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                     Source-Specific Media Attributes in the
                      Session Description Protocol (SDP)

Status of This Memo

   This document specifies an Internet standards track protocol for the
   Internet community, and requests discussion and suggestions for
   improvements. Please refer to the current edition of the "Internet
   Official Protocol Standards" (STD 1) for the standardization state
   and status of this protocol. Distribution of this memo is unlimited.

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, but does not provide any mechanism to describe
   individual media sources within a media stream. This document
   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.

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1. Introduction

   The Session Description Protocol (SDP) [RFC4566] provides mechanisms
   to describe attributes of multimedia sessions and of media streams
   (e.g., Real-time Transport Protocol (RTP) [RFC3550] sessions) within
   a multimedia session, but does not provide any mechanism to describe
   individual media sources within a media stream.

Several recently proposed protocols, notably RTP single-source
multicast [EXT-SSM], have found it useful to describe specific media
sources in SDP messages. Single-source multicast, in particular,
needs to ensure that receivers' RTP synchronization source (SSRC)
identifiers do not collide with those of media senders, as the RTP
specification [RFC3550] requires that colliding sources change their
SSRC values after a collision has been detected. Earlier work has
used mechanisms specific to each protocol to describe the individual
sources of an RTP session.

Moreover, whereas the Real-time Transport Protocol (RTP) [RFC3550] is
defined as allowing multiple sources in an RTP session (for example,
if a user has more than one camera), SDP has no existing mechanism
for an endpoint to indicate that it will be using multiple sources or
to describe their characteristics individually.

To address all these problems, this document defines a mechanism to
describe RTP sources, identified by their synchronization source
(SSRC) identifier, in SDP, to associate attributes with these
sources, and to express relationships among individual sources. It
also defines a number of new SDP attributes that apply to individual
sources ("source-level" attributes), describes how a number of
existing media stream ("media-level") attributes can also be applied
at the source level, and establishes IANA registries for source-level
attributes and source grouping semantics.

2. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
"SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this
document are to be interpreted as described in RFC 2119 [RFC2119] and
indicate requirement levels for compliant implementations.

3. Overview

In the Real-time Transport Protocol (RTP) [RFC3550], an association
among a group of communicating participants is known as an RTP
Session. An RTP session is typically associated with a single
transport address (in the case of multicast) or communication flow
(in the case of unicast), though RTP translators and single-source
multicast [EXT-SSM] can make the situation more complex. RTP
topologies are discussed in more detail in [RFC5117].

Within an RTP session, the source of a single stream of RTP packets
is known as a synchronization source (SSRC). Every synchronization
source is identified by a 32-bit numeric identifier. In addition,
receivers (who may never send RTP packets) also have source

identifiers, which are used to identify their RTP Control Protocol
(RTCP) receiver reports and other feedback messages.

Messages of the Session Description Protocol (SDP) [RFC4566], known
as session descriptions, describe multimedia sessions. A multimedia
session is a set of multimedia senders and receivers as well as the
data streams flowing from senders to receivers. A multimedia session
contains a number of media streams, which are the individual RTP
sessions or other media paths over which one type of multimedia data
is carried. Information that applies to an entire multimedia session
is called session-level information, while information pertaining to
one media stream is called media-level information. The collection
of all the information describing a media stream is known as a media
description. (Media descriptions are also sometimes known informally
as SDP "m"-lines, after the SDP syntax that begins a media
description.) Several standard information elements are defined at
both the session level and the media level. Extended information can
be included at both levels through the use of attributes.

(The term "media stream" does not appear in the SDP specification
itself, but is used by a number of SDP extensions, for instance,
Interactive Connectivity Establishment (ICE) [ICE], to denote the
object described by an SDP media description. This term is
unfortunately rather confusing, as the RTP specification [RFC3550]
uses the term "media stream" to refer to an individual media source
or RTP packet stream, identified by an SSRC, whereas an SDP media
stream describes an entire RTP session, which can contain any number
of RTP sources. In this document, the term "media stream" means an
SDP media stream, i.e., the thing described by an SDP media
description, whereas "media source" is used for a single source of
media packets, i.e., an RTP media stream.)

