

A Framework for SDP Attributes when Multiplexing

draft-nandakumar-mmusic-sdp-mux-attributes-03

Abstract

The Session Description Protocol (SDP) provides mechanisms to describe attributes of multimedia sessions and of individual media streams (e.g., Real-time Transport Protocol (RTP) sessions) within a multimedia session. In the RTCWeb WG, there is a need to use a single 5-tuple for sending and receiving media associated with multiple media descriptions ("m=" lines). Such a requirement has raised concerns over the semantic implications of the SDP attributes associated with the RTP Sessions multiplexed over a single transport layer flow.

The scope of this specification is to provide a framework for analyzing the multiplexing characteristics of SDP attributes. The specification also categorizes existing attributes based on the framework described herein.

Status of this Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <http://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on January 16, 2014.

Copyright Notice

Copyright (c) 2013 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to BCP 78 and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code

Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Table of Contents

- 1. Introduction**
- 2. Terminology**
- 3. Motivation**
- 4. SDP Attribute Analysis Framework**
- 5. Analysis of Existing Attributes**
 - 5.1. RFC4566 - SDP: Session Description Protocol**
 - 5.2. RFC4585 - RTP/AVPF**
 - 5.3. RFC5761 - Multiplexing RTP and RTCP**
 - 5.4. RFC4574 - SDP Label Attribute**
 - 5.5. RFC5432 - QoS Mechanism Selection in SDP**
 - 5.6. RFC4568 - SDP Security Descriptions**
 - 5.7. RFC5762 - RTP over DCCP**
 - 5.8. RFC6773 - DCCP-UDP Encapsulation**
 - 5.9. RFC5506 - Reduced-Size RTCP in RTP Profile**
 - 5.10. RFC6787 - Media Resource Control Protocol Version 2**
 - 5.11. RFC5245 - Interactive Connectivity Establishment (ICE)**
 - 5.12. RFC5285 - RTP Header Extensions**
 - 5.13. RFC3605 - RTCP attribute in SDP**
 - 5.14. RFC5576 - Source-Specific SDP Attributes**
 - 5.15. RFC6236 - Image Attributes in SDP**
 - 5.16. RFC6285 - Rapid Acquisition of Multicast RTP Sessions**
 - 5.17. RFC6230 - Media Control Channel Framework**
 - 5.18. RFC6364 - SDP Elements for FEC Framework**
 - 5.19. RFC4796 - Content Attribute**
 - 5.20. RFC3407 - SDP Simple Capability Declaration**
 - 5.21. RFC6284 - Port Mapping between Unicast and Multicast RTP Sessions**
 - 5.22. RFC6714 - MSRP-CEMA**
 - 5.23. RFC4583 - SDP Format for BFCP Streams**
 - 5.24. RFC5547 - SDP Offer/Answer for File Transfer**
 - 5.25. draft-ietf-mmusic-media-loopback**
 - 5.26. RFC5760 - RTCP with Unicast Feedback**
 - 5.27. RFC3611 - RTCP XR**
 - 5.28. RFC5939 - SDP Capability Negotiation**
 - 5.29. RFC6871 - SDP Media Capabilities Negotiation**
 - 5.30. RFC4567 - Key Management Extensions for SDP and RTSP**
 - 5.31. RFC4572 - Comedia over TLS in SDP**
 - 5.32. RFC4570 - SDP Source Filters**
 - 5.33. RFC6128 - RTCP Port for Multicast Sessions**
 - 5.34. RFC6189 - ZRTP**
 - 5.35. RFC4145 - Connection-Oriented Media**
 - 5.36. RFC5159 - OMA BCAST SDP Attributes**
 - 5.37. RFC6193 - Media Description for IKE in SDP**
 - 5.38. RFC6064 - SDP and RTSP Extensions for 3GPP**
 - 5.39. RFC3108 - ATM SDP**
 - 5.40. 3GPP TS 24.182**

SDP defines several attributes for capturing characteristics that apply to the individual media descriptions (described by "m=" lines") and the overall multimedia session. Typically different media types (audio, video etc) described using different media descriptions represent separate RTP Sessions that are carried over individual transport layer flows. However, in the RTCWeb WG, a requirement has arisen to multiplex several RTP Sessions over a single transport layer flow. This in turn has made necessary to understand the interpretation and usage of the SDP attributes defined for the multiplexed media descriptions.

Given the number of SDP attributes registered with the IANA [\[IANA\]](#) and possibility of new attributes being defined in the future, there is need for generic future-proof framework to analyze these attributes for their applicability in the transport multiplexing use-cases.

The document starts with providing the motivation for requiring such a framework. This is followed by introduction to the SDP attribute analysis framework/procedures, following which several sections applies the framework to the SDP attributes registered with the IANA [\[IANA\]](#)

2. Terminology

TOC

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. Motivation

TOC

The time and complications of setting up ICE [\[RFC5245\]](#) and DTLS-SRTP [\[RFC5763\]](#) transports for use by RTP, and conservation of ports, forms an requirement to try and reduce the number of transport level flows needed. This has resulted in the definition of ways, such as, [\[I-D.ietf-mmusic-sdp-bundle-negotiation\]](#) and [\[I-D.ietf-avt-multiplexing-rtp\]](#) to multiplex RTP over a single transport flow in order to preserve network resources such as port numbers. This imposes further restrictions on applicability of these SDP attributes as they are defined today.

The specific problem is that there are attribute combinations which make sense when specified on independent m-lines -- as with classical SDP -- that do not make sense when those m-lines are then multiplexed over the same transport. To give an obvious example, ICE permits each m-line to have an independently specified ice-ufrag attribute. However, if the media from multiple m-lines is multiplexed over the same ICE component, then the meaning of media-level ice-ufrag attributes becomes muddled.

As of today there are close to 250 SDP attributes registered with the IANA [\[IANA\]](#) and more will be added in the future. There is no clearly defined procedure to establish the validity/applicability of these attribute when used with transport multiplexing.

4. SDP Attribute Analysis Framework

TOC

Attributes in an SDP session description can be defined at the session-level and media-level. These attributes could be semantically grouped as noted below.

- Attributes related to media content such as media type, encoding schemes, payload types.
- Attributes specifying media transport characteristics like RTP/RTCP port numbers, network addresses, QOS.
- Metadata description attributes capturing session timing and origin information.
- Attributes establishing relationships between media streams such as grouping framework

With the above semantic grouping as the reference, the proposed framework classifies each attribute into one of the following categories:

NORMAL

Attributes that can be independently specified when multiplexing and retain their original semantics.

In the example given below, the direction and label attributes are independently specified for audio and video m=lines. These attributes are not impacted by multiplexing these media streams over a single transport layer flow.

```
v=0
o=alice 2890844526 2890844527 IN IP4 host.atlanta.example.com
s=
c=IN IP4 host.atlanta.example.com
t=0 0
m=audio 49172 RTP/AVP 99
a=sendonly
a=label:1
a=rtpmap:99 iLBC/8000
m=video 49172 RTP/AVP 31
a=recvonly
a=label:2
a=rtpmap:31 H261/90000
```

NOT RECOMMENDED

Attributes where multiplexing is not recommended if these attributes are in use in the SDP since doing so MAY result in incorrect behaviors

Example: Multiplexing media descriptions having attribute zrtp-hash defined with the media descriptions lacking it, would either complicate the handling of multiplexed stream or fail multiplexing.

```
v=0
o=bob 2890844527 2890844527 IN IP4 client.biloxi.example.com
s=
c=IN IP4 client.biloxi.example.com
t=0 0
m=audio 3456 RTP/AVP 97 // with zrtp
a=rtpmap:97 iLBC/8000
```

```
<allOneLine>
a=zrtp-hash:1.10 fe30efd02423cb054e50efd0248742ac7a52c8f91bc2
df881ae642c371ba46df
</allOneLine>
m=video 34567 RTP/AVP 31 //without zrtp
a=rtpmap:31 H261/90000
```

IDENTICAL

Attributes that **MUST** be identical across all the media descriptions being multiplexed.

Attributes such as `rtcp-mux` fall into this category. Since RTCP reporting is done per RTP Session, there is no way to receive RTCP control data for the video `m=line` in the example below. Hence `rtcp-mux` **MUST** be repeated for the video `m=line` as well, when multiplexed.

```
v=0
o=bob 2890844527 2890844527 IN IP4 client.biloxi.example.com
s=
c=IN IP4 client.biloxi.example.com
t=0 0
m=audio 34567 RTP/AVP 97
a=rtcp-mux
m=video 34567 RTP/AVP 31
a=rtpmap:31 H261/90000
a=rtcp-mux
```

SUM

Attributes can be set as they are normally used but software using them in a multiplex case, **MUST** apply the sum of all the attributes being multiplexed instead of trying to use each one. This is typically used for bandwidth or other rate limiting attributes to the underlining transport.

The software parsing the SDP sample below, should use the aggregate Application Specific (AS) bandwidth value from the individual media descriptions to determine the AS value for the multiplexed session. Thus the calculated AS value would be 256+64 bytes for the given example.

```
v=0
o=mhandley 2890844526 2890842807 IN IP4 126.16.64.4
c=IN IP4 client.biloxi.example.com
t=0 0
m=audio 49170 RTP/AVP 0
b=AS:64
m=video 51372 RTP/AVP 31
b=AS:256
```

TRANSPORT

Attributes that can be set normally for multiple items in a multiplexed group but the software **MUST** pick just one of the attribute of the given type for use. The one chosen is the attribute associated with the "`m=`"

lines that represents the information being used for the transport of the RTP.

