**RTCP XR Report Block for Burst/Gap Loss metric Reporting**
**draft-ietf-avt-rtcp-xr-burst-gap-loss-02.txt**

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**Abstract**

This document defines an RTCP XR Report Block that allows the reporting of Burst and Gap Loss metrics for use in a range of RTP applications.

**Table of Contents**

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## 1.  Introduction

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## 1.1.  Burst and Gap Loss Report Block

This draft defines a new block type to augment those defined in [RFC3611] (Friedman, T., "RTP Control Protocol Extended Reports (RTCP XR)," November 2003.) 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] (Schulzrinne, H., "RTP: A Transport Protocol for Real-Time Applications," July 2003.).

This block provides information on transient IP problems. Burst/Gap metrics are typically used in Cumulative reports however 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 terminal metrics defined in [MONARCH] (work in progress).

The definitions of Burst, Gap, Loss and Discard are consistent with definitions in [RFC3611] (Friedman, T., "RTP Control Protocol Extended Reports (RTCP XR)," November 2003.), with the clarification that Loss and Discard are defined in terms of frames. To accomodate 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] (Friedman, T., "RTP Control Protocol Extended Reports (RTCP XR)," November 2003.). The method used SHOULD produce the same result as that defined in [RFC3611] (Friedman, T., "RTP Control Protocol Extended Reports (RTCP XR)," November 2003.) for conditions of burst packet loss, but MAY produce different results for conditions of time varying jitter.

Instances of this Metrics Block refer by tag to the separate auxiliary Measurement Identity block [MEASIDENT] (Hunt, G., "RTCP XR Measurement Identifier Block," May 2009.) which contains information such as the SSRC of the measured stream, and RTP sequence numbers and time intervals indicating the span of the report.

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## 1.2.  RTCP and RTCP XR Reports                                    TOC

The use of RTCP for reporting is defined in [RFC3550] (Schulzrinne, H., "RTP: A Transport Protocol for Real-Time Applications," July 2003.). [RFC3611] (Friedman, T., "RTP Control Protocol Extended Reports (RTCP XR)," November 2003.) defined an extensible structure for reporting using an RTCP Extended Report (XR). This draft defines a new Extended Report block that MUST be used as defined in [RFC3550] (Schulzrinne, H., "RTP: A Transport Protocol for Real-Time Applications," July 2003.) and [RFC3611] (Friedman, T., "RTP Control Protocol Extended Reports (RTCP XR)," November 2003.).

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## 1.3.  Performance Metrics Framework                              TOC

The Performance Metrics Framework [PMOLFRAME] (Clark, A., "Framework for Performance Metric Development," March 2009.) provides guidance on the definition and specification of performance metrics. Metrics described in this draft either reference external definitions or define metrics generally in accordance with the guidelines in [PMOLFRAME]

(Clark, A., "Framework for Performance Metric Development," March 2009.).

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## 1.4.  Applicability

This metric is believed to be applicable to all RTP applications.

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## 2.  Definitions

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 shall be regarded as discarded. A packet shall be classified as one of received (or OK), discarded or lost.

Bursts and Gaps

> The terms Burst and Gap are used in a manner consistent with that of RTCP XR [RFC3611] (Friedman, T., "RTP Control Protocol Extended Reports (RTCP XR)," November 2003.). RTCP XR views a call as being divided into bursts, which are periods during which the loss rate is high enough to cause noticeable call quality degradation (generally over 5 percent loss rate), and gaps, which are periods during which lost packets are infrequent and hence call quality is generally acceptable.
>
> In the application of the metric to Voice over IP, if Voice Activity Detection is used the Burst and Gap Duration shall be determined as if silence frames had been sent, i.e. a period of silence in excess of Gmin frames MUST terminate a burst condition.

