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A Framework for SDP Attributes when Multiplexing
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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 Media Streams 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.

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1. Introduction

Real-Time Communication Web (RTCWeb) framework requires Real-time Transport Protocol (RTP) as the media transport protocol and Session Description Protocol (SDP) [RFC4566] for describing and negotiating multi-media communication sessions.

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 IETF RTCWEB WG, a need to use a single 5-tuple for sending and receiving media associated with multiple SDP media descriptions ("m=" lines) has been identified. This would e.g. allow the usage of a single set of Interactive Connectivity Establishment (ICE) [RFC5245] candidates for multiple media descriptions. 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

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

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

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 that are recommended against multiplexing since their usage under multiplexing might lead to incorrect behavior.

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

```
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, RTCP Multiplexing MUST to enabled for both the audio and video m=lines in the example below if they are transported over a single 5-tuple.

```
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=" line 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 video media line's a=crypto attribute is chosen since its mid value (bar) appears first in the a=group:BUNDLE line. This is due to BUNDLE grouping semantic [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 bar foo
m=audio 49172 RTP/AVP 99
a=mid:foo
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:bar
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 "Level" 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

5.1. RFC4566 - SDP: Session Description Protocol

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	Level	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
fmtp	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

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	Level	Category
rtcp-fb	The combination of a particular Payload Type along with the m=line identify the scope and applicability of a given RTCP feedback to a particular RTP Stream.	M	NORMAL

RFC4585 Attribute Analysis

Since RTCP feedback attributes are Payload Type (PT) scoped, the usage of identical Payload Type values across multiplexed m=lines is described in [I-D.ietf-mmusic-sdp-bundle-negotiation].

5.3. RFC5761 - Multiplexing RTP and RTCP

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	Level	Category
rtcp-mux	RTP and RTCP Multiplexing affect the entire RTP Session	M	IDENTICAL

RFC5761 Attribute Analysis

5.4. RFC4574 - SDP Label Attribute

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	Level	Category
label	Not Impacted	M	NORMAL

RFC4574 Attribute Analysis

5.5. RFC5432 - QoS Mechanism Selection in SDP

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

Name	Notes	Level	Category
qos-mech-send	A single DSCP code point per flow being multiplexed doesn't impact multiplexing since QOS mechanisms are signaled/scoped per flow.	B	NORMAL
qos-mech-recv	A single DSCP code point per flow being multiplexed doesn't impact multiplexing since QOS mechanisms are signaled/scoped per flow.	B	NORMAL

RFC5432 Attribute Analysis

Multiplexing consideration when multiple DSCP code points are defined per flow can be found in Section 14

5.6. RFC4568 - SDP Security Descriptions

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	Level	Category
crypto	Refer to section 6.2.5 of [I-D.ietf-mmusic-sdp-bundle-negotiation]	M	SPECIAL

RFC4568 Attribute Analysis

If the multiplexing scheme cannot ensure unique SSRCs across all the media lines, multiplexing MUST NOT be performed.

5.7. RFC5762 - RTP over DCCP

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 signaling, such that real-time applications can make use of the services provided by DCCP

Name	Notes	Current	Category
dccp-service-code	If RFC6773 is not being used in addition to RFC5762, 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 RFC6773 is being used in addition to RFC5762 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 standardized 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

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) middle boxes without modification of those middle boxes

Name	Notes	Level	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

Since RFC6773 is about tunnelling DCCP in UDP, with the UDP port being the port of the DCCP en-/de-capsulation service. This encapsulation allows arbitrary DCCP packets to be encapsulated and the DCCP port choosen MAY conflict with the port chosen for the RTP traffic.

For multiplexing several DCCP-in-UDP encapsulations on the same UDP port, with no RTP traffic on the same port implies collapsing several DCCP port spaces together. This MAY or MAY NOT work depending on the nature of DCCP encapsulations and ports choses thus rendering it to be very application dependant.

5.9. RFC5506 - Reduced-Size RTCP in RTP Profile

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

transmitted with reduced size.