In the example below, "a=crypto" attribute is defined for both the audio and the video m=lines. The one that MUST be used for the multiplexed RTP Session is the one that corresponds to m=line with mid "two" even though the audio m=line with mid "one" appears ahead of it in the SDP. This is due to BUNDLE grouping semantics

[I-D.ietf-mmusic-sdp-bundle-negotiation] which mandates the values from m=line corresponding to the mid appearing first on the a=group:BUNDLE line to be considered for setting up the RTP Transport.

```
v=0
o=alice 2890844526 2890844527 IN IP4 host.atlanta.example.com
s=
c=IN IP4 host.atlanta.example.com
t=0 0
a=group:BUNDLE two,one
m=audio 49172 RTP/AVP 99
a=mid:one
a=crypto:1 AES_CM_128_HMAC_SHA1_80
  inline:d0RmdmcmVCspeEc3QGZiNWpVLFJhQX1cfHAWJSoj|2^20|1:32
a=rtpmap:99 iLBC/8000
m=video 51374 RTP/AVP 31
a=mid:two
a=crypto:1 AES_CM_128_HMAC_SHA1_80
  inline:EcGZiNWpFJhQXdspcl1ekcmVCNWpVLcfHAWJSoj|2^20|1:32
a=rtpmap:96 H261/90000
```

SPECIAL

Attributes where the text in the source draft must be consulted for further handling when multiplexed.

As an example, for the attribute extmap, the specification defining the extension MUST be referred to understand the multiplexing implications.

TBD

This category defines attributes that need more information to assign an appropriate category.

The idea behind these categories is to provide recommendations for using the attributes under RTP session multiplexing scenarios.

Section 5 analyzes attributes listed in **IANA** [IANA] grouped under the IETF document that defines them. The "Current" column indicates whether the attribute is currently specified as:

- S -- Session level
- M -- Media level
- B -- Both

- SR -- Source-level (for a single SSRC)

5. Analysis of Existing Attributes

TOC

5.1. RFC4566 - SDP: Session Description Protocol

TOC

RFC4566 [RFC4566] defines the Session Description Protocol (SDP) that is intended for describing multimedia sessions for the purposes of session announcement, session invitation, and other forms of multimedia session initiation

| Attr Name | Notes | Current | Category |
|-----------|--------------|---------|----------|
| sendrecv | Not impacted | B | NORMAL |
| sendonly | Not impacted | B | NORMAL |
| recvonly | Not impacted | B | NORMAL |
| inactive | Not impacted | B | NORMAL |
| cat | Not impacted | S | NORMAL |
| ptime | Not Impacted | M | NORMAL |
| maxptime | Not Impacted | M | NORMAL |
| orient | Not Impacted | M | NORMAL |
| framerate | Not Impacted | M | NORMAL |
| quality | Not Impacted | M | NORMAL |
| rtpmap | Not Impacted | M | NORMAL |
| fntp | Not Impacted | M | NORMAL |
| keywds | Not impacted | S | NORMAL |
| type | Not Impacted | S | NORMAL |

| | | | |
|---------|--------------|---|--------|
| tool | Not Impacted | S | NORMAL |
| charset | Not Impacted | S | NORMAL |
| sdplang | Not Impacted | B | NORMAL |
| lang | Not Impacted | B | NORMAL |

RFC4566 Attribute Analysis

5.2. RFC4585 - RTP/AVPF

TOC

RFC4585 [RFC4585] defines an extension to the Audio-visual Profile (AVP) that enables receivers to provide, statistically, more immediate feedback to the senders and thus allows for short-term adaptation and efficient feedback-based repair mechanisms to be implemented.

| Attr Name | Notes | Current | Category |
|-----------|---|---------|-----------|
| rtcp-fb | Since RTCP feedback are reported per RTP Session, this attribute should be repeated across m= lines | M | IDENTICAL |

RFC4585 Attribute Analysis

5.3. RFC5761 - Multiplexing RTP and RTCP

TOC

RFC5761 [RFC5761] discusses issues that arise when multiplexing RTP data packets and RTP Control Protocol (RTCP) packets on a single UDP port. It describes when such multiplexing is and is not appropriate, and it explains how the Session Description Protocol (SDP) can be used to signal multiplexed sessions.

| Name | Notes | Current | Category |
|----------|---|---------|-----------|
| rtcp-mux | RTCP muxing should be repeated across all the m=lines | M | IDENTICAL |

RFC5761 Attribute Analysis

5.4. RFC4574 - SDP Label Attribute

TOC

RFC4574 [RFC4574] defines a new Session Description Protocol (SDP) media-level attribute: "label". The "label" attribute carries a pointer to a media stream in the context of an arbitrary network application that uses SDP. The sender of the SDP document can attach the "label" attribute to a particular media stream or streams. The application can then use the provided pointer to refer to each particular media stream in its context.

| Name | Notes | Current | Category |
|-------|--------------|---------|----------|
| label | Not Impacted | M | NORMAL |

RFC4574 Attribute Analysis

5.5. RFC5432 - QoS Mechanism Selection in SDP

TOC

RFC5432 [RFC5432] defines procedures to negotiate QoS mechanisms using the Session Description Protocol (SDP) offer/answer model.

| Name | Notes | Current | Category |
|---------------|---|---------|----------|
| qos-mech-send | Since QoS mechanism are signaled per flow, multiplexing multiple m=lines has no impact on per m=line QoS mechanism. | B | NORMAL |
| qos-mech-recv | Since QoS mechanism are signaled per flow, multiplexing multiple m=lines has no impact on per m=line QoS mechanism. | B | NORMAL |

RFC5432 Attribute Analysis

5.6. RFC4568 - SDP Security Descriptions

TOC

RFC4568 [RFC4568] defines a Session Description Protocol (SDP) cryptographic attribute for unicast media streams. The attribute describes a cryptographic key and other parameters that serve to configure security for a unicast media stream in either a single message or a roundtrip exchange.

| Name | Notes | Current | Category |
|------|-------|---------|----------|
|------|-------|---------|----------|

| | | | |
|--------|--|---|-----------------|
| crypto | The multiplexing scheme MUST ensure unique SSRCs across all the media lines multiplexed. In that case, cryptographic keys corresponding to the underlying transport is used. | M | TRANSPORT |
| crypto | If the multiplexing scheme cannot ensure unique SSRCs across all the media lines, multiplexing MUST NOT be performed. | M | NOT RECOMMENDED |

RFC4568 Attribute Analysis

5.7. RFC5762 - RTP over DCCP

TOC

The Real-time Transport Protocol (RTP) is a widely used transport for real-time multimedia on IP networks. The Datagram Congestion Control Protocol (DCCP) is a transport protocol that provides desirable services for real-time applications. **RFC5762** [RFC5762] specifies a mapping of RTP onto DCCP, along with associated signalling, such that real-time applications can make use of the services provided by DCCP

| Name | Notes | Current | Category |
|-------------------|--|---------|-----------------|
| dccp-service-code | If RFC 6773 is not being used in addition to RFC 5762, the port in the m= line is a DCCP port. DCCP being a connection oriented protocol, does not allow multiple connections on the same 5-tuple. | M | NOT RECOMMENDED |

RFC5762 Attribute Analysis

If RFC 6773 is being used in addition to RFC 5762 and provided that DCCP-in-UDP layer has additional demultiplexing, then it may be possible to use different DCCP service codes for each DCCP flow, given each uses a different DCCP port. Although doing so might conflict with the media type of the m= line. None of this is standardised yet and it wouldn't work as explained. Hence multiplexing MUST NOT be performed even in this alternate scenario.

5.8. RFC6773 - DCCP-UDP Encapsulation

TOC

RFC6773 [RFC6773] document specifies an alternative encapsulation of the Datagram Congestion Control Protocol (DCCP), referred to as DCCP-UDP. This encapsulation allows DCCP to be carried through the current generation of Network Address Translation (NAT) middleboxes without modification of those middleboxes

| Name | Notes | Current | Category |
|-----------|---|---------|-----------------|
| dccp-port | Multiplexing MUST NOT be performed due to potential conflict between the port used for DCCP en/decapsulation and the RTP. | M | NOT RECOMMENDED |

RFC6773 Attribute Analysis

5.9. RFC5506 - Reduced-Size RTCP in RTP Profile

TOC

RFC5506 [RFC5506] discusses benefits and issues that arise when allowing Real-time Transport Protocol (RTCP) packets to be transmitted with reduced size.

| Name | Notes | Current | Category |
|------------|---|---------|-----------|
| rtcp-rsize | RTCP reduced size MUST be repeated across all the m=lines | M | IDENTICAL |

RFC5506 Attribute Analysis

5.10. RFC6787 - Media Resource Control Protocol Version 2

TOC

The Media Resource Control Protocol Version 2 (MRCPv2) allows client hosts to control media service resources such as speech synthesizers, recognizers, verifiers, and identifiers residing in servers on the network. MRCPv2 is not a "stand-alone" protocol -- it relies on other protocols, such as the Session Initiation Protocol (SIP), to coordinate MRCPv2 clients and servers and manage sessions between them, and the Session Description Protocol (SDP) to describe, discover, and exchange capabilities. It also depends on SIP and SDP to establish the media sessions and associated parameters between the media source or sink and the media server. Once this is done, the MRCPv2 exchange operates over the control session established above, allowing the client to control the media processing resources on the speech resource server. **RFC6787** [RFC6787] defines attributes for this purpose.

| Name | Notes | Current | Category |
|----------|--------------|---------|----------|
| resource | Not Impacted | M | NORMAL |
| channel | Not Impacted | M | NORMAL |

RFC6787 Attribute Analysis

5.11. RFC5245 - Interactive Connectivity Establishment (ICE)

TOC

RFC5245 [RFC5245] describes a protocol for Network Address Translator(NAT) traversal for UDP-based multimedia sessions established with the offer/answer model. This protocol is called Interactive Connectivity Establishment (ICE). ICE makes use of the Session Traversal Utilities for NAT (STUN) protocol and its extension, Traversal Using Relay NAT (TURN). ICE can be used by any protocol utilizing the offer/answer model, such as the Session Initiation Protocol (SIP).

