Network Working Group   M. Westerlund
Internet-Draft   B. Burman
Intended status: Standards Track   Ericsson
Expires: September 24, 2015   R. Even
                                                   Huawei Technologies
                                                             M. Zanaty
                                                         Cisco Systems
                                                        March 23, 2015

RTP Header Extension for RTCP Source Description Items
draft-ietf-avtext-sdes-hdr-ext-00

Abstract

   Source Description (SDES) items are normally transported in RTP
   control protocol (RTCP). In some cases it can be beneficial to speed
   up the delivery of these items. Mainly when a new source (SSRC)
   joins an RTP session and the receivers needs this source's relation
   to other sources and its synchronization context, which are fully or
   partially identified using SDES items. To enable this optimization,
   this document specifies a new RTP header extension that can carry any
   type of SDES items.

Status of This Memo

Copyright Notice

Table of Contents

1. Introduction

This specification defines an RTP header extension [RFC3550][RFC5285]
that can carry RTCP source description (SDES) items. By including
selected SDES items in an header extension the determination of
relationship and synchronization context for new RTP streams (SSRCs)
in an RTP session can be speeded up. Which relationship and what
information depends on the SDES items carried. This becomes a
complement to using only RTCP for SDES Item delivery.

First, some requirements language is defined. The following section
motivates why this header extension is sometimes required or at least
provides a significant improvement compared to waiting for regular
RTCP packet transmissions of the information. This is followed by a
specification of the header extension. Next, a sub-space of the

header-extension URN is defined to be used for existing and future
SDES items, and the existing SDES items are registered.

2. Definitions

2.1. Requirements Language

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].

2.2. Terminology

This document uses terminology defined in "A Taxonomy of Grouping
Semantics and Mechanisms for Real-Time Transport Protocol (RTP)
Sources" [I-D.ietf-avtext-rtp-grouping-taxonomy] . In particular the
following definitions:

    Media Source

    RTP Stream

    Media Encoder

    Encoded Stream

    Participant

3. Motivation

Source Description (SDES) items are being associated with a
particular SSRC and thus RTP stream. The source description items
provide various meta data associated with the SSRC. How important it
is to have this data no later than when receiving the first RTP
packets depends on the item itself. The CNAME item is one item that
is commonly needed if not at reception of the first RTP packet for
this SSRC, so at least by the time the first media can be played out.
If not, the synchronization context cannot be determined and thus any
related streams cannot be correctly synchronized. Thus, this is a
great example for the need to have this information early when a new
RTP stream is received.

The main reason for new SSRCs in an RTP session is that a media
sources are added. This either because an end-point is adding a new
actual media source, or additional participants in a multi-party
session being added to the session. Another reason for a new SSRC
can be an SSRC collision that forces the colliding parties to select
a new SSRC.

Returning to the case of rapid media synchronization, there exist an
RTP header extension for Rapid Synchronization of RTP Flows
[RFC6051]. That header extension carries the clock information
present in the RTCP sender report (SR) packets. It however assumes
that the CNAME binding is known, which can be provided via signaling
in some cases, but not all. Thus an RTP header extension for
carrying SDES items like CNAME is a powerful combination to enable
rapid synchronization in all cases.

The Rapid Synchronization of RTP Flows specification does provide an
analysis of the initial synchronization delay for different sessions
depending on number of receivers as well as on session bandwidth
(Section 2.1 of [RFC6051]). These results are applicable also for
other SDES items that have a similar time dependency until the
information can be sent using RTCP. Thus the benefit for reduction
of initial delay before information is available can be determined
for some use cases from these figures.

That document also discusses the case of late joiners, and defines an
RTCP Feedback format to request synchronization information, which is
another potential use case for SDES items in RTP header extension.
It would for example be natural to include CNAME SDES item with the
header extension containing the NTP formatted reference clock to
ensure synchronization.

