            RTP Control Protocol (RTCP) Extended Report (XR) Block
                    for Discard Count Metric Reporting

Abstract

   This document defines an RTP Control Protocol (RTCP) Extended Report
   (XR) block that allows the reporting of a simple discard count metric
   for use in a range of RTP applications.

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.

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   and how to provide feedback on it may be obtained at
   http://www.rfc-editor.org/info/rfc7002.

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1. Introduction

1.1. Discard Count Report Block

   This document defines a new block type to augment those defined in
   [RFC3611] for use in a range of RTP applications. The new block type
   supports the reporting of the number of packets that are received
   correctly but are never played out, typically because they arrive too
   late (buffer underflow) or too early (buffer overflow) to be played
   out. The metric is applicable both to systems that use packet loss
   repair techniques (such as forward error correction [RFC5109] or
   retransmission [RFC4588]) and to those that do not.

   This metric is useful for identifying the existence, and
   characterizing the severity, of packet transport problems that may
   affect users' perceptions of a service delivered over RTP.

   This block may be used in conjunction with [RFC7003], which provides
   additional information on the pattern of discarded packets. However,
   the metric in [RFC7003] may be used independently of the metrics in
   this block.

When a Discard Count Metrics Block is sent together with a Burst/Gap
Discard Metrics Block (defined in [RFC7003]) to the media sender or
RTP-based network management system, the information carried in the
Discard Count Metrics Block and the Burst/Gap Discard Metrics Block
allows systems receiving the blocks to calculate burst/gap summary
statistics (e.g., the gap discard rate).

The metric belongs to the class of transport-related end-system
metrics defined in [RFC6792].

1.2. RTCP and RTCP Extended Reports

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

1.3. Performance Metrics Framework

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

1.4. Applicability

This metric is believed to be applicable to a large class of RTP
applications that use a de-jitter buffer [RFC5481].

Discards due to late or early arriving packets affect user
experience. The reporting of discards alerts senders and other
receivers to the need to adjust their transmission or reception
strategies. The reports allow network managers to diagnose these
user experience problems.

The ability to detect duplicate packets can be used by managers to
detect network layer or sender behavior, which may indicate network
or device issues. Based on the reports, these issues may be
addressed prior to any impact on user experience.

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].

In addition, the following terms are defined:

Received, Lost, and Discarded

   A packet shall be regarded as lost if it fails to arrive within an
   implementation-specific time window. A packet that arrives within
   this time window but is either too early or too late to be played
   out or is thrown away before playout due to packet duplication or
   redundancy shall be regarded as discarded. A packet shall not be
   regarded as discarded if it arrives within this time window but is
   dropped during decoding by some higher layer decoder, e.g., due to
   a decoding error. A packet shall be classified as one of the
   following: received (or OK), discarded, or lost. The discard
   count metric counts only discarded packets. The metric
   "cumulative number of packets lost" defined in [RFC3550] reports a
   count of packets lost from the media stream (single
   synchronization source (SSRC) within a single RTP session).
   Similarly, the metric "number of packets discarded" reports a
   count of packets discarded from the media stream (single SSRC
   within a single RTP session) arriving at the receiver. Another
   metric defined in [RFC5725] is available to report on packets that
   are not recovered by any repair techniques that may be in use.

3. Discard Count Metrics Block

   Metrics in this block report on the number of packets discarded in
   the stream arriving at the RTP end system. The measurement of these
   metrics is made at the receiving end of the RTP stream. Instances of
   this metrics block use the SSRC to refer to the separate auxiliary
   Measurement Information Block [RFC6776], which describes measurement
   periods in use (see [RFC6776], Section 4.2). This metrics block
   relies on the measurement interval in the Measurement Information
   Block indicating the span of the report and MUST be sent in the same
   compound RTCP packet as the Measurement Information Block. If the
   measurement interval is not received in the same compound RTCP packet
   as this metrics block, this metrics block MUST be discarded.

3.1. Report Block Structure

   The structure of the Discard Count Metrics Block is as follows.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    BT=24      | I |DT |  resv |       Block Length = 2        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        SSRC of Source                         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        Discard Count                          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
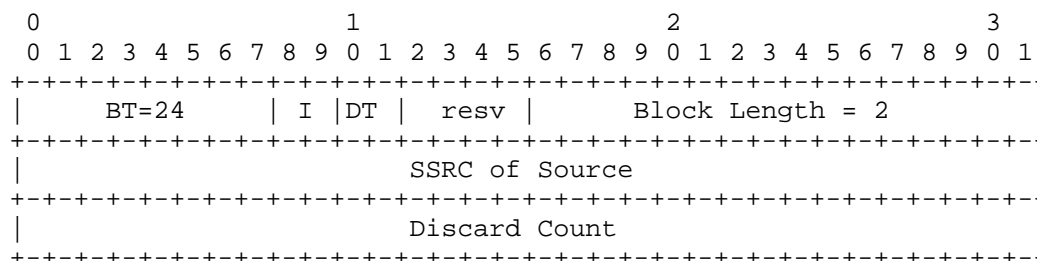
                  Figure 1: Report Block Structure

3.2. Definition of Fields in the Discard Count Metrics Block

   Block Type (BT): 8 bits

      A Discard Count Metrics Block is identified by the constant 24.

