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SDP for the WebRTC
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Abstract

The Web Real-Time Communication (WebRTC) [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 negotiataion happens based on the SDP Offer/Answer exchange mechanism described in the RFC 3264 [RFC3264].

This document serves a introductory purpose in describing the role of SDP for the most common WebRTC use-cases.

Status of this Memo

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1. Introduction

Javascript Session Exchange Protocol(JSEP) [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 multimedia session. For this purpose, SDP is used to construct [RFC3264] offers/answers for describing (media and non-media) streams as appropriate for recipients of a session description to participate in the session.

The remainder of this document is organized as follows: Section 3 and 4 provide an overview of SDP and the Offer/Answer exchange mechanism. Section 5 and 6 provide sample SDP usages 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 the [RFC4566].

The Session Description Protocol (SDP) [RFC4566] describes multimedia sessions,which can be audio,video, whiteboards,fax,modem, and other streams. It 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,Real-time Transport Protocol, and Real-time Streaming Protocol.

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

[WEBRTC] proposes JavaScript application to fully control the signaling plane of a multimedia session as described in the JSEP

specification [JSEP]. JSEP provides mechanisms to create session characterisation and media definition information to conduct the session based on SDP exchanges.

In this context,SDP serves two purposes:
   Provide grammatical structure syntatically
   Semantically convey partipant's intention and capabilities.

4. Offer/Answer and the WebRTC

This section introduces SDP Offer/Answer Exchange mechanism mandated by WebRTC for negotitating 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 [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 modelled on 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 initial setup stages as well as for eventual session updates. Javascript Session Establishment Protocol specification [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.

The following sections provide samples of SDP message details and exchanges for the most common WebRTC usecases.

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 Media streams
MAY contain zero or more non-media data streams
All the streams are secured with DTLS/SRTP
ICE processing for NAT Traversal
Sessions over IPv4-only, IPv6-only, dual-stack based clients.

As mentioned earlier [WEBRTC] proposes using SDP based Offer/Answer model to negotiate multimedia session between peers' browsers Building on the concepts from the previous sections, the following subsections attempts to describe the usage of SDP for the most common WebRTC use-cases.

In all the use-cases, Alice and Bob are assumed to be the WebRTC peers unless mentioned otherwise. Pointers to appropriate RFCs and notes are provided, wherever necessary,agains the SDP lines.

5.1. Secure Two-Way Audio,Video and Data with RTCP Feedback

This use-case allows two users to participate in a two-way communication session securely on their WebRTC enabled Web browsers.

```
title WebRTC Session - 2-Way Secure Audio,Video with RTCP Feedback
Alice->Bob: Offer(Audio:G.711,Opus,iLBC Video:H.264,VP8)
Bob->Alice: Answer(Audio:Opus,DTMF Video:H.264)
Alice->Bob: Two-way Opus Audio, H.264 Video
note right of Alice
  Session also suports RTP/RTCP Mux, RTCP feedback (nack,pli)
end note
```

More specifically, this use-case demonstrates following aspects of a WebRTC session
SRTP with DTLS based encryption
RTP and RTCP Muxing
RTCP based feedback and reduced size support
ICE processing for NAT Traversal
Audio Codec Offered : PCMU, Opus, iLBC
Audio Codec Answered : Opus
Video Codecs Offered: H.264, VP8
Video Codecs Answered: H.264
Data Channel Support
The tables (4.1 and 4.2) below capture in detail, the initial SDP Offer and Answer messages exchanged.

```
   +---------------------------------------------+-----------------------+
   | SDP Contents                                | RFC#/Notes            |
   +---------------------------------------------+-----------------------+
   | v=0                                         | [RFC4566]             |
   | o=alice 20518 0 IN IP4 0.0.0.0              | [RFC4566] - Session   |
   |                                             | Origin Information    |
   | s=                                          | [RFC4566]             |
   | t=0 0                                       | [RFC4566]             |
   | a=ice-ufrag:074c6550                        | [RFC5245] - Session   |
   |                                             | Level ICE parameter   |
   | a=ice-pwd:a28a397a4c3f31747d1ee3474af08a    | [RFC5245] - Session   |
   | 068                                         | Level ICE parameter   |
   | a=fingerprint:sha-1                         | [RFC5245] - Session   |
   | 99:41:49:83:4a:97:0e:1f:ef:6d:f7:c9:c7:7    | DTLS Fingerprint for  |
   | 0:9d:1f:66:79:a8:07                         | SRTP                  |
   | a=rtcp-rsize                                | [RFC5506] - Alice     |
   |                                             | intends to use reduced |
   |                                             | size RTCP for this    |
   |                                             | session               |
   | m=audio 54609 RTP/SAVPF 0 109 98            | [RFC4566]             |
   | c= IN IP4 24.23.204.141                     | [RFC4566]             |
   | a=rtpmap:0 PCMU/8000                        | [RFC3551]             |
   | a=rtpmap:109 opus/48000                     | [draft-spittka-payload |
   |                                             | -rtp-opus]            |
   | a=ptime:20                                  | [draft-spittka-payload |
   |                                             | -rtp-opus]            |
   | a=rtpmap:98 iLBC/8000 a=fmtp:98 mode=20     | [RFC3952]             |
   | a=sendrecv                                  | [RFC3264] - Alice can |
   |                                             | send and recv audio   |
   | a=rtcp-mux                                  | [RFC5761] - Alice can |
   |                                             | perform RTP/RTCP      |
   |                                             | Muxing on port 54609  |
   | b=AS:256                                    | [RFC4566]             |
   | b=RS:0                                      | [RFC3556]             |
   | b=RR:0                                      | [RFC3556]             |
   | a=candidate:0 1 UDP 2113667327              | [RFC5245] - Host ICE  |
   | 192.168.1.4 54609 typ host                  | Candidate             |
   | a=candidate:1 1 UDP 694302207               | [RFC5245] - Server    |
   | 24.23.204.141 54609 typ srflx raddr         | Reflexive ICE         |
   | 192.168.1.4 rport 54609                     | Candidate for the     |
   |                                             | above host candidate  |
   | a=candidate:0 2 UDP 2113667326              | [RFC5245] - Second    |
   | 192.168.1.4 64678 typ host                  | Host Candidate        |
   | a=candidate:1 2 UDP 1694302206              | [RFC5245] -Server     |
   | 24.23.204.141 64678 typ srflx raddr         | Reflexive Candidate   |
   | 192.168.1.4 rport 64678                     | for the Second Host   |
   |                                             | Candidate             |
```

```
| a=rtcp-fb:109 nack                        | [RFC5104] - Indicates  |
|                                           | NACK RTCP feedback     |
|                                           | support                |
| m=video 62537 RTP/SAVPF 99 120            | [RFC4566]              |
| c= IN IP4 24.23.204.141                   | [RFC4566]              |
| a=rtpmap:99 H264/90000                    | [RFC3984]              |
| a=fmtp:99                                 | [RFC3984]              |
| profile-level-id=4d0028;packetization-mo  |                        |
| de=1                                      |                        |
| a=rtpmap:120 VP8/90000                    | [draft-ietf-payload-vp |
|                                           | 8]                     |
| a=sendrecv                                | [RFC3264] - Alice can  |
|                                           | send and recv video    |
| a=rtcp-mux                                | [RFC5761] - Alice can  |
|                                           | perform RTP/RTCP       |
|                                           | Muxing on port 62537   |
| a=candidate:0 1 UDP 2113667327            | [RFC5245]              |
| 192.168.1.4 62537 typ host                |                        |
| a=candidate:1 1 UDP 1694302207            | [RFC5245]              |
| 24.23.204.141 62537 typ srflx raddr       |                        |
| 192.168.1.4 rport 62537                   |                        |
| a=candidate:0 2 2113667326 192.168.1.4    | [RFC5245]              |
| 54721 typ host                            |                        |
| a=candidate:1 2 UDP 1694302206            | [RFC5245]              |
| 24.23.204.141 54721 typ srflx raddr       |                        |
| 192.168.1.4 rport 54721                   |                        |
| 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=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                |
| m=application 56966 SCTP/DTLS 5000        | [draft-ietf-rtcweb-dat |
|                                           | a-channel]             |
| c= IN IP4 24.23.204.141                   | [RFC4566]              |
| a=fmtp:5000                               | [draft-ietf-rtcweb-dat |
| protocol=webrtc-datachannel;streams=16    | a-channel]             |
```

