | [RFC5506] - Bob intends to use reduced size RTCP for this session |
| a=rtcp-fb:109 nack | [RFC5104] - Indicates NACK RTCP feedback support |
| a=extmap:1 urn:ietf:params:rtp-hdrext :ssrc-audio-level | [RFC6464] Bob supports audio level RTP header extension as well |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2122194687 192.168.1.7 51556 typ host | [RFC5245] - RTP/RTCP Host ICE Candidate |
| a=candidate:1 1 UDP 1685987071 98.248.92.77 49203 typ srflx raddr 192.168.1.7 rport 51556 | [RFC5245] - RTP/RTCP Server Reflexive ICE Candidate |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |

Table 2: 5.2.1 SDP Answer

### 5.2.2. Audio/Video Session

Alice and Bob establish a two-way audio and video session with Opus as the audio codec and H.264 as the video codec.




| Offer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20518 0 IN IP4 0.0.0.0 | [RFC4566] - Session Origin Information |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio video | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=group:LS audio video | [RFC5888]Alice wants to lip sync her audio and video sreams |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 54609 UDP/TLS/RTP/SAVPF 109 0 8 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:audio | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendrecv | [RFC3264] - Alice can send and recv audio |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] - Opus Codec 48khz, 2 channels |
| a=rtpmap:0 PCMU/8000 | [RFC3551] PCMU Audio Codec |
| a=rtpmap:8 PCMA/8000 | [RFC3551] PCMA Audio Codec |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] - ICE user fragment |

| | |
|---|---|
| a=ice-pwd:a28a397a4c3f31747d1ee34 74af08a068 | [RFC5245] - ICE password parameter |
| a=fingerprint:sha-256 19:E2:1C:3B :4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73 :04: BB:05:2F:70:9F:04:A9:0E:05:E 9:26:33:E8:70:88:A2 | [RFC5245] - DTLS Fingerprint for SRTP |
| a=setup:actpass | [RFC4145] - Alice can perform DTLS before Answer arrives |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux Same port as in m-line | [RFC5761] - Alice can perform RTP/RTCP Muxing |
| a=rtcp:54609 IN IP4 24.23.204.141 | [RFC3605] |
| a=rtcp-rsize | [RFC5506] - Alice intends to use reduced size RTCP for this session |
| a=rtcp-fb:109 nack | [RFC5104] - Indicates NACK RTCP feedback support |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2122194687 192.168.1.4 61665 typ host | [RFC5245] - RTP/RTCP Host Candidate |
| a=candidate:1 1 UDP 1685987071 24.23.204.141 54609 typ srflx raddr 192.168.1.4 rport 61665 | [RFC5245] - RTP/RTCP Server Reflexive ICE Candidate |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |
| ****** Video m=line ********* | ********** |
| m=video 54609 UDP/TLS/RTP/SAVPF 99 120 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:video | [RFC5888] |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=sendrecv | [RFC3264] - Alice can send and recv video |
| a=rtpmap:99 H264/90000 | [RFC3984] - H.264 Video Codec |
| a=fmtp:99 profile-level-id=4d0028 ;packetization-mode=1 | [RFC3984] |
| a=rtpmap:120 VP8/90000 | [I-D.ietf-payload-vp8] - VP8 video codec |
| a=rtcp-fb:99 nack | [RFC5104] - Indicates NACK RTCP feedback support |
| a=rtcp-fb:99 nack pli | [RFC5104] - Indicates support for Picture loss Indication and NACK |
| a=rtcp-fb:99 ccm fir | [RFC5104] - Full Intra Frame |

Where are the RTCP candidates?



Missing fingerprint, rtpc-mux etc!
Assumed bundle-only?

| | |
|---|---|
| | Request-Codec Control Message support |
| a=rtcp-fb:120 nack | [RFC5104] - Indicates NACK RTCP feedback support |
| a=rtcp-fb:120 nack pli | [RFC5104] - Indicates support for Picture loss Indication and NACK |
| a=rtcp-fb:120 ccm fir | [RFC5104] - Full Intra Frame Request-Codec Control Message support |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |

No candidates at all on purpose?

Table 3: 5.2.2 SDP Offer

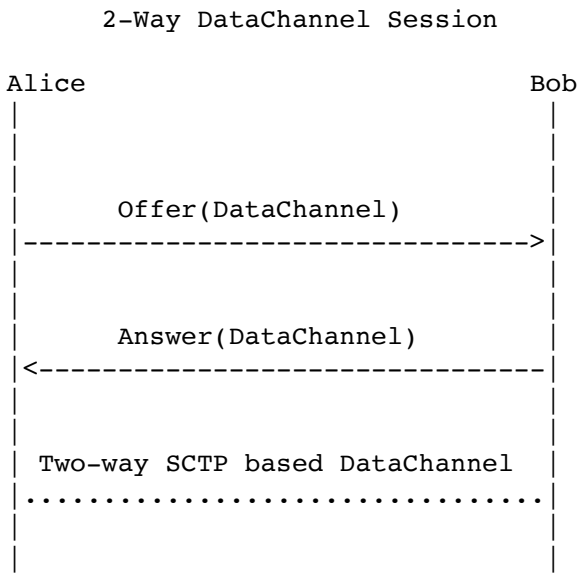
| Answer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 16833 0 IN IP4 0.0.0.0 | [RFC4566] - Session Origin Information |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio video | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=group:LS audio video | [RFC5888]Bob agrees to do the same |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 49203 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:audio | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendrecv | [RFC3264] - Bob can send and recv audio |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] - Bob accepts only Opus Codec |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:c300d85b | [RFC5245] - ICE username frag |
| a=ice-pwd:de4e99bd291c325921d5d47efbabd9a2 | [RFC5245] - ICE password |
| a=fingerprint:sha-256 6B:8B:F0:65 | [RFC5245] - DTLS Fingerprint |

| | |
|---|---|
| :5F:78:E2:51:3B:AC:6F:F3:3F:46:1B :35 :DC:B8:5F:64:1A:24:C2:43:F0:A 1:58:D0:A1:2C:19:08 | for SRTP |
| a=setup:active | [RFC4145] - Bob carries out DTLS Handshake in parallel |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] - Bob can perform RTP/RTCP Muxing |
| a=rtcp-rsize | [RFC5506] - Bob intends to use reduced size RTCP for this session |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 3618095783 192.168.1.7 49203 typ host | [RFC5245] - RTP/RTCP Host ICE Candidate |
| a=candidate:1 1 UDP 565689203 98.248.92.77 49203 typ srflx raddr 192.168.1.7 rport 51556 | [RFC5245] - RTP/RTCP Server Reflexive ICE Candidate |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |
| ****** Video m=line ********* | ********** |
| m=video 49203 UDP/TLS/RTP/SAVPF 99 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:video | [RFC5888] |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=sendrecv | [RFC3264] - Bob can send and recv video |
| a=rtpmap:99 H264/90000 | [RFC3984] - Bob accepts H.264 Video Codec. |
| a=fmtp:99 profile-level-id=4d0028 ;packetization-mode=1 | [RFC3984] |
| a=rtcp-fb:99 nack | [RFC5104] - Indicates support for NACK based RTCP feedback |
| a=rtcp-fb:99 nack pli | [RFC5104] - Indicates support for Picture loss Indication and NACK |
| a=rtcp-fb:99 ccm fir | [RFC5104] - Full Intra Frame Request- Codec Control Message support |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |

Table 4: 5.2.2 SDP Answer

### 5.2.3. Data Only Session

This scenario illustrates SDP negotiated to setup a data-only session based on SCTP Data Channel, thus enabling use-cases such as file-transfer for example.



| Offer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20518 0 IN IP4 0.0.0.0 | [RFC4566] - Session Origin Information |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE data | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Application m=line ********* | ********** |
| m=application 54609 UDP/DTLS/SCTP webrtc-datachannel | [I-D.ietf-rtcweb-data-channel] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:data | [RFC5888] |
| a=sendrecv | [RFC3264] - Alice can send and recv non-media data |
| a=sctp-port:5000 | [I-D.ietf-mmusic-sctp-sdp] |
| a=max-message-size:100000 | [I-D.ietf-mmusic-sctp-sdp] |
| a=setup:actpass | [RFC4145] - Alice can perform DTLS before Answer arrives |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=ice-ufrag:074c6550 | [RFC5245] - Session Level ICE parameter |
| a=ice-pwd:a28a397a4c3f31747d1ee3474af08a068 | [RFC5245] - Session Level ICE parameter |
| a=fingerprint:sha-256 19:E2:1C:3B:4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73:04 :BB:05:2F:70:9F:04:A9:0E:05:E9:26:33:E8:70:88:A2 | [RFC5245] - Session DTLS Fingerprint for SRTP |
| a=candidate:0 1 UDP 2113667327 192.168.1.4 61665 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1694302207 24.23.204.141 54609 typ srflx raddr 192.168.1.4 rport 61665 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |

Table 5: 5.2.3 SDP Offer

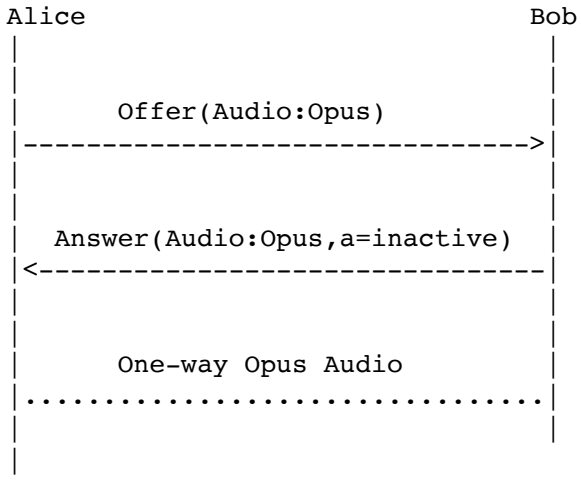
| Answer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 16833 0 IN IP4 0.0.0.0 | [RFC4566] - Session Origin Information |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE data | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| ****** Application m=line ********* | ********** |
| m=application 49203 UDP/DTLS/SCTP webrtc-datachannel | [I-D.ietf-mmusic-sctp-sdp] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:data | [RFC5888] |
| a=sendrecv | [RFC3264] - Bob can send and recv non-media data |
| a=sctp-port:5000 | [I-D.ietf-mmusic-sctp-sdp] |
| a=max-message-size:100000 | [I-D.ietf-mmusic-sctp-sdp] |
| a=setup:active | [RFC4145] - Bob carries out DTLS Handshake in parallel |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=ice-ufrag:c300d85b | [RFC5245] - Session Level ICE username frag |
| a=ice-pwd:de4e99bd291c325921d5d47efbabd9a2 | [RFC5245] - Session Level ICE password |
| a=fingerprint:sha-256 6B:8B:F0:65:5F:78:E2:51:3B:AC:6F:F3:3F:46:1B:35 :DC:B8:5F:64:1A:24:C2:43:F0:A1:58:D0:A1:2C:19:08 | [RFC5245] - Session DTLS Fingerprint for SRTP |
| a=candidate:0 1 UDP 2113667327 192.168.1.7 51556 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1694302207 98.248.92.77 49203 typ srflx raddr 192.168.1.7 rport 51556 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |

Table 6: 5.2.3 SDP Answer

### 5.2.4. Audio Call On Hold

Alice calls Bob, but when Bob answers he places Alice on hold by setting the SDP direction attribute to a=inactive in the Answer.

Audio On Hold




| Offer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20518 0 IN IP4 0.0.0.0 | [RFC4566] - Session Origin Information |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | **************************** |
| m=audio 54609 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:audio | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendrecv | [RFC3264] - Alice can send and recv audio |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] - Opus Codec 48khz, 2 channels |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] - ICE user fragment |
| a=ice-pwd:a28a397a4c3f31747d1ee3474af08a068 | [RFC5245] - ICE password |
| a=fingerprint:sha-256 19:E2:1C:3B:4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73 | [RFC5245] - DTLS Fingerprint for SRTP |

| | |
|---|---|
| :04 :BB:05:2F:70:9F:04:A9:0E:05:E 9:26:33:E8:70:88:A2 | |
| a=setup:actpass | [RFC4145] - Alice can perform DTLS before Answer arrives |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] - Alice can perform RTP/RTCP Muxing |
| a=rtcp:54609 IN IP4 24.23.204.141 | [RFC3605] |
| a=rtcp-[illegible] | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] - Indicates NACK RTCP feedback support |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2113667327 192.168.1.4 61665 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1685987071 24.23.204.141 54609 typ srflx raddr 192.168.1.4 rport 61665 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |

Same port number as in m-line

Table 7: 5.2.4 SDP Offer

| Answer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 16833 0 IN IP4 0.0.0.0 | [RFC4566] - Session Origin Information |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| ****** Audio m=line ********* | ********** |
| m=audio 49203 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:audio | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=inactive | [RFC3264] - Bob puts call On Hold |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] - Bob accepts Opus Codec |

| | |
|---|---|
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:c300d85b | [RFC5245] - ICE username frag |
| a=ice-pwd:de4e99bd291c325921d5d47efbabd9a2 | [RFC5245] - ICE password |
| a=fingerprint:sha-256 6B:8B:F0:65:5F:78:E2:51:3B:AC:6F:F3:3F:46:1B:35 :DC:B8:5F:64:1A:24:C2:43:F0:A1:58:D0:A1:2C:19:08 | [RFC5245] - DTLS Fingerprint for SRTP |
| a=setup:active | [RFC4145] - Bob carries out DTLS Handshake in parallel |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] - Bob can perform RTP/RTCP Muxing |
| a=rtcp-rsize | [RFC5506] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2113667327 192.168.1.7 51556 typ host | [RFC5245] - Host candidate |
| a=candidate:1 1 UDP 1685987071 24.23.204.141 49203 typ srflx raddr 192.168.1.7 rport 51556 | [RFC5245] - Server Reflexive candidate |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |

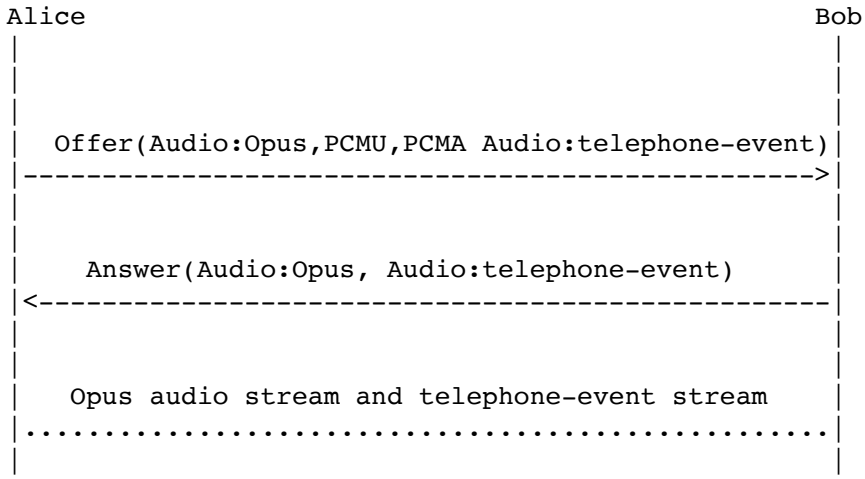
Table 8: 5.2.4 SDP Answer

### 5.2.5. Audio with DTMF Session

In this example, Alice wishes to establish two separate audio streams, one for normal audio and the other for telephone-events. Alice offers first audio stream with three codecs and the other with [RFC2833] tones (for DTMF). Bob accepts both the audio streams by choosing Opus as the audio codec and telephone-event for the other stream.

An extra m-section for DTMF?
On purpose?

Audio Session with DTMF




| Offer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20518 0 IN IP4 0.0.0.0 | [RFC4566] - Session Origin Information |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio dtmf | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | **************************** |
| m=audio 54609 UDP/TLS/RTP/SAVPF 109 0 8 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:audio | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendrecv | [RFC3264] - Alice can send and recv audio |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] - Opus Codec 48khz, 2 channels |
| a=rtpmap:0 PCMU/8000 | [RFC3551] PCMU Audio Codec |
| a=rtpmap:8 PCMA/8000 | [RFC3551] PCMA Audio Codec |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] - ICE user fragment |
| a=ice-pwd:a28a397a4c3f31747d1ee3474af08a068 | [RFC5245] - ICE password parameter |

| | |
|---|---|
| a=fingerprint:sha-256 19:E2:1C:3B :4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73 :04 :BB:05:2F:70:9F:04:A9:0E:05:E 9:26:33:E8:70:88:A2 | [RFC5245] - DTLS Fingerprint for SRTP |
| a=setup:actpass | [RFC4145] - Alice can perform DTLS before Answer arrives |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] - Alice can perform RTP/RTCP Muxing |
| a=rtcp:54609 IN IP4 24.23.204.141 | [RFC3605] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] - Indicates NACK RTCP feedback support |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2122194687 192.168.1.4 61665 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1685987071 24.23.204.141 54609 typ srflx raddr 192.168.1.4 rport 61665 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |
| ****** DTMF m=line ********* | ********** |
| m=audio 54609 UDP/TLS/RTP/SAVPF 126 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:dtmf | [RFC5888] |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=sendonly | [RFC3264] - Alice can send DTMF Events |
| a=rtpmap:126 telephone-event/8000 | [RFC2833] |
| a=rtcp-fb:109 nack | [RFC5104] - Indicates NACK RTCP feedback support |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |

Table 9: 5.2.5 SDP Offer

109 is not offered & NACK's for DTMF?

| Answer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 16833 0 IN IP4 0.0.0.0 | [RFC4566] - Session Origin |

| | |
|---|---|
| | Information |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio dtmf | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| ********** Audio m=line ********* | ********** |
| m=audio 49203 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:audio | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendrecv | [RFC3264] - Bob can send and receive Opus audio |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] - Bob accepts Opus Codec |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:c300d85b | [RFC5245] - ICE username frag |
| a=ice-pwd:de e99bd291c325921d5d47 efbabd9a2 | [RFC5245] - ICE password |
| a=fingerprint:sha-256 6B:8B:F0:65 :5F:78:E2:51 3B:AC:6F:F3:3F:46:1B :35 :DC:B8:5 :64:1A:24:C2:43:F0:A 1:58:D0:A1:2 :19:08 | [RFC5245] - Fingerprint for SRTP |
| a=setup:active | [RFC4145] - Bob carries out DTLS Handshake in parallel |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] - Bob can perform RTP/RTCP Muxing on port 49203 |
| a=rtcp-rsize | [RFC5506] - Alice intends to use reduced size RTCP for this session |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2122194687 192.168.1.7 51556 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1685987071 98.248.92.77 49203 typ srflx raddr 192.168.1.7 rport 51556 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |
| ****** DTMF m=line ********* | ********** |
| m=audio 49203 UDP/TLS/RTP/SAVPF 126 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |

On purpose no NACK support?

