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Definitions of Managed Objects for HPR using SMIv2

Status of this Memo

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2. Introduction

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 monitoring and controlling network devices with HPR (High Performance Routing) capabilities. This memo identifies managed objects for the HPR protocol.

3. The SNMP Network Management Framework

The SNMP Network Management Framework consists of several components. For the purpose of this specification, the applicable components of the Framework are the SMI and related documents [1, 2, 3], which define the mechanisms used for describing and naming objects for the purpose of management.

The Framework permits new objects to be defined for the purpose of experimentation and evaluation.

4. Overview

This document identifies objects for monitoring the configuration and active characteristics of devices with HPR capabilities. HPR is an enhancement to the Advanced Peer-to-Peer Network (APPN) architecture that provides fast data routing and improved session reliability. APPN is one of the protocols that can use the HPR transport mechanism. See the SNANAU APPN MIB [4] for management of APPN and APPN use of the HPR transport.

The HPR terms and overall architecture [5] are available at http://www.networking.ibm.com/app/aiwdoc/aiwsrc.htm.

Automatic Network Routing (ANR) is a fast low-level routing technique. Each node assigns a unique (within that node) ANR label for each out-bound link as it is activated. The label size is defined by the ANR node, and nodes only need to know how to interpret their own labels. The ANR string is a group of ANR labels encoded in a header in front of the message being sent. At each hop the node strips off its own ANR label and forwards the message onto the link with that label. The last label in the string is the Network Connection Endpoint (NCE), which identifies the component within the destination node that is to receive the message.

Rapid Transport Protocol (RTP) is an end-to-end full duplex transport connection (pipe). It provides for high-speed transport of data using ANR. RTP is connection-oriented, and delivers data in correct order reliably. Error recovery is done efficiently with selective retransmission of data. An RTP path can be switched without disrupting the sessions using it. An RTP path switch may be done automatically if a link in the path fails and another RTP path is available, or on demand to attempt to restore the optimal path.

RTP performs flow/congestion control with the Adaptive Rate-Based (ARB) algorithm, described in [5]. ARB is done only at the endpoints of the RTP pipe, so intermediate hops are not involved.

ARB regulates the flow of data over an RTP connection by adaptively changing the sender's rate based on feedback on the receiver's rate. It is designed to prevent congestion rather than react to it.

In this document, we describe HPR managed objects.

Highlights of the management functions supported by the HPR MIB module include the following:

- Identifying network connection endpoints (NCEs).
- Identifying how incoming packets are routed based on ANR labels.
- Monitoring the RTP connections between nodes.
- Ability to trigger an RTP path switch. The MIB only supports a path switch with no specified path. Some implementations may have a product-specific option to specify a new path. The hprOperatorPathSwitchSupport object identifies this support.
- Historical information about RTP path switch attempts.

This MIB module does not support:

- Configuration of HPR nodes.
- Protocol-specific uses of HPR (such as APPN).
- Traps. The APPN MIB contains a trap for Alert conditions that may affect HPR resources. The value for the affectedObject object contained in the alertTrap is determined by the implementation. It may contain a VariablePointer from the HPR MIB. The APPN/HPR Alerts are defined in [6].

4.1. HPR MIB Structure

Although HPR is an extension to APPN, the HPR MIB relies very little upon the APPN MIB. The appnNodeCounterDisconTime object in the APPN MIB is used to detect discontinuities in HPR MIB counters. The hprNodeCpName object in this MIB has the same value as the appnNodeCpName object in the APPN MIB.

The HPR MIB module contains the following collections of objects:

- hprGlobal - general HPR objects.
- hprAnrRouting - objects related to the ANR routing table.

- o hprTransportUser - objects related to users of the HPR transport.

- o hprRtp - objects related to the HPR Transport Tower.

These are described below in more detail.

4.1.1. hprGlobal group

The hprGlobal group consists of general objects such as the APPN CP (control point) name of the HPR node and the level of support for operator-requested path switches.

4.1.2. hprAnrRouting group

The hprAnrRouting group consists objects to monitor and control the counting of ANR packets received and the following table:

The hprAnrRoutingTable correlates incoming ANR labels to the outbound transmission group (TG) or local NCE to which incoming packet will be forwarded. An entry defines the label type as identifying a local NCE or a TG, identifies the NCE or TG, and counts the number of packets received with the entry's ANR label.

4.1.3. hprTransportUser group

The hprTransportUser group consists of the following table:

The hprNceTable identifies network connection endpoints and their function types. The function type can be any combination of a CP, logical unit (LU), boundary function, and route setup.

4.1.4. hprRtp group

The hprRtp group consists of the following objects and tables:

1) hprRtpGlobe

These objects contain information about the number of RTP connection setups, and control of RTP counters.

2) hprRtpTable

This table contains one entry for each RTP connection. The information includes local and remote NCE IDs and TCIDs (transport connection identifiers), timers, send rates, and statistics. A path switch can be triggered by the hprRptPathSwitchTrigger object if the agent node supports it; however, a new path cannot be specified.

3) hprRtpStatusTable

This table contains statistics and historical information for RTP path switches attempts, including old and new ANR strings and Route Selection Control Vectors (RSCVs), why the path switch was initiated, and the result (successful or reason for failure).

