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H. Asaeda
Keio University
R. Huang
Q. Wu
Huawei

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RTCP XR Blocks for Synchronization Delay and Offset Metrics Reporting
draft-asaeda-xrblock-rtcp-xr-synchronization-07

Abstract

This document defines two RTCP XR Report Blocks and associated with SDP parameters that allow the reporting of synchronization delay and offset metrics for use in a range of RTP applications.

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1. Introduction

This draft defines two new block types to augment those defined in [RFC3611], for use in a range of RTP applications.

The first new block type supports reporting of Initial Synchronization Delay to establish multimedia session. Information is recorded about time difference between the start of RTP sessions and the time the RTP receiver acquires all components of RTP sessions in the multimedia session [RFC6051].

The second new block type supports reporting of the relative synchronization offset time of two arbitrary streams (e.g., between audio and video streams), with the same RTCP CNAME included in RTCP SDES packets [RFC3550]. Information is recorded about the synchronization offset time of each RTP stream relative to the reference RTP stream with the same CNAME and General Synchronization Offset of zero.

These metrics belong to the class of terminal related transport level metrics defined in [MONARCH].

2. Terminology

2.1. Standards 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].

In addition, the following terms are defined:

Initial Synchronization Delay:

A multimedia session comprises a set of concurrent RTP sessions among a common group of participants, using one RTP session for each media type. Initial synchronization Delay is the average time for receiver to synchronize the components of a multimedia session [RFC6051].

Synchronization Offset:

The absolute delay variance of the measured RTP stream relative to the reference RTP stream in the multimedia session.

3. Applicability

The report blocks defined in this document could be used by dedicated network monitoring applications.

When joining each session in layered video sessions [RFC6190] or the multimedia session, a receiver may not synchronize playout across the multimedia session or layered video session until RTCP SR packets have been received on all of the component RTP sessions. The component RTP session are referred to as each RTP session for each media type in multimedia session or separate RTP session for each layer in the layered video session. For unicast session, the delay due to negotiation of NAT pinholes, firewall holes, quality-of-service, and media security keys is contributed to such initial synchronization playout. For multicast session, such initial synchronization delay varies with the session bandwidth, the number of members, and the number of senders in the session. The RTP flow Initial synchronization delay block can be used to report the initial synchronization delay to receive all the RTP streams belonging to the same multimedia session or layered video session. In the absence of packet loss, the initial synchronization delay equals to the average time taken to receive the first RTCP packet in the RTP session with the longest RTCP reporting interval. In the presence of packet loss, the media synchronization needs to based on the in-band mapping of RTP and NTP-format timestamps [RFC6051] or wait until the reporting interval has passed, and the next RTCP SR packet is sent.

In an RTP multimedia session, there can be an arbitrary number of streams carried in different RTP sessions, with the same RTCP CNAME. These streams may be not synchronized with each other. For example, one audio stream and one video stream belong to the same session and audio stream are transmitted lag behind video stream for multiple tens of milliseconds. The RTP Flows Synchronization Offset block can be used to report such synchronization offset between video stream and audio stream.

4. RTP Flows Initial Synchronization Delay Report Block

This block is sent by RTP receivers and reports Initial synchronization delay beyond the information carried in the standard RTCP packet format. Information is recorded about time difference between the start of RTP sessions and the time the RTP receiver acquires all components of RTP sessions [RFC6051].

4.1. Metric Block Structure

The RTP Flows Initial Synchronization Delay Report Block has the following format:

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    BT=RFISD   |   Reserved    |         Block length=2        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                      SSRC of Source                           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|               Initial Synchronization Delay                   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

4.2. Definition of Fields in RTP Flow Initial Synchronization Delay Metrics Block

Block type (BT): 8 bits

The Statistics Summary Report Block is identified by the constant <RFISD>.

Block length: 16 bits

The constant 2, in accordance with the definition of this field in Section 3 of RFC 3611 [RFC3611].