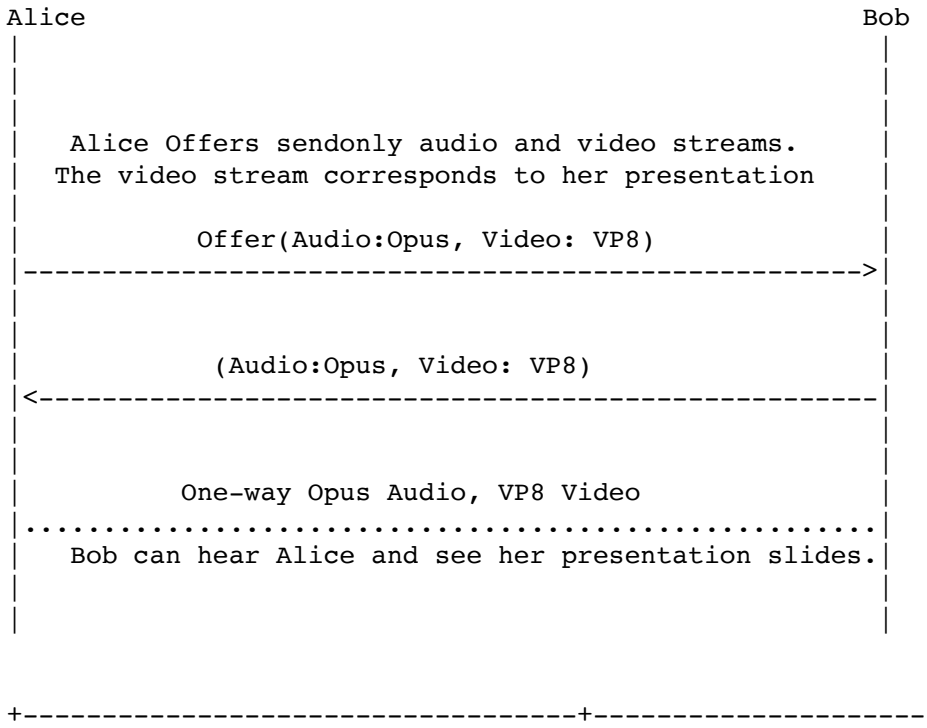
| | |
|---|---|
| a=mid:dtmf<br>a=msid:ma tb<br><br><br>a=recvonly<br><br>a=rtpmap:126 telephone-event/8000<br>a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [RFC5888]<br>Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb)<br>[RFC3264] - Alice can receive DTMF events<br>[RFC2833]<br>[I-D.ietf-mmusic-sdp-bundle-negotiation] |

Table 10: 5.2.5 SDP Answer

### 5.2.6. One Way Audio/Video Session - Document Camera

In this scenario Alice and Bob engage in a 1 way audio and video session with Bob receiving Alice's audio and her presentation slides as video stream.

One Way Audio & Video Session - Document Camera



| Offer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20519 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio video | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=group:LS audio video | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 54609 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:audio | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendonly | [RFC3264] - Send only audio stream |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] |
| a=ice-pwd:a28a397a4c3f31747d1ee3474af08a068 | [RFC5245] |
| a=fingerprint:sha-256 19:E2:1C:3B:4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73:04 :BB:05:2F:70:9F:04:A9:0E:05:E9:26:33:E8:70:88:A2 | [RFC5245] |
| a=setup:actpass | [RFC4145] - Alice can perform DTLS before Answer arrives |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp:54609 IN IP4 24.23.204.141 | [RFC3605] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2122194687 24.23.204.141 54609 typ host | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |
| ****** Video m=line ********* | ********** |
| m=video 54609 UDP/TLS/RTP/SAVPF 120 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:video | [RFC5888] |

On purpose only a host candidate?

| | |
|---|---|
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=sendonly | [RFC3264] - Send only video stream |
| a=rtpmap:120 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=content:slides | [RFC4796] -Alice's presentation video stream |
| a=rtcp-fb:120 nack | [RFC5104] |
| a=rtcp-fb:120 nack pli | [RFC5104] |
| a=rtcp-fb:120 ccm fir | [RFC5104] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |

Not supported by JSEP implementations AFAIK

Table 11: 5.2.6 SDP Offer

| Answer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 16833 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio video | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=group:LS audio video | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 49203 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:audio | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=recvonly | [RFC3264] - Receive only audio stream |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:c300d85b | [RFC5245] |
| a=ice-pwd:de4e99bd291c325921d5d47efbabd9a2 | [RFC5245] |
| a=fingerprint:sha-256 6B:8B:F0:65:5F:78:E2:51:3B:AC:6F:F3:3F:46:1B:35 :DC:B8:5F:64:1A:24:C2:43:F0:A1:58:D0:A1:2C:19:08 | [RFC5245] |

| | |
|---|---|
| a=setup:active | [RFC4145] - Bob carries out DTLS Handshake in parallel |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2113667327 98.248.92.77 49203 typ host | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |
| ****** Video m=line ********* | ********** |
| m=video 49203 UDP/TLS/RTP/SAVPF 120 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:video | [RFC5888] |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=recvonly | [RFC3264] |
| a=rtpmap:120 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=content:slides | [RFC4796]presentation stream |
| a=rtcp-fb:120 nack | [RFC5104] |
| a=rtcp-fb:120 nack pli | [RFC5104] |
| a=rtcp-fb:120 ccm fir | [RFC5104] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |

Host only?

Echoing back on a recvonly appears useless to me

Table 12: 5.2.6 SDP Answer

### 5.2.7. Audio, Video Session with BUNDLE Support Unknown

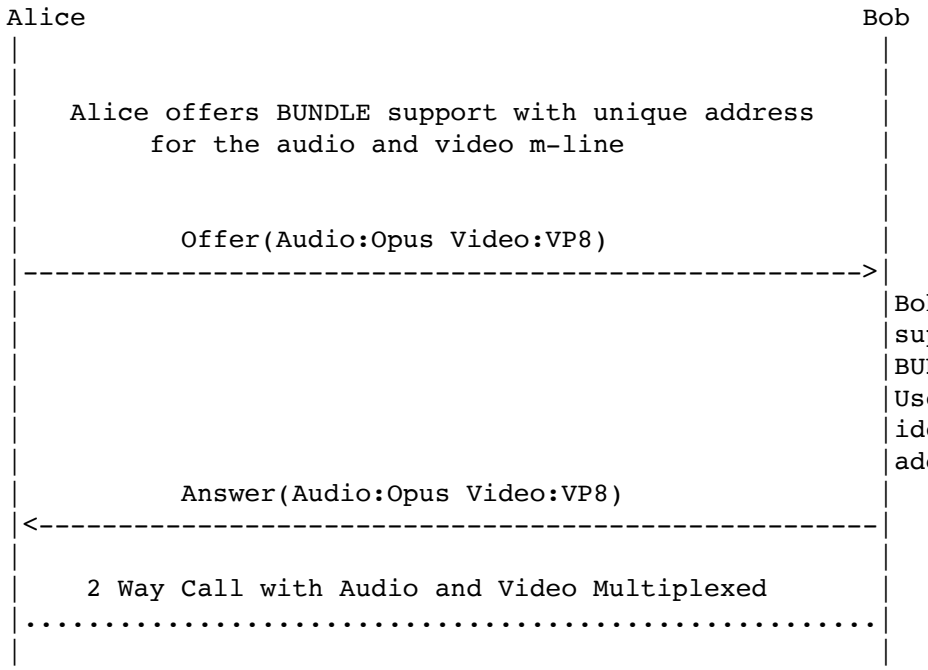
In this example, since Alice is unsure of the Bob's support of the BUNDLE framework, following steps are performed in order to negotiate and setup a BUNDLE Address for the session

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

- An SDP Answer, in which the Bob indicates its support for BUNDLE, selects the offerer's BUNDLE address, selects its own BUNDLE address and associates it with each BUNDLED m=line within the BUNDLE group.

Once the Offer/Answer exchange completes, both Alice and Bob each end up using single RTP Session for both the Media Streams.

Two-Way Secure Audio,Video with BUNDLE support unknown




| Offer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20518 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio video | [I-D.ietf-mmusic-sdp-bundle-negotiation] Alice supports grouping of m=lines under BUNDLE semantics |
| a=group:LS audio video | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 54609 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:audio | [RFC5888] Audio m=line part |

| | |
|---|---|
| | of BUNDLE group with a unique port number |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] |
| a=ice-pwd:a28a397a4c3f31747d1ee3474af08a068 | [RFC5245] |
| a=fingerprint:sha-256 19:E2:1C:3B:4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73:04 :BB:05:2F:70:9F:04:A9:0E:05:E9:26:33:E8:70:88:A2 | [RFC5245] |
| a=setup:actpass | [RFC4145] - Alice can perform DTLS before Answer arrives |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp:54610 IN IP4 24.23.204.141 | [RFC3605] - RTCP port different from RTP Port |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2122194687 192.168.1.4 61665 typ host | [RFC5245] - RTP host candidate |
| a=candidate:1 1 UDP 1685987071 24.23.204.141 54609 typ srflx raddr 192.168.1.4 rport 61665 | [RFC5245] - RTP Server Reflexive candidate |
| a=candidate:0 2 UDP 2122194687 192.168.1.4 61666 typ host | [RFC5245] - RTCP host candidate |
| a=candidate:1 2 UDP 1685987071 24.23.204.141 54610 typ srflx raddr 192.168.1.4 rport 61666 | [RFC5245] - RTCP Server Reflexive candidate |
| ****** Video m=line ********* | **************************** |
| m=video 62537 UDP/TLS/RTP/SAVPF 120 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:video | [RFC5888] Video m=line part of the Bundle group with a unique port number |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=sendrecv | [RFC3264] |

| | |
|---|---|
| a=rtpmap:120 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=ice-ufrag:6550074c | [RFC5245] |
| a=ice-pwd:74af08a068a28a397a4c3f3 1747d1ee34 | [RFC5245] |
| a=fingerprint:sha-256 19:E2:1C:3B :4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73 :04 :BB:05:2F:70:9F:04:A9:0E:05:E 9:26:33:E8:70:88:A2 | [RFC5245] |
| a=setup:actpass | [RFC4145] - Alice can perform DTLS before Answer arrives |
| a=dtls-id:2 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp:62538 IN IP4 24.23.204.141 | [RFC3605] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:120 nack | [RFC5104] |
| a=rtcp-fb:120 nack pli | [RFC5104] |
| a=rtcp-fb:120 ccm fir | [RFC5104] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2122194687 192.168.1.4 61886 typ host | [RFC5245] - RTP Host candidate |
| a=candidate:1 1 UDP 1685987071 24.23.204.141 62537 typ srflx raddr 192.168.1.4 rport 61886 | [RFC5245] - RTP Server Reflexive candidate |
| a=candidate:0 2 2122194687 192.168.1.4 61888 typ host | [RFC5245] - RTCP host candidate |
| a=candidate:1 2 UDP 1685987071 24.23.204.141 62538 typ srflx raddr 192.168.1.4 rport 61888 | [RFC5245] - RTCP Server Reflexive candidate |

Table 13: 5.2.7 SDP Offer w/BUNDLE

| Answer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 16833 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio video | [I-D.ietf-mmusic-sdp-bundle-negotiation] Bob supports BUNDLE semantics. |
| a=group:LS audio video | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 49203 UDP/TLS/RTP/SAVPF | [RFC4566] |

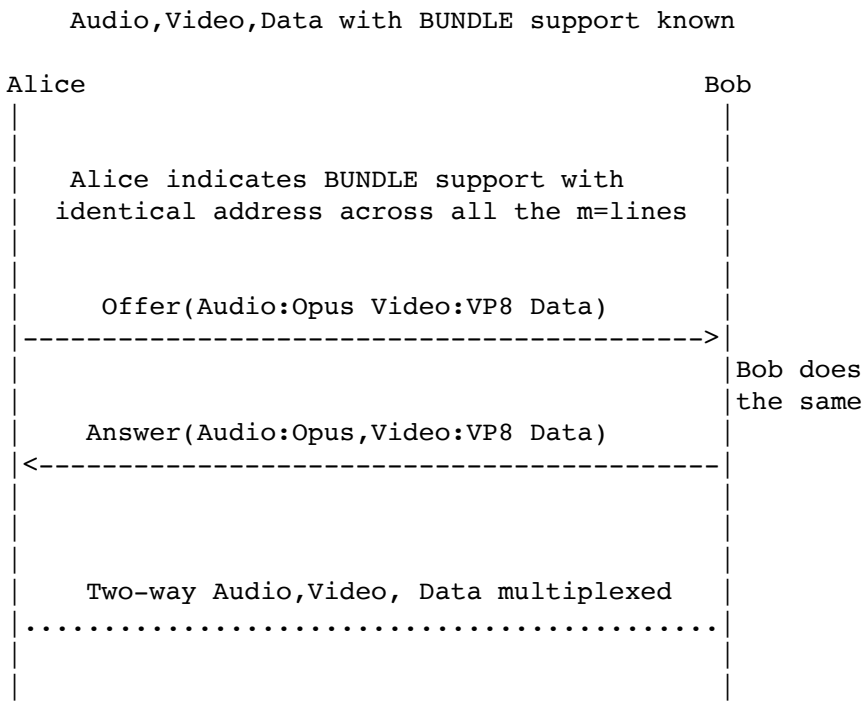
| | |
|---|---|
| 109 | |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:audio | [RFC5888] Audio m=line part of the BUNDLE group |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:c300d85b | [RFC5245] |
| a=ice-pwd:de4e99bd291c325921d5d47efbabd9a2 | [RFC5245] |
| a=fingerprint:sha-256 6B:8B:F0:65:5F:78:E2:51:3B:AC:6F:F3:3F:46:1B:35 :DC:B8:5F:64:1A:24:C2:43:F0:A1:58:D0:A1:2C:19:08 | [RFC5245] |
| a=setup:active | [RFC4145] - Bob carries out DTLS Handshake in parallel |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2122194687 192.168.1.7 49203 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1685987071 98.248.92.77 51556 typ srflx raddr 192.168.1.7 rport 49203 | [RFC5245] |
| ****** Video m=line ********* | ********** |
| m=video 49203 UDP/TLS/RTP/SAVPF 120 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:video | [RFC5888] Video m=line part of the BUNDLE group with the port from audio line repeated |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:120 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=rtcp-fb:120 nack | [RFC5104] |
| a=rtcp-fb:120 nack pli | [RFC5104] |
| a=rtcp-fb:120 ccm fir | [RFC5104] |
| a=extmap:2 urn:ietf:params:rtp- | [I-D.ietf-mmusic-sdp-bundle-n |

| | |
|---|---|
| hdrext:sdes:mid | egotiation] |

Table 14: 5.2.7 SDP Answer w/BUNDLE

### 5.2.8. Audio, Video and Data Session

This example shows SDP for negotiating a session with Audio, Video and data streams between Alice and Bob with BUNDLE support known.




| Offer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20518 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio video data | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=group:LS audio video | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |

| | |
|---|---|
| ****** Audio m=line ********* | ********** |
| m=audio 54609 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=mid:audio | [RFC5888] |
| a=sendrecv | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] |
| a=ice-pwd:a28a397a4c3f31747d1ee3474af08a068 | [RFC5245] |
| a=fingerprint:sha-256 19:E2:1C:3B:4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73:04 :BB:05:2F:70:9F:04:A9:0E:05:E9:26:33:E8:70:88:A2 | [RFC5245] |
| a=setup:actpass | [RFC4145] |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp:54609 IN IP4 24.23.204.141 | [RFC3605] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2122194687 192.168.1.4 61665 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1685987071 24.23.204.141 54609 typ srflx raddr 192.168.1.4 rport 61665 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |
| ****** Video m=line ********* | ********** |
| m=video 54609 UDP/TLS/RTP/SAVPF 120 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:video | [RFC5888] |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:120 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=rtcp-fb:120 nack | [RFC5104] |
| a=rtcp-fb:120 nack pli | [RFC5104] |
| a=rtcp-fb:120 ccm fir | [RFC5104] |
| a=extmap:2 urn:ietf:params:rtp- | [I-D.ietf-mmusic-sdp-bundle-n |

| | |
|---|---|
| hdrext:sdes:mid | egotiation] |
| ****** Application m=line ********* | ********** |
| m=application 54609 UDP/DTLS/SCTP webrtc-datachannel | [I-D.ietf-rtcweb-data-channel] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:data | [RFC5888] |
| a=sctp-port:5000 | [I-D.ietf-mmusic-sctp-sdp] |
| a=max-message-size:100000 | [I-D.ietf-mmusic-sctp-sdp] |
| a=sendrecv | [RFC3264] |

