Internet Engineering Task Force (IETF)
Request for Comments: 7294
Category: Standards Track
ISSN: 2070-1721

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July 2014

RTP Control Protocol (RTCP) Extended Report (XR) Blocks for Concealment Metrics Reporting on Audio Applications

This document defines two RTP Control Protocol (RTCP) Extended Report (XR) blocks that allow the reporting of concealment metrics for audio applications of RTP.

Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 5741.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at http://www.rfc-editor.org/info/rfc7294.

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1. Introduction

1.1. Loss Concealment and Concealed Seconds Metrics Blocks

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. 'Concealed' refers to playout of locally generated signals used to mask the impact of network impairments or to reduce the audibility of jitter buffer adaptations.

This document defines two new concealment-related block types to augment those defined in [RFC3611] for use in a range of RTP applications. These two block types extend the packet loss concealment mechanism defined in Section 4.7.6 of [RFC3611].

The first block type, the Loss Concealment Metrics Block, provides metrics for actions taken by the receiver to mitigate the effect of packet loss and packet discard. Specifically, the first metric (On-Time Playout Duration) reports the duration of normal playout of data that the receiver obtained from the sender's stream. A second metric (Loss Concealment Duration) reports the total time during which the receiver played out media data that was manufactured locally, because the sender's data for these periods was not available due to packet loss or discard. A similar metric (Buffer Adjustment Concealment Duration) reports the duration of playout of locally manufactured data replacing data that is unavailable due to adaptation of an adaptive de-jitter buffer. Further metrics (Playout Interrupt Count and Mean Playout Interrupt Size) report the number of times normal playout was interrupted and the mean duration of these interruptions.

Loss Concealment Duration and Buffer Adjustment Concealment Duration are reported separately because buffer adjustment is typically arranged to occur in silence periods, so it may have very little impact on user experience, whilst loss concealment may occur at any time.

The second block type, the Concealed Seconds Metrics Block, provides metrics for Concealed Seconds, which are measured at the receiving end of the RTP stream. Specifically, the first metric (Unimpaired Seconds) reports the number of whole seconds occupied only with normal playout of data that 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 (SCSs), reports the number of whole seconds during which the receiver played out locally generated data to conceal a lost or discarded frame percentage in excess of the configured SCS Threshold.

These metrics belongs to the class of transport-related terminal metrics defined in [RFC6792].

1.2. RTCP and RTCP Extended Reports

The use of RTCP for reporting is defined in [RFC3550]. [RFC3611] defines an extensible structure for reporting using an RTCP Extended Report (XR). This document 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 Framework [RFC6792] provides guidelines for reporting block format using RTCP XR. The metrics blocks described in this document are in accordance with those guidelines.

1.4. Applicability

These metrics are applicable to audio applications of RTP and the audio component of audio/video applications in which the packet loss concealment machinery is contained at the receiving end to mitigate the impact of network impairments to user's perception of media quality.

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].

2.2. Notations

The report blocks in this document make use of binary fractions. The following terminology is used:

Numeric formats S X:Y

where S indicates a two's complement signed representation, X the number of bits prior to the decimal place, and Y the number of bits after the decimal place.

Hence, 8:8 represents an unsigned number in the range 0.0 to 255.996 with a granularity of 0.0039. S7:8 would represent the range -127.996 to +127.996. 0:16 represents a proper binary fraction with range

0.0 to 1 - 1/65536 = 0.9999847

though note that use of flag values at the top of the numeric range slightly reduces this upper limit. For example, if the 16-bit values 0xFFFE and 0xFFFF are used as flags for "over-range" and "unavailable" conditions, a 0:16 quantity has range

0.0 to 1 - 3/65536 = 0.9999542

3. Loss Concealment Metrics Block

The Loss Concealment Metrics Block is intended to be used as described in this section, in conjunction with information from the Measurement Information Block [RFC6776]. Instances of this metrics block refer by synchronization source (SSRC) to the separate auxiliary Measurement Information Block [RFC6776], which describes measurement periods in use (see [RFC6776], Section 4.2). This metrics block relies on the measurement period in the Measurement Information Block indicating the span of the report and SHOULD be sent in the same compound RTCP packet as the Measurement Information Block. If the measurement period is not received in the same compound RTCP packet as this metrics block, this metrics block MUST be discarded.

3.1. Report Block Structure

The structure of the Loss Concealment Metrics Block is as follows.

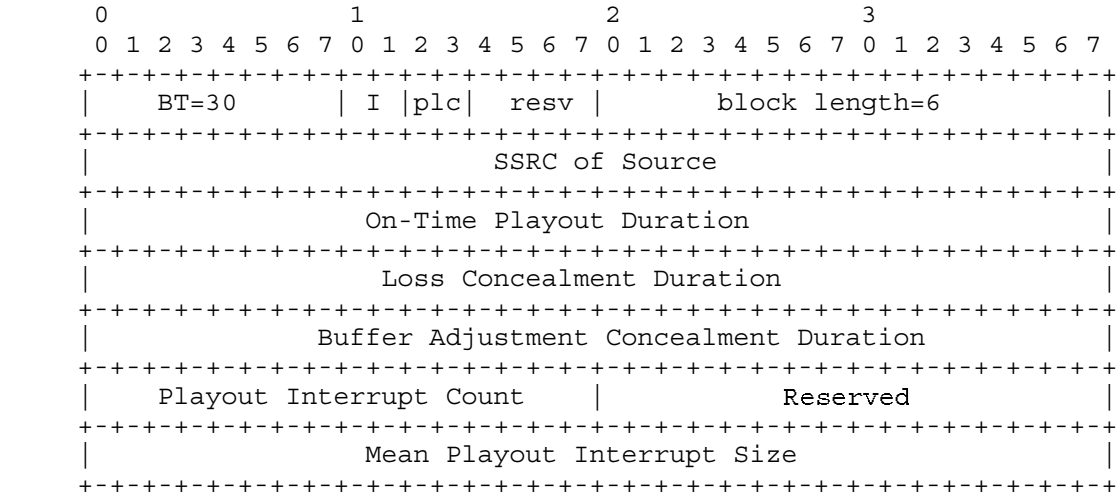

Figure 1: Loss Concealment Metrics Block

3.2. Definition of Fields in Loss Concealment Metrics Block

Block type (BT): 8 bits

A Loss Concealment Metrics Block is identified by the constant 30.

Interval Metric flag (I): 2 bits

This field is used to indicate whether the loss concealment metrics are Sampled, Interval, or Cumulative metrics:

I=10: Interval Duration - the reported value applies to the most recent measurement interval duration between successive metrics reports.

I=11: Cumulative Duration - the reported value applies to the accumulation period characteristic of cumulative measurements.

I=01: Sampled Value - the reported value is a sampled instantaneous value (not allowed in this block).

I=00: Reserved value - this value is reserved for future use.

In this document, Loss Concealment metrics can only be measured over definite intervals and cannot be sampled. Senders MUST NOT use the values I=00 or I=01. If a block is received with I=00 or I=01, the receiver MUST discard the block.

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 = enhancement

Other values are reserved.

Note that the enhancement method (plc=3) for packet loss concealment offers an improved audio quality and better robustness against packet losses [G.711] and is equivalent to "enhanced" in Section 4.7.6 of [RFC3611].

Reserved (resv): 4 bits

These bits are reserved. They MUST be set to zero by senders and ignored by receivers (see [RFC6709], Section 4.2).