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RTP Control Protocol Extended Reports (RTCP XR)
VoIP Metrics Management Information Base
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Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it defines objects for managing Real-Time Transport Control Protocol Extended Reports (RTCP XR) VoIP Metrics (RFC3611).

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1. The Internet-Standard Management Framework

For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to section 7 of RFC 3410 [RFC3410].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIV2, which is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

2. Overview

An "RTP System" may be a host end-system that runs an application program that sends or receives RTP data packets, or it may be an intermediate-system that forwards RTP packets. RTP Control Protocol (RTCP) packets are sent by senders and receivers to convey information about RTP packet transmission and reception [RFC3550]. RTCP Extended Report (XR) [RFC3611] packets are sent by receivers to convey additional information about certain types of RTP packet reception.

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.

2.1 Components

The RTCP XR MIB is structured around "Session", "Source", "Destination" and "Receiver" conceptual abstractions.

2.1.1 An RTP Session is an association of two or more participants communicating with RTP. For each participant, the session is defined by a particular pair of destination transport addresses (one network address plus a port pair for RTP and RTCP). The destination transport addresses may be common for all participants, as in the case of IP multicast, or may be different for each, as in the case of individual unicast addresses plus a common port pair," as defined in section 3 of [RFC3550].

2.1.2 A "Sender" is identified within an RTP session by a 32-bit numeric "Synchronization Source," or "SSRC", value and is "...the source of a stream of RTP packets" as defined in section 3 of [RFC3550]. The sender is also a source of RTCP Sender Report packets as specified in section 6 of [RFC3550].

2.1.3 A "Receiver" of a "stream of RTP packets" can be a unicast or multicast Receiver as described in 2.1.1, above. An RTP Receiver has an SSRC value that is unique to the session. An RTP Receiver is a source of RTCP Receiver Reports as specified in section 6 of [RFC3550] and RTCP XR VoIP Metrics Reports as specified in section 4.7 of [RFC3611].

2.2 Applicability of the MIB to RTP System Implementations

The RTCP XR MIB may be used in RTP Host Systems (end systems), see section 3 of [RFC3550], that are supporting Voice over IP (VoIP host systems) or in intermediate systems.

2.2.1 VoIP host Systems are end-systems that may use the RTCP XR MIB to collect RTP Voice over IP session data that the host is sending or receiving; these data may be used by a network manager to detect and diagnose faults that occur over the lifetime of a VoIP session as in a "help-desk" scenario.

2.2.2 Monitors of RTP Voice over IP sessions may be third-party or may be located in the RTP host. Monitors may use the RTCP XR MIB to collect Voice over IP session statistical data; these data may be used by a network manager for planning and other network-management purposes. A Monitor may use the RTCP XR MIB to collect data to permit a network manager to diagnose faults in VoIP sessions.

2.3 Relationship to the RTP MIB V2

The RTP MIB V2 [draft-ietf-avt-mib-rtp-bis-00.txt] defines a table of session identifying information. The tables in the RTCP XR MIB augment the session data from the RTP MIB V2, providing detailed performance information for RTP sessions transporting Voice over IP. The RTP MIB V2 session table MUST be implemented if the RTCP XR MIB Basic Parameter and Call Quality tables are implemented. The history table in this MIB contains aggregate information and does not have any relationship to the RTP MIB V2 session table. In implementations that use only the RTCP XR history table to report aggregate data, the RTP MIB V2 session table MUST NOT be implemented.

2.4 Relationship to the RAQMON Architecture

The Real-time Application QoS monitoring (RAQMON) Framework [RAQMON] defines an architecture that extends the Remote Monitoring (RMON) family of applications for monitoring of application QoS in real time, and an extensible data model with objects carried between RAQMON data sources and RAQMON collectors. The RAQMON work is more generic, and complementary in concept to RTCP-XR, covering a wider range of applications running concurrently, while RTCP-XR focuses on in-depth QoS monitoring of media traffic in VoIP.

The Real-time Application QoS Monitoring (RAQMON) MIB is defined by [xxx] and runs on RAQMON collectors. A performance monitoring application may query (i) RAQMON collectors for RAQMON MIB information about the QoS parameters of multiple concurrent applications (ii) end-points and gateways for in-depth RTCP-XR information about the media QoS of VoIP or (iii) both.

2.5 The Structure of the RTCP XR MIB

There are three tables in the RTCP XR MIB

The `rtcpXrBasicParametersTable` contains basic packet loss, discard and delay related parameters about a session.

The `rtcpXrVoiceQualityMetricsTable` contains information about the call quality of a session

The `rtcpXrHistoryTable` contains aggregate information about a group of sessions.

2.6 Application to multi-party and multicast calls

The RTCP XR MIB may be applied to multi-party calls. The RTP MIB Session table is defined in terms of uni-directional RTP streams from a source to a destination.

For a multi-party IP-IP conference call in which parties are directly interconnected in a mesh network, a row should be created in the session table for each such interconnection.

For a multi-party call in which parties are interconnected via a bridge function and RTP streams are literally or logically terminated at the bridge, a row should be created in the session table for the RTP sessions established to and from each endpoint and the bridge.

For a multicast call in which RTP sessions are terminated in logical IP addresses from they are redistributed, a row in the session table should be created for the source to multicast address RTP session.

```

RTCPXR-MIB DEFINITIONS ::= BEGIN
IMPORTS
    mib-2, MODULE-IDENTITY, NOTIFICATION-TYPE,
    OBJECT-TYPE, Unsigned32, Integer32,
    Gauge32, Counter32                               FROM SNMPv2-SMI
    OBJECT-GROUP, MODULE-COMPLIANCE,
    NOTIFICATION-GROUP                               FROM SNMPv2-CONF
    TEXTUAL-CONVENTION, RowPointer, DateAndTime
                                                    FROM SNMPv2-TC
    SnmpAdminString                                 FROM SNMP-FRAMEWORK-MIB
    ItuPerceivedSeverity                           FROM ITU-ALARM-TC-MIB
    rtpSessionIndex, rtpSessionCallStatus
                                                    FROM RTP-MIBV2;

rtcpXrMIB MODULE-IDENTITY
    LAST-UPDATED "200603040000Z"
    ORGANIZATION
        "IETF AVT Working Group"
    CONTACT-INFO
        "IETF AVT Working Group
        Chairs: Colin Perkins, Magnus Westerlund
        Working Group Email:  avt@ietf.org

        Editors: Alan Clark
                 Telchemy
                 Email: alan@telchemy.com

                 Amy Pendleton
                 Nortel
                 Email: aspen@nortel.com"
    DESCRIPTION
        "RTCP Extended Reports MIB
        Copyright (c) The Internet Society (2005)
        This version of the MIB module is part of
        RFC nnnn and is based on RFC3611."

    REVISION      "200603040000Z"
    DESCRIPTION   "Published as draft-ietf-avt-rtcp-xr-mib-04.txt"

-- RFC Ed: replace above draft with RFC number and remove this note

::= { mib-2 nnn }

-- IANA: need assignment of a mib-2 OID for this MIB
-- RFC Ed: replace mmm with assigned OID number and remove this note