| Name | Notes | Current | Category |
|-------------------|--|---------|-----------|
| ice-lite | Not Impacted | S | NORMAL |
| ice-options | Not Impacted | S | NORMAL |
| ice-options | Not Impacted | S | NORMAL |
| ice-pwd | Per media-level attribute MUST be used per underlying transport flow | B | TRANSPORT |
| ice-ufrag | Per media-level attribute MUST be used per underlying transport flow | B | TRANSPORT |
| candidate | Per media-level attribute MUST be used per underlying transport flow | | TRANSPORT |
| remote-candidates | Per media-level attribute MUST be used per underlying transport flow | M | TRANSPORT |

RFC5245 Attribute Analysis

5.12. RFC5285 - RTP Header Extensions

TOC

RFC5285 [RFC5285] provides a general mechanism to use the header extension feature of RTP (the Real-Time Transport Protocol). It provides the option to use a small number of small extensions in each RTP packet, where the universe of possible extensions is large and registration is de-centralized. The actual extensions in use in a session are signaled in the setup information for that session.

| Name | Notes | Current | Category |
|------|-------|---------|----------|
|------|-------|---------|----------|

| | |
|---|---------|
| extmap Specific RTP extension document MUST be referred B | SPECIAL |
|---|---------|

RFC5285 Attribute Analysis

5.13. RFC3605 - RTCP attribute in SDP

TOC

Originally, SDP assumed that RTP and RTCP were carried on consecutive ports. However, this is not always true when NATs are involved. **[RFC3605]** specifies an early mechanism to indicate the RTCP port.

| Name | Notes | Current | Category |
|------|--|---------|-----------|
| rtcp | Case1:Same RTCP port is repeated across the m=lines. Case2:Different RTCP ports renders multiplexing impossible | M | IDENTICAL |

RFC3605 Attribute Analysis

5.14. RFC5576 - Source-Specific SDP Attributes

TOC

RFC5576 [RFC5576] defines a mechanism to describe RTP media sources, which are identified by their synchronization source (SSRC) identifiers, in SDP, to associate attributes with these sources, and to express relationships among sources. It also defines several source-level attributes that can be used to describe properties of media sources.

| Name | Notes | Current | Category |
|---------------|---|---------|-----------------|
| ssrc | SSRCs repeated over multiple m=lines is forbidden if the m-lines are in the same RTP session. | M | NOT RECOMMENDED |
| ssrc-group | Refer to section Section 11 for specific analysis of the grouping semantics | M | SPECIAL |
| cname | Not Impacted [Open Issues: what are the rules for CNAME duplication across sessions?] | SR | NORMAL |
| previous-ssrc | SSRCs repeated over multiple m=lines complicates multiplexing | SR | NOT RECOMMENDED |
| fntp | Not Impacted | SR | NORMAL |

5.15. RFC6236 - Image Attributes in SDP

TOC

RFC6236 [RFC6236] proposes a new generic session setup attribute to make it possible to negotiate different image attributes such as image size. A possible use case is to make it possible for a low-end hand- held terminal to display video without the need to rescale the image, something that may consume large amounts of memory and processing power. The document also helps to maintain an optimal bitrate for video as only the image size that is desired by the receiver is transmitted.

| Name | Notes | Current | Category |
|-----------|--------------|---------|----------|
| imageattr | Not Impacted | M | NORMAL |

RFC6236 Attribute Analysis

5.16. RFC6285 - Rapid Acquisition of Multicast RTP Sessions

TOC

RFC6285 [RFC6285] describes a method using the existing RTP and RTP Control Protocol (RTCP) machinery that reduces the acquisition delay. In this method, an auxiliary unicast RTP session carrying the Reference Information to the receiver precedes or accompanies the multicast stream. This unicast RTP flow can be transmitted at a faster than natural bitrate to further accelerate the acquisition. The motivating use case for this capability is multicast applications that carry real-time compressed audio and video.

| Name | Notes | Current | Category |
|--------------|-----------------|---------|-----------------|
| rams-updates | Not recommended | M | NOT RECOMMENDED |

RFC6285 Attribute Analysis

5.17. RFC6230 - Media Control Channel Framework

TOC

RFC6230 [RFC6230] describes a framework and protocol for application deployment where the application programming logic and media processing are distributed. This implies that application programming logic can seamlessly gain access to appropriate

resources that are not co-located on the same physical network entity. The framework uses the Session Initiation Protocol (SIP) to establish an application-level control mechanism between application servers and associated external servers such as media servers.

| Name | Notes | Current | Category |
|--------|----------------|---------|----------|
| cfw-id | Not Applicable | M | NORMAL |

RFC6230 Attribute Analysis

5.18. RFC6364 - SDP Elements for FEC Framework

TOC

RFC6364 [RFC6364] specifies the use of the Session Description Protocol (SDP) to describe the parameters required to signal the Forward Error Correction (FEC) Framework Configuration Information between the sender(s) and receiver(s). This document also provides examples that show the semantics for grouping multiple source and repair flows together for the applications that simultaneously use multiple instances of the FEC Framework.

| Name | Notes | Current | Category |
|-----------------|--------------|---------|----------|
| fec-source-flow | Not Impacted | M | NORMAL |
| fec-repair-flow | Not Impacted | M | NORMAL |
| repair-window | Not Impacted | M | NORMAL |

RFC6364 Attribute Analysis

5.19. RFC4796 - Content Attribute

TOC

RFC4796 [RFC4796] defines a new Session Description Protocol (SDP) media- level attribute, 'content'. The 'content' attribute defines the content of the media stream to a more detailed level than the media description line. The sender of an SDP session description can attach the 'content' attribute to one or more media streams. The receiving application can then treat each media stream differently (e.g., show it on a big or small screen) based on its content.

| Name | Notes | Current | Category |
|------|-------|---------|----------|
|------|-------|---------|----------|

| | |
|------------------------|--------|
| content Not Impacted M | NORMAL |
|------------------------|--------|

RFC4796 Attribute Analysis

5.20. RFC3407 - SDP Simple Capability Declaration

TOC

RFC3407 [RFC3407] defines a set of Session Description Protocol (SDP) attributes that enables SDP to provide a minimal and backwards compatible capability declaration mechanism.

| Name | Notes | Current | Category |
|---------|------------------------------------|---------|----------|
| sqn | Not Impacted | B | NORMAL |
| cdsc | Not Impacted | B | NORMAL |
| cpar | Represents encapsulating attribute | B | TBD |
| cparmin | Represents encapsulating attribute | B | TBD |
| cparmax | Represents encapsulating attribute | B | TBD |

RFC3407 Attribute Analysis

For attributes that encapsulate other attributes, the negotiation procedures decides the final selection of the attribute from the one or more attributes encapsulated. Multiplexing of media lines with encapsulating attributes requires further analysis.

5.21. RFC6284 - Port Mapping between Unicast and Multicast RTP Sessions

TOC

RFC6284 [RFC6284] presents a port mapping solution that allows RTP receivers to choose their own ports for an auxiliary unicast session in RTP applications using both unicast and multicast services. The solution provides protection against denial-of-service or packet amplification attacks that could be used to cause one or more RTP packets to be sent to a victim client

| Name | Notes | Current | Category |
|-----------------|---|---------|-----------------|
| portmapping-req | Not recommended, if port mapping is required by the application | M | NOT RECOMMENDED |

5.22. RFC6714 - MSRP-CEMA

TOC

RFC6714 [RFC6714] defines a Message Session Relay Protocol (MSRP) extension, Connection Establishment for Media Anchoring (CEMA). Support of this extension is OPTIONAL. The extension allows middleboxes to anchor the MSRP connection, without the need for middleboxes to modify the MSRP messages; thus, it also enables secure end-to-end MSRP communication in networks where such middleboxes are deployed. This document also defines a Session Description Protocol (SDP) attribute, 'msrp-cema', that MSRP endpoints use to indicate support of the CEMA extension.

| Name | Notes | Current | Category |
|-----------|--------------|---------|----------|
| msrp-cema | Not Impacted | M | NORMAL |

RFC6714 Attribute Analysis

5.23. RFC4583 - SDP Format for BFCP Streams

TOC

RFC4583 [RFC4583] document specifies how to describe Binary Floor Control Protocol (BFCP) streams in Session Description Protocol (SDP) descriptions. User agents using the offer/answer model to establish BFCP streams use this format in their offers and answers

| Name | Notes | Current | Category |
|-----------|--------------|---------|----------|
| floorctrl | Not Impacted | M | NORMAL |
| confid | Not Impacted | M | NORMAL |
| userid | Not Impacted | M | NORMAL |
| floorid | Not Impacted | M | NORMAL |

RFC4583 Attribute Analysis

5.24. RFC5547 - SDP Offer/Answer for File Transfer

TOC

RFC5547 [RFC5547] provides a mechanism to negotiate the transfer of one or more files between two endpoints by using the Session Description Protocol (SDP) offer/answer model specified in **[RFC3264]**.

| Name | Notes | Current | Category |
|-------------------------------|--------------|---------|----------|
| file-selector | Not Impacted | M | NORMAL |
| file-transfer-id | Not Impacted | M | NORMAL |
| file-disposition | Not Impacted | M | NORMAL |
| file-date,file-iconfile-range | Not Impacted | M | NORMAL |
| file-iconfile-range | Not Impacted | M | NORMAL |
| file-iconfile-range | Not Impacted | M | NORMAL |

RFC5547 Attribute Analysis

5.25. draft-ietf-mmusic-media-loopback

TOC

[MEDIA_LOOPBACK] adds new SDP media types and attributes, which enable establishment of media sessions where the media is looped back to the transmitter. Such media sessions will serve as monitoring and troubleshooting tools by providing the means for measurement of more advanced VoIP, Real-time Text and Video over IP performance metrics.

| Name | Notes | Current | Category |
|-----------------------------|---|---------|-----------|
| loopback rtp-pkt-loopback | The attribute MUST be repeated across all m=lines multiplexed | M | IDENTICAL |
| loopback rtp-media-loopback | Not Impacted | M | NORMAL |
| loopback-source | Not Impacted | M | NORMAL |
| loopback-mirror | Not Impacted | M | NORMAL |

