Stream Control Transmission Protocol
Management Information Base using SMIv2

draft-ietf-sigtran-sctp-mib-07.txt

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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, designed to transport 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 amount of objects needed to manage the implementation of the SCTP.
Open Issues

- Remove this section.

- Remove Revision History

- Decide if DeleteTCB should be removed

- Decide under which object identifier branch of the SNMP tree, SCTP should be placed. This value will be obtained when submitted to the IETF queue.

- Update references to [RFC2851-update]

- Update references to [RFC2012-update]

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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 among others.

The managed objects in this MIB module have been based on [RFC2012] update: "Management Information Base for the Transmission Control Protocol (TCP)" [TCPMIB], work in progress, and the RFC 2851 update "Textual Conventions for Internet Network Addresses" [TADDRESS], work in progress.

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
- ICANN - Internet Corporation for Assigned Names and Numbers
- IETF  - Internet Engineering Task Force
- IP    - Internet Protocol
- MIB   - Management Information Base
- RFC   - Request For Comment
- 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 SNMP Framework

The SNMP Management Framework presently consists of five major components:

- An overall architecture, described in [RFC2571].
- Mechanisms for describing and naming objects and events for the purpose of management. The first version of this Structure of
Management Information (SMI) is called SMIv1 and described in [RFC1155], [RFC1212] and [RFC1215]. The second version, called SMIv2, is described in [RFC1902], [RFC1903] and [RFC1904].

- Message protocols for transferring management information. The first version of the SNMP message protocol is called SNMPv1 and described in [RFC1157]. A second version of the SNMP message protocol, which is not an Internet standards track protocol, is called SNMPv2c and described in [RFC1901] and [RFC1906]. The third version of the message protocol is called SNMPv3 and described in [RFC1906], [RFC2272] and [RFC2574].

- Protocol operations for accessing management information. The first set of protocol operations and associated PDU formats is described in [RFC1157]. A second set of protocol operations and associated PDU formats is described in [RFC1905].

- A set of fundamental applications described in [RFC2273] and the view-based access control mechanism described in [RFC2575].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the mechanisms defined in the SMI. This memo specifies a MIB module that is compliant to the SMIv2. A MIB conforming to the SMIv1 can be produced through the appropriate translations. The resulting translated MIB must be semantically equivalent, except where objects or events are omitted because no translation is possible (use of Counter64). Some machine-readable information in SMIv2 will be converted into textual descriptions in SMIv1 during the translation process. However, this loss of machine-readable information is not considered to change the semantics of the MIB.

3. MIB Structure

This chapter will explain 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 2}
  |---(xxx)sctpMIB
  |   |---(1) sctpObjects
  |   |   |---(1) sctpStats
  |   |   |   |--- <scalars>
  |   |---(2)sctpParameters
```
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 main groups are further explained along the MIB definition.
SCTP MIB includes both Counter32 and Counter64 to deal with statistics. Counter64 has been applied to 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 measures are based in the TCP model, but adapted to the SCTP states. They store the number of succeeded association attempts, how many associations have been initiated by the local or the remote SCTP layer, or just 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

It has been specified statistics related to the whole SCTP layer. There are, e.g., statistics related to either SCTP packets or SCTP chunks.

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

3.1.2 SCTP Parameters

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

SCTP RTO mechanism definition is based on the TCP MIB [RFC2012-update]. In SCTP protocol, only options ‘other’ and ‘vanj’ are valid since SCTP protocol defines Van Jacobson’s algorithm 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 Association variables and is composed of a main and two extended tables. The second group is a bunch of tables used for the reverse lookup.

It is NOT possible to create rows in any table (sctpAssocTable, sctpAssocLocalAddressTable, sctpRemAddressTable and Reverse Lookup tables).
It is NOT possible to delete rows in any table except in sctpAssocTable under the particular conditions explained below.

### 3.1.3.1 Association Table

This is the main MIB table, where all the association related information is stored per association basis. It is structured according to expanded tables. The main table is called sctpAssocTable and is indexed by sctpAssocId (the association identification) that is a value that uniquely identifies an association. The MIB does not restrict which value must be written here. It can be the tag value, the TCB creation time, or any other value the implementers decide.

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

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.

