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Session Initiation Protocol Package for Voice Quality Reporting Event
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Abstract

This document defines a SIP event package that enables the collection and reporting of metrics that measure the quality for Voice over Internet Protocol (VoIP) sessions.

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1. Introduction

This document defines a new SIP event package, vq-rtcpxr, and a new MIME type, application/vq-rtcpxr, that enable the collection and reporting of metrics that measure quality for RTP [3] sessions. The definitions of the metrics used in the event package are based on RTCP Extended Reports [4] and RTCP [3]; a mapping between the SIP event parameters and the parameters within the forementioned RFC's is defined within this document in section 4.6.2.

Monitoring of voice quality is believed to be the highest priority for usage of this mechanism and as such, the metrics in the event package are largely tailored for voice quality measurement. However, the event package is designed to be extensible for use with any RTP application. The negotiation of such extensions is not defined in this recommendation.

The event package supports reporting both the local and remote versions of these statistics. It is expected that providing all views of voice quality will help facilitate multiple provider scenarios and faster problem resolution. Note that in multi-party calls, multiple reports need to be generated: either one per endpoint or one per media session.

Configuration of usage of the event package is not covered in this document. It is the recommendation of this document that the SIP configuration framework [8] be used. The authors have defined a configuration dataset that would facilitate this support in section 5.8.

The event package can be used either with the SUBSCRIBE/NOTIFY methods or the PUBLISH method. Message flow examples for both mechanims are provided in this document.

2. Terminology

In this document, the key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT

RECOMMENDED", "MAY", and "OPTIONAL" are to be interpreted as described in BCP 14, RFC 2119 [1] and indicate requirement levels for compliant implementations.

3. SIP Events Approach

This document defines a new SIP events package [5]. A SIP UA can send these events using either the PUBLISH or SUBSCRIBE/NOTIFY methods to an entity which can make the information available to other applications. For purposes of illustration, the entities involved in SIP vq-rtcpxr event reporting will be referred to as follows:

- REPORTER is an entity involved in the measurement and reporting of media quality i.e. the SIP UA involved in a media session.

- COLLECTOR is an entity that receives SIP vq-rtcpxr events. A COLLECTOR may be a proxy server or another entity that is capable of supporting SIP vq-rtcpxr events.

The REPORTER shall be configured with one or more COLLECTOR's. The configuration process is out of scope for this recommendation, but it is suggested that the SIP configuration framework [8] be used for this purpose. A dataset should be defined for vq-rtcpxr following the suggestions in section 5.8. The REPORTER shall not send any vq-rtcpxr events where a COLLECTOR has not been configured.

3.1 PUBLISH Usage

A SIP UA that supports this specification may send the service quality metric reports using the PUBLISH method. The primary intention of using PUBLISH for this event is reduction of transaction processing.

The use of PUBLISH by this event is unique in that it does not require a soft or hard state to be maintained by either the REPORTER or the COLLECTOR. Furthermore the information that is provided in the vq-rtcpxr event is not expected to have an expiration, rather, the information is associated with the timestamps in the event itself.

The REPORTER shall populate the Request-URI of the PUBLISH method with the address of the resource (AOR) of the COLLECTOR. To ensure security of SIP proxies and the COLLECTOR, the REPORTER must be configured with the AOR of the COLLECTOR, preferably using the SIP UA configuration framework [8], as described in section 5.8.

. It is recommended that the REPORTER send an OPTIONS message to the COLLECTOR to ensure support of the PUBLISH message.

3.2 PUBLISH Overload Avoidance

A concern over the usage of the PUBLISH method is the potential overloading of servers receiving the events, particularly in the threshold reporting model. There are many approaches to solving this type of problem, but clearly the REPORTER's needs to adhere to some guidelines to reduce the probability of causing this overload condition. Some suggested solutions are:

a) limit sending of one threshold report per metric per session

b) limit sending of one threshold report per session regardless of the metric

c) limit sending a new threshold report to when a metric state has been sustained for a reasonable amount of time, e.g.20-30 seconds.

Additionally, it is recommended that COLLECTORS that receive these reports use the 503 response code and include the Retry-after header with an appropriate time delay, depending on the needs of the COLLECTOR.

3.3. SUBSCRIBE/NOTIFY Usage

The REPORTER may send the voice quality metric reports using the NOTIFY method. In this case, the COLLECTOR will send a SUBSCRIBE to the REPORTER to explicitly establish the relationship and the configuration of the AOR of the COLLECTOR is not needed, but may still be optionally supported.

The REPORTER shall populate the Request-URI of the PUBLISH method with the address of the resource (AOR) of the COLLECTOR.

4. Event Package Formal Definition

4.1. Event Package Name

This document defines a SIP Event Package as defined in RFC 3265 [2]. The event-package token name for this package is:

"vq-rtcpxr"

4.2. Event Package Parameters

No event package parameters are defined.

4.3. SUBSCRIBE Bodies

No SUBSCRIBE bodies are described by this specification.

4.4. Subscription Duration

Subscriptions to this event package MAY range from minutes to weeks. Subscriptions in hours or days are more typical and are RECOMMENDED. The default subscription duration for this event package is one hour.

4.5. NOTIFY and PUBLISH Bodies

There are three notify bodies: a session report, an interval session report, and a alert report.

The session report is used for end of session reporting. This can be generated when a voice media session terminates or when a media change occurs, such as a codec change or a session forks. This report is intended to allow cumulative metric reporting. The session reports will populate the metrics with values that are measured over the interval explicitly defined by the "start" and "stop" timestamps.

The interval report is used for periodic or interval reporting. This report is intended to capture short duration metric reporting. Interval reports will populate the metrics with values that are measured over the interval explicitly defined by the "start" and "stop" timestamps.

The threshold report is used when voice quality degrades during a session. The session report parameters are also included in the alert report to provide all of the necessary diagnostic information. Like the interval report, the metrics in the threshold reports will be populated with values that are measured over the interval explicitly defined by the "start" and "stop" timestamps.

This specification defines a new MIME type application/vq-rtcpxr

which is a text encoding of the RTCP and RTCP-XR statistics, along with some additional metrics and correlation information.

4.6. Voice Quality Event Syntax and Semantics

This section describes the syntax extensions required for event publication in SIP. The formal syntax definitions described in this section are expressed in the Augmented BNF [6] format used in SIP [2], and contains references to elements defined therein. Additionally, the definition of the timestamp format is provided in [7]. Note that most of the parameters are optional. In practice, most implementations will send a subset of the parameters. It is not the intention of this document to define what parameters may or may not be useful for monitoring the quality of a voice session, but to enable reporting of voice quality. As such, the syntax allows the implementer to choose which metrics are most appropriate for their solution. As there are no "invalid", "unknown", or "not applicable" values in the syntax, the intention is to exclude any parameters for which values are not available, not applicable, or unknown. Additionally, the authors recognize that implementers may need to add new parameter lines to the reports and new metrics to the existing parameter lines. The extension tokens are intended to fulfill this need.