```

```
--
-- RTCP Extended Reports - Voice over IP Metrics
--
-- Description
--   This MIB module provides basic voice quality monitoring
--   capabilities for Voice-over-packet systems. The MIB contains
--   3 tables of information that augment the data available in
--   the RTP MIB V2.
--       a table of basic parameters for each Stream
--       a table of call quality metrics for each Stream
--       a table of aggregate statistics for groups of calls
--   the indexes to these tables are imported from the RTP MIB V2
--   and hence this MIB MUST be used in conjunction with at least
--   the RTP session table from that MIB

-- TEXTUAL CONVENTIONS

LeveldB ::= TEXTUAL-CONVENTION
DISPLAY-HINT "d"
STATUS    current
DESCRIPTION
    "Represents a signal level in decibels (dB)."
```

```
SYNTAX    Integer32 (-120..120|127)

Rfactor ::= TEXTUAL-CONVENTION
DISPLAY-HINT "d"
STATUS    current
DESCRIPTION
    "Call or transmission quality expressed as an
    R factor in the range 0 to 120. A value of
    127 shall be interpreted as NULL or unsupported."
```

```
REFERENCE
    "ITU-T G.107"
SYNTAX    Unsigned32 (0..120|127)

ScaledMOSscore ::= TEXTUAL-CONVENTION
DISPLAY-HINT "d"
STATUS    current
DESCRIPTION
    "Call or transmission quality expressed as a
    MOS score scaled by 10. MOS is typically represented
    as a 1.0 to 5.0 score with a single decimal place and
    hence in this representation as 10 to 50. A value of
    127 shall be interpreted as NULL or unsupported."
```

```
REFERENCE
    "ITU-T P.800"
SYNTAX    Integer32 (10..50|127)

Percentage ::= TEXTUAL-CONVENTION
DISPLAY-HINT "d"
STATUS    current
DESCRIPTION
    "Percentage expressed as a rounded integer."
```

```
SYNTAX    Unsigned32 (0..100)
```

--

-- OBJECTS

--

```
rtcpXrEvents      OBJECT IDENTIFIER ::= { rtcpXrMIB 0 }
rtcpXrMIBObjects  OBJECT IDENTIFIER ::= { rtcpXrMIB 1 }
rtcpXrConformance OBJECT IDENTIFIER ::= { rtcpXrMIB 2 }
```

--

-- Table of basic RTP stream parameters

--

```
rtcpXrBaseParamTable OBJECT-TYPE
    SYNTAX SEQUENCE OF RtcpXrBaseParamEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "Table of basic parameters related to RTP sessions in
        the Session table. "
    ::= { rtcpXrMIBObjects 2 }
```

```
rtcpXrBaseParamEntry OBJECT-TYPE
    SYNTAX RtcpXrBaseParamEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "An entry in the table of basic parameters. A row in this table
        is created for each RTP session endpoint participating."
    INDEX { rtpSessionCallStatus, rtpSessionIndex }
    ::= { rtcpXrBaseParamTable 1 }
```

```
RtcpXrBaseParamEntry ::= SEQUENCE {
    rtcpXrBaseParamCodecType          OCTET STRING,
    rtcpXrBaseParamCodecBitRate       Unsigned32,
    rtcpXrBaseParamFrameDuration      Unsigned32,
    rtcpXrBaseParamFramesPerPacket    Unsigned32,
    rtcpXrBaseParamSampleRate         Unsigned32,
    rtcpXrBaseParamDurationMs         Counter32,
    rtcpXrBaseParamNetworkLossRate    Percentage,
    rtcpXrBaseParamAvgDiscardRate     Percentage,
    rtcpXrBaseParamBurstLossDensity   Percentage,
    rtcpXrBaseParamBurstLenMs         Gauge32,
    rtcpXrBaseParamGapLossDensity     Percentage,
    rtcpXrBaseParamGapLenMs           Gauge32,
    rtcpXrBaseParamAvgOWDelay          Gauge32,
    rtcpXrBaseParamAvgEndSysDelay     Gauge32,
    rtcpXrBaseParamNoiseLeveldB       LeveldB,
    rtcpXrBaseParamSignalLeveldB      LeveldB,
    rtcpXrBaseParamLocalRERLdB        LeveldB,
    rtcpXrBaseParamRemoteRERLdB       LeveldB,
    rtcpXrBaseParamPlcType             INTEGER,
    rtcpXrBaseParamJBuffAdaptMode      INTEGER,
    rtcpXrBaseParamJBuffAdaptRate     Unsigned32,
    rtcpXrBaseParamJBuffAverageDelay  Gauge32,
```

```

    rtcpXrBaseParamJBuffMaximumDelay      Gauge32,
    rtcpXrBaseParamJBuffAbsMaxDelay      Gauge32,
    rtcpXrBaseParamJitterLevel           Gauge32
}

rtcpXrBaseParamCodecType OBJECT-TYPE
    SYNTAX OCTET STRING (SIZE(0..32))
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Codec type used on this call. The format used shall be
        ITU-T G.7xx, GSM FR, GSM EFR, GSM HR, AMR, AMR WB, iLBC
        or similar. For example 'ITU G.729A'. It is recommended
        that Codecs are described in consistently with SDP."
    ::= { rtcpXrBaseParamEntry 1 }

rtcpXrBaseParamCodecBitRate OBJECT-TYPE
    SYNTAX Unsigned32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Codec rate in use at the time this data was captured
        expressed in bits per second. For example G.711 would
        have the rate 64000 and G.729 would have the rate 8000."
    ::= { rtcpXrBaseParamEntry 2 }

rtcpXrBaseParamFrameDuration OBJECT-TYPE
    SYNTAX Unsigned32 (0..16384)
    UNITS "sample clock ticks"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Companion information to Codec type. This represents the
        duration of the time interval represented by a frame, which
        is generally equivalent to the nominal spacing of frames.
        This is expressed in sample clock ticks as defined under
        rtxpXrSampleRate.
        This parameter may be equated to the SDP ptime parameter
        which is expressed in milliseconds (however which cannot
        represent certain Codec types, e.g. those with 2.5mS
        frames)."
    ::= { rtcpXrBaseParamEntry 3 }

rtcpXrBaseParamFramesPerPacket OBJECT-TYPE
    SYNTAX Unsigned32 (0..65535)
    UNITS "frames per packet"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Number of Codec frames contained in a single IP packet in
        this RTP stream at the time of sampling. The duration of
        speech per IP packet is the product of Frame Duration and
        Frames Per Packet. This may vary during a call."
    ::= { rtcpXrBaseParamEntry 4 }

```

```
rtcpXrBaseParamSampleRate OBJECT-TYPE
    SYNTAX Unsigned32 (0..16777215)
    UNITS "samples per second"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Companion information to Codec type. This represents the
         rate at which media was sampled (e.g. 8000 for narrowband
         voice, 16000 for wideband voice)."
```

```
 ::= { rtcpXrBaseParamEntry 5 }
```

```
rtcpXrBaseParamDurationMs OBJECT-TYPE
    SYNTAX Counter32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Current duration of call in milliseconds if still active,
         duration of call in milliseconds if complete."
```

```
 ::= { rtcpXrBaseParamEntry 6 }
```

```
rtcpXrBaseParamNetworkLossRate OBJECT-TYPE
    SYNTAX Percentage
    UNITS "percent"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Average rate of network packet loss."
```

```
 REFERENCE
        "See RFC3611 Section 4.7."
```

```
 ::= { rtcpXrBaseParamEntry 7 }
```

```
rtcpXrBaseParamAvgDiscardRate OBJECT-TYPE
    SYNTAX Percentage
    UNITS "percent"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Average rate of discards due to jitter."
```

```
 REFERENCE
        "See RFC3611 Section 4.7."
```

```
 ::= { rtcpXrBaseParamEntry 8 }
```

```
rtcpXrBaseParamBurstLossDensity OBJECT-TYPE
    SYNTAX Percentage
    UNITS "percent"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Density of loss and discarded packets during burst periods."
```

```
 REFERENCE
        "See RFC3611 Section 4.7."
```

```
 ::= { rtcpXrBaseParamEntry 9 }
```

```
rtcpXrBaseParamBurstLenMs OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Average length of bursts in milliseconds."
    REFERENCE
        "See RFC3611 Section 4.7."
    ::= { rtcpXrBaseParamEntry 10 }

rtcpXrBaseParamGapLossDensity OBJECT-TYPE
    SYNTAX Percentage
    UNITS "percent"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Density of loss and discarded packets during gap periods."
    REFERENCE
        "See RFC3611 Section 4.7."
    ::= { rtcpXrBaseParamEntry 11 }

rtcpXrBaseParamGapLenMs OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Average length of gaps in milliseconds."
    REFERENCE
        "See RFC3611 Section 4.7."
    ::= { rtcpXrBaseParamEntry 12 }

rtcpXrBaseParamAvgOWDelay OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Average (symmetric) one way RTCP delay on call. A value of
        zero indicates that this value has not yet been determined."
    REFERENCE
        "See RFC3611 Section 4.7."
    ::= { rtcpXrBaseParamEntry 13 }

rtcpXrBaseParamAvgEndSysDelay OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Average end system delay on call. A value of zero may
        indicate that this value has not yet been determined."
```