```
sctpAssocTable
+---------+--------------------------+
| sctpAssocId (index) | ... |
+---------+--------------------------+
| sctpAssocRemHostName | ... |
+---------+--------------------------+
| sctpAssocLocalPort | ... |
+---------+--------------------------+
| sctpAssocRemPort | ... |
+---------+--------------------------+
| sctpAssocRemPrimaryAddressType | ... |
+---------+--------------------------+
| sctpAssocRemPrimaryAddress | ... |
+---------+--------------------------+
| sctpAssocHeartBeatTimer | ... |
+---------+--------------------------+
| sctpAssocState | ... |
+---------+--------------------------+
| sctpAssocInStreams | ... |
+---------+--------------------------+
| sctpAssocOutStreams | ... |
+---------+--------------------------+
| sctpAssocMaxRetr | ... |
+---------+--------------------------+
```
Both sctpAssocLocalAddressTable and sctpAssocRemAddressTable are indexed by addresses. ‘Address’ and ‘AddressType’ use the syntax InetAddress and InetAddressType defined in the Textual Conventions for Internet Network Address [RFC2851-update]. In the general case
this syntax is valid for IPv4, IPv6 and DNS but only the first two options will be valid in this MIB.

The IP addresses that the MIB supports are defined in the [RFC2851-update]: global and non-global (either with a zone index or not) IPv4 addresses, global and non-global (either with a zone index or not) IPv6 addresses.

DNS value is not used to identify an IP address since it is only valid during initialization (once this stage is finished, both sides only use IP addresses).

To keep the name of the remote peer (when provided by the peer at initialization time), an entry has been created in the sctpAssocTable (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 required to abort an existing association, the value deleteTCB has to 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 to efficiently access conceptual rows in other tables. This is the way for not performing expensive tree walks through large number of associations. All of these tables are optional.

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

- Local Port: It allows finding the associations in which the local endpoint is using the specified local port.
- Remote Port: It allows finding the associations in which the remote endpoint is using the specified remote port.
- Remote Host Name: It allows finding the associations that have defined the specified host name as remote endpoint.
- Remote Primary IP Address: It allows finding the associations that have defined the specified remote IP address as primary.
- Remote IP address: List of all the associations that have the specified IP address belonging to the set of remote addresses.

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

```
sctpLookupRemPortTable
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| sctpAssocRemPort (index) / ... |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
All the lookup tables contain a timestamp (referred as StartTime) to indicate when a row in the table was created.

It is not possible to either create or delete rows in these tables.

### 3.2 Conformance

The conformance section points out as optional the statistics either general for the whole SCTP layer and per association or remote IP address.

Also, IP address will take the format of IPv4 and IPv6 addresses (not scoped). DNS name will not be accepted either (since names will be stored if present in the sctpRemoteHostName variable).

### 4. Definitions

SCTP-MIB DEFINITIONS ::= BEGIN

IMPORTS
   MODULE-IDENTITY, OBJECT-TYPE, Integer32, Unsigned32, Gauge32,
   Counter32, Counter64
   FROM SNMPv2-SMI                -- RFC2578
   TimeStamp
   FROM SNMPv2-TC                 -- RFC2579
   MODULE-COMPLIANCE, OBJECT-GROUP
   FROM SNMPv2-CONF               -- RFC2580
   InetAddressType, InetAddress, InetPortNumber
   FROM INET-ADDRESS-MIB          -- RFC2851-update
;

-- RFC2851 is being update. Needed to update the import clause
-- as well as other references to RFC2851 to include all the
-- textual conventions defined in the new RFC2851-update

sctpMIB MODULE-IDENTITY
   LAST-UPDATED "200202060000Z"       -- 06th February 2002
   ORGANIZATION "IETF SIGTRAN Working Group"
   CONTACT-INFO
   " Maria-Carmen Belinchon-Vergara
        Jose-Javier Pastor-Balbas

        Postal: Ericsson Espana S. A.
                Ombu street 3, 4th floor"
DESCRIPTION
"The MIB module for managing an SCTP implementation."
::= { mib-2 xxxx } -- IANA needs to choose this value
   -- when sent to the RFC editor

-- 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 SCTP associations for which the current state
   is either ESTABLISHED, SHUTDOWN-RECEIVED or SHUTDOWN-PENDING."
::= { sctpStats 1 }

sctpActiveEstabs OBJECT-TYPE
SYNTAX         Counter32
MAX-ACCESS     read-only
STATUS         current
DESCRIPTION
 "The number of times that SCTP associations have made a direct
   transition to the ESTABLISHED state from the COOKIE-ECHOED
   state: COOKIE-ECHOED -> ESTABLISHED. The upper layer has
   initiated the association attempt."
::= { sctpStats  2 }
sctpPassiveEstabs OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of times that SCTP associations have made a direct transition to the ESTABLISHED state from the CLOSED state:
CLOSED -> ESTABLISHED. The remote endpoint has initiated the association attempt."

 ::= { sctpStats 3 }

sctpAborteds OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of times that SCTP 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."

 ::= { sctpStats 4 }

sctpShutdowns OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of times that SCTP 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."

 ::= { sctpStats 5 }

-- OTHER LAYER STATISTICS

sctpOutOfBlues OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Number of out of the blue packets (SCTP packet correctly formed -right checksum- but the receiver is not able to identify the association to which this packet belongs) received by the host."

Pastor, Belinchon
::= { sctpStats 6 }

sctpChecksumErrors OBJECT-TYPE
SYNTAX        Counter32
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION   "Number of SCTP packets received from the peers with an invalid checksum."