4.6.1 ABNF Syntax Defintion

```
VQReportEvent  =  AlertReport /  SessionReport / IntervalReport


SessionReport = "VQSessionReport" CRLF
                        LocalMetrics [CRLF RemoteMetrics]
                        [DialogID]

IntervalReport = "VQIntervalReport" CRLF
                        LocalMetrics [CRLF RemoteMetrics]
                        [DialogID]

LocalMetrics  = "LocalMetrics" COLON CRLF Metrics
RemoteMetrics = "RemoteMetrics" COLON CRLF Metrics

AlertReport   = "VQAlertReport" COLON
        MetricType WSP Severity WSP Direction CRLF
```

```
          "Metrics:" CRLF
          Metrics
          [CRLF "OtherDirMetrics:" CRLF Metrics]
          [DialogID]


   Metrics = TimeStamps CRLF
      [SessionDescription CRLF]
      CallID CRLF
      LocalAddr CRLF
      RemoteAddr CRLF
      [JitterBuffer CRLF]
      [PacketLoss CRLF]
      [BurstGapLoss CRLF]
      [Delay CRLF]
      [Signal CRLF]
      [QualityEstimates CRLF]
      *(Extension CRLF)


   ; Timestamps are provided in Coordinated Universal Time (UTC)
   ; using the ABNF format provided in RFC3339,
   ;  "Date and Time on the Internet: Timestamps"
   ; These timestamps should reflect, as closely as
   ; possible, the actual time during  which the media session
   ; was running to enable correlation to events occurring
   ; in the network infrastructure and to accounting or billing
   ; records
   TimeStamps = "Timestamps" COLON StartTime WSP StopTime
   StartTime  = "START" EQUAL date-time
   StopTime   = "STOP" EQUAL date-time
```



```
   ; SessionDescription provides a shortened version of the
   ; session SDP but contains only the relevant parameters for
   ; session quality reporting purposes
   SessionDescription  = "SessionDesc" COLON
      [PayloadType WSP]
      [PayloadDesc WSP]
      [SampleRate WSP]
      [FrameDuration WSP]
      [FrameOctets WSP]
      [FramesPerPacket WSP]
      [PacketsPerSecond WSP]
      [FmtpOptions WSP]
      [PacketLossConcealment WSP]
```

```
      [SilenceSuppressionState]
      *(WSP Extension)

   ; PayloadType provides the PT parameter used in the RTP packets
   ; i.e. the codec used for decoding received RTP packets
   ; It is recommended that IANA registered values are used
   ; where possible.
   PayloadType  = "PT" EQUAL (1*3DIGIT)

   ; PayloadDesc provides a text description of the codec
   ; It is recommended that IANA registered names are used
   ; where possible.
   PayloadDesc  = "PD" EQUAL word

   ; SampleRate provides the rate at which voice was sampled
   ; in the case of narrowband codecs, the value will typically be 8000
   SampleRate = "SR" EQUAL (1*5DIGIT)

   ; FrameDuration can be combined with the FramesPerPacket to determine
   ; the packetization rate; the units for this are milliseconds.
   FrameDuration = "FD" EQUAL (1*3DIGIT)

   ; FrameOctets provides the number of octets in each frame
   ; Used where FrameDuration is not available
   FrameOctets  = "FO" EQUAL (1*4DIGIT)

   ; FramesPerPacket provides the number of frames in each RTP packet
   FramesPerPacket = "FPP" EQUAL (1*2DIGIT)

   ; Packets per second provides the number of packets, including one or
   ; more frames within each, that are transmitted per second
   PacketsPerSecond = "PPS" EQUAL (1*5DIGIT)

   ; FMTP options from SDP.  Note that the parameter is deliniated
   ; by " " to avoid parsing issues in transitioning between SDP and
   ; SIP parsing
   FmtpOptions = "FMTP" EQUAL DQUOTE word-plus DQUOTE
```



```
   ; PacketLossConcealment indicates whether a PLC algorithm was
   ; or is being used for the session.  The values follow the same
   ; numbering convention as RFC 3611.  For more details,
   ; please refer to RFC 3611, RTCP XR
```

```
; 0 - unspecified
; 1 - disabled
; 2 - enhanced
; 3 - standard
PacketLossConcealment  = "PLC" EQUAL ("0" / "1" / "2" / "3")

; SilenceSuppressionState indicates whether silence suppression,
; also known as Voice Activity Detection (VAD) is enabled.
SilenceSuppressionState  = "SSUP" EQUAL ("on" / "off")

; CallId provides the call id from the SIP header
CallID  =  "CallID" COLON Call-ID-Parm

; LocalAddr provides the IP address, port and ssrc for the
; session from the perspective of the endpoint/UA which is
; sending the report
LocalAddr   = "LocalAddr" COLON IPAddress WSP Port WSP Ssrc

; RemoteAddr provides the IP address, port and ssrc for the
; session from the perspective of the peer of the endpoint/UA
; that is sending the report
RemoteAddr  = "RemoteAddr" COLON IPAddress WSP Port WSP Ssrc

IPAddress   = "IP" EQUAL IPv6address / IPv4address
Port        = "PORT" EQUAL 1*DIGIT
Ssrc        = "SSRC" EQUAL 1*8HEXDIG


JitterBuffer = "JitterBuffer" COLON
   [JitterBufferAdaptive WSP]
   [JitterBufferRate WSP]
   [JitterBufferNominal WSP]
   [JitterBufferMax WSP]
   [JitterBufferAbsMax]
   *(WSP Extension)

; JitterBufferAdaptive indicates whether the jitter buffer in the
; endpoint is adaptive, static, or unknown.
; The values follow the same numbering convention as RFC 3611.
; For more details, please refer to that document.
; 0 - unknown
; 1 - reserved
; 2 - non-adaptive
; 3 - adaptive

JitterBufferAdaptive  = "JBA" EQUAL ("0" / "1" / "2" / "3")
```

```
; JitterBuffer metric definitions are provided in RTCP XR, RFC 3611
JitterBufferRate       = "JBR" EQUAL (1*2DIGIT) ;0-15
JitterBufferNominal    = "JBN" EQUAL (1*5DIGIT) ;0-65535
JitterBufferMax        = "JBM" EQUAL (1*5DIGIT) ;0-65535
JitterBufferAbsMax     = "JBX" EQUAL (1*5DIGIT) ;0-65535


; PacketLoss metric definitions are provided in RTCP XR, RFC 3611
PacketLoss = "PacketLoss" COLON
                  [NetworkPacketLossRate WSP]
                  [JitterBufferDiscardRate]
                  *(WSP Extension)

NetworkPacketLossRate =
  "NLR" EQUAL (1*3DIGIT ["." 1*2DIGIT]) ;percentage

JitterBufferDiscardRate =
  "JDR" EQUAL (1*3DIGIT ["." 1*2DIGIT]) ;percentage


; BurstGapLoss metric definitions are provided in RTCP XR, RFC 3611
BurstGapLoss = "BurstGapLoss" COLON
   [BurstLossDensity WSP]
   [BurstDuration WSP]
   [GapLossDensity WSP]
   [GapDuration WSP]
   [MinimumGapThreshold]
   *(WSP Extension)

BurstLossDensity =
 "BLD" EQUAL (1*3DIGIT ["." 1*2DIGIT]) ;percentage

BurstDuration =
 "BD" EQUAL (1*7DIGIT) ;0-3,600,000 -- milliseconds

GapLossDensity =
 "GLD" EQUAL (1*3DIGIT ["." 1*2DIGIT]) ;percentage

GapDuration =
 "GD" EQUAL (1*7DIGIT) ;0-3,600,000 -- milliseconds

MinimumGapThreshold =
 "GMIN" EQUAL (1*3DIGIT) ;1-255

Delay = "Delay" COLON
   [RoundTripDelay WSP]
   [EndSystemDelay WSP]
   [OneWayDelay WSP]
```

```
      [InterarrivalJitter WSP]
      [MeanAbsoluteJitter]
      *(WSP Extension)
```



```
   ; RoundTripDelay is recommended to be measured as defined in
   ; RTCP, RFC 3550.
   RoundTripDelay = "RTD" EQUAL (1*5DIGIT) ;0-65535

