              Stream Control Transmission Protocol (SCTP)
                    Management Information Base (MIB)

Status of this Memo

   This document specifies an Internet standards track protocol for the
   Internet community, and requests discussion and suggestions for
   improvements. Please refer to the current edition of the "Internet
   Official Protocol Standards" (STD 1) for the standardization state
   and status of this protocol. Distribution of this memo is unlimited.

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Abstract

   The Stream Control Transmission Protocol (SCTP) is a reliable
   transport protocol operating on top of a connectionless packet
   network such as IP. It is designed to transport public switched
   telephone network (PSTN) signaling messages over the connectionless
   packet network, but is capable of broader applications.

   This memo defines the Management Information Base (MIB) module which
   describes the minimum set of objects needed to manage the
   implementation of the SCTP.

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1. Introduction

   This memo defines the Management Information Base (MIB) module which
   describes managed objects for implementations of the SCTP.

   The document starts with a brief description of the SNMP framework
   and continues with the MIB explanation and security consideration
   sections among others.

   The managed objects in this MIB module are based on [RFC2012] update:
   "Management Information Base for the Transmission Control Protocol
   (TCP)" referred as [TCPMIB] (work in progress), and RFC 3291 "Textual
   Conventions for Internet Network Addresses" [RFC3291].

   Terms related to the SCTP architecture are explained in [RFC2960].
   Other specific abbreviations are listed below.

   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 [RFC2119].

1.1. Abbreviations

   DNS   - Domain Name System
   IANA - Internet Assigned Numbers Authority
   IETF - Internet Engineering Task Force
   IP   - Internet Protocol
   MIB   - Management Information Base
   RFC   - Request For Comments
   RTO   - Retransmission Time Out
   SCTP - Stream Control Transmission Protocol
   SMI   - Structure of Management Information
   SNMP - Simple Network Management Protocol
   TCB   - Transmission Control Block
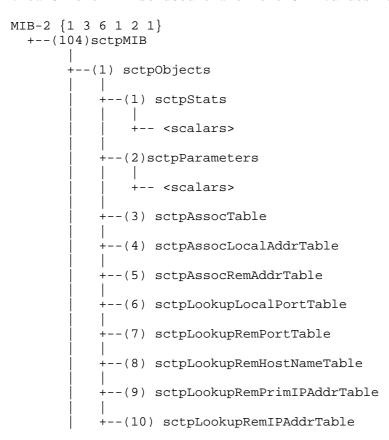   TCP   - Transmission Control Protocol

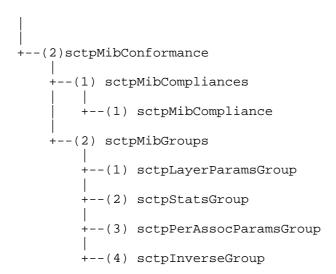2. The Internet-Standard Management Framework

    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].

3. MIB Structure

    This chapter explains the main objects this MIB defines. A detailed
    view of the MIB structure with the OID values is below.

    MIB-2 {1 3 6 1 2 1}
      +--(104)sctpMIB
           |
         +--(1) sctpObjects
         | |
         | +--(1) sctpStats
         | | |
         | | +-- <scalars>
         | |
         | +--(2)sctpParameters
         | | |
         | | +-- <scalars>
         | |
         | +--(3) sctpAssocTable
         | |
         | +--(4) sctpAssocLocalAddrTable
         | |
         | +--(5) sctpAssocRemAddrTable
         | |
         | +--(6) sctpLookupLocalPortTable
         | |
         | +--(7) sctpLookupRemPortTable
         | |
         | +--(8) sctpLookupRemHostNameTable
         | |
         | +--(9) sctpLookupRemPrimIPAddrTable
         | |
         | +--(10) sctpLookupRemIPAddrTable

```
           |
           |
        +--(2)sctpMibConformance
              |
           +--(1) sctpMibCompliances
           |    |
           |    +--(1) sctpMibCompliance
           |
           +--(2) sctpMibGroups
                  |
                +--(1) sctpLayerParamsGroup
                  |
                +--(2) sctpStatsGroup
                  |
                +--(3) sctpPerAssocParamsGroup
                  |
                +--(4) sctpInverseGroup
```

   The main groups are explained further in the MIB definition.

3.1. SCTP Objects

   This branch contains the SCTP statistics and general parameters (both
   of them scalars) and the SCTP MIB tables.

3.1.1. SCTP Statistics

   The SCTP MIB includes both Counter32s and Counter64s to deal with
   statistics. Counter64s are used for those counters, which are likely
   to wrap around in less than one hour, according to [RFC2863].

   In addition Gauge32 is also used.

3.1.1.1. State-Related Statistics

   These statistics are based on the TCP model, but adapted to the SCTP
   states. They store the number of successful association attempts,
   how many associations have been initiated by the local or the remote
   SCTP layer, and the number of associations terminated in a graceful
   (by means of SHUTDOWN procedure) or ungraceful way (by means of CLOSE
   procedure).

3.1.1.2. Statistics for traffic Measurements

   This set of objects specifies statistics related to the whole SCTP
   layer. There are, e.g., statistics related to both SCTP packets and
   SCTP chunks.

Statistics related to a specific association, or local/remote IP
addresses are defined inside their associated table.

3.1.2. SCTP Parameters

This section of the MIB contains the general variables for the SCTP
protocol. Maximum, minimum, initial and default values are listed
here.

SCTP RTO mechanism definition is based on the TCP MIB [TCPMIB]. In
SCTP, only options 'other' and 'vanj' are valid since SCTP defines
Van Jacobson's algorithm (vanj) as the one to be used to calculate
RTO. 'Other' is left for future use.

3.1.3. MIB Tables

There are several tables included in the SCTP MIB. The first group
deals with the SCTP association variables and is composed of a main
and two extended tables. The second group is a bunch of tables used
to perform reverse lookups.

It is NOT possible to create rows in any table (sctpAssocTable,
sctpAssocLocalAddrTable, sctpRemAddrTable and Reverse Lookup tables)
using SNMP.

It is NOT possible to delete rows in any table using SNMP except in
sctpAssocTable under the particular conditions explained below.

3.1.3.1. Association Table

The sctpAssocTable is the main MIB table, where all the association
related information is stored on a per association basis. It is
structured according to expanded tables. The main table is called
sctpAssocTable and is indexed by sctpAssocId (the association
identification). This is a value that uniquely identifies an
association. The MIB does not restrict what value must be written
here, however it must be unique within the table.

The sctpAssoc index is also shared by two more tables:
    - sctpAssocLocalAddrTable: to store the local IP address(es).
    - sctpAssocRemAddrTable: to store the remote addresses and the
      per-remote-address related information.

Entries in the sctpAssocTable are created when trying to establish
the association, i.e., when sending the COOKIE-ECHO message
(originating side) or the COOKIE-ACK message (server side). At this
point, i.e., at established state, all entry fields are filled in
with valid values.