The core SDP specification does not have any way of describing
individual media sources, particularly RTP synchronization sources,
within a media stream. To address this problem, in this document we
introduce a third level of information, called source-level
information. Syntactically, source-level information is described by
a new SDP media-level attribute, "ssrc", which identifies specific
synchronization sources within an RTP session and acts as a meta-
attribute mapping source-level attribute information to these
sources.

This document also defines an SDP media-level attribute, "ssrc-
group", which can represent relationships among media sources within
an RTP session in much the same way as the "group" attribute
[RFC3388] represents relationships among media streams within a
multimedia session.

4. Media Attributes

   This section defines two media-level attributes, "ssrc" and "ssrc-
   group".

4.1. The "ssrc" Media Attribute

   a=ssrc:<ssrc-id> <attribute>
   a=ssrc:<ssrc-id> <attribute>:<value>

   The SDP media attribute "ssrc" indicates a property (known as a
   "source-level attribute") of a media source (RTP stream) within an
   RTP session. <ssrc-id> is the synchronization source (SSRC) ID of the
   source being described, interpreted as a 32-bit unsigned integer in
   network byte order and represented in decimal. <attribute> or
   <attribute>:<value> represents the source-level attribute specific to
   the given media source. The source-level attribute follows the
   syntax of the SDP "a=" line. It thus consists of either a single
   attribute name (a flag) or an attribute name and value, e.g.,
   "cname:user@example.com". No attributes of the former type are
   defined by this document.

   Within a media stream, "ssrc" attributes with the same value of
   <ssrc-id> describe different attributes of the same media sources.
   Across media streams, <ssrc-id> values are not correlated (unless
   correlation is indicated by media-stream grouping or some other
   mechanism) and MAY be repeated.

   Each "ssrc" media attribute specifies a single source-level attribute
   for the given <ssrc-id>. For each source mentioned in SDP, the
   source-level attribute "cname", defined in Section 6.1, MUST be
   provided. Any number of other source-level attributes for the source
   MAY also be provided.

   The "ssrc" media attribute MAY be used for any RTP-based media
   transport. It is not defined for other transports.

   If any other SDP attributes also mention RTP SSRC values (for
   example, Multimedia Internet KEYing (MIKEY) [RFC3830] [RFC4567]), the
   values used MUST be consistent. (These attributes MAY provide
   additional information about a source described by an "ssrc"
   attribute or MAY describe additional sources.)

   Though the source-level attributes specified by the ssrc property
   follow the same syntax as session-level and media-level attributes,
   they are defined independently. All source-level attributes MUST be
   registered with IANA, using the registry defined in Section 12.2.

Figure 4 in Section 10 gives a formal Augmented Backus-Naur Form
(ABNF) [RFC5234] grammar for the "ssrc" attribute.

The "ssrc" media attribute is not dependent on charset.

4.2. The "ssrc-group" Media Attribute

a=ssrc-group:<semantics> <ssrc-id> ...

The SDP media attribute "ssrc-group" expresses a relationship among
several sources of an RTP session. It is analogous to the "group"
session-level attribute [RFC3388], which expresses a relationship
among media streams in an SDP multimedia session (i.e., a
relationship among several logically related RTP sessions). As
sources are already identified by their SSRC IDs, no analogous
property to the "mid" attribute is necessary; groups of sources are
identified by their SSRC IDs directly.

The <semantics> parameter is taken from the specification of the
"group" attribute [RFC3388]. The initial semantic values defined for
the "ssrc-group" attribute are FID (Flow Identification) [RFC3388]
and FEC (Forward Error Correction) [RFC4756]. In each case, the
relationship among the grouped sources is the same as the
relationship among corresponding sources in media streams grouped
using the SDP "group" attribute.

Though the "ssrc-group" semantic values follow the same syntax as
"group" semantic values, they are defined independently. All "ssrc-
group" semantic values MUST be registered with IANA, using the
registry defined in Section 12.3.

