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

## Abstract

This document defines an RTP Control Protocol (RTCP) Extended Report (XR) Block that allows the reporting of burst and gap loss 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/rfc6958.

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# 1. Introduction

## 1.1. Burst/Gap Loss 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 lost by the network. The losses during loss bursts are reported, together with the number of bursts and additional data, allowing the calculation of statistical parameters (mean and variance) of the distribution of burst lengths. Some uses of these metrics depend on the availability of the metric "cumulative number of packets lost" from RTCP [RFC3550].

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. The burstiness of packet loss 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 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 may be an equivalent method to that defined in [RFC3611]. The method used should produce the same result as that defined in [RFC3611] for conditions of burst packet loss but may produce different results for conditions of time-varying jitter.

### 1.2. RTCP and RTCP XR Reports

The use of RTCP for reporting is defined in [RFC3550]. [RFC3611] defines an extensible structure for reporting by 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 "Guidelines for Use of 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 jitter buffers 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 or late to be played out or thrown away before playout due to packet duplication or redundancy shall be regarded as discarded. 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 [DISCARD] reports a count of packets discarded from the media stream (single SSRC within single RTP session) arriving at the receiver. The post-repair Loss RLE metric, which is defined in [RFC5725], can be used to report the number of packets that are not recovered by any repair techniques that are in use.

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 when the loss rate is high enough to cause noticeable quality degradation (generally over 5 percent loss rate) and gaps, which are periods when lost packets are infrequent and hence quality is generally acceptable.

## 3. Burst/Gap Loss Metrics Block

Metrics in this block report on burst/gap loss in the stream arriving at the RTP system. The measurement of these metrics is made at the receiving end of the RTP stream. Each instance of this Metrics Block refers by SSRC to a separate auxiliary Measurement Information Block [RFC6776], which describes the measurement periods in use (see RFC 6776, 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 Loss Metrics Block is as follows.

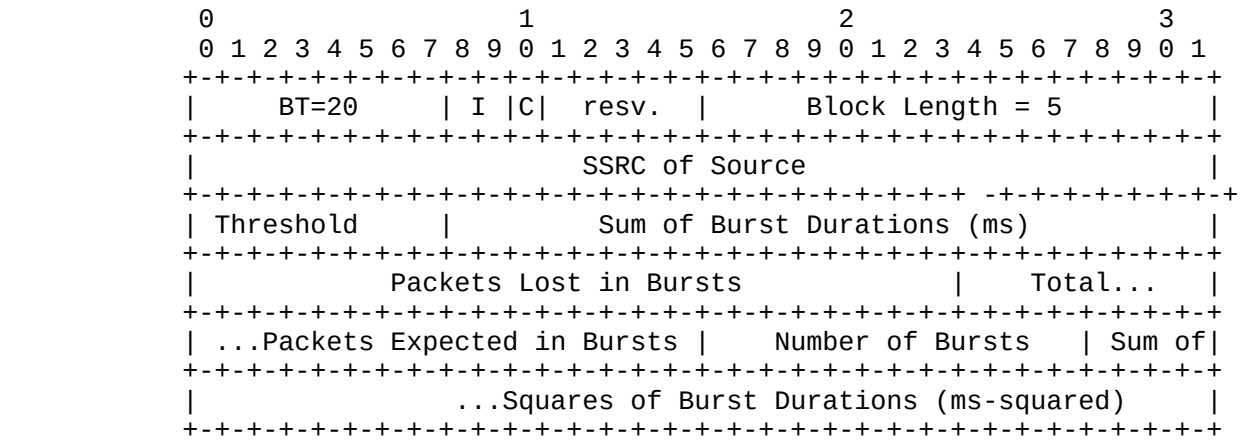


Figure 1: Report Block Structure

### 3.2. Definition of Fields in Burst/Gap Loss Metrics Block

Block Type (BT): 8 bits

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

Interval Metric flag (I): 2 bits

This field is used to indicate whether the burst/gap loss metrics are Sampled, Interval, or Cumulative metrics:

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 loss 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.

Loss and Discard Combination flag (C): 1 bit

The 'C' flag is used to indicate whether the loss/discard report is combined with the burst/gap loss report in the same compound RTCP packet. The value is set to '1' if the loss/discard report and the burst gap loss report are combined. Otherwise, the value is set to '0'. If the 'C' flag is set to '1' but the burst/gap discard was not sent, the receiver MUST discard the burst/gap loss.

Reserved (resv.): 5 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 Loss Metrics Block, the block length is equal to 5. 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 be received prior to and following a lost packet in order for this lost packet to be regarded as part of a gap. Note that the threshold is calculated in accordance with the Gmin Calculation defined in Section 4.7.2 of RFC 3611.

Sum of Burst Durations (ms): 24 bits

The total duration of bursts of lost packets in the period of the report (Interval or Cumulative).

The measured value is an 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.

Packets Lost in Bursts: 24 bits

The total number of packets lost during loss bursts.

The measured value is an 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 loss bursts (that is, the sum of received packets and lost packets).

The measured value is an 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.

Number of Bursts: 16 bits

The number of bursts in the period of the report (Interval or Cumulative).