   Note: The following representation is a conceptual mode of describing
   the relationship between the tables in this MIB. Note that the real
   relationship of the tables is by sharing an index, so tables are not
   truly within tables. Every entry is explained when defining the
   corresponding objects in the MIB.

```
   mib-2 {1 3 6 1 2 1}
     +--(104)sctpMIB
          |
         +--(1) sctpObjects
         |  |
         .  .
         .  .
         .  |
            +--(3) sctpAssocTable
            |  |
            |  +--(1) sctpAssocId (index)
            |  |
            |  +--(2) sctpAssocRemHostName
            |  |
            |  +--(3) sctpAssocLocalPort
            |  |
            |  +--(4) sctpAssocRemPort
            |  |
            |  +--(5) sctpAssocRemPrimAddrType
            |  |
            |  +--(6) sctpAssocRemPrimAddr
            |  |
            |  +--(7) sctpAssocHeartBeatInterval
            |  |
            |  +--(8) sctpAssocState
            |  |
            |  +--(9) sctpAssocInStreams
            |  |
            |  +--(10) sctpAssocOutStreams
            |  |
            |  +--(11) sctpAssocMaxRetr
            |  |
            |  +--(12) sctpAssocPrimProcess
            |  |
            |  +--(13) sctpAssocT1expireds
            |  |
            |  +--(14) sctpAssocT2expireds
            |  |
            |  +--(15) sctpAssocRtxChunks
            |  |
            |  +--(16) sctpAssocStartTime
            |  |
```

```
      |     +--(17) sctpAssocDiscontinuityTime
      |
      |
      +--(4) sctpAssocLocalAddrTable
      |    |
      |    |--(-) sctpAssocId (shared index)
      |    |
      |    +--(1) sctpAssocLocalAddrType(index)
      |    |
      |    +--(2) sctpAssocLocalAddr (index)
      |    |
      |    +--(3) sctpAssocLocalAddrStartTime
      |
      |
      +--(5) sctpAssocRemAddrTable
      |    |
      |    |--(-) sctpAssocId (shared index)
      |    |
      |    +--(1) sctpAssocRemAddrType (index)
      .    |
      .    +--(2) sctpAssocRemAddr (index)
      .    |
           +--(3) sctpAssocRemAddrActive
           |
           +--(4) sctpAssocRemAddrHBActive
           |
           +--(5) sctpAssocRemAddrRTO
           |
           +--(6) sctpAssocRemAddrMaxPathRtx
           |
           +--(7) sctpAssocRemAddrRtx
           |
           +--(8) sctpAssocRemAddrStartTime
```

   Both sctpAssocLocalAddrTable and sctpAssocRemAddrTable are indexed by
   addresses. 'Addr' and 'AddrType' use the syntax InetAddress and
   InetAddressType defined in the Textual Conventions for Internet
   Network Address (RFC3291). The InetAddressType TC has codepoints for
   unknown, IPv4, IPv6, non-global IPv4, non-global IPv6, and DNS
   addresses, but only the IPv4 and IPv6 address types are required to
   be supported by implementations of this MIB module. Implementations
   that connect multiple zones are expected to support the non-global
   IPv4 and non-global IPv6 address types as well.

   Note that DNS addresses are not used in this MIB module. They are
   always resolved to the on-the-wire form prior to connection setup,
   and the on-the-wire form is what appears in the MIB objects.

The sctpAssocLocalAddrTable table will have as many entries as local
IP addresses have been defined for the association. The
sctpAssocRemAddrTable table will contain as many entries as remote IP
addresses are known to reach the peer. For the multihoming concept
see reference RFC2960.

To keep the name of the remote peer (when provided by the peer at
initialization time), an entry has been created in the sctpAssocTable
called sctpAssocRemHostName. When no DNS name is provided by the
remote endpoint, this value will be NULL (zero-length string).
Otherwise, the received DNS name will be stored here.

If it is necessary to abort an existing association, the value
deleteTCB(9) must be written in the variable sctpAssocState. That is
the only way to delete rows in any of the mentioned tables.

3.1.3.2. Reverse Lookup Table

There are five reverse lookup tables to help management applications
efficiently access conceptual rows in other tables. These tables
allow management applications to avoid expensive tree walks through
large numbers of associations.

All of these tables are optional. If these tables are implemented,
an entry in them must be created after the entry in the main table
(sctpAssocTable) associated with it has been created. This ensures
that the field indexing the lookup table exists.

The defined reverse lookup tables allow for performing a lookup using
the following variables:

   - Local Port: It allows a management application to find all the
     associations that use a specific local port
   - Remote Port: It allows a management application to find all the
     associations that use a specific remote port
   - Remote Host Name: It allows a management application to find
     all the associations with a specific host name.
   - Remote Primary IP Address: It allows a management application
     to find all the associations that use a specific remote IP
     address as primary.
   - Remote IP address: a management application to find all the
      associations that use a specific remote IP address.

As an example the picture below shows the table to look up by local
port.

```
   MIB-2 {1 3 6 1 2 1}
     +--(104)sctpMIB
          |
          +--(1) sctpObjects
          |   |
          .   .
          .   .
          |   |
          |   +--(6) sctpLookupLocalPortTable
          |   |   |
          .   .   +--(-) sctpAssocLocalPort (shared index)
          .   .   |
                  +--(-) sctpAssocId (shared index)
                  |
                  +--(1) sctpLookupLocalPortStartTime
```

   It is not possible for the operator to either create or delete rows
   in these tables. The rows in this table will dynamically appear and
   be removed as the corresponding entries in sctpAssocTable are.

3.2. Conformance

   The conformance section recommends all the inverse lookup tables in
   this MIB as optional. General layer and per association parameters
   and statistics are considered mandatory.

   IP addresses use the global IPv4 and global IPv6 address formats.
   Unknown value and DNS name formats are not used. Names, if present,
   are stored in the sctpRemoteHostName variable.

4. Definitions

   SCTP-MIB DEFINITIONS ::= BEGIN

   IMPORTS
     MODULE-IDENTITY, OBJECT-TYPE, Integer32, Unsigned32, Gauge32,
     Counter32, Counter64, mib-2
         FROM SNMPv2-SMI   -- [RFC2578]
     TimeStamp, TruthValue
         FROM SNMPv2-TC   -- [RFC2579]
     MODULE-COMPLIANCE, OBJECT-GROUP
         FROM SNMPv2-CONF   -- [RFC2580]
     InetAddressType, InetAddress, InetPortNumber
         FROM INET-ADDRESS-MIB;   -- [RFC3291]

```
   sctpMIB MODULE-IDENTITY
     LAST-UPDATED "200409020000Z"        -- 2nd September 2004
     ORGANIZATION "IETF SIGTRAN Working Group"
     CONTACT-INFO
           "
           WG EMail: sigtran@ietf.org

           Web Page:
                 http://www.ietf.org/html.charters/sigtran-charter.html

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              Email: J.Javier.Pastor@ericsson.com
           "
     DESCRIPTION
           "The MIB module for managing SCTP implementations.

           Copyright (C) The Internet Society (2004).  This version of
           this MIB module is part of RFC 3873; see the RFC itself for
           full legal notices. "

     REVISION "200409020000Z"        -- 2nd September 2004

     DESCRIPTION " Initial version, published as RFC 3873"

     ::= {  mib-2 104 }
```

```
    -- the SCTP base variables group

    sctpObjects OBJECT IDENTIFIER ::= { sctpMIB 1 }

    sctpStats   OBJECT IDENTIFIER ::= { sctpObjects 1 }
    sctpParams  OBJECT IDENTIFIER ::= { sctpObjects 2 }

    -- STATISTICS
    -- **********

    -- STATE-RELATED STATISTICS

    sctpCurrEstab OBJECT-TYPE
      SYNTAX          Gauge32
      MAX-ACCESS      read-only
      STATUS          current
      DESCRIPTION
           "The number of associations for which the current state is
           either ESTABLISHED, SHUTDOWN-RECEIVED or SHUTDOWN-PENDING."
      REFERENCE
           "Section 4 in RFC2960 covers the SCTP  Association state
           diagram."

      ::= { sctpStats 1 }


    sctpActiveEstabs OBJECT-TYPE
      SYNTAX          Counter32
      MAX-ACCESS      read-only
      STATUS          current
      DESCRIPTION
           "The number of times that associations have made a direct
           transition to the ESTABLISHED state from the COOKIE-ECHOED
           state: COOKIE-ECHOED -> ESTABLISHED. The upper layer initiated
           the association attempt."
      REFERENCE
           "Section 4 in RFC2960 covers the SCTP  Association state
           diagram."

      ::= { sctpStats  2 }
```

```
sctpPassiveEstabs OBJECT-TYPE
  SYNTAX          Counter32
  MAX-ACCESS      read-only
  STATUS          current
  DESCRIPTION
      "The number of times that associations have made a direct
      transition to the ESTABLISHED state from the CLOSED state:
      CLOSED -> ESTABLISHED. The remote endpoint initiated the
      association attempt."
  REFERENCE
      "Section 4 in RFC2960 covers the SCTP   Association state
      diagram."

  ::= { sctpStats  3 }


sctpAborteds OBJECT-TYPE
  SYNTAX          Counter32
  MAX-ACCESS      read-only
  STATUS          current
  DESCRIPTION
      "The number of times that associations have made a direct
      transition to the CLOSED state from any state using the
      primitive 'ABORT': AnyState --Abort--> CLOSED. Ungraceful
      termination of the association."
  REFERENCE
      "Section 4 in RFC2960 covers the SCTP   Association state
      diagram."

  ::= { sctpStats  4 }


sctpShutdowns OBJECT-TYPE
  SYNTAX          Counter32
  MAX-ACCESS      read-only
  STATUS          current
  DESCRIPTION
      "The number of times that associations have made a direct
      transition to the CLOSED state from either the SHUTDOWN-SENT
      state or the SHUTDOWN-ACK-SENT state. Graceful termination of
      the association."
  REFERENCE
      "Section 4 in RFC2960 covers the SCTP   Association state
      diagram."

  ::= { sctpStats  5 }
```

