        BT's eXtended Network Quality RTP Control Protocol Extended Reports
                           (RTCP XR XNQ)

Status of This Memo

IESG Note

   The IESG has concerns about vendor code points allocation in this
   small namespace and might not approve similar documents in the
   future.

Abstract

   This document describes an RTCP XR report block, which reports packet
   transport parameters. The report block was developed by BT for pre-
   standards use in BT's next-generation network. This document has
   been produced to describe the report block in sufficient detail to
   register the block type with IANA in accordance with the
   Specification Required policy of RFC 3611. This specification does
   not standardise the new report block for use outside BT's network.

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1. Introduction

   A set of metrics of packet-transport quality has been defined by BT
   for pre-standards use in its network. These metrics are known as
   "XNQ" for "eXtended Network Quality". This document defines an
   RTCP-XR Report Block to transport the XNQ measures from an RTP end
   system to its peer, using the extension mechanism defined in [1].

   The metrics are designed to supplement the packet-loss metric in RTCP
   [2] and the roundtrip delay measurement provided by RTCP. They
   provide metrics for IP Packet Delay Variation based on the IPDV
   metric defined in [3], metrics reporting the activity of the RTP end
   system's receiver's jitter buffer, and metrics reporting "errored"
   and "severely errored" seconds.

   This document has been produced to describe the report block in
   sufficient detail to register the block type with IANA in accordance
   with the Specification Required policy of [1]. This specification
   does not standardise the new report block for use outside BT's
   network.

   Work in progress on RTCP HR [5] is likely to obsolete these metrics
   and the RTCP-XR Report Block defined here.

2. Requirements Notation

   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 [4].

3. Extended Network Quality (XNQ) Report Block

   A set of metrics of packet-transport quality has been defined by BT
   for pre-standards use in its network. These metrics are known as
   "XNQ" for "eXtended Network Quality".

   This document defines an RTCP-XR Report Block using the extension
   mechanism defined in [1]. The new Report Block provides transport of
   the XNQ measures from an RTP end system to its peer.

   The metrics are described in the following text. However, some
   additional explanation is required for the metrics vmaxdiff, vrange,
   vsum, and c, which measure aspects of packet delay variation. The
   metrics are based on the measure known as IP Packet Delay Variation
   (IPDV) defined in [3]. The IPDV of a packet is the amount by which
   the packet was delayed in the network, minus the amount a reference
   packet was delayed in the network. The reference packet is usually
   the first packet of the connection. IPDV is a signed quantity.

The metric vrange is the difference (longest minus shortest) between
the longest and shortest network packet delays seen over the duration
of the connection to date. The metric vrange is usually a positive
quantity, but may be zero if the packet delay is exactly constant
over the lifetime of the connection to date.

The metric vmaxdiff is found as follows. For each RTCP measurement
cycle, find the difference (longest minus shortest) between the
longest and shortest network packet delays within that measurement
cycle. These differences are usually all positive quantities, but a
difference may be zero if the packet delay is exactly constant
throughout the measurement cycle. Take the set of these differences
and find the maximum, which is vmaxdiff. The metric vmaxdiff is also
usually a positive quantity, but will be zero if all the members of
the set of per-cycle differences are zero.

The metric vsum is simply the sum of the per-RTCP-cycle differences,
which were obtained to find vmaxdiff as described above. The metric
c is the number of per-RTCP-cycle differences, that is, the
cardinality of the set of differences. The two metrics vsum and c
allow calculation of vsum/c, the average IPDV per RTCP measurement
cycle.

The format of the report is as shown in Figure 1.

```
  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=8      |   reserved    |       block length = 8        |
 +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
 |          begin_seq            |            end_seq            |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |          vmaxdiff             |            vrange             |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |                             vsum                              |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |              c               |            jbevents            |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |   reserved    |                  tdegnet                      |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |   reserved    |                  tdegjit                      |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |   reserved    |                    es                         |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |   reserved    |                    ses                        |
 +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
```
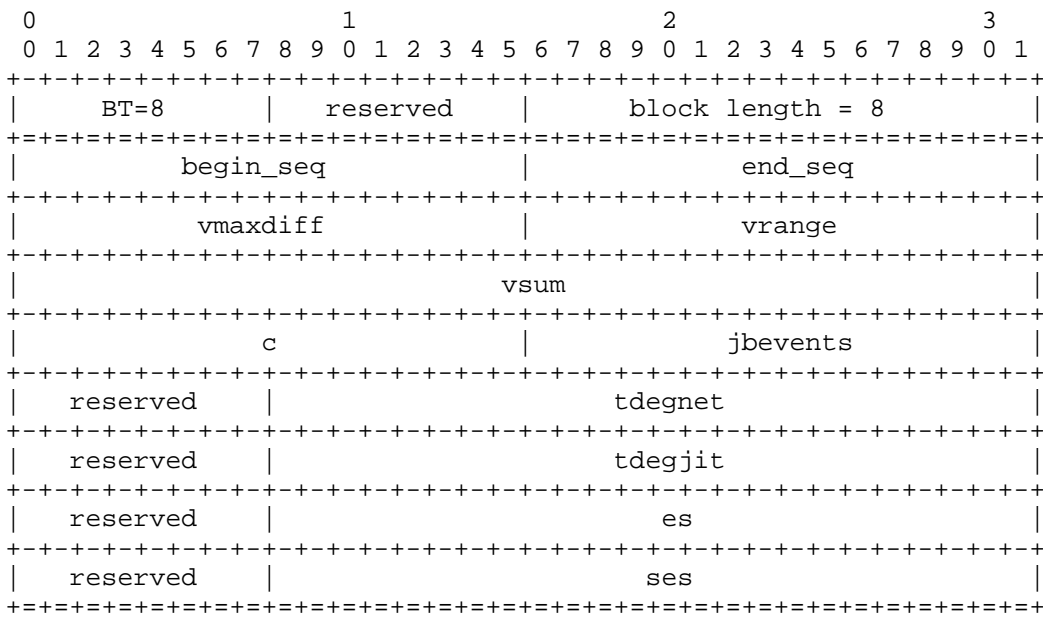
Figure 1