Some new SDES items are currently proposed, which can all benefit
from timely delivery:

MID: This is a media description identifier that matches the value
   of the SDP a=mid attribute, to associate RTP streams multiplexed
   on the same transport with their respective SDP media description
   as described in [I-D.ietf-mmusic-sdp-bundle-negotiation].

SRCNAME: This is a media source and encoding identifier to enable
   support for simulcast and improve some scalable encoding usages
   [I-D.westerlund-avtext-rtcp-sdes-srcname]. This SDES item could
   be used both for new sources and late joiners.

APPID: This SDES item provides an application specific identifier
   dynamically assigned to a particular RTP stream. The intention is
   to provide a receiver with information about the current role of
   the received RTP stream or its usage in an application
   [I-D.even-mmusic-application-token]. Thus a particular ID can be
   reassigned many times during the lifetime of an RTP session. This
   puts additional timing requirements, not only for new sources and
   late joiners, but also whenever the Application token is
   reassigned to another stream.

Based on the above, there appear to be good reasons why an RTP header
extension for SDES items is worthwhile to pursue.

4. Specification

This section first specifies the SDES item RTP header extension
format, followed by some usage considerations.

4.1. SDES Item Header Extension

The RTP header extension scheme that allows for multiple extensions
to be included is defined in "A General Mechanism for RTP Header
Extensions" [RFC5285]. That specification defines both short and
long item headers. The short headers (One-byte) are restricted to 1
to 16 bytes of data, while the long format (Two-byte) supports a data
length of 0 to 255 bytes. Thus that RTP header extension format is
capable of supporting any SDES item from a data length perspective.

The ID field, independent of short or long format, identifies both
the type of RTP header extension and, in the case of the SDES item
header extension, the type of SDES item. The mapping is done in
signaling by identifying the header extension and SDES item type
using a URN, which is defined in the IANA consideration (Section 5)
for all existing SDES items.

4.1.1. One-Byte Format

The one-byte header format for an SDES item extension element
consists of the One-Byte header (defined in Section 4.2 of
[RFC5285]), which consists of a 4-bit ID followed by a 4-bit length
field (len) that identifies how many bytes (len value +1) of data
that follows the header. The data part consists of len+1 bytes of
UTF-8 text. The type of text is determined by the ID field value and
its mapping to the type of SDES item.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  ID   |  len  | SDES Item text value ...                      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
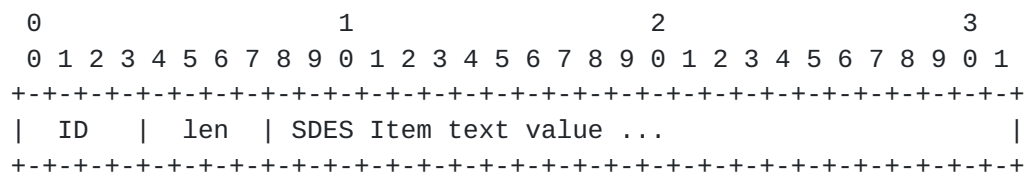
Figure 1

4.1.2. Two-Byte Format

The two-byte header format for an SDES item extension element
consists of the two-byte header (defined in Section 4.3 of
[RFC5285]), which consists of an 8-bit ID followed by an 8-bit length

field (len) that identifies how many bytes of data that follows the
header. The data part consists of len bytes of UTF-8 text. The type
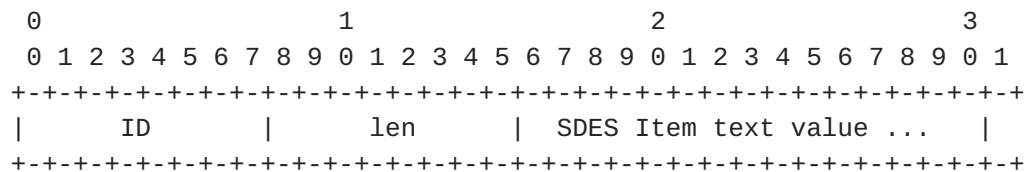of text is determined by the ID field value and its mapping to the
type of SDES item.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     ID        |     len       |  SDES Item text value ...    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 2

4.2. Usage of the SDES Item Header Extension

This section discusses various usage considerations; which form of
header extension to use, the packet expansion, and when to send SDES
items in header extension.

