Network Working Group
Request for Comments: 3873
Category: Standards Track

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September 2004

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

Status of this Memo

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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

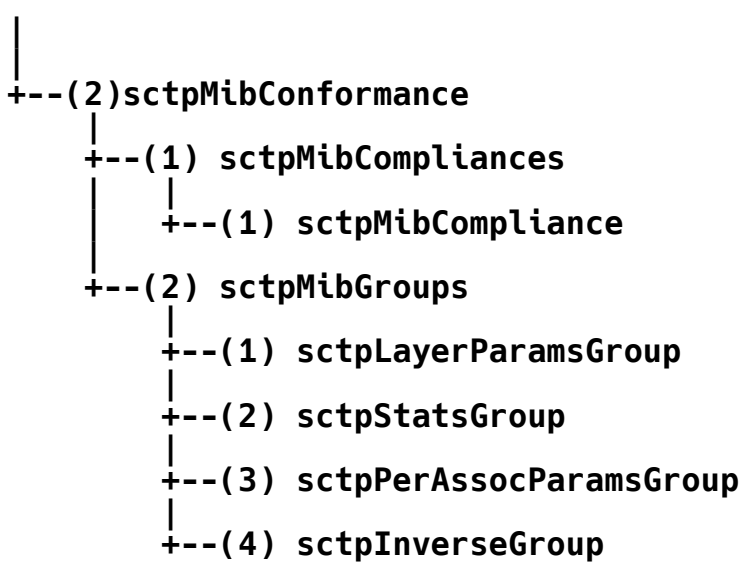
For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to section 7 of RFC 3410 [RFC3410].