Table 15: 5.2.8 SDP Offer

| Answer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 16833 0 IN IP4 0.0.0.0 | [RFC4566] - Session Origin Information |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio video data | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=group:LS audio video | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 49203 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=mid:audio | [RFC5888] |
| a=sendrecv | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:c300d85b | [RFC5245] |
| a=ice-pwd:de4e99bd291c325921d5d47efbabd9a2 | [RFC5245] |
| a=fingerprint:sha-256 6B:8B:F0:65:5F:78:E2:51:3B:AC:6F:F3:3F:46:1B:35 :DC:B8:5F:64:1A:24:C2:43:F0:A1:58:D0:A1:2C:19:08 | [RFC5245] |
| a=setup:active | [RFC4145] |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |

| | |
|---|---|
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2122194687 192.168.1.7 51556 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1685987071 98.248.92.77 49203 typ srflx raddr 192.168.1.7 rport 51556 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |
| ****** Video m=line ********* | **************************** |
| m=video 49203 UDP/TLS/RTP/SAVPF 120 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:video | [RFC5888] |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:120 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=rtcp-fb:120 nack | [RFC5104] |
| a=rtcp-fb:120 nack pli | [RFC5104] |
| a=rtcp-fb:120 ccm fir | [RFC5104] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| ****** Application m=line ********* | **************************** |
| m=application 49203 UDP/DTLS/SCTP webrtc-datachannel | [I-D.ietf-mmusic-sctp-sdp] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:data | [RFC5888] |
| a=sctp-port:5000 | [I-D.ietf-mmusic-sctp-sdp] |
| a=max-message-size:100000 | [I-D.ietf-mmusic-sctp-sdp] |
| a=sendrecv | [RFC3264] |

Table 16: 5.2.8 SDP Answer

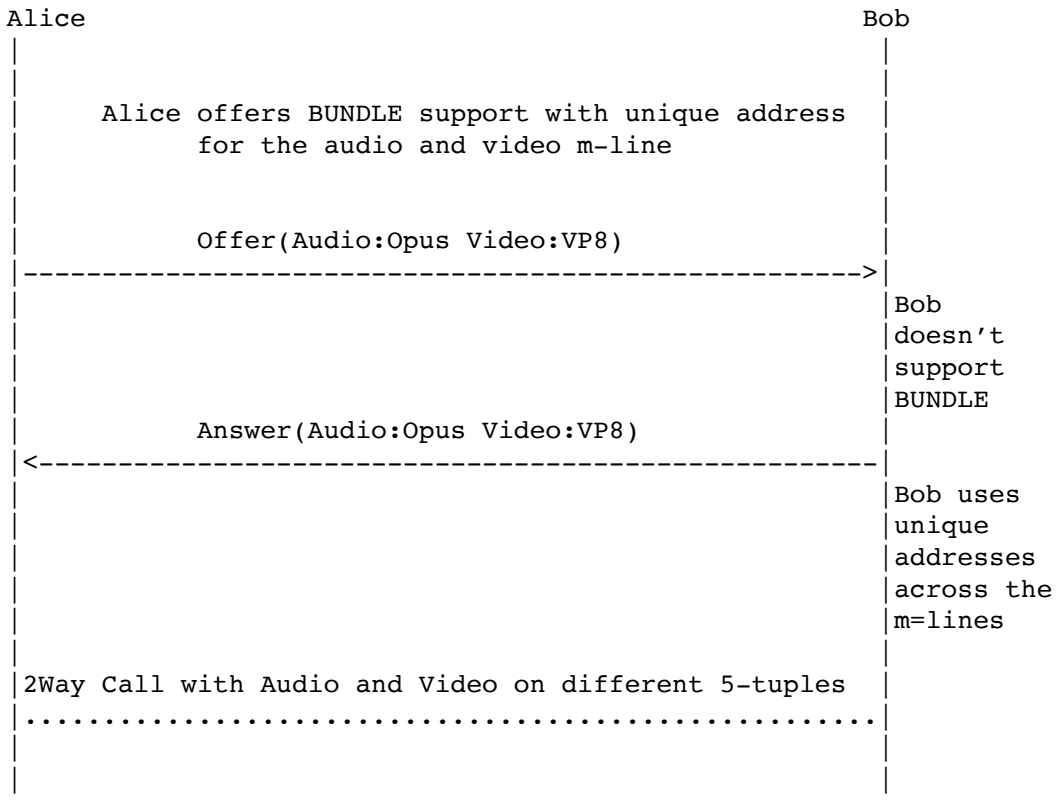
### 5.2.9. Audio, Video Session with BUNDLE Unsupported

This use-case illustrates SDP Offer/Answer exchange where the far-end (Bob) either doesn't support media bundling or doesn't want to group m=lines over a single 5-tuple.

The same is indicated by dropping the "a=group:BUNDLE" line and BUNDLE RTP header extension in the Answer SDP.

On successful Offer/Answer exchange, Alice and Bob each end up using unique 5-tuple for audio and video media streams respectively.

Two-Way Secure Audio,Video with BUNDLE Unsupported




| Offer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20518 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio video | [I-D.ietf-mmusic-sdp-bundle-negotiation] Alice supports grouping of m=lines under BUNDLE semantics |

| | |
|---|---|
| a=group:LS audio video | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 54609 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:audio | [RFC5888] Audio m=line part of BUNDLE group with a unique port number |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] |
| a=ice-pwd:a28a397a4c3f31747d1ee3474af08a068 | [RFC5245] |
| a=fingerprint:sha-256 19:E2:1C:3B:4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73:04 :BB:05:2F:70:9F:04:A9:0E:05:E9:26:33:E8:70:88:A2 | [RFC5245] |
| a=setup:actpass | [RFC4145] - Alice can perform DTLS before Answer arrives |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp:55232 IN IP4 24.23.204.141 | [RFC3605] - RTCP port different from RTP port |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2122194687 192.168.1.4 61665 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1685987071 24.23.204.141 54609 typ srflx raddr 192.168.1.4 rport 61665 | [RFC5245] |
| a=candidate:0 2 UDP 2122194687 192.168.1.4 61666 typ host | [RFC5245] |
| a=candidate:1 2 UDP 1685987071 24.23.204.141 55232 typ srflx raddr 192.168.1.4 rport 61666 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |
| ****** Video m=line ********* | ********** |
| m=video 54332 UDP/TLS/RTP/SAVPF 120 | [RFC4566] |

| | |
|---|---|
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:video | [RFC5888] Video m=line part of the BUNDLE group with a unique port number |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:120 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=ice-ufrag:7872093 | [RFC5245] |
| a=ice-pwd:ee3474af08a068a28a397a4c3f31747d1 | [RFC5245] |
| a=fingerprint:sha-256 19:E2:1C:3B:4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73:04 :BB:05:2F:70:9F:04:A9:0E:05:E9:26:33:E8:70:88:A2 | [RFC5245] |
| a=setup:actpass | [RFC4145] - Alice can perform DTLS before Answer arrives |
| a=dtls-id:2 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp:60052 IN IP4 24.23.204.141 | [RFC3605] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:120 nack | [RFC5104] |
| a=rtcp-fb:120 nack pli | [RFC5104] |
| a=rtcp-fb:120 ccm fir | [RFC5104] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2122194687 192.168.1.4 71775 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1685987071 24.23.204.141 54332 typ srflx raddr 192.168.1.4 rport 71775 | [RFC5245] |
| a=candidate:0 2 2122194687 192.168.1.4 71776 typ host | [RFC5245] |
| a=candidate:1 2 UDP 1685987071 24.23.204.141 60052 typ srflx raddr 192.168.1.4 rport 71776 | [RFC5245] |

On purpose no end-of-candidates?
Although the audio m-section has EOC?!

Table 17: 5.2.9 SDP Offer w/BUNDLE

| Answer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 16833 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |

| | |
|---|---|
| t=0 0 | [RFC4566] |
| a=group:LS audio video | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 53214 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:audio | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:c300d85b | [RFC5245] |
| a=ice-pwd:de4e99bd291c325921d5d47efbabd9a2 | [RFC5245] |
| a=fingerprint:sha-256 6B:8B:F0:65:5F:78:E2:51:3B:AC:6F:F3:3F:46:1B:35 :DC:B8:5F:64:1A:24:C2:43:F0:A1:58:D0:A1:2C:19:08 | [RFC5245] |
| a=setup:active | [RFC4145] - Bob carries out DTLS Handshake in parallel |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext :ssrc-audio-level | [RFC6464] |
| a=candidate:0 1 UDP 2122194687 192.168.1.7 51556 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1685987071 98.248.92.77 53214 typ srflx raddr 192.168.1.7 rport 51556 | [RFC5245] |
| a=candidate:0 2 UDP 2122194687 192.168.1.7 51558 typ host | [RFC5245] |
| a=candidate:1 2 UDP 1685987071 98.248.92.77 60065 typ srflx raddr 192.168.1.7 rport 51558 | [RFC5245] |
| ****** Video m=line ********* | ********** |
| m=video 58679 UDP/TLS/RTP/SAVPF 120 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |

rtcp-mux is supported
so no second set of candidates

No end-of-candidates on purpose?

| | |
|---|---|
| a=mid:video<br>a=msid:ma tb | [RFC5888]<br>Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:120 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=ice-ufrag:85bC300 | [RFC5245] |
| a=ice-pwd:325921d5d47efbabd9a2de4e99bd291c | [RFC5245] |
| a=fingerprint:sha-256 6B:8B:F0:65:5F:78:E2:51:3B:AC:6F:F3:3F:46:1B:35 :DC:B8:5F:64:1A:24:C2:43:F0:A1:58:D0:A1:2C:19:08 | [RFC5245] |
| a=setup:active | [RFC4145] - Bob carries out DTLS Handshake in parallel |
| a=dtls-id:2 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:120 nack | [RFC5104] |
| a=rtcp-fb:120 nack pli | [RFC5104] |
| a=rtcp-fb:120 ccm fir | [RFC5104] |
| a=candidate:0 1 UDP 2122194687 192.168.1.7 61556 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1685987071 98.248.92.77 58679 typ srflx raddr 192.168.1.7 rport 61556 | [RFC5245] |
| a=candidate:0 1 UDP 2122194687 192.168.1.7 61558 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1685987071 98.248.92.77 56507 typ srflx raddr 192.168.1.7 rport 61558 | [RFC5245] |

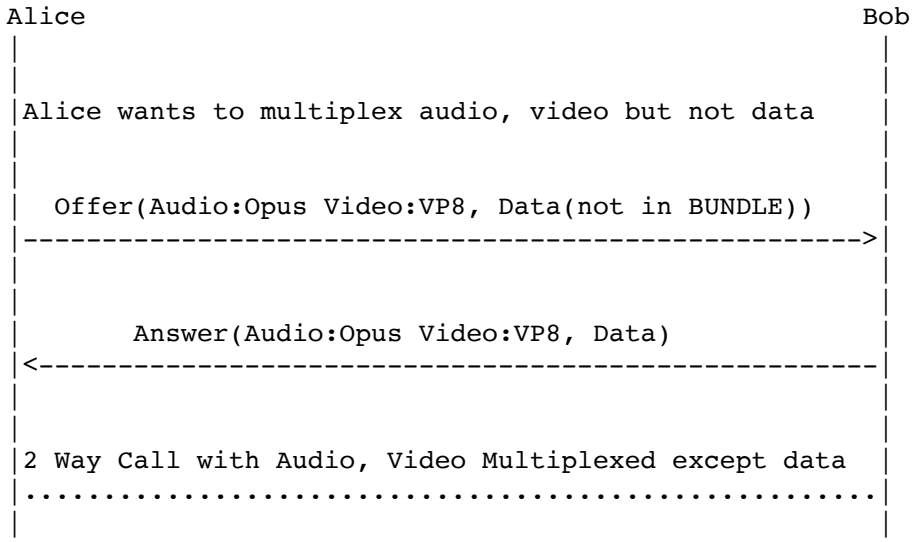
1. No RTCP candidates as rtcp-mux has been negotiated
2. What the heck is another 0 1 host candidates suppose to mean?

Table 18: 5.2.9 SDP Answer without BUNDLE

### 5.2.10. Audio, Video BUNDLED, but Data (Not BUNDLED)

This example show-cases SDP for negotiating a session with Audio, Video and data streams between Alice and Bob with data stream not being part of the BUNDLE group. This is shown by assigning unique port for data media section and not adding the "mid" identification tag to the BUNDLE group.

Audio, Video, with Data (Not in BUNDLE)




| Offer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20518 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio video | [I-D.ietf-mmusic-sdp-bundle-negotiation] Alice wants to BUNDLE only audio and video media. |
| a=group:LS audio video | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 54609 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:audio | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] |
| a=ice-pwd:a28a397a4c3f31747d1ee34 | [RFC5245] |

| | |
|---|---|
| 74af08a068 | |
| a=fingerprint:sha-256 19:E2:1C:3B :4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73 :04 :BB:05:2F:70:9F:04:A9:0E:05:E 9:26:33:E8:70:88:A2 | [RFC5245] |
| a=setup:actpass | [RFC4145] |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp:54609 IN IP4 24.23.204.141 | [RFC3605] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2113667327 192.168.1.4 54609 typ host | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |
| ********* Video m=line ********* | ********** |
| a=video 54609 UDP/TLS/RTP/SAVPF 120 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:video | [RFC5888] |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:120 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=rtcp-fb:120 nack | [RFC5104] |
| a=rtcp-fb:120 nack pli | [RFC5104] |
| a=rtcp-fb:120 ccm fir | [RFC5104] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| ******** Application m=line ********* | ********** |
| m=application 10000 UDP/DTLS/SCTP webrtc-datachannel | [I-D.ietf-rtcweb-data-channel] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:data | [RFC5888] |
| a=sctp-port:5000 | [I-D.ietf-mmusic-sctp-sdp] |
| a=max-message-size:100000 | [I-D.ietf-mmusic-sctp-sdp] |
| a=sendrecv | [RFC3264] |
| a=setup:actpass | [RFC4145] |
| a=ice-ufrag:89819013 | [RFC5245] |
| a=ice-pwd:1747d1ee3474af08a068a28 a397a4c3f3 | [RFC5245] |
| a=fingerprint:sha-256 29:E2:1C:3B :4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73 | [RFC5245] |

RTCP candidate is missing!!!

No srvflx on purpose?

Bundle-only missing

Different cert fingerprint!?!?!

| | |
|---|---|
| :04: BB:05:2F:70:9F:04:A9:0E:05:E | |
| 9:26:33:E8:70:88:A2 | |
| a=candidate:0 1 UDP 2113667327 | [RFC5245] |
| 192.168.1.4 10000 typ host | |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |

Table 19: 5.2.10 SDP Offer

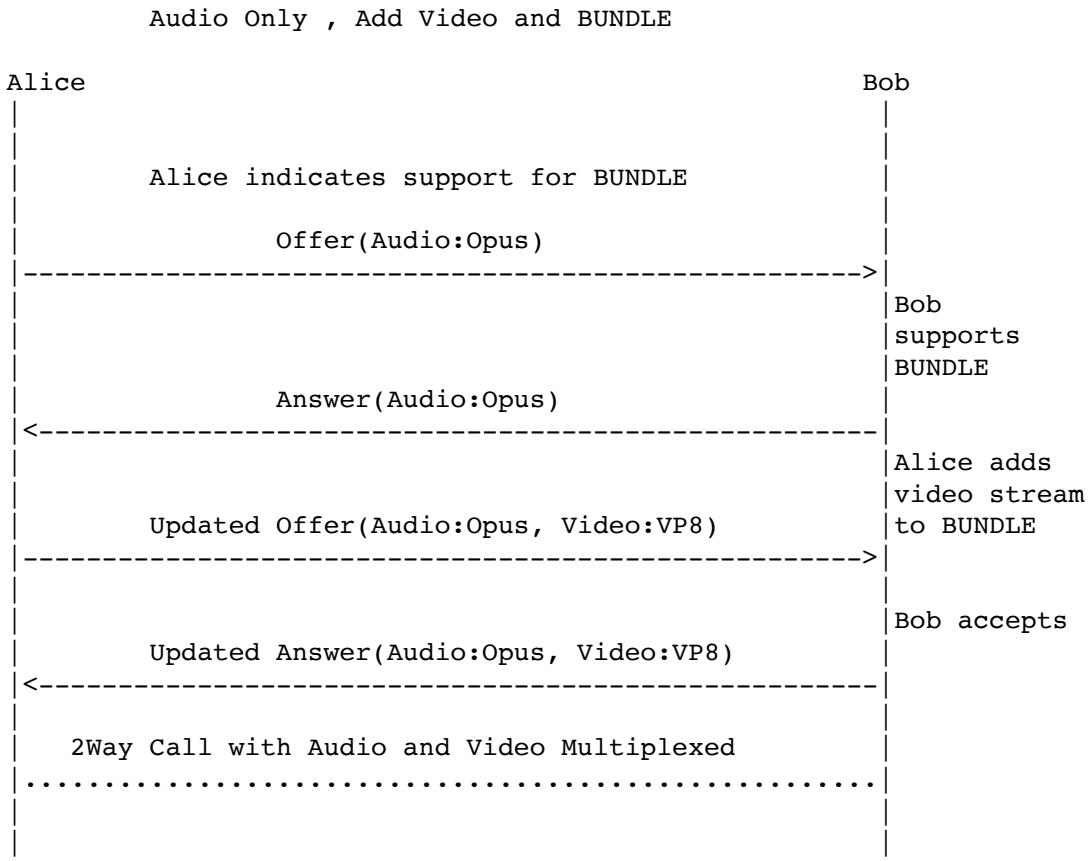
| Answer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 16833 0 IN IP4 0.0.0.0 | [RFC4566] - Session Origin Information |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio video | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=group:LS audio video | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 49203 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:audio | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:c300d85b | [RFC5245] |
| a=ice-pwd:de4e99bd291c325921d5d47efbabd9a2 | [RFC5245] |
| a=fingerprint:sha-256 6B:8B:F0:65:5F:78:E2:51:3B:AC:6F:F3:3F:46:1B:35 :DC:B8:5F:64:1A:24:C2:43:F0:A1:58:D0:A1:2C:19:08 | [RFC5245] |
| a=setup:active | [RFC4145] |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp- | [I-D.ietf-mmusic-sdp-bundle-n |

| | |
|---|---|
| hdrext:sdes:mid | egotiation] |
| a=candidate:0 1 UDP 2113667327 192.168.1.7 49203 typ host | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |
| ****** Video m=line ********* | **************************** |
| m=video 49203 UDP/TLS/RTP/SAVPF 120 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:video | [RFC5888] |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:120 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=rtcp-fb:120 nack | [RFC5104] |
| a=rtcp-fb:120 nack pli | [RFC5104] |
| a=rtcp-fb:120 ccm fir | [RFC5104] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| ****** Application m=line ********* | **************************** |
| m=application 20000 UDP/DTLS/SCTP webrtc-datachannel | [I-D.ietf-mmusic-sctp-sdp] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:data | [RFC5888] |
| a=sctp-port:5000 | [I-D.ietf-mmusic-sctp-sdp] |
| a=max-message-size:100000 | [I-D.ietf-mmusic-sctp-sdp] |
| a=setup:active | [RFC4145] |
| a=sendrecv | [RFC3264] |
| a=ice-ufrag:991Ca2a5e | [RFC5245] |
| a=ice-pwd:921d5d47efbabd9a2d3e4e99bd291c325 | [RFC5245] |
| a=fingerprint:sha-256 7B:8B:F0:65:5F:78:E2:51:3B:AC:6F:F3:3F:40:1B:35: DC:B8:5F:64:1A:24:C2:43:F0:A1:58:D0:A1:2C:19:08 | [RFC5245] Different cert fingerprint?! |
| a=candidate:0 1 UDP 2113667327 192.168.1.7 20000 typ host | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |

Table 20: 5.2.10 SDP Answer

### 5.2.11. Audio Only, Add Video to BUNDLE

This example involves 2 Offer/Answer exchanges. First one is used to negotiate and setup BUNDLE support for Audio-only session followed by an updated Offer/Answer exchange to add video stream to the ongoing session. Also the newly added video stream is BUNDLED with the audio stream.



| Offer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20518 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio | [I-D.ietf-mmusic-sdp-bundle-negotiation] Alice adds audio m=line to the BUNDLE group |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 54609 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:audio | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] |
| a=ice-pwd:a28a397a4c3f31747d1ee3474af08a068 | [RFC5245] |
| a=fingerprint:sha-256 19:E2:1C:3B:4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73:04 :BB:05:2F:70:9F:04:A9:0E:05:E9:26:33:E8:70:88:A2 | [RFC5245] |
| a=setup:actpass | [RFC4145] |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp:54609 IN IP4 24.23.204.141 | [RFC3605] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2113667327 192.168.1.4 61665 typ host | [RFC5245] |
| a=candidate:1 1 UDP 694302207 24.23.204.141 54609 typ srflx raddr 192.168.1.4 rport 61665 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |

Missing RTCP candidate

Table 21: 5.2.11 SDP Offer

| Answer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 16833 0 IN IP4 0.0.0.0 | [RFC4566] - Session Origin Information |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 49203 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:audio | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:c300d85b | [RFC5245] |
| a=ice-pwd:de4e99bd291c325921d5d47efbabd9a2 | [RFC5245] |
| a=fingerprint:sha-256 6B:8B:F0:65:5F:78:E2:51:3B:AC:6F:F3:3F:46:1B:35 :DC:B8:5F:64:1A:24:C2:43:F0:A1:58:D0:A1:2C:19:08 | [RFC5245] |
| a=setup:active | [RFC4145] |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2113667327 192.168.1.7 51556 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1694302207 98.248.92.77 49203 typ srflx raddr 192.168.1.7 rport 51556 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |

Table 22: 5.2.10 SDP Answer

| Updated Offer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | Version number incremented [RFC4566] |
| o=- 20518 1 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio video | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=group:LS audio video | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 54609 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:audio | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] |
| a=ice-pwd:a28a397a4c3f31747d1ee3474af08a068 | [RFC5245] |
| a=fingerprint:sha-256 19:E2:1C:3B:4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73:04 :BB:05:2F:70:9F:04:A9:0E:05:E9:26:33:E8:70:88:A2 | [RFC5245] |
| a=setup:actpass | [RFC4145] |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp]Alice want's to use the same DTLS association |
| a=rtcp-mux | [RFC5761] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2113667327 192.168.1.4 61665 typ host | [RFC5245] |
| a=candidate:1 1 UDP 694302207 24.23.204.141 54609 typ srflx raddr 192.168.1.4 rport 61665 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |
| ****** Video m=line ********* | ********** |

| | |
|---|---|
| m=video 54609 UDP/TLS/RTP/SAVPF 120 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:video | [RFC5888] |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:120 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=rtcp-fb:120 nack | [RFC5104] |
| a=rtcp-fb:120 nack pli | [RFC5104] |
| a=rtcp-fb:120 ccm fir | [RFC5104] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |

Missing a=bundle-only

Table 23: 5.2.11 SDP Updated Offer

| Updated Answer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] Version number incremented |
| o=- 16833 1 IN IP4 0.0.0.0 | [RFC4566] - Session Origin Information |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio video | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=group:LS audio video | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 49203 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:audio | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:c300d85b | [RFC5245] |
| a=ice-pwd:de4e99bd291c325921d5d47efbabd9a2 | [RFC5245] |
| a=fingerprint:sha-256 6B:8B:F0:65:5F:78:E2:51:3B:AC:6F:F3:3F:46:1B | [RFC5245] |

| | |
|---|---|
| :35 :DC:B8:5F:64:1A:24:C2:43:F0:A 1:58:D0:A1:2C:19:08 | |
| a=setup:active | [RFC4145] |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp]Bob agrees to use the same DTLS association |
| a=rtcp-mux | [RFC5761] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2113667327 192.168.1.7 51556 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1694302207 98.248.92.77 49203 typ srflx raddr 192.168.1.7 rport 51556 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |
| ****** Video m=line ********* | ********** |
| m=video 49203 UDP/TLS/RTP/SAVPF 120 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:video | [RFC5888] |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:120 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=rtcp-fb:120 nack | [RFC5104] |
| a=rtcp-fb:120 nack pli | [RFC5104] |
| a=rtcp-fb:120 ccm fir | [RFC5104] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |

Table 24: 5.2.11 SDP Updated Answer

## 5.3. MultiResolution, RTX, FEC Examples

This section deals with scenarios related to multi-source, multi-stream negotiation such as layered coding, simulcast, along with techniques that deal with providing robustness against transmission errors such as FEC and RTX. Also to note, mechanisms such as FEC and RTX could be envisioned in the above basic scenarios as well.

#### 5.3.1. Sendonly Simulcast Session with 2 cameras and 2 encodings per camera

The SDP below shows Offer/Answer exchange with one audio and two video sources. Each of the video source can be sent at two different resolutions.

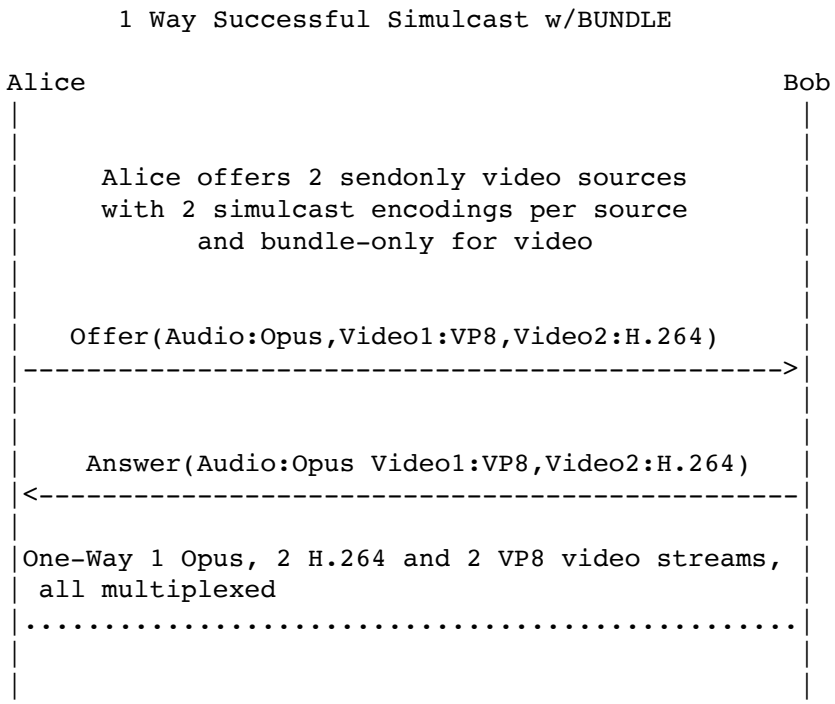
One video source corresponds to VP8 encoding, while the other corresponds to H.264 encoding.

[I-D.ietf-mmusic-rid] framework is used to further constrain the media format encodings and map the payload types (PT) to the 'rid' identifiers.

[I-D.ietf-mmusic-sdp-simulcast] framework identifies the simulcast streams via their 'rid' identifiers.

bundle-only attribute is used for the video sources in the Offer to ensure enabling video sources in the context of BUNDLE alone.

BUNDLE grouping framework enables multiplexing of all the 5 streams (1 audio stream + 4 video streams) over a single RTP Session.



| Offer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20519 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE m0 m1 m2 | [I-D.ietf-mmusic-sdp-bundle-negotiation] Alice supports grouping of m=lines under BUNDLE semantics |
| a=group:LS m0 m1 | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ********* Audio m-line ********* | ********** |
| m=audio 54609 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:m0 | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendonly | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] |
| a=ice-pwd:a28a397a4c3f31747d1ee3474af08a068 | [RFC5245] |
| a=fingerprint:sha-256 19:E2:1C:3B:4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73:04:BB:05:2F:70:9F:04:A9:0E:05:E9:26:33:E8:70:88:A2 | [RFC5245] |
| a=setup:actpass | [RFC4145] |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp:54609 IN IP4 24.23.204.141 | [RFC3605] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2113667327 192.168.1.4 61665 typ host | [RFC5245] |
| a=candidate:1 1 UDP 694302207 24.23.204.141 54609 typ srflx raddr 192.168.1.4 rport 61665 | [RFC5245] |

m0 and m1 LypSync, but not the same stream (ta vs tb)?

Missing RTCP candidate

| | |
|---|---|
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |
| ****** Video-1 m=line ********* | ********** |
| m=video 0 UDP/TLS/RTP/SAVPF 98 100 | bundle-only video line with port number set to zero |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=bundle-only | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=mid:m1 | [RFC5888] Video m=line part of BUNDLE group |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=sendonly | [RFC3264] - Send only video stream |
| a=rtpmap:98 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=fmtp:98 max-fr=30 | [RFC4566] |
| a=rtpmap:100 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=fmtp:100 max-fr=15 | [RFC4566] |
| a=rtcp-fb: nack | [RFC5104] |
| a=rtcp-fb:* nack pli | [RFC5104] |
| a=rtcp-fb:* ccm fir | [RFC5104] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=rid:1 send pt=98;max-width=1280;max-height=720; | [I-D.ietf-mmusic-rid] 1:1 rid mapping to payload type and specify resolution constraints |
| a=rid:2 send pt=100;max-width=640;max-height=480; | [I-D.ietf-mmusic-rid] 1:1 rid mapping to payload type and specify resolution constraints |
| a=simulcast: send 1;~2 | [I-D.ietf-mmusic-sdp-simulcast] Alice can send 2 resolutions identified by the 'rid' identifiers Also, the second stream is initially paused. |
| ****** Video-2 m=line ********* | ********** |
| m=video 0 UDP/TLS/RTP/SAVPF 101 102 | bundle-only video line with port number set to zero |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=bundle-only | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=mid:m2 | [RFC5888] Video m=line part of BUNDLE group |

Missing RID header extension

Really bad RID example

No Space!

| | |
|---|---|
| a=msid:ma tc | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tc) |
| a=sendonly | [RFC3264] - Send only video stream |
| a=rtpmap:101 H264/90000 | [RFC3984] |
| a=rtpmap:102 H264/90000 | [RFC3984] |
| a=fmtp:101 profile-level-id=42401f ;packetization-mode=0;max-fr=30 | [RFC3984]Camera-2,Encoding-1 |
| a=fmtp:102 profile-level-id=42401f ;packetization-mode=1;max-fr=15 | [RFC3984]Camera-2,Encoding-2 |
| a=rtcp-fb:* nack | [RFC5104] |
| a=rtcp-fb:* nack pli | [RFC5104] |
| a=rtcp-fb:* ccm fir | [RFC5104] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=rid:3 send pt=101;max-width=1280 ;max-height=720; | [I-D.ietf-mmusic-rid] 1:1 rid mapping to payload type and specify resolution constraints |
| a=rid:4 send pt=102;max-width=640 ;max-height=360; | [I-D.ietf-mmusic-rid] 1:1 rid mapping to payload type and specify resolution constraints |
| a=simulcast: send 3;4 | [I-D.ietf-mmusic-sdp-simulcast] Alice can send 2 resolutions identified by the 'rid' identifiers |

Missing RID Ext

Extra Space!

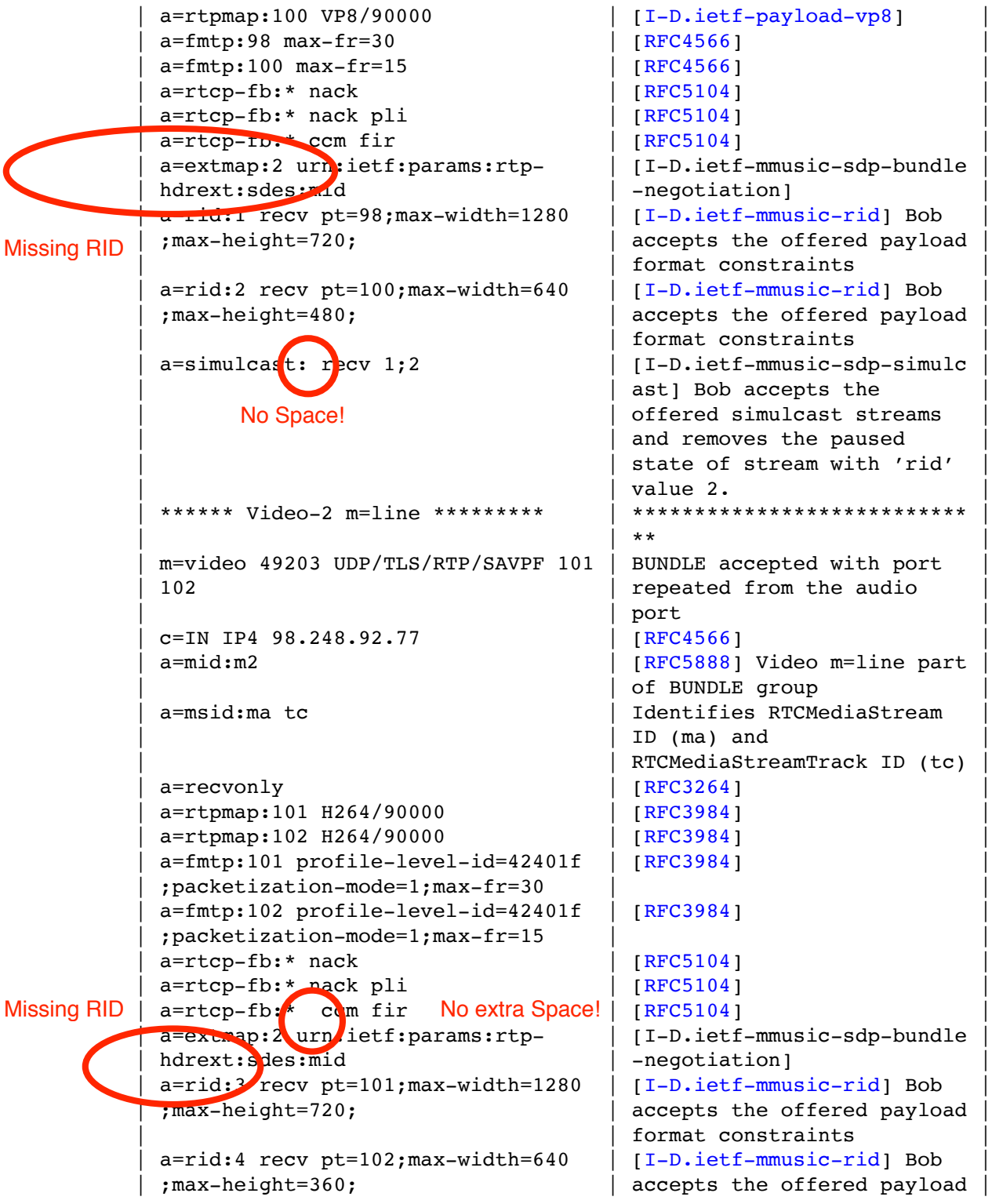
Really bad RID example

No Space!