::= { sctpStats 7 }

sctpOutCtrlChunks OBJECT-TYPE
SYNTAX        Counter64
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION   "Number of SCTP control chunks sent to the peers (no retransmissions included)."

::= { sctpStats 8 }

sctpOutOrderChunks OBJECT-TYPE
SYNTAX        Counter64
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION   "Number of SCTP ordered data chunks sent to the peers (no retransmissions included)."

::= { sctpStats 9 }

sctpOutUnorderChunks OBJECT-TYPE
SYNTAX        Counter64
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION   "Number of SCTP unordered chunks (data chunks in which the U bit is set to 1) sent to the peers (no retransmissions included)."

::= { sctpStats 10 }

sctpInCtrlChunks OBJECT-TYPE
SYNTAX        Counter64
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION   "Number of SCTP control chunks received from the peers (no duplicated included)."
::= { sctpStats 11 }

sctpInOrderChunks OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Number of SCTP ordered data chunks received from the peers
(no duplicated included)."

::= { sctpStats 12 }

sctpInUnorderChunks OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Number of SCTP unordered chunks (data chunks in which the U
bit is set to 1) received from the peers (no duplicated
included)."

::= { sctpStats 13 }

sctpFragUsrMsgs OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"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
"Number of user messages reassembled."

::= { sctpStats 15 }

sctpOutSCTPPacks OBJECT-TYPE
SYNTAX Counter64
sctpInSCTPPacks OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION "Number of SCTP packets received from the peers."
::= { sctpStats 17 }

-- 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."
::= { 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, measured in milliseconds. More
refined semantics for objects of this type depend upon the
algorithm used to determine the retransmission timeout.
Minimum recommended value is 1000 milliseconds. Some telephony
applications could require less than 1 second."
::= { 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, measured in milliseconds. More refined semantics for objects of this type depend upon the algorithm used to determine the retransmission timeout. Recommended value is 60000 milliseconds."

::= { sctpParams 3 }

sctpRtoInitial OBJECT-TYPE
SYNTAX Unsigned32
UNITS "milliseconds"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Initial value for the Retransmission timer. Recommended value is 3000 milliseconds."

::= { sctpParams 4 }

sctpMaxAssoc OBJECT-TYPE
SYNTAX Integer32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The limit on the total number of SCTP 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. Recommended value: 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). Recommended value: 8 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,
sctpAssocRemPrimaryAddressType InetAddressType,
sctpAssocRemPrimaryAddress  InetAddress,
sctpAssocHeartBeatTimer   Unsigned32,
sctpAssocState            INTEGER,
sctpAssocInStreams        Unsigned32,
sctpAssocOutStreams       Unsigned32,
sctpAssocMaxRetr          Unsigned32,
sctpAssocPrimaryProcess   Unsigned32,
sctpAssocT1expireds       Counter32,  -- Statistic
sctpAssocT2expireds       Counter32,  -- Statistic
sctpAssocRtxChunks        Counter32,  -- Statistic
sctpAssocStartTime        TimeStamp

sctpAssocId OBJECT-TYPE
SYNTAX         Unsigned32
MAX-ACCESS     not-accessible
STATUS         current
DESCRIPTION
"Association Identification. Value identifying the association
(typically the Initiate Verification Tag).
Value zero is reserved to indicate no association."
 ::= { sctpAssocEntry 1 }

sctpAssocRemHostName OBJECT-TYPE
SYNTAX         OCTET STRING (SIZE(0..255))
MAX-ACCESS     read-only
STATUS         current
DESCRIPTION
"Peer’s DNS name. If no DNS domain name was received at init
time (embedded in the INIT or INIT-ACK chunk) from the peer,
this entry will be meaningless, therefore it will contain a
zero-length string value. Otherwise, the remote host name
received at init time will be stored."
 ::= { sctpAssocEntry 2 }

sctpAssocLocalPort OBJECT-TYPE
SYNTAX         InetPortNumber (1..65535)
MAX-ACCESS     read-only
STATUS         current
DESCRIPTION
"Local SCTP port number used for this association."
::= { sctpAssocEntry 3 }

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

::= { sctpAssocEntry 4 }

sctpAssocRemPrimaryAddressType OBJECT-TYPE
SYNTAX       InetAddressType
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION  "Internet type of primary destination IP address. They are interpreted according to the RFC2851-update.

The unknown (0) value MUST be used if the value of the corresponding InetAddress object is a zero-length string (when the endpoint does still not determined the Primary Address). It may also be used for error conditions (IP address different from IPv4 or IPv6).

This value will be filled in after the INIT or INIT ACK chunks have been received and the primary path is selected by SCTP. Until this occurs, the type will be unknown."

::= { sctpAssocEntry 5 }

sctpAssocRemPrimaryAddress OBJECT-TYPE
SYNTAX       InetAddress
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION  "Primary destination IP address. An InetAddress value is always interpreted within the context of an InetAddressType value.

