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RTP Control Protocol (RTCP) Extended Report (XR) Blocks for QoE Metric Reporting
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Abstract

This document defines an RTP Control Protocol (RTCP) Extended Report (XR) Block including two new segment types and associated SDP parameters that allow the reporting of QoE metrics for use in a range of RTP applications.

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1. Introduction

1.1. QoE Metrics Report Block

This document defines a new block type to augment those defined in [RFC3611], for use in a range of RTP applications.

The new block type provides information on media quality using one of several standard metrics (i.e.,Mean Opinion Score(MoS)).

The metrics belong to the class of application level metrics defined in [RFC6792].

1.2. RTCP and RTCP XR Reports

The use of RTCP for reporting is defined in [RFC3550]. [RFC3611] defined an extensible structure for reporting using an RTCP Extended Report (XR). This document defines a new Extended Report block for use with [RFC3550] and [RFC3611].

1.3. Performance Metrics Framework

The Performance Metrics Framework [RFC6390] provides guidance on the definition and specification of performance metrics. The RTP Monitoring Architectures [RFC6792] provides guidelines for reporting block format using RTCP XR. The XR block type described in this document are in accordance with the guidelines in [RFC6390] and [RFC6792].

1.4. Applicability

The QoE Metrics Report Block can be used in any application of RTP for which QoE measurement algorithms are defined.

The factors that affect real-time audio/video application quality can be split into two categories. The first category consists of transport-specific factors such as packet loss, delay and jitter (which also translates into losses in the playback buffer). The factors in the second category are application-specific factors that affect real time application (e.g., video) quality. These factors can be but are not limited to video codec and loss recovery technique, coding bit rate, packetization scheme, and content characteristics.

Compared with application-specific factors, the transport-specific factors sometimes are not sufficient to measure real time media quality, since the ability to analyze the real time media in the application layer provides quantifiable measurements for end user

Quality of Experience (QoE) that may not be captured in the transmission layers or from the RTP layer down. In a typical scenario, monitoring of the transmission layers can produce statistics suggesting that quality is not an issue, such as the fact that network jitter is not excessive. However, problems may occur in the service layers leading to poor subscriber QoE. Therefore monitoring using only network-level measurements may be insufficient when application layer media quality is required.

In order to provide accurate measures of real time media quality when transporting real time media across a network, the QoE Metrics is highly required which can be conveyed in the RTCP XR packets [RFC3611] and may have the following three benefits:

- Tuning the content encoder algorithm to satisfy real time data quality requirements.
- Determining which system techniques to use in a given situation and when to switch from one technique to another as system parameters change.
- Verifying the continued correct operation of an existing system.

2. Terminology

2.1. Standards Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

The terminology used is

Numeric formats S X:Y

where S indicates a two's complement signed representation, X the number of bits prior to the decimal place and Y the number of bits after the decimal place.
Hence 8:8 represents an unsigned number in the range 0.0 to 255.996 with a granularity of 0.0039. S7:8 would represent the range -127.996 to +127.996. 0:16 represents a proper binary fraction with range
0.0 to 1 - 1/65536 = 0.9999847
though note that use of flag values at the top of the numeric range slightly reduces this upper limit. For example, if the 16- bit values 0xfffe and 0xffff are used as flags for "over-range" and "unavailable" conditions, a 0:16 quantity has range

0.0 to 1 - 3/65536 = 0.9999542

3. QoE Metrics Block

Multimedia application QoE metric is commonly expressed as a MOS ("Mean Opinion Score"), MOS is on a scale from 1 to 5, in which 5 represents excellent and 1 represents unacceptable. MOS scores are usually obtained using subjective testing or using objective algorithm. However Subjective testing to estimate the multimedia quality may be not suitable for measuring the multimedia quality since the results may vary from test to test. Therefore using objective algorithm to calculate MOS scores is RECOMMENDED. ITU-T recommendations (e.g., [G.107][G.107.1][P.862][P.862.1][P.862.2][P.863][P.564][G.1082][P.1201.1][P.1201.2][P.1202.1][P.1202.2]) define the methodologies for assessment of the performance of multimedia stream and provides a method to evaluate QoE estimation algorithms and objective model for video and audio. Hence this document recommends vendors and implementers to use these International Telecommunication Union (ITU)-specified methodologies to measure parameters when possible.

