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RTP Control Protocol (RTCP) Extended Reports (XR) for Bytes Discarded Metric
draft-singh-xrblock-rtcp-xr-bytes-discarded-metric-00

Abstract

   The RTP 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 report
   computing the bytes discarded from the de-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 (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.

   RFC3611 [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.

In addition to lost packets, RFC3611 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
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].
The discard metric is believed to be applicable to a large class of
RTP applications which use a de-jitter buffer RFC5481 [RFC5481].

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

o Reporting the number of discarded packets in a measurement
   interval, i.e., 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]. If an
   endpoint needs to report packet discard due to other reasons than
   early- and late-arrival (for example, discard due to duplication,
   redundancy, etc.) then it should consider using the Discarded
   Packets Report Block [I-D.ietf-xrblock-rtcp-xr-discard].

o Reporting gaps and bursts of discarded packets during a
   measurement interval, i.e., the last reporting interval or the
   duration of the session
   [I-D.ietf-xrblock-rtcp-xr-burst-gap-discard].

o Reporting run-length encoding of discarded packet during a
   measurement interval, i.e., between a set of sequence numbers
   [I-D.ietf-xrblock-rtcp-xr-discard-rle-metrics].

However, none of these metrics allow a receiver to report precisely
the number of bytes that were discarded. While this information
could in theory be derived from high-frequency reporting on the
number of discarded packets [I-D.ietf-xrblock-rtcp-xr-discard] or
from the Discard RLE report
[I-D.ietf-xrblock-rtcp-xr-discard-rle-metrics], 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 (by storing a map of sequence numbers and
packet sizes) and reporting overhead.

An XR block is defined in this document to indicate the number of
bytes discarded, 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].

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

3. 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 |E|reserved |        block length=2          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                      SSRC of source                          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                   number of bytes discarded                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 1: XR Bytes Discarded Report Block

Block Type (BT, 8 bits): A Bytes Discarded Packets Report Block is
identified by the constant BDR.

[Note to RFC Editor: please replace BDR with the IANA provided RTCP
XR block type for this block. Please remove this note prior to
publication as an RFC.]

The Interval Metric flag (I) (2 bits) is used to indicate whether the
discard metric is 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). Since the bytes discarded are not
measured at a particular time instance but over one or several
reporting intervals, the metric MUST NOT be reported as a Sampled
Metric (I=01). In addition, the value I=00 is reserved and MUST NOT
be sent, and MUST be discarded when received.

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 it reports bytes discarded due to early
arrival and is set to '0' if it reports bytes discarded due to late
arrival. If a duplicate packet is received and discarded, these
duplicate packets are ignored and not reported. In case both early
and late discarded packets shall be reported, two Bytes Discarded
report blocks MUST be included.

reserved (5 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.

block length (16 bits) MUST be set to 2, in accordance with the
definition of this field in [RFC3611]. The block MUST be discarded
if the block length is set to a different value.

The 'number of bytes discarded' is a 32-bit unsigned integer value
indicating the total number of bytes discarded. Bytes discarded
corresponds to the RTP payload size of every RTP packet that is
discarded (due to early or late arrival). Hence, the bytes discarded
ignores the size of any RTP header extensions and the size of the
padding bits. Also the discarded packet is associated to the
interval in which it was discarded and not when it was expected.

If Interval Metric flag (I=11) is set, the value in the field
indicates the number of bytes discarded from the start of the
session, if Interval Metric flag (I=01) is set, it indicates the
number of bytes discarded since the last RTCP XR Byte Discarded Block
was received.

If the XR block follows a measurement identity block [RFC6776] in the
same RTCP compound packet then the cumulative (I=11) or the interval
(I=10) for this report block corresponds to the values of the
"measurement duration" in the measurement information block.

If the receiver sends the Bytes Discarded Report Block without the
measurement identity block then the discard block MUST be sent in
conjunction with an RTCP Receiver Report (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 Bytes Discarded Report is up to the
discretion of the media receiver, as is the reporting granularity.

However, it is RECOMMENDED that the media receiver signals all
discarded packets using the method defined in this document. If all
packets over a reporting period were discarded, the media receiver
MAY use the Discard Report Block [I-D.ietf-xrblock-rtcp-xr-discard]
instead.

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

4.2. Media Sender

The media sender MUST be prepared to operate without receiving any
Bytes Discarded reports. If Bytes Discarded reports 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 any RTCP reports but no Bytes
Discard report blocks and is aware that the media receiver supports
Bytes Discard report blocks, it MAY assume that no packets were
discarded at the media receiver.

The media sender SHOULD accept the Bytes Discarded Report Block only
if it is received in a compound RTCP receiver report or if it is
preceded by a measurement identity block [RFC6776]. Under all other
circumstances it MUST ignore the block.

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 [RFC3611]).

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

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

   xr-format        =/ xr-discard-bytes

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

The parameter 'discard-bytes' to indicate support for the Bytes
Discarded Report Block defined in Section 3.

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

6. Security Considerations

The Bytes Discarded block does not provide per-packet statistics,
hence the risk to confidentiality documented in Section 7, paragraph
3 of [RFC3611] does not apply. 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 [I-D.ietf-avt-srtp-not-mandatory] 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 [I-D.ietf-avtcore-rtp-security-options])
and might be more suitable.

Additionally, The security considerations of [RFC3550], [RFC3611],
and [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
[RFC3611].

7.1. XR Report Block Registration

This document extends the IANA "RTP Control Protocol Extended Reports
(RTCP XR) Block Type Registry" by a new value: BDR (Bytes Discarded
Report).

[Note to RFC Editor: please replace BDR with the IANA provided RTCP
XR block type for this block here and in the diagrams above. Please
remove this note prior to publication as an RFC.]

7.2. SDP Parameter Registration

This document registers a new parameters for the Session Description
Protocol (SDP), "discard-bytes" in the "RTP Control Protocol Extended

Reports (RTCP XR) Session Description Protocol (SDP) Parameters
Registry".

7.3. Contact information for IANA registrations

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8. Acknowledgments

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valuable feedback on earlier versions of this draft.

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9.2. Informative References

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Appendix A. Metrics represented using RFC6390 Template

   RFC EDITOR NOTE: please change XXXX in [RFCXXXX] by the new RFC
   number, when assigned.

   a. Bytes Discarded Metric

   * Metric Name: Bytes Discarded Metric

   * Metric Description: Total number of bytes discarded over the
      period covered by this report.

   * Method of Measurement or Calculation: See section 4, number of
      bytes discarded definition [RFCXXXX].

   * Units of Measurement: See section 4, number of bytes discarded
      definition [RFCXXXX].

   * Measurement Point(s) with Potential Measurement Domain: See
      section 4, 1st paragraph [RFCXXXX].

   * Measurement Timing: See section 4, last three paragraphs of
      [RFCXXXX] for measurement timing and for the Interval Metric
      flag.

   * Use and applications: See section 1, paragraph 1 of [RFCXXXX].

   * Reporting model: See RFC3611.

Appendix B. Change Log

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

B.1. changes in draft-singh-xrblock-rtcp-xr-bytes-discarded-metric-00

   o Bytes discarded metric split from
      [I-D.ietf-xrblock-rtcp-xr-discard-rle-metrics].

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