This value will be filled in after INIT or INIT ACK chunks have been received and the primary path is selected by SCTP. Until this occurs, the type will be zero-length string."

::= { sctpAssocEntry 6 }

sctpAssocHeartBeatTimer OBJECT-TYPE
SYNTAX       Unsigned32
units                   "milliseconds"
max-access             read-only
status                 current
description
"The current heartbeat time-out. The recommended default value
is 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 is the only value that may be set by a
management station. Accordingly, it is appropriate for an
agent to return a 'badValue' response if a management station
attempts to set this object to any other value.
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."
::= { sctpAssocEntry 8 }

sctpAssocInStreams OBJECT-TYPE
syntax                 Unsigned32
max-access             read-only
status                 current
description
"Inbound Streams according to the negotiation at association
start up. This parameter has to be read-only by the manager."
 ::= { sctpAssocEntry 9 }

sctpAssocOutStreams OBJECT-TYPE
SYNTAX     Unsigned32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
   "Outbound Streams according to the negotiation at association
   start up. This parameter has to be read-only by the manager."
 ::= { 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 calling the appropriate primitives.
   This value has to be smaller than the addition of all the
   maximum number for all the paths
   (sctpAssocRemAddressMaxPathRtx).
   Recommended value: 10 attempts."
 ::= { sctpAssocEntry 11 }

sctpAssocPrimaryProcess OBJECT-TYPE
SYNTAX     Unsigned32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
   "The number identifies the system level process which
   holds primary responsibility of 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
"Number of times that T1 timer expired (timer for sending
either INIT or COOKIE-ECHO chunks and receiving an
acknowledgment)."

::= { sctpAssocEntry 13 }

sctpAssocT2expireds OBJECT-TYPE
SYNTAX    Counter32
MAX-ACCESS read-only
STATUS    current
DESCRIPTION
"Number of times that T2-shutdown timer expired (shutdown
timer)."

::= { sctpAssocEntry 14 }

sctpAssocRtxChunks OBJECT-TYPE
SYNTAX    Counter32
MAX-ACCESS read-only
STATUS    current
DESCRIPTION
"Number of data chunks retransmitted to the peer in the
current association."

::= { sctpAssocEntry 15 }

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

::= { sctpAssocEntry 16 }

-- Expanded tables: Including Multi-home feature

-- Local Address TABLE
-- *******************
sctpAssocLocalAddressTable OBJECT-TYPE
SYNTAX    SEQUENCE OF SctpAssocLocalAddressEntry
"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 }

sctpAssocLocalAddressEntry OBJECT-TYPE
SYNTAX     SctpAssocLocalAddressEntry
MAX-ACCESS     not-accessible
STATUS         current
DESCRIPTION
   "Local information about the available addresses."
INDEX     {    sctpAssocId, -- shared index
            sctpAssocLocalAddressType,
            sctpAssocLocalAddress }

::= { sctpAssocLocalAddressTable 1 }

SctpAssocLocalAddressEntry ::= SEQUENCE {  
  sctpAssocLocalAddressType         InetAddressType,  
  sctpAssocLocalAddress             InetAddress,  
  sctpAssocLocalAddressStartTime     TimeStamp  
}

sctpAssocLocalAddressType OBJECT-TYPE
SYNTAX         InetAddressType
MAX-ACCESS     not-accessible
STATUS         current
DESCRIPTION
   "Internet type of local IP address used for this association. They are interpreted according to the RFC2851-update.

The unknown (0) value MUST be used if the value of the corresponding InetAddress object is a zero-length string (when the endpoint does still not determined the address(-es)). It may also be used for error conditions (IP address different from IPv4 or IPv6).

This value will be filled in after the INIT or INIT ACK chunks have been received. Until this occurs, the type will be unknown."

::= { sctpAssocLocalAddressEntry 1 }
sctpAssocLocalAddress OBJECT-TYPE
SYNTAX InetAddress (SIZE(1..36))
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The value of a local IP address available for this association. An InetAddress value is always interpreted within the context of an InetAddressType value. If SCTP is using a DNS name, the mapping to IP address/es will be done at reception of INIT or INIT_ACK chunks. Until this occurs, it will contain a zero value.

The sctpAssocRemAddress may not be empty due to the SIZE restriction."