   ; EndSystemDelay metric is defined in RTCP XR, RFC 3611
   EndSystemDelay = "ESD" EQUAL (1*5DIGIT) ;0-65535

   ; OneWayDelay is recommended to be measured according to
   ; recommendations provided by the IPPM working group but may be
   ; based on alternative measurement recommendations
   OneWayDelay = "OWD" EQUAL (1*5DIGIT) ;0-65535

   ; Interarrival Jitter is recommended to be measured as defined
   ; in RTCP, RFC 3550, but may be based on alternatives
   InterarrivalJitter = "IAJ" EQUAL (1*5DIGIT) ;0-65535

   ; Mean Absolute Jitter is recommended to be measured as defined
   ; by ITU-T G.1020 where it is known as MAPDV
   MeanAbsoluteJitter = "MAJ" EQUAL (1*5DIGIT);0-65535


   ; Signal metrics definitions are provided in RTCP XR, RFC 3611
   Signal = "Signal" COLON
      [SignalLevel WSP]
      [NoiseLevel WSP]
      [ResidualEchoReturnLoss]
      *(WSP Extension)

   ; SignalLevel will normally be a positive value
   ; the absence of the negative sign indicates a positive value
   ; where the signal level is negative, the sign must be included
   SignalLevel = "SL" EQUAL (["-"] 1*2DIGIT)

   ; NoiseLevel will normally be negative but to align with the
   ; the encoding of SignalLevel, the sign must be explicitly included
   ; again, the absence of a sign indicates a positive value
   NoiseLevel  = "NL" EQUAL (["-"] 1*2DIGIT)

   ; Residual Echo Return Loss (RERL) the ratio between
```

```
; the original signal and the echo level as measured after
; echo cancellation or suppression has been applied.
; Expressed in decibels (dB).
ResidualEchoReturnLoss = "RERL" EQUAL (1*3DIGIT)
```



```
; Voice Quality estimation metrics
; The definition of these metrics are provided in RTCP XR and
; the new High Resolution proposal, RTCP HD.

; Each quality estmiate has an optional associated algorithm.
; These fields permit the implementation to use a variety
; of different calculation methods for each type of metric
QualityEstimates  = "QualityEst" COLON
   [ListeningQualityR WSP]
   [RLQEstAlg WSP]
   [ConversationalQualityR WSP]
   [RCQEstAlg WSP]
   [ExternalR-In WSP]
   [ExtRInEstAlg WSP]
   [ExternalR-Out WSP]
   [ExtROutEstAlg WSP]
   [MOS-LQ WSP]
   [MOSLQEstAlg WSP]
   [MOS-CQ WSP]
   [MOSCQEstAlg WSP]
   [QoEEstAlg]
   *(WSP Extension)

ListeningQualityR = "RLQ" EQUAL (1*3DIGIT) ; 0 - 120

RLQEstAlg = "RLQEstAlg" EQUAL word ; "PESQ", "G.107", or other

ConversationalQualityR = "RCQ" EQUAL (1*3DIGIT) ; 0 - 120

RCQEstAlg = "RCQEstAlg" EQUAL word ; "PESQ", "G.107", or other

; ExternalR-In is measured by the local endpoint for incoming
; connection on "other" side of this endpoint
;   e.g. PhoneA <---> Bridge <----> Phone B
;   ListeningQualityR = quality for PhoneA ----> Bridge path
;   ExternalR-In = quality for Bridge <---- PhoneB path

ExternalR-In = "EXTRI" EQUAL (1*3DIGIT) ; 0 - 120
```

```
   ExtRInEstAlg = "ExtRIEstAlg" EQUAL word ; "PESQ" or other

   ; ExternalR-Out is copied from RTCP XR message received from the
   ; remote endpoint on "other" side of this endpoint
   ;   e.g. PhoneA <---> Bridge <----> Phone B
   ;   ExternalR-Out = quality for Bridge -----> PhoneB path

   ExternalR-Out = "EXTRO" EQUAL (1*3DIGIT) ; 0 - 120

   ExtROutEstAlg = "ExtROEstAlg" EQUAL word ; "PESQ" or other

   MOS-LQ = "MOSLQ" EQUAL (DIGIT ["." 1*2DIGIT]) ; 0.0 - 4.9

   MOSLQEstAlg = "MOSLQEstAlg" EQUAL word ; "PESQ" or other

   MOS-CQ = "MOSCQ" EQUAL (DIGIT ["." 1*2DIGIT])  ; 0.0 - 4.9

   MOSCQEstAlg = "MOSCQEstAlg" EQUAL word ; "PESQ" or other
```



```
   ; alternative to the separate estimation algorithms
   ; for use when the same algorithm is used for all measurements
   QoEEstAlg = "QoEEstAlg" EQUAL word; "PESQ" or other

   ; DialogID provides the identification of the dialog with
   ; which the media session is related.  This value is taken
   ; from the SIP header.
   DialogID  = "DialogID" COLON Call-ID-Parm *(SEMI did-parm)
   did-parm  = to-tag / from-tag / word
   to-tag    = "to-tag" EQUAL token
   from-tag  = "from-tag" EQUAL token

   ; MetricType provides the metric on which a notification of
   ; threshold violation was based.  The more commonly used metrics
   ; for alerting purposes are included here explicitly and the
   ; token parameter allows for extension
   MetricType = "Type" EQUAL "RLQ" / "RCQ" / "EXTR" /
      "MOSLQ" / "MOSCQ" /
      "BD" / "NLR" / "JDR" /
      "RTD" / "ESD" / "IAD" /
      "RERL" / Extension

   Direction = "Dir" EQUAL "local" / "remote"
```

```
Severity  = "Severity" EQUAL "Warning" / "Critical" /
   "Clear"

Call-ID-Parm =  word [ "@" word ]

; miscellaneous needs for ABNF
; some of these are pulled out of RFC2234 or RFC3261
; where this is the case, it is noted.

; taken from RFC2234
CRLF =  %x0D.0A
DIGIT =  %x30-39
WSP    =  SP / HTAB ; white space
SP     =  " "
HTAB   =  %x09 ; horizontal tab
HEXDIG =  DIGIT / "A" / "B" / "C" / "D" / "E" / "F" /
             "a" / "b" / "c" / "d" / "e" / "f"
DQUOTE  =  %x22 ; " (Double Quote)
ALPHA   =  %x41-5A / %x61-7A   ; A-Z / a-z

; taken from RFC3261
alphanum  =  ALPHA / DIGIT
LWS   =  [*WSP CRLF] 1*WSP ; linear whitespace
SWS   =  [LWS] ; sep whitespace
SEMI =  SWS ";" SWS ; semicolon
EQUAL   =  SWS "=" SWS ; equal
COLON   =  SWS ":" SWS ; colon
token       =  1*(alphanum / "-" / "." / "!" / "%" / "*"
                / "_" / "+" / "`" / "'" / "~" )
```



```
IPv4address     =  1*3DIGIT "." 1*3DIGIT "." 1*3DIGIT "." 1*3DIGIT
IPv6address     =  hexpart [ ":" IPv4address ]
hexpart         =  hexseq / hexseq "::" [ hexseq ] / "::" [ hexseq ]
hexseq          =  hex4 *( ":" hex4)
hex4            =  1*4HEXDIG


; DATE-TIME format
; taken from RFC3339, refer for more information
date-fullyear    = 4DIGIT ; e.g. 2006
date-month       = 2DIGIT ; e.g. 01 or 11
date-mday        = 2DIGIT ; e.g. 02 or 22
time-hour        = 2DIGIT ; e.g. 01 or 13
time-minute      = 2DIGIT ; e.g. 03 or 55
```

```
time-second     = 2DIGIT ; e.g. 01 or 59

time-secfrac    = "." 1*DIGIT
time-numoffset  = ("+" / "-") time-hour ":" time-minute
time-offset     = "Z" / time-numoffset

partial-time = time-hour ":" time-minute ":" time-second [time-secfrac]
full-date    = date-fullyear "-" date-month "-" date-mday
full-time    = partial-time time-offset

date-time       = full-date "T" full-time

;
; Miscellaneous definitions for the syntax
;

Extension = word-plus

word  =  1*(alphanum / "-" / "." / "!" / "%" / "*" /
   "_" / "+" / "`" / "'" / "~" /
   "(" / ")" / "<" / ">" /
   ":" / "\" / DQUOTE /
   "/" / "[" / "]" / "?" )


word-plus =  1*(alphanum /  "-"  /  "."  /  "!"  / "%" / "*" /
   "_"  /  "+"  /  "`"  /  "'"  /  "~"  /
   "("  /  ")"  /  "<"  /  ">"  /  ":"  /
   "\"  /  "/"  /  "["  /  "]"  /  "?"  /
   "{"  /  "}"  /  "="  /  " ")
```