5. Definitions

```
HPR-MIB DEFINITIONS ::= BEGIN

  IMPORTS
        DisplayString, DateAndTime, TimeStamp, TEXTUAL-CONVENTION
                FROM SNMPv2-TC

        Counter32, Gauge32, Unsigned32, TimeTicks,
        OBJECT-TYPE, MODULE-IDENTITY
                FROM SNMPv2-SMI

        MODULE-COMPLIANCE, OBJECT-GROUP
                FROM SNMPv2-CONF

        snanauMIB
                FROM SNA-NAU-MIB

        SnaControlPointName
                FROM APPN-MIB;

hprMIB MODULE-IDENTITY
        LAST-UPDATED  "970514000000Z"
        ORGANIZATION  "AIW APPN / HPR MIB SIG"
        CONTACT-INFO

                "

                        Bob Clouston
                        Cisco Systems
                        7025 Kit Creek Road
                        P.O. Box 14987
                        Research Triangle Park, NC 27709, USA
                        Tel:    1 919 472 2333
                        E-mail: clouston@cisco.com

                        Bob Moore
                        IBM Corporation
                        800 Park Offices Drive
                        RHJA/664
                        P.O. Box 12195
```

```
                        Research Triangle Park, NC 27709, USA
                        Tel:    1 919 254 4436
                        E-mail: remoore@ralvm6.vnet.ibm.com
                "
      DESCRIPTION
                "This is the MIB module for objects used to
                 manage network devices with HPR capabilities."
::= { snanauMIB 6 }
-- snanauMIB ::= { mib-2 34 }

-- ************************************************************************
-- Textual Conventions
-- ************************************************************************
-- SnaControlPointName is imported from the APPN MIB

HprNceTypes ::= TEXTUAL-CONVENTION
      STATUS current
      DESCRIPTION
          "A bit string identifying the set of functions provided by a
          network connection endpoint (NCE).  The following values are
          defined:

                bit 0:  control point
                bit 1:  logical unit
                bit 2:  boundary function
                bit 3:  route setup
          "

      SYNTAX BITS { controlPoint(0),
                    logicalUnit(1),
                    boundaryFunction(2),
                    routeSetup(3) }

HprRtpCounter ::= TEXTUAL-CONVENTION
      STATUS current
      DESCRIPTION
          "An object providing statistics for an RTP connection.  A
          Management Station can detect discontinuities in this counter
          by monitoring the correspondingly indexed
          hprRtpCounterDisconTime object."

      SYNTAX Counter32

-- ************************************************************************
  hprObjects         OBJECT IDENTIFIER ::= { hprMIB 1 }
-- ************************************************************************

-- ************************************************************************
```

```
hprGlobal            OBJECT IDENTIFIER ::= { hprObjects 1 }
-- ************************************************************************
-- The hprGlobal group applies to both intermediate and end nodes.
-- ************************************************************************

hprNodeCpName OBJECT-TYPE
      SYNTAX SnaControlPointName
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "Administratively assigned network name for the APPN node
          where this HPR implementation resides.  If this object has
          the same value as the appnNodeCpName object in the APPN MIB,
          then the two objects are referring to the same APPN node."

      ::= { hprGlobal 1 }

hprOperatorPathSwitchSupport  OBJECT-TYPE
      SYNTAX INTEGER {
                      notSupported(1),
                      switchTriggerSupported(2),
                      switchToPathSupported(3)
                     }
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "This object indicates an implementation's level of support
          for an operator-requested path switch.

            notSupported(1)           - the agent does not support
                                        operator-requested path switches
            switchTriggerSupported(2) - the agent supports a 'switch
                                        path now' command from an
                                        operator, but not a command to
                                        switch to a specified path
            switchToPathSupported(3)  - the agent supports both a
                                        'switch path now' command and a
                                        command to switch to a specified
                                        path.  Note that the latter
                                        command is not available via
                                        this MIB; a system that supports
                                        it must do so via other means,
                                        such as a local operator
                                        interface."

      ::= { hprGlobal 2 }

-- ************************************************************************
```

```
hprAnrRouting        OBJECT IDENTIFIER ::= { hprObjects 2 }
-- ****************************************************************

hprAnrsAssigned OBJECT-TYPE
      SYNTAX Counter32
      UNITS "ANR labels"
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The count of ANR labels assigned by this node since it was
          last re-initialized.  A Management Station can detect
          discontinuities in this counter by monitoring the
          appnNodeCounterDisconTime object in the APPN MIB."

      ::= { hprAnrRouting 1 }

hprAnrCounterState  OBJECT-TYPE
      SYNTAX INTEGER {
                      notActive(1),
                      active(2)
                     }
      MAX-ACCESS read-write
      STATUS current
      DESCRIPTION
          "This object is used for a network management station to turn
          on/off the counting of ANR packets in the hprAnrRoutingTable.
          The initial value of this object is an implementation choice.

                 notActive(1) - the counter hprAnrPacketsReceived
                                returns no meaningful value
                 active(2)    - the counter hprAnrPacketsReceived is
                                being incremented and is returning
                                meaningful values"

      ::= { hprAnrRouting 2 }

hprAnrCounterStateTime OBJECT-TYPE
      SYNTAX DateAndTime
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The time when the hprAnrCounterState object last changed its
          value.  The initial value returned by this object is the time
          at which the APPN node instrumented with this MIB was last
          brought up."

      ::= { hprAnrRouting 3 }
```

```
hprAnrRoutingTable OBJECT-TYPE
      SYNTAX SEQUENCE OF HprAnrRoutingEntry
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
          "The ANR Routing table provides a means of correlating an
          incoming ANR label (i.e., one assigned by this node) with the
          TG over which a packet containing the label will be forwarded.
          When the ANR label identifies a local NCE, the hprAnrOutTgDest
          and hprAnrOutTgNum objects have no meaning.  The table also
          contains an object to count the number of packets received
          with a given ANR label."

      ::= { hprAnrRouting 4 }

hprAnrRoutingEntry OBJECT-TYPE
      SYNTAX HprAnrRoutingEntry
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
          "The ANR label is used to index this table."

      INDEX  { hprAnrLabel }

      ::= { hprAnrRoutingTable 1 }

HprAnrRoutingEntry ::= SEQUENCE {
     hprAnrLabel             OCTET STRING,