SSRC of Source: 32 bits

The SSRC of the media source SHALL be set to the value of the SSRC identifier carried in an arbitrary RTP stream belonging to the same multimedia session.

Initial Synchronization Delay: 32 bits

The average delay, expressed in units of 1/65536 seconds, from the RTCP packets received on all of the components RTP sessions to the beginning of session [RFC6051]. The value is calculated based on the information contained in RTCP SR packets or the in-band mapping of RTP and NTP-format timestamps [RFC6051]. If there is no packet loss, the initial synchronization delay is expected to be equal to the average time taken to receive the first RTCP packet in the RTP session with the longest RTCP reporting interval.

If the measurement is unavailable, the value of this field with all bits set to 1 SHOULD be reported.

5. RTP Flows Synchronization Offset Metrics Block

In the RTP multimedia sessions, there can be an arbitrary number of streams and each stream (e.g., audio stream or video stream) is sent in a separate RTP stream. The receiver associates RTP streams to be synchronized by means of RTCP CNAME contained in the RTCP Source Description (SDES) packets [RFC3550].

This block is sent by RTP receivers and reports synchronization offset of the arbitrary two RTP streams that needs to be synchronized in the RTP multimedia session. Information is recorded about the actual delay variance of the measured RTP stream relative to he reference RTP stream with the same CNAME. The reference RTP stream can be chosen as the arbitrary stream with minimum delay according to the common criterion defined in section 6.2.2.1 of [Y.1540].

5.1. Metric Block Structure

The RTP Flow General Synchronization Offset Report Block has the following format:

```
    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
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |    BT=RFSO    |   Reserved    |         Block length=3        |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                        SSRC of source                         |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |         Synchronization Offset, most significant word         |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |         Synchronization Offset, least significant word        |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

5.2. Definition of Fields in RTP Flow General Synchronization Offset Metrics Block

Block type (BT): 8 bits

The RTP Flow General Synchronization Offset Report Block is identified by the constant <RFSO>.

Block length: 16 bits

The constant 3, in accordance with the definition of this field in Section 3 of RFC 3611 [RFC3611].

SSRC of Source: 32 bits

The SSRC of the media source SHALL be set to the value of the SSRC identifier of the reference RTP stream to which the XR relates.

Synchronization Offset: 64 bits

The synchronization offset of one RTP stream relative to the reference RTP stream with the same CNAME. The Synchronization Offset of the reference stream should be zero. This value is calculated based on the interarrival time between an arbitrary RTP packet and the reference RTP packet with the same CNAME, and timestamps of this arbitrary RTP packet and the reference RTP packet with the same CNAME. The value of this field is represented using a 64-bit NTP-format timestamp as defined in [RFC5905], which is 64-bit unsigned fixed-point number with the integer part in the first 32 bits and the fractional part in the last 32 bits.

If the measurement is unavailable, the value of this field with all bits set to 1 SHOULD be reported.

6. SDP Signaling

Two new parameters are defined for the two report blocks defined in this document to be used with Session Description Protocol (SDP) [RFC4566] using the Augmented Backus-Naur Form (ABNF) [RFC5234]. They have the following syntax within the "rtcp-xr" attribute [RFC3611]:

```
rtcp-xr-attrib =  "a=rtcp-xr:"
                  [xr-format *(SP xr-format)] CRLF
xr-format = RTP-flows-init-syn-delay
          / RTP-flows-syn-offset
RTP-flows-init-syn-delay = "RTP-flows-init-syn-delay"
                           ["=" max-size]
RTP-flow-syn-offset = "RTP-flows-syn-offset"
                      ["=" max-size]
max-size = 1*DIGIT ; maximum block size in octets
```

Refer to Section 5.1 of RFC 3611 [RFC3611] for a detailed description and the full syntax of the "rtcp-xr" attribute.

7. IANA Considerations

New report block types for RTCP XR are subject to IANA registration.

For general guidelines on IANA allocations for RTCP XR, refer to Section 6.2 of [RFC3611].

This document assigns two new block type values in the RTCP XR Block Type Registry:

