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RTP Control Protocol (RTCP) Extended Report (XR) Block for Concealed Seconds metric Reporting
draft-ietf-xrblock-rtcp-xr-concsec-01.txt

Abstract

This document defines an RTP Control Protocol(RTCP) Extended Report (XR) Block that allows the reporting of Concealed Seconds metrics primarily for audio applications of RTP.

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1. Introduction

1.1. Concealed Seconds Block

This draft defines a new block type to augment those defined in [RFC3611], for use primarily in audio applications of RTP.

At any instant, the audio output at a receiver may be classified as either 'normal' or 'concealed'. 'Normal' refers to playout of audio payload received from the remote end, and also includes locally generated signals such as announcements, tones and comfort noise. Concealment refers to playout of locally-generated signals used to mask the impact of network impairments such as lost packets or to reduce the audibility of jitter buffer adaptations.

> Editor's Note: For video application, the output at a receiver should also be classified as either normal or concealed. Should this paragraph be clear about this?

The new block type provides metrics for concealment. Specifically, the first metric (Unimpaired Seconds) reports the number of whole seconds occupied only with normal playout of data which the receiver obtained from the sender's stream. The second metric (Concealed Seconds) reports the number of whole seconds during which the receiver played out any locally-generated media data. A third metric (Severely Concealed Seconds (SCS)) reports the number of whole seconds during which the receiver played out locally-generated data for more than SCS Threshold (ms).

The metric belongs to the class of transport-related end system metrics defined in [MONARCH].

1.2. RTCP and RTCP XR Reports

The use of RTCP for reporting is defined in [RFC3550]. [RFC3611] defined an extensible structure for reporting using an RTCP Extended Report (XR). This draft defines a new Extended Report block that MUST be used as defined in [RFC3550] and [RFC3611].

1.3. Performance Metrics Framework

The Performance Metrics Framework [RFC6390] provides guidance on the definition and specification of performance metrics. The RTP Monitoring Architectures [MONARCH] provides guideline for reporting block format using RTCP XR. The Metrics Block described in this document are in accordance with the guidelines in [RFC6390] and [MONARCH].

1.4. Applicability

This metric is primarily applicable to audio applications of RTP. EDITOR'S NOTE: are there metrics for concealment of transport errors for video?

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:

Editor's Note: For Video loss concealment, at least the following four methods are used,i.e., Frame freeze,inter-frame extrapolation, interpolation, Noise insertation, should this section consider giving definition of these four methods for video loss concealment?

3. Loss Concealment Block

This sub-block provides a description of potentially audible impairments due to lost and discarded packets at the endpoint, expressed on a time basis analogous to a traditional PSTN T1/E1 errored seconds metric.

Editor's Note: Should impairment also cover video application?

The following metrics are based on successive one second intervals as declared by a local clock. This local clock does NOT need to be synchronized to any external time reference. The starting time of this clock is unspecified. Note that this implies that the same loss pattern could result in slightly different count values, depending on where the losses occur relative to the particular one-second demarcation points. For example, two loss events occurring 50ms apart could result in either one concealed second or two, depending on the particular 1000 ms boundaries used.

The seconds in this sub-block are not necessarily calendar seconds. At the tail end of a session, periods of time of less than 1000ms shall be incorporated into these counts if they exceed 500ms and shall be disregarded if they are less than 500ms.