::= { sctpAssocLocalAddressEntry 2 }

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

::= { sctpAssocLocalAddressEntry 3 }

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

sctpAssocRemAddressTable OBJECT-TYPE
SYNTAX SEQUENCE OF SctpAssocRemAddressEntry
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 }

sctpAssocRemAddressEntry OBJECT-TYPE
SYNTAX SctpAssocRemAddressEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Information about the most important variables for every remote IP address"

INDEX { sctpAssocId, -- shared index
  sctpAssocRemAddressType,
  sctpAssocRemAddress }

::= { sctpAssocRemAddressTable 1 }

SctpAssocRemAddressEntry ::= SEQUENCE {
  sctpAssocRemAddressType            InetAddressType,
  sctpAssocRemAddress                InetAddress,
  sctpAssocRemAddressStatus          INTEGER,
  sctpAssocRemAddressHBFlag          INTEGER,
  sctpAssocRemAddressRTO             Unsigned32,
  sctpAssocRemAddressMaxPathRtx      Unsigned32,
  sctpAssocRemAddressRtx             Counter32,     -- Statistic
  sctpAssocRemAddressStartTime       TimeStamp
}

sctpAssocRemAddressType OBJECT-TYPE
SYNTAX         InetAddressType
MAX-ACCESS     not-accessible
STATUS         current
DESCRIPTION "Internet type of a remote IP address available for this association. They are interpreted according to the RFC2851 update.

The unknown (0) value MUST be used if the value of the corresponding InetAddress object is a zero-length string (when the endpoint does still not determined the Primary Address). It may also be used for error conditions (IP address different from IPv4 or IPv6).

This value will be filled in after the INIT or INIT ACK chunks have been received. Until this occurs, the type will be unknown."

::= { sctpAssocRemAddressEntry 1 }

sctpAssocRemAddress OBJECT-TYPE
SYNTAX         InetAddress (SIZE(1..36))
MAX-ACCESS     not-accessible
STATUS         current
DESCRIPTION "The value of a remote IP address available for this association. An InetAddress value is always interpreted within the context of an InetAddressType value. If SCTP is using a
DNS name, the mapping to IP address/es will be done at reception of INIT or INIT_ACK chunks. Until this occurs, it will contain a zero value.

The sctpAssocRemAddress may not be empty due to the SIZE restriction.

::= { sctpAssocRemAddressEntry 2 }

sctpAssocRemAddressStatus OBJECT-TYPE
SYNTAX INTEGER {
active(0),
inactive(1)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The current status of the remote transport address, according to [RFC2960].
Active means that the threshold of no answer received from this IP address has not been reached. Inactive means that either no heartbeat was received from this address, or any other message, reaching the threshold defined by the protocol."

::= { sctpAssocRemAddressEntry 3 }

sctpAssocRemAddressHBFlag OBJECT-TYPE
SYNTAX INTEGER {
active(0),
inactive(1)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The optional Heartbeat associated to one destination transport address could be active or not (value equal to 0 or 1, respectively).

An active destination transport address is the one considered available by a peer endpoint for receiving SCTP packets, as it is described in [RFC2960]."

::= { sctpAssocRemAddressEntry 4 }

sctpAssocRemAddressRTO 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."
::= { sctpAssocRemAddressEntry 5 }

sctpAssocRemAddressMaxPathRtx 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]. Recommended value 5 attempts."
::= { sctpAssocRemAddressEntry 6 }

-- Remote Address Statistic

sctpAssocRemAddressRtx OBJECT-TYPE  
SYNTAX         Counter32
MAX-ACCESS     read-only
STATUS         current
DESCRIPTION    "Number of DATA chunks retransmissions as defined in [RFC2960]."
::= { sctpAssocRemAddressEntry 7 }

sctpAssocRemAddressStartTime OBJECT-TYPE  
SYNTAX         TimeStamp
MAX-ACCESS     read-only
STATUS         current
DESCRIPTION    "The value of SysUpTime at the time that this row was created."
::= { sctpAssocRemAddressEntry 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 got"
 ::= { 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."
 ::= { 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."
::= { 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 got"
::= { 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"

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."

::= { 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, it can be got a list of associations that have that the specified IP address as primary within the remote set of active addresses"

::= { 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. "

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INDEX { sctpAssocRemPrimaryAddressType, 
sctpAssocRemPrimaryAddress, 
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."
 ::= { 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 got"
 ::= { 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 { sctpAssocRemAddressType, 
sctpAssocRemAddress, 
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."

::= { sctpLookupRemIPAddrEntry 1 }

-- 4.1 Conformance Information

sctpConformance OBJECT IDENTIFIER ::= { sctpMIB 2 }
sctpCompliances OBJECT IDENTIFIER ::= { sctpConformance 1 }
sctpGroups OBJECT IDENTIFIER ::= { sctpConformance 2 }

-- 4.1.1 Units of conformance

--
-- MODULE GROUPS
--

sctpParamsGroup OBJECT-GROUP
OBJECTS { sctpRtoAlgorithm,
    sctpRtoMin,
    sctpRtoMax,
    sctpRtoInitial,
    sctpMaxAssoc,
    sctpValCookieLife,
    sctpMaxInitRetr
}

STATUS current
DESCRIPTION "Common parameters for all the associations. They can usually be referred as configuration parameters"