Table 25: 5.3.1 SDP Offer

| Answer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20519 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE m0 m1 m2 | [I-D.ietf-mmusic-sdp-bundle-negotiation] Alice supports grouping of m=lines under BUNDLE semantics |
| a=group:LS m0 m1 | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |

| | |
|---|---|
| ****** Audio m=line ********* | ********** |
| | ** |
| m=audio 49203 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:m0 | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=recvonly | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:c300d85b | [RFC5245] |
| a=ice-pwd:de4e99bd291c325921d5d47ef babd9a2 | [RFC5245] |
| a=fingerprint:sha-256 6B:8B:F0:65:5 F:78:E2:51:3B:AC:6F:F3:3F:46:1B:35 :DC:B8:5F:64:1A:24:C2:43:F0:A1:58:D 0:A1:2C:19:08 | [RFC5245] |
| a=setup:active | [RFC4145] |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp-rsize | [RFC5506] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2113667327 192.168.1.7 61665 typ host | [RFC5245] |
| a=candidate:1 1 UDP 694302207 98.248.92.77 49203 typ srflx raddr 192.168.1.4 rport 61665 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |
| ****** Video-1 m=line ********* | ********** |
| | ** |
| m=video 49203 UDP/TLS/RTP/SAVPF 98 100 | BUNDLE accepted with port repeated from the audio port |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:m1 | [RFC5888] Video m=line part of BUNDLE group |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=recvonly | [RFC3264] - receive only video stream |
| a=rtpmap:98 VP8/90000 | [I-D.ietf-payload-vp8] |


a=rtpmap:100 VP8/90000
[I-D.ietf-payload-vp8]
a=fmtp:98 max-fr=30
[RFC4566]
a=fmtp:100 max-fr=15
[RFC4566]
a=rtcp-fb:* nack
[RFC5104]
a=rtcp-fb:* nack pli
[RFC5104]
a=rtcp-fb:* ccm fir
[RFC5104]
a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid
[I-D.ietf-mmusic-sdp-bundle-negotiation]
a=rid:1 recv pt=98;max-width=1280;max-height=720;
[I-D.ietf-mmusic-rid] Bob accepts the offered payload format constraints
Missing RID
a=rid:2 recv pt=100;max-width=640;max-height=480;
[I-D.ietf-mmusic-rid] Bob accepts the offered payload format constraints
a=simulcast: recv 1;2
No Space!
[I-D.ietf-mmusic-sdp-simulcast] Bob accepts the offered simulcast streams and removes the paused state of stream with 'rid' value 2.
****** Video-2 m=line *********
**********
m=video 49203 UDP/TLS/RTP/SAVPF 101 102
BUNDLE accepted with port repeated from the audio port
c=IN IP4 98.248.92.77
[RFC4566]
a=mid:m2
[RFC5888] Video m=line part of BUNDLE group
a=msid:ma tc
Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tc)
a=recvonly
[RFC3264]
a=rtpmap:101 H264/90000
[RFC3984]
a=rtpmap:102 H264/90000
[RFC3984]
a=fmtp:101 profile-level-id=42401f;packetization-mode=1;max-fr=30
[RFC3984]
a=fmtp:102 profile-level-id=42401f;packetization-mode=1;max-fr=15
[RFC3984]
a=rtcp-fb:* nack
[RFC5104]
a=rtcp-fb:* nack pli
[RFC5104]
Missing RID
a=rtcp-fb:* ccm fir
No extra Space!
[RFC5104]
a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid
[I-D.ietf-mmusic-sdp-bundle-negotiation]
a=rid:3 recv pt=101;max-width=1280;max-height=720;
[I-D.ietf-mmusic-rid] Bob accepts the offered payload format constraints
a=rid:4 recv pt=102;max-width=640;max-height=360;
[I-D.ietf-mmusic-rid] Bob accepts the offered payload

| | |
|---|---|
| a=simulcast: recv 3;4 | format constraints [I-D.ietf-mmusic-sdp-simulcast] Bob accepts the offered simulcast streams. |

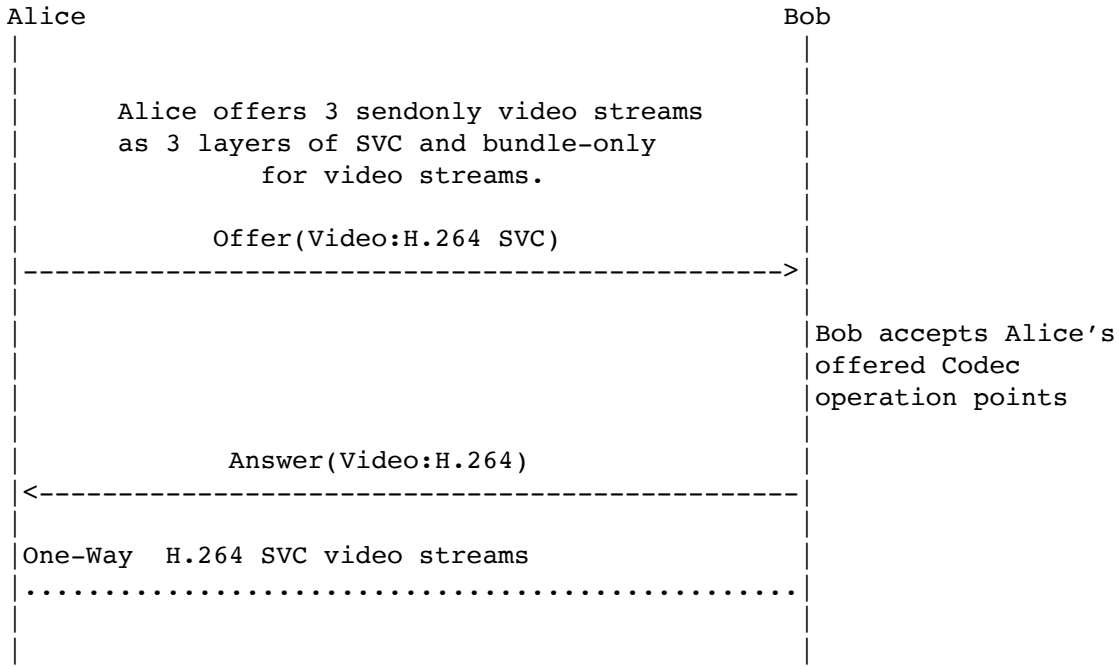
No Space

Table 26: 5.3.1 SDP Answer

### 5.3.2. Successful SVC Video Session

This section shows an SDP Offer/Answer for a session with an audio and a single video source. The video source is encoded as layered coding at 3 different resolutions based on [RFC5583]. The video m=line shows 3 streams with last stream (payload 100) dependent on streams with payload 96 and 97 for decoding.

SVC Session - 3 Layers w/BUNDLE




| Offer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |

| | |
|---|---|
| o=- 20519 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE m0 m1 | [I-D.ietf-mmusic-sdp-bundle-negotiation] Alice supports grouping of m=lines under BUNDLE semantics |
| a=group:LS m0 m1 | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 54609 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:m0 | [RFC5888] Audio m=line part of BUNDLE group with a unique port number |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendonly | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] |
| a=ice-pwd:a28a397a4c3f31747d1ee3474af08a068 | [RFC5245] |
| a=fingerprint:sha-256 19:E2:1C:3B:4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73:04 :BB:05:2F:70:9F:04:A9:0E:05:E9:26:33:E8:70:88:A2 | [RFC5245] |
| a=setup:actpass | [RFC4145] |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp:54609 IN IP4 24.23.204.141 | [RFC3605] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2113667327 192.168.1.4 61665 typ host | [RFC5245] |
| a=candidate:1 1 UDP 694302207 24.23.204.141 54609 typ srflx raddr 192.168.1.4 rport 61665 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |
| ****** Video m=line ********* | ********** |
| m=video 0 UDP/TLS/RTP/SAVPF 96 97 100 | bundle-only video line with port number set to zero |

Same port numbers as in the m-line?

| c=IN IP4 24.23.204.141 | [RFC4566] |
|---|---|
| a=bundle-only | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=mid:m1 | [RFC5888] Video m=line part of BUNDLE group |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tc) |
| a=sendonly | [RFC3264] - Send only video stream |
| a=rtpmap:96 H264/90000 | [RFC3984] |
| a=fmtp:96 profile-level-id=4d0028; packetization-mode=1 ;max-fr=30;max-fs=8040 | [RFC3984]H.264 Layer 1 |
| a=rtpmap:97 H264/90000 | [RFC3984] |
| a=fmtp:97 profile-level-id=4d0028 ;packetization-mode=1; max-fr=15 ;max-fs=1200 | [RFC3984] H.264 Layer 2 |
| a=rtpmap:100 H264-SVC/90000 | [RFC3984] |
| a=fmtp:100 profile-level-id=4d0028;packetization-mode=1; max-fr=30;max-fs=8040 | [RFC3984] |
| a=depend:100 lay m1:96,97; | [RFC5583]Layer 3 dependent on layers 1 and 2 |
| a=rtcp-fb:* nack | [RFC5104] |
| a=rtcp-fb:* nack pli | [RFC5104] |
| a=rtcp-fb:* ccm fir | [RFC5104] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |

No semicolon

Table 27: 5.3.2 SDP Offer with SVC

| Answer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20519 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE m0 m1 | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=group:LS m0 m1 | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 49203 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |

| | |
|---|---|
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:m0 | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=recvonly | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] |
| a=ice-pwd:a28a397a4c3f31747d1ee3474af08a068 | [RFC5245] |
| a=fingerprint:sha-256 6B:8B:F0:65:5F:78:E2:51:3B:AC:6F:F3:3F:46:1B:35 :DC:B8:5F:64:1A:24:C2:43:F0:A1:58:D0:A1:2C:19:08 | [RFC5245] |
| a=setup:active | [RFC4145] |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2113667326 192.168.1.7 51556 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1694302206 98.248.92.77 49203 typ srflx raddr 192.168.1.5 rport 51556 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |
| ****** Video m=line ********* | ********** |
| m=video 49203 UDP/TLS/RTP/SAVPF 96 100 | BUNDLE accepted Bundle address same as audio m=line. |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:m1 | [RFC5888] Video m=line part of BUNDLE group |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=recvonly | [RFC3264] - Receive only video stream |
| a=rtpmap:96 H264/90000 | [RFC3984] |
| a=fmtp:96 profile-level-id=4d0028;packetization-mode=1; max-fr=30;max-fs=8040 | [RFC3984]H.264 Layer 1 |
| a=rtpmap:100 H264-SVC/90000 | [RFC3984] |
| a=fmtp:100 profile-level-id=4d0028;packetization-mode=1; | [RFC3984] |

| | |
|---|---|
| max-fr=30;max-fr=8040 | |
| a=depend:100 lay m1:96; | [RFC5583] Bob chooses 2 Codec Operation points |
| a=rtcp-fb:* nack | [RFC5104] |
| a=rtcp-fb:* nack pli | [RFC5104] |
| a=rtcp-fb:* ccm fir | [RFC5104] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |

No semicolon

Table 28: 5.3.2 SDP Answer with SVC

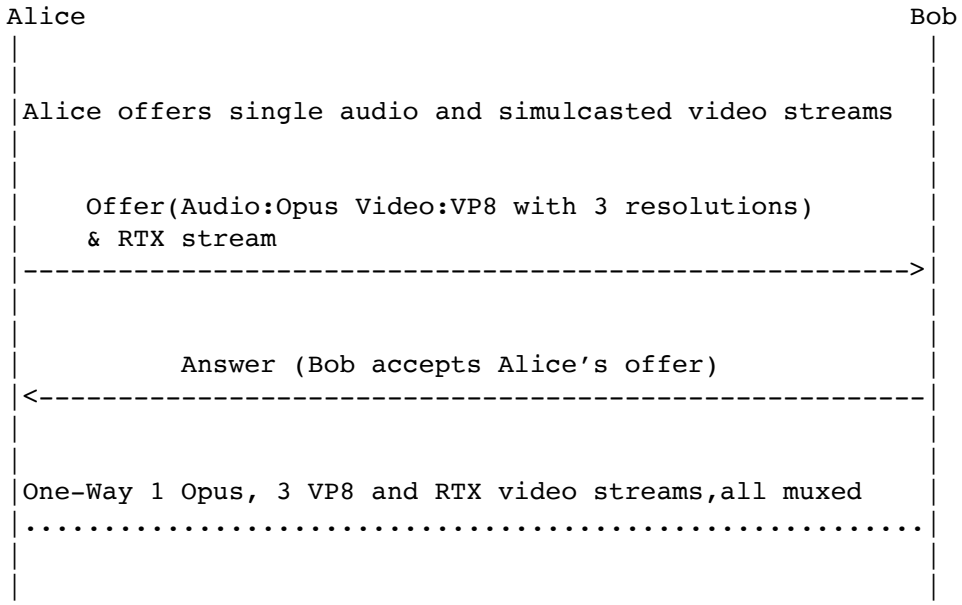
### 5.3.3. Successful Simulcast Video Session with Retransmission

This section shows an SDP Offer/Answer exchange for a simulcast scenario with 3 resolutions and has [RFC4588] style re-transmission flows.

[I-D.ietf-mmusic-rid] framework is used to specify all the (3) resolution constraints mapped to a single Payload Type (98).

[I-D.ietf-mmusic-sdp-simulcast] framework identifies the simulcast streams via their 'rid' identifiers.

Simulcast Streams with Retransmission




| Offer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20519 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE m0 m1 | [I-D.ietf-mmusic-sdp-bundle-negotiation] Alice supports grouping of m=lines under BUNDLE semantics |
| a=group:LS m0 m1 | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 54609 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:m0 | [RFC5888] Audio m=line part of BUNDLE group with a unique port number |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendonly | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |

| | |
|---|---|
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] |
| a=ice-pwd:a28a397a4c3f31747d1ee34 74af08a068 | [RFC5245] |
| a=fingerprint:sha-256 19:E2:1C:3B :4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73 :04 :BB:05:2F:70:9F:04:A9:0E:05:E 9:26:33:E8:70:88:A2 | [RFC5245] |
| a=setup:actpass | [RFC4145] |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp:54609 IN IP4 24.23.204.141 | [RFC3605] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp- hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp- hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-n egotiation] |
| a=candidate:0 1 UDP 2113667327 192.168.1.4 61665 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1694302207 24.23.204.141 54609 typ srflx raddr 192.168.1.4 rport 61665 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |
| ****** Video m=line ********* | **************************** |
| m=video 0 UDP/TLS/RTP/SAVPF 98 103 | bundle-only video line with port number set to zero |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=bundle-only | [I-D.ietf-mmusic-sdp-bundle-n egotiation] |
| a=mid:m1 | [RFC5888] |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=sendonly | [RFC3264] |
| a=rtpmap:98 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=fmtp:98 max-fr=30 | [RFC4566] |
| a=rtpmap:103 rtx/90000 | [RFC4588] |
| a=fmtp:103 apt=98;rtx-time=200 | [RFC4588] |
| a=rtcp-fb:* nack | [RFC5104] |
| a=rtcp-fb:* nack pli | [RFC5104] |
| a=rtcp-fb:* ccm fir | [RFC5104] |
| a=extmap:2 urn:ietf:params:rtp- hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-n egotiation] |
| a=rid:1 send pt=98;max-fs=921600 ;max-fr=30; | [I-D.ietf-mmusic-rid] |
| a=rid:2 send pt=98;max-fs=614400 ;max-fr=15; | [I-D.ietf-mmusic-rid] |

| | |
|---|---|
| a=rid:3 send pt=98;max-fs=230400 ;max-fr=30; | [I-D.ietf-mmusic-rid] |
| a=simulcast: send 1;2;3 | [I-D.ietf-mmusic-sdp-simulcast] Alice can send all the simulcast streams |

Table 29: 5.3.3 SDP Offer w/Simulcast, RTX

| Answer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20519 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE m0 m1 | [I-D.ietf-mmusic-sdp-bundle-negotiation] Bob supports grouping of m=lines under BUNDLE semantics |
| a=group:LS m0 m1 | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 49203 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:m0 | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=recvonly | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] |
| a=ice-pwd:a28a397a4c3f31747d1ee3474af08a068 | [RFC5245] |
| a=fingerprint:sha-256 6B:8B:F0:65:5F:78:E2:51:3B:AC:6F:F3:3F:46:1B:35 :DC:B8:5F:64:1A:24:C2:43:F0:A1:58:D0:A1:2C:19:08 | [RFC5245] |
| a=setup:active | [RFC4145] |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |

| | |
|---|---|
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2113667326 192.168.1.7 51556 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1694302206 98.248.92.77 49203 typ srflx raddr 192.168.1.7 rport 51556 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |
| ********* Video m=line ********* | ********** |
| m=video 49203 UDP/TLS/RTP/SAVPF 98 100 101 103 | BUNDLE accepted with Bundle address identical to audio m-line |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:m1 | [RFC5888] Video m=line part of BUNDLE group |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=recvonly | [RFC3264] |
| a=rtpmap:98 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=fmtp:98 max-fr=30 | [RFC4566] |
| a=rtpmap:103 rtx/90000 | [RFC4588] |
| a=fmtp:103 apt=98;rtx-time=200 | [RFC4588] |
| a=rtcp-fb:* nack | [RFC5104] |
| a=rtcp-fb:* nack pli | [RFC5104] |
| a=rtcp-fb:* ccm fir | [RFC5104] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=rid:1 recv pt=98;max-fs=921600;max-fr=30; | [I-D.ietf-mmusic-rid] |
| a=rid:2 recv pt=98;max-fs=614400;max-fr=15; | [I-D.ietf-mmusic-rid] |
| a=rid:3 recv pt=98;max-fs=230400;max-fr=30; | [I-D.ietf-mmusic-rid] |
| a=simulcast: recv 1;2;3 | [I-D.ietf-mmusic-sdp-simulcast] Bob accepts the offered simulcast streams |

WTF is this?