3.1. Report Block Structure

Concealed Seconds metrics block

```
 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=NCS     | I |plc|Rserved|       block length=4          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                          SSRC of Source                       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     Unimpaired Seconds                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     Concealed Seconds                         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Severely Concealed Seconds    | RESERVED      | SCS Threshold |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 1: Report Block Structure

3.2. Definition of Fields in Concealed Seconds Metrics Block

Block type (BT): 8 bits

A Concealed Seconds Metrics Report Block is identified by the constant NCS.

[Note to RFC Editor: please replace NCS with the IANA provided RTCP XR block type for this block.]

Interval Metric flag (I): 2 bit

This field is used to indicate whether the Concealed Seconds metrics are Sampled, Interval or Cumulative metrics, that is, whether the reported values applies to the most recent measurement interval duration between successive metrics reports (I=10) (the Interval Duration) or to the accumulation period characteristic of cumulative measurements (I=11) (the Cumulative Duration) or is a sampled instantaneous value (I=01) (Sampled Value).

Packet Loss Concealment Method (plc): 2 bits

This field is used to identify the packet loss concealment method in use at the receiver, according to the following code:

bits 014-015

0 = silence insertion

1 = simple replay, no attenuation

2 = simple replay, with attenuation

3 = enhanced

Other values reserved

Editor's Note 1 : In the packet loss concealment methods,"Enhanced" is defines as one new Packet loss Concealment method? However it is not clear what this packet loss concealment method looks like?

Editor's Note 2: For Video loss concealment, there are a range of methods used, for example:

(i) Frame freeze In this case the impaired video frame is not displayed and the previously displayed frame is hence "frozen" for the duration of the loss event

(ii) Inter-frame extrapolation If an area of the video frame is damaged by loss, the same area from the previous frame(s) can be used to estimate what the missing pixels would have been. This can work well in a scene with no motion but can be very noticeable if there is significant movement from one frame to another. Simple decoders may simply re-use the pixels that were in the missing area, more complex decoders may try to use several frames to do a more complex extrapolation.

(iii) Interpolation A decoder may use the undamaged pixels in the image to estimate what the missing block of image should have

(iv) Noise insertion A decoder may insert random pixel values - which would generally be less noticeable than a blank rectangle in the image.

Therefore more text required in the future draft to discuss Techniques for Video Loss Concealment method in this document.

Reserved (resv): 4 bits

These bits are reserved. They SHOULD be set to zero by senders and MUST be ignored by receivers.

Block Length: 16 bits

The length of this report block in 32-bit words, minus one. For the Delay block, the block length is equal to 4.

SSRC of source: 32 bits

As defined in Section 4.1 of [RFC3611].

Unimpaired Seconds: 32 bits

A count of the number of unimpaired Seconds that have occurred.

An unimpaired Second is defined as a continuous period of 1000ms during which no frame loss or discard due to late arrival has occurred. Every second in a session must be classified as either OK or Concealed.

Normal playout of comfort noise or other silence concealment signal during periods of talker silence, if VAD [VAD] is used, shall be counted as unimpaired seconds.

Editor's Note: It should be clear that VAD does not apply to video.

If the measured value exceeds 0xFFFFFFFD, the value 0xFFFFFFFE SHOULD be reported to indicate an over-range measurement. If the measurement is unavailable, the value 0xFFFFFFFF SHOULD be reported.

Concealed Seconds: 32 bits

A count of the number of Concealed Seconds that have occurred.

A Concealed Second is defined as a continuous period of 1000ms during which any frame loss or discard due to late arrival has occurred.

Equivalently, a concealed second is one in which some Loss-type concealment has occurred. Buffer adjustment-type concealment SHALL not cause Concealed Seconds to be incremented, with the following exception. An implementation MAY cause Concealed Seconds to be incremented for 'emergency' buffer adjustments made during talkspurts.

Loss-type concealment is reactive insertion or deletion of samples in the audio playout stream due to effective frame loss at the audio decoder. "Effective frame loss" is the event in which a frame of coded audio is simply not present at the audio decoder when required. In this case, substitute audio samples are generally formed, at the decoder or elsewhere, to reduce audible impairment.

Buffer Adjustment-type concealment is proactive or controlled insertion or deletion of samples in the audio playout stream due to jitter buffer adaptation, re-sizing or re-centering decisions

within the endpoint.

Because this insertion is controlled, rather than occurring randomly in response to losses, it is typically less audible than loss-type concealment. For example, jitter buffer adaptation events may be constrained to occur during periods of talker silence, in which case only silence duration is affected, or sophisticated time-stretching methods for insertion/deletion during favorable periods in active speech may be employed. For these reasons, buffer adjustment-type concealment MAY be exempted from inclusion in calculations of Concealed Seconds and Severely Concealed Seconds.

Editor's Note: In this document, two kind of concealments are defined: a. Loss-type concealment b. Buffer Adjustment-type concealment Loss-type concealment is applicable to both audio and video. However Buffer Adjustment-type concealment is usually applied to audio. Should this section be clear about this?

However, an implementation SHOULD include buffer-type concealment in counts of Concealed Seconds and Severely Concealed Seconds if the event occurs at an 'inopportune' moment, with an emergency or large, immediate adaptation during active speech, or for unsophisticated adaptation during speech without regard for the underlying signal, in which cases the assumption of low-audibility cannot hold. In other words, jitter buffer adaptation events which may be presumed to be audible SHOULD be included in Concealed Seconds and Severely Concealed Seconds counts.

Concealment events which cannot be classified as Buffer Adjustment- type MUST be classified as Loss-type.

For clarification, the count of Concealed Seconds MUST include the count of Severely Concealed Seconds.

If the measured value exceeds 0xFFFFFFFD, the value 0xFFFFFFFE SHOULD be reported to indicate an over-range measurement. If the measurement is unavailable, the value 0xFFFFFFFF SHOULD be reported.

Severely Concealed Seconds: 16 bits

A count of the number of Severely Concealed Seconds.

A Severely Concealed Second is defined as a non-overlapping period of 1000 ms during which the cumulative amount of time that has

been subject to frame loss or discard due to late arrival, exceeds the SCS Threshold.

If the measured value exceeds 0xFFFD, the value 0xFFFE SHOULD be reported to indicate an over-range measurement. If the measurement is unavailable, the value 0xFFFF SHOULD be reported.

Reserved: 8 bits

These bits are reserved. They SHOULD be set to zero by senders and MUST be ignored by receivers.

SCS Threshold: 8 bits

The SCS Threshold defines the amount of time corresponding to lost or discarded frames that must occur within a one second period in order for the second to be classified as a Severely Concealed Second. This is expressed in milliseconds and hence can represent a range of 0.1 to 25.5 percent loss or discard.

A default threshold of 50ms (5% effective frame loss per second) is suggested.

4. SDP Signaling

[RFC3611] defines the use of SDP (Session Description Protocol) [RFC4566] for signaling the use of XR blocks. XR blocks MAY be used without prior signaling.

4.1. SDP rtcp-xr-attrib Attribute Extension

This section augments the SDP [RFC4566] attribute "rtcp-xr" defined in [RFC3611] by providing an additional value of "xr-format" to signal the use of the report block defined in this document.

The SDP attribute for the block has an additional optional paremeter, "thresh", used to supply a value for the SCS Threshold parameter. If this parameter is present, the RTP system receiving the SDP SHOULD use this value for the current session. If the parameter is not present, the RTP system SHOULD use a locally configured value.