a=sendrecv	[RFC3264] - Alice can send and recv non-media data
a=rtcp-mux	[RFC5761] - Alice can perform RTP/RTCP Muxing on port 56966
a=candidate:0 1 UDP 2113667327 192.168.1.7 56966 typ host	[RFC5245]
a=candidate:1 1 UDP 1694302207 24.23.204.141 56966 typ srflx raddr 192.168.1.7 rport 56966	[RFC5245]
a=candidate:0 2 UDP 2113667326 192.168.1.7 51641 typ host	[RFC5245]
a=candidate:1 2 UDP 1694302206 24.23.204.141 51641 typ srflx raddr 192.168.1.7 rport 51641	[RFC5245]
a=rtcp-fb:5000 nack	[RFC5104] - Indicates NACK feedback support for the data-channel

Table 1: 4.1 SDP Offer

SDP Contents	RFC#/Notes
v=0	[RFC4566]
o=bob 16833 0 IN IP4 0.0.0.0	[RFC4566] - Session Origin Information
s=	[RFC4566]
t=0 0	[RFC4566]
a=ice-ufrag:c300d85b	[RFC5245] - Session Level ICE username frag
a=ice-pwd:de4e99bd291c325921d5d47efbabd9 a2	[RFC5245] - Session Level ICE password
a=fingerprint:sha-1 99:41:49:83:4a:97:0e:1f:ef:6d:f7:c9:c7:7 0:9d:1f:66:79:a8:07	[RFC5245] - Session DTLS Fingerprint for SRTP
a=rtcp-rsize	[RFC5506] - Alice intends to use reduced size RTCP for this session
m=audio 49203 RTP/SAVPF 109	[RFC4566]
c= IN IP4 98.248.92.77	[RFC4566]
a=rtpmap:109 opus/48000	[draft-spittka-payload -rtp-opus]
a=ptime:20	[draft-spittka-payload -rtp-opus]
a=sendrecv	[RFC3264] - Bob can send and recv audio
a=rtcp-mux	[RFC5761] - Bob can perform RTP/RTCP Muxing on port 49203
a=candidate:0 1 UDP 2113667327 192.168.1.7 49203 typ host	[RFC5245] - Host ICE Candidate for Opus Stream
a=ccandidate:1 1 UDP 1694302207 98.248.92.77 49203 typ srflx raddr 192.168.1.7 rport 49203	[RFC5245] - Server Reflexive ICE Candidate for the above host candidate
a=candidate:candidate:0 2 UDP 2113667326 192.168.1.7 60065 typ host	[RFC5245] - Second Host Candidate
a=candidate:1 2 UDP 1694302206 98.248.92.77 60065 typ srflx raddr 192.168.1.7 rport 60065	[RFC5245] -Server Reflexive Candidate for the Second Host Candidate
m=video 63130 RTP/SAVPF 99	[RFC4566]
c= IN IP4 98.248.92.771	[RFC4566]
a=rtpmap:99 H264/90000	[RFC3984]

a=fmtp:99 profile-level-id=4d0028;packetization-mode=1	[RFC3984]
a=sendrecv	[RFC3264] - Bob can send and recv video
a=rtcp-mux	[RFC5761] - Bob can perform RTP/RTCP Muxing on port 63130
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: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
m=application 55700 SCTP/DTLS 5000	[draft-ietf-rtcweb-data-channel]
c= IN IP4 98.248.92.771	[RFC4566]
a=fmtp:5000 protocol=webrtc-datachannel;streams=16	[draft-ietf-rtcweb-data-channel]
a=sendrecv	[RFC3264] - Bob can send and recv non-media data
a=rtcp-mux	[RFC5761] - Bob can perform RTP/RTCP Muxing on port 55700
a=candidate:0 1 UDP 2113667327 192.168.1.7 55700 typ host	[RFC5245] - Refer 4.1 SDP Offer
a=candidate:1 1 UDP 1694302207 98.248.92.77 55700 typ srflx raddr 192.168.1.7 rport 55700	[RFC5245] Refer 4.1 SDP Offer
a=candidate:0 2 UDP 2113667326 192.168.1.7 58137 typ host	[RFC5245] Refer 4.1 SDP Offer
a=candidate:1 2 UDP 1694302206 98.248.92.77 58137 typ srflx raddr 192.168.1.7 rport 581371	[RFC5245] Refer 4.1 SDP Offer

a=rtcp-fb:5000 nack	[RFC5104] - Indicates NACK feedback support for the data-channel