5.26. RFC5760 - RTCP with Unicast Feedback

TOC

RFC5760 [RFC5760] specifies an extension to the Real-time Transport Control Protocol (RTCP) to use unicast feedback to a multicast sender. The proposed extension is useful for single-source multicast sessions such as Source-Specific Multicast (SSM) communication where the traditional model of many-to-many group communication is either not available or not desired.

| Name | Notes | Current | Category |
|--------------|---|---------|-----------|
| rtcp-unicast | The attribute MUST be reported across all m=lines multiplexed | M | IDENTICAL |

RFC5760 Attribute Analysis

5.27. RFC3611 - RTCP XR

TOC

RFC3611 [RFC3611] defines the Extended Report (XR) packet type for the RTP Control Protocol (RTCP), and defines how the use of XR packets can be signaled by an application if it employs the Session Description Protocol (SDP).

| Name | Notes | Current | Category |
|---------|---|---------|-----------|
| rtcp-xr | The attribute MUST be reported across all m=lines multiplexed | B | IDENTICAL |

RFC3611 Attribute Analysis

5.28. RFC5939 - SDP Capability Negotiation

TOC

RFC5939 [RFC5939] defines a general SDP Capability Negotiation framework. It also specifies how to provide attributes and transport protocols as capabilities and negotiate them using the framework. Extensions for other types of capabilities (e.g., media types and media formats) may be provided in other documents.

| Name | Notes | Current | Category |
|------|--|---------|----------|
| pcfg | Depends on capability being negotiated | M | SPECIAL |

| | | | |
|------|--|---|---------|
| acfg | Depends on capability being negotiated | M | SPECIAL |
| csup | Not Impacted | B | NORMAL |
| creq | Not Impacted | B | NORMAL |
| acap | Represents encapsulation attribute | B | TBD |
| tcap | Represents encapsulation attribute | B | TBD |

RFC5939 Attribute Analysis

For attributes that encapsulate other attributes, the negotiation procedures decides the final selection of the attribute from the one or more attributes encapsulated. Multiplexing of media lines with encapsulating attributes requires further analysis.

5.29. RFC6871 - SDP Media Capabilities Negotiation

TOC

Session Description Protocol (SDP) capability negotiation provides a general framework for indicating and negotiating capabilities in SDP. The base framework defines only capabilities for negotiating transport protocols and attributes. **[MEDIA_CAP]** extends the framework by defining media capabilities that can be used to negotiate media types and their associated parameters.

| Name | Notes | Current | Category |
|--------|--|---------|----------|
| rmcap | Not Impacted | B | NORMAL |
| omcap | Not Impacted | B | NORMAL |
| mfcap | Not Impacted | B | NORMAL |
| mscap | mscap represents encapsulating attribute | B | TBD |
| lcfg | Need to revisit this later | B | TBD |
| sescap | Not Impacted | S | NORMAL |

draft-ietf-mmusic-sdp-media-capabilities Attribute Analysis

For attributes that encapsulate other attributes, the negotiation procedures decides

the final selection of the attribute from the one or more attributes encapsulated. Multiplexing of media lines with encapsulating attributes requires further analysis.

5.30. RFC4567 - Key Management Extensions for SDP and RTSP

TOC

RFC4567 [RFC4567] defines general extensions for Session Description Protocol (SDP) and Real Time Streaming Protocol (RTSP) to carry messages, as specified by a key management protocol, in order to secure the media. These extensions are presented as a framework, to be used by one or more key management protocols. As such, their use is meaningful only when complemented by an appropriate key management protocol.

| Name | Notes | Current | Category |
|----------|--|---------|-----------|
| key-mgmt | Key management protocol MUST be identical across all the m=lines | B | IDENTICAL |

RFC4567 Attribute Analysis

5.31. RFC4572 - Comedia over TLS in SDP

TOC

RFC4572 [RFC4572] specifies how to establish secure connection-oriented media transport sessions over the Transport Layer Security (TLS) protocol using the Session Description Protocol (SDP). It defines a new SDP protocol identifier, 'TCP/TLS'. It also defines the syntax and semantics for an SDP 'fingerprint' attribute that identifies the certificate that will be presented for the TLS session. This mechanism allows media transport over TLS connections to be established securely, so long as the integrity of session descriptions is assured.

| Name | Notes | Current | Category |
|-------------|--|---------|-----------|
| fingerprint | Fingerprint value MUST be identical across all the m=lines | B | IDENTICAL |

RFC4572 Attribute Analysis

5.32. RFC4570 - SDP Source Filters

TOC

RFC4570 [RFC4570] describes how to adapt the Session Description Protocol (SDP) to express one or more source addresses as a source filter for one or more destination "connection" addresses. It defines the syntax and semantics for an SDP "source-filter" attribute that may reference either IPv4 or IPv6 address(es) as either

an inclusive or exclusive source list for either multicast or unicast destinations. In particular, an inclusive source-filter can be used to specify a Source-Specific Multicast (SSM) session

| Name | Notes | Current | Category |
|---------------|--|---------|-----------|
| source-filter | he attribute MUST be repeated across all m=lines multiplexed | B | IDENTICAL |

RFC4570 Attribute Analysis

5.33. RFC6128 - RTCP Port for Multicast Sessions

TOC

The Session Description Protocol (SDP) has an attribute that allows RTP applications to specify an address and a port associated with the RTP Control Protocol (RTCP) traffic. In RTP-based source-specific multicast (SSM) sessions, the same attribute is used to designate the address and the RTCP port of the Feedback Target in the SDP description. However, the RTCP port associated with the SSM session itself cannot be specified by the same attribute to avoid ambiguity, and thus, is required to be derived from the "m=" line of the media description. Deriving the RTCP port from the "m=" line imposes an unnecessary restriction. **RFC6128** [RFC6128] removes this restriction by introducing a new SDP attribute.

| Name | Notes | Current | Category |
|----------------|--|---------|-----------|
| multicast-rtcp | Multicast RTCP port MUST be identical across all the m=lines | B | IDENTICAL |

RFC6128 Attribute Analysis

5.34. RFC6189 - ZRTP

TOC

RFC6189 [RFC6189] defines ZRTP, a protocol for media path Diffie-Hellman exchange to agree on a session key and parameters for establishing unicast Secure Real-time Transport Protocol (SRTP) sessions for Voice over IP (VoIP) applications.

| Name | Notes | Current | Category |
|-----------|--|---------|-----------------|
| zrtp-hash | Complicates if all the m=lines are not authenticated as given in the example below | M | NOT RECOMMENDED |

RFC6189 Attribute Analysis

Example: Multiplexing media descriptions having attribute zrtp-hash defined with the media descriptions lacking it, would either complicate the handling of multiplexed stream or fail multiplexing.

```
v=0
o=bob 2890844527 2890844527 IN IP4 client.biloxi.example.com
s=
c=IN IP4 client.biloxi.example.com
t=0 0
m=audio 3456 RTP/AVP 97
a=rtpmap:97 iLBC/8000
<allOneLine>
a=zrtp-hash:1.10 fe30efd02423cb054e50efd0248742ac7a52c8f91bc2
df881ae642c371ba46df
</allOneLine>
m=video 34567 RTP/AVP 31
a=rtpmap:31 H261/90000
```

5.35. RFC4145 - Connection-Oriented Media

TOC

RFC4145 [RFC4145] describes how to express media transport over TCP using the Session Description Protocol (SDP). It defines the SDP 'TCP' protocol identifier, the SDP 'setup' attribute, which describes the connection setup procedure, and the SDP 'connection' attribute, which handles connection reestablishment.

| Name | Notes | Current | Category |
|------------|--|---------|----------|
| setup | Should be identical across all m=lines | B | R |
| connection | Should be identical across all m=lines | B | R |

RFC4145 Attribute Analysis

5.36. RFC5159 - OMA BCAST SDP Attributes

TOC

RFC5159 [RFC5159] provides descriptions of Session Description Protocol (SDP) attributes used by the Open Mobile Alliance's Broadcast Service and Content Protection specification.

| Name | Notes | Current | Category |
|------|-------|---------|----------|
|------|-------|---------|----------|

| | | | |
|--------------------|-------------------------------------|---|-----|
| bcastversion | Might cause legacy interop issues | S | TBD |
| stkmstream | Might cause legacy interop purposes | B | TBD |
| SRTPAuthentication | Might cause legacy interop issues | M | TBD |
| SRTPROCTxRate | Might cause legacy interop issues | M | TBD |

RFC5159 Attribute Analysis

5.37. RFC6193 - Media Description for IKE in SDP

TOC

RFC6193 [RFC6193] specifies how to establish a media session that represents a virtual private network using the Session Initiation Protocol for the purpose of on-demand media/application sharing between peers. It extends the protocol identifier of the Session Description Protocol (SDP) so that it can negotiate use of the Internet Key Exchange Protocol (IKE) for media sessions in the SDP offer/answer model.

| Name | Notes | Current | Category |
|------------------|--|---------|-----------|
| ike-setup | Attribute MUST be identical across all the m=lines | B | IDENTICAL |
| psk-fingerprint | Attribute MUST be identical across all the m=lines | B | IDENTICAL |
| ike-esp | Attribute MUST be identical across all the m=lines | B | IDENTICAL |
| ike-esp-udpencap | Attribute MUST be identical across all the m=lines | B | IDENTICAL |

RFC6193 Attribute Analysis

With the above SDP constraints, a session multiplexed with multiple m=lines will use only one IPsec association for all of the m= lines.