REFERENCE

"See RFC3611 Section 4.7."
 ::= { rtcpXrBaseParamEntry 14 }

rtcpXrBaseParamNoiseLeveldBm OBJECT-TYPE

SYNTAX LeveldB

UNITS "dBm0"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Measured received silent period noise level in dBm.
A value of 127 indicates that this parameter is not available.

In midpoint applications this parameter may not be available. If this is a midstream device and call quality metrics were calculated using the value of this parameter reported from the endpoint in an RTCP XR payload then the value used in this calculation MAY be reported."

REFERENCE

"See RFC3611 Section 4.7."
 ::= { rtcpXrBaseParamEntry 15 }

rtcpXrBaseParamSignalLeveldBm OBJECT-TYPE

SYNTAX LeveldB

UNITS "dBm0"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Measured received signal level during talkspurts in dBm.
A value of 127 indicates that this parameter is not available.

In midpoint applications this parameter may not be available. If this is a midstream device and call quality metrics were calculated using the value of this parameter reported from the endpoint in an RTCP XR payload then the value used in this calculation MAY be reported."

REFERENCE

"See RFC3611 Section 4.7."
 ::= { rtcpXrBaseParamEntry 16 }

rtcpXrBaseParamLocalRERLdB OBJECT-TYPE

SYNTAX LeveldB

UNITS "dBm"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Residual Echo Return Loss measured at this endpoint, or at the terminating endpoint of this RTP session. This relates to the echo level from the network beyond the terminating endpoint and may be interpreted as either line echo in the case of a gateway or acoustic echo in the case of a handset.

Note that this echo affects conversational quality as perceived by the user at the originating end of this RTP session.

A value of 127 indicates that this parameter is not available.

In midpoint applications this parameter may not be available. If this is a midstream device and call quality metrics were calculated using the value of this parameter reported from the endpoint in an RTCP XR payload then the value used in this calculation MAY be reported."

REFERENCE

"See RFC3611 Section 4.7."

::= { rtcpXrBaseParamEntry 17 }

rtcpXrBaseParamRemoterERERLdB OBJECT-TYPE

SYNTAX LeveldB

UNITS "dBm"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Residual Echo Return Loss measured at originating endpoint of this RTP session (i.e. the remote endpoint if this MIB is implemented in an endpoint).

Note that this affects the conversational quality metrics reported by the terminating (this) endpoint, hence is useful in understanding what has affected the reported call quality metrics

A value of 127 indicates that this parameter is not available.

In midpoint applications this parameter may not be available. If this is a midstream device and call quality metrics were calculated using the value of this parameter reported from the endpoint in an RTCP XR payload then the value used in this calculation MAY be reported."

REFERENCE

"See RFC3611 Section 4.7."

::= { rtcpXrBaseParamEntry 18 }

rtcpXrBaseParamPlcType OBJECT-TYPE

SYNTAX INTEGER { disabled(1),
enhanced(2),
standard(3),
unspecified (4)}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Defines type of packet loss concealment used on this call."

REFERENCE

"See RFC3611 Section 4.7."

::= { rtcpXrBaseParamEntry 19 }

```
rtcpXrBaseParamJBuffAdaptMode OBJECT-TYPE
    SYNTAX INTEGER { reserved (1),
                    nonAdaptive (2),
                    adaptive (3),
                    unknown (4) }
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Defines if jitter buffer is in fixed or adaptive mode."
    REFERENCE
        "See RFC3611 Section 4.7."
    ::= { rtcpXrBaseParamEntry 20 }

rtcpXrBaseParamJBuffAdaptRate OBJECT-TYPE
    SYNTAX Unsigned32 (0..15)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Estimated adaptation rate of jitter buffer."
    REFERENCE
        "See RFC3611 Section 4.7."
    ::= { rtcpXrBaseParamEntry 21 }

rtcpXrBaseParamJBuffAverageDelay OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Average size of jitter buffer in mS."
    REFERENCE
        "See RFC3611 Section 4.7."
    ::= { rtcpXrBaseParamEntry 22 }

rtcpXrBaseParamJBuffMaximumDelay OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Maximum delay through jitter buffer at current size in mS."
    REFERENCE
        "See RFC3611 Section 4.7."
    ::= { rtcpXrBaseParamEntry 23 }

rtcpXrBaseParamJBuffAbsMaxDelay OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Absolute maximum size jitter buffer can reach in mS."
```

REFERENCE

"See RFC3611 Section 4.7."
 ::= { rtcpXrBaseParamEntry 24 }

rtcpXrBaseParamJitterLevel OBJECT-TYPE

SYNTAX Gauge32

UNITS "milliseconds"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Average jitter level measured according to RFC3550 and
 represented in terms of milliseconds."

REFERENCE

"See RFC3550 Section 6.4."
 ::= { rtcpXrBaseParamEntry 25 }

--

-- Table of Call Quality Metrics

--

rtcpXrCallQualityTable OBJECT-TYPE

SYNTAX SEQUENCE OF RtcpXrCallQualityEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Table of voice quality metrics. A row is created
 in this table for each row in the Session table."

::= { rtcpXrMIBObjects 3 }

rtcpXrCallQualityEntry OBJECT-TYPE

SYNTAX RtcpXrCallQualityEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in the table of voice quality metrics. A row in
 this table is created for each row in the Session
 table."

INDEX { rtpSessionCallStatus, rtpSessionIndex }

::= { rtcpXrCallQualityTable 1 }

RtcpXrCallQualityEntry ::= SEQUENCE {

rtcpXrCallQualityRCQ

Rfactor,

rtcpXrCallQualityRLQ

Rfactor,

rtcpXrCallQualityExternalRCQ

Rfactor,

rtcpXrCallQualityMOSLQ

ScaledMOSscore,

rtcpXrCallQualityRLQestAlgorithm

ScaledMOSscore,

rtcpXrCallQualityRCQestAlgorithm

OCTET STRING,

rtcpXrCallQualityMOSLQestAlgorithm

OCTET STRING,

rtcpXrCallQualityMOSLQestAlgorithm

OCTET STRING,

rtcpXrCallQualityMOSLQestAlgorithm

OCTET STRING

}

```
rtcpXrCallQualityRCQ OBJECT-TYPE
    SYNTAX Rfactor
    UNITS "R factor"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Conversational quality R factor for this call. This value
        SHOULD be calculated using ITU G.107 (The E Model) or
        extended versions thereof."
    REFERENCE
        "See RFC3611 Section 4.7."
    ::= { rtcpXrCallQualityEntry 1 }

rtcpXrCallQualityRLQ OBJECT-TYPE
    SYNTAX Rfactor
    UNITS "R factor"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Listening quality R factor for this call. This value
        SHOULD be calculated using ITU G.107 (The E Model) or
        extended versions thereof."
    ::= { rtcpXrCallQualityEntry 2 }

rtcpXrCallQualityExternalRCQ OBJECT-TYPE
    SYNTAX Rfactor
    UNITS "R factor"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "External R factor for this call. This value
        SHOULD be calculated using ITU G.107 (The E Model) or
        extended versions thereof.
        The External R factor relates to the quality of an
        incoming voice from another network segment. For example
        if a conference bridge terminates and re-creates voice
        streams then an R factor would be calculated at the bridge
        for the endpoint A to bridge segment and relayed to the
        subsequent bridge to endpoint B as an External R factor.
        This allows endpoint B to estimate the end-to-end call
        quality."
    ::= { rtcpXrCallQualityEntry 3 }

rtcpXrCallQualityMOS CQ OBJECT-TYPE
    SYNTAX ScaledMOSscore
    UNITS "MOS x 10"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Estimated conversational quality MOS for this call
        expressed in MOS x 10 (e.g. 41 = MOS of 4.1). This value
        MAY be calculated by converting the R-CQ value to a MOS."
```