    -- OTHER LAYER STATISTICS

    sctpOutOfBlues OBJECT-TYPE
      SYNTAX   Counter32
      MAX-ACCESS   read-only
      STATUS   current
      DESCRIPTION
          "The number of out of the blue packets received by the host.
           An out of the blue packet is an SCTP packet correctly formed,
           including the proper checksum, but for which the receiver was
           unable to identify an appropriate association."
      REFERENCE
          "Section 8.4 in RFC2960 deals with the Out-Of-The-Blue
           (OOTB) packet definition and procedures."

      ::= { sctpStats 6 }

    sctpChecksumErrors OBJECT-TYPE
      SYNTAX   Counter32
      MAX-ACCESS   read-only
      STATUS   current
      DESCRIPTION
          "The number of SCTP packets received with an invalid
           checksum."
      REFERENCE
          "The checksum is located at the end of the SCTP packet as per
           Section 3.1 in RFC2960. RFC3309 updates SCTP to use a 32 bit
           CRC checksum."

    ::= { sctpStats 7 }

    sctpOutCtrlChunks OBJECT-TYPE
      SYNTAX   Counter64
      MAX-ACCESS   read-only
      STATUS   current
      DESCRIPTION
          "The number of SCTP control chunks sent (retransmissions are
           not included). Control chunks are those chunks different from
           DATA."
      REFERENCE
          "Sections 1.3.5 and 1.4 in RFC2960 refer to control chunk as
           those chunks different from those that contain user
           information, i.e., DATA chunks."

      ::= { sctpStats 8 }

```
   sctpOutOrderChunks OBJECT-TYPE
      SYNTAX          Counter64
      MAX-ACCESS      read-only
      STATUS          current
      DESCRIPTION
          "The number of SCTP ordered data chunks sent (retransmissions
          are not included)."
      REFERENCE
          "Section 3.3.1 in RFC2960 defines the ordered data chunk."

      ::= { sctpStats  9 }

   sctpOutUnorderChunks OBJECT-TYPE
      SYNTAX          Counter64
      MAX-ACCESS      read-only
      STATUS          current
      DESCRIPTION
          "The number of SCTP unordered chunks (data chunks in which the
          U bit is set to 1) sent (retransmissions are not included)."
      REFERENCE
          "Section 3.3.1 in RFC2960 defines the unordered data chunk."

      ::= { sctpStats  10 }

   sctpInCtrlChunks OBJECT-TYPE
      SYNTAX          Counter64
      MAX-ACCESS      read-only
      STATUS          current
      DESCRIPTION
          "The number of SCTP control chunks received (no duplicate
          chunks included)."
      REFERENCE
          "Sections 1.3.5 and 1.4 in RFC2960 refer to control chunk as
          those chunks different from those that contain user
          information, i.e., DATA chunks."

      ::= { sctpStats  11 }


   sctpInOrderChunks OBJECT-TYPE
      SYNTAX          Counter64
      MAX-ACCESS      read-only
      STATUS          current
      DESCRIPTION
          "The number of SCTP ordered data chunks received (no duplicate
          chunks included)."
```

       REFERENCE
           "Section 3.3.1 in RFC2960 defines the ordered data chunk."

       ::= { sctpStats 12 }

    sctpInUnorderChunks OBJECT-TYPE
       SYNTAX   Counter64
       MAX-ACCESS   read-only
       STATUS   current
       DESCRIPTION
           "The number of SCTP unordered chunks (data chunks in which the
           U bit is set to 1) received (no duplicate chunks included)."
       REFERENCE
           "Section 3.3.1 in RFC2960 defines the unordered data chunk."

       ::= { sctpStats 13 }

    sctpFragUsrMsgs OBJECT-TYPE
       SYNTAX   Counter64
       MAX-ACCESS   read-only
       STATUS   current
       DESCRIPTION

           "The number of user messages that have to be fragmented
           because of the MTU."

       ::= { sctpStats 14 }

    sctpReasmUsrMsgs OBJECT-TYPE
       SYNTAX   Counter64
       MAX-ACCESS   read-only
       STATUS   current
       DESCRIPTION
           "The number of user messages reassembled, after conversion
           into DATA chunks."
       REFERENCE
           "Section 6.9 in RFC2960 includes a description of the
           reassembly process."

       ::= { sctpStats 15 }

```
   sctpOutSCTPPacks OBJECT-TYPE
     SYNTAX          Counter64
     MAX-ACCESS      read-only
     STATUS          current
     DESCRIPTION
         "The number of SCTP packets sent. Retransmitted DATA chunks
         are included."

     ::= { sctpStats  16 }


   sctpInSCTPPacks OBJECT-TYPE
     SYNTAX          Counter64
     MAX-ACCESS      read-only
     STATUS          current
     DESCRIPTION
         "The number of SCTP packets received. Duplicates are
         included."

     ::= { sctpStats  17 }

   sctpDiscontinuityTime OBJECT-TYPE
     SYNTAX          TimeStamp
     MAX-ACCESS      read-only
     STATUS          current
     DESCRIPTION
         "The value of sysUpTime on the most recent occasion at which
         any one or more of this general statistics counters suffered a
         discontinuity.  The relevant counters are the specific
         instances associated with this interface of any Counter32 or
         Counter64 object contained in the SCTP layer statistics
         (defined below sctpStats branch).  If no such discontinuities
         have occurred since the last re-initialization of the local
         management subsystem, then this object contains a zero value."
     REFERENCE
         "The inclusion of this object is recommended by RFC2578."

     ::= { sctpStats 18 }


   -- PROTOCOL GENERAL VARIABLES
   -- *************************

   sctpRtoAlgorithm OBJECT-TYPE
     SYNTAX            INTEGER {
                        other(1),     -- Other new one. Future use
                        vanj(2)       -- Van Jacobson's algorithm
                     }
```

```
      MAX-ACCESS      read-only
      STATUS          current
      DESCRIPTION
          "The algorithm used to determine the timeout value (T3-rtx)
          used for re-transmitting unacknowledged chunks."
      REFERENCE
          "Section 6.3.1 and 6.3.2 in RFC2960 cover the RTO calculation
          and retransmission timer rules."
      DEFVAL {vanj} -- vanj(2)

      ::= { sctpParams 1 }


   sctpRtoMin OBJECT-TYPE
      SYNTAX          Unsigned32
      UNITS           "milliseconds"
      MAX-ACCESS      read-only
      STATUS          current
      DESCRIPTION
          "The minimum value permitted by a SCTP implementation for the
          retransmission timeout value, measured in milliseconds.  More
          refined semantics for objects of this type depend upon the
          algorithm used to determine the retransmission timeout value.

          A retransmission time value of zero means immediate
          retransmission.

          The value of this object has to be lower than or equal to
          stcpRtoMax's value."
      DEFVAL {1000} -- milliseconds

      ::= { sctpParams 2 }

   sctpRtoMax OBJECT-TYPE
      SYNTAX          Unsigned32
      UNITS           "milliseconds"
      MAX-ACCESS      read-only
      STATUS          current
      DESCRIPTION
          "The maximum value permitted by a SCTP implementation for the
          retransmission timeout value, measured in milliseconds.  More
          refined semantics for objects of this type depend upon the
          algorithm used to determine the retransmission timeout value.

          A retransmission time value of zero means immediate re-
          transmission.
```

          The value of this object has to be greater than or equal to
          stcpRtoMin's value."
      DEFVAL {60000} -- milliseconds

       ::= { sctpParams 3 }

   sctpRtoInitial OBJECT-TYPE
      SYNTAX   Unsigned32
      UNITS   "milliseconds"
      MAX-ACCESS   read-only
      STATUS   current
      DESCRIPTION
          "The initial value for the retransmission timer.