5.38. RFC6064 - SDP and RTSP Extensions for 3GPP

TOC

The Packet-switched Streaming Service (PSS) and the Multimedia Broadcast/Multicast Service (MBMS) defined by 3GPP use the Session Description Protocol (SDP) and Real Time Streaming Protocol (RTSP) with some extensions. **RFC6064** [RFC6064] provides information about these extensions and registers the RTSP and SDP extensions with IANA.

| Name | Notes | Current | Category |
|--------------------------|--|---------|-----------------|
| X-predecbufsize | Case1:Aggregate total when video m-lines are muxed Case2:Multiplexing with audio m=lines is invalid | M | NOT RECOMMENDED |
| X-initpredecbufperiod | Case1:Aggregate total when video m-lines are muxed Case2:Multiplexing with audio m=lines is invalid | M | NOT RECOMMENDED |
| X-initpostdecbufperiod | Case1:Aggregate total when video m-lines are muxed Case2:Multiplexing with audio m=lines is invalid | M | NOT RECOMMENDED |
| X-decbyterate | Case1:Aggregate total when video m-lines are muxed Case2:Multiplexing with audio m=lines is invalid | M | NOT RECOMMENDED |
| 3gpp-videopostdecbufsize | Case1:Aggregate total when video m-lines are muxed. Case2:Multiplexing with audio m=lines is invalid | M | NOT RECOMMENDED |
| framesize | Not Impacted | M | NORMAL |
| 3GPP-Integrity-Key | Not Impacted | S | NORMAL |
| 3GPP-SRTP-Config | Same config SHALL apply to all the m=lines multiplexed | M | NORMAL |
| alt,alt-default-id | Specifying alternate m=lines when session with multiple m=lines of different types cannot be clearly specified | M | TBD |
| alt-group | Complicates selection of alternate m=lines grouped with alt-group on multiplexing | M | TBD |
| 3GPP-Adaptation-Support | Not recommended for legacy interop purposes | M | TBD |
| 3GPP-QoE-Metricsn | Not recommended for legacy interop purposes | B | TBD |
| 3GPP-Asset-Info | Not recommended for legacy interop purposes | B | TBD |

| | | | |
|-------------|--|---|-----|
| mbms-mode | Not recommended for legacy interop purposes | B | TBD |
| mbms-flowid | Multiplexing multiple m=lines complicates FEC mappings to the transport addresses. | M | TBD |
| mbms-repair | Not recommended for legacy interop purposes | B | TBD |

RFC6064 Attribute Analysis

5.39. RFC3108 - ATM SDP

TOC

RFC3108 [RFC3108] describes conventions for using the Session Description Protocol (SDP) for characterizing ATM bearer connections using an AAL1, AAL2 or AAL5 adaptation layers.

For AAL1, AAL2 and AAL5, bearer connections can be used to transport single media streams. In addition, for AAL1 and AAL2, multiple media streams may be multiplexed into a bearer connection. For all adaptation types (AAL1, AAL2 and AAL5), bearer connections may be bundled into a single media group. In all cases addressed by RFC3108, a real-time media stream (voice, video, voiceband data, pseudo-wire and others) or a multiplex of media streams is mapped directly into an ATM connection. RFC3108 does not address cases where ATM serves as a low-level transport pipe for IP packets which in turn may carry one or more real-time (e.g. VoIP) media sessions with a life-cycle different from that of the underlying ATM transport.

| Name | Notes | Current | Category |
|-------------|--------------|---------|----------|
| aalType | Not Impacted | B | NORMAL |
| eecid | Not Impacted | B | NORMAL |
| aalType | Not Impacted | B | NORMAL |
| capability | Not Impacted | B | NORMAL |
| qosClass | Not Impacted | B | NORMAL |
| bcob | Not Impacted | B | NORMAL |
| stc | Not Impacted | B | NORMAL |
| upcc | Not Impacted | B | NORMAL |
| atmQOSparms | Not Impacted | B | NORMAL |
| atmTrfcDesc | Not Impacted | B | NORMAL |
| abrParms | Not Impacted | B | NORMAL |
| abrSetup | Not Impacted | B | NORMAL |
| bearerType | Not Impacted | B | NORMAL |
| lij | Not Impacted | B | NORMAL |
| anycast | Not Impacted | B | NORMAL |

| | | | |
|-----------------------|--------------|---|--------|
| cache | Not Impacted | B | NORMAL |
| bearerSigIE | Not Impacted | B | NORMAL |
| aalApp | Not Impacted | B | NORMAL |
| cbrRate | Not Impacted | B | NORMAL |
| sbc | Not Impacted | B | NORMAL |
| clkrec | Not Impacted | B | NORMAL |
| fec | Not Impacted | B | NORMAL |
| prtfl | Not Impacted | B | NORMAL |
| structure | Not Impacted | B | NORMAL |
| cpsSDUsize | Not Impacted | B | NORMAL |
| aal2CPS | Not Impacted | B | NORMAL |
| aal2CPSSDUrate | Not Impacted | B | NORMAL |
| aal2sscs3661unassured | Not Impacted | B | NORMAL |
| aal2sscs3661assured | Not Impacted | B | NORMAL |
| aal2sscs3662 | Not Impacted | B | NORMAL |
| aal5sscop | Not Impacted | B | NORMAL |
| atmmap | Not Impacted | B | NORMAL |
| silenceSupp | Not Impacted | B | NORMAL |
| ecan | Not Impacted | B | NORMAL |
| gc | Not Impacted | B | NORMAL |
| profileDesc | Not Impacted | B | NORMAL |
| vsel | Not Impacted | B | NORMAL |
| dsel | Not Impacted | B | NORMAL |
| fsel | Not Impacted | B | NORMAL |
| onewaySel | Not Impacted | B | NORMAL |
| codeconfig | Not Impacted | B | NORMAL |
| isup_usi | Not Impacted | B | NORMAL |
| isup_usi | Not Impacted | B | NORMAL |
| chain | Not Impacted | B | NORMAL |

RFC3108 Attribute Analysis

5.40. 3GPP TS 24.182

TOC

3GPP TS 24.182 [3GPP TS 24.182] specifies IP multimedia subsystem Custom Alerting tones

| Name | Notes | Current | Category |
|------------|---|---------|----------|
| g.3gpp.cat | Usage defined for the IP Multimedia Subsystem | M | NORMAL |

3GPP TS 24.182 Attribute Analysis

5.41. 3GPP TS 24.183

TOC

3GPP TS 24.183 [3GPP TS 24.183] specifies IP multimedia subsystem Custom Ringing Signal

| Name | Notes | Current | Category |
|------------|---|---------|----------|
| g.3gpp.crs | Usage defined for the IP Multimedia Subsystem | M | NORMAL |

3GPP TS 24.183 Attribute Analysis

5.42. 3GPP TS 24.229

TOC

3GPP TS 24.229 [3GPP TS 24.229] IP multimedia call control protocol based on Session Initial protocol and Session Description Protocol.

| Name | Notes | Current | Category |
|-----------------|---|---------|-----------|
| secondary-realm | Per media-level attribute MUST be used per underlying transport | M | TRANSPORT |
| visited-realm | Per media-level attribute MUST be used per underlying transport | M | TRANSPORT |
| omr-m-cksum | Not Impacted | M | NORMAL |
| omr-s-cksum | Not Impacted | M | NORMAL |
| omr-m-att | Not Impacted | M | NORMAL |
| omr-s-bw | Not Impacted | M | NORMAL |
| omr-s-bw | Not Impacted | M | NORMAL |
| omr-m-att | Not Impacted | M | NORMAL |
| omr-codecs | Not Impacted | M | NORMAL |

5.43. ITU T.38

ITU T.38 **[T.38]** defines procedures for real-time Group 3 facsimile communications over IP networks.

| Name | Notes | Current | Category |
|-----------------------|--------------|---------|----------|
| T38FaxVersion | Not Impacted | S | NORMAL |
| T38MaxBitRate | Not Impacted | S | NORMAL |
| T38FaxFillBitRemoval | Not Impacted | S | NORMAL |
| T38FaxTranscodingMMR | Not Impacted | S | NORMAL |
| T38FaxTranscodingJBIG | Not Impacted | S | NORMAL |
| T38FaxRateManagement | Not Impacted | S | NORMAL |
| T38FaxMaxBuffer | Not Impacted | S | NORMAL |
| T38FaxMaxDatagram | Not Impacted | S | NORMAL |
| T38FaxUdpEC | Not Impacted | S | NORMAL |

Historic Attribute Analysis

The ITU T.38 attributes are clearly unaffected by multiplexing and are specific to the working of the fax protocol itself.

5.44. ITU-T H.248.15

ITU-T H.248.15 **[H.248.15]** defines Gateway Control Protocol SDP H.248 package attribute

| Name | Notes | Current | Category |
|------|-------|---------|----------|
|------|-------|---------|----------|

| | | | |
|----------|--|---|---------|
| h248item | <p>It is also only applicable for signaling the inclusion of H.248 extension packages to a gateway via the local and remote descriptors. The attribute itself is unaffected by multiplexing, but the packaged referenced in a specific use of the attribute may be impacted. Further analysis of each package is needed to determine if there is an issue. This is only a concern in environments using a decomposed server/gateway with H.248 signaled between them. The ITU-T will need to do further analysis of various packages when they specify how to signal the use of multiplexing to a gateway.</p> | B | SPECIAL |
|----------|--|---|---------|

Historic Attribute Analysis

5.45. RFC4975 - The Message Session Relay Protocol

TOC

RFC4975 [RFC4975] the Message Session Relay Protocol, a protocol for transmitting a series of related instant messages in the context of a session. Message sessions are treated like any other media stream when set up via a rendezvous or session creation protocol such as the Session Initiation Protocol.

| Name | Notes | Current | Category |
|----------------------|--------------|---------|----------|
| accept-types | Not Impacted | M | NORMAL |
| accept-wrapped-types | Not Impacted | M | NORMAL |
| max-size | Not Impacted | M | NORMAL |
| path | Not Impacted | M | NORMAL |

RFC4975 Attribute Analysis

5.46. Historical

TOC

This section specifies analysis for the attributes that are included for historic usage alone by the **[IANA]**.

| Name | Notes | Current | Category |
|---------|----------------|----------------|----------|
| rtpred1 | Not Applicable | Not-Applicable | TBD |

| | | | |
|--------------------|----------------|----------------|-----|
| rtpred2 | Not Applicable | Not-Applicable | TBD |
| PSCid | Not Applicable | Not-Applicable | TBD |
| bc_service | Not Applicable | Not-Applicable | TBD |
| bc_program | Not Applicable | Not-Applicable | TBD |
| bc_service_package | Not Applicable | Not-Applicable | TBD |

Unknowns Attribute Analysis

6. bwtype Attribute Analysis

TOC

This section specifies handling of specific bandwidth attributes when used in multiplexing scenarios.