4.6.2 Parameter Definitions and Mappings

4.6.2.1 General mapping percentages from 8 bit, fixed point numbers

RFC3611 uses an 8 bit, fixed point number with the binary point at the left edge of the field. This value is calculated by dividing the total number of packets lost by the total number of packets expected and multiplying the result by 256, and taking the integer part.

For any RTCP XR parameter in this format, to map into the

equivalent SIP vq-rtcpxr parameter, simply reverse the equation i.e. divide by 256.

4.6.2.2 Timestamps

Following SIP and other IETF convention, timestamps are provided in Coordinated Universal Time (UTC) using the ABNF format provided in IETF RFC3339 [x]. These timestamps should reflect, as closely as possible, the actual time during which the media session was running to enable correlation to related events occurring in the network and to accounting or billing records.

4.6.2.3 SessionDescription

The parameters in this field provide a shortened version of the session SDP(s), containing only the relevant parameters for session quality reporting purposes.

Payload Type

This is the "payload type" parameter used in the RTP packets i.e. the codec. This field can also be mapped from the SDP "rtpmap" attribute field "payload type". IANA registered types should be used.

Payload Desc

This parameter is not mapped from any specific SDP or RTP field; provides a text description of the Payload Type/codec.

Sample Rate

This parameter is mapped from the SDP "rtpmap" attribute field "clock rate". The field provides the rate at which voice was sampled, measured in Hertz (hZ).

Frame Duration

This parameter is not contained in RTP or SDP but can usually be obtained from the device codec. The field reflects the amount of voice content in each frame within the RTP payload, measured in milliseconds. Note this value can be combined with the FramesPerPacket to determine the packetization rate.

Frame Octets

This parameter is not contained in RTP or SDP but is usually provided by the device codec. The field provides the number of octets in each frame within the RTP payload. This field is usually not provided when FrameDuration is provided.

Frames Per Packet

This parameter is not contained in RTP or SDP but can usually be obtained from the device codec. This fiels provides the number of frames in each RTP packet. Note this value can be combined with the FrameDuration to determine the packetization rate.

Packets Per Second

This parameter is not contained in RTP or SDP but can usually be obtained from the device codec. Packets per second provides the number of RTP packets that are transmitted per second.

FMTP

This parameter is taken directly from the SDP attribute "fmtp".

Silence Suppression State

This parameter does not correspond to SDP, RTP, or RTCP XR. It indicates whether silence suppression, also known as Voice Activity Detection (VAD) is enabled for the identified session.

Packet Loss Concealment

This value corresponds to "PLC" in RFC3611 in the

VoIP Metrics Report Block. The values defined by RFC3611 are reused by this recommendation and therefore no mapping is required.

4.6.2.4 LocalAddr

This field provides the IP address, port and synchronization source (SSRC) for the session from the perspective of the endpoint that is sending the event. The IPAddress can be IPv4 or IPv6 format. The SSRC is taken from SDP, RTCP, or RTCP XR input paramters.

4.6.2.5 RemoteAddr

This field provides the IP address, port and ssrc of the session peer from the perspective of the endpoint sending the event.

4.6.2.6 Jitter Buffer Parameters

Jitter Buffer Adaptive

This value corresponds to "JBA" in RFC3611 in the VoIP Metrics Report Block. The values defined by RFC3611 are reused by this recommendation and therefore no mapping is required.

Jitter Buffer Rate

This value corresponds to "JB rate" in RFC3611 in the VoIP Metrics Report Block. The parameter does not require any mapping calculations.

Jitter Buffer Nominal

This value corresponds to "JB nominal" in RFC3611 in the VoIP Metrics Report Block. The parameter does not require any mapping calculations.

Jitter Buffer Max

This value corresponds to "JB maximum" in RFC3611 in the VoIP Metrics Report Block. The parameter does not require any conversion.

Jitter Buffer Abs Max

This value corresponds to "JB abs max" in RFC3611 in the VoIP Metrics Report Block. The parameter does not require any conversion.

4.6.2.7 Packet Loss Parameters

Network Packet Loss Rate

This value corresponds to "loss rate" in RFC3611 in the VoIP Metrics Report Block. For conversion, see "General mapping percentages from 8 bit, fixed point numbers".

Jitter Buffer Discard Rate

This value corresponds to "discard rate" in RFC3611 in the VoIP Metrics Report Block. For conversion, see "General mapping percentages from 8 bit, fixed point numbers".

4.6.2.8 Burst/Gap Parameters

Burst Loss Density

This value corresponds to "burst density" in RFC3611 in the VoIP Metrics Report Block. For conversion, see "General mapping percentages from 8 bit, fixed point numbers".

Burst Duration

This value corresponds to "burst duration" in RFC3611 in the VoIP Metrics Report Block. This value requires no conversion; the exact value sent in an RTCP XR VoIP Metrics Report Block can be included in the SIP vq-rtcpxr parameter.

Gap Loss Density

This value corresponds to "gap density" in RFC3611 in the VoIP Metrics Report Block.

See "General mapping percentages from 8 bit, fixed point numbers".