This block reports the multimedia application performance or media quality beyond the information carried in the standard RTCP packet format. Information is recorded about QoE metric which provides a measure that gives a numerical indication of the perceived quality of the media received. The measurement of metrics in this block are usually made at the receiving end of the RTP stream. Instances of this Metrics Block refer by Synchronization source (SSRC) to the separate auxiliary Measurement Information block [RFC6776] which describes measurement periods in use (see RFC6776 section 4.2).

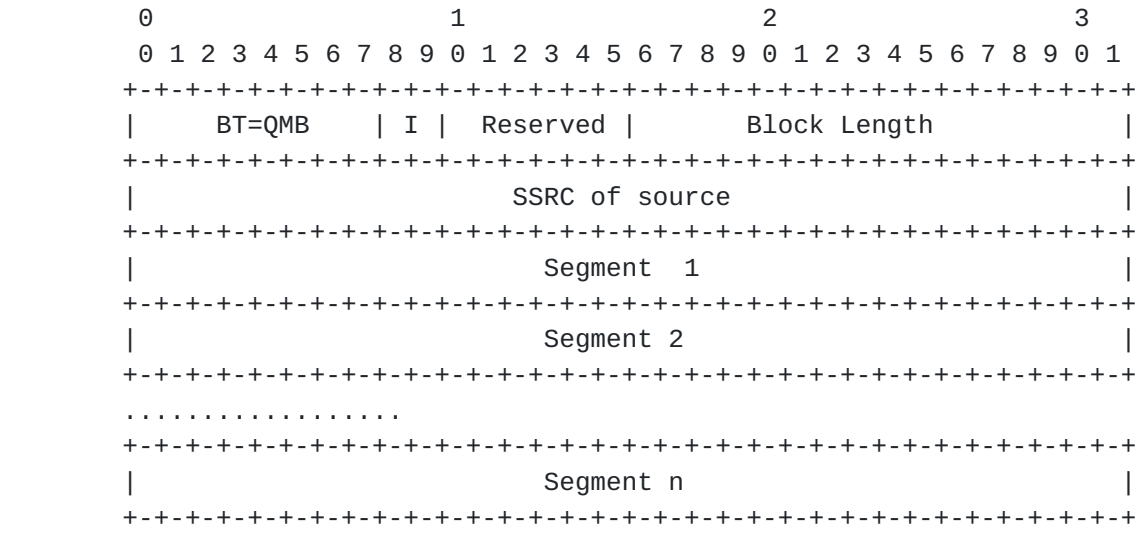
This Metrics Block relies on the measurement period in the Measurement Information block indicating the span of the report. Senders MUST send this block in the same compound RTCP packet as the measurement information block. Receivers MUST verify that the measurement period is received in the same compound RTCP packet as this Metrics Block. If not, this Metrics Block MUST be discarded.

3.1. Metric Block Structure

The report block contents are dependent upon a series of flag bits carried in the first part of the header. Not all parameters need to be reported in each block. Flags indicate which are and which are not reported. The fields corresponding to unreported parameters MUST be present, and MUST be set to zero. The receiver MUST ignore any QoE Metrics Block with a non-zero value in any field flagged as

unreported. The encoding of QoE metrics block payload consists of a series of 32 bit units called segments that describe payload Type, MoS algorithm and MoS value.

The QoE Metrics Block has the following format:



3.2. Definition of Fields in QoE Metrics Block

Block type (BT): 8 bits

The QoE Metrics Block is identified by the constant <QMB>.