The measured value is an unsigned value. If the measured value exceeds 0xFFFD, the value 0xFFFE MUST be reported to indicate an over-range measurement. If the measurement is unavailable, the value 0xFFFF MUST be reported.

Sum of Squares of Burst Durations (ms-squared): 36 bits

The sum of the squares of burst durations (where individual burst durations are expressed in ms) in the period of the report (Interval or Cumulative). The units for this quantity are milliseconds-squared.

The measured value is an unsigned value. If the measured value exceeds 0xFFFFFFFFD, the value 0xFFFFFFFFE MUST be reported to indicate an over-range measurement. If the measurement is unavailable, the value 0xFFFFFFFFF MUST be reported.

## 3.3. Derived Metrics Based on Reported Metrics

The metrics described here are intended to be used as described in this section, in conjunction with information from the Measurement Information Block [RFC6776] and also with the metric "cumulative number of packets lost" provided in standard RTCP [RFC3550].

These metrics provide information relevant to statistical parameters, including:

- the fraction of packets lost during bursts (i.e., Burst Loss Rate in [SUMSTAT]), which can be calculated using the metric "Packets Loss in Bursts" and the metric "Total Packets Expected in Bursts" provided in the Burst/Gap Loss Metrics Block.

- the fraction of packets lost during gaps (i.e., Gap Loss Rate in [SUMSTAT]), which can be calculated using the metric "Packets Loss in Bursts" and the metric "Total Packets Expected in Bursts" provided in the Burst/Gap Loss Metrics Block.

- burst duration mean [SUMSTAT], which can be calculated using the metric "Packets Loss in Bursts" and the metric "Total Packets Expected in Bursts" provided in the Burst/Gap Loss Metrics Block.

- burst duration variance [SUMSTAT], which can be calculated using the metric "Packets Loss in Bursts" and the metric "Total Packets Expected in Bursts" provided in the Burst/Gap Loss Metrics Block.

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

## 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 when the loss rate is high enough to cause noticeable call quality degradation (generally over 5 percent loss rate), and gaps, which are periods when lost packets are infrequent and hence call quality is generally acceptable.

If Voice Activity Detection is used, the Burst and Gap Durations 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] causes a burst during which the call quality is degraded to a similar extent as it would be during a typical Pulse Code Modulation (PCM) Severely Errored Second.

## 5. SDP Signaling

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

### 5.1. SDP rtcp-xr-attrib 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 below.

```
xr-format =/ xr-bgl-block

xr-bgl-block = "burst-gap-loss"
```

### 5.2. Offer/Answer Usage

When SDP is used in the 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].

## 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 Loss Metrics Block".

### 6.2. New RTCP XR SDP Parameter

This document also registers a new parameter "burst-gap-loss" 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:

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## 7. Security Considerations

This block does not provide per-packet statistics, so the risk to confidentiality documented in Section 7, paragraph 3 of [RFC3611] does not apply. However, the gaps indicated within this block could be used to detect the timing of other events on the path between the sender and receiver. For example, a competing multimedia stream might cause a loss burst for the duration of the stream, allowing the receiver of this block to know when the competing stream was active. This risk is not a significant threat since the only information leaked is the timing of the loss, not the cause. Besides this, it is believed that this proposed RTCP XR report block introduces no other new security considerations beyond those described in [RFC3611].

## 8. Contributors

Geoff Hunt wrote the initial draft of this document.

## 9. Acknowledgments

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## Appendix A. Metrics Represented Using the Template from RFC 6390

The six metrics defined in this document are described below using the template from Section 5.4.4 of RFC 6390.

a. Threshold Metric

* Metric Name: Threshold in RTP

* Metric Description: The Threshold is equivalent to Gmin in [RFC3611], i.e., the number of successive RTP packets that must be received prior to and following a lost RTP packet in order for this lost RTP 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. Sum of Burst Durations Metric

* Metric Name: Sum of Burst Durations in RTP

* Metric Description: The total duration of bursts of lost RTP packets in the period of the report.

* Method of Measurement or Calculation: See Section 3.2, Sum of Burst Durations definition.

* Units of Measurement: See Section 3.2, Sum of Burst Durations 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. Packets Lost in Bursts Metric

* Metric Name: RTP Packets lost in bursts

* Metric Description: The total number of RTP packets lost during loss bursts.

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

* Units of Measurement: See Section 3.2, Packets lost 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.

d. Total Packets Expected in Bursts Metric

* Metric Name: Total RTP packets expected in bursts

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

e. Number of Bursts Metric

* Metric Name: Number of bursts in RTP

* Metric Description: The total duration of bursts of lost RTP packets in the period of the report.

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

* Units of Measurement: See Section 3.2, Number of 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.

f. Sum of Squares of Burst Durations Metric

* Metric Name: Sum of Squares of Burst Durations in RTP

* Metric Description: The sum of the squares of burst durations (where individual burst durations are expressed in ms) over in the period of the report.

* Method of Measurement or Calculation: See Section 3.2, Sum of Squares of Burst Durations definition.

* Units of Measurement: See Section 3.2, Sum of Squares of Burst Durations 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.

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