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Real-time Transport Control Protocol (RTCP) Extension Report (XR) for Run Length Encoding of Discarded Packets
draft-ietf-xrblock-rtcp-xr-discard-rle-metrics-00.txt

Abstract

The Real-time Transport Control Protocol (RTCP) is used in conjunction with the Real-time Transport Protocol (RTP) in 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 jitter buffer after successful reception.

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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 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 sender to adapt its media transmission and/or encoding dynamically to the observed path characteristics.

RFC3611 [RFC3611] defines RTCP eXtension Reports as a detailed reporting framework to provide more than just the coarse RR statistics. The detailed reporting may enable a sender to react more appropriately to the observed networking conditions as these can be characterized better, albeit at the expense of extra overhead.

Among many other fields, RFC3611 specifies the Loss RLE block which define 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, RFC3611 defines the notion of "discarded" packets: packets that were received but dropped from the jitter buffer because they were either too early (for buffering) or too late (for playout). This metric is part of the 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 RFC3611 [RFC3611].

Recently proposed extensions to the XR reporting suggest enhancing this discard metric:

- Reporting the number of discarded packets during either the last reporting interval or since the beginning of the session, as indicated by a flag in the suggested XR report [I-D.ietf-xrblock-rtcp-xr-discard].
- Reporting gaps and bursts of discarded packets during the last reporting interval or cumulatively since the beginning of the session [I-D.ietf-xrblock-rtcp-xr-burst-gap-discard].

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 or from the gap/burst report, 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 incur 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 [RFC3611].

Complementary to or instead of the indication which packets were lost, an XR block is defined to indicate the number of bytes lost, per interval or for the duration of the session, similar to other XR report blocks.

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] and indicate requirement levels for compliant implementations.

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

3. XR Discard RLE Report Block

The XR Discard RLE report block uses the same format as specified for the loss and duplicate report blocks in RFC3611 [RFC3611]. Figure Figure 1 recaps the packet format. The fields "BT", "T", "block length", "SSRC of source", "begin_seq", and "end_seq" SHALL have the same semantics and representation as defined in RFC3611. The "chunks" encoding the run length SHALL have the same representation as in RFC3611, but encode discarded packets.

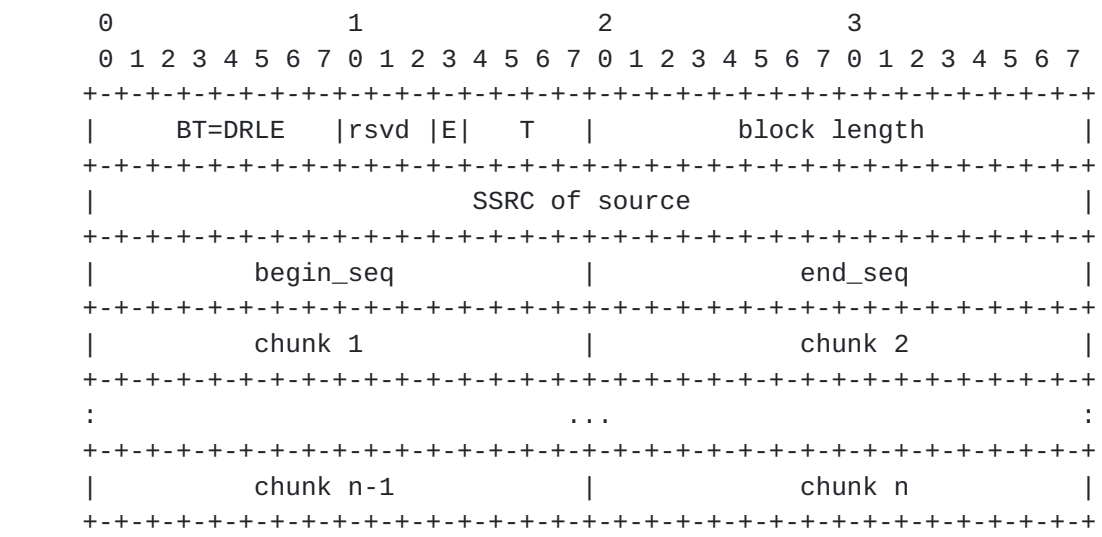

Figure 1: XR Discard Report Block

The 'E' bit is introduced to distinguish between packets discarded due to early arrival and those discarded due to late arrival. The 'E' bit MUST be set to '1' if the chunks represent packets discarded due to too early arrival and MUST be 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. Packets reported in both MUST be considered as discarded without further information available, packets reported in neither 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.

Editor's node: is it acceptable to use one of the 'reserved' bits for this purpose or should two block types be used?

4. XR Bytes Discarded Report Block

The XR Bytes Discarded report block uses the following format which follows the model of the framework for performance metric development [RFC6390].