::= { sctpGroups 1 }
sctpStatsGroup OBJECT-GROUP
   OBJECTS   {sctpCurrEstab,
              sctpActiveEstabs,
              sctpPassiveEstabs,
              sctpAborteds,
              sctpShutdowns,
              sctpOutOfBlues,
              sctpChecksumErrors,
              sctpOutCtrlChunks,
              sctpOutOrderChunks,
              sctpOutUnorderChunks,
              sctpInCtrlChunks,
              sctpInOrderChunks,
              sctpInUnorderChunks,
              sctpFragUsrMsgs,
              sctpReasmUsrMsgs,
              sctpOutSCTPPacks,
              sctpInSCTPPacks,
              sctpAssocRemAddressRtx
       }  

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

::= { sctpGroups 2 }

sctpAssocTableParamsGroup OBJECT-GROUP
   OBJECTS   {sctpAssocRemHostName,
              sctpAssocLocalPort,
              sctpAssocRemPort,
              sctpAssocRemPrimaryAddressType,
              sctpAssocRemPrimaryAddress,
              sctpAssocHeartBeatTimer,
              sctpAssocState,
              sctpAssocInStreams,
              sctpAssocOutStreams,
              sctpAssocMaxRetr,
              sctpAssocPrimaryProcess,
              sctpAssocT1expireds,
              sctpAssocT2expireds,
              sctpAssocRtxChunks,
              sctpAssocStartTime,
              sctpAssocLocalAddressStartTime,
              sctpAssocRemAddressStatus,
              sctpAssocRemAddressHBFlag,
              sctpAssocRemAddressRTO,
              sctpAssocRemAddressMaxPathRtx,
sctpAssocRemAddressStartTime

STATUS    current
DESCRIPTION
"The SCTP group of objects to manage specific local and remote
SCTP variables (local and remote tables). These variables
include all the SCTP basic features."

::= { sctpGroups 3 }

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

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

::= { sctpGroups 4 }

-- 4.1.2 Compliance Statements

--

-- MODULE COMPLIANCES
--

sctpCompliance MODULE-COMPLIANCE
STATUS    current
DESCRIPTION
"The compliance statement for SNMPv3 entities which implement
SCTP.

The SCTP MIB specifies in this compliant implementation that
only need to support IPv4/IPv6 addresses without a zone index,
unknown type and DNS names. Support for IPv4/IPv6 addresses
without zone indices is not required."

MODULE  -- this module
MANDATORY-GROUPS
   { sctpParamsGroup,
     sctpAssocTableParamsGroup
   }

GROUP sctpStatsGroup
DESCRIPTION
"Group to cover all SCTP statistics. This will be implemented when statistics are required."

GROUP sctpInverseGroup
DESCRIPTION
"Objects used in inverse lookup tables. This should be implemented for easier lookups in the association tables, when it is required."

OBJECT sctpAssocRemPrimaryAddressType
SYNTAX InetAddressType { unknown(0),
                        ipv4(1),
                        ipv6(2)
                    }
DESCRIPTION
"It is only required to have IPv4 and IPv6 addresses without zone indices. Unknown values must also be supported in case the IP address has a zero string length or an invalid/unknown format.

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

OBJECT sctpAssocLocalAddressType
SYNTAX InetAddressType { unknown(0),
                        ipv4(1),
                        ipv6(2)
                    }
DESCRIPTION
"It is only required to have IPv4 and IPv6 addresses without zone indices. Unknown values must also be supported in case the IP address has an invalid/unknown format.

Addresses with zone indices are required if an implementation can connect multiple zones."

OBJECT sctpAssocRemAddressType
SYNTAX InetAddressType { unknown(0),
                        ipv4(1),
                        ipv6(2)
DESCRIPTION

"It is only required to have IPv4 and IPv6 addresses without zone indices. Unknown values must also be supported in case the IP address has an invalid/unknown format.

Addresses with zone indices are required if an implementation can connect multiple zones."

::= { sctpCompliances 1 }

END

5. Compiling Notes

After compiling the MIB the following warnings can be got:

@ index of row 'sctpLookupRemHostNameEntry' can exceed OID size limit by 141 subidentifier(s)

@ index of row 'sctpLookupRemPrimIPAddrEntry' can exceed OID size limit by 142 subidentifier(s)

These two come from the fact that sctpAssocRemPrimaryAddress has the default InetAddress size of (0..255) which exceeds OID size limitations. Introducing a size restriction on sctpAssocRemPrimaryAddress would make the warning go away although it would be one of those more arbitrary restrictions.

Some compilers can also show the following warnings:

@ refined object 'sctpAssocLocalAddressType' not listed in a mandatory or optional group

@ refined object 'sctpAssocRemAddressType' not listed in a mandatory or optional group

The compliance statement refines these object which are not listed in one of the groups. The interesting thing is that you can’t list them in one of the groups since the SMIV2 disallows to list not accessible objects. (It can actually be considered as a bug in SMIV2.) One solution would be to just put these two refinements into a DESCRIPTION clause or a comment.