REFERENCE

"See RFC3611 Section 4.7."
 ::= { rtcpXrCallQualityEntry 4 }

rtcpXrCallQualityMOSLQ OBJECT-TYPE

SYNTAX ScaledMOSscore

UNITS "MOS x 10"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Estimated listening quality MOS for this call
expressed in MOS x 10 (e.g. 41 = MOS of 4.1). This value
MAY be calculated by converting the R-CQ value to a MOS."

REFERENCE

"See RFC3611 Section 4.7."
 ::= { rtcpXrCallQualityEntry 5 }

rtcpXrCallQualityRLQestAlgorithm OBJECT-TYPE

SYNTAX OCTET STRING (SIZE(0..128))

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Call quality algorithm used to determine R-LQ factors.
For example, 'ITU-T G.107' for the ITU G.107
E model or 'ETSI TS101329-5E' for ETSI
TS 101 329-5 Annex E."
 ::= { rtcpXrCallQualityEntry 6 }

rtcpXrCallQualityRCQestAlgorithm OBJECT-TYPE

SYNTAX OCTET STRING (SIZE(0..128))

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Call quality algorithm used to determine R-CQ factors.
For example, 'ITU-T G.107' for the ITU G.107
E model or 'ETSI TS101329-5E' for ETSI
TS 101 329-5 Annex E."
 ::= { rtcpXrCallQualityEntry 7 }

rtcpXrCallQualityMOSLQestAlgorithm OBJECT-TYPE

SYNTAX OCTET STRING (SIZE(0..128))

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Call quality algorithm used to determine MOS-LQ scores.
If any localized parameter scaling is used
(for example Japan's TTC MOS scaling) then this
MUST also be reported."
 ::= { rtcpXrCallQualityEntry 8 }

```

rtcpXrCallQualityMOSQEstAlgorithm OBJECT-TYPE
    SYNTAX OCTET STRING (SIZE(0..128))
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Call quality algorithm used to determine MOS-CQ scores.
        If any localized parameter scaling is used
        (for example Japan's TTC MOS scaling) then this
        MUST also be reported."
    ::= { rtcpXrCallQualityEntry 9 }

```

```

--
-- History Table
--
--

```

```

rtcpXrHistoryTable OBJECT-TYPE
    SYNTAX SEQUENCE OF RtcpXrHistoryEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "Table of aggregate measurement data for groups
        of RTP sessions. A group may be a flow or any
        other logical association of streams."
    ::= { rtcpXrMIBObjects 4 }

```

```

rtcpXrHistoryEntry OBJECT-TYPE
    SYNTAX RtcpXrHistoryEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "An entry in the table of call history records."
    INDEX { rtcpXrHistoryIndex }
    ::= { rtcpXrHistoryTable 1 }

```

```

RtcpXrHistoryEntry ::= SEQUENCE {
    rtcpXrHistoryIndex                Unsigned32,
    rtcpXrHistoryGroupName            OCTET STRING,
    rtcpXrHistoryStartTime            DateAndTime,
    rtcpXrHistoryStopTime            DateAndTime,
    rtcpXrHistoryNumOfSessions        Counter32,
    rtcpXrHistoryMinDurationMs        Gauge32,
    rtcpXrHistoryMaxDurationMs        Gauge32,
    rtcpXrHistoryAvgDurationMs        Gauge32,
    rtcpXrHistoryMaxNetworkLossRate   Percentage,
    rtcpXrHistoryAvgNetworkLossRate   Percentage,
    rtcpXrHistoryMaxDiscardRate        Percentage,
    rtcpXrHistoryAvgDiscardRate        Percentage,
    rtcpXrHistoryMaxBurstLossDensity   Percentage,
    rtcpXrHistoryAvgBurstLossDensity   Percentage,
    rtcpXrHistoryMinBurstLenMs        Gauge32,
    rtcpXrHistoryMaxBurstLenMs        Gauge32,
    rtcpXrHistoryAvgBurstLenMs        Gauge32,
    rtcpXrHistoryMaxGapLossDensity     Percentage,

```

```

rtcpXrHistoryAvgGapLossDensity      Percentage,
rtcpXrHistoryMinGapLenMs            Gauge32,
rtcpXrHistoryMaxGapLenMs            Gauge32,
rtcpXrHistoryAvgGapLenMs            Gauge32,
rtcpXrHistoryMinOneWayDelay          Gauge32,
rtcpXrHistoryMaxOneWayDelay          Gauge32,
rtcpXrHistoryAvgOneWayDelay          Gauge32,
rtcpXrHistoryOneWayDelayCount        Counter32,
rtcpXrHistoryMinEndSystemDelay       Gauge32,
rtcpXrHistoryMaxEndSystemDelay       Gauge32,
rtcpXrHistoryAvgEndSystemDelay       Gauge32,
rtcpXrHistoryEndSystemDelayCount     Counter32,
rtcpXrHistoryMinJitterLevel          Gauge32,
rtcpXrHistoryMaxJitterLevel          Gauge32,
rtcpXrHistoryAvgJitterLevel          Gauge32,
rtcpXrHistoryMinNoiseLeveldBm        LeveldB,
rtcpXrHistoryMaxNoiseLeveldBm        LeveldB,
rtcpXrHistoryAvgNoiseLeveldBm        LeveldB,
rtcpXrHistoryNoiseLevelCount         Counter32,
rtcpXrHistoryMinSignalLeveldBm       LeveldB,
rtcpXrHistoryMaxSignalLeveldBm       LeveldB,
rtcpXrHistoryAvgSignalLeveldBm       LeveldB,
rtcpXrHistorySignalLevelCount        Counter32,
rtcpXrHistoryMinLocalRERLdB          LeveldB,
rtcpXrHistoryMaxLocalRERLdB          LeveldB,
rtcpXrHistoryAvgLocalRERLdB          LeveldB,
rtcpXrHistoryLocalRERLCount          Counter32,
rtcpXrHistoryMinRemoteRERLdB         LeveldB,
rtcpXrHistoryMaxRemoteRERLdB         LeveldB,
rtcpXrHistoryAvgRemoteRERLdB         LeveldB,
rtcpXrHistoryRemoteRERLCount         Counter32,
rtcpXrHistoryMinRCQ                  Rfactor,
rtcpXrHistoryMaxRCQ                  Rfactor,
rtcpXrHistoryAvgRCQ                  Rfactor,
rtcpXrHistoryRCQCount                Counter32,
rtcpXrHistoryMinRLQ                  Rfactor,
rtcpXrHistoryMaxRLQ                  Rfactor,
rtcpXrHistoryAvgRLQ                  Rfactor,
rtcpXrHistoryRLQCount                Counter32,
rtcpXrHistoryMinMOSCQ                ScaledMOSscore,
rtcpXrHistoryMaxMOSCQ                ScaledMOSscore,
rtcpXrHistoryAvgMOSCQ                ScaledMOSscore,
rtcpXrHistoryMOSCQCount              Counter32,
rtcpXrHistoryMinMOSLQ                ScaledMOSscore,
rtcpXrHistoryMaxMOSLQ                ScaledMOSscore,
rtcpXrHistoryAvgMOSLQ                ScaledMOSscore,
rtcpXrHistoryMOSLQCount              Counter32,
rtcpXrHistoryCQAlgorithm              OCTET STRING,
rtcpXrHistoryReset                    INTEGER
}