          A retransmission time value of zero means immediate re-
          transmission."
      DEFVAL {3000} -- milliseconds

       ::= { sctpParams 4 }

   sctpMaxAssocs OBJECT-TYPE
      SYNTAX   Integer32 (-1 | 0..2147483647)
      MAX-ACCESS   read-only
      STATUS   current
      DESCRIPTION
          "The limit on the total number of associations the entity can
          support. In entities where the maximum number of associations
          is dynamic, this object should contain the value -1."

       ::= { sctpParams 5 }

   sctpValCookieLife OBJECT-TYPE
      SYNTAX   Unsigned32
      UNITS   "milliseconds"

      MAX-ACCESS   read-only
      STATUS   current
      DESCRIPTION
          "Valid cookie life in the 4-way start-up handshake procedure."
      REFERENCE
          "Section 5.1.3 in RFC2960 explains the cookie generation
          process. Recommended value is per section 14 in RFC2960."
      DEFVAL {60000} -- milliseconds

       ::= { sctpParams 6 }

```
   sctpMaxInitRetr OBJECT-TYPE
     SYNTAX          Unsigned32
     MAX-ACCESS      read-only
     STATUS          current
     DESCRIPTION
         "The maximum number of retransmissions at the start-up phase
         (INIT and COOKIE ECHO chunks). "
     REFERENCE
         "Section 5.1.4, 5.1.6 in RFC2960 refers to Max.Init.Retransmit
         parameter. Recommended value is per section 14 in RFC2960."
     DEFVAL {8} -- number of attempts

     ::= { sctpParams 7 }


   -- TABLES
   -- ******

   -- the SCTP Association TABLE

   -- The SCTP association table contains information about each
   -- association in which the local endpoint is involved.


   sctpAssocTable OBJECT-TYPE
     SYNTAX          SEQUENCE OF SctpAssocEntry
     MAX-ACCESS      not-accessible
     STATUS          current
     DESCRIPTION
         "A table containing SCTP association-specific information."

     ::= { sctpObjects 3 }


   sctpAssocEntry OBJECT-TYPE
     SYNTAX          SctpAssocEntry
     MAX-ACCESS      not-accessible

     STATUS          current
     DESCRIPTION
         "General common variables and statistics for the whole
         association."
     INDEX           { sctpAssocId }

     ::= { sctpAssocTable 1 }
```

```
    SctpAssocEntry ::= SEQUENCE {
      sctpAssocId                       Unsigned32,
      sctpAssocRemHostName              OCTET STRING,
      sctpAssocLocalPort                InetPortNumber,
      sctpAssocRemPort                  InetPortNumber,
      sctpAssocRemPrimAddrType          InetAddressType,
      sctpAssocRemPrimAddr              InetAddress,
      sctpAssocHeartBeatInterval        Unsigned32,
      sctpAssocState                    INTEGER,
      sctpAssocInStreams                Unsigned32,
      sctpAssocOutStreams               Unsigned32,
      sctpAssocMaxRetr                  Unsigned32,
      sctpAssocPrimProcess              Unsigned32,
      sctpAssocT1expireds               Counter32,      -- Statistic
      sctpAssocT2expireds               Counter32,      -- Statistic
      sctpAssocRtxChunks                Counter32,      -- Statistic
      sctpAssocStartTime                TimeStamp,
      sctpAssocDiscontinuityTime        TimeStamp
      }


    sctpAssocId OBJECT-TYPE
      SYNTAX          Unsigned32 (1..4294967295)
      MAX-ACCESS      not-accessible
      STATUS          current
      DESCRIPTION
          "Association Identification. Value identifying the
          association. "

      ::= { sctpAssocEntry 1 }


    sctpAssocRemHostName OBJECT-TYPE
      SYNTAX          OCTET STRING (SIZE(0..255))
      MAX-ACCESS      read-only
      STATUS          current
      DESCRIPTION
          "The peer's DNS name. This object needs to have the same
          format as the encoding in the DNS protocol.  This implies that
          the domain name can be up to 255 octets long, each octet being
          0<=x<=255 as value with US-ASCII A-Z having a case insensitive
          matching.

          If no DNS domain name was received from the peer at init time
          (embedded in the INIT or INIT-ACK chunk), this object is
          meaningless. In such cases the object MUST contain a zero-
          length string value. Otherwise, it contains the remote host
          name received at init time."
```

```
   ::= { sctpAssocEntry 2 }


sctpAssocLocalPort OBJECT-TYPE
  SYNTAX          InetPortNumber (1..65535)
  MAX-ACCESS      read-only
  STATUS          current
  DESCRIPTION
       "The local SCTP port number used for this association."

  ::= { sctpAssocEntry 3 }


sctpAssocRemPort OBJECT-TYPE
  SYNTAX          InetPortNumber (1..65535)
  MAX-ACCESS      read-only
  STATUS          current
  DESCRIPTION
       "The remote SCTP port number used for this association."

  ::= { sctpAssocEntry 4 }


sctpAssocRemPrimAddrType OBJECT-TYPE
  SYNTAX          InetAddressType
  MAX-ACCESS      read-only
  STATUS          current
  DESCRIPTION
       "The internet type of primary remote IP address. "

  ::= { sctpAssocEntry 5 }

sctpAssocRemPrimAddr OBJECT-TYPE
  SYNTAX          InetAddress
  MAX-ACCESS      read-only
  STATUS          current
  DESCRIPTION
       "The primary remote IP address. The type of this address is
       determined by the value of sctpAssocRemPrimAddrType.

       The client side will know this value after INIT_ACK message
       reception, the server side will know this value when sending
       INIT_ACK message. However, values will be filled in at
       established(4) state."

  ::= { sctpAssocEntry 6 }
```

```
   sctpAssocHeartBeatInterval OBJECT-TYPE
     SYNTAX          Unsigned32
     UNITS           "milliseconds"
     MAX-ACCESS      read-only
     STATUS          current
     DESCRIPTION
         "The current heartbeat interval..

         Zero value means no HeartBeat, even when the concerned
         sctpAssocRemAddrHBFlag object is true."
     DEFVAL {30000} -- milliseconds

     ::= { sctpAssocEntry 7 }


   sctpAssocState OBJECT-TYPE
     SYNTAX          INTEGER {
                        closed(1),
                        cookieWait(2),
                        cookieEchoed(3),
                        established(4),
                        shutdownPending(5),
                        shutdownSent(6),
                        shutdownReceived(7),
                        shutdownAckSent(8),
                        deleteTCB(9)
                        }
     MAX-ACCESS      read-write
     STATUS          current
     DESCRIPTION
         "The state of this SCTP association.

         As in TCP, deleteTCB(9) is the only value that may be set by a
         management station. If any other value is received, then the
         agent must return a wrongValue error.

         If a management station sets this object to the value
         deleteTCB(9), then this has the effect of deleting the TCB (as
         defined in SCTP) of the corresponding association on the
         managed node, resulting in immediate termination of the
         association.

         As an implementation-specific option, an ABORT chunk may be
         sent from the managed node to the other SCTP endpoint as a
         result of setting the deleteTCB(9) value. The ABORT chunk
         implies an ungraceful association shutdown."
```

      REFERENCE

           "Section 4 in RFC2960 covers the SCTP Association state
           diagram."