Interval Metric flag (I): 2 bits

This field is used to indicate whether the QoE metrics are Sampled, Interval or Cumulative metrics [RFC6792]:

I=10: Interval Duration - the reported value applies to the most recent measurement interval duration between successive metrics reports.
I=11: Cumulative Duration - the reported value applies to the accumulation period characteristic of cumulative measurements.
I=01: Sampled Value - the reported value is a sampled instantaneous value.

In this document, the value I=00 is reserved for future use. Senders MUST NOT use the values I=00. If a block is received with I=00, the receiver MUST discard the block.

Reserved: 6 bits

This field is reserved for future definition. In the absence of such a definition, the bits in this field MUST be set to zero and ignored by the receiver (See RFC6709 section 4.2).

Block Length: 16 bits

The length of this report block in 32-bit words, minus one. For the QoE Metrics Block, the block length is variable length.

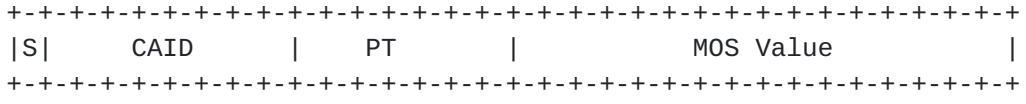
SSRC of source: 32 bits

As defined in Section 4.1 of [RFC3611].

Segment i: 32 bits

There are two segment types defined in this document: single stream Audio/Video per SSRC segment, multi-channel audio per SSRC segment. Multi-channel audio per SSRC segment is used to deal with the case where Multi-channel audios are carried in one RTP stream while single stream Audio/Video per SSRC segment is used to deal with the case where each media stream is identified by SSRC and sent in separate RTP stream. The leftmost bit of the segment determines its type. If the leftmost bit of the segment is zero, then it is single stream segment. If the leftmost bit is one, then it is multi-channel audio segment. Note that two segment types can not be present in the same metric block.

3.2.1. **Single Stream audio/video** per SSRC Segment



Segment Type (S): 1 bit

This field is used to identify the segment type used in this report block. A zero identifies this as a single stream Audio/Video per SSRC segment. Single stream means there is only one media stream carried in one RTP stream. The single stream Audio/Video per SSRC segment can be used to report the MoS value associated with the media stream identified by SSRC. If there are multiple media streams and they want to use the single stream Audio/Video per SSRC segment to report the MOS value, they should be carried in the separate RTP streams with each identified by different SSRC. In this case, multiple QoE Metrics Blocks are

required to report the MOS value corresponding to each media stream using single stream Audio/Video per SSRC segment in the same RTCP XR packet.

Calg Algorithm ID (CAID) : 8bits

The 8-bit CAID is the local identifier of calculation algorithm associated with this segment in the range 1-255 inclusive.

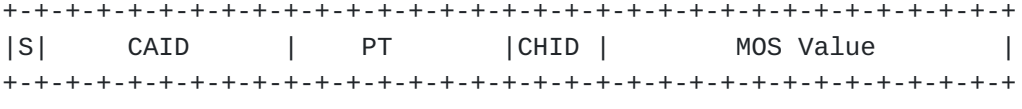
Payload Type (PT): 7 bits

QoE metrics reporting depends on the payload format in use. This field identifies the format of the RTP payload. For RTP sessions where multiple payload formats can be negotiated or the payload format changes during the mid-session), the value of this field will be used to indicate what payload format was in use for the reporting interval.

MOS Value: 16 bits

The estimated mean opinion score for multimedia application performance is defined as including the effects of delay,loss, discard,jitter and other effects that would affect media quality. It is expressed in numeric format 8:8 with the value in the range 0.0 to 255.996. The valid the measured value ranges from 0.0 to 50.0, corresponding to MoS x 10 as for MoS. If the measured value is over ranged, the value 0xFFFE MUST be reported to indicate an over-range measurement. If the measurement is unavailable, the value 0xFFFF MUST be reported. Values other than 0xFFFE,0xFFFF and the valid range defined above MUST NOT be sent and MUST be ignored by the receiving system.

3.2.2. Multi-Channel audio per SSRC Segment



Segment Type (S): 1 bit

This field is used to identify the segment type used in this report block. A one identifies this as a multi-channel audio segment.