```

```
rtcpXrHistoryIndex OBJECT-TYPE
    SYNTAX Unsigned32 (0..4294967295)
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "Index for this set of aggregate data."
    ::= { rtcpXrHistoryEntry 1 }

rtcpXrHistoryGroupName OBJECT-TYPE
    SYNTAX OCTET STRING (SIZE(0..128))
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "Name of this set of aggregate data. Examples may include
        a flow, an interface or some other logical grouping of
        RTP sessions."
    ::= { rtcpXrHistoryEntry 2 }

rtcpXrHistoryStartTime OBJECT-TYPE
    SYNTAX DateAndTime
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Time at which this history was reset or started."
    ::= {rtcpXrHistoryEntry 3 }

rtcpXrHistoryStopTime OBJECT-TYPE
    SYNTAX DateAndTime
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Time at which this history was stopped."
    ::= {rtcpXrHistoryEntry 4 }

rtcpXrHistoryNumOfSessions OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Number of calls included in this history."
    ::= {rtcpXrHistoryEntry 5 }

rtcpXrHistoryMinDurationMs OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Minimum duration of calls."
    ::= {rtcpXrHistoryEntry 6 }
```

```
rtcpXrHistoryMaxDurationMs OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Maximum duration of calls."
    ::= {rtcpXrHistoryEntry 7 }

rtcpXrHistoryAvgDurationMs OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Average duration of calls within this history."
    ::= {rtcpXrHistoryEntry 8 }

rtcpXrHistoryMaxNetworkLossRate OBJECT-TYPE
    SYNTAX Percentage
    UNITS "percent"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Maximum loss rate occurring on any call in this history."
    ::= {rtcpXrHistoryEntry 9 }

rtcpXrHistoryAvgNetworkLossRate OBJECT-TYPE
    SYNTAX Percentage
    UNITS "percent"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Mean for all calls in this history of the individual
         per call packet loss rate."
    ::= {rtcpXrHistoryEntry 10 }

rtcpXrHistoryMaxDiscardRate OBJECT-TYPE
    SYNTAX Percentage
    UNITS "percent"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Maximum discard rate occurring on any call in this history."
    ::= {rtcpXrHistoryEntry 11 }
```

```
rtcpXrHistoryAvgDiscardRate OBJECT-TYPE
    SYNTAX Percentage
    UNITS "percent"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Mean for all calls in this history of the individual
        per call packet discard rate."
    ::= {rtcpXrHistoryEntry 12 }

rtcpXrHistoryMaxBurstLossDensity OBJECT-TYPE
    SYNTAX Percentage
    UNITS "percent"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Maximum of the per-call average burst densities for any
        call in this history. A value of 0 shall be reported if
        no bursts were reported."
    ::= {rtcpXrHistoryEntry 13 }

rtcpXrHistoryAvgBurstLossDensity OBJECT-TYPE
    SYNTAX Percentage
    UNITS "percent"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Mean for all calls in this history of the individual
        per call burst density. A value of 0 shall be reported if
        no bursts were reported."
    ::= {rtcpXrHistoryEntry 14 }

rtcpXrHistoryMinBurstLenMs OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Minimum of the per-call burst length for all calls in this
        history for which a burst length was reported. A value of
        0 shall be reported if no bursts were present."
    ::= {rtcpXrHistoryEntry 15 }

rtcpXrHistoryMaxBurstLenMs OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Maximum of the per-call burst length for all calls in this
        history for which a burst length was reported. A value of
        0 shall be reported if no bursts were present."
    ::= {rtcpXrHistoryEntry 16 }
```

rtcpXrHistoryAvgBurstLenMs OBJECT-TYPE

SYNTAX Gauge32

UNITS "milliseconds"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Mean of the per-call burst length for all calls in this history for which a burst length was reported. A value of 0 shall be reported if no bursts were present."

::= {rtcpXrHistoryEntry 17 }

rtcpXrHistoryMaxGapLossDensity OBJECT-TYPE

SYNTAX Percentage

UNITS "percent"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Maximum of the per-call gap density for all calls in this history for which a gap density was reported. A value of 0 shall be reported if no gaps were present."

::= {rtcpXrHistoryEntry 18 }

rtcpXrHistoryAvgGapLossDensity OBJECT-TYPE

SYNTAX Percentage

UNITS "percent"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Mean of the per-call gap density for all calls in this history for which a gap density was reported. A value of 0 shall be reported if no gaps were present."

::= {rtcpXrHistoryEntry 19 }

rtcpXrHistoryMinGapLenMs OBJECT-TYPE

SYNTAX Gauge32

UNITS "milliseconds"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Minimum of the per-call gap length for all calls in this history for which a gap length was reported. A value of 0 shall be reported if no gaps were present."