4.2.1. One or Two Byte Headers

The RTP header extensions for SDES items MAY use either the one-byte
or two-byte header formats, depending on the text value size for the
used SDES items. The one-byte header SHOULD be used when all non
SDES item header extensions supports the one-byte format and all SDES
item text values contain at most 16 bytes. Note that the RTP header
extension specification does not allow mixing one-byte and two-byte
headers for the same RTP stream (SSRC), so if the value size of any
of the SDES items value requires the two-byte header, the all other
header extensions MUST also use the two-byte header format.

For example using CNAMEs that are generated according to "Guidelines
for Choosing RTP Control Protocol (RTCP) Canonical Names (CNAMEs)"
[RFC7022], using short term persistent values, and if 96-bit random
values prior to base64 encoding are sufficient, then they will fit
into the One-Byte header format.

4.2.2. MTU and Packet Expansion

The RTP packet size will clearly increase when they include the
header extension. How much depends on which header extensions and
their data parts. The SDES items can vary in size. There are also
some use-cases which require transmitting multiple SDES items in the
same packet to ensure that all relevant data reaches the receiver.
An example of that is when you need both the CNAME, a SRCNAME and an
appId plus the rapid time synchronization extension from RFC 6051.
Such a combination is quite likely to result in at least 16+3+1+8

bytes of data plus the headers, which will be another 8 bytes for
one-byte headers, thus in total 36 bytes.

The packet expansion can cause an issue when it cannot be taken into
account when producing the RTP payload. Thus an RTP payload that is
created to meet a particular IP level Maximum Transmission Unit
(MTU), taking the addition of IP/UDP/RTP headers into account but
excluding RTP header extensions suddenly exceeds the MTU, resulting
in IP fragmentation. IP fragmentation is known to negatively impact
the loss rate due to middleboxes unwilling or not capable of dealing
with IP fragments.

As this is a real issue, the media encoder and payload packetizer
should be flexible and be capable of handling dynamically varying
payload size restrictions to counter the packet expansion caused by
header extensions. If that is not possible, some reasonable worst
case packet expansion should be calculated and used to reduce the RTP
payload size of all RTP packets the sender transmits.

4.2.3. Transmission Considerations

The general recommendation is to only send header extensions when
needed. This is especially true for SDES items that can be sent in
periodic repetitions of RTCP throughout the whole session. Thus, the
different usages (Section 4.2.4) have different recommendations.
First some general considerations for getting the header extensions
delivered to the receiver:

1. The probability for packet loss and burst loss determine how many
    repetitions of the header extensions will be required to reach a
    targeted delivery probability, and if bust loss is likely what
    dispersion would be needed to avoid getting multiple header
    extensions lost in a single burst.

2. How early the SDES item information is needed, from the first
    received RTP data or only after some set of packets are received,
    can guide if the header extension(s) should be in all of the
    first N packets or be included only once per set of packets, for
    example once per video frame.

3. The use of RTP level robustness mechanisms, such as RTP
    retransmission [RFC4588], or Forward Error Correction, e.g.,
    [RFC5109] may treat packets differently from a robustness
    perspective, and SDES header extensions should be added to
    packets that get a treatment corresponding to the relative
    importance of receiving the information.

In summary, the number of header extension transmissions should be
tailored to a desired probability of delivery taking the receiver
population size into account. For the very basic case, N repetitions
of the header extensions should be sufficient, but may not be
optimal. N is selected so that probability of delivery of at least
one out of the N reaches the target value when calculating 1-P^N,
where P is the probability of packet loss. For point to point or
small receiver populations, it might also be possible to use
feedback, such as RTCP, to determine when the information in the
header extensions has likely reached all receivers.