Table 2: 4.1 SDP Answer

5.2. Secure Two-way Audio,Video,Data and remove data stream

This scenario builds upon from the usecase in the section 5.1 It extends by Alice removing data-stream once the session is in progress.

```
title WebRTC Session (Audio,Video,Datachannel) - Drop Datachannel
note right of Alice
    Alice & Bob are in a two-way audio,video and datachannel session.
   Alice decides to stop the datachannel stream
end note
Alice->Bob: Offer(Audio:Opus Video:VP8, Application: Drop)
Bob->Alice: Answer(Audio:Opus Video:VP8, Application:Drop)
Alice->Bob: Two-way Opus Audio and VP8 Video
```

As a precondition, A Two-Way Audio,Video and Data Session is already setup.

SDP Contents	RFC#/Notes
v=0	[RFC4566]
o=alice 20519 0 IN IP4 0.0.0.0	[RFC4566]
s=	[RFC4566]
t=0 0	[RFC4566]
a=ice-ufrag:074c6550	[RFC5245]
a=ice-pwd:a28a397a4c3f31747d1ee3474af08a 068	[RFC5245]
a=fingerprint:sha-1 99:41:49:83:4a:97:0e:1f:ef:6d:f7:c9:c7:7 0:9d:1f:66:79:a8:07	[RFC5245]
a=rtcp-rsize	[RFC5506]
m=audio 54609 RTP/SAVPF 0 109 98	[RFC4566]
c= IN IP4 24.23.204.141	[RFC4566]
a=rtpmap:0 PCMU/8000	[RFC3551]
a=rtpmap:109 opus/48000	[draft-spittka-payload -rtp-opus]
a=ptime:20	[draft-spittka-payload -rtp-opus]
a=rtpmap:98 iLBC/8000 a=fmtp:98 mode=20	[RFC3952]
a=sendrecv	[RFC3264]

a=rtcp-mux	[RFC5761]
a=candidate:0 1 UDP 2113667327	[RFC5245]
192.168.1.4 54609 typ host	
a=candidate:1 1 UDP 694302207	[RFC5245]
24.23.204.141 54609 typ srflx raddr	
192.168.1.4 rport 54609	
a=candidate:0 2 UDP 2113667326	[RFC5245]
192.168.1.4 64678 typ host	
a=candidate:1 2 UDP 1694302206	[RFC5245]
24.23.204.141 64678 typ srflx raddr	
192.168.1.4 rport 64678	
a=rtcp-fb:109 nack	[RFC5104]
m=video 62537 RTP/SAVPF 99 120	[RFC4566]
c= IN IP4 24.23.204.141	[RFC4566]
a=rtpmap:99 H264/90000	[RFC3984]
a=fmtp:99	[RFC3984]
profile-level-id=4d0028;packetization-mo	
de=1	
a=rtpmap:120 VP8/90000	[draft-ietf-payload-vp
	8]
a=sendrecv	[RFC3264]
a=rtcp-mux	[RFC5761]
a=candidate:0 1 UDP 2113667327	[RFC5245]
192.168.1.4 62537 typ host	
a=candidate:1 1 UDP 1694302207	[RFC5245]
24.23.204.141 62537 typ srflx raddr	
192.168.1.4 rport 62537	
a=candidate:0 2 2113667326 192.168.1.4	[RFC5245]
54721 typ host	
a=candidate:1 2 UDP 1694302206	[RFC5245]
24.23.204.141 54721 typ srflx raddr	
192.168.1.4 rport 54721	
a=rtcp-fb:99 nack pli	[RFC5104]
a=rtcp-fb:99 ccm fir	[RFC5104]
a=rtcp-fb:120 nack pli	[RFC5104]
a=rtcp-fb:120 ccm fir	[RFC5104]
m=application 0 SCTP/DTLS 5000	[draft-ietf-rtcweb-dat
	a-channel] - Port 0
	indicates dropping
	data stream
c= IN IP4 24.23.204.141	[RFC4566]
a=fmtp:5000	[draft-ietf-rtcweb-dat
protocol=webrtc-datachannel;streams=16	a-channel]
a=sendrecv	[RFC3264]
a=rtcp-mux	[RFC5761]
a=candidate:0 1 UDP 2113667327	[RFC5245]
192.168.1.7 56966 typ host	

a=candidate:1 1 UDP 1694302207 24.23.204.141 56966 typ srflx raddr 192.168.1.7 rport 56966	[RFC5245]
a=candidate:0 2 UDP 2113667326 192.168.1.7 51641 typ host	[RFC5245]
a=candidate:1 2 UDP 1694302206 24.23.204.141 51641 typ srflx raddr 192.168.1.7 rport 51641	[RFC5245]
a=rtcp-fb:5000 nack	[RFC5104]