::= {rtcpXrHistoryEntry 20 }

```
rtcpXrHistoryMaxGapLenMs OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Maximum of the per-call gap length for all calls in this
        history for which a gap length was reported. A value of
        0 shall be reported if no gaps were present."
    ::= {rtcpXrHistoryEntry 21 }

rtcpXrHistoryAvgGapLenMs OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Mean of the per-call gap length for all calls in this
        history for which a gap length was reported. A value of
        0 shall be reported if no gaps were present."
    ::= {rtcpXrHistoryEntry 22 }

rtcpXrHistoryMinOneWayDelay OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Minimum of the per-call OW Delays for all calls in this
        history for which a Delay was reported. A value of
        0 shall be reported if no Delay values were reported."
    ::= {rtcpXrHistoryEntry 23 }

rtcpXrHistoryMaxOneWayDelay OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Maximum of the per-call OW Delays for all calls in this
        history for which a Delay was reported. A value of
        0 shall be reported if no Delay values were reported."
    ::= {rtcpXrHistoryEntry 24 }

rtcpXrHistoryAvgOneWayDelay OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Mean of the per-call OW Delays for all calls in this
        history for which a Delay was reported. A value of
        0 shall be reported if no Delay values were reported."
    ::= {rtcpXrHistoryEntry 25 }
```

```
rtcpXrHistoryOneWayDelayCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Number of sessions included in the One Way Delay
        history values (as Delay may not be available on
        all calls."
    ::= {rtcpXrHistoryEntry 26 }

rtcpXrHistoryMinEndSystemDelay OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Minimum of the per-call ES Delays for all calls in this
        history for which an ES Delay was reported."
    ::= {rtcpXrHistoryEntry 27 }

rtcpXrHistoryMaxEndSystemDelay OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Maximum of the per-call ES Delays for all calls in this
        history for which an ES Delay was reported."
    ::= {rtcpXrHistoryEntry 28 }

rtcpXrHistoryAvgEndSystemDelay OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Mean of the per-call ES Delays for all calls in this
        history for which an ES Delay was reported."
    ::= {rtcpXrHistoryEntry 29 }

rtcpXrHistoryEndSystemDelayCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Number of sessions included in the End System
        Delay history values (as End System Delay
        may not be available on all calls."
    ::= {rtcpXrHistoryEntry 30 }
```

```
rtcpXrHistoryMinJitterLevel OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Minimum of the per-call jitter for all calls in this
         history for which a jitter value was reported."
    ::= {rtcpXrHistoryEntry 31 }

rtcpXrHistoryMaxJitterLevel OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Maximum of the per-call jitter for all calls in this
         history for which a jitter value was reported."
    ::= {rtcpXrHistoryEntry 32 }

rtcpXrHistoryAvgJitterLevel OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "milliseconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Mean of the per-call jitter for all calls in this
         history for which a jitter value was reported."
    ::= {rtcpXrHistoryEntry 33 }

rtcpXrHistoryMinNoiseLeveldBm OBJECT-TYPE
    SYNTAX LeveldB
    UNITS "dBm0"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Minimum of the per-call Noise Level for all calls in this
         history for which a Noise Level value was reported."
    ::= {rtcpXrHistoryEntry 34 }

rtcpXrHistoryMaxNoiseLeveldBm OBJECT-TYPE
    SYNTAX LeveldB
    UNITS "dBm0"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Maximum of the per-call Noise Level for all calls in this
         history for which a Noise Level value was reported."
    ::= {rtcpXrHistoryEntry 35 }
```

```
rtcpXrHistoryAvgNoiseLeveldBm OBJECT-TYPE
    SYNTAX LeveldB
    UNITS "dBm0"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Mean of the per-call Noise Level for all calls in this
        history for which a Noise Level value was reported."
    ::= {rtcpXrHistoryEntry 36 }

rtcpXrHistoryNoiseLevelCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Number of sessions included in the Noise Level
        history values (as Noise Level is an optional
        parameter and may not be present on all calls."
    ::= {rtcpXrHistoryEntry 37 }

rtcpXrHistoryMinSignalLeveldBm OBJECT-TYPE
    SYNTAX LeveldB
    UNITS "dBm0"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Minimum of the per-call Signal Level for all calls in this
        history for which a Signal Level value was reported."
    ::= {rtcpXrHistoryEntry 38 }

rtcpXrHistoryMaxSignalLeveldBm OBJECT-TYPE
    SYNTAX LeveldB
    UNITS "dBm0"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Maximum of the per-call Signal Level for all calls in this
        history for which a Signal Level value was reported."
    ::= {rtcpXrHistoryEntry 39 }

rtcpXrHistoryAvgSignalLeveldBm OBJECT-TYPE
    SYNTAX LeveldB
    UNITS "dBm0"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Mean of the per-call Signal Level for all calls in this
        history for which a Signal Level value was reported."
    ::= {rtcpXrHistoryEntry 40 }
```

```
rtcpXrHistorySignalLevelCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Number of sessions included in the Signal Level
        history values (as Signal Level is an optional
        parameter and may not be present on all calls."
    ::= {rtcpXrHistoryEntry 41 }

rtcpXrHistoryMinLocalRERLdB OBJECT-TYPE
    SYNTAX LeveldB
    UNITS "dBm"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Minimum of the per-call local RERL for all calls in this
        history for which a local RERL value was reported."
    ::= {rtcpXrHistoryEntry 42 }

rtcpXrHistoryMaxLocalRERLdB OBJECT-TYPE
    SYNTAX LeveldB
    UNITS "dBm"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Maximum of the per-call local RERL for all calls in this
        history for which a local RERL value was reported."
    ::= {rtcpXrHistoryEntry 43 }

rtcpXrHistoryAvgLocalRERLdB OBJECT-TYPE
    SYNTAX LeveldB
    UNITS "dBm"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Mean of the per-call local RERL for all calls in this
        history for which a local RERL value was reported."
    ::= {rtcpXrHistoryEntry 44 }

rtcpXrHistoryLocalRERLCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Number of sessions included in the Local RERL
        history values (as Local RERL is an optional
        parameter and may not be present on all calls."
    ::= {rtcpXrHistoryEntry 45 }
```

```
rtcpXrHistoryMinRemoteRERLdB OBJECT-TYPE
    SYNTAX LeveldB
    UNITS "dBm"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Minimum of the per-call remote RERL for all calls in this
        history for which a remote RERL value was reported."
    ::= {rtcpXrHistoryEntry 46 }

rtcpXrHistoryMaxRemoteRERLdB OBJECT-TYPE
    SYNTAX LeveldB
    UNITS "dBm"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Maximum of the per-call remote RERL for all calls in this
        history for which a remote RERL value was reported."
    ::= {rtcpXrHistoryEntry 47 }

rtcpXrHistoryAvgRemoteRERLdB OBJECT-TYPE
    SYNTAX LeveldB
    UNITS "dBm"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Mean of the per-call remote RERL for all calls in this
        history for which a remote RERL value was reported."
    ::= {rtcpXrHistoryEntry 48 }

rtcpXrHistoryRemoteRERLCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Number of sessions included in the Remote RERL
        history values (as Remote RERL is an optional
        parameter and may not be present on all calls)."
    ::= {rtcpXrHistoryEntry 49 }

rtcpXrHistoryMinRCQ OBJECT-TYPE
    SYNTAX Rfactor
    UNITS "R factor"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Minimum of the per-call R-CQ for all calls in this
        history for which an R-CQ value was reported."
    ::= {rtcpXrHistoryEntry 50 }
```

```
rtcpXrHistoryMaxRCQ OBJECT-TYPE
    SYNTAX Rfactor
    UNITS "R factor"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Maximum of the per-call R-CQ for all calls in this
        history for which an R-CQ value was reported."
    ::= {rtcpXrHistoryEntry 51 }
```

```
rtcpXrHistoryAvgRCQ OBJECT-TYPE
    SYNTAX Rfactor
    UNITS "R factor"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Mean of the per-call R-CQ for all calls in this
        history for which an R-CQ value was reported."
    ::= {rtcpXrHistoryEntry 52 }
```

```
rtcpXrHistoryRCQCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Number of sessions included in the R CQ
        history values (as R CQ is an optional
        parameter and may not be present on all calls."
    ::= {rtcpXrHistoryEntry 53 }
```

```
rtcpXrHistoryMinRLQ OBJECT-TYPE
    SYNTAX Rfactor
    UNITS "R factor"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Minimum of the per-call R-LQ for all calls in this
        history for which an R-LQ value was reported."
    ::= {rtcpXrHistoryEntry 54 }
```

```
rtcpXrHistoryMaxRLQ OBJECT-TYPE
    SYNTAX Rfactor
    UNITS "R factor"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Maximum of the per-call R-LQ for all calls in this
        history for which an R-LQ value was reported."
    ::= {rtcpXrHistoryEntry 55 }
```

```
rtcpXrHistoryAvgRLQ OBJECT-TYPE
    SYNTAX Rfactor
    UNITS "R factor"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Mean of the per-call R-LQ for all calls in this
        history for which an R-LQ value was reported."
    ::= {rtcpXrHistoryEntry 56 }

rtcpXrHistoryRLQCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Number of sessions included in the R LQ
        history values (as R LQ is an optional
        parameter and may not be present on all calls."
    ::= {rtcpXrHistoryEntry 57 }

rtcpXrHistoryMinMOSCQ OBJECT-TYPE
    SYNTAX ScaledMOSscore
    UNITS "MOS x 10"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Minimum of the per-call MOS-CQ for all calls in this
        history for which a MOS-CQ value was reported."
    ::= {rtcpXrHistoryEntry 58 }

rtcpXrHistoryMaxMOSCQ OBJECT-TYPE
    SYNTAX ScaledMOSscore
    UNITS "MOS x 10"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Maximum of the per-call MOS-CQ for all calls in this
        history for which a MOS-CQ value was reported."
    ::= {rtcpXrHistoryEntry 59 }

rtcpXrHistoryAvgMOSCQ OBJECT-TYPE
    SYNTAX ScaledMOSscore
    UNITS "MOS x 10"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Mean of the per-call MOS-CQ for all calls in this
        history for which a MOS-CQ value was reported."
    ::= {rtcpXrHistoryEntry 60 }
```

```
rtcpXrHistoryMOSQCCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Number of sessions included in the MOS CQ
        history values (as MOS CQ is an optional
        parameter and may not be present on all calls."
    ::= {rtcpXrHistoryEntry 61 }

rtcpXrHistoryMinMOSLQ OBJECT-TYPE
    SYNTAX ScaledMOSscore
    UNITS "MOS x 10"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Minimum of the per-call MOS-LQ for all calls in this
        history for which a MOS-LQ value was reported."
    ::= {rtcpXrHistoryEntry 62 }

rtcpXrHistoryMaxMOSLQ OBJECT-TYPE
    SYNTAX ScaledMOSscore
    UNITS "MOS x 10"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Maximum of the per-call MOS-LQ for all calls in this
        history for which a MOS-LQ value was reported."
    ::= {rtcpXrHistoryEntry 63 }

rtcpXrHistoryAvgMOSLQ OBJECT-TYPE
    SYNTAX ScaledMOSscore
    UNITS "MOS x 10"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Mean of the per-call MOS-LQ for all calls in this
        history for which a MOS-LQ value was reported."
    ::= {rtcpXrHistoryEntry 64 }

rtcpXrHistoryMOSLQCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Number of sessions included in the MOS LQ
        history values (as MOS LQ is an optional
        parameter and may not be present on all calls."
    ::= {rtcpXrHistoryEntry 65 }
```

```

rtcpXrHistoryCQAlgorithm OBJECT-TYPE
    SYNTAX OCTET STRING (SIZE(0..32))
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Call quality algorithm used - if consistent
        for all calls in this history."
    ::= { rtcpXrHistoryEntry 66 }

rtcpXrHistoryReset OBJECT-TYPE
    SYNTAX INTEGER { running (1),
                    stop (2),
                    reset (3)
                  }
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "Status of this row in the history table.
        Writing a value of 2 to this object MUST cause
        history updates to be stopped for this row. Writing
        a value of 3 to this object MUST cause the history
        row to be reset.
        Reads MUST return a value of 1 if the row is still
        being updated or 2 if the row update has stopped."
    ::= { rtcpXrHistoryEntry 67 }

--
-- Notifications
--

rtcpXrVoipThresholdViolation NOTIFICATION-TYPE
    OBJECTS { rtcpXrVoipAlertSeverity, rtcpXrVoipAlertType,
              rtcpXrVoipAlertInfoType, rtcpXrVoipAlertPointer }
    STATUS current
    DESCRIPTION
        "Notification that voice quality has changed
        Sent immediately when the condition is detected."
    ::= { rtcpXrEvents 1 }

rtcpXrEventParam OBJECT IDENTIFIER ::= { rtcpXrEvents 2 }

rtcpXrVoipAlertType OBJECT-TYPE
    SYNTAX SnmpAdminString
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Text description of the type of alert.  Where possible,
        this parameter should be populated with the correct
        rtcpXrVoipEntry or rtcpXrVoipHistory description."
    ::= { rtcpXrEventParam 1 }