CAlg Algorithm ID (CAID) : 8bits

The 8-bit ID is the local identifier of this segment in the range 1-255 inclusive.

Payload Type (PT): 7 bits

As defined in Section 3.2.1 of this document.

Channel Identifier (CHID): 3 bits

If multiple channels of audio are carried in one RTP stream, each channel of audio will be viewed as a independent channel(e.g., left channel audio, right channel audio). This field is used to identify each channel carried in the same media stream. The default Channel mapping follows static ordering rule described in the section 4.1 of [RFC3551]. However there are some payload formats that use different channel mappings, e.g., AC-3 audio over RTP [RFC4184] only follow AC-3 channel order scheme defined in [ATSC]. Enhanced AC-3 Audio over RTP [RFC4598] uses dynamic channel transform mechanism. In order that the appropriate channel mapping can be determined, QoE reports need to be tied to an RTP payload format, i.e., including the payload type of the reported media according to [RFC6792] and using Payload Type to determine the appropriate channel mapping.

MOS Value: 13 bits

The estimated mean opinion score for multimedia application performance is defined as including the effects of delay,loss, discard,jitter and other effects that would affect multimedia quality . It is expressed in numeric format 6:7 with the value in the range 0.0 to 63.992. The valid the measured value ranges from 0.0 to 50.0, corresponding to MoS x 10 as for MoS. If the measured value is over ranged, the value 0x1FFE MUST be reported to indicate an over-range measurement. If the measurement is unavailable, the value 0x1FFF MUST be reported. Values other than 0x1FFE,0x1FFF and the valid range defined above MUST NOT be sent and MUST be ignored by the receiving system.

4. SDP Signaling

[RFC3611] defines the use of SDP (Session Description Protocol) [RFC4566] for signaling the use of XR blocks. However XR blocks MAY be used without prior signaling (see section 5 of RFC3611).

4.1. SDP rtcp-xr-attrib Attribute Extension

This section augments the SDP [RFC4566] attribute "rtcp-xr" defined in [RFC3611] by providing an additional value of "xr-format" to signal the use of the report block defined in this document. Within the "xr-format", the syntax element "calgextmap" is an attribute as defined in [RFC4566] and used to signal the mapping of the local identifier (CAID) in the segment extension defined in section 3.2 to the calculation algorithm. Specific extensionattributes are defined by the specification that defines a specific extension name; there might be several.

```
xr-format =/ xr-qoe-block
xr-qoe-block = "qoe-metrics" ["=" extmap *("," calgextmap)]
calgextmap =  mapentry "=" extensionname [SP extentionattributes]
direction = "sendonly" / "recvonly" / "sendrecv" / "inactive"
mapentry =  "calg:" 1*5 DIGIT ["/" direction]
extensionname = "P564";ITU-T P.564 Compliant Algorithm [P.564]
              / "G107";ITU-T G.107 [G.107]
              / "G107_1";ITU-T G.107.1 [G.107.1]
              / "TS101_329";ETSI TS 101 329-5 Annex E [ ETSI]
              /"JJ201_1 ";TTC JJ201.1 [TTC]
              /"P1201_1";ITU-T P.1201.2 [P.1201.1]
              /"P1201_2";ITU-T P.1201.2 [P.1201.2]
              /"P1202_1";ITU-T P.1202.1 [P.1202.1]
              /"P1202_2";ITU-T P.1202.2 [P.1202.2]
              /"P.862.2";ITU-T P.862.2 [P.862.2]
              /"P.863"; ITU-T P.863 [P.863]
              / non-ws-string
extentionattributes = mosref
                    /attributes-ext
mosref =  "mosref=" ("l"; lower resolution
                     /"m"; middle resolution
                     / "h";higher resolution
                    / non-ws-string)
mostype = "mostype=" ("e"; Estimated MoS [P.800.1]
                        /"s";subjective MoS [P.800.1]
                        /"o";objective MoS [P.800.1]
                        /non-ws-string)
attributes-ext = non-ws-string
SP = <Define in RFC5234>
non-ws-string  = 1*(%x21-FF)
```

Each local identifier (CAID)of calculation algorithm used in the segment defined in the section 3.2 is mapped to a string using an attribute of the form:

```
a=calgextmap:<value> ["/"<direction>] <name> [<extensionattributes>]
```

where <name> is a calculation algorithm name, as above, <value> is the local identifier (CAID)of the calculation algorithm associated with the segment defined in this document and is an integer in the valid range inclusive.