   The report consists of an RTCP-XR block header and a single 8-word
   sub-block.

   block type (BT): 8 bits

      An XNQ Metrics Report Block is identified by the constant 8.

   reserved: 8 bits

      These fields are reserved for future definition. In the absence
      of such a definition, the bits in these fields MUST be set to zero
      and MUST be ignored by the receiver.

   block length: 16 bits

      Defined in Section 3 of [1].

   begin_seq: 16 bits

      As defined in Section 4.1 of [1].

   end_seq: 16 bits

      As defined in Section 4.1 of [1].

   vmaxdiff: 16 bits unsigned

      Largest IPDV difference seen to date within a single RTCP
      measurement cycle, measured in RTP timestamp units. If the
      measured value exceeds 0xFFFE, the value 0xFFFF should be reported
      to indicate an over-range measurement.

   vrange: 16 bits unsigned

      Largest IPDV difference over the lifetime of the RTP flow to date,
      measured in RTP timestamp units. If the measured value exceeds
      0xFFFE, the value 0xFFFF should be reported to indicate an over-
      range measurement.

   vsum: 32 bits unsigned

      Sum of the peak IPDV difference values within each RTCP cycle,
      summed over RTCP cycles over the lifetime of the RTP flow to date.
      If the measured value exceeds 0xFFFFFFFE, the value 0xFFFFFFFF
      should be reported to indicate an over-range measurement.

   c: 16 bits unsigned

      Number of RTCP cycles over which vsum was accumulated. If the
      measured value exceeds 0xFFFE, the value 0xFFFF should be reported
      to indicate an over-range measurement.

   jbevents: 16 bits unsigned

      Cumulative number of jitter buffer adaptation events over the
      lifetime of the RTP flow to date. If the measured value exceeds
      0xFFFE, the value 0xFFFF should be reported to indicate an over-
      range measurement.

   tdegnet: 24 bits unsigned

      The total time in sample periods affected either by packets
      unavailable due to network loss, or late delivery of packets,
      since the start of transmission. If the measured value exceeds
      0xFFFFFE, the value 0xFFFFFF should be reported to indicate an
      over-range measurement.

   tdegjit: 24 bits unsigned

      The total time in sample periods degraded by jitter buffer
      adaptation events, e.g., where the jitter buffer either plays out
      a sample sequence not originating at the transmitter, repeats
      samples, or chooses not to play out a sample sequence that was
      sent by the transmitter. If the measured value exceeds 0xFFFFFE,
      the value 0xFFFFFF should be reported to indicate an over-range
      measurement.

   es: 24 bits unsigned

      cumulative seconds affected by "unavailable packet" events over
      the lifetime of this ephemeral, to date. If the measured value
      exceeds 0xFFFFFE, the value 0xFFFFFF should be reported to
      indicate an over-range measurement.

   ses: 24 bits unsigned

      cumulative seconds affected by severe "unavailable packet" events
      over the lifetime of this ephemeral, to date. If the measured
      value exceeds 0xFFFFFE, the value 0xFFFFFF should be reported to
      indicate an over-range measurement.

4. IANA Considerations

IANA has allocated the number 8 within the registry "RTP Control
Protocol Extended Reports (RTCP XR) Block Types" to the RTCP XR
report block described here. This registry is defined in [1].

5. Security Considerations

It is believed that this proposed RTCP XR report block introduces no
new security considerations beyond those described in [1]. Some of
the considerations in [1] do not apply to this report block.
Specifically, XNQ does not provide per-packet statistics so the risk
to confidentiality documented in Section 7, paragraph 3 of [1] does
not apply, and XNQ packets cannot be very large so the risk of denial
of service documented in Section 7, paragraph 7 of [1] does not
apply.

6. References

6.1. Normative References

   [1] Friedman, T., "RTP Control Protocol Extended Reports (RTCP XR)",
        RFC 3611, November 2003.

   [2] Schulzrinne, H., "RTP: A Transport Protocol for Real-Time
        Applications", RFC 3550, July 2003.

   [3] ITU-T, "Recommendation Y.1540, Internet protocol data
        communication service -- IP packet transfer and availability
        performance parameters", December 2002.

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

6.2. Informative References

   [5] Clark, A., "RTCP HR - High Resolution VoIP Metrics Report
        Blocks", Work in Progress, November 2007.

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