(The other "group" semantics registered with IANA as of this writing
are not useful for source grouping. LS (Lip Synchronization)
[RFC3388] is redundant for sources within a media stream as RTP
sources with the same CNAME are implicitly synchronized in RTP. SRF
(Single Reservation Flow) [RFC3524] and ANAT (Alternative Network
Address Types) [RFC4091] refer specifically to the media stream's
transport characteristics. CS (Composite Session) [FLUTE] is used to
group FLUTE sessions, and so is not applicable to RTP.)

The "ssrc-group" attribute indicates the sources in a group by
listing the <ssrc-id>s of the sources in the group. It MUST list at
least one <ssrc-id> for a group and MAY list any number of additional
ones. Every <ssrc-id> listed in an "ssrc-group" attribute MUST be
defined by a corresponding "ssrc:" line in the same media
description.

The "ssrc-group" media attribute is not dependent on charset.

Figure 5 in Section 10 gives a formal Augmented Backus-Naur Form
(ABNF) [RFC5234] grammar for the "ssrc-group" attribute.

5. Usage of Identified Source Identifiers in RTP

The synchronization source identifiers used in an RTP session are
chosen randomly and independently by endpoints. As such, it is
possible for two RTP endpoints to choose the same SSRC identifier.
Though the probability of this is low, the RTP specification
[RFC3550] requires that all RTP endpoints MUST be prepared to detect
and resolve collisions.

As a result, all endpoints MUST be prepared for the fact that
information about specific sources identified in a media stream might
be out of date. The actual binding between SSRCs and source CNAMEs
can only be identified by the source description (SDES) RTCP packets
transmitted on the RTP session.

When endpoints are choosing their own local SSRC values for media
streams for which source-level attributes have been specified, they
MUST NOT use for themselves any SSRC identifiers mentioned in media
descriptions they have received for the media stream.

However, sources identified by SDP source-level attributes do not
otherwise affect RTP transport logic. Specifically, sources that are
only known through SDP, for which neither RTP nor RTCP packets have
been received, MUST NOT be counted for RTP group size estimation, and
report blocks MUST NOT be sent for them in SR or RR RTCP messages.

Endpoints MUST NOT assume that only the sources mentioned in SDP will
be present in an RTP session; additional sources, with previously
unmentioned SSRC IDs, can be added at any time, and endpoints MUST be
prepared to receive packets from these sources. (How endpoints
handle such packets is not specified here; they SHOULD be handled in
the same manner as packets from additional sources would be handled
had the endpoint not received any a=ssrc: attributes at all.)

An endpoint that observes an SSRC collision between its explicitly
signaled source and another entity that has not explicitly signaled
an SSRC MAY delay its RTP collision-resolution actions [RFC3550] by
5*1.5*Td, where Td is the deterministic, calculated, reporting
interval for receivers defined in Section 6.3.1 of the RTP
specification [RFC3550], to see whether the conflict still exists.
(This gives precedence to explicitly signaled sources and places the
burden of collision resolution on non-signaled sources.) SSRC
collisions between multiple explicitly-signaled sources, however,
MUST be acted upon immediately.

If, following RTP's collision-resolution procedures [RFC3550], a
source identified by source-level attributes has been forced to
change its SSRC identifier, the author of the SDP containing the
source-level attributes for these sources SHOULD send out an updated
SDP session description with the new SSRC if the mechanism by which
SDP is being distributed for the multimedia session has a mechanism
to distribute updated SDP. This updated SDP MUST include a
"previous-ssrc" source-level attribute, described in Section 6.2,
listing the source's previous SSRC ID. (If only a single source with
a given CNAME has collided, the other RTP session members can infer a
correspondence between the source's old and new SSRC IDs without
requiring an updated session description. However, if more than one
source collides at once, or if sources are leaving and re-joining,
this inference is not possible. To avoid confusion, therefore,
sending updated SDP messages is always RECOMMENDED.)