Name	Notes	Level	Category
rtcp-rsize	Reduced size RTCP affects the entire RTP Session	M	IDENTICAL

RFC5506 Attribute Analysis

5.10. RFC6787 - Media Resource Control Protocol Version 2

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	Level	Category
resource	Not Impacted	M	NORMAL
channel	Not Impacted	M	NORMAL

RFC6787 Attribute Analysis

5.11. RFC5245 - Interactive Connectivity Establishment (ICE)

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	Level	Category
ice-lite	Not Impacted	S	NORMAL
ice-options	Not Impacted	S	NORMAL
ice-pwd	ice-pwd MUST be the one that corresponds to the m=line chosen for setting up the underlying transport flow	B	TRANSPORT
ice-ufrag	ice-ufrag MUST be the one that corresponds to the m=line chosen for setting up the underlying transport flow	B	TRANSPORT
candidate	ice candidate MUST be the one that corresponds to the m=line chosen for setting up the underlying transport flow	M	TRANSPORT
remote-candidates	ice remote candidate MUST be the one that corresponds to the m=line chosen for setting up the underlying transport flow	M	TRANSPORT

RFC5245 Attribute Analysis

5.12. RFC5285 - RTP Header Extensions

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	Level	Category
extmap	Specific RTP extension document MUST be referred	B	SPECIAL

RFC5285 Attribute Analysis

5.13. RFC3605 - RTCP attribute in SDP

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	Level	Category
rtcp	Identical attribute value MUST be used since the RTCP port affects the entire RTP session.	M	IDENTICAL

RFC3605 Attribute Analysis

5.14. RFC5576 - Source-Specific SDP Attributes

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	Level	Category
ssrc	Refer to Notes below	M	SPECIAL
ssrc-group	Refer to section Section 9 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	Refer to notes below	SR	SPECIAL
fmtp	Not Impacted	SR	NORMAL

RFC5576 Attribute Analysis

If SSRCs are repeated across m=lines being multiplexed, they MUST all represent the same underlying RTP Source. For more details on implications of SSRC values with in the context of multiplexing please refer to [I-D.ietf-mmusic-sdp-bundle-negotiation]

5.15. RFC6236 - Image Attributes in SDP

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	Level	Category
imageattr	Not Impacted	M	NORMAL

RFC6236 Attribute Analysis

5.16. RFC6285 - Rapid Acquisition of Multicast RTP Sessions

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	Level	Category
rams-updates	Not recommended	M	NOT RECOMMENDED

RFC6285 Attribute Analysis

5.17. RFC6230 - Media Control Channel Framework

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	Level	Category
cfw-id	Not Applicable	M	NORMAL

RFC6230 Attribute Analysis

5.18. RFC6364 - SDP Elements for FEC Framework

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	Level	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

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	Level	Category
content	Not Impacted	M	NORMAL

RFC4796 Attribute Analysis

5.20. RFC3407 - SDP Simple Capability Declaration

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	Level	Category
sqn	Not Impacted	B	NORMAL
csdc	Not Impacted.	B	NORMAL
cpar	Refer to Section 15	B	SPECIAL
cparmin	Refer to Section 15	B	SPECIAL
cparmax	Refer to Section 15	B	SPECIAL

RFC3407 Attribute Analysis

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

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	Level	Category
portmapping-req	Not recommended, if port mapping is required by the application	M	NOT RECOMMENDED

RFC6284 Attribute Analysis

5.22. RFC6714 - MSRP-CEMA

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 middle boxes to anchor the MSRP connection, without the need for middle boxes to modify the MSRP messages; thus, it also enables secure end-to-end MSRP communication in networks where such middle boxes 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	Level	Category
msrp-cema	Not Impacted	M	NORMAL

RFC6714 Attribute Analysis

5.23. RFC4583 - SDP Format for BFCP Streams

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	Level	Category
floorctrl	Must be repeated across all the multiplexed m=lines	M	IDENTICAL
confid	Not Impacted	M	NORMAL
userid	Not Impacted	M	NORMAL
floorid	The floorid MUST be globally unique	M	NORMAL

RFC4583 Attribute Analysis

5.24. RFC5547 - SDP Offer/Answer for File Transfer

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	Level	Category
file-selector	Not Impacted	M	NORMAL
file-transfer-id	Not Impacted	M	NORMAL
file-disposition	Not Impacted	M	NORMAL
file-date	Not Impacted	M	NORMAL
file-iconfile-range	Not Impacted	M	NORMAL

