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RTCP XR Report Block for Concealed Seconds metric Reporting
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Abstract

This document defines an RTCP XR Report Block that allows the reporting of Concealed Seconds metrics primarily for audio applications of RTP.

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1. Introduction

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1.1. Concealed Seconds Block

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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 primarily in audio applications of RTP. At any instant, the audio output at a receiver may be classified as either 'normal' or 'concealed'. 'Normal' refers to playout of audio payload received from the remote end, and also includes locally generated signals such as announcements, tones and comfort noise. Concealment refers to playout of locally-generated signals used to mask the impact of network impairments such as lost packets or to reduce the audibility of jitter buffer adaptations.
The new block type provides metrics for concealment. Specifically, the first metric (Unimpaired Seconds) reports the number of whole seconds occupied only with normal playout of data which the receiver obtained from the sender's stream. The second metric (Concealed Seconds) reports the number of whole seconds during which the receiver played out any

locally-generated media data. A third metric (Severely Concealed Seconds) reports the number of whole seconds during which the receiver played out locally-generated data for more than SCS Threshold (ms). The metric belongs to the class of transport-related terminal metrics defined in [MONARCH] (work in progress).
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.

1.2. RTCP and RTCP XR Reports

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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.).

1.3. Performance Metrics Framework

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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.).

1.4. Applicability

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This metric is primarily applicable to audio applications of RTP. The reason for this restriction is that, for many video codecs, packet data may contain occasional complete reference pictures, and otherwise consists of data specifying picture changes relative to a complete reference picture. Loss of an RTP video media packet could degrade the user experience for a variable amount of time between the time of loss

and the next complete reference picture. In contrast, in the audio case the degradation almost always persists for a predictable period of time from the loss of the packet, which might be simply the duration of the audio data encoded in the lost packet. However if a useful Concealed Seconds metric can be defined for an RTP video application, either in general or for a specific type of video codec, the Concealed Seconds and Severely Concealed Seconds metrics and the metric block type defined here MAY be used.

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2. Concealed Seconds Metrics Block

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This sub-block provides a description of potentially audible impairments due to lost and discarded packets at the endpoint, expressed on a time basis analogous to a traditional PSTN T1/E1 errored seconds metric.
The following metrics are based on successive one second intervals as declared by a local clock. This local clock does NOT need to be synchronized to any external time reference. The starting time of this clock is unspecified. Note that this implies that the same loss pattern could result in slightly different count values, depending on where the losses occur relative to the particular one-second demarcation points. For example, two loss events occurring 50ms apart could result in either one concealed second or two, depending on the particular 1000 ms boundaries used.
The seconds in this sub-block are not necessarily calendar seconds. At the tail end of a call, periods of time of less than 1000ms shall be incorporated into these counts if they exceed 500ms and shall be disregarded if they are less than 500ms.

2.1. Report Block Structure

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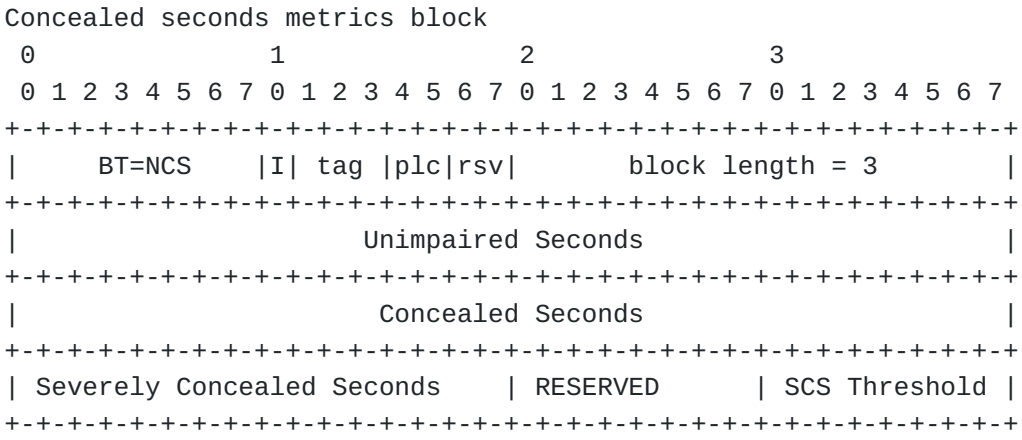


Figure 1: Report Block Structure

2.2. Definition of Fields in Concealed Seconds Metrics Block

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block type (BT): 8 bits

> A Concealed Seconds Metrics Report Block is identified by the constant NCS.

[Note to RFC Editor: please replace NCS 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 Concealed Seconds metric block is an Interval or a Cumulative report, that is, whether the reported values apply 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 Concealed Seconds Metrics block. Note that there may be more than one Measurement Identifier block per RTCP packet.