6.1. RFC4566 - SDP: Session Description Protocol

TOC

| Name | Notes | Current | Category |
|-----------|---|---------|-------------|
| bwtype:CT | Aggregate bandwidth for the conference | S | NORMAL |
| bwtype:AS | There are 2 interpretations for this attribute As a session attribute, it specifies the session aggregate unless media-level b=RR and/or b=RS attributes are used. Under this interpretation the multiplexing scheme has no impact and belongs to NORMAL category. For the media level usage, the aggregate of individual bandwidth values is considered. | B | NORMAL, SUM |

RFC4566 bwtype Analysis

6.2. RFC3556 - SDP Bandwidth Modifiers for RTCP Bandwidth

TOC

RFC3556 [RFC3556] defines an extension to the Session Description Protocol (SDP) to specify two additional modifiers for the bandwidth attribute. These modifiers may be used to specify the bandwidth allowed for RTP Control Protocol (RTCP) packets in a Real-time Transport Protocol (RTP) session

| Name | Notes | Current | Category |
|-----------|--|---------|------------|
| bwtype:RS | Session level usage represents session aggregate and media level usage indicates SUM of the individual values while multiplexing | B | NORMAL,SUM |
| bwtype:RR | Session level usage represents session aggregate and media level usage indicates SUM of the individual values while multiplexing | B | NORMAL,SUM |

RFC3556 bwtype Analysis

6.3. RFC3890 - Bandwidth Modifier for SDP

TOC

RFC3890 [RFC3890] defines a Session Description Protocol (SDP) Transport Independent Application Specific Maximum (TIAS) bandwidth modifier that does not include transport overhead; instead an additional packet rate attribute is defined. The transport independent bit-rate value together with the maximum packet rate can then be used to calculate the real bit-rate over the transport actually used.

| Name | Notes | Current | Category |
|-------------|---|---------|----------|
| bwtype:TIAS | The usage of TIAS is not clearly defined Offer/Answer usage. | B | TBD |
| maxprate | The usage of TIAS and maxprate is not well defined under multiplexing | B | TBD |

RFC3890 bwtype Analysis

The intention of TIAS is that the media level bit-rate is multiplied with the known per-packet overhead for the selected transport and the maxprate value to determine the worst case bit-rate from the transport to more accurately capture the required usage. Summing TIAS values independently across m=lines and multiplying the computed sum with maxprate and the per-packet overhead would inflate the value significantly. Instead performing multiplication and adding the individual values is a more appropriate usage. This still ignores the fact that this is a send side declaration, and not intended for receiver negotiation.

7. rtcp-fb Attribute Analysis

TOC

This section analyzes rtcp-fb SDP attributes [**RTCP-FB**].

7.1. RFC4585 - RTP/AVPF

TOC

RFC4585 [RFC4585] defines an extension to the Audio-visual Profile (AVP) that enables receivers to provide, statistically, more immediate feedback to the senders and thus allows for short-term adaptation and efficient feedback-based repair mechanisms to be implemented.

| Attr Name | Notes | Current | Category |
|-----------|--------------|---------|----------|
| ack | Not Impacted | M | NORMAL |
| app | Not Impacted | M | NORMAL |
| nack | Not Impacted | M | NORMAL |
| trr-int | Not Impacted | M | NORMAL |

RFC4585 Attribute Analysis

7.2. RFC5104 - Codec Control Messages in AVPF

TOC

RFC5104 [RFC5104] specifies a few extensions to the messages defined in the Audio-Visual Profile with Feedback (AVPF). They are helpful primarily in conversational multimedia scenarios where centralized multipoint functionalities are in use. However, some are also usable in smaller multicast environments and point-to-point calls.

| Attr Name | Notes | Current | Category |
|-----------|--------------|---------|----------|
| ccm | Not Impacted | M | Normal |

RFC5104 Attribute Analysis

8. rtcp-fb "ack/nack" Attribute Analysis

TOC

This section analyzes rtcp-fb SDP attributes specific to ack and nack feedback types **[ACK-NACK]**.

8.1. RFC4585 - RTP/AVPF

TOC

RFC4585 [RFC4585] defines an extension to the Audio-visual Profile (AVP) that enables receivers to provide, statistically, more immediate feedback to the senders and thus allows for short-term adaptation and efficient feedback-based repair mechanisms to be implemented.

| Attr Name | Notes | Current | Category |
|-----------|--|---------|----------|
| nack sli | Not Impacted | M | NORMAL |
| nack pli | Not Impacted | M | NORMAL |
| ack rpsi | Not Impacted | M | NORMAL |
| ack app | Feedback parameters MUST be handled in the app specific way when multiplexed | M | SPECIAL |
| nack rpsi | Not Impacted | M | NORMAL |
| nack app | Feedback parameters MUST be handled in the app specific way when multiplexed | M | SPECIAL |

RFC4585 Attribute Analysis

8.2. RFC6285 - Unicast-Based RAMS

TOC

| Name | Notes | Current | Category |
|----------|--------------|---------|----------|
| nack rai | Not Impacted | M | NORMAL |

RFC6285 Attribute Analysis

8.3. RFC6679 - ECN for RTP over UDP/IP

TOC

RFC6679 [RFC6679] specifies how Explicit Congestion Notification (ECN) can be used with the Real-time Transport Protocol (RTP) running over UDP, using the RTP Control Protocol (RTCP) as a feedback mechanism. It defines a new RTCP Extended Report (XR) block for periodic ECN feedback, a new RTCP transport feedback message for timely reporting of congestion events, and a Session Traversal Utilities for NAT (STUN) extension used in the optional initialisation method using Interactive

Connectivity Establishment (ICE)

| Name | Notes | Current | Category |
|-----------------|---|---------|-----------|
| ecn-capable-rtp | ECN markup are enabled at the RTP Session level | M | IDENTICAL |
| nack ecn | This attribute enables ECN at the RTP session level | M | IDENTICAL |

RFC6679 Attribute Analysis

8.4. RFC6642 - Third-Party Loss Report

TOC

In a large RTP session using the RTP Control Protocol (RTCP) feedback mechanism defined in RFC 4585 [RFC4585], a feedback target may experience transient overload if some event causes a large number of receivers to send feedback at once. This overload is usually avoided by ensuring that feedback reports are forwarded to all receivers, allowing them to avoid sending duplicate feedback reports. However, there are cases where it is not recommended to forward feedback reports, and this may allow feedback implosion. RFC6642 [RFC6642] memo discusses these cases and defines a new RTCP Third-Party Loss Report that can be used to inform receivers that the feedback target is aware of some loss event, allowing them to suppress feedback. Associated Session Description Protocol (SDP) signaling is also defined.

| Name | Notes | Current | Category |
|-------|--------------|---------|----------|
| tlei | Not Impacted | M | NORMAL |
| pslei | Not Impacted | M | NORMAL |

RFC6642 Attribute Analysis

9. Codec Control Messages Analysis

TOC

This section analyzes rtcp-fb Codec Control Message [CCM].

9.1. RFC5104 - Codec Control Messages in AVPF

TOC

| Attr Name | Notes | Current | Category |
|-----------|-------|---------|----------|
|-----------|-------|---------|----------|

| | | | |
|-------|--------------|---|--------|
| fir | Not Impacted | M | NORMAL |
| tmnbr | Not Impacted | M | NORMAL |
| tstr | Not Impacted | M | NORMAL |
| vbcm | Not Impacted | M | NORMAL |

RFC5104 Attribute Analysis

10. group Attribute Analysis

TOC

This section analyzes SDP "group" semantics **[GROUP-SEM]**.

10.1. RFC5888 - SDP Grouping Framework

TOC

RFC5888 [RFC5888] defines a framework to group "m" lines in the Session Description Protocol (SDP) for different purposes.

| Name | Notes | Current | Category |
|-----------|--------------|---------|----------|
| group:LS | Not Impacted | S | NORMAL |
| group:FID | Not Impacted | S | NORMAL |

RFC5888 Attribute Analysis

10.2. RFC3524 - Mapping Media Streams to Resource Reservation Flows

TOC

RFC3524 [RFC3524] defines an extension to the Session Description Protocol (SDP) grouping framework. It allows requesting a group of media streams to be mapped into a single resource reservation flow. The SDP syntax needed is defined, as well as a new "semantics" attribute called Single Reservation Flow (SRF).

| Name | Notes | Current | Category |
|-----------|--------------|---------|----------|
| group:SRF | Not Impacted | S | NORMAL |

10.3. RFC4091 - ANAT Semantics

RFC4091 [RFC4091] defines the Alternative Network Address Types (ANAT) semantics for the Session Description Protocol (SDP) grouping framework. The ANAT semantics allow alternative types of network addresses to establish a particular media stream.

| Name | Notes | Current | Category |
|------------|--------------|---------|-----------------|
| group:ANAT | Not Impacted | S | NOT RECOMMENDED |

RFC4091 Attribute Analysis

10.4. RFC5956 - FEC Grouping Semantics in SDP

RFC5956 [RFC5956] defines the semantics for grouping the associated source and FEC-based (Forward Error Correction) repair flows in the Session Description Protocol (SDP). The semantics defined in the document are to be used with the SDP Grouping Framework (RFC 5888). These semantics allow the description of grouping relationships between the source and repair flows when one or more source and/or repair flows are associated in the same group, and they provide support for additive repair flows. SSRC-level (Synchronization Source) grouping semantics are also defined in this document for Real-time Transport Protocol (RTP) streams using SSRC multiplexing.

| Name | Notes | Current | Category |
|--------------|--------------|---------|----------|
| group:FEC-FR | Not Impacted | S | NORMAL |

RFC5956 Attribute Analysis

10.5. RFC5583 - Signaling Media Decoding Dependency in SDP

RFC5583 [RFC5583] defines semantics that allow for signaling the decoding dependency of different media descriptions with the same media type in the Session Description Protocol (SDP). This is required, for example, if media data is separated and transported in different network streams as a result of the use of a layered or multiple descriptive media coding process.

| Name | Notes | Current | Category |
|------------|--------------|---------|----------|
| depend lay | Not Impacted | M | NORMAL |
| depend mdc | Not Impacted | M | NORMAL |

RFC5583 Attribute Analysis

11. ssrc-group Attribute Analysis

TOC

This section analyzes "ssrc-group" semantics [**SSRC-GROUP**].