Table 3: 4.2 SDP Updated Offer w/DataChannel Drop

```
   +---------------------------------------+-----------------------+
   | SDP Contents                          | RFC#/Notes            |
   +---------------------------------------+-----------------------+
   | v=0                                   | [RFC4566]             |
   | o=bob 16833 0 IN IP4 0.0.0.0          | [RFC4566]             |
   | s=                                    | [RFC4566]             |
   | t=0 0                                 | [RFC4566]             |
   | a=ice-ufrag:c300d85b                  | [RFC5245]             |
   | a=ice-pwd:de4e99bd291c325921d5d47efbabd9 | [RFC5245]          |
   | a2                                    |                       |
   | a=fingerprint:sha-1                   | [RFC5245]             |
   | 99:41:49:83:4a:97:0e:1f:ef:6d:f7:c9:c7:7 |                    |
   | 0:9d:1f:66:79:a8:07                   |                       |
   | a=rtcp-rsize                          | [RFC5506]             |
   | m=audio 49203 RTP/SAVPF 109           | [RFC4566]             |
   | c= IN IP4 98.248.92.77                | [RFC4566]             |
   | a=rtpmap:109 opus/48000               | [draft-spittka-payload |
   |                                       | -rtp-opus]            |
   | a=ptime:20                            | [draft-spittka-payload |
   |                                       | -rtp-opus]            |
   | a=sendrecv                            | [RFC3264]             |
   | a=rtcp-mux                            | [RFC5761]             |
   | a=candidate:0 1 UDP 2113667327        | [RFC5245]             |
   | 192.168.1.7 49203 typ host            |                       |
   | a=ccandidate:1 1 UDP 1694302207       | [RFC5245]             |
   | 98.248.92.77 49203 typ srflx raddr    |                       |
   | 192.168.1.7 rport 49203               |                       |
   | a=candidate:candidate:0 2 UDP 2113667326 | [RFC5245]          |
   | 192.168.1.7 60065 typ host            |                       |
   | a=candidate:1 2 UDP 1694302206        | [RFC5245]             |
   | 98.248.92.77 60065 typ srflx raddr    |                       |
   | 192.168.1.7 rport 60065               |                       |
   | m=video 63130 RTP/SAVPF 99 120        | [RFC4566]             |
   | c= IN IP4 98.248.92.771               | [RFC4566]             |
   | a=rtpmap:99 H264/90000                | [RFC3984]             |
   | a=fmtp:99                             | [RFC3984]             |
   | profile-level-id=4d0028;packetization-mo |                    |
   | de=1                                  |                       |
   | a=rtpmap:120 VP8/90000                | [draft-ietf-payload-vp |
   |                                       | 8]                    |
   | a=sendrecv                            | [RFC3264]             |
   | a=rtcp-mux                            | [RFC5761]             |
   | a=candidate:0 1 UDP 2113667327        | [RFC5245]             |
   | 192.168.1.7 63130 typ host            |                       |
   | a=candidate:1 1 UDP 1694302207        | [RFC5245]             |
   | 98.248.92.77 63130 typ srflx raddr    |                       |
   | 192.168.1.7 rport 63130               |                       |
```

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:99 nack pli	[RFC5104]
a=rtcp-fb:99 ccm fir	[RFC5104]
m=application 0 SCTP/DTLS 5000	[draft-ietf-rtcweb-data-channel] Bob accepts dropping the data stream
c= IN IP4 98.248.92.771	[RFC4566]
a=fmtp:5000 protocol=webrtc-datachannel;streams=16	[draft-ietf-rtcweb-data-channel]
a=sendrecv	[RFC3264]
a=rtcp-mux	[RFC5761]
a=candidate:0 1 UDP 2113667327 192.168.1.7 55700 typ host	[RFC5245]
a=candidate:1 1 UDP 1694302207 98.248.92.77 55700 typ srflx raddr 192.168.1.7 rport 55700	[RFC5245]
a=candidate:0 2 UDP 2113667326 192.168.1.7 58137 typ host	[RFC5245]
a=candidate:1 2 UDP 1694302206 98.248.92.77 58137 typ srflx raddr 192.168.1.7 rport 581371	[RFC5245]
a=rtcp-fb:5000 nack	[RFC5104]

Table 4: 4.2 SDP Updated Answer

5.3. Secure Two-Way Audio,Video w/Bundle

This use-case demonstrates a successfull audio and video multiplexing scenario with SDP Bundle negotiation.

The semantics of group:BUNLDE attribute would be defined for two different scenarios as follows

Receiver Supports Bundle: In this case, the receiver places a group:BUNDLE line in the answer and it sends all the media to the mids in the BUNDLE group to the port number identified for the m-line corresponding to the first mid in the BUNDLE group. Thus, Alice recieves Audio and Video multiplexed onto the port 54609 as as per the example below.

Receiver Doesn't Support Bundle: In this case, the receiver doesn't include a group:BUNDLE attribute and audio/video RTP streams are sent to the appropriate ports specified in the offer.

```
title WebRTC Session - 2-Way Secure Audio,Video with Bundle
Alice->Bob: Offer(Audio:Opus Video:VP8)
Bob->Alice: Answer(Audio:Opus Video:VP8)
Alice->Bob: Two-way Opus Audio, H.264 Video
note right of Alice
  Session also suports RTP/RTCP Mux, RTCP feedback (nack,pli) with
  multiplexing of audio and video RTP data.
end note

+-------------------------------------------+-------------------------+
| SDP Contents                              | RFC#/Notes              |
+-------------------------------------------+-------------------------+
| v=0                                       | [RFC4566]               |
| o=alice 20518 0 IN IP4 0.0.0.0            | [RFC4566]               |
| s=                                        | [RFC4566]               |
| t=0 0                                     | [RFC4566]               |
| a=ice-ufrag:074c6550                      | [RFC5245]               |
| a=ice-pwd:a28a397a4c3f31747d1ee3474af08a  | [RFC5245]               |
| 068                                       |                         |
| a=fingerprint:sha-1                       | [RFC5245]               |
| 99:41:49:83:4a:97:0e:1f:ef:6d:f7:c9:c7:7  |                         |
| 0:9d:1f:66:79:a8:07                       |                         |
| a=rtcp-rsize                              | [RFC5506]               |
| a=group:BUNDLE foo bar                    | [RFC5888]Alice          |
|                                           | supports grouping of    |
|                                           | m= lines                |
| m=audio 54609 RTP/SAVPF 109               | [RFC4566]               |
| c= IN IP4 24.23.204.141                   | [RFC4566]               |
| a=mid:foo                                 | [RFC5888]Audio m= line  |
|                                           | part of Bundle group    |
| a=rtpmap:109 opus/48000                   | [draft-spittka-payload  |
|                                           | -rtp-opus]              |
| a=ptime:20                                | [draft-spittka-payload  |
|                                           | -rtp-opus]              |
| a=sendrecv                                | [RFC3264]               |
| a=rtcp-mux                                | [RFC5761]               |
| a=candidate:0 1 UDP 2113667327            | [RFC5245]               |
| 192.168.1.4 54609 typ host                |                         |
| a=candidate:1 1 UDP 694302207             | [RFC5245]               |
| 24.23.204.141 54609 typ srflx raddr       |                         |
| 192.168.1.4 rport 54609                   |                         |
| a=candidate:0 2 UDP 2113667326            | [RFC5245]               |
| 192.168.1.4 64678 typ host                |                         |
| a=candidate:1 2 UDP 1694302206            | [RFC5245]               |
| 24.23.204.141 64678 typ srflx raddr       |                         |
| 192.168.1.4 rport 64678                   |                         |
| a=rtcp-fb:109 nack                        | [RFC5104]               |
| m=video 62537 RTP/SAVPF 120               | [RFC4566]               |
```