Example:
a=rtcp-xr:qoe-metrics=calg:1=G107,calg:2=P1202_1

A usable mapping MUST use IDs in the valid range, and each ID in this range MUST be unique and used only once for each stream or each channel in the stream.

The mapping MUST be provided per media stream (in the media-level section(s) of SDP, i.e., after an "m=" line).

The syntax element "mosref" is referred to the media resolution relative reference (e.g., Narrowband (3.4kHz) Speech and Standard Definition (SD) Resolution Video with lower resolution, Wideband (7kHz) Speech and High Definition (HD) Resolution Video with higher resolution). MOS scores reported in the QoE block might vary with the MoS reference; For example, MOS values for narrowband, wideband codecs occupy the same range but SHOULD be reported in different value. For video application, MoS scores for SD resolution, HD resolution video also occupy the same ranges and SHOULD be reported in different value.

4.2. Offer/Answer Usage

When SDP is used in offer-answer context, the SDP Offer/Answer usage defined in [RFC3611] applies. In the offer answer context, the signaling described above might be used in three ways:

- asymmetric behavior (segment extensions sent in only one direction),
- the offer of mutually exclusive alternatives, or
- the offer of more segments than can be sent in a single session.

A direction attribute MAY be included in a calgextmap; without it, the direction implicitly inherits, of course, from the RTCP stream direction.

Segment extension, with their directions, MAY be signaled for an "inactive" stream. It is an error to use an extension direction incompatible with the stream direction (e.g., a "sendonly" attribute for a "recvonly" stream).

If an segment extension is offered as "sendrecv", explicitly or implicitly, and asymmetric behavior is desired, the SDP MAY be

modified to modify or add direction qualifiers for that segment extension.

A mosref attribute and mos type attribute MAY be included in an calgextmap; without it, the mosref and most type attribute implicitly inherits, of course, from the name attribute (e.g., P.1201.1 [P.1201.1] indicates lower resolution used while P.1201.2 [P.1201.2] indicates higher resolution used) or payload type carried in the segment extension (e.g.,EVRC-WB [RFC5188] indicates using Wideband Codec). However not all payload types or MoS algorithm names indicate resolution to be used and mos type to be used.

If an answerer receives an offer with an mosref attribute value it doesn't support (e.g.,the answerer only supports "l" and receives "h"from offerer), the answer SHOULD reject the mosref attribute value offered by the offerer.

If the answerer wishes to reject a mosref attribute offered by the offerer, it sets identifiers associated with segment extensions in the answer to the value in the range 4096-4351. The rejected answer MUST contain 'mosref ' attribute whose value is the value of the SDP offer.

Local identifiers in the valid range inclusive in an offer or answer must not be used more than once per media section. A session update MAY change the direction qualifiers of segment extensions under use. A session update MAY add or remove segment extension(s). Identifiers values in the valid range MUST NOT be altered (remapped).

If a party wishes to offer mutually exclusive alternatives, then multiple segment extensions with the same identifier in the (unusable) range 4096-4351 MAY be offered; the answerer SHOULD select at most one of the offered extensions with the same identifier, and remap it to a free identifier in the valid range, for that extension to be usable. Note that two segment types defined in section 3 are also two exclusive alternatives.

If more segment extensions are offered in the valid range, the answerer SHOULD choose those that are desired, and place the offered identifier value "as is" in the SDP answer.