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## 3.  Burst/Gap Loss Block

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## 3.1.  Report Block Structure

```
    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=NBGL    |I| tag | resv  |          block length = 4      |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   | Threshold    |       Sum of Burst Durations (ms)             |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |          Packets Lost in Bursts            |     Total...     |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   | ...Packets expected in bursts |  Number of bursts   | Sum of|
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |            ...Squares of Burst Durations (ms-squared)    |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
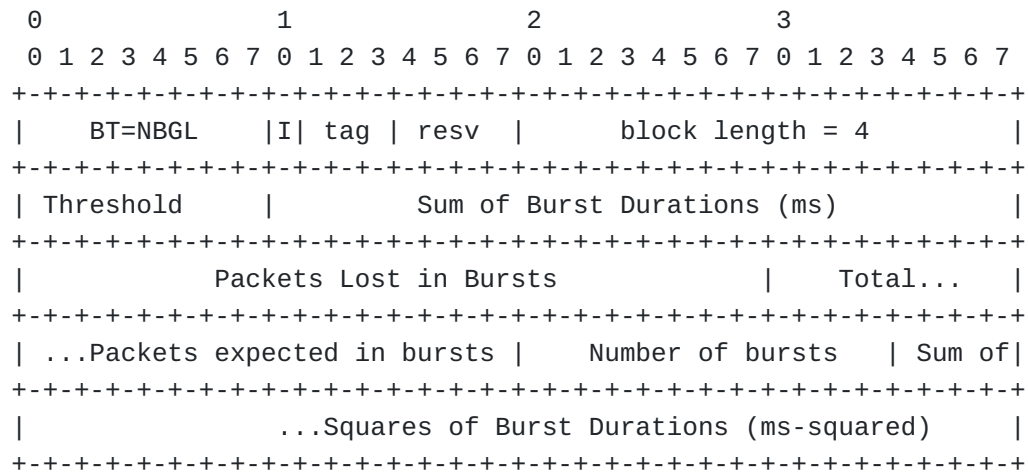
**Figure 1: Report Block Structure**

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

block type (BT): 8 bits

   A Burst/Gap Loss Report Block is identified by the constant NBGL.

[Note to RFC Editor: please replace NBGL with the IANA provided RTCP XR
block type for this block.]
Interval Metric flag (I): 1 bit

   This field is used to indicate whether the Burst/Gap Loss metric is
   an Interval or a Cumulative metric, that is, whether the reported
   value applies to the most recent measurement interval duration
   between successive metrics reports (I=1) (the Interval Duration) or
   to the accumulation period characteristic of cumulative measurements
   (I=0) (the Cumulative Duration). Numerical values for both these
   intervals are provided in the Measurement Identifier block
   referenced by the tag field below.

Measurement Identifier association (tag): 3 bits

   This field is used to identify the Measurement Identifier block
   [MEASIDENT] (Hunt, G., "RTCP XR Measurement Identifier Block,"

May 2009.) which describes this measurement. The relevant
Measurement Identifier block has the same tag value as the Burst/Gap
Loss block. Note that there may be more than one Measurement
Identifier block per RTCP packet.

Reserved (resv): 4 bits

> These bits are reserved. They SHOULD be set to zero by senders and
> MUST be ignored by receivers.

block length: 16 bits

> The length of this report block in 32-bit words, minus one. For the
> Burst/Gap Loss block, the block length is equal to 4.

Threshold: 8 bits

> The Threshold is equivalent to Gmin in [RFC3611] (Friedman, T., "RTP
> Control Protocol Extended Reports (RTCP XR)," November 2003.), i.e.
> the number of successive frames that must be received prior to and
> following a lost frame in order for this lost frame to be regarded
> as part of a gap.

Sum of Burst Durations (ms): 24 bits

> The total duration of bursts of lost frames in the period of the
> report (Interval or Cumulative).
>
> If the measured value exceeds 0xFFFFFD, the value 0xFFFFFE SHOULD be
> reported to indicate an over-range measurement. If the measurement
> is unavailable, the value 0xFFFFFF SHOULD be reported.

Packets lost in bursts: 24 bits

> The total number of packets lost during loss bursts.
>
> If the measured value exceeds 0xFFFFFD, the value 0xFFFFFE SHOULD be
> reported to indicate an over-range measurement. If the measurement
> is unavailable, the value 0xFFFFFF SHOULD 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).
>
> If the measured value exceeds 0xFFFFFD, the value 0xFFFFFE SHOULD be
> reported to indicate an over-range measurement. If the measurement
> is unavailable, the value 0xFFFFFF SHOULD be reported.

Number of bursts: 16 bits

> The number of bursts in the period of the report (Interval or Cumulative).
>