c= IN IP4 24.23.204.141	[RFC4566]
a=mid:bar	[RFC5888]Video m=line part of the Bundle group
a=rtpmap:120 VP8/90000	[draft-ietf-payload-vp8]
a=sendrecv	[RFC3264]
a=rtcp-mux	[RFC5761]
a=candidate:0 1 UDP 2113667327 192.168.1.4 62537 typ host	[RFC5245]
a=candidate:1 1 UDP 1694302207 24.23.204.141 62537 typ srflx raddr 192.168.1.4 rport 62537	[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]
a=rtcp-fb:120 ccm fir	[RFC5104]

Table 5: 4.3 SDP Offer w/Bundle

```
+---------------------------------------+-----------------------+
| SDP Contents                          | RFC#/Notes            |
+---------------------------------------+-----------------------+
| v=0                                   | [RFC4566]             |
| o=bob 16833 0 IN IP4 0.0.0.0          | [RFC4566]             |
| s=                                    | [RFC4566]             |
| t=0 0                                 | [RFC4566]             |
| a=ice-ufrag:c300d85b                  | [RFC5245]             |
| a=ice-pwd:de4e99bd291c325921d5d47efbabd9 | [RFC5245]          |
| a2                                    |                       |
| a=fingerprint:sha-1                   | [RFC5245]             |
| 99:41:49:83:4a:97:0e:1f:ef:6d:f7:c9:c7:7 |                    |
| 0:9d:1f:66:79:a8:07                   |                       |
| a=rtcp-rsize                          | [RFC5506]             |
| a=group:BUNDLE foo bar                | Bob supports grouping |
|                                       | of m= lines and       |
|                                       | indicates his interest |
|                                       | in the same as well   |
|                                       | [RFC5888]             |
| m=audio 49203 RTP/SAVPF 109           | [RFC4566]             |
| c= IN IP4 98.248.92.77                | [RFC4566]             |
| a=mid:foo                             | [RFC5888]Audio m=line |
|                                       | part of the Bundle    |
|                                       | group                 |
| a=rtpmap:109 opus/48000               | [draft-spittka-payload |
|                                       | -rtp-opus]            |
| a=ptime:20                            | [draft-spittka-payload |
|                                       | -rtp-opus]            |
| a=sendrecv                            | [RFC3264]             |
| a=rtcp-mux                            | [RFC5761]             |
| a=candidate:0 1 UDP 2113667327        | [RFC5245]             |
| 192.168.1.7 49203 typ host            |                       |
| a=candidate:1 1 UDP 1694302207        | [RFC5245]             |
| 98.248.92.77 49203 typ srflx raddr    |                       |
| 192.168.1.7 rport 49203               |                       |
| a=candidate:candidate:0 2 UDP 2113667326 | [RFC5245]          |
| 192.168.1.7 60065 typ host            |                       |
| a=candidate:1 2 UDP 1694302206        | [RFC5245]             |
| 98.248.92.77 60065 typ srflx raddr    |                       |
| 192.168.1.7 rport 60065               |                       |
| m=video 63130 RTP/SAVPF 120           | [RFC4566]             |
| c= IN IP4 98.248.92.771               | [RFC4566]             |
| a=mid:bar                             | [RFC5888]Video m=line |
|                                       | part of the Bundle    |
|                                       | group                 |
| a=rtpmap:120 VP8/90000                | [draft-ietf-payload-vp |
|                                       | 8]                    |
| a=sendrecv                            | [RFC3264]             |
```

a=rtcp-mux	[RFC5761]
a=candidate:0 1 UDP 2113667327	[RFC5245]
192.168.1.7 63130 typ host	
a=candidate:1 1 UDP 1694302207	[RFC5245]
98.248.92.77 63130 typ srflx raddr	
192.168.1.7 rport 63130	
a=candidate:0 2 UDP 2113667326	[RFC5245]
192.168.1.7 56607 typ host	
a=candidate:1 2 UDP 1694302206	[RFC5245]
98.248.92.77 56607 typ srflx raddr	
192.168.1.7 rport 56607	

Table 6: 4.3 SDP Answer w/Bundle

5.4. Successful One Way Session with 2 Video Streams

In this scenario Alice and Bob engage in one-way multimedia session with Bob receiving two video streams, one corresponding to Alice's video and other corresponding to her presentation slides.

```
title 1 Way Audio & Video w/2 Video Streams
note right of Alice
Alice offers 2 sendonly video streams
one for her video feed and other for her presentation slides.
end note
Alice->Bob: Offer(Audio:Opus, Video1,2: VP8)
note right of Bob
Bob accepts Alice's offer
end note
Bob->Alice: Answer(Audio:Opus, Video1,2: VP8)
Alice->Bob: One-way Opus Audio, VP8 Video
note right of Alice
Bob can hear Alice and see her video feed as well
as her presentation slides.
end note
```