4.2.4. Different Usages

4.2.4.1. New SSRC

A new SSRC joins an RTP session. As this SSRC is completely new for
everyone, the goal is to ensure that all receivers with high
probability receives the information in the header extension. Thus
header extension transmission strategies that allow some margins in
the delivery probability should be considered.

4.2.4.2. Late Joiner

In a multi-party RTP session where one or a small number of receivers
join a session where the majority of receivers already have all
necessary information, the use of header extensions to deliver
relevant information should be tailored to reach the new receivers.
The trigger to send header extensions can for example either be RTCP
from new receiver(s) or an explicit request like the Rapid
Resynchronization Request defined in [RFC6051].

4.2.4.3. Information Change

In cases when the SDES item text value is changed and the new SDES
information is tightly coupled to and thus needs to be synchronized
with a related change in the RTP stream, use of a header extension is
far superior to RTCP SDES. In this case it is equal or even more
important with timely SDES information than in the case of new SSRCs
(Section 4.2.4.1). Continued use of the old SDES information can
lead to really undesired effects in the application. Application
Token [I-D.even-mmusic-application-token] would be one such case.
Thus, header extension transmission strategies with high probability
of delivery should be chosen.

4.2.5. **SDES Items in RTCP**

   As this RTP header extensions information, i.e. SDES Items can and
   will be sent also in RTCP it is worth some reflections on this
   interaction. There also exist the possibility to schedule a non-
   regular RTCP packet transmission containing important SDES items if
   one uses a RTP/AVPF based RTP profile. Depending on which mode ones
   RTCP feedback transmitter is working on extra RTCP packets may be
   sent as immediate or early packets, enabling more timely deliver of
   SDES information.

   There is however two aspects that differ between using RTP header
   extension and any non-regular transmission of RTCP packets. First,
   as the RTCP packet is a separate packet, there is no direct relation
   and also no fate sharing between the relevant media data and the SDES
   information. The order of arrival for the packets will matter. With
   a header-extension the SDES items can be ensured to arrive if the
   media data to played out arrives. Secondly, it is difficult to
   determine if an RTCP packet is actually delivered. This, as the RTCP
   packets lack both sequence number or a mechanism providing feedback
   on the RTCP packets themselves.

5. **IANA Considerations**

   This IANA section firstly proposes to:

   o Reserve the SDES item RTP header extension defined in this
      document for use with current and future SDES items.

   o Register and assign the URN sub-space "urn:ietf:params:rtp-
      hdrext:sdes:" in the RTP Compact Header Extensions registry.

   The reason to require registering a URN within that sub-space is that
   the name represent an RTCP Source Description item, where a
   specification is strongly recommended. The formal policy is
   maintained from the main space, i.e. Expert Review.

   Secondly, it is proposed that only the current existing SDES items
   that are critical for immediate media processing, and therefore
   should fate share their delivery with RTP media, are registered for
   usage in the RTP Compact Header Extensions registry :

   URN   SDES Item   Reference
   ===
   urn:ietf:params:rtp-hdrext:sdes:cname   CNAME   [RFC3550]

6. Security Considerations

Source Description items may contain data that are sensitive from a
security perspective. There exist SDES items that are or may be
sensitive from a user privacy perspective, like CNAME, NAME, EMAIL,
PHONE, LOC and H323-CADDR. Others may contain sensitive information
like NOTE and PRIV, while others may be sensitive from profiling
implementations for vulnerability or other reasons, like TOOL. The
CNAME sensitivity can vary depending on how it is generated and what
persistence it has. A short term CNAME identifier generated using a
random number generator may have minimal security implications, while
one of the form user@host has privacy concerns and one generated from
a MAC address has long term tracking potentials.

The above security concerns may have to be put in relation to needs
of third party monitoring. In RTP sessions where any type of
confidentiality protection is enabled, the SDES item header
extensions SHOULD also be protected per default. This implies that
to provide confidentiality, users of SRTP need to implement encrypted
header extensions per [RFC6904]. Commonly, it is expected that the
same security level is applied both RTCP packets carrying SDES items,
as a RTP header extension containing a SDES item. If the security
level is different it is important to consider the security
properties as the worst in each aspect for the different
configurations.