6. References


[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, Harvard University, March 1997


7. Security Consideration

The deleteTCB management object, defined in this MIB, has a MAX-ACCESS clause of read-write. This is because it allows operators to tear down the associations. Such object 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.

It is thus important to control even GET access to these objects and possibly to even encrypt the values of these object when sending them over the network via SNMP. Not all versions of SNMP provide features for such a secure environment.

SNMPv1 by itself is not a secure environment. Even if security measures are taken (e.g., using IPSEC), there is no per-user control as to who (once an IPSEC association is established between hosts) is allowed to GET or SET the objects in this MIB.

It is recommended that the implementers consider the security features as provided by the SNMPv3 framework. Specifically, the use of the User-based Security Model RFC 2574 [RFC2574] and the View-based Access Control Model RFC 2575 [RFC2575] is recommended.

It is then a customer/user responsibility to ensure that the SNMP entity giving access to an instance of this MIB, 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.
8. Acknowledgments

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10. Revision History

10.1 Changes from <SCTP-MIB-predraft-01.txt>

- Open issues updated

- Section 2: Reference to RFC227x changed to RFC257x

- Section 4: Inside the sctpRtoAlgorithm definition has been put "other" first rather than last. That way, it won’t end up in the middle of things when new enumerations are added later.

10.2 Changes from <draft-ietf-sigtran-sctp-mib-00.txt>

- Change of "Simple" word to "Stream" word in SCTP acronyms

- Version of the MIB based on SCTPv10

- Section 2: Update SNMP Framework to include the standard explanation

- New Structure for the MIB:

  sctp
  \- sctpObjects
  \- sctpScalars
Section 4.1.2: Unit of Conformance updated (functional structure).

MAX-ACCESS clauses reviewed

The general statistics has been re-ordered, placed before the tables.

In SMIv2, indexes should be not-accessible (= the object type is a column in a table used as index and may not be used as an operand in any operation != SMIv1) (pp109-110 in [])

IPv6 compatible:
- Change of Primary/Local/Remote addresses
- PENDING: check "MODULE-COMPLIANCE"

Row Status included in AssocTable, AssocLocal and AssocRem to create, modify and delete rows in the tables.

SCTP general statistics changed from Counter32 to Counter64 since it supports more data changes.

sctpCurrEstab ("State-related variables and statistics" section) variable changed from Gauge32 to Counter32.

sctpAssocRemAddressT1expired and sctpAssocRemAddressT2expired have been removed from the remote table and added in the general association data since they are variables per association (not per IP address).

sctpAssocDropDatag statistic has been removed from the general association statistics since it had an ambiguous meaning.

Explained the meaning of the unordered chunks (chunks in which the U bit is set to 1) in sctpStatOutOfOrderSentChunks and sctpStatOutOfOrderRecChunks.

Added sctpChecksumErrorCounter to collect information about wrong checksums received from the peer.

Specify that sctpStatSentChunks and sctpStatRecChunks does not contain retransmission chunks.

Reword the Security Considerations chapter pointing out that IPsec does not secure the network but it provides end-to-end security over a network.
o sctpAssocRemAddressRtxChunks replaced as a variable per association, meaning the number of chunks retransmitted to the peer in the current association.

o sctpHeartBeatMisses and sctpMaxRetr have been replaced from the general SCTP statistics to the remote IP address table (sctpHeartBeatMisses) and in the association table (sctpMaxRetr).

o Specify that the retransmissions in the general SCTP statistics include control plus data chunks.

o Included heartbeat timer for remote IP address.

o Removed sctpAssocRemAddressHeartBeatMisses variable from the remote IP address table.

o Removed sctpAssocRemAddressT3expired variable from the remote IP address table.

o Updated variables to the new SCTP states defined in v10.

10.3 Changes from <draft-ietf-sigtran-sctp-mib-01.txt>

o sctpRtoMin - stray "." outside the double-quotes in the DESCRIPTION clause.

o sctpRtoMax - stray "." outside the double-quotes in the DESCRIPTION clause.

o sctpAssocRemHostName - the type OCTECT STRING should be OCTET STRING.

o sctpAssocRemPrimaryAddress - the DESCRIPTION clause is missing its closing double-quote.

o sctpConformance - this is defined as { sctpMIB 2 }, then never used; instead sctpMIBConformance (which is undefined) is used in the definition of sctpMIBGroups and sctpMIBCompliances.

o Reworded the MIB organization

o Removed maximum number of concurrent associations

o In sctpMIBCompliance, removed a missing comma in MANDATORY-GROUPS.

o In sctpAssocTablesVariablesGroup and sctpAssocStatGroup, removed extra commas at end of OBJECTS list.

o sctpAssocInStreams. ACCESS changed from read-create to read-only.
o sctpAssocRemAddressHeartBeatFlag and sctpAssocRemAddressHBTimer changed from per remote IP address to per association.