     hprAnrType              INTEGER,
     hprAnrOutTgDest         DisplayString,
     hprAnrOutTgNum          INTEGER,
     hprAnrPacketsReceived   Counter32,
     hprAnrCounterDisconTime TimeStamp
     }

hprAnrLabel OBJECT-TYPE
      SYNTAX OCTET STRING (SIZE (1..8))
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
          "The first ANR label in an incoming packet."

      ::= { hprAnrRoutingEntry 1 }

hprAnrType OBJECT-TYPE
      SYNTAX INTEGER {
                     nce(1),
                     tg(2)
```

```
                    }
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "An object indicating whether an ANR label assigned by this
          node identifies a local NCE or a TG on which outgoing packets
          are forwarded.

              nce(1)  - the ANR label identifies a local NCE.  In this
                        case the hprAnrOutTgDest and hprAnrOutTgNum
                        objects have no meaning.
              tg(2)   - the ANR label identifies a TG."

      ::= { hprAnrRoutingEntry 2 }

hprAnrOutTgDest OBJECT-TYPE
      SYNTAX DisplayString (SIZE (0 | 3..17))
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "Destination node for the TG over which packets with this ANR
          label are forwarded.  This is the fully qualified name of an
          APPN network node or end node, formatted according to the
          SnaControlPointName textual convention.  If the ANR label
          identifies a local NCE, then this object returns a zero-length
          string.

          This object corresponds to the appnLocalTgDest object in the
          APPN MIB."

      ::= { hprAnrRoutingEntry 3 }

hprAnrOutTgNum OBJECT-TYPE
      SYNTAX INTEGER (0..255)
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "Number of the TG over which packets with this ANR label are
          forwarded.  If the ANR label identifies a local NCE, then this
          object returns the value 0, since 0 is not a valid TG number
          for a TG that supports HPR.

          This object corresponds to the appnLocalTgNum object in the
          APPN MIB."

      ::= { hprAnrRoutingEntry 4 }

hprAnrPacketsReceived OBJECT-TYPE
```

```
      SYNTAX Counter32
      UNITS "ANR packets"
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The count of packets received with this ANR label as their
          first label.

          A Management Station can detect discontinuities in this
          counter by monitoring the hprAnrCounterDisconTime object in
          the same row."

      ::= { hprAnrRoutingEntry 5 }

hprAnrCounterDisconTime OBJECT-TYPE
      SYNTAX TimeStamp
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The value of the sysUpTime object when the
          hprAnrPacketsReceived counter for this ANR label last
          experienced a discontinuity.  This will be the more recent of
          two times:  the time at which the ANR label was associated with
          either an outgoing TG or a local NCE, or the time at which the
          ANR counters were last turned on or off."

      ::= { hprAnrRoutingEntry 6 }

-- ****************************************************************
hprTransportUser     OBJECT IDENTIFIER ::= { hprObjects 3 }
-- ****************************************************************
-- Transport Service User (TU) Table: (RTP Connection Users)
--
-- There will be several users of the HPR transport and each HPR node
-- shall maintain a table of these users.
-- ****************************************************************

hprNceTable OBJECT-TYPE
      SYNTAX SEQUENCE OF HprNceEntry
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
          "The Network Connection Endpoint (NCE) table."

      ::= { hprTransportUser 1 }

hprNceEntry OBJECT-TYPE
      SYNTAX HprNceEntry
```

```
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
          "The NCE ID is used to index this table."

      INDEX  { hprNceId }

      ::= { hprNceTable 1 }

HprNceEntry ::= SEQUENCE {
     hprNceId            OCTET STRING,
     hprNceType          HprNceTypes,
     hprNceDefault       HprNceTypes,
     hprNceInstanceId    OCTET STRING
     }

hprNceId OBJECT-TYPE
      SYNTAX OCTET STRING (SIZE (1..8))
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
          "The Network Connection Endpoint (NCE) ID.  NCEs identify
          Control Points (Cp), Logical Units (Lu), HPR Boundary
          Functions (Bf) and Route Setup (Rs) Functions.  A value for
          this object can be retrieved from any of the following
          objects in the APPN MIB:

               - appnLsCpCpNceId
               - appnLsRouteNceId
               - appnLsBfNceId
               - appnIsInRtpNceId
               - appnIsRtpNceId

          In each case this value identifies a row in this table
          containing information related to that in the APPN MIB."

      ::= { hprNceEntry 1 }

hprNceType OBJECT-TYPE
      SYNTAX HprNceTypes
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "A bit string identifying the function types provided by this
          Network Connection Endpoint (NCE)."

      ::= { hprNceEntry 2 }
```

```
hprNceDefault OBJECT-TYPE
      SYNTAX HprNceTypes
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "A bit string identifying the function types for which this
          Network Connection Endpoint (NCE) is the default NCE.  While
          default NCEs are not explicitly defined in the architecture,
          some implementations provide them; for such implementations,
          it is useful to make this information available to a
          Management Station."

      ::= { hprNceEntry 3 }

hprNceInstanceId   OBJECT-TYPE
      SYNTAX OCTET STRING (SIZE (4))
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The NCE instance identifier (NCEII) identifying the current
          instance of this NCE.  An NCEII is used to denote different
          instances (IPLs) of an NCE component.  Each time an NCE is
          activated (IPL'd), it acquires a different, unique NCEII."

      ::= { hprNceEntry 4 }

-- ************************************************************************
hprRtp               OBJECT IDENTIFIER ::= { hprObjects 4 }
-- ************************************************************************
-- ************************************************************************
--
-- The RTP group is implemented by all managed nodes supporting the
-- HPR Transport Tower.  The group contains several scalars (simple
-- objects) and a table.
-- ************************************************************************

-- ************************************************************************
hprRtpGlobe          OBJECT IDENTIFIER ::= { hprRtp 1}
-- ************************************************************************
hprRtpGlobeConnSetups  OBJECT-TYPE
      SYNTAX Counter32
      UNITS "RTP connection setups"
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The count of RTP connection setups in which this node has
          participated, as either sender or receiver, since it was last
          re-initialized.  Retries of a setup attempt do not cause the
```

```
          counter to be incremented.

          A Management Station can detect discontinuities in this
          counter by monitoring the appnNodeCounterDisconTime object
          in the APPN MIB."

      ::= { hprRtpGlobe 1 }

hprRtpGlobeCtrState OBJECT-TYPE
      SYNTAX INTEGER {
                      notActive(1),
                      active(2)
                     }
      MAX-ACCESS read-write
      STATUS current
      DESCRIPTION
          "This object allows a network management station to turn the
          counters in the hprRtpTable on and off.  The initial value of