   Interval Metric flag (I): 2 bits

      This field indicates whether the reported metric is an Interval,
      Cumulative, or Sampled metric [RFC6792]:

         I=10: Interval Duration - the reported value applies to the
         most recent measurement interval duration between successive
         metrics reports.

         I=11: Cumulative Duration - the reported value applies to the
         accumulation period characteristic of cumulative measurements.

         I=01: Sampled Value - the reported value is a sampled
         instantaneous value.

      In this document, the discard count metric can only be measured
      over definite intervals and cannot be sampled. Accordingly, the
      value I=01, indicating a sampled value, MUST NOT be sent, and MUST
      be discarded when received. In addition, the value I=00 is
      reserved and also MUST NOT be sent, and MUST be discarded when
      received.

Discard Type (DT): 2 bits

   This field is used to identify the discard type used in this
   report block. The discard type is defined as follows:

      00: Report packet discarded or being thrown away before playout
      due to packet duplication.

      01: Report packet discarded due to too early to be played out.

      10: Report packet discarded due to too late to be played out.

   The value DT=11 is reserved for future definition and MUST NOT be
   sent, and MUST be discarded when received.

   An endpoint MAY report any combination of discard types in each
   reporting interval by including several Discard Count Metrics
   Blocks in a single RTCP XR packet.

   Some systems send duplicate RTP packets for robustness or error
   resilience. This is NOT RECOMMENDED since it breaks RTCP packet
   statistics. If duplication is desired for error resilience, the
   mechanism described in [RTPDUP] can be used, since this will not
   cause breakage of RTP streams or RTCP statistics.

Reserved (resv): 4 bits

   These bits are reserved. They MUST be set to zero by senders and
   ignored by receivers (see [RFC6709], Section 4.2).

Block Length: 16 bits

   The length of this report block in 32-bit words, minus one, in
   accordance with the definition in [RFC3611]. This field MUST be
   set to 2 to match the fixed length of the report block. 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].

   Discard Count

      Number of packets discarded over the period (Interval or
      Cumulative) covered by this report.

      The measured value is an unsigned value. If the measured value
      exceeds 0xFFFFFFFD, the value 0xFFFFFFFE MUST be reported to
      indicate an over-range measurement. If the measurement is
      unavailable, the value 0xFFFFFFFF MUST be reported.

      Note that the number of packets expected in the period associated
      with this metric (whether Interval or Cumulative) is available
      from the difference between a pair of extended sequence numbers in
      the Measurement Information Block [RFC6776], so it need not be
      repeated in this block.

4. SDP Signaling

   [RFC3611] defines the use of the Session Description Protocol (SDP)
   [RFC4566] for signaling the use of XR blocks. However, XR blocks MAY
   be used without prior signaling (see Section 5 of RFC 3611).

4.1. SDP rtcp-xr Attribute Extension

   This section augments the SDP [RFC4566] attribute "rtcp-xr" defined
   in [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-pdc-block
   xr-pdc-block = "pkt-discard-count"

4.2. Offer/Answer Usage

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

5. 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].

5.1. New RTCP XR Block Type Value

   This document assigns the block type value 24 in the IANA "RTP
   Control Protocol Extended Reports (RTCP XR) Block Type Registry" to
   the "Discard Count Metrics Block".

5.2. New RTCP XR SDP Parameter

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

5.3. Contact Information for Registrations

   The following contact information is provided for all registrations
   in this document:

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6. Security Considerations

   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. Where this is a concern, the implementation should apply
   encryption and authentication to this report block. For example,
   this can be achieved by using the Audio-Visual Profile with Feedback
   (AVPF) profile together with the Secure RTP profile, as defined in
   [RFC3711]; an appropriate combination of those two profiles ("SAVPF")
   is specified in [RFC5124].

   Besides this, it is believed that this 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.

7. Contributors

   Geoff Hunt wrote the initial draft of this document.

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   Yamada.

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Appendix A. Metrics Represented Using the Template from RFC 6390

    a. Number of Packets Discarded Metric

        * Metric Name: Number of RTP packets discarded.

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

        * Method of Measurement or Calculation: See Section 3.2, Discard
           Count definition.

        * Units of Measurement: See Section 3.2, Discard Count
           definition.

        * Measurement Point(s) with Potential Measurement Domain: See
           Section 3, 1st paragraph.

        * Measurement Timing: See Section 3, 1st paragraph for
           measurement timing and Section 3.2 for Interval Metric flag.

        * Use and Applications: See Section 1.4.

        * Reporting Model: See RFC 3611.

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