SDP Contents	RFC#/Notes
v=0	[RFC4566]
o=alice 20519 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=fingerprint:sha-1 99:41:49:83:4a:97:0e:1f:ef:6d:f7:c9:c7:70:9d:1f:66:79:a8:07	[RFC5245]
a=rtcp-rsize	[RFC5506]
m=audio 54609 RTP/SAVPF 109	[RFC4566]
c= IN IP4 24.23.204.141	[RFC4566]
a=rtpmap:109 opus/48000	[draft-spittka-payload-rtp-opus]
a=ptime:20	[draft-spittka-payload-rtp-opus]
a=sendonly	[RFC3264] - Send only audio stream
a=rtcp-mux	[RFC5761]
a=candidate:0 1 UDP 2113667327 192.168.1.4 54609 typ host	[RFC5245]
a=candidate:0 2 UDP 2113667326 192.168.1.4 64678 typ host	[RFC5245]
a=rtcp-fb:109 nack	[RFC5104]
m=video 62537 RTP/SAVPF 120	[RFC4566]
c= IN IP4 24.23.204.141	[RFC4566]
a=rtpmap:120 VP8/90000	[draft-ietf-payload-vp8]
a=content:speaker	[RFC4796] - Stream 1 for Alice's video
a=sendonly	[RFC3264] - Send only video stream
a=rtcp-mux	[RFC5761]
a=candidate:0 1 UDP 2113667327 192.168.1.4 62537 typ host	[RFC5245]
a=candidate:0 2 UDP 2113667326 192.168.1.4 54721 typ host	[RFC5245]
a=rtcp-fb:120 nack pli	[RFC5104]
a=rtcp-fb:120 ccm fir	[RFC5104]
m=video 62539 RTP/SAVPF 120	[RFC4566]
c= IN IP4 24.23.204.141	[RFC4566]
a=rtpmap:120 VP8/90000	[draft-ietf-payload-vp8]

a=content:slides	[RFC4796] - Stream 2 for Alice's slides
a=sendonly	[RFC3264] - Send only video stream
a=rtcp-mux	[RFC5761]
a=candidate:0 1 UDP 2113667327 192.168.1.4 62539 typ host	[RFC5245]
a=candidate:0 2 UDP 2113667326 192.168.1.4 54723 typ host	[RFC5245]
a=rtcp-fb:120 nack pli	[RFC5104]
a=rtcp-fb:120 ccm fir	[RFC5104]

Table 7: 4.4 SDP Offer

SDP Contents	RFC#/Notes
v=0	[RFC4566]
o=bob 16833 0 IN IP4 0.0.0.0	[RFC4566]
s=	[RFC4566]
t=0 0	[RFC4566]
a=ice-ufrag:c300d85b	[RFC5245]
a=ice-pwd:de4e99bd291c325921d5d47efbabd9a2	[RFC5245]
a=fingerprint:sha-1 99:41:49:83:4a:97:0e:1f:ef:6d:f7:c9:c7:70:9d:1f:66:79:a8:07	[RFC5245]
a=rtcp-rsize	[RFC5506]
m=audio 49203 RTP/SAVPF 109	[RFC4566]
c= IN IP4 98.248.92.77	[RFC4566]
a=rtpmap:109 opus/48000	[draft-spittka-payload-rtp-opus]
a=ptime:20	[draft-spittka-payload-rtp-opus]
a=recvonly	[RFC3264] - Receive only audio stream
a=rtcp-mux	[RFC5761]
a=candidate:0 1 UDP 2113667327 192.168.1.7 49203 typ host	[RFC5245]
a=candidate:0 2 UDP 2113667326 192.168.1.7 60065 typ host	[RFC5245]
m=video 63130 RTP/SAVPF 120	[RFC4566]
c= IN IP4 98.248.92.771	[RFC4566]
a=rtpmap:120 VP8/90000	[draft-ietf-payload-vp8]
a=content:speaker	[RFC4796] - Stream 1 for Alice's Video
a=recvonly	[RFC3264] - Receive Only Video Stream 1
a=rtcp-mux	[RFC5761]
a=candidate:0 1 UDP 2113667327 192.168.1.7 63130 typ host	[RFC5245]
a=candidate:0 2 UDP 2113667326 192.168.1.7 56607 typ host	[RFC5245]
a=rtcp-fb:120 nack pli	[RFC5104]
a=rtcp-fb:120 ccm fir	[RFC5104]
m=video 63133 RTP/SAVPF 120	[RFC4566]
c= IN IP4 98.248.92.771	[RFC4566]
a=rtpmap:120 VP8/90000	[draft-ietf-payload-vp8]
a=content:slides	[RFC4796] - Stream 2 for Alice's Slides

```
| a=recvonly                          | [RFC3264] - Receive    |
|                                     | Only Video Stream 2    |
| a=rtcp-mux                          | [RFC5761]              |
| a=candidate:0 1 UDP 2113667327      | [RFC5245]              |
| 192.168.1.7 63133 typ host          |                        |
| a=candidate:0 2 UDP 2113667326      | [RFC5245]              |
| 192.168.1.7 56609 typ host          |                        |
| a=rtcp-fb:120 nack pli              | [RFC5104]              |
| a=rtcp-fb:120 ccm fir               | [RFC5104]              |
+-------------------------------------+------------------------+
```

Table 8: 4.4 SDP Answer

5.5. Add New Media (video)

This scenario describes the message exchanges when Alice decides to add video to an existing audio-only session

```
title Add New Media(Video)
Alice->Bob: Offer(Audio:G.711,Opus,iLBC)
Bob->Alice: Answer(Audio:Opus)
Alice->Bob: Two-way Opus Audio
note right of Alice
Alice decides to add Video
end note
Alice->Bob: Offer(Audio:G.711,Opus,iLBC Video:VP8)
Bob->Alice: Answer(Audio:Opus, Video:VP8)
Alice->Bob: Two-way Opus Audio, VP8 Video
```

SDP Contents	RFC#/Notes
v=0	[RFC4566]
o=alice 20519 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=fingerprint:sha-1 99:41:49:83:4a:97:0e:1f:ef:6d:f7:c9:c7:70:9d:1f:66:79:a8:07	[RFC5245]
a=rtcp-rsize	[RFC5506]
m=audio 54609 RTP/SAVPF 0 109 98	[RFC4566]
c= IN IP4 24.23.204.141	[RFC4566]
a=rtpmap:0 PCMU/8000	[RFC3551]
a=rtpmap:109 opus/48000	[draft-spittka-payload-rtp-opus]
a=ptime:20	[draft-spittka-payload-rtp-opus]
a=rtpmap:98 iLBC/8000 a=fmtp:98 mode=20	[RFC3952]
a=sendrecv	[RFC3264]
a=rtcp-mux	[RFC5761]
b=AS:256	[RFC4566]
a=candidate:0 1 UDP 2113667327 192.168.1.4 54609 typ host	[RFC5245]
a=candidate:1 1 UDP 694302207 24.23.204.141 54609 typ srflx raddr 192.168.1.4 rport 54609	[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]