          this object is an implementation choice.

                 notActive(1) - the counters in the hprRtpTable are
                                returning no meaningful values
                 active(2)    - the counters in the hprRtpTable are
                                being incremented and are returning
                                meaningful values"

      ::= { hprRtpGlobe 2 }

hprRtpGlobeCtrStateTime OBJECT-TYPE
      SYNTAX DateAndTime
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The time when the value of the hprRtpGlobeCtrState object
          last changed.  The initial value returned by this object is
          the time at which the APPN node instrumented with this MIB
          was last brought up."

      ::= { hprRtpGlobe 3 }

-- ************************************************************************
-- The RTP Connection Table
-- There may be many RTP connections on a node supporting the functions
-- specified in the RTP option set.  Each node implementing this option
-- set shall maintain a table of these RTP connections.
-- ************************************************************************

hprRtpTable OBJECT-TYPE
```

```
      SYNTAX SEQUENCE OF HprRtpEntry
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
          "The RTP Connection table"

      ::= { hprRtp 2 }

hprRtpEntry OBJECT-TYPE
      SYNTAX HprRtpEntry
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
          "The local NCE ID and local TCID are used to index this
          table."

      INDEX
             { hprRtpLocNceId,
               hprRtpLocTcid }

      ::= { hprRtpTable 1 }

HprRtpEntry ::= SEQUENCE {
     hprRtpLocNceId          OCTET STRING,       -- local nce id
     hprRtpLocTcid           OCTET STRING,       -- local tcid
     hprRtpRemCpName         SnaControlPointName,-- remote cp name
     hprRtpRemNceId          OCTET STRING,       -- remote nce id
     hprRtpRemTcid           OCTET STRING,       -- remote tcid
     hprRtpPathSwitchTrigger INTEGER,            -- trigger (read-write)
     hprRtpRscv              OCTET STRING,       -- rscv
     hprRtpTopic             DisplayString,      -- topic (cos)
     hprRtpState             INTEGER,            -- state
     hprRtpUpTime            TimeTicks,          -- up time

     hprRtpLivenessTimer     Unsigned32,         -- liveness timer
     hprRtpShortReqTimer     Unsigned32,         -- short request timer
     hprRtpPathSwTimer       Unsigned32,         -- path switch timer
     hprRtpLivenessTimeouts  HprRtpCounter,      -- liveness timeouts
     hprRtpShortReqTimeouts  HprRtpCounter,      -- short req timeouts

     hprRtpMaxSendRate       Gauge32,            -- maximum send rate
     hprRtpMinSendRate       Gauge32,            -- minimum send rate
     hprRtpCurSendRate       Gauge32,            -- current send rate

     hprRtpSmRdTripDelay     Gauge32,            -- smooth rnd trip
                                                    delay

     hprRtpSendPackets       HprRtpCounter,      -- packets sent
```

```
     hprRtpRecvPackets       HprRtpCounter,      -- packets received
     hprRtpSendBytes         HprRtpCounter,      -- bytes sent
     hprRtpRecvBytes         HprRtpCounter,      -- bytes received

     hprRtpRetrPackets       HprRtpCounter,      -- pkts re-xmitted
     hprRtpPacketsDiscarded  HprRtpCounter,      -- pkts discarded
     hprRtpDetectGaps        HprRtpCounter,      -- gaps detected
     hprRtpRateReqSends      HprRtpCounter,      -- rate req send

     hprRtpOkErrPathSws      HprRtpCounter,      -- ok  err path sws
     hprRtpBadErrPathSws     HprRtpCounter,      -- bad err path sws
     hprRtpOkOpPathSws       HprRtpCounter,      -- ok  op  path sws
     hprRtpBadOpPathSws      HprRtpCounter,      -- bad op  path sws

     hprRtpCounterDisconTime TimeStamp           -- discontinuity ind
        }

hprRtpLocNceId OBJECT-TYPE
      SYNTAX OCTET STRING (SIZE (1..8))
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
          "The local Network Connection Endpoint (NCE) ID of this RTP
          connection.  NCEs identify CPs, LUs, Boundary Functions (BFs),
          and Route Setup (RS) components.  A value for this object can
          be retrieved from any of the following objects in the APPN
          MIB:

               - appnLsCpCpNceId
               - appnLsRouteNceId
               - appnLsBfNceId
               - appnIsInRtpNceId
               - appnIsRtpNceId

          In each case this value identifies a row in this table
          containing information related to that in the APPN MIB."

      ::= { hprRtpEntry 1 }

hprRtpLocTcid OBJECT-TYPE
      SYNTAX OCTET STRING (SIZE (8))
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
          "The local TCID of this RTP connection.  A value for this
          object can be retrieved from either the appnIsInRtpTcid object
          or the appnIsRtpTcid object the APPN MIB; in each case this
          value identifies a row in this table containing information
```

```
          related to that in the APPN MIB."

      ::= { hprRtpEntry 2 }

hprRtpRemCpName OBJECT-TYPE
      SYNTAX SnaControlPointName
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "Administratively assigned network name for the remote node of
          this RTP connection."

      ::= { hprRtpEntry 3 }

hprRtpRemNceId OBJECT-TYPE
      SYNTAX OCTET STRING (SIZE (1..8))
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The remote Network Connection Endpoint (NCE) of this RTP
          connection.  NCEs identify CPs, LUs, Boundary Functions (BFs),
          and Route Setup (RS) components."

      ::= { hprRtpEntry 4 }

hprRtpRemTcid OBJECT-TYPE
      SYNTAX OCTET STRING (SIZE (8))
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The remote TCID of this RTP connection."

      ::= { hprRtpEntry 5 }

hprRtpPathSwitchTrigger OBJECT-TYPE
      SYNTAX INTEGER {
                      ready(1),
                      switchPathNow(2)
                     }
      MAX-ACCESS read-write
      STATUS current
      DESCRIPTION
          "Object by which a Management Station can trigger an operator-
          requested path switch, by setting the value to
          switchPathNow(2).  Setting this object to switchPathNow(2)
          triggers a path switch even if its previous value was already
          switchPathNow(2).
```

```
          The value ready(1) is returned on GET operations until a SET
          has been processed; after that the value received on the most
          recent SET is returned.

          This MIB module provides no support for an operator-requested
          switch to a specified path."

      ::= { hprRtpEntry 6 }

hprRtpRscv OBJECT-TYPE
      SYNTAX OCTET STRING (SIZE (0..255))
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The forward Route Selection Control Vector for this RTP
          connection.  The format of this vector is described in SNA
          Formats.

          The value returned in this object during a path switch is
          implementation-dependent:  it may be the old path, the new
          path, a zero-length string, or some other valid RSCV string."

      ::= { hprRtpEntry 7 }

hprRtpTopic OBJECT-TYPE
      SYNTAX DisplayString (SIZE(8))
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The topic for this RTP connection.  This is used to indicate
          the Class of Service."

      ::= { hprRtpEntry 8 }

hprRtpState OBJECT-TYPE
      SYNTAX INTEGER {
                      rtpListening(1),
                      rtpCalling(2),
                      rtpConnected(3),
                      rtpPathSwitching(4),
                      rtpDisconnecting(5),
                      other(99)