Endpoints MUST NOT reuse the same SSRC ID for identified sources with
the same CNAME for at least the duration of the RTP session's
participant timeout interval (see Section 6.3.5 of [RFC3550]). They
SHOULD NOT reuse any SSRC ID ever mentioned in SDP (either by
themselves or by other endpoints) for the entire lifetime of the RTP
session.

Endpoints MUST be prepared for the possibility that other parties in
the session do not understand SDP source-level attributes, unless
some higher-level mechanism normatively requires them. See Section 9
for more discussion of this.

6. Source Attributes

This section describes specific source attributes that can be applied
to RTP sources.

6.1. The "cname" Source Attribute

   a=ssrc:<ssrc-id> cname:<cname>

The "cname" source attribute associates a media source with its
Canonical End-Point Identifier (CNAME) source description (SDES)
item. This MUST be the CNAME value that the media sender will place
in its RTCP SDES packets; it therefore MUST follow the syntax
conventions of CNAME defined in the RTP specification [RFC3550]. If
a session participant receives an RTCP SDES packet associating this
SSRC with a different CNAME, it SHOULD assume there has been an SSRC
collision and that the description of the source that was carried in
the SDP description is not applicable to the actual source being
received. This source attribute is REQUIRED to be present if any
source attributes are present for a source. The "cname" attribute

     MUST NOT occur more than once for the same ssrc-id within a given
     media stream.

     The "cname" source attribute is not dependent on charset.

     Figure 6 in Section 10 gives a formal Augmented Backus-Naur Form
     (ABNF) [RFC5234] grammar for the "cname" attribute.

6.2. The "previous-ssrc" Source Attribute

     a=ssrc:<ssrc-id> previous-ssrc:<ssrc-id> ...

     The "previous-ssrc" source attribute associates a media source with
     previous source identifiers used for the same media source.
     Following an SSRC change due to an SSRC collision involving a media
     source described in SDP, the updated session description describing
     the source's new SSRC (described in Section 5) MUST include the
     "previous-ssrc" attribute associating the new SSRC with the old one.
     If further updated SDP descriptions are published describing the
     media source, the "previous-ssrc" attribute SHOULD be included if the
     session description was generated before the participant timeout of
     the old SSRC, and MAY be included after that point. This attribute,
     if present, MUST list at least one previous SSRC and MAY list any
     number of additional SSRCs for the source if the source has collided
     more than once. This attribute MUST be present only once for each
     source.

     The "previous-ssrc" source attribute is not dependent on charset.

     Figure 7 in Section 10 gives a formal Augmented Backus-Naur Form
     (ABNF) [RFC5234] grammar for the previous-ssrc attribute.

6.3. The "fmtp" Source Attribute

     a=ssrc:<ssrc> fmtp:<format> <format specific parameters>

     The "fmtp" source attribute allows format-specific parameters to be
     conveyed about a given source. The <format> parameter MUST be one of
     the media formats (i.e., RTP payload types) specified for the media
     stream. The meaning of the <format specific parameters> is unique
     for each media type. This parameter MUST only be used for media
     types for which source-level format parameters have explicitly been
     specified; media-level format parameters MUST NOT be carried over
     blindly.

     The "fmtp" source attribute is not dependent on charset.

6.4. Other Source Attributes

   This document only defines source attributes that are necessary or
   useful for an endpoint to decode and render the sources in a media
   stream. It does not include any attributes that would contribute to
   an endpoint's decision to accept or reject a stream, e.g., in an
   offer/answer exchange. Such attributes are for future consideration.