Gap Duration

This value corresponds to "gap duration" in RFC3611 in the VoIP Metrics Report Block. This value requires no conversion; the exact value sent in an RTCP XR VoIP Metrics Report Block can be included in the SIP vq-rtcpxr parameter.

Minimum Gap Threshold

This value corresponds to "Gmin" in RFC3611 in the VoIP Metrics Report Block. This value requires no conversion; the exact value sent in an RTCP XR VoIP Metrics Report Block can be included in the SIP vq-rtcpxr parameter.

4.2.6.10 Delay Parameters

Round Trip Delay

This value corresponds to "round trip delay" in RFC3611 in the VoIP Metrics Report Block. This parameter does no require any conversion.

End System Delay

This value corresponds to "end system delay" in RFC3611 in the VoIP Metrics Report Block. This parameter does no require any conversion.

One Way Delay

This value may be measured based on IETF IPPM recommendations or may be calculated as described in RFC3611:

```
one way delay  =  ( RTD + ESD(A) + ESD(B) ) / 2
```

The parameter is expected to be expressed in milliseconds.

Interarrival Jitter

It is recommended that IAJ be measured as defined in RTCP, RFC 3550. The parameter is expected to be expressed in milliseconds.

Mean Absolute Jitter

It is recommended that MAJ be measured as defined by ITU-T G.1020. This parameter is often referred to as MAPDV. The parameter is expected to be expressed in milliseconds.

4.2.6.11 Signal-related Parameters

Signal Level

This field corresponds to "signal level" in RFC3611 in the VoIP Metrics Report Block. This field provides the voice signal relative level is defined as the ratio of the signal level to a 0 dBm0 reference, expressed in decibels. This value can be used directly without extra conversion.

Noise Level

This field corresponds to "noise level" in RFC3611 in the VoIP Metrics Report Block. This field provide the ratio of the silent period background noise level to a 0 dBm0 reference, expressed in decibels. This value can be used directly without extra conversion.

Residual Echo Return Loss (RERL)

This field corresponds to "RERL" in RFC3611 in the VoIP Metrics Report Block. This field provides the ratio between the

original signal and the echo level in decibels, as measured after echo cancellation or suppression has been applied. This value can be used directly without extra conversion.

4.2.6.13 Quality Scores

ListeningQualityR

This field does not have a direct mapping from RFC3611 but is expected to be provided in the RTCP High Resolution (RTCP HR) draft [x]. The parameter reflects voice quality measured only from the listening related parameters i.e. does not include RERL, delay, signal level, or noise level. The scale used will typically be ITU-T G.107 compliant (0-100) but can be greater where wideband audio codecs are used.

RLQEstAlg

This field provides a text description of the algorithm used to estimate ListeningQualityR.

ConversationalQualityR

This field corresponds to "R factor" in RFC3611 in the VoIP Metrics Report Block. This parameter provides a cumulative measurement of voice quality including all metrics per ITU-T G.107 definition (but may be extended by vendor specific metrics as well.) The scale used will typically be ITU-T G.107 compliant (0-100) but can be greater where wideband audio codecs are used. Although in most cases the value does not need to be converted, a value of 127 indicates that this parameter is unavailable and should not be included in the vq-rtcpxr event.

RCQEstAlg

This field provides a text description of the algorithm used to estimate ConversationalQualityR

ExternalR-In

This field corresponds to "ext. R factor" in RFC3611 in the VoIP Metrics Report Block. This parameter reflects voice quality as measured by the local endpoint for incoming connection on "other" side (refer to RFC3611 for a more detailed explanation). The scale used will typically be ITU-T G.107 compliant (0-100) but can be greater where

wideband audio codecs are used. Although in most cases the value does not need to be converted, a value of 127 indicates that this parameter is unavailable and should not be included in the vq-rtcpxr event.

ExtRInEstAlg

This field provides a text description of the algorithm used to estimate ExternalR-In.

ExternalR-Out

This field corresponds to "ext. R factor" in RFC3611 in the VoIP Metrics Report Block. Here, the value is copied from RTCP XR message received from the remote endpoint on "other" side of this endpoint refer to RFC3611 for a more detailed explanation). The scale used will typically be ITU-T G.107 compliant (0-100) but can be greater where wideband audio codecs are used. Although in most cases the value does not need to be converted, a value of 127 indicates that this parameter is unavailable and should not be included in the vq-rtcpxr event.

ExtROutEstAlg

This field provides a text description of the algorithm used to estimate ExternalR-Out.

MOS-LQ

This field corresponds to "MOSLQ" in RFC3611 in the VoIP Metrics Report Block. This parameter is the estimated mean opinion score for listening voice quality on a scale from 1 to 5, in which 5 represents excellent and 1 represents unacceptable. The RFC3611 format is expressed as an integer in the range 10 to 50, corresponding to MOS x 10. Therefore the value should be divided by 10 to convert to vq-rtcpxr format. Additionally, a value of 127 in RFC3611 indicates that the parameter is unavailable and should not be included in the vq-rtcpxr event.

MOSLQEstAlg

This field provides a text description of the algorithm used to estimate MOS-LQ.

MOS-CQ

This field corresponds to "MOSCQ" in RFC3611 in the VoIP Metrics Report Block. This parameter is the estimated mean opinion score for conversation voice quality on a scale from 1 to 5, in which 5 represents excellent and 1 represents unacceptable. The RFC3611 format is expressed as an integer in the range 10 to 50, corresponding to MOS x 10. Therefore the value should be divided by 10 to convert to vq-rtcpxr format. Additionally, a value of 127 in RFC3611 indicates that the parameter is unavailable and should not be included in the vq-rtcpxr event.

MOSCQEstAlg

This field provides a text description of the algorithm used to estimate MOS-CQ.

QoEEstAlg

This field provides a text description of the algorithm used to estimate all voice quality metrics. This parameter is provided as an alternative to the separate estimation algorithms for use when the same algorithm is used for all measurements.

4.7. Message Flow and Syntax Examples

This section shows a number of message flow examples showing how the event package works.

4.7.1. End of Session Report using PUBLISH

```
   Alice            Proxy/Registrar        Collector            Bob
   |                    |                    |                    |
   |                    |                    |                    |
   | REGISTER Allow-Event:vq-rtcpxr  F1      |                    |
   |------------------->|                    |                    |
   |      200 OK F2     |                    |                    |
   |<-------------------|                    |                    |
   |      INVITE F3     |                    |                    |
   |------------------->|                    |                    |
   |                    |      INVITE F4     |                    |
   |                    |---------------------------------------->|
   |                    |      200 OK F5     |                    |
   |                    |<----------------------------------------|
   |     200 OK F6      |                    |                    |
   |<-------------------|                    |                    |
   |        ACK F7      |                    |                    |
   |------------------->|                    |                    |
   |                    |      ACK F8        |                    |
   |                    |---------------------------------------->|
   |        RTP         |                    |                    |
   |<============================================================>|
   |        RTCP        |                    |                    |
   |<============================================================>|
   |                    |                    |                    |
   |    BYE F9          |                    |                    |
   |------------------->|      BYE F10       |                    |
   |                    |---------------------------------------->|
   |                    |     200 OK F11     |                    |
   |                    |<----------------------------------------|
   |     200 OK F12     |                    |                    |
   |<-------------------|                    |                    |
   |  PUBLISH Event:vq-rtcpxr F13            |                    |
   |------------------->|                    |                    |
   |                    | PUBLISH Event:vq-rtcpxr F14             |
   |                    |------------------->|                    |
   |                    |     200 OK F15     |                    |
   |                    |<-------------------|                    |
   |     200 OK F16     |                    |                    |
   |<-------------------|                    |                    |
```

Figure 1. End of session report sent after session termination.