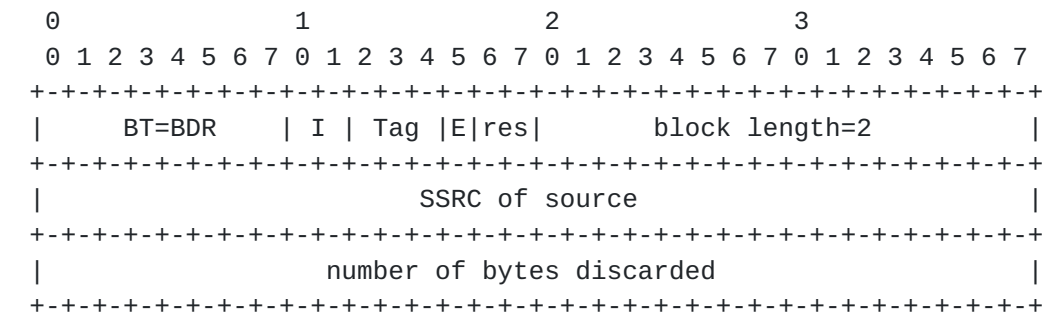

Figure 2: XR Bytes Discarded Report Block

The Interval Metric flag (I) (2 bits) is used to indicate whether the Post-Repair Loss metric is Sampled, Interval, or a Cumulative metric, that is, whether the reported value applies to the most recent measurement interval duration between successive reports (I=10, the Interval Duration) or to the accumulation period characteristic of cumulative measurements (I=11, the Cumulative Duration) or is a sampled value (I=01). Numerical values for sampled duration are provided in the Measurement Identifier block referenced by the tag field below.

Measurement Identifier association (Tag) 3 bits: This field is used to identify the Measurement Identifier block which describes the sampled measurement. The tag in the corresponding Measurement Identifier block has the same tag value. Note that there may be more than one Measurement Identifier block per RTCP packet. The tag MUST be set to 0 when using cumulative or interval durations.

The 'E' bit is introduced to distinguish between packets discarded due to early arrival and those discarded due to late arrival. The 'E' bit MUST be set to '1' if the chunks represent packets discarded due to too early arrival and MUST be set to '0' otherwise. In case both early and late discarded packets shall be reported, two Bytes Discarded report blocks MUST be included.

The 'number of bytes discarded' is a 32-bit unsigned integer value indicating the total number of bytes discarded (I=0) or the number of bytes discarded since the last RTCP XR Bytes Discarded block was sent.

Bytes Discarded Report Blocks SHOULD be sent in conjunction with an RTCP RR as a compound RTCP packet.

Editor's note: is it acceptable to use one of the 'reserved' bits for this purpose or should two block types be used?

5. Protocol Operation

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

5.1. Reporting Node (Receiver)

Transmission of RTCP XR Discard RLE Reports is up to the discretion of the receiver, as is the reporting granularity. However, it is RECOMMENDED that the receiver signals all discarded packets using the method defined in this document. If all packets over a reporting period were lost, the receiver MAY use the Discard Report Block [I-D.ietf-xrblock-rtcp-xr-discard] instead. In case of limited available reporting bandwidth, it is up to the receiver whether or not to include RTCP XR Discard RLE reports or not.

The receiver MAY send the Discard RLE Reports as part of the regularly scheduled RTCP packets as per RFC3550. It MAY also include Discard RLE Reports in immediate or early feedback packets as per RFC4585.

5.2. Media Sender

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

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

6. SDP signaling

The report blocks specified in this document define extensions to RTCP XR reporting. Whether or not this specific extended report is sent is left to the discretion of the receiver. Its presence may enable better operation of the sender since more detailed information is available. Not providing this information will make the sender rely on other RTCP report metrics.

A participant of a media session MAY use SDP to signal its support for this attribute. In this case, the RTCP XR attribute as defined in RFC3611 [RFC3611] MUST be used. The SDP RFC4566 [RFC4566] attribute 'xr-format' defined in RFC3611 is augmented as described in

the following to indicate the discard metric.

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

xr-format       =/ xr-discard-rle
                 / xr-discard-bytes

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

The literal 'discard-rle' MUST be used to indicate support for the Discard RLE Report Block defined in section Section 3, the literal 'discard-bytes' to indicate support for the Bytes Discarded Report Block defined in section Section 4

For signaling support for the discard metric, the rules defined in RFC3611 apply. Generally, senders and receivers SHOULD indicate this capability if they support this metric and would like to use it in the specific media session being signaled. The receiver MAY decide not to send discard information unless it knows about the sender's support to save on RTCP reporting bandwidth.

A participant in a media session MAY use the two report blocks specified in this document without any explicit (SDP) signaling.

7. Security Considerations

The security considerations of RFC3550 [RFC3550], RFC3611 [RFC3611], and RFC4585 [RFC4585] apply. Since this document offers only a more precise reporting for an already existing metric, no further security implications are foreseen.

8. 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 [RFC3611].

8.1. XR Report Block Registration

This document extends the IANA "RTCP XR Block Type Registry" by two new values: DRLE and BDR.

[Note to RFC Editor: please replace DRLE and BDR with the IANA

provided RTCP XR block type for this block here and in the diagrams above.]

8.2. SDP Parameter Registration

This document registers two new parameters for the Session Description Protocol (SDP), "discard-rle" and "discard-bytes", in the "RTCP XR SDP Parameters Registry".

8.3. Contact information for IANA registrations

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9. Normative References

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[I-D.ietf-xrblock-rtcp-xr-burst-gap-discard]
Hunt, G., Clark, A., Huang, R., and W. Wu, "RTCP XR Report Block for Burst/Gap Discard metric Reporting", draft-ietf-xrblock-rtcp-xr-burst-gap-discard-00 (work in progress), October 2011.

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Appendix A. Change Log

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

A.1. changes in draft-ietf-xrblock-rtcp-xr-discard-rle-metrics-00

- Changed the interval flag from 1 to 2 bits in the discarded bytes report. Also added the measurement identification tag to the block.
- Added this section.

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