7. Examples

   This section gives several examples of SDP descriptions of media
   sessions containing source attributes. For brevity, only the media
   sections of the descriptions are given.

   m=audio 49168 RTP/AVP 0
   a=ssrc:314159 cname:user@example.com

   Figure 1: Example of a declaration of a single synchronization source

   The example in Figure 1 shows an audio stream advertising a single
   source.

   m=video 49170 RTP/AVP 96
   a=rtpmap:96 H264/90000
   a=ssrc:12345 cname:another-user@example.com
   a=ssrc:67890 cname:another-user@example.com

    Figure 2: Example of a media stream containing several independent
                  sources from a single session member

   The example in Figure 2 shows a video stream where one participant
   (identified by a single CNAME) has several cameras. The sources
   could be further distinguished by RTCP Source Description (SDES)
   information.

   m=video 49174 RTP/AVPF 96 98
   a=rtpmap:96 H.264/90000
   a=rtpmap:98 rtx/90000
   a=fmtp:98 apt=96;rtx-time=3000
   a=ssrc-group:FID 11111 22222
   a=ssrc:11111 cname:user3@example.com
   a=ssrc:22222 cname:user3@example.com
   a=ssrc-group:FID 33333 44444
   a=ssrc:33333 cname:user3@example.com
   a=ssrc:44444 cname:user3@example.com

               Figure 3: Example of the relationships among
                       several retransmission sources

The example in Figure 3 shows how the relationships among sources
used for RTP retransmission [RFC4588] can be explicitly signaled.
This prevents the complexity of associating original sources with
retransmission sources when SSRC multiplexing is used for RTP
retransmission, as is described in Section 5.3 of [RFC4588].

8. Usage With the Offer/Answer Model

When used with the SDP Offer/Answer Model [RFC3264], SDP source-
specific attributes describe only the sources that each party is
willing to send (whether it is sending RTP data or RTCP report
blocks). No mechanism is provided by which an answer can accept or
reject individual sources within a media stream; if the set of
sources in a media stream is unacceptable, the answerer's only option
is to reject the media stream or the entire multimedia session.

The SSRC IDs for sources described by an SDP answer MUST be distinct
from the SSRC IDs for sources of that media stream in the offer.
Similarly, new SSRC IDs in an updated offer MUST be distinct from the
SSRC IDs for that media stream established in the most recent offer/
answer exchange for the session and SHOULD be distinct from any SSRC
ID ever used by either party within the multimedia session (whether
or not it is still being used).

9. Backward Compatibility

According to the definition of SDP, interpreters of SDP session
descriptions ignore unknown attributes. Thus, endpoints MUST be
prepared that recipients of their RTP media session may not
understand their explicit source descriptions, unless some external
mechanism indicates that they were understood. In some cases (such
as RTP Retransmission [RFC4588]), this may constrain some choices
about the bitstreams that are transmitted.

Source descriptions are specified in this document such that RTP
endpoints that are compliant with the RTP specification [RFC3550]
will be able to decode the media streams they describe whether or not
they support explicit source descriptions. However, some deployed
RTP implementations may not actually support multiple media sources
in a media stream. Media senders MAY wish to restrict themselves to
a single source at a time unless they have some means of concluding
that the receivers of the media stream support source multiplexing.

10. Formal Grammar

   This section gives a formal Augmented Backus-Naur Form (ABNF)
   [RFC5234] grammar for each of the new media and source attributes
   defined in this document. Grammars for existing session or media
   attributes that have been extended to be source attributes are not
   included.

```
   ssrc-attr = "ssrc:" ssrc-id SP attribute
   ; The base definition of "attribute" is in RFC 4566.
   ; (It is the content of "a=" lines.)

   ssrc-id = integer ; 0 .. 2**32 - 1

   attribute =/ ssrc-attr
```

              Figure 4: Syntax of the "ssrc" media attribute


```
   ssrc-group-attr = "ssrc-group:" semantics *(SP ssrc-id)

   semantics       = "FEC" / "FID" / token
                      ; Matches RFC 3388 definition and
                      ; IANA registration rules in this doc.

   token           = <as defined in RFC 4566>

   attribute       =/ ssrc-group-attr
```

           Figure 5: Syntax of the "ssrc-group" media attribute


```
   cname-attr = "cname:" cname

   cname = byte-string
   ; Following the syntax conventions for CNAME as defined in RFC 3550.
   ; The definition of "byte-string" is in RFC 4566.

   attribute =/ cname-attr
```

              Figure 6: Syntax of the "cname" source attribute


```
   previous-ssrc-attr = "previous-ssrc:" ssrc-id *(SP ssrc-id)

   attribute =/ previous-ssrc-attr
```

         Figure 7: Syntax of the "previous-ssrc" source attribute

11. Security Considerations

   All the security implications of RTP [RFC3550] and of SDP [RFC4566]
   apply. Explicitly describing the multiplexed sources of an RTP media
   stream does not appear to add any further security issues.