In the message flow depicted in Figure 1, the following message is sent in F13.

```
PUBLISH sip:collector@example.org SIP/2.0
Via: SIP/2.0/UDP pc22.example.org;branch=z9hG4bK3343d7
Max-Forwards: 70
To: <sip:proxy@example.org>
From: Alice <sip:alice@example.org>;tag=a3343df32
Call-ID: 1890463548@alice.example.org
CSeq: 4331 PUBLISH
Allow: INVITE, ACK, CANCEL, OPTIONS, BYE, REFER,
SUBSCRIBE, NOTIFY
Event: vq-rtcpxr
Accept: application/sdp, message/sipfrag
Content-Type: application/vq-rtcpxr
Content-Length: ...

VQSessionReport
LocalMetrics:
Timestamps:START=2004-10-10T18:23:43Z STOP=2004-10-01T18:26:02Z
SessionDesc:PT=18 PD=G729 SR=8000 FD=20 FO=20 FPP=2 PPS=50
                FMTP="annexb=no" PLC=3 SSUP=on
CallID:1890463548@alice.example.org
LocalAddr:IP=10.10.1.100 PORT=5000 SSRC=2468abcd
RemoteAddr:IP=11.1.1.150 PORT=5002 SSRC=1357efff
JitterBuffer:JBA=3 JBR=2 JBN=40 JBM=80 JBX=120
PacketLoss:NLR=5.0 JDR=2.0
BurstGapLoss:BLD=0 BD=0 GLD=2.0 GD=500 GMIN=16
Delay:RTD=200 ESD=140 OWD=100 IAJ=2 MAJ=10
Signal:SL=2 NL=-10 RERL=55
QualityEst:RLQ=90 RCQ=85 EXTRI=90 MOSLQ=3.4 MOSCQ=3.3 QoEEstAlg=AlgX
RemoteMetrics:
Timestamps:START=2004-10-10T18:23:43Z STOP=2004-10-01T18:26:02Z
SessionDesc:PT=18 PD=G729 SR=8000 FD=20 FO=20 FPP=2 PPS=50
                FMTP="annexb=no" PLC=3 SSUP=on
CallID:1890463548@alice.example.org
LocalAddr:IP=11.1.1.150 PORT=5002 SSRC=1357efff
RemoteAddr:IP=10.10.1.100 PORT=5000 SSRC=2468abcd
JitterBuffer:JBA=3 JBR=2 JBN=40 JBM=80 JBX=120
PacketLoss:NLR=5.0 JDR=2.0
BurstGapLoss:BLD=0 BD=0 GLD=2.0 GD=500 GMIN=16
Delay:RTD=200 ESD=140 OWD=100 IAJ=2 MAJ=10
Signal:SL=2 NL=-10 RERL=55
QualityEst:RLQ=90 RCQ=85 MOSLQ=3.4 MOSCQ=3.3 QoEEstAlg=AlgX
DialogID:1890463548@alice.example.org;to-tag=8472761;
                from-tag=9123dh311
```

4.7.2. Alert Report using PUBLISH

```
   Alice            Proxy/Registrar        Collector            Bob
   |                    |                    |                    |
   |      INVITE F1     |                    |                    |
   |------------------->|                    |                    |
   |                    |      INVITE F2     |                    |
   |                    |---------------------------------------->|
   |                    |      200 OK F3     |                    |
   |                    |<----------------------------------------|
   |     200 OK F4      |                    |                    |
   |<-------------------|                    |                    |
   |        ACK F5      |                    |                    |
   |------------------->|                    |                    |
   |                    |      ACK F6        |                    |
   |                    |---------------------------------------->|
   |        RTP         |                    |                    |
   |<============================================================>|
   |        RTCP        |                    |                    |
   |<============================================================>|
   |  PUBLISH Event:vq-rtcpxr F7             |                    |
   |------------------->|                    |                    |
   |                    | PUBLISH Event:vq-rtcpxr F8              |
   |                    |------------------->|                    |
   |                    |     200 OK F9      |                    |
   |                    |<-------------------|                    |
   |     200 OK F10     |                    |                    |
   |<-------------------|                    |                    |
   |                    |                    |                    |
   |      BYE F12       |                    |                    |
   |------------------->|      BYE F13       |                    |
   |                    |---------------------------------------->|
   |                    |     200 OK F14     |                    |
   |                    |<----------------------------------------|
   |     200 OK F15     |                    |                    |
   |<-------------------|                    |                    |
```

   Figure 2. Alert report message flow

In the message flow depicted in Figure 2, the following message is sent in F7:

```
PUBLISH sip:collector@example.org SIP/2.0
Via: SIP/2.0/UDP pc22.example.org;branch=z9hG4bK3343d7
Max-Forwards: 70
To: <sip:collector@example.org>
From: Alice <sip:alice@example.org>;tag=a3343df32
Call-ID: 1890463548@alice.example.org
CSeq: 4321 PUBLISH
Allow: INVITE, ACK, CANCEL, OPTIONS, BYE, REFER,
SUBSCRIBE, NOTIFY
Event: vq-rtcpxr
Accept: application/sdp, message/sipfrag
Content-Type: application/vq-rtcpxr
Content-Length: ...

VQAlertReport: Type=RLQ Severity=Warning Dir=local
Metrics:
Timestamps:START=2004-10-10T18:23:43Z STOP=2004-10-01T18:26:02Z
SessionDesc:PT=0 PD=PCMU SR=8000 FD=20 FO=160 FPP=1 PPS=50
                PLC=3 SSUP=on
CallID:1890463548@alice.example.org
LocalAddr:IP=10.10.1.100 PORT=5000 SSRC=2a4b6c8d
RemoteAddr:IP=11.1.1.150 PORT=5002 SSRC=9f7e5d3c
JitterBuffer:JBA=3 JBR=2 JBN=40 JBM=80 JBX=120
PacketLoss:NLR=5.0 JDR=2.0
BurstGapLoss:BLD=0 BD=0 GLD=2.0 GD=500 GMIN=16
Delay:RTD=200 ESD=140 OWD=100 IAJ=2 MAJ=10
Signal:SL=2 NL=-10 RERL=55
QualityEst:RLQ=90 RCQ=85 EXTR=90 MOSLQ=3.4 MOSCQ=3.3 QoEEstAlg=AlgX
OtherDirMetrics:
Timestamps:START=2004-10-10T18:23:43Z STOP=2004-10-01T18:26:02Z
SessionDesc:PT=0 PD=PCMU SR=8000 FD=20 FO=160 FPP=1 PPS=50
                PLC=3 SSUP=on
CallID:1890463548@alice.example.rog
LocalAddr:IP=11.1.1.150 PORT=5002 SSRC=9f7e5d3c
RemoteAddr:IP=10.10.1.100 PORT=5000 SSRC=2a4b6c8d
JitterBuffer:JBA=3 JBR=2 JBN=40 JBM=80 JBX=120
PacketLoss:NLR=5.0 JDR=2.0
BurstGapLoss:BLD=0 BD=0 GLD=2.0 GD=500 GMIN=16
Delay:RTD=200 ESD=140 OWD=100 IAJ=2 MAJ=10
Signal:SL=2 NL=-10 RERL=55
QualityEst:RLQ=90 RCQ=85 EXTRI=90 MOSLQ=3.4 MOSCQ=3.3 QoEEstAlg=AlgX
DialogID:1890463548@alice.example.org;to-tag=8472761;
        from-tag=9123dh3111
```

