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RTP Control Protocol (RTCP) Extended Report (XR) for RLE of Discarded Packets

Abstract

The RTP Control Protocol (RTCP) is used in conjunction with the Real-time Transport Protocol (RTP) in order to provide a variety of short-term and long-term reception statistics. The available reporting may include aggregate information across longer periods of time as well as individual packet reporting. This document specifies a per-packet report metric capturing individual packets discarded from the de-jitter buffer after successful reception.

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/rfc7097.

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1. Introduction

RTP [RFC3550] provides a transport for real-time media flows such as audio and video together with the RTP Control Protocol (RTCP), which provides periodic feedback about the media streams received in a specific duration. In addition, RTCP can be used for timely feedback about individual events to report (e.g., packet loss) [RFC4585]. Both long-term and short-term feedback enable a media sender to adapt its media transmission and/or encoding dynamically to the observed path characteristics.

RFC 3611 [RFC3611] defines RTCP Extended Reports as a detailed reporting framework to provide more than just the coarse Receiver Report (RR) statistics. The detailed reporting may enable a media sender to react more appropriately to the observed networking conditions as these can be characterized better, although at the expense of extra overhead.

Among many other report blocks, RFC 3611 specifies the Loss Run Length Encoding (RLE) block, which reports runs of packets received and lost with the granularity of individual packets. This can help both error recovery and path loss characterization. In addition to lost packets, RFC 3611 defines the notion of "discarded" packets: packets that were received but dropped from the de-jitter buffer because they were either too early (for buffering) or too late (for playout). The "discard rate" metric is part of the Voice over IP (VoIP) metrics report block even though it is not just applicable to audio: it is specified as the fraction of discarded packets since the beginning of the session (see Section 4.7.1 of RFC 3611 [RFC3611]). The discard metric is believed to be applicable to a large class of RTP applications that use a de-jitter buffer [RFC5481].

Recently proposed extensions to the Extended Reports (XRs) reporting suggest enhancing this discard metric:

- Reporting the number of discarded packets in a measurement interval, i.e., either during the last reporting interval or since the beginning of the session, as indicated by a flag in the suggested XR [RFC7002]. If an endpoint needs to report packet discard due to reasons other than early and late arrival (for example, discard due to duplication, redundancy, etc.), then it should consider using the Discarded Packets report block [RFC7002].

- Reporting gaps and bursts of discarded packets during a measurement interval, i.e., the last reporting interval or the duration of the session [RFC7003].

- o Reporting the sum of payload bytes discarded during a measurement interval, i.e., the last reporting interval or the duration of the session [DISCARD-METRIC].

However, none of these metrics allow a receiver to report precisely which packets were discarded. While this information could in theory be derived from high-frequency reporting on the number of discarded packets [RFC7002] or from the gap/burst report [RFC7003], these two mechanisms do not appear feasible: the former would require an unduly high amount of reporting, which still might not be sufficient due to the non-deterministic scheduling of RTCP packets. The latter incurs significant complexity and reporting overhead and might still not deliver the desired accuracy.

This document defines a discard report block following the idea of the run-length encoding applied for lost and received packets in [RFC3611].

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 BCP 14, RFC 2119 [RFC2119].

The terminology defined in RTP [RFC3550] and in the extensions for XR reporting [RFC3611] applies.

3. RTCP XR Discard RLE Report Block

The RTCP XR Discard RLE report block uses the same format as specified for the loss and duplicate report blocks in RFC 3611 [RFC3611]. Figure 1 describes the packet format. The fields "BT", "T", "block length", "SSRC of source", "begin_seq", and "end_seq" have the same semantics and representation as defined in [RFC3611], with the addition of the "E" flag to indicate the reason for discard. The "chunks" encoding the run length have the same representation as in RFC 3611, but encode discarded packets. A definition of a discarded packet is given in RFC 7002 [RFC7002].

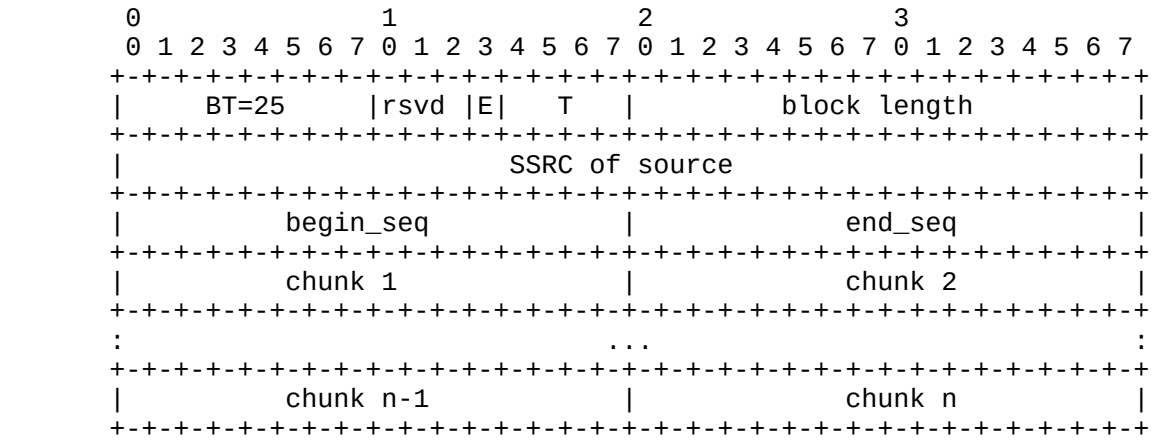

Figure 1: RTCP XR Discard RLE Report Block

Block Type (BT, 8 bits): A Discard RLE report block is identified by the constant 25.

rsvd (3 bits): This field is reserved for future definition. In the absence of such definition, the bits in this field MUST be set to zero and MUST be ignored by the receiver.