RFC5547 Attribute Analysis

5.25. RFC6489 - SDP and RTP Media Loopback Extension

[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	Level	Category
loopback rtp-pkt-loopback	Not Impacted	M	NORMAL
loopback rtp-media-loopback	Not Impacted	M	NORMAL
loopback-source	Not Impacted	M	NORMAL
loopback-mirror	Not Impacted	M	NORMAL

An Extension to the Session Description Protocol (SDP) and Real-time Transport Protocol (RTP) for Media Loopback

5.26. RFC5760 - RTCP with Unicast Feedback

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	Level	Category
rtcp-unicast	The attribute MUST be reported across all m=lines multiplexed	M	IDENTICAL

RFC5760 Attribute Analysis

5.27. RFC3611 - RTCP XR

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	Level	Category
rtcp-xr	Not Impacted	B	NORMAL

RFC3611 Attribute Analysis

5.28. RFC5939 - SDP Capability Negotiation

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	Level	Category
pcfg	Refer to section Section 15	M	SPECIAL
acfg	Refer to section Section 15	M	SPECIAL
csup	Not Impacted	B	NORMAL
creq	Not Impacted	B	NORMAL
acap	Refer to section Section 15	B	SPECIAL
tcap	Refer to section Section 15	B	SPECIAL

RFC5939 Attribute Analysis

5.29. RFC6781 - SDP Media Capabilities Negotiation

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. [RFC6781] extends the framework by defining media capabilities that can be used to negotiate media types and their associated parameters.

Name	Notes	Level	Category
rmcap	Not Impacted	B	NORMAL
omcap	Not Impacted	B	NORMAL
mfcap	Not Impacted	B	NORMAL
mscap	Refer to section Section 15	B	SPECIAL
lcfg	Refer to section Section 15	B	SPECIAL
sescap	Not Impacted	S	NORMAL

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

5.30. RFC4567 - Key Management Extensions for SDP and RTSP

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	Level	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

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	Level	Category
fingerprint	Fingerprint value from the m=line defining the underlying transport is chosen	B	TRANSPORT

RFC4572 Attribute Analysis

5.32. RFC4570 - SDP Source Filters

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	Level	Category
source-filter	The attribute MUST be repeated across all m=lines multiplexed	B	IDENTICAL

RFC4570 Attribute Analysis

5.33. RFC6128 - RTCP Port for Multicast Sessions

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	Level	Category
multicast-rtcp	Multicast RTCP port MUST be identical across all the m=lines	B	IDENTICAL

RFC6128 Attribute Analysis

5.34. RFC6189 - ZRTP

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	Level	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

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	Level	Category
setup	MUST be identical across all m=lines	B	IDENTICAL
connection	MUST be identical across all m=lines	B	IDENTICAL

RFC4145 Attribute Analysis

5.36. RFC5159 - OMA BCAST SDP Attributes

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	Level	Category
bcastversion	Not Impacted	S	NORMAL
stkmstream	Not Impacted	B	NORMAL
SRTPAuthentication	Not Impacted	M	NORMAL
SRTPROCTxRate	Not Impacted	M	NORMAL

RFC5159 Attribute Analysis

5.37. RFC6193 - Media Description for IKE in SDP

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	Level	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

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	Level	Category
X-predecbufsize	Refer to notes below	M	NOT RECOMMENDED
X-initpredecbufperiod	Refer to notes below	M	NOT RECOMMENDED
X-initpostdecbufperiod	Refer to notes below	M	NOT RECOMMENDED

X-decbyterate	Refer to notes below	M	NOT RECOMMENDED
3gpp-videopostdecbufsize	Refer to notes below	M	NOT RECOMMENDED
framesize	Refer to notes below	M	NOT RECOMMENDED
3GPP-Integrity-Key	Refer to notes below	S	NOT RECOMMENDED
3GPP-SRTP-Config	Refer to notes below	M	NOT RECOMMENDED
alt,alt-default-id	Refer to notes below	M	NOT RECOMMENDED
alt-group	Refer to notes below	M	NOT RECOMMENDED
3GPP-Adaptation-Support	Refer to notes below	M	NOT RECOMMENDED
3GPP-Asset-Informatio	Refer to notes below	B	NOT RECOMMENDED
mbms-mode	Refer to notes below	B	NOT RECOMMENDED
mbms-flowid	MRefer to notes below	M	NOT RECOMMENDED
mbms-repair	Refer to notes below	B	NOT RECOMMENDED