Packet Loss Concealment Method (plc): 2 bits

> This field is used to identify the packet loss concealment method in use at the receiver, according to the following code:

```
bits 0-3
      0 = silence insertion
      1 = simple replay, no attenuation
      2 = simple replay, with attenuation
      3 = enhanced
      Other values reserved
```

Reserved (rsv): 2 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 Concealed Seconds block, the block length is equal to 3.

Unimpaired Seconds: 32 bits

> A count of the number of unimpaired Seconds that have occurred.
>
> An unimpaired Second is defined as a continuous period of 1000ms during which no frame loss or discard due to late arrival has occurred. Every second in a call must be classified as either OK or Concealed.
>
> Normal playout of comfort noise or other silence concealment signal during periods of talker silence, if VAD is used, shall be counted as unimpaired seconds.
>
> If the measured value exceeds 0xFFFFFFFD, the value 0xFFFFFFFE SHOULD be reported to indicate an over-range measurement. If the measurement is unavailable, the value 0xFFFFFFFF SHOULD be reported.

Concealed Seconds: 32 bits

> A count of the number of Concealed Seconds that have occurred.
>
> A Concealed Second is defined as a continuous period of 1000ms during which any frame loss or discard due to late arrival has occurred.
>
> Equivalently, a concealed second is one in which some Loss-type concealment has occurred. Buffer adjustment-type concealment SHALL

not cause Concealed Seconds to be incremented, with the following exception. An implementation MAY cause Concealed Seconds to be incremented for 'emergency' buffer adjustments made during talkspurts.

Loss-type concealment is reactive insertion or deletion of samples in the audio playout stream due to effective frame loss at the audio decoder. "Effective frame loss" is the event in which a frame of coded audio is simply not present at the audio decoder when required. In this case, substitute audio samples are generally formed, at the decoder or elsewhere, to reduce audible impairment.

Buffer Adjustment-type concealment is proactive or controlled insertion or deletion of samples in the audio playout stream due to jitter buffer adaptation, re-sizing or re-centering decisions within the endpoint.

Because this insertion is controlled, rather than occurring randomly in response to losses, it is typically less audible than loss-type concealment. For example, jitter buffer adaptation events may be constrained to occur during periods of talker silence, in which case only silence duration is affected, or sophisticated time-stretching methods for insertion/deletion during favorable periods in active speech may be employed. For these reasons, buffer adjustment-type concealment MAY be exempted from inclusion in calculations of Concealed Seconds and Severely Concealed Seconds.

However, an implementation SHOULD include buffer-type concealment in counts of Concealed Seconds and Severely Concealed Seconds if the event occurs at an 'inopportune' moment, with an emergency or large, immediate adaptation during active speech, or for unsophisticated adaptation during speech without regard for the underlying signal, in which cases the assumption of low-audibility cannot hold. In other words, jitter buffer adaptation events which may be presumed to be audible SHOULD be included in Concealed Seconds and Severely Concealed Seconds counts.

Concealment events which cannot be classified as Buffer Adjustment-type MUST be classified as Loss-type.

For clarification, the count of Concealed Seconds MUST include the count of Severely Concealed Seconds.

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

Severely Concealed Seconds: 16 bits

A count of the number of Severely Concealed Seconds.

> A Severely Concealed Second is defined as a non-overlapping period of 1000 ms during which the cumulative amount of time that has been subject to frame loss or discard due to late arrival, exceeds the SCS Threshold.
>
> 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.

RESERVED: 8 bits

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

SCS Threshold: 8 bits

> The SCS Threshold defines the amount of time corresponding to lost or discarded frames that must occur within a one second period in order for the second to be classified as a Severely Concealed Second. This is expressed in milliseconds and hence can represent a range of 0.1 to 25.5 percent loss or discard.
>
> A default threshold of 50ms (5% effective frame loss per second) is suggested.

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3. SDP Signaling

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[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.
The SDP attribute for the block has an additional optional paremeter, "thresh", used to supply a value for the SCS Threshold parameter. If this parameter is present, the RTP system receiving the SDP SHOULD use this value for the current session. If the parameter is not present, the RTP system SHOULD use a locally configured value.
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-conc-sec-block

```
xr-conc-sec-block = "conc-sec" ["=" thresh]

          thresh      = 1*DIGIT          ; threshold for SCS (ms)
          DIGIT          = %x30-39
```

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4. IANA Considerations

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New block types for RTCP XR are subject to IANA registration. For general guidelines on IANA considerations for RTCP XR, refer to [RFC3611].

4.1. New RTCP XR Block Type value

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

4.2. New RTCP XR SDP Parameter

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This document also registers a new parameter "conc-sec" in the "RTCP XR SDP Parameters Registry".

4.3. Contact information for registrations

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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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5. Security Considerations

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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.

6. Contributors

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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.

7. Changes from previous version

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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.

8. References

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8.1. Normative References

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[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.

8.2. Informative References

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[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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