Similarly, if more segment extensions are offered than can be fit in the valid range, identifiers in the range 4096-4351 MAY be offered; the answerer SHOULD choose those that are desired, and remap them to a free identifier in the valid range.

Note that the range 4096-4351 for these negotiation identifiers is deliberately restricted to allow expansion of the range of valid

identifiers in future. Segment extensions with an identifier outside the valid range cannot, of course, be used.

Example (port numbers, RTP profiles, payload IDs and rtpmaps, etc. all omitted for brevity):

The offer:

a=rtcp-xr:qoe- metrics=calg:4906=P1201_l,calg:4906=P1202_l,calg:4907=G107

The answerer is interested in transmission P.1202.1 on lower resolution application, but doesn't support P.1201.1 on lower resolution application at all. It is interested in transmission G.107. It therefore adjusts the declarations:

a=rtcp-xr:qoe-metrics=calg:1=P1202_l,calg:2=G107

5. 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].

5.1. New RTCP XR Block Type value

This document assigns the block type value QMB in the IANA " RTP Control Protocol Extended Reports (RTCP XR) Block Type Registry" to the "QoE Metrics Block".

[Note to RFC Editor: please replace QMB with the IANA provided RTCP XR block type for this block.]

5.2. New RTCP XR SDP Parameter

This document also registers a new parameter "qoe-metrics" in the " RTP Control Protocol Extended Reports (RTCP XR) Session Description Protocol (SDP) Parameters Registry".

5.3. The SDP calgextmap Attribute

This section contains the information required by [RFC4566] for an SDP attribute.

o contact name, email address:

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- attribute name (as it will appear in SDP): calgextmap
- long-form attribute name in English: calculation algorithm map definition
- type of attribute (session level, media level, or both): both
- whether the attribute value is subject to the charset attribute: not subject to the charset attribute
- a one-paragraph explanation of the purpose of the attribute: This attribute defines the mapping from the local identifier (CAID) in the segment extension defined in section 3.2 into the calculation algorithm name as documented in specifications and appropriately registered.
- a specification of appropriate attribute values for this attribute: see RFC xxxx.

5.4. New registry of calculation algorithms

This document creates a new registry to be called "RTCP XR QoE metric block - multimedia application Calculation Algorithm" as a sub-registry of the "RTP Control Protocol Extended Reports (RTCP XR) Block Type Registry". This registry applies to the multimedia session where each type of media are sent in a separate RTP stream and also applies to the session where Multi-channel audios are carried in one RTP stream. Policies for this new registry are as follows:

- The information required to support this assignment is an unambiguous definition of the new metric, covering the base measurements and how they are processed to generate the reported metric.

- The review process for the registry is "Specification Required" as described in Section 4.1 of [RFC5226].

- Entries in the registry are identified by entry name and mapped to the local identifier (CAID) in the segment extension defined in section 3.2.

- Registration Template

  The following information must be provided with each registration:
  * Name: A string uniquely and unambiguously identifying the Calculation algorithm for use in protocols.
  * Name Description: A valid Description of the Calculation algorithm name.
  * Reference: The reference which defines the calculation algorithm corresponding to the Name and Name Description.

* Type: The media type to which the calculation algorithm is applied

o Initial assignments are as follows:

Name	Name Description	Reference	Type
P564	ITU-T P.564 Compliant Algorithm	[P.564]	Voice
G107	ITU-T G.107	[G.107]	Voice
TS101_329	ETSI TS 101 329-5 Annex E	[ETSI]	Voice
JJ201_1	TTC JJ201.1	[TTC]	Voice
G107_1	ITU-T G.107.1	[G.107.1]	Voice
P862	ITU-T P.862	[P.862]	Voice
P862_2	ITU-T P.862.2	[P.862.2]	Voice
P863	ITU-T P.863	[P.863]	Voice
P1201_1	ITU-T P.1201.1	[P.1201.1]	Multimedia
P1201_2	ITU-T P.1201.2	[P.1201.2]	Multimedia
P1202_1	ITU-T P.1202.1	[P.1202.1]	Video
P1202_2	ITU-T P.1202.2	[P.1202.2]	Video

6. Security Considerations

The new RTCP XR report blocks proposed in this document introduces no new security considerations beyond those described in [RFC3611].