```
Name:       RFISD
Long Name:  RTP Flows Initial Synchronization Delay
Value       <RFISD>
Reference:  Section 4

Name:       RFSO
Long Name:  RTP Flows Synchronization Offset Metrics Block
Value       <RFSO>
Reference:  Section 5
```

This document also registers two new SDP [RFC4566] parameters for the "rtcp-xr" attribute in the RTCP XR SDP Parameters Registry:

* "RTP-flows-init-syn-delay"
* "RTP-flows-syn-offset"

The contact information for the registrations is:

Qin Wu
sunseawq@huawei.com
101 Software Avenue, Yuhua District
Nanjing, Jiangsu 210012, China

8. Security Considerations

The new RTCP XR report blocks proposed in this document introduces no new security considerations beyond those described in [RFC3611].

9. Acknowledgements

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10. References

10.1. Normative References

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10.2. Informative References

[MONARCH] Wu, Q., "Monitoring Architectures for RTP", ID draft-ietf-avtcore-monarch-13, May 2012.

[Y.1540] ITU-T, "ITU-T Rec. Y.1540, IP packet transfer and availability performance parameters", November 2007.

Appendix A. Change Log

Note to the RFC-Editor: please remove this section prior to publication as an RFC.

A.1. draft-asaeda-xrblock-rtcp-xr-syncronization-07

Editorial changes are made from the previous version 06.

A.2. draft-asaeda-xrblock-rtcp-xr-syncronization-06

The following are the major changes compared to previous version 05:

- o Define synchronization offset as 64 bit NTP-format timestamp to meet synchronization resolution requirements for some RTP applications.
- o Add the definition of Initial Synchronization Delay in section 2.
- o Other editorial changes.

A.3. draft-asaeda-xrblock-rtcp-xr-syncronization-05

The following are the major changes compared to previous version 04:

- o Remove per packet reporting and only report a single value of general synchronization offset.

A.4. draft-asaeda-xrblock-rtcp-xr-syncronization-04

The following are the major changes compared to previous version 03:

- o Add a definition for synchronization offset.
- o Use additional text in applicability section to clarify the difference between synchronization delay and offset.
- o Add a reference to tell how to select the reference stream.
- o Other Editorial Changes.

A.5. draft-asaeda-xrblock-rtcp-xr-syncronization-03

The following are the major changes compared to previous version 02:

- o Support multiple general synchronization offset reporting.
- o Other Editorial Changes.

A.6. draft-asaeda-xrblock-rtcp-xr-syncronization-02

The following are the major changes compared to previous version 01:

- o Clarify which synchronization is reported in section 4 and 5.
- o Allow calculating the synchronization delay based on RTP header extension defined in RFC6051
- o Explain what the components of RTP session are in section 3.

A.7. draft-asaeda-xrblock-rtcp-xr-syncronization-01

The following are the major changes compared to previous version:

o Separate Synchronization Delay and Offset Metrics Block into two independent block based on comments on the list.

A.8. draft-asaeda-xrblock-rtcp-xr-syncronization-00

The following are the major changes compared to previous version:

This document is separated from draft-wu-xrblock-rtcp-xr-quality-monitoring-01 with some editorial changes and focuses on RTP Flow Initial Synchronization Delay and RTP Flows General Synchronization Offset.

Authors' Addresses

Hitoshi Asaeda
Keio University
Graduate School of Media and Governance
5322 Endo
Fujisawa, Kanagawa 252-0882
Japan

Email: asaeda@wide.ad.jp

Rachel Huang
Huawei Technologies Co., Ltd.
101 Software Avenue, Yuhua District
Nanjing, Jiangsu 210012
China

Email: Rachel@huawei.com

Qin Wu
Huawei Technologies Co., Ltd.
101 Software Avenue, Yuhua District
Nanjing, Jiangsu 210012
China

Email: sunseawq@huawei.com