12. IANA Considerations

12.1. New SDP Media-Level Attributes

   This document defines two SDP media-level attributes: "ssrc" and
   "ssrc-group". These attributes have been registered by IANA under
   "Session Description Protocol (SDP) Parameters" under "att-field
   (media level only)".

   The "ssrc" attribute is used to identify characteristics of media
   sources within a media stream. Its format is defined in Section 4.1.

   The "ssrc-group" attribute is used to identify relationships among
   media sources within a media stream. Its format is defined in
   Section 4.2.

12.2. Registry for Source-Level Attributes

   This specification creates a new IANA registry named "att-field
   (source level)" within the SDP parameters registry. Source
   attributes MUST be registered with IANA and documented under the same
   rules as for SDP session-level and media-level attributes as
   specified in [RFC4566].

   New attribute registrations are accepted according to the
   "Specification Required" policy of [RFC5226], provided that the
   specification includes the following information:

   o contact name, email address, and telephone number

   o attribute name (as it will appear in SDP)

   o long-form attribute name in English

   o whether the attribute value is subject to the charset attribute

   o a one-paragraph explanation of the purpose of the attribute

   o a specification of appropriate attribute values for this attribute

   The above is the minimum that IANA will accept. The Expert Reviewer
   will determine if the proposed attributes are expected to see
   widespread use and interoperability; in that case, the attributes
   MUST be specified in a Standards Track RFC.

Submitters of registrations should ensure that the specification is
in the spirit of SDP attributes, most notably that the attribute is
platform independent in the sense that it makes no implicit
assumptions about operating systems and does not name specific pieces
of software in a manner that might inhibit interoperability.

Source-level attributes that are substantially similar in semantics
to existing session-level or media-level attributes SHOULD reuse the
same attribute name as those session-level or media-level attributes.
Source-level attributes SHOULD NOT reuse attribute names of session-
level or media-level attributes that are unrelated or substantially
different.

The initial set of source attribute names, with definitions in
Section 6 of this document, is in Figure 8.

```
Type               SDP Name                   Reference
----               ------------------         ---------
att-field (source level)
                   cname                      [RFC5576]
                   previous-ssrc              [RFC5576]
                   fmtp                       [RFC5576]
```

   Figure 8: Initial contents of the IANA Source Attribute Registry

12.3. Registry for Source Grouping Semantics

This specification creates a new IANA registry named 'Semantics for
the "ssrc-group" SDP Attribute' within the SDP parameters registry.
Source group semantics MUST be defined in Standards Track RFCs, under
the same rules as [RFC3388].

The IANA Considerations section of the RFC MUST include the following
information, which appears in the IANA registry along with the RFC
number of the publication:

o A brief description of the semantics.

o Token to be used within the group attribute. This token may be of
   any length, but SHOULD be no more than four characters long.

o Reference to a Standards Track RFC.

Source grouping semantic values that are substantially similar to
existing media grouping semantic values SHOULD reuse the same
semantics name as those media grouping semantics. Source grouping
semantics SHOULD NOT reuse source grouping semantic names that are
unrelated or substantially different.

   The initial set of source grouping semantic values, for the semantics
   specified in Section 4.2 of this document, is in Figure 9.

   Semantics   Token   Reference
   -------------------   -----   ---------
   Flow Identification   FID   [RFC5576]
   Forward Error Correction   FEC   [RFC5576]

    Figure 9: Initial Contents of IANA Source Group Semantics Registry

13. References

13.1. Normative References

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