3GPP-QoE-Metrics:Corruption duration	Refer to notes below	M	NOT RECOMMENDED
3GPP-QoE-Metrics:Rebuffering duration	Refer to notes below	M	NOT RECOMMENDED
3GPP-QoE-Metrics:Initial buffering duration	Refer to notes below	M	NOT RECOMMENDED
3GPP-QoE-Metrics:Successive loss of RTP packets	Refer to notes below	M	NOT RECOMMENDED
3GPP-QoE-Metrics:Frame rate deviation	Refer to notes below	M	NOT RECOMMENDED
3GPP-QoE-Metrics:Jitter duration	Refer to notes below	M	NOT RECOMMENDED
3GPP-QoE-Metrics:Content Switch Time	Refer to notes below	B	NOT RECOMMENDED
3GPP-QoE-Metrics:Average Codec Bitrat	Refer to notes below	M	NOT RECOMMENDED
3GPP-QoE-Metrics:Codec Information	Refer to notes below	M	NOT RECOMMENDED
3GPP-QoE-Metrics:Buffer Status	Refer to notes below	M	NOT RECOMMENDED

RFC6064 Attribute Analysis

[RFC6064] defines SDP attributes that are applicable in the declarative usage of SDP alone. For purposes of this document, only the Offer/Answer usage of SDP is considered as mandated by

[I-D.ietf-mmusic-sdp-bundle-negotiation].

5.39. RFC3108 - ATM SDP

RFC3108 [RFC3108] describes conventions for using the Session Description Protocol (SDP) described for controlling ATM Bearer Connections, and any associated ATM Adaptation Layer (AAL)

Name	Notes	Level	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
codecconfig	Not Impacted	B	NORMAL
isup_usi	Not Impacted	B	NORMAL
isup_usi	Not Impacted	B	NORMAL
chain	Not Impacted	B	NORMAL

RFC3108 Attribute Analysis

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.

5.40. 3GPP TS 24.182

3GPP TS 24.182 [R3GPPTS24.182] specifies IP multimedia subsystem Custom Alerting tones

Name	Notes	Level	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

3GPP TS 24.183 [R3GPPTS24.183]specifies IP multimedia subsystem Custom Ringing Signal

Name	Notes	Level	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

3GPP TS 24.229 [R3GPPTS24.229]IP multimedia call control protocol based on Session Initial protocol and Session Description Protocol.

Name	Notes	Level	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

3GPP TS 24.229 Attribute Analysis

5.43. ITU T.38

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

Name	Notes	Level	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	Level	Category
h248item	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.	B	SPECIAL

Historic Attribute Analysis

5.45. RFC4975 - The Message Session Relay Protocol

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	Level	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

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

Name	Notes	Level	Category
rtpred1	Historic attributes.	Not-Applcable	NOT RECOMMENDED
rtpred2	Historic attributes.	Not-Applcable	NOT RECOMMENDED
PSCid	Not Applicable	Not-Applcable	TBD
bc_service	Not Applicable	Not-Applcable	TBD
bc_program	Not Applicable	Not-Applcable	TBD
bc_service_package	Not Applicable	Not-Applcable	TBD

Unknowns Attribute Analysis

6. bwtype Attribute Analysis

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

6.1. RFC4566 - SDP: Session Description Protocol

Name	Notes	Level	Category
bwtype:CT	Aggregate bandwidth for the conference	S	NORMAL
bwtype:AS	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 thus NORMAL category applies.	B	NORMAL
bwtype:AS	For the media level usage,the aggregate of individual bandwidth values is considered.	B	SUM

RFC4566 bwtype Analysis

6.2. RFC3556 - SDP Bandwidth Modifiers for RTCP Bandwidth

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	Level	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