      ::= { sctpAssocEntry 8 }

   sctpAssocInStreams OBJECT-TYPE
      SYNTAX   Unsigned32 (1..65535)
      MAX-ACCESS   read-only
      STATUS   current
      DESCRIPTION
           "Inbound Streams according to the negotiation at association
           start up."
      REFERENCE
           "Section 1.3 in RFC2960 includes a definition of stream.
           Section 5.1.1 in RFC2960 covers the streams negotiation
           process."

      ::= { sctpAssocEntry 9 }

   sctpAssocOutStreams OBJECT-TYPE
      SYNTAX   Unsigned32 (1..65535)
      MAX-ACCESS   read-only
      STATUS   current
      DESCRIPTION
           "Outbound Streams according to the negotiation at association
           start up. "
      REFERENCE
           "Section 1.3 in RFC2960 includes a definition of stream.
           Section 5.1.1 in RFC2960 covers the streams negotiation
           process."

      ::= { sctpAssocEntry 10 }

   sctpAssocMaxRetr OBJECT-TYPE
      SYNTAX   Unsigned32
      MAX-ACCESS   read-only
      STATUS   current
      DESCRIPTION
           "The maximum number of data retransmissions in the association
           context. This value is specific for each association and the
           upper layer can change it by calling the appropriate
           primitives. This value has to be smaller than the addition of
           all the maximum number for all the paths
           (sctpAssocRemAddrMaxPathRtx).

          A value of zero value means no retransmissions."
     DEFVAL {10} -- number of attempts

       ::= { sctpAssocEntry 11 }

   sctpAssocPrimProcess OBJECT-TYPE
         SYNTAX   Unsigned32
         MAX-ACCESS read-only
         STATUS   current
         DESCRIPTION
          "This object identifies the system level process which holds
          primary responsibility for the SCTP association.
          Wherever possible, this should be the system's native unique
          identification number. The special value 0 can be used to
          indicate that no primary process is known.

          Note that the value of this object can be used as a pointer
          into the swRunTable of the HOST-RESOURCES-MIB(if the value is
          smaller than 2147483647) or into the sysApplElmtRunTable of
          the SYSAPPL-MIB."

       ::= { sctpAssocEntry 12 }

   -- Association Statistics

   sctpAssocT1expireds OBJECT-TYPE
     SYNTAX   Counter32
     MAX-ACCESS   read-only
     STATUS   current
     DESCRIPTION
          "The T1 timer determines how long to wait for an
          acknowledgement after sending an INIT or COOKIE-ECHO chunk.
          This object reflects the number of times the T1 timer expires
          without having received the acknowledgement.

          Discontinuities in the value of this counter can occur at re-
          initialization of the management system, and at other times as
          indicated by the value of sctpAssocDiscontinuityTime."
     REFERENCE
          "Section 5 in RFC2960."

       ::= { sctpAssocEntry 13 }

   sctpAssocT2expireds OBJECT-TYPE
     SYNTAX   Counter32
     MAX-ACCESS   read-only

         STATUS   current
         DESCRIPTION
              "The T2 timer determines how long to wait for an
              acknowledgement after sending a SHUTDOWN or SHUTDOWN-ACK
              chunk. This object reflects the number of times that T2- timer
              expired.

              Discontinuities in the value of this counter can occur at re-
              initialization of the management system, and at other times as
              indicated by the value of sctpAssocDiscontinuityTime."
       REFERENCE
              "Section 9.2 in RFC2960."
         ::= { sctpAssocEntry 14 }

     sctpAssocRtxChunks OBJECT-TYPE
         SYNTAX   Counter32
         MAX-ACCESS   read-only
         STATUS   current
         DESCRIPTION
              "When T3-rtx expires, the DATA chunks that triggered the T3
              timer will be re-sent according with the retransmissions
              rules. Every DATA chunk that was included in the SCTP packet
              that triggered the T3-rtx timer must be added to the value of
              this counter.

              Discontinuities in the value of this counter can occur at re-
              initialization of the management system, and at other times as
              indicated by the value of sctpAssocDiscontinuityTime."
       REFERENCE
              "Section 6 in RFC2960 covers the retransmission process and
              rules."

         ::= { sctpAssocEntry 15 }

     sctpAssocStartTime OBJECT-TYPE
         SYNTAX   TimeStamp
         MAX-ACCESS   read-only
         STATUS   current
         DESCRIPTION
              "The value of sysUpTime at the time that the association
              represented by this row enters the ESTABLISHED state, i.e.,
              the sctpAssocState object is set to established(4). The
              value of this object will be zero:
              - before the association enters the established(4)
                state, or

```
              - if the established(4) state was entered prior to
                the last re-initialization of the local network management
                subsystem."

         ::= { sctpAssocEntry 16 }

     sctpAssocDiscontinuityTime OBJECT-TYPE
        SYNTAX           TimeStamp
        MAX-ACCESS       read-only
        STATUS           current
        DESCRIPTION
              "The value of sysUpTime on the most recent occasion at which
              any one or more of this SCTP association counters suffered a
              discontinuity.  The relevant counters are the specific
              instances associated with this interface of any Counter32 or
              Counter64 object contained in the sctpAssocTable or
              sctpLocalAddrTable or sctpRemAddrTable.  If no such
              discontinuities have occurred since the last re-initialization
              of the local management subsystem, then this object contains a
              zero value. "
        REFERENCE
              "The inclusion of this object is recommended by RFC2578."

         ::= { sctpAssocEntry 17 }

     -- Expanded tables: Including Multi-home feature

     -- Local Address TABLE
     -- ******************

     sctpAssocLocalAddrTable OBJECT-TYPE
        SYNTAX           SEQUENCE OF SctpAssocLocalAddrEntry
        MAX-ACCESS       not-accessible
        STATUS           current
        DESCRIPTION
              "Expanded table of sctpAssocTable based on the AssocId index.
              This table shows data related to each local IP address which
              is used by this association."

         ::= { sctpObjects  4 }

     sctpAssocLocalAddrEntry OBJECT-TYPE
        SYNTAX           SctpAssocLocalAddrEntry
        MAX-ACCESS       not-accessible
        STATUS           current
        DESCRIPTION
              "Local information about the available addresses. There will
              be an entry for every local IP address defined for this
```

```
        association.
        Implementors need to be aware that if the size of
        sctpAssocLocalAddr exceeds 114 octets then OIDs of column
        instances in this table will have more than 128 sub-
        identifiers and cannot be accessed using SNMPv1, SNMPv2c, or
        SNMPv3."
   INDEX     {    sctpAssocId,    -- shared index
                  sctpAssocLocalAddrType,
                  sctpAssocLocalAddr }

   ::= { sctpAssocLocalAddrTable 1 }


 SctpAssocLocalAddrEntry ::= SEQUENCE {
   sctpAssocLocalAddrType        InetAddressType,
   sctpAssocLocalAddr            InetAddress,
   sctpAssocLocalAddrStartTime   TimeStamp
   }


 sctpAssocLocalAddrType OBJECT-TYPE
   SYNTAX          InetAddressType
   MAX-ACCESS      not-accessible
   STATUS          current
   DESCRIPTION
        "Internet type of local IP address used for this association."


   ::= { sctpAssocLocalAddrEntry 1 }

 sctpAssocLocalAddr OBJECT-TYPE
   SYNTAX          InetAddress
   MAX-ACCESS      not-accessible
   STATUS          current
   DESCRIPTION
        "The value of a local IP address available for this
        association. The type of this address is determined by the
        value of sctpAssocLocalAddrType."

   ::= { sctpAssocLocalAddrEntry 2 }
```

```
    sctpAssocLocalAddrStartTime OBJECT-TYPE
      SYNTAX           TimeStamp
      MAX-ACCESS       read-only
      STATUS           current
      DESCRIPTION
           "The value of sysUpTime at the time that this row was
           created."

      ::= { sctpAssocLocalAddrEntry 3 }

    -- Remote Addresses TABLE
    -- *********************

    sctpAssocRemAddrTable OBJECT-TYPE
      SYNTAX           SEQUENCE OF SctpAssocRemAddrEntry
      MAX-ACCESS       not-accessible
      STATUS           current
      DESCRIPTION
           "Expanded table of sctpAssocTable based on the AssocId index.
           This table shows data related to each remote peer IP address
           which is used by this association."

      ::= { sctpObjects  5 }


    sctpAssocRemAddrEntry OBJECT-TYPE
      SYNTAX           SctpAssocRemAddrEntry
      MAX-ACCESS       not-accessible
      STATUS           current
      DESCRIPTION
           "Information about the most important variables for every
           remote IP address. There will be an entry for every remote IP
           address defined for this association.

           Implementors need to be aware that if the size of
           sctpAssocRemAddr exceeds 114 octets then OIDs of column
           instances in this table will have more than 128 sub-
           identifiers and cannot be accessed using SNMPv1, SNMPv2c, or
           SNMPv3."
      INDEX   { sctpAssocId,   -- shared index
                 sctpAssocRemAddrType,
                 sctpAssocRemAddr }

      ::= { sctpAssocRemAddrTable 1 }
```

```
    SctpAssocRemAddrEntry ::= SEQUENCE {
      sctpAssocRemAddrType                InetAddressType,
      sctpAssocRemAddr                    InetAddress,
      sctpAssocRemAddrActive              TruthValue,
      sctpAssocRemAddrHBActive            TruthValue,
      sctpAssocRemAddrRTO                 Unsigned32,
      sctpAssocRemAddrMaxPathRtx          Unsigned32,
      sctpAssocRemAddrRtx                 Counter32,      -- Statistic
      sctpAssocRemAddrStartTime           TimeStamp
      }


    sctpAssocRemAddrType OBJECT-TYPE
      SYNTAX          InetAddressType
      MAX-ACCESS      not-accessible
      STATUS          current
      DESCRIPTION
          "Internet type of a remote IP address available for this
          association."
      ::= { sctpAssocRemAddrEntry 1 }


    sctpAssocRemAddr OBJECT-TYPE
      SYNTAX          InetAddress
      MAX-ACCESS      not-accessible
      STATUS          current
      DESCRIPTION
          "The value of a remote IP address available for this
          association. The type of this address is determined by the
          value of sctpAssocLocalAddrType."

      ::= { sctpAssocRemAddrEntry 2 }


    sctpAssocRemAddrActive OBJECT-TYPE
      SYNTAX          TruthValue
      MAX-ACCESS      read-only
      STATUS          current
      DESCRIPTION
          "This object gives information about the reachability of this
          specific remote IP address.

          When the object is set to 'true' (1), the remote IP address is
          understood as Active. Active means that the threshold of no
          answers received from this IP address has not been reached.
```