                     }
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The state of the RTP connection, from the perspective of the
          local RTP protocol machine:
```

```
                rtpListening      - connection open; waiting for other end
                                    to call in
                rtpCalling        - connection opened, attempting to call
                                    out, have not yet received any data
                                    from other end
                rtpConnected      - connection is active; responded to a
                                    call-in or received other end's TCID
                                    from a call-out attempt
                rtpPathSwitching  - the path switch timer is running;
                                    attempting to find a new path for this
                                    connection.
                rtpDisconnecting  - no sessions are using this connection;
                                    in process of bringing it down
                other             - the connection is not in any of the
                                    states listed above."

        ::= { hprRtpEntry 9 }

hprRtpUpTime OBJECT-TYPE
        SYNTAX TimeTicks
        UNITS "1/100ths of a second"
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
            "The length of time the RTP connection has been up, measured
            in 1/100ths of a second."

        ::= { hprRtpEntry 10 }

hprRtpLivenessTimer OBJECT-TYPE
        SYNTAX Unsigned32
        UNITS "1/100ths of a second"
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
            "The value of the liveness (ALIVE) timer of this RTP
            connection, in units of 1/100th of a second.  When this timer
            expires and no packet has arrived from the partner since it
            was last set, packets with Status Request indicators will be
            sent to see if the RTP connection is still alive."

        ::= { hprRtpEntry 11 }

hprRtpShortReqTimer  OBJECT-TYPE
        SYNTAX Unsigned32
        UNITS "1/100ths of a second"
        MAX-ACCESS read-only
        STATUS current
```

```
      DESCRIPTION
          "The value of the RTP SHORT_REQ timer, in units of 1/100 of a
          second.  This timer represents the maximum time that a sender
          waits for a reply from a receiver."

      ::= { hprRtpEntry 12 }

hprRtpPathSwTimer OBJECT-TYPE
      SYNTAX Unsigned32
      UNITS "1/100ths of a second"
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The length of time that RTP should attempt a path switch
          for a connection, in units of 1/100th of a second."

      ::= { hprRtpEntry 13 }

hprRtpLivenessTimeouts OBJECT-TYPE
      SYNTAX HprRtpCounter
      UNITS "liveness timeouts"
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The count of liveness timeouts for this RTP connection."

      ::= { hprRtpEntry 14 }

hprRtpShortReqTimeouts OBJECT-TYPE
      SYNTAX HprRtpCounter
      UNITS "short request timeouts"
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The count of short request timeouts for this RTP connection."

      ::= { hprRtpEntry 15 }

hprRtpMaxSendRate OBJECT-TYPE
      SYNTAX Gauge32
      UNITS "bytes per second"
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The high-water mark for this RTP connection's send rate, in
          units of bytes per second.  This is the high-water mark for
          the entire life of the connection, not just the high-water
          mark for the connection's current path.
```

```
            For more details on this and other parameters related to HPR,
            see the High Performance Routing Architecture Reference."

        ::= { hprRtpEntry 16 }

hprRtpMinSendRate OBJECT-TYPE
        SYNTAX Gauge32
        UNITS "bytes per second"
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
            "The low-water mark for this RTP connection's send rate, in
            units of bytes per second.  This is the low-water mark for the
            entire life of the connection, not just the low-water mark for
            the connection's current path.

            For more details on this and other parameters related to HPR,
            see the High Performance Routing Architecture Reference."

        ::= { hprRtpEntry 17 }

hprRtpCurSendRate OBJECT-TYPE
        SYNTAX Gauge32
        UNITS "bytes per second"
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
            "The current send rate for this RTP connection, in units of
            bytes per second.

            For more details on this and other parameters related to HPR,
            see the High Performance Routing Architecture Reference."

        ::= { hprRtpEntry 18 }

hprRtpSmRdTripDelay OBJECT-TYPE
        SYNTAX Gauge32
        UNITS "1/1000ths of a second"
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
            "The smoothed round trip delay for this RTP connection, in
            units of 1/1000th of a second (ms).

            For more details on this and other parameters related to HPR,
            see the High Performance Routing Architecture Reference."

        ::= { hprRtpEntry 19 }
```

```
hprRtpSendPackets OBJECT-TYPE
      SYNTAX HprRtpCounter
      UNITS "RTP packets"
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The count of packets successfully sent on this RTP
          connection."

      ::= { hprRtpEntry 20 }

hprRtpRecvPackets OBJECT-TYPE
      SYNTAX HprRtpCounter
      UNITS "RTP packets"
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The count of packets received on this RTP connection.  The
          counter is incremented only once if duplicate copies of a
          packet are received."

      ::= { hprRtpEntry 21 }

hprRtpSendBytes OBJECT-TYPE
      SYNTAX HprRtpCounter
      UNITS "bytes"
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The count of bytes sent on this RTP connection.  Both RTP
          Transport Header (THDR) bytes and data bytes are included in
          this count."

      ::= { hprRtpEntry 22 }

hprRtpRecvBytes OBJECT-TYPE
      SYNTAX HprRtpCounter
      UNITS "bytes"
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The count of bytes received on this RTP connection.  Both RTP
          Transport Header (THDR) bytes and data bytes are included in
          this count."

      ::= { hprRtpEntry 23 }

hprRtpRetrPackets OBJECT-TYPE
```

```
      SYNTAX HprRtpCounter
      UNITS "RTP packets"
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The count of packets retransmitted on this RTP connection."

      ::= { hprRtpEntry 24 }

hprRtpPacketsDiscarded OBJECT-TYPE
      SYNTAX HprRtpCounter
      UNITS "RTP packets"
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The count of packets received on this RTP connection and then
          discarded.  A packet may be discarded because it is determined
          to be a duplicate, or for other reasons."

      ::= { hprRtpEntry 25 }

hprRtpDetectGaps OBJECT-TYPE
      SYNTAX HprRtpCounter
      UNITS "gaps"
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The count of gaps detected on this RTP connection."

      ::= { hprRtpEntry 26 }

hprRtpRateReqSends OBJECT-TYPE
      SYNTAX HprRtpCounter
      UNITS "rate requests"
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The count of Rate Requests sent on this RTP connection."

      ::= { hprRtpEntry 27 }

hprRtpOkErrPathSws OBJECT-TYPE
      SYNTAX HprRtpCounter
      UNITS "path switch attempts"
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The count of successful path switch attempts for this RTP
```

```
            connection due to errors."

        ::= { hprRtpEntry 28 }