4.7.3. End of Session Report using NOTIFY

```
   Alice            Proxy/Registrar        Collector             Bob
   |                    |                      |                     |
   |                    |                      |                     |
   | REGISTER Allow-Event:vq-rtcpxr F1         |                     |
   |------------------->|                      |                     |
   |      200 OK F2     |                      |                     |
   |<-------------------|                      |                     |
   |                    |  SUBSCRIBE Event:vq-rtcpxr F3              |
   |                    |<---------------------|                     |
   | SUBSCRIBE Event:vq-rtcpxr F4              |                     |
   |<-------------------|                      |                     |
   |     200 OK F5      |                      |                     |
   |------------------->|                      |                     |
   |                    |   200 OK F6          |                     |
   |                    |--------------------->|                     |
   |      INVITE F7     |                      |                     |
   |------------------->|                      |                     |
   |                    |      INVITE F8       |                     |
   |                    |------------------------------------------->|
   |                    |      200 OK F9       |                     |
   |                    |<-------------------------------------------|
   |     200 OK F10     |                      |                     |
   |<-------------------|                      |                     |
   |        ACK F11     |                      |                     |
   |------------------->|                      |                     |
   |                    |      ACK F12         |                     |
   |                    |------------------------------------------->|
   |        RTP         |                      |                     |
   |<===============================================================>|
   |        RTCP, RTCP XR                      |                     |
   |<===============================================================>|
   |                    |                      |                     |
   |    BYE F13         |                      |                     |
   |------------------->|      BYE F14         |                     |
   |                    |------------------------------------------->|
   |                    |     200 OK F15       |                     |
   |                    |<-------------------------------------------|
   |     200 OK F16     |                      |                     |
   |<-------------------|                      |                     |
   |  NOTIFY Event:vq-rtcpxr F17               |                     |
   |------------------->|                      |                     |
   |                    | NOTIFY Event:vq-rtcpxr F18                 |
```

```
   |                    |------------------->|                    |
   |                    |      200 OK F19    |                    |
   |                    |<-------------------|                    |
   |     200 OK F20     |                    |                    |
   |<-------------------|                    |                    |
```

Figure 3. Summary report with NOTIFY sent after session termination.

In the call flow depicted in Figure 3, the following message format is sent in F17:

```
NOTIFY sip:collector@example.org SIP/2.0
Via: SIP/2.0/UDP pc22.example.org;branch=z9hG4bK3343d7
Max-Forwards: 70
To: <sip:collector@example.org>;tag=43524545
From: Alice <sip:alice@example.org>;tag=a3343df32
Call-ID: 1890463548@alice.example.org
CSeq: 4321 NOTIFY
Contact: <sip:alice@pc22.example.org>
Allow: INVITE, ACK, CANCEL, OPTIONS, BYE, REFER,
SUBSCRIBE, NOTIFY
Event: vq-rtcpxr
Accept: application/sdp, message/sipfrag
Subscription-State: active;expires=3600
Content-Type: application/vq-rtcpxr
Content-Length: ...

VQSessionReport
LocalMetrics:
Timestamps:START=2004-10-10T18:23:43Z STOP=2004-10-01T18:26:02Z
SessionDesc:PT=0 PD=PCMU SR=8000 FD=20 FO=160 FPP=1 PPS=50
                PLC=3 SSUP=on
CallID:1890463548@alice.example.org
LocalAddr:IP=10.10.1.100 PORT=5000 SSRC=1a3b5c7d
RemoteAddr:IP=11.1.1.150 PORT=5002 SSRC=2468abcd
JitterBuffer:JBA=3 JBR=2 JBN=40 JBM=80 JBX=120
PacketLoss:NLR=5.0 JDR=2.0
BurstGapLoss:BLD=0 BD=0 GLD=2.0 GD=500 GMIN=16
Delay:RTD=200 ESD=140 OWD=100 IAJ=2 MAJ=10
Signal:SL=2 NL=-10 RERL=55
QualityEst:RLQ=90 RCQ=85 EXTRI=90 MOSLQ=3.4 MOSCQ=3.3 QoEEstAlg=AlgX
```

```
RemoteMetrics:
Timestamps:START=2004-10-10T18:23:43Z STOP=2004-10-01T18:26:02Z
SessionDesc:PT=0 PD=PCMU SR=8000 FD=20 FO=160 FPP=1 PPS=50
                PLC=3 SSUP=on
CallID:1890463548@alice.example.org
LocalAddr:IP=11.1.1.150 PORT=5002 SSRC=2468abcd
RemoteAddr:IP=10.10.1.100 PORT=5000 SSRC=1a3b5c7d
JitterBuffer:JBA=3 JBR=2 JBN=40 JBM=80 JBX=120
PacketLoss:NLR=5.0 JDR=2.0
BurstGapLoss:BLD=0 BD=0 GLD=2.0 GD=500 GMIN=16
Delay:RTD=200 ESD=140 OWD=100 IAJ=2 MAJ=10
Signal:SL=2 NL=-10 RERL=55
QualityEst:RLQ=90 RCQ=85 EXTRI=90 MOSLQ=3.4 MOSCQ=3.3 QoEEstAlg=AlgX
DialogID:1890463548@alice.example.org;to-tag=8472761;
        from-tag=9123dh311
```


4.7.4. Mid Session Threshold Violation using NOTIFY

```
Alice               Proxy/Registrar        Collector              Bob
  |                     |                     |                     |
  |                     |                     |                     |
  | REGISTER Allow-Event:vq-rtcpxr F1         |                     |
  |-------------------->|                     |                     |
  |      200 OK F2      |                     |                     |
  |<--------------------|                     |                     |
  |                     |  SUBSCRIBE Event:vq-rtcpxr F3             |
  |                     |<--------------------|                     |
  | SUBSCRIBE Event:vq-rtcpxr F4              |                     |
  |<--------------------|                     |                     |
  |     200 OK F5       |                     |                     |
  |-------------------->|                     |                     |
  |                     |   200 OK F6         |                     |
  |                     |-------------------->|                     |
  |      INVITE F7      |                     |                     |
  |-------------------->|                     |                     |
  |                     |      INVITE F8      |                     |
  |                     |------------------------------------------>|
  |                     |      200 OK F9      |                     |
  |                     |<------------------------------------------|
  |     200 OK F10      |                     |                     |
  |<--------------------|                     |                     |
```

```
|        ACK F11      |                    |                    |
|-------------------->|                    |                    |
|                     |      ACK F12       |                    |
|                     |----------------------------------------->|
|        RTP          |                    |                    |
|<=============================================================>|
|        RTCP, RTCP XR                     |                    |
|<=============================================================>|
|  NOTIFY Event:vq-rtcpxr F17              |                    |
|-------------------->|                    |                    |
|                     | NOTIFY Event:vq-rtcpxr F18              |
|                     |-------------------->|                    |
|                     |     200 OK F19     |                    |
|                     |<--------------------|                    |
|     200 OK F20      |                    |                    |
|<--------------------|                    |                    |
|                     |                    |                    |
|    BYE F13          |                    |                    |
|-------------------->|      BYE F14       |                    |
|                     |----------------------------------------->|
|                     |     200 OK F15     |                    |
|                     |<-----------------------------------------|
|     200 OK F16      |                    |                    |
|<--------------------|                    |                    |
|  NOTIFY Event:vq-rtcpxr F17              |                    |
|-------------------->|                    |                    |
|                     | NOTIFY Event:vq-rtcpxr F18              |
|                     |-------------------->|                    |
|                     |     200 OK F19     |                    |
|                     |<--------------------|                    |
|     200 OK F20      |                    |                    |
|<--------------------|                    |                    |
```

Figure 4. Summary report sent during session with threshold report.

