Internet Engineering Task Force (IETF)
Request for Comments: 7003
Category: Standards Track
ISSN: 2070-1721

A. Clark
Telchemy
R. Huang
Q. Wu, Ed.
Huawei

September 2013

RTP Control Protocol (RTCP) Extended Report (XR) Block for Burst/Gap Discard Metric Reporting

Abstract

This document defines an RTP Control Protocol (RTCP) Extended Report (XR) block that allows the reporting of burst and gap discard metrics 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.

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/rfc7003.

Table of Contents

1. Introduction

1.1. Burst/Gap Discard Metrics 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 proportion of packets discarded by the jitter buffer at the receiver, using packet discard logic according to the jitter buffer algorithms. The discards during discard bursts are reported, together with the number of bursts. This block is intended to be used in conjunction with [RFC7002], which provides the total packets discarded and on which this block therefore depends. However, the metric in [RFC7002] may be used independently of the metrics in this block.

This block provides information on transient IP problems. Burst/gap metrics are typically used in cumulative reports; however, they also may be used in interval reports (see the Interval Metric flag in Section 3.2). The burstiness of packet discard affects user experience, may influence any sender strategies to mitigate the problem, and may also have diagnostic value.

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

The definitions of "burst", "gap", "loss", and "discard" are consistent with the definitions in [RFC3611]. To accommodate the range of jitter buffer algorithms and packet discard logic that may be used by implementors, the method used to distinguish between bursts and gaps shall use an equivalent method to that defined in Section 4.7.2 of [RFC3611]. Note that reporting the specific jitter buffer algorithms and/or packet discard logic is out of the scope of this document.

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

The Performance Metrics Framework [RFC6390] provides guidance on the definition and specification of performance metrics. The RTP Monitoring Framework [RFC6792] provides guidelines 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

These metrics are applicable to a range of RTP applications that contain de-jitter buffers [RFC5481] at the receiving end to smooth variation in packet-arrival time and don’t use stream repair means, e.g., Forward Error Correction (FEC) [RFC5109] and/or retransmission [RFC4588].

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 too early to be played out, too late to be played out, or 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 received (or OK), discarded, or lost. 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" defined in [RFC7002] 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. Note that the term "discard" defined here builds on the "discard" definition in [RFC3611] but extends the concept to take into account packet duplication and reports different types of discard counts [RFC7002].

Bursts and Gaps

The terms "burst" and "gap" are used in a manner consistent with that of RTCP XR [RFC3611]. RTCP XR views an RTP stream as being divided into bursts, which are periods during which the discard rate is high enough to cause noticeable quality degradation (generally over 5 percent discard rate), and gaps, which are periods during which discarded packets are infrequent and hence quality is generally acceptable.

3. Burst/Gap Discard Metrics Block

Metrics in this block report on burst/gap discard in the stream arriving at the RTP system. Measurements of these metrics are made at the receiving end of the RTP stream. Instances of this metrics block use the synchronization source (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 period in the Measurement Information Block indicating the span of the report. Senders MUST send this block in the same compound RTCP packet as the

Measurement Information Block. Receivers MUST verify that the measurement period is received in the same compound RTCP packet as this metrics block. If not, this metrics block MUST be discarded.

3.1. Report Block Structure

The structure of the Burst/Gap Discard Metrics Block is as follows.

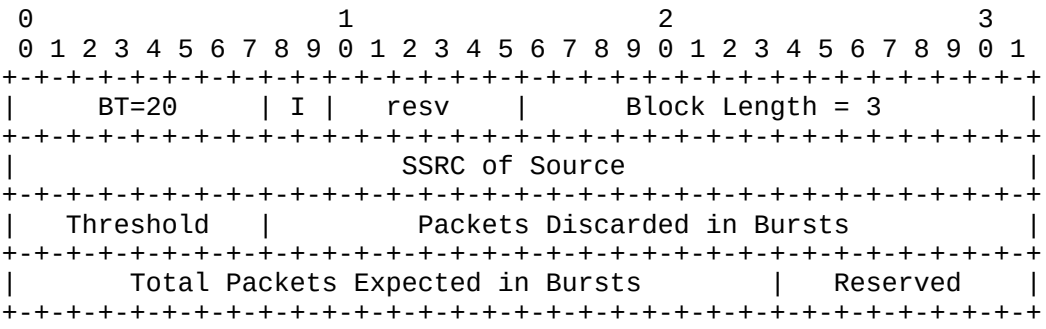

Figure 1: Report Block Structure

3.2. Definition of Fields in Burst/Gap Discard Metrics Block

Block Type (BT): 8 bits

A Burst/Gap Discard Metrics Block is identified by the constant 20.