        When the object is set to 'false' (2), the remote IP address
        is understood as Inactive. Inactive means that either no
        heartbeat or any other message was received from this address,
        reaching the threshold defined by the protocol."

    REFERENCE
        "The remote transport states are defined as Active and
        Inactive in the SCTP, RFC2960."

    ::= { sctpAssocRemAddrEntry 3 }

  sctpAssocRemAddrHBActive OBJECT-TYPE
    SYNTAX   TruthValue
    MAX-ACCESS   read-only
    STATUS   current
    DESCRIPTION
        "This object indicates whether the optional Heartbeat check
        associated to one destination transport address is activated
        or not (value equal to true or false, respectively). "

    ::= { sctpAssocRemAddrEntry 4 }

  sctpAssocRemAddrRTO OBJECT-TYPE -- T3-rtx- Timer
    SYNTAX   Unsigned32
    UNITS   "milliseconds"
    MAX-ACCESS   read-only
    STATUS   current
    DESCRIPTION
        "The current Retransmission Timeout. T3-rtx timer as defined
        in the protocol SCTP."
    REFERENCE
        "Section 6.3 in RFC2960 deals with the Retransmission Timer
        Management."

    ::= { sctpAssocRemAddrEntry 5 }

  sctpAssocRemAddrMaxPathRtx OBJECT-TYPE
    SYNTAX   Unsigned32
    MAX-ACCESS   read-only
    STATUS   current
    DESCRIPTION
        "Maximum number of DATA chunks retransmissions allowed to a
        remote IP address before it is considered inactive, as defined
        in RFC2960."

      REFERENCE
            "Section 8.2, 8.3 and 14 in RFC2960."
      DEFVAL {5} -- number of attempts

      ::= { sctpAssocRemAddrEntry 6 }

   -- Remote Address Statistic

   sctpAssocRemAddrRtx OBJECT-TYPE
      SYNTAX   Counter32
      MAX-ACCESS   read-only
      STATUS   current
      DESCRIPTION
            "Number of DATA chunks retransmissions to this specific IP
            address. When T3-rtx expires, the DATA chunk that triggered
            the T3 timer will be re-sent according to the retransmissions
            rules. Every DATA chunk that is included in a SCTP packet and
            was transmitted to this specific IP address before, will be
            included in this counter.

            Discontinuities in the value of this counter can occur at re-
            initialization of the management system, and at other times as
            indicated by the value of sctpAssocDiscontinuityTime."

      ::= { sctpAssocRemAddrEntry 7 }

   sctpAssocRemAddrStartTime OBJECT-TYPE
      SYNTAX   TimeStamp
      MAX-ACCESS   read-only
      STATUS   current
      DESCRIPTION
            "The value of sysUpTime at the time that this row was
            created."

      ::= { sctpAssocRemAddrEntry 8 }

   -- ASSOCIATION INVERSE TABLE
   -- ************************

   -- BY LOCAL PORT

   sctpLookupLocalPortTable OBJECT-TYPE
      SYNTAX   SEQUENCE OF SctpLookupLocalPortEntry
      MAX-ACCESS   not-accessible
      STATUS   current
      DESCRIPTION
            "With the use of this table, a list of associations which are

        using the specified local port can be retrieved."

    ::= { sctpObjects 6 }

    sctpLookupLocalPortEntry OBJECT-TYPE
      SYNTAX   SctpLookupLocalPortEntry
      MAX-ACCESS   not-accessible
      STATUS   current
      DESCRIPTION
           "This table is indexed by local port and association ID.
           Specifying a local port, we would get a list of the
           associations whose local port is the one specified."

      INDEX   { sctpAssocLocalPort,
                       sctpAssocId }

      ::= { sctpLookupLocalPortTable 1 }

    SctpLookupLocalPortEntry::= SEQUENCE {
      sctpLookupLocalPortStartTime   TimeStamp
      }

    sctpLookupLocalPortStartTime OBJECT-TYPE
      SYNTAX   TimeStamp
      MAX-ACCESS   read-only
      STATUS   current
      DESCRIPTION
           "The value of sysUpTime at the time that this row was created.

           As the table will be created after the sctpAssocTable
           creation, this value could be equal to the sctpAssocStartTime
           object from the main table."