hprRtpBadErrPathSws OBJECT-TYPE
        SYNTAX HprRtpCounter
        UNITS "path switch attempts"
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
            "The count of unsuccessful path switches for this RTP
            connection due to errors."

        ::= { hprRtpEntry 29 }

hprRtpOkOpPathSws OBJECT-TYPE
        SYNTAX HprRtpCounter
        UNITS "path switches"
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
            "The count of successful path switches for this RTP connection
            due to operator requests."

        ::= { hprRtpEntry 30 }

hprRtpBadOpPathSws OBJECT-TYPE
        SYNTAX HprRtpCounter
        UNITS "path switches"
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
            "The count of unsuccessful path switches for this RTP
            connection due to operator requests.  This counter is not
            incremented by an implementation that does not support
            operator-requested path switches, even if a Management Station
            requests such a path switch by setting the
            hprRtpPathSwitchTrigger object."

        ::= { hprRtpEntry 31 }

hprRtpCounterDisconTime OBJECT-TYPE
        SYNTAX TimeStamp
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
            "The value of the sysUpTime object when the counters for this
            RTP connection last experienced a discontinuity.  This will be
```

```
          the more recent of two times:  the time at which the
          connection was established or the time at which the HPR
          counters were last turned on or off."

      ::= { hprRtpEntry 32 }

-- ****************************************************************
-- The RTP Connection Status Table
--  This table contains statistics and historical information related to
--  both successful and unsuccessful RTP path switches.  This
--  information can be important for both trend analysis and problem
--  determination.
--
--  Note the terminology here:  when RTP is triggered to find a new path
--  for a connection, this initiates a 'path switch,' which will end up
--  being either successful or unsuccessful.  During this path switch,
--  RTP will make one or more 'path switch attempts,' which are attempts
--  to find a new path for the connection and switch the connection to
--  it.  This 'new' path may be the same path that the connection was
--  using before the path switch.
--
--  It is an implementation option how many entries to keep in this
--  table, and how long to retain any individual entry.
-- ****************************************************************
hprRtpStatusTable OBJECT-TYPE
      SYNTAX SEQUENCE OF HprRtpStatusEntry
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
          "RTP Connection Status Table:  This table contains historical
          information on RTP connections.  An entry is created in this
          table when a path switch is completed, either successfully or
          unsuccessfully."

      ::= { hprRtp 3 }

hprRtpStatusEntry OBJECT-TYPE
      SYNTAX HprRtpStatusEntry
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
          "This table is indexed by local NCE ID, local TCID, and an
          integer hprRtpStatusIndex.  Thus the primary grouping of table
          rows is by RTP connection, with the multiple entries for a
          given RTP connection ordered by time."

      INDEX
             { hprRtpStatusLocNceId,
```

```
                hprRtpStatusLocTcid,
                hprRtpStatusIndex }

      ::= { hprRtpStatusTable 1 }

  HprRtpStatusEntry ::= SEQUENCE {
     hprRtpStatusLocNceId          OCTET STRING, -- local nce id
     hprRtpStatusLocTcid           OCTET STRING, -- local tcid
     hprRtpStatusIndex             Unsigned32,   -- index
     hprRtpStatusStartTime         DateAndTime,  -- time stamp
     hprRtpStatusEndTime           DateAndTime,  -- time stamp
     hprRtpStatusRemCpName         SnaControlPointName,-- remote cp name
     hprRtpStatusRemNceId          OCTET STRING, -- remote nce id
     hprRtpStatusRemTcid           OCTET STRING, -- remote tcid
     hprRtpStatusNewRscv           OCTET STRING, -- new rscv
     hprRtpStatusOldRscv           OCTET STRING, -- old rscv
     hprRtpStatusCause             INTEGER,      -- cause
     hprRtpStatusLastAttemptResult INTEGER       -- result of last
                                          }

hprRtpStatusLocNceId OBJECT-TYPE
      SYNTAX OCTET STRING (SIZE (1..8))
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
          "The local Network Connection Endpoint (NCE) of this RTP
          connection.  NCEs identify CPs, LUs, Boundary Functions (BFs),
          and Route Setup (RS) components."

      ::= { hprRtpStatusEntry 1 }

hprRtpStatusLocTcid OBJECT-TYPE
      SYNTAX OCTET STRING (SIZE (8))
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
          "The local TCID of this RTP connection."

      ::= { hprRtpStatusEntry 2 }

hprRtpStatusIndex OBJECT-TYPE
      SYNTAX Unsigned32 (1..4294967295)
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
          "Table index.  This value begins at one and is incremented
          when a new entry is added to the table.  It is an
          implementation choice whether to run a single counter for
```

```
            all entries in the table, or to run a separate counter for
            the entries for each RTP connection.  In the unlikely event
            of a wrap, it is assumed that Management Stations will have
            the ability to order table entries correctly."

        ::= { hprRtpStatusEntry 3 }

hprRtpStatusStartTime OBJECT-TYPE
        SYNTAX DateAndTime
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
            "The time when the path switch began."

        ::= { hprRtpStatusEntry 4 }

hprRtpStatusEndTime OBJECT-TYPE
        SYNTAX DateAndTime
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
            "The time when the path switch was ended, either successfully
            or unsuccessfully."

        ::= { hprRtpStatusEntry 5 }

hprRtpStatusRemCpName OBJECT-TYPE
        SYNTAX SnaControlPointName
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
            "Administratively assigned network name for the remote node of
            this RTP connection."

        ::= { hprRtpStatusEntry 6 }

hprRtpStatusRemNceId OBJECT-TYPE
        SYNTAX OCTET STRING (SIZE (1..8))
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
            "The remote Network Connection Endpoint (NCE) of this RTP
            connection.  NCEs identify CPs, LUs, Boundary Functions (BFs),
            and Route Setup (RS) components."

        ::= { hprRtpStatusEntry 7 }

hprRtpStatusRemTcid OBJECT-TYPE
```

```
      SYNTAX OCTET STRING (SIZE (8))
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The remote TCID of this RTP connection."

      ::= { hprRtpStatusEntry 8 }

hprRtpStatusNewRscv OBJECT-TYPE
      SYNTAX OCTET STRING (SIZE (0..255))
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The new Route Selection Control Vector for this RTP
          connection.  A zero-length string indicates that no value is
          available, perhaps because the implementation does not save
          RSCVs."

      ::= { hprRtpStatusEntry 9 }

hprRtpStatusOldRscv OBJECT-TYPE
      SYNTAX OCTET STRING (SIZE (0..255))
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The old Route Selection Control Vector for this RTP
          connection.  A zero-length string indicates that no value is
          available, perhaps because the implementation does not save
          RSCVs."

      ::= { hprRtpStatusEntry 10 }

hprRtpStatusCause OBJECT-TYPE
      SYNTAX INTEGER {
                      other(1),
                      rtpConnFail(2),