Interval Metric flag (I): 2 bits

This field is used to indicate whether the burst/gap discard metrics are Sampled, Interval, or Cumulative metrics [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, burst/gap discard metrics can only be measured over definite intervals and cannot be sampled. Also, the value I=00 is reserved for future use. Senders MUST NOT use the values I=00 or I=01. If a block is received with I=00 or I=01, the receiver MUST discard the block.

Reserved (resv): 6 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. For the Burst/Gap Discard Metrics Block, the block length is equal to 3. 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].

Threshold: 8 bits

The Threshold is equivalent to Gmin in [RFC3611], i.e., the number of successive packets that must not be discarded prior to and following a discard packet in order for this discarded packet to be regarded as part of a gap. Note that the Threshold is set in accordance with the Gmin calculation defined in Section 4.7.2 of [RFC3611].

Packets Discarded in Bursts: 24 bits

The total number of packets discarded during discard bursts.

The measured value is unsigned value. If the measured value exceeds 0xFFFFFD, the value 0xFFFFFE MUST be reported to indicate an over-range measurement. If the measurement is unavailable, the value 0xFFFFFF MUST be reported.

Total Packets Expected in Bursts: 24 bits

The total number of packets expected during discard bursts (that is, the sum of received packets and lost packets).

The measured value is unsigned value. If the measured value exceeds 0xFFFFFD, the value 0xFFFFFE MUST be reported to indicate an over-range measurement. If the measurement is unavailable, the value 0xFFFFFF MUST be reported.

Reserved: 8 bits

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

3.3. Derived Metrics Based on Reported Metrics

The metrics described here are intended to be used in conjunction with information from the Measurement Information Block [RFC6776] and also with the metric "number of packets discarded" provided in the RTCP XR Discard Count Metrics Block [RFC7002].

These metrics provide the following information relevant to statistical parameters, including:

- The fraction of packets discarded during bursts (Burst Discard Rate in [RFC7004]), which can be calculated using the metric "Packets Discarded in Bursts" and the metric "Total Packets Expected in Bursts" provided in the Burst/Gap Discard Metrics Block.

- The fraction of packets discarded during gaps (Gap Discard Rate in [RFC7004]), which can be calculated using the metric "Packets Discarded in Bursts" and the metric "Total Packets Expected in Bursts" provided in the Burst/Gap Discard Metrics Block.

The details on calculation these parameters in the metrics are described in [RFC7004].

4. Considerations for Voice-over-IP Applications

This metrics block is applicable to a broad range of RTP applications. Where the metric is used with a Voice-over-IP (VoIP) application and the stream repair means is not available, the following considerations apply.

RTCP XR views a call as being divided into bursts, which are periods during which the discard rate is high enough to cause noticeable call quality degradation (generally over 5 percent discard rate) and gaps, which are periods during which discarded packets are infrequent and hence call quality is generally acceptable.

If voice activity detection is used, the burst and gap duration shall be determined as if silence packets had been sent, i.e., a period of silence in excess of Gmin packets will terminate a burst condition.

The recommended value for the threshold Gmin in [RFC3611] results in a burst being a period of time during which the call quality is degraded to a similar extent to a typical pulse code modulation (PCM) severely errored second.

5. SDP Signaling

[RFC3611] defines the use of SDP (Session Description Protocol) [RFC4566] for signaling the use of XR blocks. XR blocks MAY be used without prior signaling.