> If the measured value exceeds 0xFFFD, the value 0xFFFE SHOULD be reported to indicate an over-range measurement. If the measurement is unavailable, the value 0xFFFF SHOULD 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) over in the period of the report (Interval or Cumulative). The units for this quantity are milliseconds-squared.
>
> If the measured value exceeds 0xFFFFFFFFD, the value 0xFFFFFFFFE SHOULD be reported to indicate an over-range measurement. If the measurement is unavailable, the value 0xFFFFFFFFF SHOULD be reported.

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### 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 Identity block (which MUST be present in the same RTCP packet as the Burst/Gap Loss block) and also with the metric "cumulative number of packets lost" provided in standard RTCP [RFC3550] (Schulzrinne, H., "RTP: A Transport Protocol for Real-Time Applications," July 2003.).
The fraction of packets lost during bursts is the quotient: Packets Lost in Bursts / Total Packets expected in Bursts
The fraction of packets lost during gaps is the quotient: (number of packets lost - Packets Lost in Bursts) / (Packets Expected - Total Packets expected in Bursts)
where "number of packets lost" is obtained from standard RTCP [RFC3550] (Schulzrinne, H., "RTP: A Transport Protocol for Real-Time Applications," July 2003.) and Packets Expected is calculated as the difference between "extended last sequence number" and "extended first sequence number" (Interval or Cumulative) provided in the Measurement Identity block [MEASIDENT] (Hunt, G., "RTCP XR Measurement Identifier Block," May 2009.) associated with this Burst/Gap Loss block.
Note that if the metric is to be calculated on an Interval basis, a difference must be taken between the current and preceding values of "cumulative number of packets lost" in RTCP, to obtain the "number of packets lost" for the reporting interval.
The mean burst duration is obtained as the quotient:
mean = Sum of Burst Durations / Number of Bursts

The variance of the burst duration is obtained using the standard
result:
var = ( Sum of Squares of Burst Durations - Number of Bursts * mean^2
) / (Number of Bursts - 1)

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## 4.  Considerations for Voice-over-IP applications

This metric block is applicable to a broad range of RTP applications.
Where the metric is used with a Voice-overIP (VoIP) application, the
following considerations apply.
RTCP XR views a call as being divided into bursts, which are periods
during which the loss rate is high enough to cause noticeable call
quality degradation (generally over 5 percent loss rate), and gaps,
which are periods during which lost 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 frames had been sent, i.e. a period of silence
in excess of Gmin frames MUST terminate a burst condition.
The recommended value for the threshold Gmin in [RFC3611] (Friedman,
T., "RTP Control Protocol Extended Reports (RTCP XR)," November 2003.)
results in a Burst being a period of time during which the call quality
is degraded to a similar extent to a typical PCM Severely Errored
Second.

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## 5.  SDP Signaling

[RFC3611] (Friedman, T., "RTP Control Protocol Extended Reports (RTCP
XR)," November 2003.) defines the use of SDP (Session Description
Protocol) [RFC4566] (Handley, M., "SDP: Session Description Protocol,"
July 2006.) for signaling the use of XR blocks. XR blocks MAY be used
without prior signaling.
This section augments the SDP [RFC4566] (Handley, M., "SDP: Session
Description Protocol," July 2006.) attribute "rtcp-xr" defined in
[RFC3611] (Friedman, T., "RTP Control Protocol Extended Reports (RTCP
XR)," November 2003.) by providing an additional value of "xr-format"