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	Level	Category
bwtype:TIAS	The usage of TIAS is not clearly defined Offer/Answer usage.	B	SPECIAL
maxprate	The usage of TIAS and maxprate is not well defined under multiplexing	B	SPECIAL

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

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

7.1. RFC4585 - RTP/AVPF

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	Level	Category
ack rpsi	Not Impacted	M	NORMAL
ack app	Feedback parameters MUST be handled in the app specific way when multiplexed	M	SPECIAL
nack	Not Impacted	M	NORMAL
nack pli	Not Impacted	M	NORMAL
nack sli	Not Impacted	M	NORMAL
nack rpsi	Not Impacted	M	NORMAL
nack app	Feedback parameters MUST be handled in the app specific way when multiplexed	M	SPECIAL
trr-int	This attribute applies to RTP Session as a whole	M	IDENTICAL

RFC4585 Attribute Analysis

7.2. RFC5104 - Codec Control Messages in AVPF

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	Level	Category
ccm	Not Impacted	M	Normal

RFC5104 Attribute Analysis

7.3. RFC6285 - Unicast-Based RAMS

Name	Notes	Level	Category
nack rai	Not Impacted	M	NORMAL

RFC6285 Attribute Analysis

7.4. RFC6679 - ECN for RTP over UDP/IP

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 initialization method using Interactive Connectivity Establishment (ICE)

Name	Notes	Level	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

7.5. RFC6642 - Third-Party Loss Report

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	Level	Category
nack tllei	Not Impacted	M	NORMAL
nack pslei	Not Impacted	M	NORMAL

RFC6642 Attribute Analysis

7.6. RFC5104 - Codec Control Messages in AVPF

Attr Name	Notes	Level	Category
ccm fir	Not Impacted	M	NORMAL
ccm tmmbr	Not Impacted	M	NORMAL
ccm tstr	Not Impacted	M	NORMAL
ccm vbcm	Not Impacted	M	NORMAL

RFC5104 Attribute Analysis

8. group Attribute Analysis

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

8.1. RFC5888 - SDP Grouping Framework

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

Name	Notes	Level	Category
group:LS	Not Impacted	S	NORMAL
group:FID	Not Impacted	S	NORMAL

RFC5888 Attribute Analysis

8.2. RFC3524 - Mapping Media Streams to Resource Reservation Flows

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	Level	Category
group:SRF	Not Impacted	S	NORMAL

RFC3524 Attribute Analysis

8.3. 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	Level	Category
group:ANAT	ANAT semantics is obseleted	S	NOT RECOMMENDED

RFC4091 Attribute Analysis

8.4. 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	Level	Category
group:FEC-FR	Not Impacted	S	NORMAL

RFC5956 Attribute Analysis

8.5. 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	Level	Category
depend lay	Not Impacted	M	NORMAL
depend mdc	Not Impacted	M	NORMAL

```
          |            |               |       |          |
          +------------+---------------+-------+----------+
```

RFC5583 Attribute Analysis

The usage of identical Payload Type values across multiplexed m=lines is described in [I-D.ietf-mmusic-sdp-bundle-negotiation].

9. ssrc-group Attribute Analysis

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

9.1. RFC5576 - Source-Specific SDP Attributes

Name	Notes	Level	Category
FID	Not Impacted	M	NORMAL
FEC	Not Impacted	M	NORMAL
FEC-FR	Not Impacted	M	NORMAL

RFC5576 Attribute Analysis

10. QoS Mechanism Token Analysis

This section analyzes QoS tokes specified with SDP[QOS].

10.1. RFC5432 - QoS Mechanism Selection in SDP

Name	Notes	Level	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

11. k= Attribute Analysis

11.1. RFC4566 SDP: Session Description Protocol

Name	Notes	Level	Category
k=	It is NOT recommended to use this attribute	S	NOT RECOMMENDED

RFC4566 Attribute Analysis

12. content Atribute Analysis

12.1. RFC4796

Name	Notes	Level	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

13. Payload Formats

13.1. 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	Level	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.

14. Multiplexing Media Streams and DSCP Markings

Note: This section does not yet have WG consensus but is included as a proposal to the WG. There are two options being proposed, A and B. The authors suggest A.