5.1. 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-bgd-block

xr-bgd-block = "burst-gap-discard"
```

5.2. 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 in Offer/Answer for unilateral parameters, refer to Section 5.2 of [RFC3611].

6. 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].

6.1. New RTCP XR Block Type Value

This document assigns the block type value 20 in the IANA "RTP Control Protocol Extended Reports (RTCP XR) Block Type Registry" to the "Burst/Gap Discard Metrics Block".

6.2. New RTCP XR SDP Parameter

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

6.3. Contact Information for Registrations

The contact information for the registrations is:

Qin Wu (sunseawq@huawei.com)
101 Software Avenue, Yuhua District
Nanjing, Jiangsu 210012
China

7. Security Considerations

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.

8. Contributors

Geoff Hunt wrote the initial draft of this document.

9. Acknowledgments

The authors gratefully acknowledge reviews and feedback provided by Bruce Adams, Philip Arden, Amit Arora, Claire Bi, Bob Biskner, Benoit Claise, Kevin Connor, Claus Dahm, Randy Ethier, Roni Even, Stephen Farrell, Jim Frauenthal, Albert Higashi, Tom Hock, Shane Holthaus, Paul Jones, Rajesh Kumar, Paul Kyzivat, Keith Lantz, Mohamed Mostafa, Amy Pendleton, Colin Perkins, Mike Ramalho, Ravi Raviraj, Dan Romascanu, Albrecht Schwarz, Tom Taylor, and Hideaki Yamada.

10. References

10.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC3550] Schulzrinne, H., Casner, S., Frederick, R., and V. Jacobson, "RTP: A Transport Protocol for Real-Time Applications", STD 64, RFC 3550, July 2003.

[RFC3611] Friedman, T., Caceres, R., and A. Clark, "RTP Control Protocol Extended Reports (RTCP XR)", RFC 3611, November 2003.

[RFC4566] Handley, M., Jacobson, V., and C. Perkins, "SDP: Session Description Protocol", RFC 4566, July 2006.

[RFC5234] Crocker, D. and P. Overell, "Augmented BNF for Syntax Specifications: ABNF", STD 68, RFC 5234, January 2008.

[RFC5725] Begen, A., Hsu, D., and M. Lague, "Post-Repair Loss RLE Report Block Type for RTP Control Protocol (RTCP) Extended Reports (XRs)", RFC 5725, February 2010.

[RFC6776] Clark, A. and Q. Wu, "Measurement Identity and Information Reporting Using a Source Description (SDES) Item and an RTCP Extended Report (XR) Block", RFC 6776, October 2012.

[RFC7002] Clark, A., Zorn, G., and Q. Wu, "RTP Control Protocol (RTCP) Extended Report (XR) for Discard Count Metric Reporting", RFC 7002, September 2013.

[RFC7004] Zorn, G., Schott, R., Wu, Q., Ed., and R. Huang, "RTP Control Protocol (RTCP) Extended Report (XR) Blocks for Summary Statistics Metrics Reporting", RFC 7004, September 2013.

10.2. Informative References

[RFC4588] Rey, J., Leon, D., Miyazaki, A., Varsa, V., and R. Hakenberg, "RTP Retransmission Payload Format", RFC 4588, July 2006.

[RFC5109] Li, A., "RTP Payload Format for Generic Forward Error Correction", RFC 5109, December 2007.

[RFC5481] Morton, A. and B. Claise, "Packet Delay Variation Applicability Statement", RFC 5481, March 2009.

[RFC6390] Clark, A. and B. Claise, "Guidelines for Considering New Performance Metric Development", BCP 170, RFC 6390, October 2011.

[RFC6709] Carpenter, B., Aboba, B., and S. Cheshire, "Design Considerations for Protocol Extensions", RFC 6709, September 2012.

[RFC6792] Wu, Q., Hunt, G., and P. Arden, "Guidelines for Use of the RTP Monitoring Framework", RFC 6792, November 2012.

Appendix A. Metrics Represented Using the Template from RFC 6390

a. Burst/Gap Discard Threshold in RTP Metric

* Metric Name: Burst/gap discard threshold in RTP

* Metric Description: The Threshold is equivalent to Gmin in [RFC3611], i.e., the number of successive packets that must not be discarded prior to and following a discard packet in order for this discarded packet to be regarded as part of a gap.

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

* Units of Measurement: See Section 3.2, Threshold definition.

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

* Measurement Timing: See Section 3, 2nd paragraph for measurement timing and Section 3.2 for Interval Metric flag.

* Use and Applications: See Section 1.4.

* Reporting Model: See RFC 3611.

b. Packets Discarded in Bursts Metric

* Metric Name: RTP packets discarded in bursts

* Metric Description: The total number of RTP packets discarded during discard bursts.

* Method of Measurement or Calculation: See Section 3.2, Packets Discarded in Bursts definition.

* Units of Measurement: See Section 3.2, Packets Discarded in Bursts definition.

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

* Measurement Timing: See Section 3, 2nd paragraph for measurement timing and Section 3.2 for Interval Metric flag.

* Use and Applications: See Section 1.4.

* Reporting Model: See RFC 3611.

c. Total Packets Expected in Discard Bursts Metric

* Metric Name: Total RTP packets expected in discard bursts

* Metric Description: The total number of packets expected during discard bursts (that is, the sum of received packets and lost packets).

* Method of Measurement or Calculation: See Section 3.2, Total Packets Expected in Bursts definition.

* Units of Measurement: See Section 3.2, Total Packets Expected in Bursts definition.

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

* Measurement Timing: See Section 3, 2nd paragraph for measurement timing and Section 3.2 for Interval Metric flag.

* Use and Applications: See Section 1.4.

* Reporting Model: See RFC 3611.

Authors' Addresses

Alan Clark
Telchemy Incorporated
2905 Premiere Parkway, Suite 280
Duluth, GA 30097
USA

EMail: alan.d.clark@telchemy.com

Rachel Huang
Huawei Technologies Co., Ltd.
101 Software Avenue, Yuhua District
Nanjing, Jiangsu 210012
China

EMail: Rachel@huawei.com

Qin Wu (editor)
Huawei
101 Software Avenue, Yuhua District
Nanjing, Jiangsu 210012
China

EMail: sunseawq@huawei.com