In the call flow depicted in Figure 4, the following message format is sent in F17:

```
NOTIFY sip:collector@example.org SIP/2.0
Via: SIP/2.0/UDP pc22.example.org;branch=z9hG4bK3343d7
Max-Forwards: 70
To: <sip:collector@example.org>
From: Alice <sip:alice@example.org>;tag=a3343df32
```

```
Call-ID: 1890463548@alice.example.org
CSeq: 4321 PUBLISH
Allow: INVITE, ACK, CANCEL, OPTIONS, BYE, REFER,
SUBSCRIBE, NOTIFY
Event: vq-rtcpxr
Accept: application/sdp, message/sipfrag
Content-Type: application/vq-rtcpxr
Content-Length: ...

VQAlertReport: Type=RLQ Severity=Warning Dir=local
Metrics:
Timestamps:START=2004-10-10T18:23:43Z STOP=2004-10-01T18:26:02Z
SessionDesc:PT=0 PD=PCMU SR=8000 FD=20 FO=160 FPP=1 PPS=50
        PLC=3 SSUP=on
CallID:1890463548@alice.example.org
LocalAddr:IP=10.10.1.100 PORT=5000 SSRC=1a3b5c7d
RemoteAddr:IP=11.1.1.150 PORT=5002 SSRC=2468abcd
JitterBuffer:JBA=3 JBR=2 JBN=40 JBM=80 JBX=120
PacketLoss:NLR=5.0 JDR=2.0
BurstGapLoss:BLD=0 BD=0 GLD=2.0 GD=500 GMIN=16
Delay:RTD=200 ESD=140 OWD=100 IAJ=2 MAJ=10
Signal:SL=2 NL=-10 RERL=55
QualityEst:RLQ=90 RCQ=85 EXTR=90 MOSLQ=3.4 MOSCQ=3.3 QoEEstAlg=AlgX
OtherDirMetrics:
Timestamps:START=2004-10-10T18:23:43Z STOP=2004-10-01T18:26:02Z
SessionDesc:PT=0 PD=PCMU SR=8000 FD=20 FO=160 FPP=1 PPS=50
                PLC=3 SSUP=on
CallID:1890463548@alice.example.org
LocalAddr:IP=11.1.1.150 PORT=5002 SSRC=2468abcd
RemoteAddr:IP=10.10.1.100 PORT=5000 SSRC=1a3b5c7d
JitterBuffer:JBA=3 JBR=2 JBN=40 JBM=80 JBX=120
PacketLoss:NLR=5.0 JDR=2.0
BurstGapLoss:BLD=0 BD=0 GLD=2.0 GD=500 GMIN=10
Delay:RTD=200 ESD=140 OWD=100 IAJ=2 MAJ=10
Signal:SL=2 NL=-10 RERL=55
QualityEst:RLQ=90 RCQ=85 EXTRI=90 MOSLQ=3.4 MOSCQ=3.3 QoEEstAlg=AlgX
DialogID:1890463548@alice.example.org;to-tag=8472761;
        from-tag=9123dh31111
```


4.8 Configuration Dataset for vq-rtcpxr Events

It is the suggestion of the authors that the SIP configuration framework [8] be used to establish the necessary parameters for usage of vq-rtcpxr events. A dataset for this purpose is provided below:

```
<?xml version="1.0" encoding="UTF-8"?>
   <xs:schema targetNamespace="urn:ietf:params:xml:ns:vqrtcpxrdataset"
         xmlns:tns="urn:ietf:params:xml:ns:vqrtcpxrdataset"
         xmlns:xs="http://www.w3.org/2001/XMLSchema"

     <xs:element name="rtcpxr-collector">
        <xs:complexType>
             <xs:sequence>
               <xs:element name="address" type=xs:string/>
               <xs:element name="port" type=xs:integer/>
             </xs:sequence>
        </xs:complexType>
     </xs:element>

   </xs:schema>
       <xs:complexType>
         <xs:sequence>
           <xs:element name="threshold-parameter">
             <xs:sequence>
               <xs:element name="parameter-name" type=xs:string/>
               <xs:element name="warning-level" type=xs:integer/>
               <xs:element name="excessive-level" type=xs:integer/>
             </xs:sequence>
           </xs:element>
           </xs:sequence>
         </xs:complexType>
     </xs:element>

     <xs:element name="session-report-settings">
       <xs:complexType>
         <xs:sequence>
           <xs:element name="enable" type=xs:boolean/>
           <xs:element name="remote-report" type=xs:boolean/>
         </xs:sequence>
       </xs:complexType>
     </xs:element>

     <xs:element name="interval-report-settings">
       <xs:complexType>
         <xs:sequence>
           <xs:element name="enable" type=xs:boolean/>
           <xs:element name="remote-report" type=xs:boolean/>
           <xs:element name="timer" type=xs:integer/>
         </xs:sequence>
       </xs:complexType>
     </xs:element>

   </xs:schema>
```

5. IANA Considerations

This document registers a new SIP Event Package and a new MIME type.

5.1. SIP Event Package Registration

Package name: vq-rtcpxr

Type: package

Contact: Amy Pendleton <aspen@nortel.com>

Published Specification: This document

5.2. application/vq-rtcp-xr MIME Registration

MIME media type name: application

MIME subtype name: vq-rtcpxr

Mandatory parameters: none

Optional parameters: none

Encoding considerations: text

Security considerations: See next section.

Interoperability considerations: none.

Published specification: This document.

Applications which use this media type: This document type is being used in notifications of VoIP quality reports.

Additional Information:

Magic Number: None

File Extension: None

Macintosh file type code: "TEXT"

Personal and email address for further information: Amy Pendleton <aspen@nortel.com>

Intended usage: COMMON

Author/Change controller: The IETF.

6. Security Considerations

RTCP reports can contain sensitive information since they can provide information about the nature and duration of a session established between two or more endpoints. As a result, any third party wishing to obtain this information SHOULD be properly authenticated by the SIP UA using standard SIP mechanisms and according to the recommendations in [5]. Additionally the event content MAY be encrypted to ensure confidentiality; the mechanisms for providing confidentiality are detailed in [2].

7. Contributors

The authors would like to thank Rajesh Kumar, Dave Oran and Tom Redman for their discussions.

8. Normative References

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