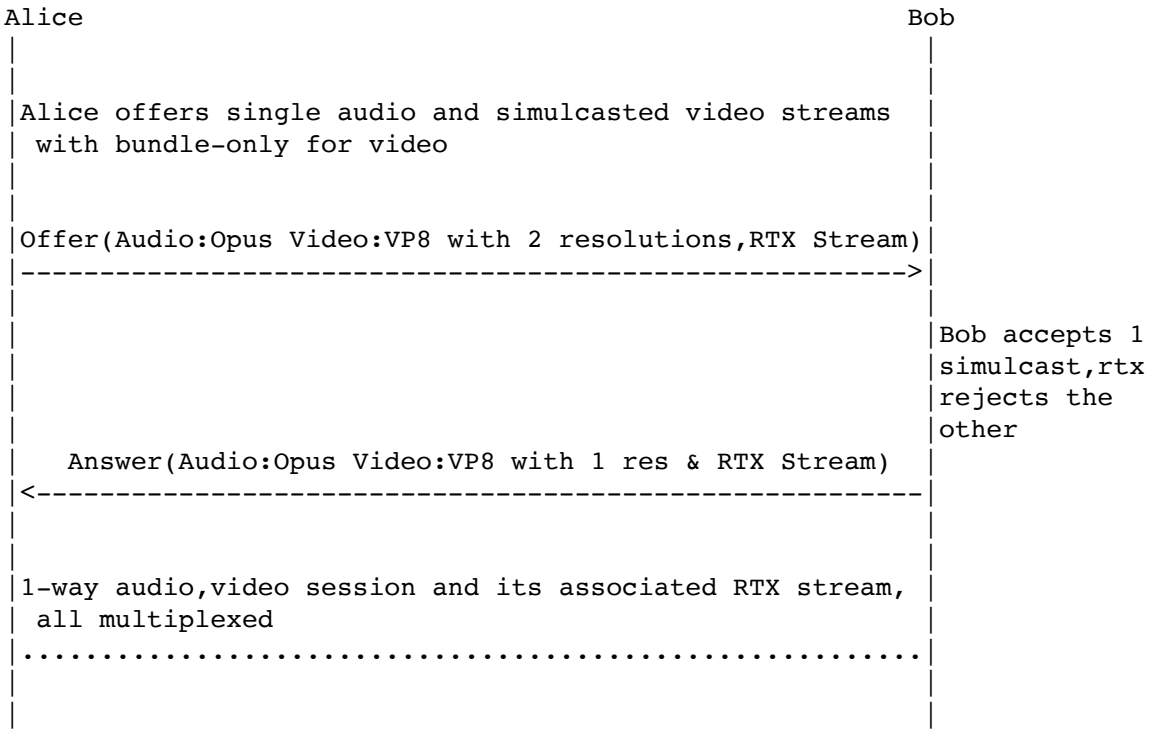
Table 30: 5.3.3 SDP Answer w/Simulcast, RTX

### 5.3.4. Successful 1-way Simulcast Session with 2 resolutions and RTX - One resolution rejected

This section shows an SDP Offer/Answer exchange for a simulcast scenario with 2 two resolutions.

It also showcases where Bob rejects one of the Simulcast Video Stream which results in the rejection of the associated repair stream implicitly.

Simulcast Streams with Retransmission Rejected




| Offer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20519 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE m0 m1 | [I-D.ietf-mmusic-sdp-bundle-negotiation] Alice supports grouping of m=lines under BUNDLE semantics |
| a=group:LS m0 m1 | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |

| | |
|---|---|
| m=audio 54609 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:m0 | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendonly | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] |
| a=ice-pwd:a28a397a4c3f31747d1ee3474af08a068 | [RFC5245] |
| a=fingerprint:sha-256 19:E2:1C:3B:4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73:04 :BB:05:2F:70:9F:04:A9:0E:05:E9:26:33:E8:70:88:A2 | [RFC5245] |
| a=setup:actpass | [RFC4145] |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp:54609 IN IP4 24.23.204.141 | [RFC3605] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2113667327 192.168.1.4 61665 typ host | [RFC5245] |
| a=candidate:1 1 UDP 694302207 24.23.204.141 54609 typ srflx raddr 192.168.1.4 rport 61665 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |
| ****** Video m=line ********* | **************************** |
| m=video 0 UDP/TLS/RTP/SAVPF 98 100 101 103 | bundle-only video line with port number set to zero |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=bundle-only | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=mid:m1 | [RFC5888] |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb |
| a=sendonly | [RFC3264] |
| a=rtpmap:98 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=rtpmap:100 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=rtpmap:101 rtx/90000 | [RFC4588] |
| a=rtpmap:103 rtx/90000 | [RFC4588] |

| | |
|---|---|
| a=fmtp:98 max-fr=30;max-fs=8040 | [RFC4566] |
| a=fmtp:100 max-fr=15;max-fs=1200 | [RFC4566] |
| a=fmtp:101 apt=98;rtx-time=200 | [RFC4588] |
| a=fmtp:103 apt=100;rtx-time=200 | [RFC4588] |
| a=rtcp-fb:* nack | [RFC5104] |
| a=rtcp-fb:* nack pli | [RFC5104] |
| a=rtcp-fb:* ccm fir | [RFC5104] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=rid:1 send pt=98; | [I-D.ietf-mmusic-rid] 1:1 mapping between the PT and the 'rid' identifier |
| a=rid:2 send pt=100; | [I-D.ietf-mmusic-rid] 1:1 mapping between the PT and the 'rid' identifier |
| a=simulcast: send 1;2 | [I-D.ietf-mmusic-sdp-simulcast] |

Table 31: 5.3.4 SDP Offer w/Simulcast, RTX

| Answer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20519 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE m0 m1 | [I-D.ietf-mmusic-sdp-bundle-negotiation] Bob supports grouping of m=lines under BUNDLE semantics |
| a=group:LS m0 m1 | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 49203 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:m0 | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=recvonly | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] |
| a=ice-pwd:a28a397a4c3f31747d1ee34 | [RFC5245] |

| | |
|---|---|
| 74af08a068 | |
| a=fingerprint:sha-256 6B:8B:F0:65 :5F:78:E2:51:3B:AC:6F:F3:3F:46:1B :35 :DC:B8:5F:64:1A:24:C2:43:F0:A 1:58:D0:A1:2C:19:08 | [RFC5245] |
| a=setup:active | [RFC4145] |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp-rsize | [RFC5506] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2113667326 192.168.1.7 51556 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1694302206 98.248.92.77 49203 typ srflx raddr 192.168.1.7 rport 51556 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |
| ****** Video m=line ********* | ********** |
| m=video 49203 UDP/TLS/RTP/SAVPF 98 101 | BUNDLE accepted with Bundle address identical to audio m-line |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:m1 | [RFC5888] |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=recvonly | [RFC3264] |
| a=rtpmap:98 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=rtpmap:101 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=fmtp:98 max-fr=30;max-fs=8040 | [RFC4566] |
| a=fmtp:101 apt=98;rtx-time=200 | [RFC4588] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=rid:1 recv pt=98; | [I-D.ietf-mmusic-rid] |
| a=simulcast: recv 1 | [I-D.ietf-mmusic-sdp-simulcast] Bob rejects the second simulcast stream and the associated rtx stream. |

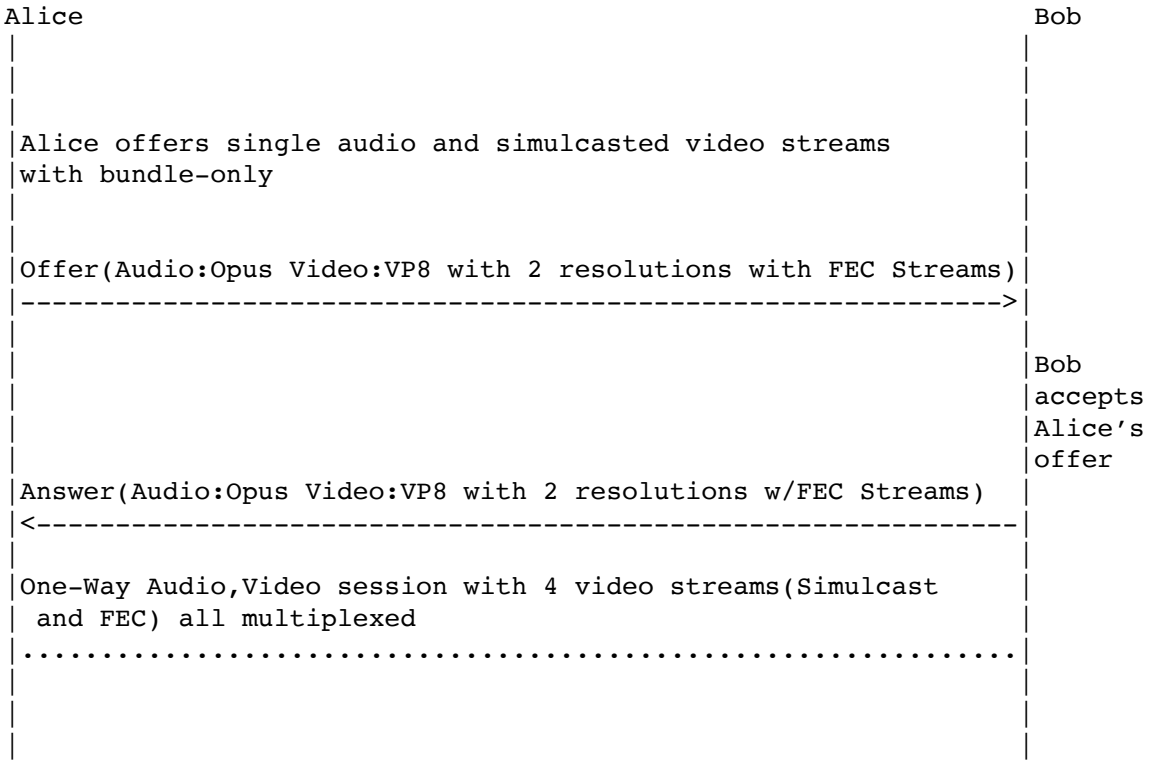
Table 32: 5.3.4 SDP Answer (one Simulcast Rejected)

### 5.3.5. Simulcast Video Session with Forward Error Correction

This section shows an SDP Offer/Answer exchange for Simulcast video stream at two resolutions and and has [RFC5956] style FEC flows.

On completion of the Offer/Answer exchange mechanism we end up one audio stream, 2 simulcast video streams and 2 associated FEC streams are sent over a single 5-tuple.

Simulcast Streams with Forward Error Correction




| Offer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20519 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE m0 m1 | [I-D.ietf-mmusic-sdp-bundle-negotiation] Alice supports grouping of m=lines under |

| | |
|---|---|
| | BUNDLE semantics |
| a=group:LS m0 m1 | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 54609 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:m0 | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendonly | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] |
| a=ice-pwd:a28a397a4c3f31747d1ee3474af08a068 | [RFC5245] |
| a=fingerprint:sha-256 19:E2:1C:3B:4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73:04 :BB:05:2F:70:9F:04:A9:0E:05:E9:26:33:E8:70:88:A2 | [RFC5245] |
| a=setup:actpass | [RFC4145] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp:54609 IN IP4 24.23.204.141 | [RFC3605] |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2113667327 192.168.1.4 61665 typ host | [RFC5245] |
| a=candidate:1 1 UDP 694302207 24.23.204.141 54609 typ srflx raddr 192.168.1.4 rport 61665 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |
| ****** Video m=line ********* | ********** |
| m=video 0 UDP/TLS/RTP/SAVPF 98 100 101 103 | bundle-only video line with port number set to zero |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=bundle-only | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=mid:m1 | [RFC5888] Video m=line part of BUNDLE group |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |

| | |
|---|---|
| a=sendonly | [RFC3264] |
| a=rtpmap:98 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=rtpmap:100 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=rtpmap:101 flexfec/90000 | [I-D.ietf-payload-flexible-fec-scheme] |
| a=rtpmap:103 flexfec/90000 | [I-D.ietf-payload-flexible-fec-scheme] |
| a=fmtp:98 max-fr=30;max-fs=8040 | [RFC4566] |
| a=fmtp:100 max-fr=15;max-fs=1200 | [RFC4566] |
| a=fmtp:101 L=5; D=10; ToP=2; repair-window=200000 | [I-D.ietf-payload-flexible-fec-scheme] |
| a=fmtp:103 L=5; D=10; ToP=2; repair-window=200000 | [I-D.ietf-payload-flexible-fec-scheme] |
| a=rtcp-fb:* nack | [RFC5104] |
| a=rtcp-fb:* nack pli | [RFC5104] |
| a=rtcp-fb:* ccm fir | [RFC5104] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=rid:1 send pt=98; | [I-D.ietf-mmusic-rid] 1:1 mapping between the PT and the 'rid' identifier |
| a=rid:2 send pt=100; | [I-D.ietf-mmusic-rid] 1:1 mapping between the PT and the 'rid' identifier |
| a=simulcast: send 1;2 | [I-D.ietf-mmusic-sdp-simulcast] |

Table 33: 5.3.5 SDP Offer

| Answer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20519 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE m0 m1 | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=group:LS m0 m1 | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 49203 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:m0 | [RFC5888] Audio m=line part of BUNDLE group with a unique |

| | | |
|---|---|---|
| | | port number |
| a=msid:ma ta | | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=recvonly | | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | | [RFC4566] |
| a=ice-ufrag:074c6550 | | [RFC5245] |
| a=ice-pwd:a28a397a4c3f31747d1ee3474af08a068 | | [RFC5245] |
| a=fingerprint:sha-256 6B:8B:F0:65:5F:78:E2:51:3B:AC:6F:F3:3F:46:1B:35 :DC:B8:5F:64:1A:24:C2:43:F0:A1:58:D0:A1:2C:19:08 | | [RFC5245] |
| a=setup:active | | [RFC4145] |
| a=dtls-id:1 | | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | | [RFC5761] |
| a=rtcp-rsize | | [RFC5506] |
| a=rtcp-fb:109 nack | | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2113667326 192.168.1.7 51556 typ host | | [RFC5245] |
| a=candidate:1 1 UDP 1694302206 98.248.92.77 49203 typ srflx raddr 192.168.1.7 rport 51556 | | [RFC5245] |
| a=end-of-candidates | | [I-D.ietf-mmusic-trickle-ice] |
| ****** Video m=line ********* | | ********** |
| m=video 49203 UDP/TLS/RTP/SAVPF 98 100 101 103 | | BUNDLE accepted with Bundle Address identical to audio m=line. |
| c=IN IP4 98.248.92.77 | | [RFC4566] |
| a=mid:m1 | | [RFC5888] Video m=line part of BUNDLE group |
| a=msid:ma tb | | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=recvonly | | [RFC3264] |
| a=rtpmap:98 VP8/90000 | | [I-D.ietf-payload-vp8] |
| a=rtpmap:100 VP8/90000 | | [I-D.ietf-payload-vp8] |
| a=rtpmap:101 flexfec/90000 | | [I-D.ietf-payload-flexible-fec-scheme] |
| a=rtpmap:103 flexfec/90000 | | [I-D.ietf-payload-flexible-fec-scheme] |
| a=fmtp:98 max-fr=30;max-fs=8040 | | [RFC4566] |
| a=fmtp:100 max-fr=15;max-fs=1200 | | [RFC4566] |

| | |
|---|---|
| a=fmtp:101 L=5; D=10; ToP=2; repair-window=200000 | [I-D.ietf-payload-flexible-fec-scheme] |
| a=fmtp:103 L=5; D=10; ToP=2; repair-window=200000 | [I-D.ietf-payload-flexible-fec-scheme] |
| a=rtcp-fb:* nack | [RFC5104] |
| a=rtcp-fb:* nack pli | [RFC5104] |
| a=rtcp-fb:* ccm fir | [RFC5104] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=rid:1 recv pt=98; | [I-D.ietf-mmusic-rid] |
| a=rid:2 recv pt=100; | [I-D.ietf-mmusic-rid] |
| a=simulcast: recv 1;2 | [I-D.ietf-mmusic-sdp-simulcast] |

Table 34: 5.3.5 SDP Answer

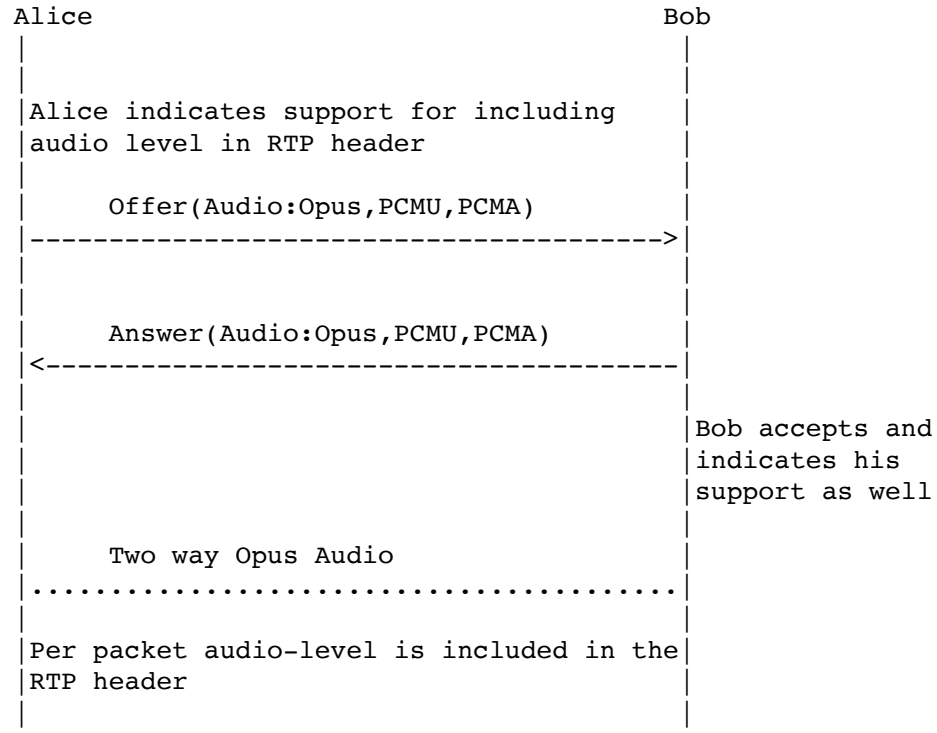
## 5.4. Others

The examples in the section provide SDP Offer/Answer exchange for a variety of scenarios related to RTP Header extension for conference usages, Legacy Interop scenarios and more.