As the SDES items are used by the RTP based application to establish
relationships between RTP streams or between an RTP stream and
information about the originating Participant, there SHOULD be strong
requirements on integrity and source authentication of the header
extensions. If not, an attacker can modify the SDES item value to
create erroneous relationship bindings in the receiving application.

7. Acknowledgements

The authors likes to thanks the following individuals for feedback
and suggestions; Colin Perkins.

8. References

8.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
           Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC3550] Schulzrinne, H., Casner, S., Frederick, R., and V.
           Jacobson, "RTP: A Transport Protocol for Real-Time
           Applications", STD 64, RFC 3550, July 2003.

   [RFC5285] Singer, D. and H. Desineni, "A General Mechanism for RTP
              Header Extensions", RFC 5285, July 2008.

   [RFC6904] Lennox, J., "Encryption of Header Extensions in the Secure
              Real-time Transport Protocol (SRTP)", RFC 6904, April
              2013.

8.2. Informative References

   [I-D.even-mmusic-application-token]
              Even, R., Lennox, J., and Q. Wu, "The Session Description
              Protocol (SDP) Application Token Attribute", draft-even-
              mmusic-application-token-03 (work in progress), April
              2014.

   [I-D.ietf-avtext-rtp-grouping-taxonomy]
              Lennox, J., Gross, K., Nandakumar, S., and G. Salgueiro,
              "A Taxonomy of Grouping Semantics and Mechanisms for Real-
              Time Transport Protocol (RTP) Sources", draft-ietf-avtext-
              rtp-grouping-taxonomy-06 (work in progress), March 2015.

   [I-D.ietf-mmusic-sdp-bundle-negotiation]
              Holmberg, C., Alvestrand, H., and C. Jennings,
              "Negotiating Media Multiplexing Using the Session
              Description Protocol (SDP)", draft-ietf-mmusic-sdp-bundle-
              negotiation-18 (work in progress), March 2015.

   [I-D.westerlund-avtext-rtcp-sdes-srcname]
              Westerlund, M., "RTCP Source Description Item SRCNAME to
              Label Individual Media Sources", draft-westerlund-avtext-
              rtcp-sdes-srcname-03 (work in progress), October 2013.

   [RFC4588] Rey, J., Leon, D., Miyazaki, A., Varsa, V., and R.
              Hakenberg, "RTP Retransmission Payload Format", RFC 4588,
              July 2006.

   [RFC5109] Li, A., "RTP Payload Format for Generic Forward Error
              Correction", RFC 5109, December 2007.

   [RFC6051] Perkins, C. and T. Schierl, "Rapid Synchronisation of RTP
              Flows", RFC 6051, November 2010.

   [RFC6776] Clark, A. and Q. Wu, "Measurement Identity and Information
              Reporting Using a Source Description (SDES) Item and an
              RTCP Extended Report (XR) Block", RFC 6776, October 2012.

   [RFC7022] Begen, A., Perkins, C., Wing, D., and E. Rescorla,
              "Guidelines for Choosing RTP Control Protocol (RTCP)
              Canonical Names (CNAMEs)", RFC 7022, September 2013.

Authors' Addresses

   Magnus Westerlund
   Ericsson
   Farogatan 6
   SE-164 80 Stockholm
   Sweden

   Phone: +46 10 714 82 87
   Email: magnus.westerlund@ericsson.com

   Bo Burman
   Ericsson
   Kistavagen 25
   SE-164 80 Stockholm
   Sweden

   Phone: +46 10 714 13 11
   Email: bo.burman@ericsson.com

   Roni Even
   Huawei Technologies
   Tel Aviv
   Israel

   Email: roni.even@mail01.huawei.com

   Mo Zanaty
   Cisco Systems
   7100 Kit Creek
   RTP, NC 27709
   USA

   Email: mzanaty@cisco.com