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
```



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

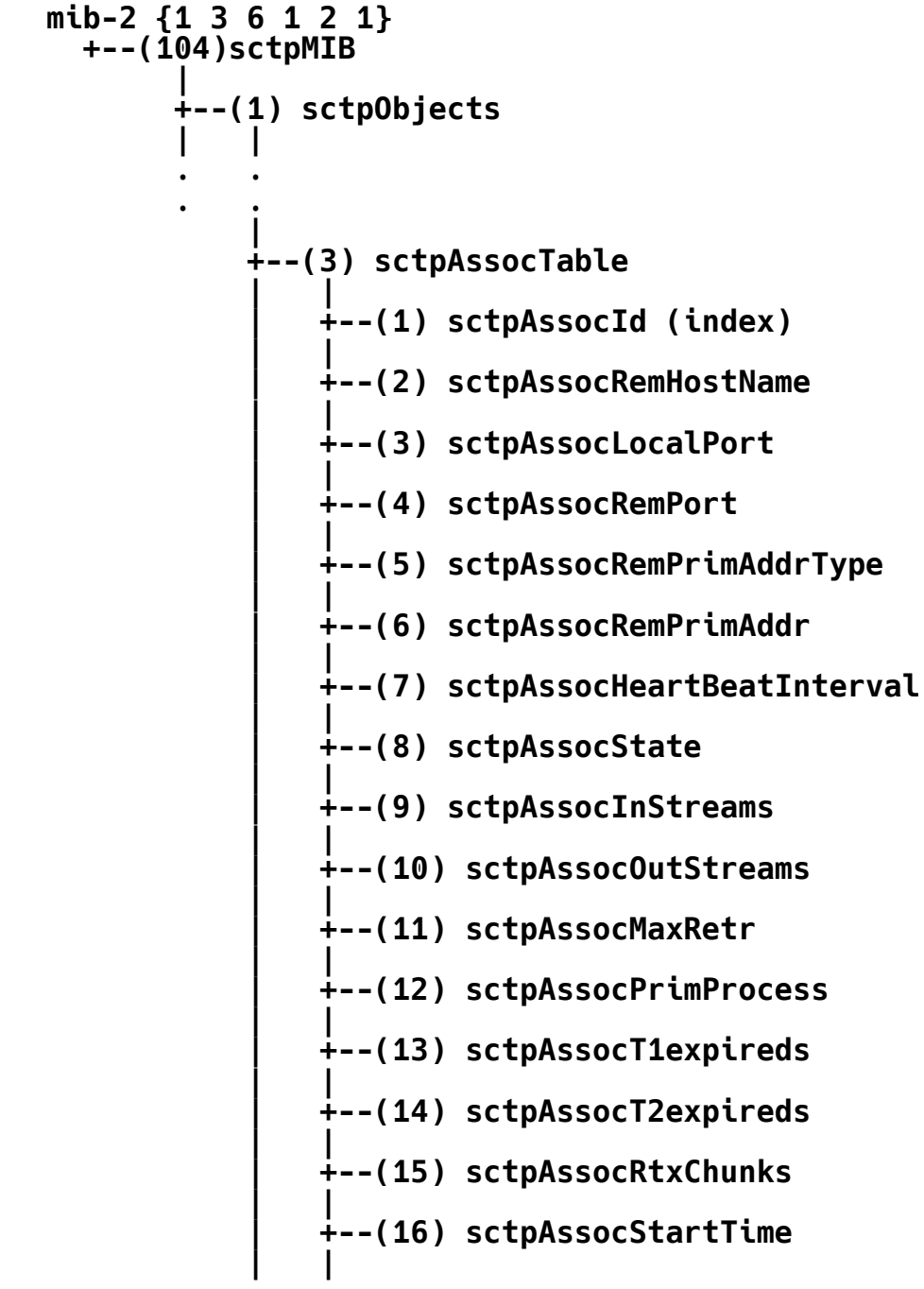
The sctpAssocTable is the main MIB table, where all the association related information is stored on a per association basis. It is structured according to expanded tables. The main table is called sctpAssocTable and is indexed by sctpAssocId (the association identification). This is a value that uniquely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

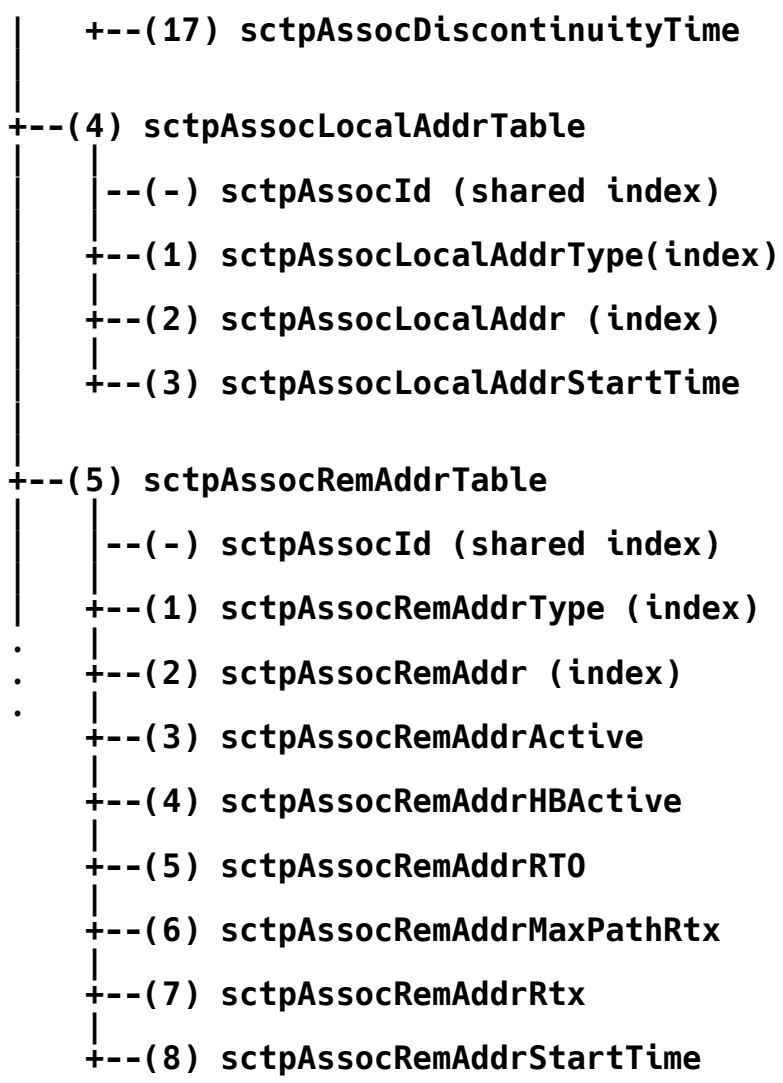
The sctpAssoc index is also shared by two more tables:

- 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.





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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                      Spain
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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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[MIBGUIDE] Heard, C.M., "Guidelines for MIB Authors and Reviewers", Work in Progress, February 2003.

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:

- 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:

- 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.

- 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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Acknowledgement

Funding for the RFC Editor function is currently provided by the Internet Society.