```

```

rtcpXrVoipAlertInfoType OBJECT-TYPE
    SYNTAX INTEGER { adminStringOnly (1),
                    sessionPointer (2),
                    historyPointer (3)
                  }
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Indicates the type of information returned in the
         rtcpXrVoipAlertInfo parameter."
    ::= { rtcpXrEventParam 2 }

rtcpXrVoipAlertPointer OBJECT-TYPE
    SYNTAX RowPointer
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Pointer to the table of call session information to
         identify the specific call that triggered the alert."
    ::= { rtcpXrEventParam 3 }

rtcpXrVoipAlertSeverity OBJECT-TYPE
    SYNTAX ItuPerceivedSeverity
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The severity of the alert as defined in ITU-T X.733 and
         RFC3877."
    REFERENCE
        "See Alarm MIB - RFC3877."
    ::= { rtcpXrEventParam 4 }

--
-- MODULE GROUPS
--
-- There are four types of RTCP XR VoIP Metrics System.
--
-- RTCP XR VOIP Metrics Systems MUST implement one of the four
-- identified types of system and SHOULD NOT implement the
-- rtcpXrMinimalCompliance system, which is included only
-- for reasons of compatibility with RFC3611's minimal
-- requirements.
--

rtcpXrCompliances OBJECT IDENTIFIER ::= { rtcpXrConformance 1 }
rtcpXrGroups OBJECT IDENTIFIER ::= { rtcpXrConformance 2 }

rtcpXrFullMetricsCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "Describes the requirements for conformance to the
         rtcpXr MIB for VoIP devices that support basic
         reporting."

```

```

MODULE -- this module
MANDATORY-GROUPS {
    rtcpXrBaseParamGroup,
    rtcpXrCallQualityGroup
}
 ::= { rtcpXrCompliances 1 }

rtcpXrMetricsAlertsCompliance MODULE-COMPLIANCE
STATUS current
DESCRIPTION
    "Describes the requirements for conformance to the
    rtcpXr MIB for VoIP devices that support reporting
    and alerts."
MODULE -- this module
MANDATORY-GROUPS {
    rtcpXrBaseParamGroup,
    rtcpXrCallQualityGroup,
    rtcpXrNotificationParmsGroup,
    rtcpXrNotificationsGroup
}
 ::= { rtcpXrCompliances 2 }

rtcpXrMetricsHistoryCompliance MODULE-COMPLIANCE
STATUS current
DESCRIPTION
    "Describes the requirements for conformance to the
    rtcpXr MIB for VoIP devices that support reporting,
    call history and alerts."
MODULE -- this module
MANDATORY-GROUPS {
    rtcpXrBaseParamGroup,
    rtcpXrCallQualityGroup,
    rtcpXrMIBHistoryGroup,
    rtcpXrNotificationParmsGroup,
    rtcpXrNotificationsGroup
}
 ::= { rtcpXrCompliances 3 }

rtcpXrHistoryCompliance MODULE-COMPLIANCE
STATUS current
DESCRIPTION
    "Describes the requirements for conformance to the
    rtcpXr MIB for VoIP devices that support only
    call history."
MODULE -- this module
MANDATORY-GROUPS { rtcpXrMIBHistoryGroup
}
 ::= { rtcpXrCompliances 4 }

rtcpXrMinimalCompliance MODULE-COMPLIANCE
STATUS current
DESCRIPTION
    "Describes the minimal requirements for conformance to
    the rtcpXr MIB - NOT RECOMMENDED."
MODULE -- this module

```

```

MANDATORY-GROUPS {
    rtcpXrBaseParamGroup
}
 ::= { rtcpXrCompliances 5 }

rtcpXrBaseParamGroup OBJECT-GROUP
OBJECTS {
    rtcpXrBaseParamCodecType,
    rtcpXrBaseParamCodecBitRate,
    rtcpXrBaseParamFrameDuration,
    rtcpXrBaseParamFramesPerPacket,
    rtcpXrBaseParamSampleRate,
    rtcpXrBaseParamDurationMs,
    rtcpXrBaseParamNetworkLossRate,
    rtcpXrBaseParamAvgDiscardRate,
    rtcpXrBaseParamBurstLossDensity,
    rtcpXrBaseParamBurstLenMs,
    rtcpXrBaseParamGapLossDensity,
    rtcpXrBaseParamGapLenMs,
    rtcpXrBaseParamAvgOWDelay,
    rtcpXrBaseParamAvgEndSysDelay,
    rtcpXrBaseParamNoiseLeveldBm,
    rtcpXrBaseParamSignalLeveldBm,
    rtcpXrBaseParamLocalRERLdB,
    rtcpXrBaseParamRemoteRERLdB,
    rtcpXrBaseParamPlcType,
    rtcpXrBaseParamJBuffAdaptMode,
    rtcpXrBaseParamJBuffAdaptRate,
    rtcpXrBaseParamJBuffAverageDelay,
    rtcpXrBaseParamJBuffMaximumDelay,
    rtcpXrBaseParamJBuffAbsMaxDelay,
    rtcpXrBaseParamJitterLevel
}
STATUS current
DESCRIPTION
    "Objects used in rtcpXr VoIP Metrics MIB"
 ::= { rtcpXrGroups 1 }

rtcpXrCallQualityGroup OBJECT-GROUP
OBJECTS {
    rtcpXrCallQualityRCQ,
    rtcpXrCallQualityRLQ,
    rtcpXrCallQualityExternalRCQ,
    rtcpXrCallQualityMOSCQ,
    rtcpXrCallQualityMOSLQ,
    rtcpXrCallQualityRLQestAlgorithm,
    rtcpXrCallQualityRCQestAlgorithm,
    rtcpXrCallQualityMOSLQestAlgorithm,
    rtcpXrCallQualityMOSCQestAlgorithm
}
STATUS current
DESCRIPTION
    "Call quality objects used in rtcpXr VoIP Metrics MIB"
 ::= { rtcpXrGroups 2 }