7. Authors

This draft merges ideas from two drafts addressing the QoE metric Reporting issue. The authors of these drafts are listed below (in alphabetical order):

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Appendix A. Example of User Quality of Experience Evaluation for video stream

To evaluate user quality of experience levels using objective test data, MoS Scores provide a familiar, easily understood numeric representation of video, audio, and overall audiovisual quality. Unlike audio, video is even more sensitive to transport impairments , and even low rates of packet loss can cause severe degradation in perceived quality. However, all occurrences of packet loss do not have an equal impact on perceptual quality, in part because of the way video frames are structured during the encoding process - such as frame properties including frame type, frame structure and quantization parameter (QP), and in part due to subjective factors - such as the degree to which perception is affected by the levels of motion, detail in the video sequence, and decoder characteristic parameters including media resolution,codec type. When a video stream is sent from the media source to RTP receiving end and get monitored. in order to provide accurate evaluation of video quality, one possible QoE evaluation method is having network nodes that implement network management tools in place. They may know frame properties,perception degree, decoder characteristic parameters of this video stream using some out of band means, gather transport impairment information received from the RTP receiving end and use them as MoS calculation input parameters to calculate MoS scores by choosing appropriate MoS calculation algorithm. Such MoS Scores value can be useful for troubleshooting or comparing video quality

across different service types.

Appendix B. Metrics represented using RFC6390 Template

RFC EDITOR NOTE: please change XXXX in [RFCXXXX] by the new RFC number, when assigned.

a. MoS Value Metric

* Metric Name: MoS

* Metric Description: The estimated mean opinion score for multimedia application performance is defined as including the effects of delay,loss, discard,jitter and other effects that would affect multimedia quality.

* Method of Measurement or Calculation: See section 3.2.1, MoS value definition [RFCXXXX].

* Units of Measurement: See section 3.2.1, MoS value definition [RFCXXXX].

* Measurement Point(s) with Potential Measurement Domain: See section 3, 2nd paragraph [RFCXXXX].

* Measurement Timing: See section 3, 3rd paragraph [RFCXXXX] for measurement timing and section 3.1 [RFCXXXX] for Interval Metric flag.

* Use and applications: See section 1.4 [RFCXXXX].

* Reporting model: See RFC3611.

b. Segment Type Metric

* Metric Name: Segment Type

* Metric Description: It is used to identify the segment type used in this report block. For more details, see section 3.2.1, Segment type definition.

* Method of Measurement or Calculation: See section 3.2.1, Segment Type definition [RFCXXXX].

* Units of Measurement: See section 3.2.1, Segment Type definition [RFCXXXX].

* Measurement Point(s) with Potential Measurement Domain: See section 3, 2nd paragraph [RFCXXXX].

* Measurement Timing: See section 3, 3rd paragraph [RFCXXXX] for measurement timing and section 3.1 [RFCXXXX] for Interval Metric flag.

* Use and applications: See section 1.4 [RFCXXXX].

* Reporting model: See RFC3611.

c. Calg Algorithm Identifier Metric

* Metric Name: Calg Algorithm Identifier

* Metric Description: It is the local identifier of calculation Algorithm associated with this segment in the range 1-255 inclusive.

* Method of Measurement or Calculation: See section 3.2.1, Calg Algorithm ID definition [RFCXXXX].

* Units of Measurement: See section 3.2.1, Calg Algorithm ID definition[RFCXXXX].

* Measurement Point(s) with Potential Measurement Domain: See section 3, 2nd paragraph [RFCXXXX].

* Measurement Timing: See section 3, 3rd paragraph [RFCXXXX] for measurement timing and section 3.1 [RFCXXXX] for Interval Metric flag.

* Use and applications: See section 1.4 [RFCXXXX].