```
xr-format =/ xr-conc-sec-block

xr-conc-sec-block = "conc-sec" ["=" thresh]

thresh      = 1*DIGIT          ; threshold for SCS (ms)
DIGIT          = <as defined in Section 3.4 of [RFC5234]>
```

4.2. Offer/Answer Usage

When SDP is used in offer-answer context, the SDP Offer/Answer usage defined in [RFC3611] applies.

5. IANA Considerations

New block types for RTCP XR are subject to IANA registration. For general guidelines on IANA considerations for RTCP XR, refer to [RFC3611].

5.1. New RTCP XR Block Type value

This document assigns the block type value NJB in the IANA "RTCP XR Block Type Registry" to the "Concealed Seconds Metrics Block".

[Note to RFC Editor: please replace NCS with the IANA provided RTCP XR block type for this block.]

5.2. New RTCP XR SDP Parameter

This document also registers a new parameter "conc-sec" in the "RTCP XR SDP Parameters Registry".

5.3. Contact information for registrations

The contact information for the registrations is:

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6. Security Considerations

It is believed that this proposed RTCP XR report block introduces no new security considerations beyond those described in [RFC3611]. This block does not provide per-packet statistics so the risk to confidentiality documented in Section 7, paragraph 3 of [RFC3611] does not apply.

7. Contributors

Geoff Hunt wrote the initial draft of this document.

8. Acknowledgements

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9. References

9.1. Normative References

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

[RFC3550] Schulzrinne, H., "RTP: A Transport Protocol for Real-Time Applications", RFC 3550, July 2003.

[RFC3611] Friedman, T., Caceres, R., and A. Clark, "RTP Control Protocol Extended Reports (RTCP XR)", November 2003.

[RFC4566] Handley, M., Jacobson, V., and C. Perkins, "SDP: Session Description Protocol", July 2006.

9.2. Informative References

[MONARCH] Hunt, G., "Monitoring Architectures for RTP", ID draft-ietf-avtcore-monarch-22, September 2012.

[RFC6390] Clark, A. and B. Claise, "Framework for Performance Metric Development", RFC 6390, October 2011.

[VAD] "http://en.wikipedia.org/wiki/Voice_activity_detection".

Appendix A. Change Log

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

A.1. draft-ietf-xrblock-rtcp-xr-concsec-01

The following are the major changes to previous version :

- o Outdated references update.
- o Add Editor's notes to point out where to require more texts for video loss concealment support
- o Other Editorial changes.

A.2. draft-ietf-xrblock-rtcp-xr-concsec-00

The following are the major changes to previous version :

- o Updated references.
- o Allocate two bits for interval metric flag and 32 bit for SSRC
- o Other editorial changes to get in line with MONARCH and MeasID draft.

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