Real-time Transport Control Protocol (RTCP) Extension Report (XR) for
Run Length Encoding of Discarded Packets
draft-ietf-xrblock-rtcp-xr-discard-rle-metrics-01.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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Table of Contents

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:
   o 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].
   o 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.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    BT=DRLE    |rsvd |E|   T   |            block length        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        SSRC of source                         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          begin_seq            |            end_seq             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          chunk 1              |            chunk 2             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
:                             ...                                :
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          chunk n-1            |            chunk n             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

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.

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].

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     BT=BDR    | I | Tag |E|res|          block length=2        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        SSRC of source                         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    number of bytes discarded                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 2: XR Bytes Discarded Report Block

The Interval Metric flag (I) (2 bits) is used to indicate whether the
discard 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).
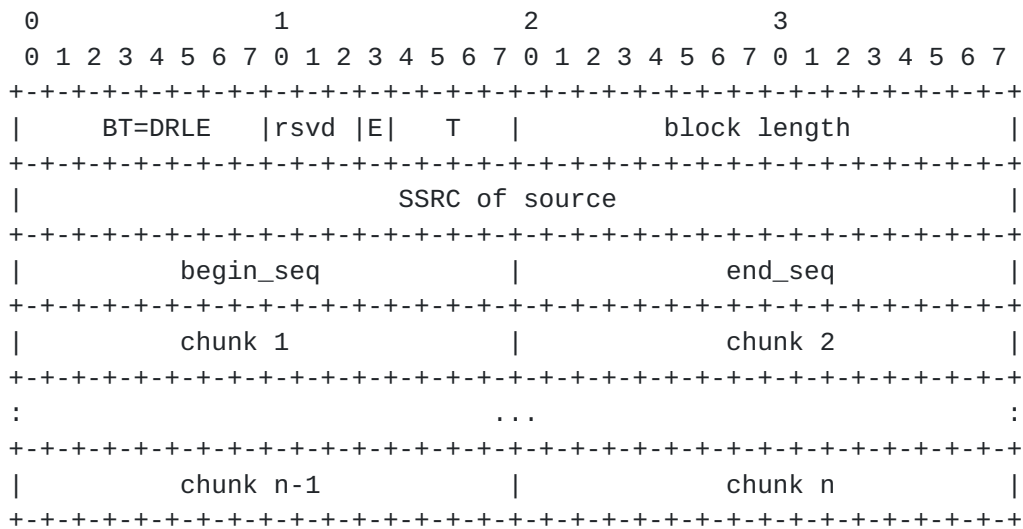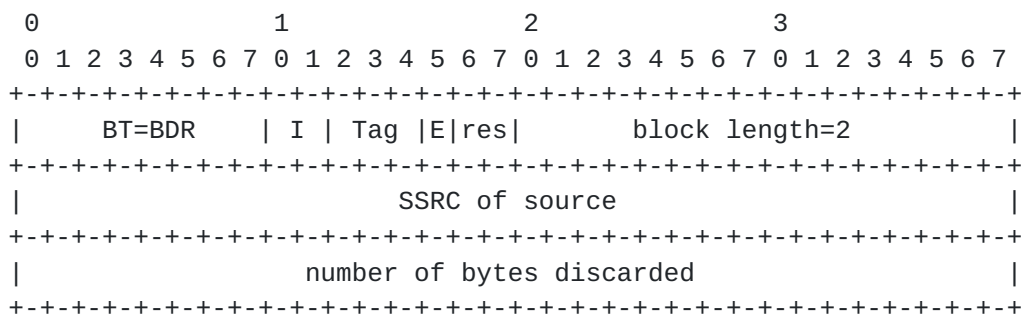
The 'E' bit is introduced to distinguish between packets discarded
due to early arrival and those discarded due to late arrival. The
'E' bit MUST be set to '1' if the chunks represent packets discarded
due to too early arrival and MUST be set to '0' otherwise. In case
both early and late discarded packets 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=11), or the number
of bytes discarded since the last RTCP XR Bytes Discarded block was
sent (I=10), or bytes discarded in a measurement interval (I=01)
[I-D.ietf-xrblock-rtcp-xr-meas-identity].

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

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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            information Reporting using SDES item and XR Block",
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[RFC6390]   Clark, A. and B. Claise, "Guidelines for Considering New
            Performance Metric Development", BCP 170, RFC 6390,
            October 2011.

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

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

A.2. changes in draft-ietf-xrblock-rtcp-xr-discard-rle-metrics-01

o Removed the measurement identification tag to the block.

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