* Reporting model: See RFC3611.

d. Payload Type Metric

* Metric Name: Payload Type

* Metric Description: It is used to identify the format of the RTP payload. For more details, see section 3.2.1, payload type definition.

* Method of Measurement or Calculation: See section 3.2.1, Payload type definition [RFCXXXX].

* Units of Measurement: See section 3.2.1, payload type definition[RFCXXXX].

* Measurement Point(s) with Potential Measurement Domain: See section 3, 2nd paragraph [RFCXXXX].

* Measurement Timing: See section 3, 3rd paragraph [RFCXXXX] for measurement timing and section 3.1 [RFCXXXX] for Interval Metric flag.

* Use and applications: See section 1.4 [RFCXXXX].

* Reporting model: See RFC3611.

e. Channel Identifier Metric

* Metric Name: Payload Type

* Metric Description: It is used to identify each channel carried in the same media stream. For more details, see section 3.2.2, channel identifier definition.

* Method of Measurement or Calculation: See section 3.2.2, Channel Identifier definition [RFCXXXX].

* Units of Measurement: See section 3.2.2, channel identifier definition[RFCXXXX].

* Measurement Point(s) with Potential Measurement Domain: See section 3, 2nd paragraph [RFCXXXX].

* Measurement Timing: See section 3, 3rd paragraph [RFCXXXX] for measurement timing and section 3.1 [RFCXXXX] for Interval Metric flag.

* Use and applications: See section 1.4 [RFCXXXX].

* Reporting model: See RFC3611.

Appendix C. Change Log

C.1. draft-ietf-xrblock-rtcp-xr-qoe-09

The following are the major changes compared to previous version:

- Address comments recieved from WGLC, PM-DIR Review and SDP review.
- Change an existing SDP attribute 'extmap' to new SDP attribute 'calgextmap' and add new SDP attribute registry.
- Add Reference to G.107.1, P.862.1, P.862.2 and P.863 for new calculation algorithms.
- Add MoS type attribute to distinguish different MoS type.
- Other Editorial changes.

C.2. draft-ietf-xrblock-rtcp-xr-qoe-08

The following are the major changes compared to previous version:

- Remove mostype attribute from SDP extension since it can inferred from payload type.
- Clarify mosref attribute usage in the O/A.

C.3. draft-ietf-xrblock-rtcp-xr-qoe-07

The following are the major changes compared to previous version:

- Some editorial changes to get in line with burst gap related draft.
- Add an appendix to apply RFC6390 template.

C.4. draft-ietf-xrblock-rtcp-xr-qoe-06

The following are the major changes compared to previous two versions:

- A few Contact information update.
- A few Acknowledgement section update.

C.5. draft-ietf-xrblock-rtcp-xr-qoe-04

The following are the major changes compared to previous version:

- Split two references P.NAMS and P.NBAMS into four references.
- SDP signaling update.
- Add one example to explain User QoE evaluation for video stream

C.6. draft-ietf-xrblock-rtcp-xr-qoe-03

The following are the major changes compared to previous version:

- Add one new reference to support TTC JJ201.01.
- Update two references P.NAMS and P.NBAMS.
- Other Editorial changes based on comments applied to PDV and Delay drafts.

C.7. draft-ietf-xrblock-rtcp-xr-qoe-02

The following are the major changes compared to previous version:

- Remove leftmost second bit since it is ueeless.
- Change 13bits MoS value field into 14 bits to increase MoS precision.
- Fix some typo and make some editorial changes.

C.8. draft-ietf-xrblock-rtcp-xr-qoe-01

The following are the major changes compared to previous version:

- Remove layered support from the QoE metric draft.
- Allocate 7 bits in the block header for payload type to indicate what type of payload format is in use and add associated definition of payload type.
- Clarify using Payload Type to determine the appropriate channel mapping in the definition of Channel Identifier.

C.9. draft-ietf-xrblock-rtcp-xr-qoe-00

The following are the major changes compared to previous version:

- Allocate one more bit in the single stream per SSC segment to get alignment with the other two segment type.

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