                      locLinkFail(3),
                      remLinkFail(4),
                      operRequest(5)
                     }
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The reason for the path switch:

               other(1)       - Reason other than those listed below,
               rtpConnFail(2) - RTP connection failure detected,
               locLinkFail(3) - Local link failure,
```

```
                remLinkFail(4) - Remote link failure (learned from TDUs),
                operRequest(5) - Operator requested path switch. "

      ::= { hprRtpStatusEntry 11 }

hprRtpStatusLastAttemptResult  OBJECT-TYPE
      SYNTAX INTEGER { successful(1),
                       initiatorMoving(2),
                       directorySearchFailed(3),
                       rscvCalculationFailed(4),
                       negativeRouteSetupReply(5),
                       backoutRouteSetupReply(6),
                       timeoutDuringFirstAttempt(7),
                       otherUnsuccessful(8)
                     }
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
          "The result of the last completed path switch attempt.  If the
          path switch is aborted in the middle of a path switch attempt
          because the path switch timer expires, the result of the
          previous path switch attempt is reported.

          The values are defined as follows:

             successful(1)               - The final path switch
                                           attempt was successful.
             initiatorMoving(2)          - The final path switch
                                           attempt failed because the
                                           initiator is mobile, and
                                           there was no active link
                                           out of this node.
             directorySearchFailed(3)    - The final path switch
                                           attempt failed because a
                                           directory search for the
                                           destination node's CP name
                                           failed.
             rscvCalculationFailed(4)    - The final path switch
                                           attempt failed because an
                                           RSCV to the node containing
                                           the remote RTP endpoint
                                           could not be calculated.
             negativeRouteSetupReply(5)  - The final path switch
                                           attempt failed because route
                                           setup failed for the new
                                           path.
             backoutRouteSetupReply(6)   - The final path switch
                                           attempt failed because the
```

```
                                          remote RTP endpoint refused
                                          to continue the RTP
                                          connection.
            timeoutDuringFirstAttempt(7) - The path switch timer
                                          expired during the first
                                          path switch attempt.
            otherUnsuccessful(8)         - The final path switch
                                          attempt failed for a reason
                                          other than those listed
                                          above."

      ::= { hprRtpStatusEntry 12 }


-- ************************************************************
-- Conformance information
-- ************************************************************

hprConformance       OBJECT IDENTIFIER ::= { hprMIB 2 }

hprCompliances       OBJECT IDENTIFIER ::= { hprConformance 1 }
hprGroups            OBJECT IDENTIFIER ::= { hprConformance 2 }

-- Compliance statements

hprCompliance  MODULE-COMPLIANCE
      STATUS  current
      DESCRIPTION
          "The compliance statement for the SNMPv2 entities that
          implement the HPR MIB."

      MODULE  -- this module

--    Unconditionally mandatory groups
          MANDATORY-GROUPS  {
                             hprGlobalConfGroup,
                             hprAnrRoutingConfGroup,
                             hprTransportUserConfGroup
                            }

--    Conditionally mandatory groups
          GROUP   hprRtpConfGroup
          DESCRIPTION
              "The hprRtpConfGroup is mandatory for HPR implementations
              supporting the HPR transport tower."

      ::= { hprCompliances 1 }
```

```
-- Units of conformance
hprGlobalConfGroup OBJECT-GROUP
        OBJECTS {
                 hprNodeCpName,
                 hprOperatorPathSwitchSupport
                }
      STATUS  current
      DESCRIPTION
          "A collection of objects providing the instrumentation of HPR
          general information and capabilities."

      ::= { hprGroups 1 }

hprAnrRoutingConfGroup OBJECT-GROUP
        OBJECTS {
                 hprAnrsAssigned,
                 hprAnrCounterState,
                 hprAnrCounterStateTime,
                 hprAnrType,
                 hprAnrOutTgDest,
                 hprAnrOutTgNum,
                 hprAnrPacketsReceived,
                 hprAnrCounterDisconTime
                }
      STATUS  current
      DESCRIPTION
          "A collection of objects providing instrumentation for the
          node's ANR routing."

      ::= { hprGroups 2 }

hprTransportUserConfGroup OBJECT-GROUP
        OBJECTS {
                 hprNceType,
                 hprNceDefault,
                 hprNceInstanceId
                }
      STATUS  current
      DESCRIPTION
          "A collection of objects providing information on the users of
          the HPR transport known to the node."

      ::= { hprGroups 3 }

hprRtpConfGroup  OBJECT-GROUP
        OBJECTS {
                 hprRtpGlobeConnSetups,
                 hprRtpGlobeCtrState,
```

```
                hprRtpGlobeCtrStateTime,
                hprRtpRemCpName,
                hprRtpRemNceId,
                hprRtpRemTcid,
                hprRtpPathSwitchTrigger,
                hprRtpRscv,
                hprRtpTopic,
                hprRtpState,
                hprRtpUpTime,
                hprRtpLivenessTimer,
                hprRtpShortReqTimer,
                hprRtpPathSwTimer,
                hprRtpLivenessTimeouts,
                hprRtpShortReqTimeouts,

                hprRtpMaxSendRate,
                hprRtpMinSendRate,
                hprRtpCurSendRate,

                hprRtpSmRdTripDelay,

                hprRtpSendPackets,
                hprRtpRecvPackets,
                hprRtpSendBytes,
                hprRtpRecvBytes,

                hprRtpRetrPackets,
                hprRtpPacketsDiscarded,
                hprRtpDetectGaps,
                hprRtpRateReqSends,

                hprRtpOkErrPathSws,
                hprRtpBadErrPathSws,
                hprRtpOkOpPathSws,
                hprRtpBadOpPathSws,
                hprRtpCounterDisconTime,

                hprRtpStatusStartTime,
                hprRtpStatusEndTime,
                hprRtpStatusRemNceId,
                hprRtpStatusRemTcid,
                hprRtpStatusRemCpName,
                hprRtpStatusNewRscv,
                hprRtpStatusOldRscv,
                hprRtpStatusCause,
                hprRtpStatusLastAttemptResult

               }
```

```
      STATUS  current
      DESCRIPTION
          "A collection of objects providing the instrumentation for RTP
          connection end points."

      ::= { hprGroups 4 }

-- end of conformance statement

END
```