Table 9: 4.5 SDP Initial Audio Only Offer

SDP Contents	RFC#/Notes
v=0	[RFC4566]
o=bob 16833 0 IN IP4 0.0.0.0	[RFC4566]
s=	[RFC4566]
t=0 0	[RFC4566]
a=ice-ufrag:c300d85b	[RFC5245]
a=ice-pwd:de4e99bd291c325921d5d47efbabd9 a2	[RFC5245]
a=fingerprint:sha-1 99:41:49:83:4a:97:0e:1f:ef:6d:f7:c9:c7:7 0:9d:1f:66:79:a8:07	[RFC5245]
a=rtcp-rsize	[RFC5506]
m=audio 49203 RTP/SAVPF 109	[RFC4566]
c= IN IP4 98.248.92.77	[RFC4566]
a=rtpmap:109 opus/48000	[draft-spittka-payload -rtp-opus]
a=ptime:20	[draft-spittka-payload -rtp-opus]
a=sendrecv	[RFC3264]
a=rtcp-mux	[RFC5761]
a=candidate:0 1 UDP 2113667327 192.168.1.7 49203 typ host	[RFC5245]
a=ccandidate:1 1 UDP 1694302207 98.248.92.77 49203 typ srflx raddr 192.168.1.7 rport 49203	[RFC5245]
a=candidate: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]

Table 10: 4.5 SDP Answer- Audio Only

Alice decides to add Video to the current session

SDP Contents	RFC#/Notes
v=0	[RFC4566]
o=alice 20520 0 IN IP4 0.0.0.0	[RFC4566] - Increased Version Number
s=	[RFC4566]
t=0 0	[RFC4566]
a=ice-ufrag:074c6550	[RFC5245]
a=ice-pwd:a28a397a4c3f31747d1ee3474af08a068	[RFC5245]
a=fingerprint:sha-1 99:41:49:83:4a:97:0e:1f:ef:6d:f7:c9:c7:70:9d:1f:66:79:a8:07	[RFC5245]
a=rtcp-rsize	[RFC5506]
m=audio 54609 RTP/SAVPF 0 109 98	[RFC4566]
c= IN IP4 24.23.204.141	[RFC4566]
a=rtpmap:0 PCMU/8000	[RFC3551]
a=rtpmap:109 opus/48000	[draft-spittka-payload-rtp-opus]
a=ptime:20	[draft-spittka-payload-rtp-opus]
a=rtpmap:98 iLBC/8000 a=fmtp:98 mode=20	[RFC3952]
a=sendrecv	[RFC3264]
a=rtcp-mux	[RFC5761]
a=candidate:0 1 UDP 2113667327 192.168.1.4 54609 typ host	[RFC5245]
a=candidate:1 1 UDP 694302207 24.23.204.141 54609 typ srflx raddr 192.168.1.4 rport 54609	[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]
m=video 62537 RTP/SAVPF120	[RFC4566]
c= IN IP4 24.23.204.141	[RFC4566]
a=rtpmap:120 VP8/90000	[draft-ietf-payload-vp8]
a=sendrecv	[RFC3264]
a=rtcp-mux	[RFC5761]
a=candidate:0 1 UDP 2113667327 192.168.1.4 62537 typ host	[RFC5245]
a=candidate:1 1 UDP 1694302207 24.23.204.141 62537 typ srflx raddr 192.168.1.4 rport 62537	

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]
a=rtcp-fb:120 ccm fir	[RFC5104]

Table 11: 4.5 SDP Updated Offer w/Video

SDP Contents	RFC#/Notes
v=0	[RFC4566]
o=bob 16833 0 IN IP4 0.0.0.0	[RFC4566]
s=	[RFC4566]
t=0 0	[RFC4566]
a=ice-ufrag:c300d85b	[RFC5245]
a=ice-pwd:de4e99bd291c325921d5d47efbabd9 a2	[RFC5245]
a=fingerprint:sha-1 99:41:49:83:4a:97:0e:1f:ef:6d:f7:c9:c7:7 0:9d:1f:66:79:a8:07	[RFC5245]
a=rtcp-rsize	[RFC5506]
m=audio 49203 RTP/SAVPF 109	[RFC4566]
c= IN IP4 98.248.92.77	[RFC4566]
a=rtpmap:109 opus/48000	[draft-spittka-payload -rtp-opus]
a=ptime:20	[draft-spittka-payload -rtp-opus]
a=sendrecv	[RFC3264]
a=rtcp-mux	[RFC5761]
a=candidate:0 1 UDP 2113667327 192.168.1.7 49203 typ host	[RFC5245]
a=ccandidate:1 1 UDP 1694302207 98.248.92.77 49203 typ srflx raddr 192.168.1.7 rport 49203	[RFC5245]
a=candidate: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]
m=video 63130 RTP/SAVPF 99 120	[RFC4566]
c= IN IP4 98.248.92.771	[RFC4566]
a=rtpmap:120 VP8/90000	[draft-ietf-payload-vp 8]
a=sendrecv	[RFC3264]

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]

Table 12: 4.5 SDP Updated Answer

6. WebRTC <-> Legacy Interop Examples

In this section, we attempt to provide session descriptions showcasing inter-operability between a WebRTC end-point and a Legacy VOIP end-point. The ideas included in here are not fully baked into the standards and might be controversial in nature. The hope here is to demonstrate a plausible SDP composition to enchance seamless inter-operability between the aforementioned communication systems.

6.1. Secure Two-Way Audio,Video w/Feedback - WebRTC <-> Legacy Interop

In the scenario desribed below, Alice sends [RFC3264] Offer with two sets of media descriptions per media type.

One set that correponds to [WEBRTC] Compliant RTP/SAVPF based audio and video descriptions.

Another set with RTP/AVP based audio and video descriptions for the legacy Interop purposes.