### 5.4.1. Audio Session - Voice Activity Detection

This example shows Alice indicating the support of the RTP header extension to include the audio-level of the audio sample carried in the RTP packet.

2-Way Audio with VAD




| Offer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20518 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 54609 UDP/TLS/RTP/SAVPF 109 0 8 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:audio | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |

| | |
|---|---|
| a=rtpmap:0 PCMU/8000 | [RFC3551] |
| a=rtpmap:8 PCMA/8000 | [RFC3551] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] |
| a=ice-pwd:a28a397a4c3f31747d1ee34 74af08a068 | [RFC5245] |
| a=fingerprint:sha-256 19:E2:1C:3B :4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73 :04 :BB:05:2F:70:9F:04:A9:0E:05:E 9:26:33:E8:70:88:A2 | [RFC5245] |
| a=setup:actpass | [RFC4145] |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp:54609 IN IP4 24.23.204.141 | [RFC3605] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:* nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2113667327 192.168.1.4 61665 typ host | [RFC5245] |
| a=candidate:1 1 UDP 694302207 24.23.204.141 54609 typ srflx raddr 192.168.1.4 rport 61665 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |

Table 35: 5.4.1 SDP Offer

| Answer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 16833 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 49203 UDP/TLS/RTP/SAVPF 109 0 98 | [RFC4566] |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:audio | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack |

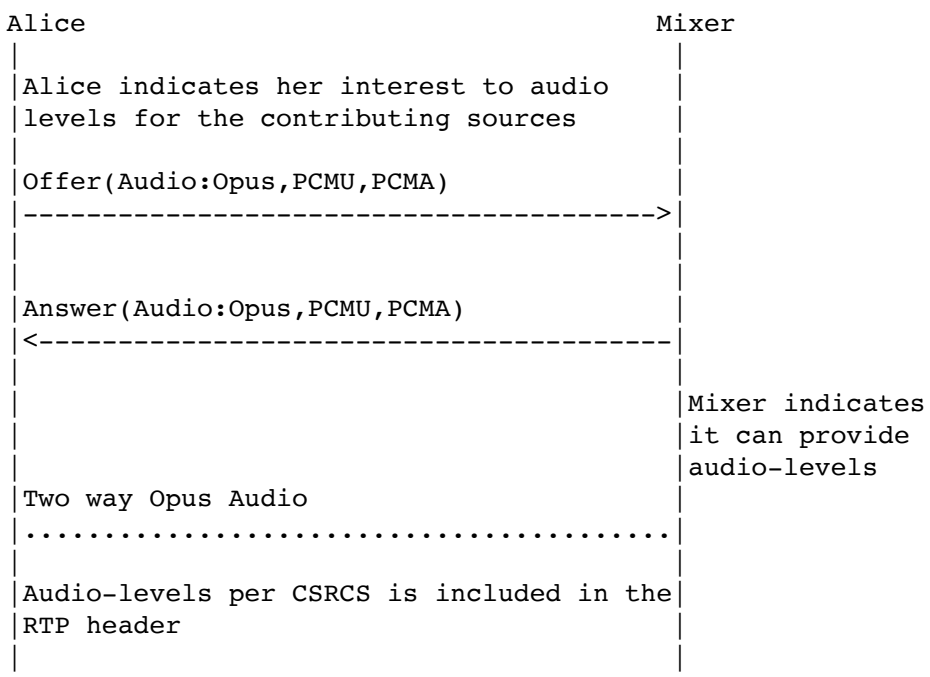
| | | |
|---|---|---|
| | | ID (ta) |
| a=sendrecv | | [RFC3264] - Bob can send and recv audio |
| a=rtpmap:109 opus/48000/2 | | [I-D.ietf-payload-rtp-opus] - Bob accepts only Opus Codec |
| a=rtpmap:0 PCMU/8000 | | [RFC3551] PCMU Audio Codec |
| a=rtpmap:0 PCMA/8000 | | [RFC3551] PCMA Audio Codec |
| a=maxptime:120 | | [RFC4566] |
| a=ice-ufrag:c300d85b | | [RFC5245] |
| a=ice-pwd:de4e99bd291c325921d5d47efbabd9a2 | | [RFC5245] |
| a=fingerprint:sha-256 6B:8B:F0:65:5F:78:E2:51:3B:AC:6F:F3:3F:46:1B:35 :DC:B8:5F:64:1A:24:C2:43:F0:A1:58:D0:A1:2C:19:08 | | [RFC5245] |
| a=setup:active | | [RFC4145] |
| a=dtls-id:1 | | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | | [RFC5761] - Bob can perform RTP/RTCP Muxing on port 49203 |
| a=rtcp-rsize | | [RFC5506] |
| a=rtcp-fb:* nack | | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2113667327 192.168.1.7 51556 typ host | | [RFC5245] |
| a=candidate:1 1 UDP 1694302207 98.248.92.77 49203 typ srflx raddr 192.168.1.7 rport 51556 | | [RFC5245] |
| a=end-of-candidates | | [I-D.ietf-mmusic-trickle-ice] |

Table 36: 5.4.1 SDP Answer

### 5.4.2. Audio Conference - Voice Activity Detection

This example shows SDP for RTP header extension that allows RTP-level mixers in audio conferences to deliver information about the audio level of individual participants.

Audio Conference with VAD Support




| Offer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20518 0 IN IP4 0.0.0.0 | [RFC4566] - Session Origin Information |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 54609 UDP/TLS/RTP/SAVPF 109 0 8 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:audio | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendrecv | [RFC3264] - Alice can send and recv audio |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |

| | |
|---|---|
| a=rtpmap:0 PCMU/8000 | [RFC3551] PCMU Audio Codec |
| a=rtpmap:0 PCMA/8000 | [RFC3551] PCMA Audio Codec |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] |
| a=ice-pwd:a28a397a4c3f31747d1ee34 74af08a068 | [RFC5245] |
| a=fingerprint:sha-256 19:E2:1C:3B :4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73 :04 :BB:05:2F:70:9F:04:A9:0E:05:E 9:26:33:E8:70:88:A2 | [RFC5245] |
| a=setup:actpass | [RFC4145] |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp:54609 IN IP4 24.23.204.141 | [RFC3605] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:* nack | [RFC5104] |
| a=extmap:1/recvonly urn:ietf:params:rtp-hdrext:csrc-audio-level | [RFC6465] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:3 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2113667327 192.168.1.4 61665 typ host | [RFC5245] |
| a=candidate:1 1 UDP 694302207 24.23.204.141 54609 typ srflx raddr 192.168.1.4 rport 61665 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |

Table 37: 5.4.2 SDP Offer

| Answer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 16833 0 IN IP4 0.0.0.0 | [RFC4566] - Session Origin Information |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE audio | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 49203 UDP/TLS/RTP/SAVPF 109 0 98 | [RFC4566] |

| | |
|---|---|
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=mid:audio | [RFC5888] |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=rtpmap:0 PCMU/8000 | [RFC3551] PCMU Audio Codec |
| a=rtpmap:0 PCMA/8000 | [RFC3551] PCMA Audio Codec |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:c300d85b | [RFC5245] |
| a=ice-pwd:de4e99bd291c325921d5d47efbabd9a2 | [RFC5245] |
| a=fingerprint:sha-256 6B:8B:F0:65:5F:78:E2:51:3B:AC:6F:F3:3F:46:1B:35 :DC:B8:5F:64:1A:24:C2:43:F0:A1:58:D0:A1:2C:19:08 | [RFC5245] |
| a=setup:active | [RFC4145] |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:* nack | [RFC5104] |
| a=extmap:1/sendonly urn:ietf:params:rtp-hdrext:csrc-audio-level | [RFC6465] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2113667327 192.168.1.7 51556 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1694302207 98.248.92.77 49203 typ srflx raddr 192.168.1.7 rport 51556 | [RFC5245] |
| a=end-of-candidates | [I-D.ietf-mmusic-trickle-ice] |

Table 38: 5.4.2 SDP Answer

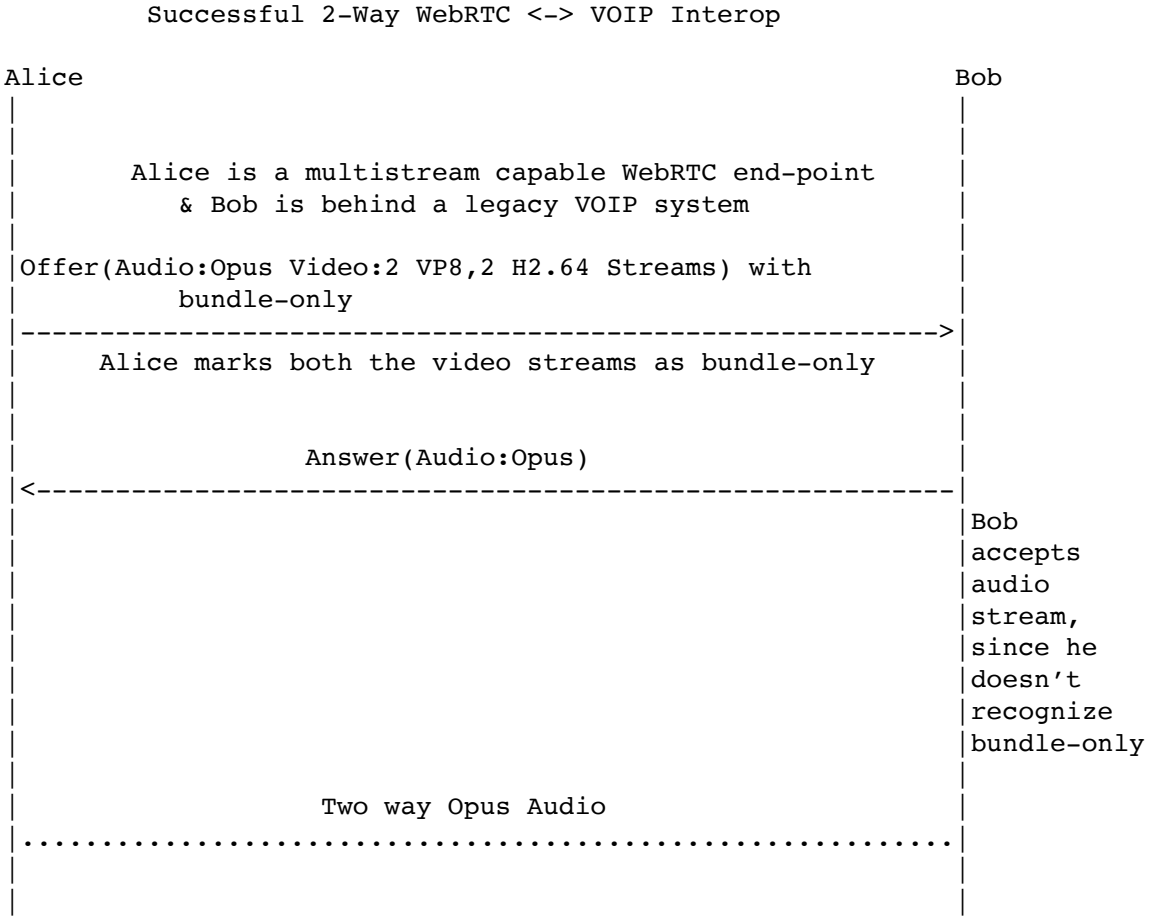
### 5.4.3. Successful legacy Interop Fallback with bundle-only

In the scenario described below, Alice is a multi-stream capable WebRTC endpoint while Bob is a legacy VOIP end-point. The SDP Offer/Answer exchange demonstrates successful session setup with fallback to audio only stream negotiated via bundle-only framework between the end-points. Specifically,

- Offer from Alice describes 2 cameras via 2 video m=lines with both marked as bundle-only.

- Since Bob doesnot recognize either the BUNDLE mechanism or the bundle-only attribute, he accepts only the audio stream from Alice.

NOTE: Since Alice is unaware of Bob's support for BUNDLE framework, Alice ensures to include separate RTP/RTCP ports and candidate information.




| Offer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20519 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=group:BUNDLE m0 m1 m2 | [I-D.ietf-mmusic-sdp-bundle |

| | |
|---|---|
| | -negotiation] Alice supports grouping of m=lines under BUNDLE semantics |
| a=group:LS m0 m1 | [RFC5888] |
| a=ice-options:trickle | [I-D.ietf-mmusic-trickle-ice] |
| ****** Audio m=line ********* | ********** |
| m=audio 54609 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=mid:m0 | [RFC5888] Audio m=line part of BUNDLE group with a unique port number |
| a=msid:ma ta | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (ta) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] |
| a=ice-pwd:a28a397a4c3f31747d1ee3474af08a068 | [RFC5245] |
| a=fingerprint:sha-256 19:E2:1C:3B:4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73:04:BB:05:2F:70:9F:04:A9:0E:05:E9:26:33:E8:70:88:A2 | [RFC5245] |
| a=setup:actpass | [RFC4145] |
| a=dtls-id:1 | [I-D.ietf-mmusic-dtls-sdp] |
| a=rtcp-mux | [RFC5761] |
| a=rtcp:64678 IN IP4 24.23.204.141 | [RFC3605] |
| a=rtcp-rsize | [RFC5506] |
| a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-audio-level | [RFC6464] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=candidate:0 1 UDP 2113667327 192.168.1.4 61665 typ host | [RFC5245] |
| a=candidate:1 1 UDP 694302207 24.23.204.141 54609 typ srflx raddr 192.168.1.4 rport 61665 | [RFC5245] |
| a=candidate:0 1 UDP 2113667326 192.168.1.4 61667 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1694302206 24.23.204.141 64678 typ srflx raddr 192.168.1.4 rport 61667 | [RFC5245] |
| ****** Video-1 m=line ********* | ********** |

| | |
|---|---|
| | ** |
| m=video 0 UDP/TLS/RTP/SAVPF 98 100 | bundle-only video line with port number set to zero |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=bundle-only | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=mid:m1 | [RFC5888] Video m=line part of BUNDLE group |
| a=msid:ma tb | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tb) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:98 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=imageattr:98 [x=1280,y=720] | [RFC6236] |
| a=fmtp:98 max-fr=30 | [RFC4566] |
| a=rtcp-fb:* nack | [RFC5104] |
| a=rtcp-fb:* nack pli | [RFC5104] |
| a=rtcp-fb:* ccm fir | [RFC5104] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| ****** Video-2 m=line ********* | ********** ** |
| m=video 0 UDP/TLS/RTP/SAVPF 101 103 | bundle-only video line with port number set to zero |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=bundle-only | [I-D.ietf-mmusic-sdp-bundle-negotiation] |
| a=mid:m2 | [RFC5888] Video m=line part of BUNDLE group |
| a=msid:ma tc | Identifies RTCMediaStream ID (ma) and RTCMediaStreamTrack ID (tc) |
| a=sendrecv | [RFC3264] |
| a=rtpmap:101 H264/90000 | [RFC3984] |
| a=rtpmap:103 H264/90000 | [RFC3984] |
| a=fmtp:101 profile-level-id=4d0028;packetization-mode=1;max-fr=30 | [RFC3984]Camera-2,Encoding-1 Resolution |
| a=rtcp-fb:* nack | [RFC5104] |
| a=rtcp-fb:* nack pli | [RFC5104] |
| a=rtcp-fb:* ccm fir | [RFC5104] |
| a=extmap:2 urn:ietf:params:rtp-hdrext:sdes:mid | [I-D.ietf-mmusic-sdp-bundle-negotiation] |

Table 39: 5.4.3 SDP Simulcast bundle-only

| Answer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20519 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| ****** Audio m=line ********* | ********** ***** |
| m=audio 49203 UDP/TLS/RTP/SAVPF 109 | [RFC4566] |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=rtcp:60065 IN IP4 24.23.204.141 | [RFC3605] |
| a=sendrecv | [RFC3264] |
| a=rtpmap:109 opus/48000/2 | [I-D.ietf-payload-rtp-opus] |
| a=maxptime:120 | [RFC4566] |
| a=ice-ufrag:ufrag:c300d85b | [RFC5245] |
| a=ice-pwd:de4e99bd291c325921d5d47efbabd9a2 | [RFC5245] |
| a=fingerprint:sha-256 6B:8B:F0:65:5F:78:E2:51:3B:AC:6F:F3:3F:46:1B:35 :DC:B8:5F:64:1A:24:C2:43:F0:A1:58:D0:A1:2C:19:08 | [RFC5245] |
| a=setup:active | [RFC4145] |
| a=rtcp-rsize | [RFC5506] |
| a=rtcp-fb:109 nack | [RFC5104] |
| a=extmap:1 urn:ietf:params:rtp-hdrext :ssrc-audio-level | [RFC6464] |
| a=candidate:0 1 UDP 2113667327 192.168.1.7 51556 typ host | [RFC5245] |
| a=candidate:1 1 UDP 694302207 98.248.92.77 49203 typ srflx raddr 192.168.1.7 rport 51556 | [RFC5245] |
| a=candidate:0 2 UDP 2113667326 192.168.1.7 51558 typ host | [RFC5245] |
| a=candidate:1 2 UDP 1694302206 98.248.92.77 60065 typ srflx raddr 192.168.1.7 rport 51558 | [RFC5245] |
| ****** Video m=line ********* | ********** ***** |
| m=video 0 UDP/TLS/RTP/SAVPF 98 100 | Bob doesn't recognize bundle-only and hence the m=line is rejected implicitly due to port 0 |
| ****** Video m=line ********* | ********** ***** |
| m=video 0 UDP/TLS/RTP/SAVPF 98 100 | Bob doesn't recognize bundle-only and hence the m=line is rejected |