11.1. RFC5576 - Source-Specific SDP Attributes

TOC

| Name | Notes | Current | Category |
|--------|--------------|---------|----------|
| FID | Not Impacted | M | NORMAL |
| FEC | Not Impacted | M | NORMAL |
| FEC-FR | Not Impacted | M | NORMAL |

RFC5576 Attribute Analysis

12. QoS Mechanism Token Analysis

TOC

This section analyzes QoS tokens specified with SDP[**QOS**].

12.1. RFC5432 - QoS Mechanism Selection in SDP

TOC

| Name | Notes | Current | Category |
|------|--|---------|----------|
| rsvp | Not Impacted, since QOS mechanisms are applied per flow. | B | NORMAL |
| nsis | Not Impacted, since QOS mechanisms are applied per flow. | B | NORMAL |

RFC5432 Attribute Analysis

13. k= Attribute Analysis

[TOC](#)

13.1. RFC4566 SDP: Session Description Protocol

[TOC](#)

| Name | Notes | Current | Category |
|-------------|---|----------------|-----------------|
| k= | It is NOT recommended to use this attribute | S | NOT RECOMMENDED |

RFC4566 Attribute Analysis

14. content Attribute Analysis

[TOC](#)

14.1. RFC4796 - MSRP Relays

[TOC](#)

| Name | Notes | Current | Category |
|-----------------|--------------|----------------|-----------------|
| content:slides | Not Impacted | M | NORMAL |
| content:speaker | Not Impacted | M | NORMAL |
| content:main | Not Impacted | M | NORMAL |
| content:sl | Not Impacted | M | NORMAL |
| content:alt | Not Impacted | M | NORMAL |

RFC4796 Attribute Analysis

15. Payload Formats

[TOC](#)

15.1. RFC5109 - RTP Payload Format for Generic FEC

RFC5109 [RFC5109] describes a payload format for generic Forward Error Correction (FEC) for media data encapsulated in RTP. It is based on the exclusive-or (parity) operation. The payload format allows end systems to apply protection using various protection lengths and levels, in addition to using various protection group sizes to adapt to different media and channel characteristics. It enables complete recovery of the protected packets or partial recovery of the critical parts of the payload depending on the packet loss situation.

| Name | Notes | Current | Category |
|--------------------|--|---------|-----------------|
| audio/ulpfec | Not recommended for multiplexing due to reuse of SSRCS | M | NOT RECOMMENDED |
| video/ulpfec | Not recommended for multiplexing due to reuse of SSRCS | M | NOT RECOMMENDED |
| text/ulpfec | Not recommended for multiplexing due to reuse of SSRCS | M | NOT RECOMMENDED |
| application/ulpfec | Not recommended for multiplexing due to reuse of SSRCS | M | NOT RECOMMENDED |

RFC5109 Payload Format Analysis

Draft draft-lennox-payload-ulp-ssrc-mux proposes a simple fix to make it possible to use ULP with multiplexing and ULP is allowed when used with that.

16. IANA Considerations

IANA shall register categories from this specification by expanding the Session Description Protocol (SDP) Parameters table with a column listing categories against each SDP parameter.

```

+-----+
| Category |
+-----+
| NORMAL |
+-----+
| NOT RECOMMENDED |
+-----+
| IDENTICAL |
+-----+

```

| | | |
|---------|-----------|--|
| | TRANSPORT | |
| +-----+ | | |
| | SPECIAL | |
| ----- | | |

17. Security Considerations

TOC

All the attributes which involve security key needs a careful review to ensure two-time pad vulnerability is not created

18. Acknowledgments

TOC

I would like to thank Cullen Jennings for suggesting the categories, contributing text and helping review the draft.

I would like also to thank following experts on their inputs and reviews as listed - Rohan Mahy(5.45), Eric Burger(5.22), Christian Huitema(5.13), Christer Holmberg(5.22,5.40,5.41), Richard Ejzak (5.42,5.43,5.44),Colin Perkins(5.7,5.8), Magnus westerlund(5.3,5.9,6.1,6.2,6.3,8.3), Subha Dhesikan(5.5,12.1), Dan Wing(5.6,5.34,5.37), Eric Rescorla (5.11), Ali C Begen(5.1,5.16,5.18,8.2,5.33,13.1), Rajesh Kumar(5.39), Flemming Andreassen(5.28,5.29,5.20)

19. Change Log

TOC

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

Changes from draft-nandakumar-mmusic-mux-attributes-02

- Updated Sections 5.3,5.5,5.6,5.7,5.9,5.8,5.11,5.13,5.20,5.22,5.28,5.29,5.34,5.37,5.39,5.40,5.41,5.42,5.43,5.44,5.45,6.1,6.2,6.3,8,3,12.1 based on the inputs from the respective RFC Authors.

Changes from draft-nandakumar-mmusic-mux-attributes-01

- Replaced Category BAD with NOT RECOMMENDED.
- Added Category TBD.
- Updated IANA Consideration Section.

Changes from draft-nandakumar-mmusic-mux-attributes-00

- Added new section for dealing with FEC payload types.

20. References

TOC

20.1. Normative References

- [RFC2119] [Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels,"](#) BCP 14, RFC 2119, March 1997 ([TXT](#), [HTML](#), [XML](#)).
- [RFC4566] [Handley, M., Jacobson, V., and C. Perkins, "SDP: Session Description Protocol,"](#) RFC 4566, July 2006 ([TXT](#)).
-

20.2. Informative References

- [3GPP TS 24.182] ["IP Multimedia Subsystem \(IMS\) Customized Alerting Tones \(CAT\); Protocol specification."](#)
- [3GPP TS 24.183] ["IP Multimedia Subsystem \(IMS\) Customized Ringing Signal \(CRS\); Protocol specification."](#)
- [3GPP TS 24.229] ["IP multimedia call control protocol based on Session Initiation Protocol \(SIP\) and Session Description Protocol \(SDP\);"](#)
- [ACK-NACK] ["Session Description Protocol \(SDP\) RTCP ACK/NACK Feedback attributes."](#)
- [CCM] ["Session Description Protocol \(SDP\) RTCP-FB Codec Control Messages."](#)
- [GROUP-SEM] ["Session Description Protocol \(SDP\) "group" semantics."](#)
- [H.248.15] ["Gateway control protocol: SDP H.248 package attribute."](#)
- [I-D.ietf-avt-multiplexing-rtp] [El-Khatib, K., Luo, G., Bochmann, G., and Pinjiang. Feng, "Multiplexing Scheme for RTP Flows between Access Routers,"](#) Internet-Draft <http://tools.ietf.org/html/draft-ietf-avt-multiplexing-rtp-01>, October 1999.
- [I-D.ietf-mmusic-sdp-bundle-negotiation] [Holmberg, C., Alvestrand, H., and C. Jennings, "Multiplexing Negotiation Using Session Description Protocol \(SDP\) Port Numbers,"](#) draft-ietf-mmusic-sdp-bundle-negotiation-03 (work in progress), February 2013 ([TXT](#)).
- [IANA] ["Session Description Protocol \(SDP\) Parameters."](#)
- [MEDIA_CAP] [Kaplan, H., Hedayat, K., and N. Venna, "Session Description Protocol \(SDP\) Media Capabilities Negotiation,"](#) draft-ietf-mmusic-sdp-media-capabilities-17 (work in progress), January 2013 ([TXT](#)).
- [MEDIA_LOOPBACK] [Kaplan, H., Hedayat, K., Venna, N., Jones, P., and N. Stratton, "An Extension to the Session Description Protocol \(SDP\) and Real-time Transport Protocol \(RTP\) for Media Loopback,"](#) draft-ietf-mmusic-media-loopback-27 (work in progress), January 2013 ([TXT](#)).
- [QOS] ["Session Description Protocol \(SDP\) QoS Mechanism Tokens."](#)
- [RFC3108] [Kumar, R. and M. Mostafa, "Conventions for the use of the Session Description Protocol \(SDP\) for ATM Bearer Connections,"](#) RFC 3108, May 2001 ([TXT](#)).
- [RFC3264] [Rosenberg, J. and H. Schulzrinne, "An Offer/Answer Model with Session Description Protocol \(SDP\),"](#) RFC 3264, June 2002 ([TXT](#)).
- [RFC3407] [Andreasen, F., "Session Description Protocol \(SDP\) Simple Capability Declaration,"](#) RFC 3407, October 2002 ([TXT](#)).
- [RFC3524] [Camarillo, G. and A. Monrad, "Mapping of Media Streams to Resource Reservation Flows,"](#) RFC 3524, April 2003 ([TXT](#)).
- [RFC3556] [Casner, S., "Session Description Protocol \(SDP\) Bandwidth Modifiers for RTP Control Protocol \(RTCP\) Bandwidth,"](#) RFC 3556, July 2003 ([TXT](#)).
- [RFC3605] [Huitema, C., "Real Time Control Protocol \(RTCP\) attribute in Session Description Protocol \(SDP\),"](#) RFC 3605, October 2003 ([TXT](#)).
- [RFC3611] [Friedman, T., Caceres, R., and A. Clark, "RTP Control Protocol Extended Reports \(RTCP XR\),"](#) RFC 3611, November 2003 ([TXT](#)).
- [RFC3890] [Westerlund, M., "A Transport Independent Bandwidth Modifier for the Session Description Protocol \(SDP\),"](#) RFC 3890, September 2004 ([TXT](#)).
- [RFC4091] [Camarillo, G. and J. Rosenberg, "The Alternative Network Address Types \(ANAT\) Semantics for the Session Description Protocol \(SDP\) Grouping Framework,"](#) RFC 4091, June 2005 ([TXT](#)).
- [RFC4145] [Yon, D. and G. Camarillo, "TCP-Based Media Transport in the Session Description Protocol \(SDP\),"](#) RFC 4145, September 2005 ([TXT](#)).
- [RFC4567] [Arkko, J., Lindholm, F., Naslund, M., Norrman, K., and E. Carrara, "Key Management Extensions for Session Description Protocol \(SDP\) and Real Time Streaming Protocol](#)