6. Acknowledgments

This MIB module is the product of the IETF SNA NAU MIB WG and the AIW APPN/HPR MIBs SIG. Thanks to Ray Bird, IBM Corporation; Jim Cobban, Nortel; and Laura Petrie, IBM Corporation, for their contributions and review.

7. References

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[4] Clouston, B., and B. Moore, "Definition of Managed Objects for APPN", RFC 2115, June 1997.

[5] IBM, APPN High Performance Routing Architecture Reference, SV40-1018-00.

[6] IBM, SNA/MS Formats, GC31-8302-00

8. Security Considerations

In most cases, MIBs are not themselves security risks; if SNMP security is operating as intended, the use of a MIB to view information about a system, or to change some parameter at the system, is a tool, not a threat.

None of the read-only objects in the HPR MIB reports a password, user data, or anything else that is particularly sensitive. Some enterprises view their network configuration itself, as well as information about network usage and performance, as corporate assets; such enterprises may wish to restrict SNMP access to most of the objects in the MIB.

One read-write object in the MIB can affect network operations:

- hprRtpPathSwitchTrigger: Setting this object to 'switchPathNow' triggers an immediate path switch attempt. An HPR path switch does not itself disrupt the SNA sessions using the RTP connection undergoing the path switch. However, frequent path switches for many RTP connections can have an adverse impact on overall network performance.

  It is recommended that SNMP access to this object be restricted.

  Other read-write objects control the gathering of network management data; controlling access to these objects is less critical.

9. Authors' Addresses

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