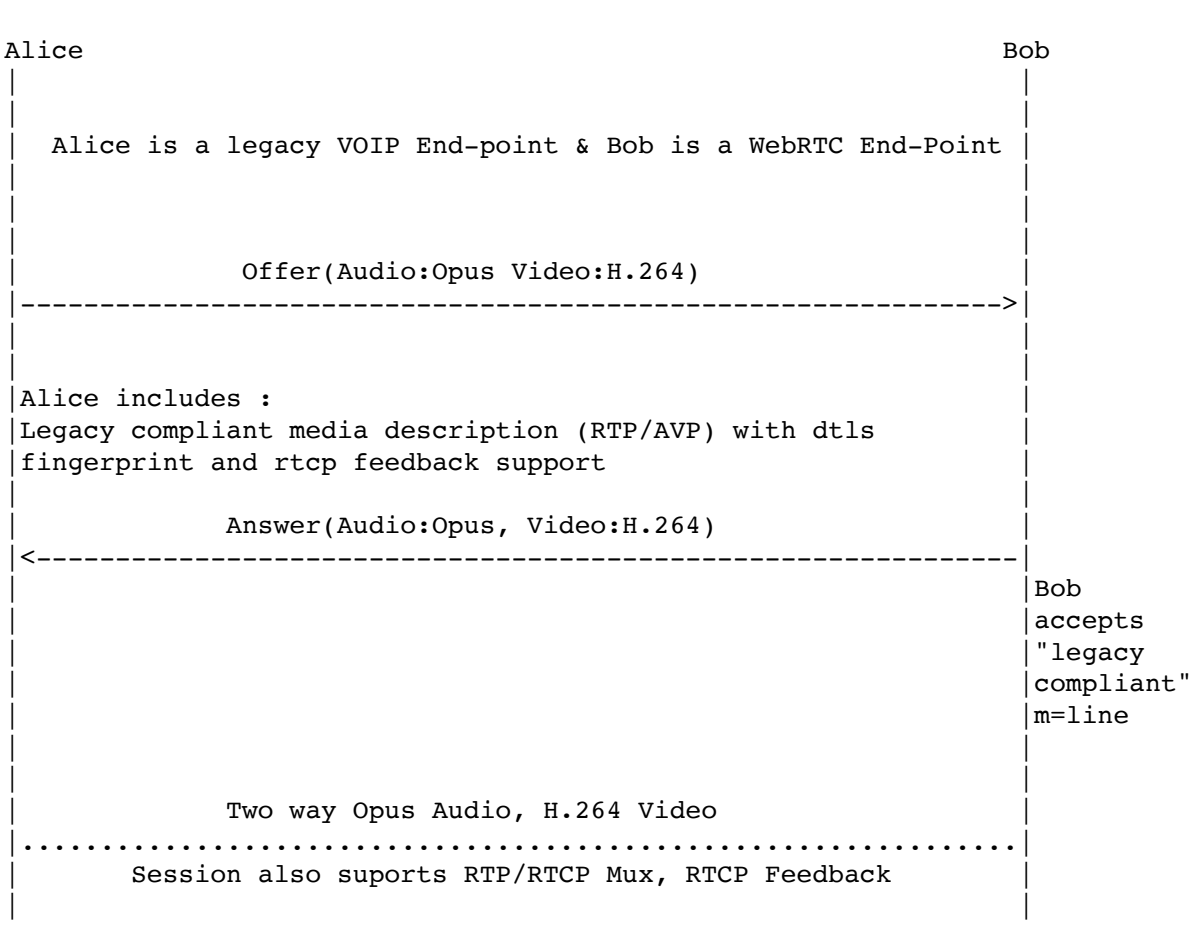
| | | implicitly due to port 0 |
|---|---|---|

Table 40: 5.4.3 SDP Answer

### 5.4.4. Legacy Interop with RTP/AVP profile

In the scenario desribed below, Alice is a legacy end-point which sends [RFC3264] Offer with RTP/AVP based audio and video descriptions along with DTLS fingerprint and RTCP feedback information.

On the other hand, Bob being a WebRTC end-point follows the procedures in section 5.1.2 of [I-D.ietf-rtcweb-jsep] and accepts the Alice's offer for DTLS-SRTP based session with RTCP feedback.



| Offer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 20518 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| a=ice-ufrag:074c6550 | [RFC5245] |
| a=ice-pwd:a28a397a4c3f31747d1ee3474af08a068 | [RFC5245] |
| a=rtcp-rsize | [RFC5506] |
| ****** Audio m=line ********* | ********** ***** |
| m=audio 54732 RTP/AVP 109 | [RFC4566]Alice includes RTP/AVP audio stream description |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=fingerprint:sha-256 19:E2:1C:3B:4B:9F:81:E6:B8:5C:F4:A5:A8:D8:73:04 :BB:05:2F:70:9F:04:A9:0E:05:E9:26:33:E8:70:88:A2 | [RFC5245] |
| a=rtpmap:109 opus/48000 | |
| a=ptime:20 | |
| a=sendrecv | [RFC3264] |
| a=rtcp-mux | [RFC5761]Alice still includes RTP/RTCP Mux support |
| a=candidate:0 1 UDP 2113667327 192.168.1.4 54732 typ host | [RFC5245] |
| a=candidate:1 1 UDP 694302207 24.23.204.141 54732 typ srflx raddr 192.168.1.4 rport 54732 | [RFC5245] |
| a=candidate:0 2 UDP 2113667326 192.168.1.4 64678 typ host | [RFC5245] |
| a=candidate:1 2 UDP 1694302206 24.23.204.141 64678 typ srflx raddr 192.168.1.4 rport 64678 | [RFC5245] |
| a=rtcp-fb:109 nack | [RFC5104]She adds her intent for NACK RTCP feedback support |
| ****** Video m=line ********* | ********** ***** |
| m=video 62445 RTP/AVP 120 | [RFC4566]Alice includes RTP/AVP video stream description |
| c=IN IP4 24.23.204.141 | [RFC4566] |
| a=fingerprint:sha-256 DC:B8:5F:64:1A:24:C2:43:F0:A1:58:D0:A1:2C:19:08 :6B:8B | [RFC5245] |

| | |
|---|---|
| :F0:65:5F:78:E2:51:3B:AC:6F:F3:3F:46:1 B:35 | |
| a=rtpmap:120 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=sendrecv | [RFC3264] |
| a=rtcp-mux | [RFC5761]Alice intends to perform RTP/RTCP Mux |
| a=candidate:0 1 UDP 2113667327 192.168.1.4 62445 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1694302207 24.23.204.141 62537 typ srflx raddr 192.168.1.4 rport 62445 | [RFC5245] |
| a=candidate:0 2 2113667326 192.168.1.4 54721 typ host | [RFC5245] |
| a=candidate:1 2 UDP 1694302206 24.23.204.141 54721 typ srflx raddr 192.168.1.4 rport 54721 | [RFC5245] |
| a=rtcp-fb:120 nack pli | [RFC5104] Alice indicates support for Picture loss Indication and NACK RTCP feedback |
| a=rtcp-fb:120 ccm fir | [RFC5104] |

Table 41: 5.4.5 SDP Offer

| Answer SDP Contents | RFC#/Notes |
|---|---|
| v=0 | [RFC4566] |
| o=- 16833 0 IN IP4 0.0.0.0 | [RFC4566] |
| s=- | [RFC4566] |
| t=0 0 | [RFC4566] |
| ****** Audio m=line ********* | ********** ***** |
| m=audio 49203 RTP/AVP 109 | [RFC4566] Bob accepts RTP/AVP based audio stream |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=rtpmap:109 opus/48000 | |
| a=ptime:20 | |
| a=sendrecv | [RFC3264] |
| a=ice-ufrag:c300d85b | [RFC5245] |
| a=ice-pwd:de4e99bd291c325921d5d47efbabd9a2 | [RFC5245] |
| a=fingerprint:sha-256 BB:05:2F:70:9F:0 4:A9:0E:05:E9:26:33:E8:70:88:A2 :19:E2 :1C:3B:4B:9F:81:E6:B8:5C:F4:A5:A8:D8:7 | [RFC5245] |

| | |
|---|---|
| 3:04 | |
| a=rtcp-mux | [RFC5761] |
| a=candidate:0 1 UDP 2113667327 192.168.1.7 49203 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1694302207 98.248.92.77 49203 typ srflx raddr 192.168.1.7 rport 49203 | [RFC5245] |
| a=candidate:0 2 UDP 2113667326 192.168.1.7 60065 typ host | [RFC5245] |
| a=candidate:1 2 UDP 1694302206 98.248.92.77 60065 typ srflx raddr 192.168.1.7 rport 60065 | [RFC5245] |
| a=rtcp-fb:109 nack | [RFC5104] |
| ****** Video m=line ********* | ********** ***** |
| m=video 63130 RTP/SAVP 120 | [RFC4566] Bob accepts RTP/AVP based video stram |
| c=IN IP4 98.248.92.77 | [RFC4566] |
| a=rtpmap:120 VP8/90000 | [I-D.ietf-payload-vp8] |
| a=sendrecv | [RFC3264] |
| a=ice-ufrag:e39091na | [RFC5245] |
| a=ice-pwd:dbc325921d5dd29e4e99147efbabd9a2 | [RFC5245] |
| a=fingerprint:sha-256 BB:0A9:0E:05:E9:26:33:E8:70:88:A25:2F:70:9F:04: :19:E2:1C:3B:4B:9F:81:5:2F:70:9F:04::F4:A5:A8:D8: | [RFC5245] |
| a=rtcp-mux | [RFC5761] |
| a=candidate:0 1 UDP 2113667327 192.168.1.7 63130 typ host | [RFC5245] |
| a=candidate:1 1 UDP 1694302207 98.248.92.77 63130 typ srflx raddr 192.168.1.7 rport 63130 | [RFC5245] |
| a=candidate:0 2 UDP 2113667326 192.168.1.7 56607 typ host | [RFC5245] |
| a=candidate:1 2 UDP 1694302206 98.248.92.77 56607 typ srflx raddr 192.168.1.7 rport 56607 | [RFC5245] |
| a=rtcp-fb:120 nack pli | [RFC5104] |
| a=rtcp-fb:120 ccm fir | [RFC5104] |

Table 42: 5.4.5 SDP Answer

## 6. IANA Considerations

This document requires no actions from IANA.

## 7. Acknowledgments

We would like to thank Justin Uberti, Chris Flo, Paul Kyzivat for their detailed review and inputs.

## 8. Change Log

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

Changes from draft-ietf-rtcweb-sdp-02 to draft-ietf-rtcweb-sdp-04

- Alignment with JSEP-19.
- Added a=identity example.
- Added a=dtls-id, a=group:LS in the examples.
- Added Appendix section to capture list of checklists for the attributes.
- Removed SSRC lines to match JSEP-19.
- Closed open issues on a=fingerprint, a=rtcp and a=rtcp-mux-only from ietf96 to reflect JSEP-19.
- Simplied Inter-op example

Changes from draft-ietf-rtcweb-sdp-02

- Version increment to avoid expiry

Changes from draft-ietf-rtcweb-sdp-01

- Complete face-lift
- Added visual markers around m=lines to indicate their type, added spacing between tables for aiding readers
- Updated table names to indicate offer vs answer
- Attempted to align to latest versions of SCTP, BUNDLE, MSID drafts
- Added mid header extensions to all the lines

- Harmonized BUNDLE semantics and conventions updated.

Changes from draft-ietf-rtcweb-sdp-00

- Updated Simulcast/FEC/RTX examples to use RID framework
- Fixed BUNDLE references for a=bundle-only

Changes from draft-nandakumar-rtcweb-sdp-08

- Fixed typos
- Moved to a WG version

Changes from draft-nandakumar-rtcweb-sdp-06 and draft-nandakumar-rtcweb-sdp-07

- Added clarification on Call-Flow diagram usage
- More cleanups

Changes from draft-nandakumar-rtcweb-sdp-05

- Added Ascii chart for all the SDP Eaxamples
- Improved text and updated SDP Examples for Simulcast and FEC
- Fixed MediaStream ID Semantics SDP Errors

Changes from draft-nandakumar-rtcweb-sdp-04

- Interim version of the draft to avert expiry
- Corrected placement of c= line as per RFC4566
- Updated simulcast SDP to reflect draft-westerlund-avtcore-rtp-simulcast-04

Changes from draft-nandakumar-rtcweb-sdp-03

- Aligned more closely with JSEP version -05
- Added Conventions to help readability
- Add more examples to clarify BUNDLE use-cases

Changes from draft-nandakumar-rtcweb-sdp-02

- Major refactoring was done to group the examples in to categories
- SDP was updated through out to reflect JSEP-04 style of defining attributes per m=line than at the session level.
- Added 8 new examples.
- Updated references for Trickle, Unified Plan
- Add section to explain the syntax conventions followed in the examples.

Changes from draft-nandakumar-rtcweb-sdp-01

- Updated references to OPUS RTP Payload Specification.
- Updated BUNDLE examples based on the latest draft-ietf-mmusic-sdp-bundle-negotiation.
- Added examples for multiple audio and video flows based on Unified Plan.
- Added new examples for RTX and FEC streams
- Updated Simulcast and SVC examples

Changes from draft-nandakumar-rtcweb-sdp-00

- Fixed editorial comments on the mailing list.
- Updated Data-channel SDP information based on draft-ietf-mmusic-sctp-sdp.
- Updated BUNDLE examples based on draft-ietf-mmusic-sdp-bundle-negotiation.
- Added examples for few more BUNDLE variants
- Added new examples for Simulcast and SVC

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# Appendix A. Appendix

## A.1. JSEP SDP Attributes Checklist

This section compiles a high-level checklist of required SDP attributes to be verified against the examples defined in this specification. The goal here is to ensure that the examples are compliant to the rules defined in section 5 of the [I-D.ietf-rtcweb-jsep] specification.

### A.1.1. Common Checklist

This subsection lists SDP attributes that mostly apply at the session level.

- v=0 MUST be the first SDP line
- o= line MUST follow with values '-' for username, 64 bit value for session id and dummy values for 'nettype', 'addrtype' and 'unicast-address' (such as IN IP4 0.0.0.0)
- o= line MUST have the session version incremented in the cases of subsequent offers.

- s= MUST be the third line with value '-'.
- t= line MUST follow with values for 'start-time' and 'stop-time' set to zeroes.
- a=identity line MUST be included at the session level if WEBRTC Identity is being used.
- a=ice-options:trickle MUST be present at the session level in all offers and answers when supported.

### A.1.2. RTP Media Description Checklist

Following set of checklist items apply to RTP audio and video media descriptions.

- The media description's port value MUST either be set to dummy value of '9' or MUST use the port from the default candidate, if available.
- The media description's proto value MUST be 'UDP/TLS/RTP/SAVPF' for JSEP offers.
- JSEP answerer MUST support any combination of RTP/[S]AVP[F] for interoperability scenarios as defined in section 5 of [I-D.ietf-rtcweb-jsep]
- c= line MUST be the first line in a media description. A dummy value of 'IN IP 0.0.0.0' is set if there are no candidates gathered or its value MUST match the default candidate.
- a=mid attribute MUST be in included.
- One of a=sendrecv/a=sendonly/a=recvonly/a=inactive SDP direction attributes MUST be present.
- a=rtpmap and a=fmtp attributes per primary, retransmission and forward error correction media format MUST be included.
- a=rtcp-fb lines for each supported feedback mechanism MUST be included when using RTP with feedback
- a=imageattr can be optionally present for video media descriptions.
- a=msid line MUST be included for all the media senders identifying the MediaStreamTrack (i.e when a=sendonly/a=sendrecv attribute is present).

- a=extmap line identifying the BUNDLE header extension MUST be present.

- a=extmap lines for other supported RTP header extensions MUST be included.

- a=rid line 'per encoding' with the direction of 'send' MUST be included when further constraining the media format or multiple encodings per media format is needed.

- a=simulcast line MUST be present if there exists more than one 'a=rid' lines for the media senders.

- a=bundle-only attribute MUST be present for media descriptions that are impacted by various bundle policies (such as max-bundle/ balanced)

- For media descriptions that aren't "a=bundle-only" and that have unique address, following attributes MUST be present:

  * a=ice-ufrag and a=ice-pwd

  * a=fingerprint

  * a=setup with value 'actpass' in the offers and a value of 'active'/'passive' in the answerer.

  * a=dtls-id

  * a=rtcp

  * a=rtcp-mux

  * For offerers requiring RTCP to be multiplexed, 'a=rtcp-mux-only' line

  * a=rtcp-rsize

- a=group:BUNDLE line with all the 'mid' identifiers part of BUNDLE is included at the session level.

- a=group:LS session level attribute MUST be included wth 'mid' identifiers that are part of the lip same sync group.

### A.1.3. DataChannel Media Description checklist

If a datachannel is required, an 'application' type media description MUST be included with the following properties:

- Media description's proto value MUST be 'UDP/DTLS/SCTP' in the JSEP offers.
- An JSEP answerer MUST support reception of 'UDP/DTLS/SCTP'/'TCP/DTLS/SCTP'/'DTLS/SCTP' for backward compatibility reasons.
- A value of 'webrtc-datachannel' MUST be used for the media description 'fmt' value.
- a=mid line MUST be present.
- a=sctp-port with SCTP port number MUST be included.
- a=max-message-size MAY be included, if appropriate.

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