Also to note, Alice includes session level DTLS information and media level RTCP feedback information as applicable to both the sets of media descriptions

On the other hand, Bob being a Legacy VOIP end-point, recognizes only the media descriptions with RTP/AVP as the application protocol. The security and fedback requirements for the session are either handled by a intermediate gateway or with some combination of Bob's capabilities and the intermediate gateway.

```
title Successful 2-Way WebRTC <-> VOIP Interop
note right of Alice
Alice is on a WebRTC end-point & Bob is behind a legacy VOIP system
end note
Alice->Bob: Offer(Audio:Opus Video:VP8)
note right of Alice
 Alice includes 2 copies of media descriptions
 1. WebRTC compliant media description (RTP/SAVPF)
 2. Legacy compliant media description (RTP/AVP)
end note
Bob->Alice: Answer(Audio:Opus Video:VP8)
note right of Bob
 Bob recognizes"legacy compliant" media description from Alice.
 and accepts the same.
end note
Alice->Bob: Two-way Opus Audio, VP8 Video
note right of Alice
  Session also suports RTP/RTCP Mux, RTCP feedback (nack,pli)
end note
```

SDP Contents	RFC#/Notes
v=0	[RFC4566]
o=alice 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=fingerprint:sha-1 99:41:49:83:4a:97:0e:1f:ef:6d:f7:c9:c7:70:9d:1f:66:79:a8:07	[RFC5245]
a=rtcp-rsize	[RFC5506]
m=audio 54609 RTP/SAVPF 109	[RFC4566]
c= IN IP4 24.23.204.141	[RFC4566]
a=rtpmap:109 opus/48000	[draft-spittka-payload-rtp-opus]
a=ptime:20	[draft-spittka-payload-rtp-opus]
a=sendrecv	[RFC3264]
a=rtcp-mux	[RFC5761]
a=candidate:0 1 UDP 2113667327 192.168.1.4 54609 typ host	[RFC5245]
a=candidate:1 1 UDP 694302207 24.23.204.141 54609 typ srflx raddr 192.168.1.4 rport 54609	[RFC5245]

```
   | a=candidate:0 2 UDP 2113667326         | [RFC5245]              |
   | 192.168.1.4 64678 typ host             |                        |
   | a=candidate:1 2 UDP 1694302206         | [RFC5245]              |
   | 24.23.204.141 64678 typ srflx raddr    |                        |
   | 192.168.1.4 rport 64678                |                        |
   | a=rtcp-fb:109 nack                     | [RFC5104]              |
   | m=video 62537 RTP/SAVPF 120            | [RFC4566]              |
   | c= IN IP4 24.23.204.141                | [RFC4566]              |
   | a=rtpmap:120 VP8/90000                 | [draft-ietf-payload-vp |
   |                                        | 8]                     |
   | a=sendrecv                             | [RFC3264]              |
   | a=rtcp-mux                             | [RFC5761]              |
   | a=candidate:0 1 UDP 2113667327         | [RFC5245]              |
   | 192.168.1.4 62537 typ host             |                        |
   | a=candidate:1 1 UDP 1694302207         | [RFC5245]              |
   | 24.23.204.141 62537 typ srflx raddr    |                        |
   | 192.168.1.4 rport 62537                |                        |
   | a=candidate:0 2 2113667326 192.168.1.4 | [RFC5245]              |
   | 54721 typ host                         |                        |
   | a=candidate:1 2 UDP 1694302206         | [RFC5245]              |
   | 24.23.204.141 54721 typ srflx raddr    |                        |
   | 192.168.1.4 rport 54721                |                        |
   | a=rtcp-fb:120 nack pli                 | [RFC5104]              |
   | a=rtcp-fb:120 ccm fir                  | [RFC5104]              |
   | ---------------                        | These set of media     |
   |                                        | descriptions are for   |
   |                                        | Legacy Inter-op        |
   |                                        | purposes               |
   | 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-1                    | [RFC5245]              |
   | 99:41:49:83:4a:97:0e:1f:7f:7d:f9:c9:c7:7 |                      |
   | 0:9d:1f:66:79:a8:07                    |                        |
   | a=rtpmap:109 opus/48000                | [draft-spittka-payload |
   |                                        | -rtp-opus]             |
   | a=ptime:20                             | [draft-spittka-payload |
   |                                        | -rtp-opus]             |
   | a=sendrecv                             | [RFC3264]              |
   | a=rtcp-mux                             | [RFC5761]Alice still   |
   |                                        | includes RTP/RTCP Mux  |
   |                                        | support                |
   | a=candidate:0 1 UDP 2113667327         | [RFC5245]              |
   | 192.168.1.4 54732 typ host             |                        |
   | a=candidate:1 1 UDP 694302207          | [RFC5245]              |
   | 24.23.204.141 54732 typ srflx raddr    |                        |
   | 192.168.1.4 rport 54732                |                        |
```

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
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-1 99:41:49:83:4a:97:0e:1f:ef:7d:f7:c9:c7:70:9d:1f:66:79:a8:07	[RFC5245]
a=rtpmap:120 VP8/90000	[draft-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 13: 5.1 SDP Offer

SDP Contents	RFC#/Notes
v=0	[RFC4566]
o=bob 16833 0 IN IP4 0.0.0.0	[RFC4566]
s=	[RFC4566]
t=0 0	[RFC4566]
a=ice-ufrag:c300d85b	[RFC5245]
a=ice-pwd:de4e99bd291c325921d5d47efbabd9 a2	[RFC5245]
a=fingerprint:sha-1 99:41:49:83:4a:97:0e:1f:ef:6d:f7:c9:c7:7 0:9d:1f:66:79:a8:07	[RFC5245]
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	[draft-spittka-payload -rtp-opus]
a=ptime:20	[draft-spittka-payload -rtp-opus]
a=sendrecv	[RFC3264]
a=candidate:0 1 UDP 2113667327 192.168.1.7 49203 typ host	[RFC5245]
a=ccandidate:1 1 UDP 1694302207 98.248.92.77 49203 typ srflx raddr 192.168.1.7 rport 49203	[RFC5245]
a=candidate: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]
m=video 63130 RTP/SAVP 120	[RFC4566] Bob accepts RTP/AVP based video stream
c= IN IP4 98.248.92.771	[RFC4566]
a=rtpmap:120 VP8/90000	[draft-ietf-payload-vp 8]
a=sendrecv	[RFC3264]
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          | [RFC5245]              |
| 98.248.92.77 56607 typ srflx raddr      |                        |
| 192.168.1.7 rport 56607                 |                        |
+-----------------------------------------+------------------------+
```

Table 14: 5.1 SDP Answer

7. IANA Considerations

This document requires no actions from IANA.

8. References

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