14.1. Option A

This section provides two rules for multiplexing multiple media streams with DSCP markings over a single 5-tuple.

Rule 1: Media Streams with markings from different service classes MUST NOT be multiplexed. For example, a media stream with DSCP Marking EF MUST NOT be multiplexed with a media stream marked with AF class. Likewise, a media stream with DSCP marking AF3x MUST NOT be multiplexed with a media stream marked with AF4x.

Rule 2: Media Streams that belong to the same service class, even with different drop precedence, MAY be multiplexed. Thus media streams that all belong to the EF group or all that belong to the AF4X class can be multiplexed.

For WebRTC applications following the advice in [I-D.dhesikan-tsvwg-rtcweb-qos], the above rules end up allowing the audio and video to be multiplexed in many, but not all, cases.

14.2. Option B

Media Streams MAY be multiplexed regardless of what the setting of the DSCP Per Hop Behavior group (PHB).

15. Multiplexing Considerations for Encapsulating Attributes

NOTE: The analysis given below is still Work-In-Progress and will be updated soon.

This sections deals with recommendations for defining the multiplexing charactersitics of the SDP attributes that encaspsulate other SDP attributes. Such attributes as of today, for example, are defined in [RFC3407], [RFC5939] and [RFC6781] as part of a generic framework for indicating and negotiating transport, media and media format related capabilities in the SDP.

The behavior of such attributes under multiplexing is in turn defined by the multiplexing behavior of the attributes they encapsulate which are made known once the negotiation process is completed.

Example 1: Below SDP example captures the following aspects.

1. The Offerer offers audio and video streams with several different RTP profiles (AVP, SAVP, SAVPF) as potential configurations.
2. ANSWER - 1 corresponds to the SDP answer where the Answerer accepts RTP/SAVPF as the default profile for both the media streams. In this scenario both the media streams can be successfully multiplexed.
3. In ANSWER - 2 SDP, the Answerer accepts the profile RTP/SAVPF for the audio stream and RTP/AVPF for the video stream. This scenario results in the failure of the multiplexing as defined in the section 7.2 of the BUNDLE specifcation [I-D.ietf-mmusic-sdp-bundle-negotiation].

```
v=0
o=- 25678 753849 IN IP4 192.0.2.1
s=
t=0 0
c=IN IP4 192.0.2.1
m=audio 3456 RTP/AVP 98
a=tcap:1 RTP/SAVPF
a=rtpmap:98 OPUS/48000/2
a=pcfg:1 t=1

m=video 51372 RTP/AVP 101
a=rtpmap:101 H264/90000
a=tcap:2 RTP/SAVPF RTP/AVPF
a=pcfg:2 t=2|3


ANSWER - 1
-----------
v=0
o=- 24351 621814 IN IP4 192.0.2.2
s=
m=audio 3456 RTP/SAVPF 98
a=rtpmap:98 OPUS/48000/2
a=acfg:1 t=1

m=video 51372 RTP/SAVPF 101
a=rtpmap:101 H264/90000
a=acfg:2 t=2

ANSWER - 2
-----------
v=0
o=- 24351 621814 IN IP4 192.0.2.2
s=
m=audio 3456 RTP/SAVPF 98
a=rtpmap:98 OPUS/48000/2
a=acfg:1 t=1

m=video 51372 RTP/AVPF 101
a=rtpmap:101 H264/90000
a=acfg:2 t=3
```

Example 2: Below SDP example captures the following aspects.

1. Offerer offers use of plain RTP and Secure RTP as alternatives. For the Secure RTP stream, it can be established using either DTLS-SRTP or SDP security descriptions