      ::= { sctpLookupLocalPortEntry 1 }

    -- BY REMOTE PORT

    sctpLookupRemPortTable OBJECT-TYPE
      SYNTAX   SEQUENCE OF SctpLookupRemPortEntry
      MAX-ACCESS   not-accessible
      STATUS   current

```
   DESCRIPTION
        "With the use of this table, a list of associations which are
        using the specified remote port can be got"

   ::= { sctpObjects  7 }

sctpLookupRemPortEntry OBJECT-TYPE
   SYNTAX          SctpLookupRemPortEntry
   MAX-ACCESS      not-accessible
   STATUS          current
   DESCRIPTION
        "This table is indexed by remote port and association ID.
        Specifying a remote port we would get a list of the
        associations whose local port is the one specified "

   INDEX          { sctpAssocRemPort,
                    sctpAssocId }

   ::= { sctpLookupRemPortTable 1 }

SctpLookupRemPortEntry::= SEQUENCE {
   sctpLookupRemPortStartTime           TimeStamp
   }


sctpLookupRemPortStartTime OBJECT-TYPE
   SYNTAX          TimeStamp
   MAX-ACCESS      read-only
   STATUS          current
   DESCRIPTION
        "The value of sysUpTime at the time that this row was created.

        As the table will be created after the sctpAssocTable
        creation, this value could be equal to the sctpAssocStartTime
        object from the main table."

   ::= { sctpLookupRemPortEntry 1 }

-- BY REMOTE HOST NAME

sctpLookupRemHostNameTable OBJECT-TYPE
   SYNTAX          SEQUENCE OF SctpLookupRemHostNameEntry
   MAX-ACCESS      not-accessible
   STATUS          current
   DESCRIPTION
        "With the use of this table, a list of associations with that
        particular host can be retrieved."
```

```
      ::= { sctpObjects  8 }


   sctpLookupRemHostNameEntry OBJECT-TYPE
      SYNTAX         SctpLookupRemHostNameEntry
      MAX-ACCESS     not-accessible
      STATUS         current
      DESCRIPTION
           "This table is indexed by remote host name and association ID.
           Specifying a host name we would get a list of the associations
           specifying that host name as the remote one.

           Implementors need to be aware that if the size of
           sctpAssocRemHostName exceeds 115 octets then OIDs of column
           instances in this table will have more than 128 sub-
           identifiers and cannot be accessed using SNMPv1, SNMPv2c, or
           SNMPv3."

      INDEX          { sctpAssocRemHostName,
                      sctpAssocId }

      ::= { sctpLookupRemHostNameTable 1 }


   SctpLookupRemHostNameEntry::= SEQUENCE {
      sctpLookupRemHostNameStartTime            TimeStamp
      }

   sctpLookupRemHostNameStartTime OBJECT-TYPE
      SYNTAX         TimeStamp
      MAX-ACCESS     read-only
      STATUS         current
      DESCRIPTION
           "The value of sysUpTime at the time that this row was created.

           As the table will be created after the sctpAssocTable
           creation, this value could be equal to the sctpAssocStartTime
           object from the main table."

      ::= { sctpLookupRemHostNameEntry 1 }
```

    -- BY REMOTE PRIMARY IP ADDRESS

    sctpLookupRemPrimIPAddrTable OBJECT-TYPE
      SYNTAX   SEQUENCE OF SctpLookupRemPrimIPAddrEntry
      MAX-ACCESS   not-accessible
      STATUS   current
      DESCRIPTION
          "With the use of this table, a list of associations that have
          the specified IP address as primary within the remote set of
          active addresses can be retrieved."

      ::= { sctpObjects 9 }

    sctpLookupRemPrimIPAddrEntry OBJECT-TYPE
      SYNTAX   SctpLookupRemPrimIPAddrEntry
      MAX-ACCESS   not-accessible
      STATUS   current
      DESCRIPTION
          "This table is indexed by primary address and association ID.
          Specifying a primary address, we would get a list of the
          associations that have the specified remote IP address marked
          as primary.
          Implementors need to be aware that if the size of
          sctpAssocRemPrimAddr exceeds 114 octets then OIDs of column
          instances in this table will have more than 128 sub-
          identifiers and cannot be accessed using SNMPv1, SNMPv2c, or
          SNMPv3."

      INDEX   { sctpAssocRemPrimAddrType,
                        sctpAssocRemPrimAddr,
                        sctpAssocId }

      ::= { sctpLookupRemPrimIPAddrTable 1 }

    SctpLookupRemPrimIPAddrEntry::= SEQUENCE {
      sctpLookupRemPrimIPAddrStartTime   TimeStamp
      }

    sctpLookupRemPrimIPAddrStartTime OBJECT-TYPE
      SYNTAX   TimeStamp
      MAX-ACCESS   read-only
      STATUS   current

       DESCRIPTION
            "The value of SysUpTime at the time that this row was created.

            As the table will be created after the sctpAssocTable
            creation, this value could be equal to the sctpAssocStartTime
            object from the main table."

        ::= { sctpLookupRemPrimIPAddrEntry 1 }

    -- BY REMOTE IP ADDRESS

    sctpLookupRemIPAddrTable OBJECT-TYPE
      SYNTAX   SEQUENCE OF SctpLookupRemIPAddrEntry
      MAX-ACCESS   not-accessible
      STATUS   current
      DESCRIPTION
            "With the use of this table, a list of associations that have
            the specified IP address as one of the remote ones can be
            retrieved. "

        ::= { sctpObjects 10 }

    sctpLookupRemIPAddrEntry OBJECT-TYPE
      SYNTAX   SctpLookupRemIPAddrEntry
      MAX-ACCESS   not-accessible
      STATUS   current
      DESCRIPTION
            "This table is indexed by a remote IP address and association
            ID. Specifying an IP address we would get a list of the
            associations that have the specified IP address included
            within the set of remote IP addresses."

      INDEX   { sctpAssocRemAddrType,
                       sctpAssocRemAddr,
                       sctpAssocId }

        ::= { sctpLookupRemIPAddrTable 1 }

    SctpLookupRemIPAddrEntry::= SEQUENCE {

      sctpLookupRemIPAddrStartTime   TimeStamp
      }

```
    sctpLookupRemIPAddrStartTime OBJECT-TYPE
      SYNTAX          TimeStamp
      MAX-ACCESS      read-only
      STATUS          current
      DESCRIPTION
          "The value of SysUpTime at the time that this row was created.

          As the table will be created after the sctpAssocTable
          creation, this value could be equal to the sctpAssocStartTime
          object from the main table."

      ::= { sctpLookupRemIPAddrEntry 1 }


    -- 4.1 Conformance Information

    sctpMibConformance     OBJECT IDENTIFIER ::= { sctpMIB 2 }
    sctpMibCompliances     OBJECT IDENTIFIER ::= { sctpMibConformance 1 }
    sctpMibGroups          OBJECT IDENTIFIER ::= { sctpMibConformance 2 }


    -- 4.1.1 Units of conformance

    --
    -- MODULE GROUPS
    --

    sctpLayerParamsGroup OBJECT-GROUP
      OBJECTS    { sctpRtoAlgorithm,
                   sctpRtoMin,
                   sctpRtoMax,
                   sctpRtoInitial,
                   sctpMaxAssocs,
                   sctpValCookieLife,
                   sctpMaxInitRetr
                 }

      STATUS     current
      DESCRIPTION
          "Common parameters for the SCTP layer, i.e., for all the
          associations. They can usually be referred to as configuration
          parameters."

      ::= { sctpMibGroups 1 }
```

```
   sctpStatsGroup OBJECT-GROUP
     OBJECTS   { sctpCurrEstab,
                 sctpActiveEstabs,
                 sctpPassiveEstabs,
                 sctpAborteds,
                 sctpShutdowns,
                 sctpOutOfBlues,
                 sctpChecksumErrors,
                 sctpOutCtrlChunks,
                 sctpOutOrderChunks,
                 sctpOutUnorderChunks,
                 sctpInCtrlChunks,
                 sctpInOrderChunks,
                 sctpInUnorderChunks,
                 sctpFragUsrMsgs,
                 sctpReasmUsrMsgs,
                 sctpOutSCTPPacks,
                 sctpInSCTPPacks,
                 sctpDiscontinuityTime,
                 sctpAssocT1expireds,
                 sctpAssocT2expireds,
                 sctpAssocRtxChunks,
                 sctpAssocRemAddrRtx
               }

     STATUS    current
     DESCRIPTION
         "Statistics group. It includes the objects to collect state
         changes in the SCTP protocol local layer and flow control
         statistics."

     ::= { sctpMibGroups 2 }


   sctpPerAssocParamsGroup OBJECT-GROUP
     OBJECTS   { sctpAssocRemHostName,
                 sctpAssocLocalPort,
                 sctpAssocRemPort,
                 sctpAssocRemPrimAddrType,
                 sctpAssocRemPrimAddr,
                 sctpAssocHeartBeatInterval,
                 sctpAssocState,
                 sctpAssocInStreams,
                 sctpAssocOutStreams,
                 sctpAssocMaxRetr,
                 sctpAssocPrimProcess,
                 sctpAssocStartTime,
                 sctpAssocDiscontinuityTime,
```

```
                 sctpAssocLocalAddrStartTime,
                 sctpAssocRemAddrActive,
                 sctpAssocRemAddrHBActive,
                 sctpAssocRemAddrRTO,
                 sctpAssocRemAddrMaxPathRtx,
                 sctpAssocRemAddrStartTime
               }
      STATUS    current
      DESCRIPTION
           "The SCTP group of objects to manage per-association
           parameters. These variables include all the SCTP basic
           features."

      ::= { sctpMibGroups 3 }

    sctpPerAssocStatsGroup OBJECT-GROUP
                   OBJECTS
               { sctpAssocT1expireds,
                 sctpAssocT2expireds,
                 sctpAssocRtxChunks,
                 sctpAssocRemAddrRtx
               }

      STATUS    current
      DESCRIPTION
           "Per Association Statistics group. It includes the objects to
           collect flow control statistics per association."

      ::= { sctpMibGroups 4 }

    sctpInverseGroup OBJECT-GROUP
      OBJECTS    { sctpLookupLocalPortStartTime,
                   sctpLookupRemPortStartTime,
                   sctpLookupRemHostNameStartTime,
                   sctpLookupRemPrimIPAddrStartTime,
                   sctpLookupRemIPAddrStartTime
                 }

      STATUS    current
      DESCRIPTION
           "Objects used in the inverse lookup tables."

      ::= { sctpMibGroups 5 }
```