to signal the use of the report block defined in this document.
rtcp-xr-attrib = "a=" "rtcp-xr" ":" [xr-format *(SP xr-format)] CRLF
(defined in [RFC3611] (Friedman, T., "RTP Control Protocol Extended
Reports (RTCP XR)," November 2003.))
xr-format =/ xr-bgl-block
xr-bgl-block = "brst-gap-loss"

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## 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].

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### 6.1.  New RTCP XR Block Type value

This document assigns the block type value NBGL in the IANA "RTCP XR Block Type Registry" to the "Concealed Seconds Metrics Block". [Note to RFC Editor: please replace NBGL with the IANA provided RTCP XR block type for this block.]

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### 6.2.  New RTCP XR SDP Parameter

This document also registers a new parameter "brst-gap-loss" in the "RTCP XR SDP Parameters Registry".

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### 6.3.  Contact information for registrations

The contact information for the registrations is:
Geoff Hunt (geoff.hunt@bt.com)
Orion 2 PP3, Adastral Park, Martlesham Heath, Ipswich IP5 3RE, United Kingdom

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## 7.  Security Considerations

It is believed that this proposed RTCP XR report block introduces no new security considerations beyond those described in [RFC3611] (Friedman, T., "RTP Control Protocol Extended Reports (RTCP XR)," November 2003.). This block does not provide per-packet statistics so the risk to confidentiality documented in Section 7, paragraph 3 of [RFC3611] (Friedman, T., "RTP Control Protocol Extended Reports (RTCP XR)," November 2003.) does not apply.

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## 8.  Contributors

The authors gratefully acknowledge the comments and contributions made by Bruce Adams, Philip Arden, Amit Arora, Bob Biskner, Kevin Connor, Claus Dahm, Randy Ethier, Roni Even, Jim Frauenthal, Albert Higashi, Tom Hock, Shane Holthaus, Paul Jones, Rajesh Kumar, Keith Lantz, Mohamed Mostafa, Amy Pendleton, Colin Perkins, Mike Ramalho, Ravi Raviraj, Albrecht Schwarz, Tom Taylor, and Hideaki Yamada.

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## 9.  Changes from previous version

[TOC]

Changed BNF for SDP following Christian Groves' and Tom Taylor's comments (4th and 5th May 2009), now aligned with RFC 5234 section 3.3 "Incremental Alternatives".
Updated references.

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## 10.  References

[TOC]

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### 10.1. Normative References

[TOC]

| | |
|---|---|
| [MEASIDENT] | Hunt, G., "RTCP XR Measurement Identifier Block," ID draft-ietf-avt-rtcp-xr-meas-identity-02, May 2009. |
| [RFC2119] | Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels," RFC 2119, BCP 14, March 1997. |
| [RFC3550] | Schulzrinne, H., "RTP: A Transport Protocol for Real-Time Applications," RFC 3550, July 2003. |
| [RFC3611] | Friedman, T., "RTP Control Protocol Extended Reports (RTCP XR)," RFC 3611, November 2003. |
| [RFC4566] | Handley, M., "SDP: Session Description Protocol," RFC 4566, July 2006. |

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### 10.2. Informative References

[TOC]

| | |
|---|---|
| [DISCARD] | Hunt, G., "RTCP XR Report Block for Discard metric Reporting," ID draft-ietf-rtcp-xr-discard-02, May 2009. |
| [MONARCH] | Hunt, G., "Monitoring Architectures for RTP," ID draft-hunt-avt-monarch-01, August 2008. |
| [PMOLFRAME] | |

Clark, A., "Framework for Performance Metric Development," ID draft-ietf-pmol-metrics-framework-02, March 2009.

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