The 'E' bit is introduced to distinguish between packets discarded due to early arrival and those discarded due to late arrival. The 'E' bit is set to '1' if the chunks represent packets discarded due to arriving too early and is set to '0' otherwise.

In case both early and late discarded packets shall be reported, two Discard RLE report blocks MUST be included; their sequence number range MAY overlap, but individual packets MUST only be reported as either early or late and not appear marked in both. If packets appear in both report blocks, the conflicting packets will be ignored. Packets not reported in either block are considered to be properly received and not discarded.

Discard RLE report blocks SHOULD be sent in conjunction with an RTCP RR as a compound RTCP packet.

4. Protocol Operation

This section describes the behavior of the reporting node (= media receiver) and the media sender.

4.1. Reporting Node (Receiver)

Transmission of RTCP XR Discard RLE report blocks is up to the discretion of the media receiver, as is the reporting granularity. However, it is RECOMMENDED that the media receiver signal all discarded packets using the method defined in this document. If all packets over a reporting period are discarded, the media receiver MAY use the Discard Report Block [RFC7002] instead. In case of limited available reporting bandwidth, it is up to the receiver whether or not to include RTCP XR Discard RLE report blocks.

The media receiver MAY send the Discard RLE report blocks as part of the regularly scheduled RTCP packets, as per RFC 3550. It MAY also include Discard RLE report blocks in immediate or early feedback packets, as per RFC 4585.

4.2. Media Sender

The media sender MUST be prepared to operate without receiving any Discard RLE report blocks. If Discard RLE report blocks are generated by the media receiver, the media sender cannot rely on all these reports being received, nor can the media sender rely on a regular generation pattern from the media receiver.

However, if the media sender receives RTCP XR reports but the reports contain no Discard RLE report blocks and is aware that the media receiver supports Discard RLE report blocks, it MAY assume that no packets were discarded at the media receiver.

5. SDP Signaling

A participant of a media session MAY use SDP to signal its support for the report block specified in this document or use them without any prior signaling (see Section 5 of RFC 3611 [RFC3611]).

For signaling in SDP, the RTCP XR attribute as defined in RFC 3611 [RFC3611] MUST be used. The SDP [RFC4566] attribute 'xr-format' defined in RFC 3611 is augmented as described in the following to indicate the discard RLE metric.

```
rtcp-xr-attrib = "a=" "rtcp-xr" ":" [xr-format *(SP xr-format)]
                 CRLF   ; defined in [RFC3611]

xr-format      =/ xr-discard-rle

xr-discard-rle = "discard-rle"
```

The parameter 'discard-rle' is used to indicate support for the Discard RLE report block defined in Section 3.

When SDP is used in Offer/Answer context, the mechanism defined in RFC 3611 [RFC3611] for unilateral "rtcp-xr" attribute parameters applies (see Section 5.2 of RFC 3611 [RFC3611]).

6. Security Considerations

The Discard RLE report block provides per-packet statistics so the risk to confidentiality documented in Section 7, Paragraph 3, of RFC 3611 [RFC3611] applies. In some situations, returning very detailed error information (e.g., over-range measurement or measurement unavailable) using this report block can provide an attacker with insight into the security processing. Implementers should consider the guidance in [NO-SRTP] 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 RFC 3711 [RFC3711]; an appropriate combination of the two profiles (an "SAVPF") is specified in RFC 5124 [RFC5124]. However, other mechanisms also exist [SRTP-OPTIONS] and might be more suitable.

Additionally, The security considerations of RFC 3550 [RFC3550], RFC 3611 [RFC3611], and RFC 4585 [RFC4585] apply.

7. IANA Considerations

New block types for RTCP XR are subject to IANA registration. For general guidelines on IANA considerations for RTCP XR, refer to RFC 3611.

7.1. XR Report Block Registration

This document extends the IANA "RTP Control Protocol Extended Reports (RTCP XR) Block Type Registry" by assigning value 25 to DRLE (Discard RLE Report).

7.2. SDP Parameter Registration

This document registers ’discard-rle’ in the "RTCP XR SDP Parameters".

7.3. Contact Information for IANA Registrations

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8. Acknowledgments

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Appendix A. Metrics Represented Using the Template from RFC 6390

a. RLE of Discarded RTP Packets Metric

* Metric Name: RLE - Run-length encoding of Discarded RTP Packets Metric.

* Metric Description: Instances of RTP packets discarded over the period covered by this report.

* Method of Measurement or Calculation: See Section 3 for the definition of Discard RLE, and Section 4.1 of RFC 3611 for RLE.

* Units of Measurement: Every RTP packet in the interval is reported as discarded or not. See Section 3 for the definition.

* Measurement Point(s) with Potential Measurement Domain: The measurement of these metrics is made at the receiving end of the RTP stream.

* Measurement Timing: Each RTP packet between a beginning sequence number (begin_seq) and ending sequence number (end_seq) is reported as discarded or not. See Section 3 for the definition of Discard RLE.

* Use and applications: See Section 1, paragraph 1.

* Reporting model: See RFC 3611.

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