    -- 4.1.2 Compliance Statements

    --
    -- MODULE COMPLIANCES
    --

    sctpMibCompliance MODULE-COMPLIANCE
      STATUS   current
      DESCRIPTION
           "The compliance statement for SNMP entities which implement
           this SCTP MIB Module.

           There are a number of INDEX objects that cannot be represented
           in the form of OBJECT clauses in SMIv2, but for which we have
           the following compliance requirements, expressed in OBJECT
           clause form in this description clause:

    -- OBJECT   sctpAssocLocalAddrType
    -- SYNTAX   InetAddressType {ipv4(1), ipv6(2)}
    -- DESCRIPTION
    --   It is only required to have IPv4 and IPv6 addresses without
    --   zone indices.
    --   The address with zone indices is required if an
    --   implementation can connect multiple zones.
    --
    -- OBJECT   sctpAssocLocalAddr
    -- SYNTAX   InetAddress (SIZE(4|16))
    -- DESCRIPTION
    --   An implementation is only required to support globally
    --   unique IPv4 and IPv6 addresses.
    --
    -- OBJECT   sctpAssocRemAddrType
    -- SYNTAX   InetAddressType {ipv4(1), ipv6(2)}
    -- DESCRIPTION
    --   It is only required to have IPv4 and IPv6 addresses without
    --   zone indices.
    --   The address with zone indices is required if an
    --   implementation can connect multiple zones.
    --
    -- OBJECT   sctpAssocRemAddr
    -- SYNTAX   InetAddress (SIZE(4|16))
    -- DESCRIPTION
    --   An implementation is only required to support globally
    --   unique IPv4 and IPv6 addresses.
    --
           " -- closes DESCRIPTION clause of MODULE-COMPLIANCE

      MODULE -- this module

```
          MANDATORY-GROUPS      {   sctpLayerParamsGroup,
                                    sctpPerAssocParamsGroup,
                                    sctpStatsGroup,
                                    sctpPerAssocStatsGroup
                                }

          OBJECT   sctpAssocRemPrimAddrType
          SYNTAX   InetAddressType { ipv4(1),
                                     ipv6(2)
                                   }
          DESCRIPTION
               "It is only required to have IPv4 and IPv6 addresses
               without zone indices.

               The address with zone indices is required if an
               implementation can connect multiple zones."

          OBJECT   sctpAssocRemPrimAddr
          SYNTAX   InetAddress (SIZE(4|16))
          DESCRIPTION
               "An implementation is only required to support globally
               unique IPv4 and globally unique IPv6 addresses."


          OBJECT sctpAssocState
          WRITE-SYNTAX  INTEGER { deleteTCB(9) }
          MIN-ACCESS read-only
          DESCRIPTION
               "Only the deleteTCB(9) value MAY be set by a management
               station at most. A read-only option is also considered to
               be compliant with this MIB module description."

          GROUP sctpInverseGroup
          DESCRIPTION
               "Objects used in inverse lookup tables. This should be
               implemented, at the discretion of the implementers, for
               easier lookups in the association tables"

      ::= { sctpMibCompliances 1 }

   END
```

5. Compiling Notes

   When compiling the MIB module warnings similar to the following may
   occur:

      - warning: index of row 'sctpAssocLocalAddrEntry' can exceed OID
         size limit by 141 subidentifier(s)
      - warning: index of row 'sctpAssocRemAddrEntry' can exceed OID
         size limit by 141 subidentifier(s)
      - warning: index of row 'sctpLookupRemHostNameEntry' can exceed
         OID size limit by 140 subidentifier(s)
      - warning: index of row 'sctpLookupRemPrimIPAddrEntry' can exceed
         OID size limit by 141 subidentifier(s)
      - warning: index of row 'sctpLookupRemIPAddrEntry' can exceed OID
         size limit by 141 subidentifier(s)

   These warnings are due to the fact that the row objects have index
   objects of type InetAddress or OCTET STRING whose size limit is 255
   octets, and if that size limit were reached the names of column
   instances in those rows would exceed the 128 sub-identifier limit
   imposed by current versions of the SNMP. Actual limitations for the
   index object sizes are noted in the conceptual row DESCRIPTION
   clauses. For the InetAddress index objects these size limits will
   not be reached with any of the address types in current use.

6. References

6.1. Normative References

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7. Security Considerations

   There are management objects defined in this MIB that have a MAX-
   ACCESS clause of read-write and/or read-create. Such objects may be
   considered sensitive or vulnerable in some network environments. The
   support for SET operations in a non-secure environment without proper
   protection can have a negative effect on network operations. These
   are the tables and objects and their sensitivity/vulnerability:

   o The sctpAssocState object has a MAX-ACCESS clause of read-write,
      which allows termination of an arbitrary connection. Unauthorized
      access could cause a denial of service.

   Some of the readable objects in this MIB module (i.e., objects with a
   MAX-ACCESS other than not-accessible) may be considered sensitive or
   vulnerable in some network environments. Thus, it is important to
   control even GET and/or NOTIFY access to these objects and possibly
   to even encrypt the values of these objects when sending them over
   the network via SNMP. These are the tables and objects and their
   sensitivity/vulnerability:

   o The sctpAssocTable, sctpAssocLocalAddressTable,
      sctpAssocRemAddressTable and the lookup tables contain objects
      providing information on the active associations on the device,
      local and peer's IP addresses, the status of these associations
      and the associated processes. This information may be used by an
      attacker to launch attacks against known/unknown weakness in
      certain protocols/applications.

   o The sctpAssocTable contains objects providing information on local
      and remote ports objects, that can be used to identify what ports
      are open on the machine and can thus suggest what attacks are
      likely to succeed, without the attacker having to run a port
      scanner.

   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.

The above objects also have privacy implications, i.e., they disclose
who is connecting to what hosts. These are sensitive from a
perspective of preventing traffic analysis, and also to protect
individual privacy.

8. Acknowledgments

The authors wish to thank Juergen Schoenwaelder, David Partain, Shawn
A. Routhier, Ed Yarwood, John Linton, Shyamal Prasad, Juan-Francisco
Martin, Dave Thaler, and Bert Wijnen for their invaluable comments.

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