2. ANSWER - 1 corresponds to the SDP answer where the Answerer accepts DTLS based encryption for both the audio and video streams. This scenario can lead to successfull multiplexing of the audio and the video streams.
3. In ANSWER - 2 SDP, the Answerer accepts plain RTP for the audio stream and DTLS based encryption for the video stream. This scenario results in unsuccesfull multiplexing of the media streams since the encryption scheme applies to the entire RTP Session and cannot be applied to video media stream alone when multiplexed.

```
OFFER
-----
v=0
o=- 25678 753849 IN IP4 192.0.2.1
s=
t=0 0
c=IN IP4 192.0.2.1
a=acap:1 setup:actpass
a=acap:2 fingerprint: SHA-1 \
          4A:AD:B9:B1:3F:82:18:3B:54:02:12:DF:3E:5D:49:6B:19:E5:7C:AB
a=tcap:1 UDP/TLS/RTP/SAVP RTP/SAVP
m=audio 59000 RTP/AVP 98
a=rtpmap:98 AMR/8000
a=acap:3 crypto:1 AES_CM_128_HMAC_SHA1_32
         inline:NzB4d1BINUAvLEw6UzF3WSJ+PSdFcGdUJShpX1Zj|2^20|1:32
a=pcfg:1 t=1 a=1,2
a=pcfg:2 t=2 a=3

m=video 59123 RTP/AVP 100
a=rtpmap:100 VP8/90000
a=pcfg:3 t=1 a=1,2


ANSWER - 1
-----------
v=0
o=- 24351 621814 IN IP4 192.0.2.2
s=
t=0 0
c=IN IP4 192.0.2.2

m=audio 54568 UDP/TLS/RTP/SAVP 98
a=rtpmap:98 AMR/8000
a=acfg:1 t=1 a=1,2

m=video 54968 UDP/TLS/RTP/SAVP 100
a=rtpmap:100 VP8/90000
```

```
a=acfg:3 t=1 a=1,2


ANSWER - 2
-----------
v=0
o=- 24351 621814 IN IP4 192.0.2.2
s=
t=0 0
c=IN IP4 192.0.2.2
m=audio 54568 RTP/AVP 98
a=rtpmap:98 AMR/8000

m=video 54968 UDP/TLS/RTP/SAVP 100
a=rtpmap:100 VP8/90000
a=setup:active
a=fingerprint: SHA-1 \
    FF:FF:FF:B1:3F:82:18:3B:54:02:12:DF:3E:5D:49:6B:19:E5:7C:AB
a=acfg:3 t=1 a=1,2
```

In conclusion, the mutliplexing behavior of the encapsulating attributes are defined based on the multiplexing behavior of the attributes they encapsulate. Thus care should be taken in determining if certain combinations of these attributes can be used in the context of transport multplexing.

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

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

18. Acknowledgments

I would like to thank Cullen Jennings for suggesting the categories, contributing text and reviewing the draft. I would also link to thank Magnus, Christer and Dan on suggesting structural changes helping improve the document readability.

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19. Change Log

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

Changes from draft-ietf-mmusic-sdp-mux-attributes-00

- Added Section 15 to provide recommendations on multiplexing SDP encapsulating attributes. Also updated sections 5.20, 5.28, 5.29 to refer to Section 15.
- Updated Section 5.38 to incorporate PM-dir review inputs from Qin Wu
- Updated Sections 5.2,5.14,8.5 to refer to BUNDLE draft for more clarity.
- Fixed few nits regarding sentence clarity and fill-in the NOTES section where information was lacking.

Changes from draft-nandakumar-mmusic-mux-attributes-05

- Renamed the document to be a WG document.
- Added Section 14.

- Updated Open Issues based on IETF88 discussions.

Changes from draft-nandakumar-mmusic-mux-attributes-04
- Added few OPEN ISSUES that needs to be discussed.
- Updated sections 5.10,5.23,5,24,5,25,7.2,9.1,5.12,5.27,8.4, 5.44,5.11,5.4,5.19,10.1,10.5,5.21,10.4,15.1
- Updated Table Column name Current to Level and improved TRANSPORT category explanation on suggestions form Dan Wing.
- Grouped all the rtcp-fb attribute analysis under a single section as suggested by Magnus/

Changes from draft-nandakumar-mmusic-mux-attributes-03
- Maintenance change to clean up grammatical nits and wordings.

Changes from draft-nandakumar-mmusic-mux-attributes-02
- Updated Sections 5.3,5.5,5.6,5.7,5.9,5.8,5.11,5.13,5.22,5.34, 5.37,5.40,5.41,5.42,5.43,5.44,5.45,6.1,6.2,6.3,8,3,12.1 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.

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