```

```
rtcpXrMIBHistoryGroup OBJECT-GROUP
  OBJECTS {
    rtcpXrHistoryGroupName,
    rtcpXrHistoryStartTime,
    rtcpXrHistoryStopTime,
    rtcpXrHistoryNumOfSessions,
    rtcpXrHistoryMinDurationMs,
    rtcpXrHistoryMaxDurationMs,
    rtcpXrHistoryAvgDurationMs,
    rtcpXrHistoryMaxNetworkLossRate,
    rtcpXrHistoryAvgNetworkLossRate,
    rtcpXrHistoryMaxDiscardRate,
    rtcpXrHistoryAvgDiscardRate,
    rtcpXrHistoryMaxBurstLossDensity,
    rtcpXrHistoryAvgBurstLossDensity,
    rtcpXrHistoryMinBurstLenMs,
    rtcpXrHistoryMaxBurstLenMs,
    rtcpXrHistoryAvgBurstLenMs,
    rtcpXrHistoryMaxGapLossDensity,
    rtcpXrHistoryAvgGapLossDensity,
    rtcpXrHistoryMinGapLenMs,
    rtcpXrHistoryMaxGapLenMs,
    rtcpXrHistoryAvgGapLenMs,
    rtcpXrHistoryMinOneWayDelay,
    rtcpXrHistoryMaxOneWayDelay,
    rtcpXrHistoryAvgOneWayDelay,
    rtcpXrHistoryOneWayDelayCount,
    rtcpXrHistoryMinEndSystemDelay,
    rtcpXrHistoryMaxEndSystemDelay,
    rtcpXrHistoryAvgEndSystemDelay,
    rtcpXrHistoryEndSystemDelayCount,
    rtcpXrHistoryAvgJitterLevel,
    rtcpXrHistoryMinJitterLevel,
    rtcpXrHistoryMaxJitterLevel,
    rtcpXrHistoryMinNoiseLeveldBm,
    rtcpXrHistoryMaxNoiseLeveldBm,
    rtcpXrHistoryAvgNoiseLeveldBm,
    rtcpXrHistoryNoiseLevelCount,
    rtcpXrHistoryMinSignalLeveldBm,
    rtcpXrHistoryMaxSignalLeveldBm,
    rtcpXrHistoryAvgSignalLeveldBm,
    rtcpXrHistorySignalLevelCount,
    rtcpXrHistoryMinLocalRERLdB,
    rtcpXrHistoryMaxLocalRERLdB,
    rtcpXrHistoryAvgLocalRERLdB,
    rtcpXrHistoryLocalRERLCount,
    rtcpXrHistoryMinRemoteRERLdB,
    rtcpXrHistoryMaxRemoteRERLdB,
    rtcpXrHistoryAvgRemoteRERLdB,
    rtcpXrHistoryRemoteRERLCount,
    rtcpXrHistoryMinRCQ,
    rtcpXrHistoryMaxRCQ,
    rtcpXrHistoryAvgRCQ,
    rtcpXrHistoryRCQCount,
```

```

    rtcpXrHistoryMinRLQ,
    rtcpXrHistoryMaxRLQ,
    rtcpXrHistoryAvgRLQ,
    rtcpXrHistoryRLQCount,
    rtcpXrHistoryMinMOSCQ,
    rtcpXrHistoryMaxMOSCQ,
    rtcpXrHistoryAvgMOSCQ,
    rtcpXrHistoryMOSCQCount,
    rtcpXrHistoryMinMOSLQ,
    rtcpXrHistoryMaxMOSLQ,
    rtcpXrHistoryAvgMOSLQ,
    rtcpXrHistoryMOSLQCount,
    rtcpXrHistoryCQAlgorithm,
    rtcpXrHistoryReset
  }
  STATUS current
  DESCRIPTION
    "Objects used in rtcpXr VoIP History MIB"
  ::= { rtcpXrGroups 3 }

rtcpXrNotificationParmsGroup OBJECT-GROUP
  OBJECTS {
    rtcpXrVoipAlertSeverity,
    rtcpXrVoipAlertType,
    rtcpXrVoipAlertInfoType,
    rtcpXrVoipAlertPointer
  }
  STATUS current
  DESCRIPTION
    "Notification parameters emitted by a rtcpXr endpoint."
  ::= { rtcpXrGroups 4 }

rtcpXrNotificationsGroup NOTIFICATION-GROUP
  NOTIFICATIONS {
    rtcpXrVoipThresholdViolation
  }
  STATUS current
  DESCRIPTION
    "Notifications emitted by a rtcpXr endpoint."
  ::= { rtcpXrGroups 5 }

```

END

4. Security Considerations

Access to `rtcpXrHistoryReset` can result in resetting the table of aggregate call quality information, which results in the loss of useful management data.

It is thus important to control even GET and/or NOTIFY access to these objects and possibly to even encrypt their values when sending them over the network via SNMP.

SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example by using IPSec), even then, there is no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in this MIB module.

It is RECOMMENDED that implementers consider the security features as provided by the SNMPv3 framework (see [RFC3410], section 8), including full support for the SNMPv3 cryptographic mechanisms (for authentication and privacy).

Further, deployment of SNMP versions prior to SNMPv3 is NOT RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to enable cryptographic security. It is then a customer/operator responsibility to ensure that the SNMP entity giving access to an instance of this MIB module is properly configured to give access to the objects only to those principals (users) that have legitimate rights to indeed GET or SET (change/create/delete) them.

5. IANA Considerations

An OID within the `mib-2` tree is requested, following which this note may be deleted.

6. Acknowledgements

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8. Normative References

- [RFC3550] Shulzrinne, H., Casner, S., Frederick, R. and V. Jacobson, "RTP: A Transport Protocol for real-time applications," RFC 3550, July 2003.
- [RFC3611] Friedman, T., Caceres, R., Clark, A., "RTP Control Protocol Reporting Extensions (RTCP XR)," RFC 3611, [October/November] 2003
- [RFC2578] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M. and S. Waldbusser, "Structure of Management Information Version 2 (SMIV2)", STD 58, RFC 2578, December 1999.
- [RFC2579] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M. and S. Waldbusser, "Textual Conventions for SMIV2", STD 58, RFC 2579, December 1999.
- [RFC2580] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M. and S. Waldbusser, "Conformance Statements for SMIV2", STD 58, RFC 2580, December 1999.

9. Informative References

- [RFC3410] Case, J., Mundy, R., Partain, D. and Stewart, B., "Introduction and Applicability Statements for Internet Standard Management Framework", RFC 3410, December 2002
- [RAQMON] Siddiqui, A., Romascanu, D.,
[draft-ietf-rmonmib-framework-16.txt](#)

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