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RTP Control Protocol (RTCP) Extended Report (XR) Block for Effective Loss Index Reporting
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Abstract

This document defines a new metric for RTP applications to measure the effectiveness of stream repair means, and an RTP Control Protocol (RTCP) Extended Report (XR) Block to report the metric.

Status of This Memo

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1. Introduction

RTP applications often use stream repair means, e.g. FEC (Forward Error Correction) [RFC5109] and/or retransmission [RFC4588] to improve the robustness of media streams. With the presence of those stream repair means, a degree of packet loss can be recovered for a media stream. In the past, some RTCP Extend Reports (XRs) were defined to reflect the situation of post-repair loss. For example, [RFC5725] defines an XR block using Run Length Encoding (RLE) to report post-repair loss; [RFC7509] defines count metrics for post-repair loss.

This document proposes a new metric Effective Loss Index (ELI) to measure the effectiveness of stream repair means. The new metric provides a simpler view on the post-repair loss than the mechanisms documented in [RFC5725] and [RFC7509]. EFI is an index, so the values reported from different RTP sources can be compared directly, which makes it easier to rank the effectiveness of loss repair means. An example use case is to find endpoints whose ELI values are at bottom 10%. For those endpoints, more informative XR reports such as

those in [RFC5725] and [RFC7509] can then be used to discover more details about the loss situations.

This document also defines an XR block to report the metric, which can be found out in Section 3.

1.1. Effective Loss Index

Effective Loss Index (ELI) uses a simple model to measure the effectiveness of loss repair. The model assumes that repair means are applied onto packets by batches of equal size. Lower ELI means that the repair was more successful. Specifically, a batch is identified by a range of RTP sequence numbers. The size of a batch is number of packets. An application can agree upon a default batch size, or use the SDP signaling defined in Section 4.1 to communicate one.

An RTP endpoint is thought to process received packets and apply repair means batch by batch. For each batch, if there is still some unrecoverable loss after having applied the repair means, then the repair means are deemed as ineffective. The ineffectiveness is denoted by Effective Loss Factor (ELF), along with a parameter Effective Loss Threshold, showing below:

```
if Post-Repair Loss > Effective Loss Threshold
   Effective Loss Factor = 1
else
   Effective Loss Factor = 0
endif
```

Figure 1: Calculation of Effective Loss Factor

The parameters in Figure 1 are explained below:

- Post-Repair Loss is the number of packet lost after repair in the batch.

- Effective Loss Threshold is in number of packets.

The minimum value of Effective Loss Threshold is zero. This document does not mandate any value for Effective Loss Threshold. Applications can prescribe a value for themselves without signaling. On the other hand, SDP signaling defined in Section 4.1 can be used to communicate the value. Determining an Effective Loss Threshold value for use can be empirical, applications may have to try out and change the value from time to time, depending on their needs.

Effective Loss Index is an integer derived by calculating the average Effective Loss Factor across a sequence of consecutive batches of RTP packets. Let ELF(i) be the Effective Loss Factor calculated for i-th batch, and N as number of batches in the sequence, then Effective Loss Index is calculated as:

$$\text{Effective Loss Index} = \frac{ELF(1)+ELF(2)+ \ldots +ELF(N)}{N} \times 10000$$

Figure 2: Calculation of Effective Loss Index

The following is an example of how to calculate Effective Loss Index. For simplicity and demonstration purpose, the size of batches is assumed to be 3, and the Effective Loss Threshold is assumed to be 1. The example processes a sequence of 9 RTP packets in 3 batches.

Batch	Post-Repair Loss	Effective Loss Factor
1 2 3	2, 3	1
4 5 6	5	0
7 8 9	7	0

$$\text{Effective Loss Index} = \frac{1 + 0 + 0}{3} \times 10000 = 3333$$

1.2. Applicability

The metric defined by this document is applicable to a range of RTP applications that send packets in batches of equal length, probably with stream repair means (e.g., Forward Error Correction (FEC) [RFC5109] and/or retransmission [RFC4588]) applied on the batches. Note that in order to not interfere with the batches being protected, any additional packets generated by the stream repair means SHOULD be in a different RTP stream.

The number of batches among which ELI is calculated should not be too few, otherwise the result may be too biased. However, specifying a minimal number of batches seems unrealistic, due to the stream repair means used by applications can be quite different. This document leaves it to applications to choose a suitable minimal value for the number of batches.

1.3. RTCP and RTCP XR Reports

The use of RTCP for reporting is defined in [RFC3550]. [RFC3611] defines an extensible structure for reporting by using an RTCP Extended Report (XR). This document defines a new Extended Report block for use with [RFC3550] and [RFC3611].