- ([RTSP](#)),” RFC 4567, July 2006 ([TXT](#)).
- [RFC4568] Andreasen, F., Baugher, M., and D. Wing, “[Session Description Protocol \(SDP\) Security Descriptions for Media Streams](#),” RFC 4568, July 2006 ([TXT](#)).
- [RFC4570] Quinn, B. and R. Finlayson, “[Session Description Protocol \(SDP\) Source Filters](#),” RFC 4570, July 2006 ([TXT](#)).
- [RFC4572] Lennox, J., “[Connection-Oriented Media Transport over the Transport Layer Security \(TLS\) Protocol in the Session Description Protocol \(SDP\)](#),” RFC 4572, July 2006 ([TXT](#)).
- [RFC4574] Levin, O. and G. Camarillo, “[The Session Description Protocol \(SDP\) Label Attribute](#),” RFC 4574, August 2006 ([TXT](#)).
- [RFC4583] Camarillo, G., “[Session Description Protocol \(SDP\) Format for Binary Floor Control Protocol \(BFCP\) Streams](#),” RFC 4583, November 2006 ([TXT](#)).
- [RFC4585] Ott, J., Wenger, S., Sato, N., Burmeister, C., and J. Rey, “[Extended RTP Profile for Real-time Transport Control Protocol \(RTCP\)-Based Feedback \(RTP/AVPF\)](#),” RFC 4585, July 2006 ([TXT](#)).
- [RFC4796] Hautakorpi, J. and G. Camarillo, “[The Session Description Protocol \(SDP\) Content Attribute](#),” RFC 4796, February 2007 ([TXT](#)).
- [RFC4975] Campbell, B., Mahy, R., and C. Jennings, “[The Message Session Relay Protocol \(MSRP\)](#),” RFC 4975, September 2007 ([TXT](#)).
- [RFC5104] Wenger, S., Chandra, U., Westerlund, M., and B. Burman, “[Codec Control Messages in the RTP Audio-Visual Profile with Feedback \(AVPF\)](#),” RFC 5104, February 2008 ([TXT](#)).
- [RFC5109] Li, A., “[RTP Payload Format for Generic Forward Error Correction](#),” RFC 5109, December 2007 ([TXT](#)).
- [RFC5159] Dondeti, L. and A. Jerichow, “[Session Description Protocol \(SDP\) Attributes for Open Mobile Alliance \(OMA\) Broadcast \(BCAST\) Service and Content Protection](#),” RFC 5159, March 2008 ([TXT](#)).
- [RFC5245] Rosenberg, J., “[Interactive Connectivity Establishment \(ICE\): A Protocol for Network Address Translator \(NAT\) Traversal for Offer/Answer Protocols](#),” RFC 5245, July 2006 ([TXT](#)).
- [RFC5285] Singer, D. and H. Desineni, “[A General Mechanism for RTP Header Extensions](#),” RFC 5285, July 2008 ([TXT](#)).
- [RFC5432] Polk, J., Dhesikan, S., and G. Camarillo, “[Quality of Service \(QoS\) Mechanism Selection in the Session Description Protocol \(SDP\)](#),” RFC 5432, March 2009 ([TXT](#)).
- [RFC5506] Johansson, I., “[Support for Reduced-Size Real-Time Transport Control Protocol \(RTCP\): Opportunities and Consequences](#),” RFC 5506, April 2009 ([TXT](#)).
- [RFC5547] Garcia-Martin, M., Isomaki, M., Camarillo, G., Loreto, S., and P. Kyzivat, “[A Session Description Protocol \(SDP\) Offer/Answer Mechanism to Enable File Transfer](#),” RFC 5547, May 2009 ([TXT](#)).
- [RFC5576] Lennox, J., Ott, J., and T. Schierl, “[Source-Specific Media Attributes in the Session Description Protocol \(SDP\)](#),” RFC 5576, June 2009 ([TXT](#)).
- [RFC5583] Schierl, T. and S. Wenger, “[Signaling Media Decoding Dependency in the Session Description Protocol \(SDP\)](#),” RFC 5583, July 2009 ([TXT](#)).
- [RFC5760] Ott, J., Chesterfield, J., and E. Schooler, “[RTP Control Protocol \(RTCP\) Extensions for Single-Source Multicast Sessions with Unicast Feedback](#),” RFC 5760, February 2010 ([TXT](#)).
- [RFC5761] Perkins, C. and M. Westerlund, “[Multiplexing RTP Data and Control Packets on a Single Port](#),” RFC 5761, April 2010 ([TXT](#)).
- [RFC5762] Perkins, C., “[RTP and the Datagram Congestion Control Protocol \(DCCP\)](#),” RFC 5762, April 2010 ([TXT](#)).
- [RFC5763] Fischl, J., Tschofenig, H., and E. Rescorla, “[Framework for Establishing a Secure Real-time Transport Protocol \(SRTP\) Security Context Using Datagram Transport Layer Security \(DTLS\)](#),” RFC 5763, May 2010 ([TXT](#)).
- [RFC5888] Camarillo, G. and H. Schulzrinne, “[The Session Description Protocol \(SDP\) Grouping Framework](#),” RFC 5888, June 2010 ([TXT](#)).
- [RFC5939] Andreasen, F., “[Session Description Protocol \(SDP\) Capability Negotiation](#),” RFC 5939, September 2010 ([TXT](#)).
- [RFC5956] Begen, A., “[Forward Error Correction Grouping Semantics in the Session Description Protocol](#),” RFC 5956, September 2010 ([TXT](#)).
- [RFC6064] Westerlund, M. and P. Frojdh, “[SDP and RTSP Extensions Defined for 3GPP Packet-Switched Streaming Service and Multimedia Broadcast/Multicast Service](#),” RFC 6064, January 2011 ([TXT](#)).
- [RFC6128] Begen, A., “[RTP Control Protocol \(RTCP\) Port for Source-Specific Multicast \(SSM\) Sessions](#),” RFC 6128, February 2011 ([TXT](#)).
- [RFC6189] Zimmermann, P., Johnston, A., and J. Callas, “[ZRTP: Media Path Key Agreement for](#)

- [Unicast Secure RTP](#)," RFC 6189, April 2011 ([TXT](#)).
- [RFC6193] Saito, M., Wing, D., and M. Toyama, "[Media Description for the Internet Key Exchange Protocol \(IKE\) in the Session Description Protocol \(SDP\)](#)," RFC 6193, April 2011 ([TXT](#)).
- [RFC6230] Boulton, C., Melanchuk, T., and S. McGlashan, "[Media Control Channel Framework](#)," RFC 6230, May 2011 ([TXT](#)).
- [RFC6236] Johansson, I. and K. Jung, "[Negotiation of Generic Image Attributes in the Session Description Protocol \(SDP\)](#)," RFC 6236, May 2011 ([TXT](#)).
- [RFC6284] Begen, A., Wing, D., and T. Van Caenegem, "[Port Mapping between Unicast and Multicast RTP Sessions](#)," RFC 6284, June 2011 ([TXT](#)).
- [RFC6285] Ver Steeg, B., Begen, A., Van Caenegem, T., and Z. Vax, "[Unicast-Based Rapid Acquisition of Multicast RTP Sessions](#)," RFC 6285, June 2011 ([TXT](#)).
- [RFC6364] Begen, A., "[Session Description Protocol Elements for the Forward Error Correction \(FEC\) Framework](#)," RFC 6364, October 2011 ([TXT](#)).
- [RFC6642] Wu, Q., Xia, F., and R. Even, "[RTP Control Protocol \(RTCP\) Extension for a Third-Party Loss Report](#)," RFC 6642, June 2012 ([TXT](#)).
- [RFC6679] Westerlund, M., Johansson, I., Perkins, C., O'Hanlon, P., and K. Carlberg, "[Explicit Congestion Notification \(ECN\) for RTP over UDP](#)," RFC 6679, August 2012 ([TXT](#)).
- [RFC6714] Holmberg, C., Blau, S., and E. Burger, "[Connection Establishment for Media Anchoring \(CEMA\) for the Message Session Relay Protocol \(MSRP\)](#)," RFC 6714, August 2012 ([TXT](#)).
- [RFC6773] Phelan, T., Fairhurst, G., and C. Perkins, "[DCCP-UDP: A Datagram Congestion Control Protocol UDP Encapsulation for NAT Traversal](#)," RFC 6773, November 2012 ([TXT](#)).
- [RFC6787] Burnett, D. and S. Shanmugham, "[Media Resource Control Protocol Version 2 \(MRCPv2\)](#)," RFC 6787, November 2012 ([TXT](#)).
- [RTCP-FB] "[Session Description Protocol \(SDP\) RTCP Feedback attributes](#)."
- [SSRC-GROUP] "[Session Description Protocol \(SDP\) "ssrc-group" semantics](#)."
- [T.38] "[Procedures for real-time Group 3 facsimile communication over IP networks](#)."

Author's Address

TOC

Suhas Nandakumar
Cisco
170 West Tasman Drive
San Jose, CA 95134
USA
Email: snandaku@cisco.com