1.4. Performance Metrics Framework

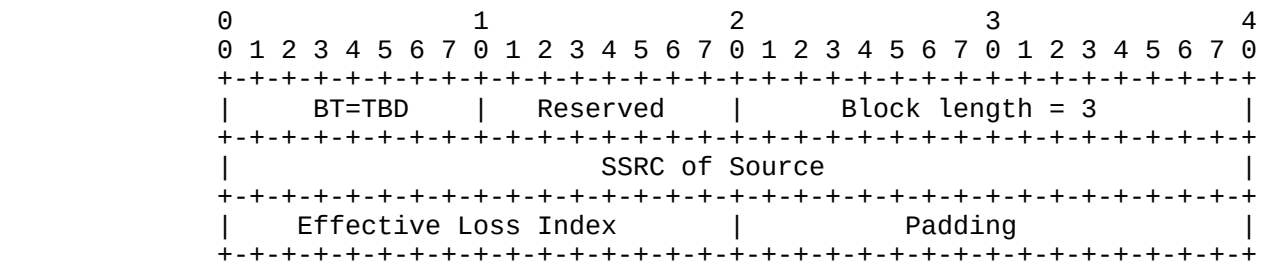
The Performance Metrics Framework [RFC6390] provides guidance on the definition and specification of performance metrics. The "Guidelines for Use of the RTP Monitoring Framework" [RFC6792] provides guidelines for reporting block format using RTCP XR. The Metrics Block described in this document is in accordance with the guidelines in [RFC6390] and [RFC6792].

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].

3. Effective Loss Index Report Block

The Effective Loss Index Report Block has the following format:



Block Type (BT): 8 bits: An Effect Loss Index Report Block is identified by the constant 'TBD'.

[[Editor Note: should replace 'TBD' with assigned value]]

Reserved: 8 bits: These bits are reserved for future use. They MUST be set to zero by senders and ignored by receivers (see Section 4.2 of [RFC6709]).

Block length: 16 bits: This field is in accordance with the definition in [RFC3611]. In this report block, it MUST be set to

3. The block MUST be discarded if the block length is set to a different value.

SSRC of source: 32 bits: As defined in Section 4.1 of [RFC3611].

Effective Loss Index: 16 bits: The value of this field SHOULD be set to the calculated result of Effective Loss Index (as in Figure 2).

Padding: 16 bits: These bits MUST be set to zero by senders and ignored by receivers.

4. SDP Signaling

[RFC3611] defines the use of SDP (Session Description Protocol) for signaling the use of RTCP XR blocks. However, XR blocks MAY be used without prior signaling (see Section 5 of [RFC3611]).

4.1. SDP rtcp-xr-attrib Attribute Extension

This session augments the SDP attribute "rtcp-xr" defined in Section 5.1 of [RFC3611] by providing an additional value of "xr-format" to signal the use of the report block defined in this document. The ABNF [RFC5234] syntax is as follows.

```
xr-format =/ xr-eli-block

xr-eli-block = "effective-loss-index"
               [ ":" effective-loss-batch-size]
               [ ">" effective-loss-threshold]

effective-loss-batch-size  = 1*DIGIT
                             ; the batch size is in number of packets

effective-loss-threshold   = 1*DIGIT
                             ; the threshold is in number of packets

DIGIT = %x30-39
```

The SDP attribute "xr-eli-block" is designed to contain two optional values, one for signaling the batch size, another for the Effective Loss Threshold. Here are some examples:

1. signaling both batch size (100) and Effective Loss Threshold (2)

xr-eli-block = "effective-loss-index" : "100" > "2"

2. signaling only batch size (100)

xr-eli-block = "effective-loss-index" : "100"

3. signaling only Effective Loss Threshold (2)

xr-eli-block = "effective-loss-index" > "2"

4.2. Offer/Answer Usage

When SDP is used in offer/answer context, the SDP Offer/Answer usage defined in [RFC3611] for the unilateral "rtcp-xr" attribute parameters applies. For detailed usage of Offer/Answer for unilateral parameters, refer to Section 5.2 of [RFC3611].

5. Security Considerations

This proposed RTCP XR 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.

An attacker may put incorrect information in the Effective Loss Index reports. Implementers should consider the guidance in [RFC7202] for using appropriate security mechanisms, i.e., where security is a concern, the implementation should apply encryption and authentication to the report block. For example, this can be achieved by using the AVPF profile together with the Secure RTP profile as defined in [RFC3711] an appropriate combination of the two profiles (an "SAVPF") is specified in [RFC5124] However, other mechanisms also exist (documented in [RFC7201] and might be more suitable.

6. 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].

6.1. New RTCP XR Block Type Value

This document assigns the block type value ’TBD’ in the IANA "RTP Control Protocol Extended Reports (RTCP XR) Block Type Registry" to the "Post-Repair Loss Count Metrics Report Block".

[[Editor Note: should replace 'TBD' with assigned value]]

6.2. New RTCP XR SDP Parameter

This document also registers a new parameter "effective-loss-index" in the "RTP Control Protocol Extended Reports (RTCP XR) Session Description Protocol (SDP) Parameters Registry".

6.3. Contact Information for Registrations

The contact information for the registrations is:

RAI Area Directors <rai-ads@ietf.org>

7. Acknowledgements

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Appendix A. Metric Represented Using the Template from RFC 6390

A.1. Effective Loss Index

- Metric Name: RTP Effective Loss Index.
- Metric Description: The effectiveness of stream repair means applied on a sequence of RTP packets.
- Method of Measurement or Calculation: See the "Effective Loss Index" definition in Section 1.1. It is directly measured and must be measured for the primary source RTP packets with no further chance of repair.
- Units of Measurement: This metric is expressed as a 16-bit unsigned integer value representing the effectiveness of stream repair means.
- Measurement Point(s) with Potential Measurement Domain: It is measured at the receiving end of the RTP stream.
- Measurement Timing: This metric relies on the sequence number interval to determine measurement timing.
- Use and Applications: These metrics are applicable to any RTP application, especially those that use loss-repair mechanisms. See Section 1 for details.
- Reporting Model: See RFC 3611.

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