o Comment on sctpAssocRemAddressHBTimer specifies now that the manager can change it.

o ACCESS on sctpAssocRemAddressHBTimer changed from read-only to read-write.

o ACCESS on sctpAssocRemAddressRetransCount changed from read-write to read-only.

o Move sctpStatChecksumErrorCounter from general statistics to per association.

o sctpMaxInStreams Â» ItÂ’s a sctp-user feature.

o sctpStatRetransChunks Â» ItÂ’s more useful to have this statistic in a association basis

o sctpAssocRemAddressHeartBeatFlag and sctpAssocRemAddressHBTimer have been created again instead of per association in order to follow the draft. If some implementations want to have the same value for all the associations they have, they should set all the variables in the different remote addresses to the same value.

10.3 Changes from <draft-ietf-sigtran-sctp-mib-02.txt>

o Deleting all the RowStatus Structure. Associated text rewording in Tables section.

o Variable StartTime added in all the tables in order to specify the creation time.

o Adding the Association reverse lookup table for easier management. Associated text rewording in tables section.

o Remove sctpInitialT1 and sctpInitialT2, since these values are equal to RTO.

o Change of the Heartbeats to a per-association basis

o Conformance up-to-date with all of this.

10.4 Changes from <draft-ietf-sigtran-sctp-mib-03.txt>

Main changes are due to the alignment with the TCP and UDP MIBs and the inclusion of new lookup tables.

o Convert MIB to a read-only
o Counters ends with 's'
o Include 'unknown' as an option for InetAddressType in conformance

o Terminology fix: CLOSED state, unordered chunks instead of out-of-order, ..

o HBFlag changed to per remote address

o ChecksumErrors out of the AssocTable and hangs from Scalars

o Update Ports from Unsigned32 to InetPortNumber according to RFC2851-update

o Rework inverse tables: five new lookup tables

o Remove INTEGER32 and change it to UNSIGNED32

o Replace Counter32 by Counter64

o Split Sent and Received chunks per association into control, ordered and unordered chunks

10.5 Changes from <draft-ietf-sigtran-sctp-mib-04.txt>

Changes due to the IETF-51 meeting and requests from the mailing list.
o Typo errors

o Objects renumbering

o All counters to Counter32 to be backward compatible, not to waste memory. Operators needing more than 32 bits will do it by augmentations.

o Limit the number of IP address size when index

o Specify that a port number with value zero means unknown port number according to the RFC2851-update

Changes due to the alignment with the RFC2851-update.

o Include clarification text of the IP address types supported in the SCTP MIB. Chapter 3.1.2.1 (Association table)

o Remote Primary IP address: Addition of the ipv4z an ipv6z types for non-globally IP addresses in which a scope identifier is needed.
Addition of the scope of ipv6 type. All of them according to the RFC2851-update v04

- InetAddressType for local and remote IP addresses:

  Limit UNKNOWN type only for unknown IP address format. Remove UNKNOWN type for zero-length value in the InetAddress since it will be never zero-length due to the size restriction (0..64)

  Addition of the ipv4z an ipv6z types for non-globally IP addresses in which a scope identifier is needed. Addition of the scope of ipv6 type. All of them according to the RFC2851-update v04

- Clarify when mapping DNS <-> IPaddress occurs with the remote IP addresses

- Conformance:

  Description: Specify that the SCTP MIB only need to support IPv4/IPv6 addresses without a zone index, unknown type and DNS names. Support for IPv4/IPv6 addresses with zone indices is not required.

  InetAddressType for primary, local and remote IP addresses: Clarify that the implementation is only required to support IPv4 and IPv6 address types without zone indices. Clarify also that UNKNOWN type is only used in case of local and remote addresses when invalid/unknown IP address format

  InetAddress value of primary, local and remote IP address: Removal of the InetAddress values supported. Limitation of the supported IP address types is already included in the InetAddressType

- Revision of the RFC2851-update v05. Changes in this draft does not affect the SCTP MIB.

10.6 Changes from <draft-ietf-sigtran-sctp-mib-05.txt>

Changes due to the IPv6mib Design Team and the Sigtran mailing list.

- RFC2851-update v06 (changes) does not affect the SCTP MIB

- Typo errors

- Restructure the MIB organization (tree):

  sctp
  `- sctpParameters
  `- sctpStats

- Modify conformance section according to the new MIB structure. Statistics and lookup tables will be optional
o Clarify that the SCTP MIB is based on the TCP MIB update (RFC2012update) and the TCs for Internet Network Addresses (RFC2851update) ì» remove reference to RFC2452

o Replace "Sent" by "out" and "Received" by "in" in statistics

o Change the sctpAssocId to exclude the value zero. This allows other MIBs to reference associations and to use the value 0 to indicate no association

o Clarify sctpRemHostName to be zero-length value when no remote host name was received at the initialization stage

o Limit the range of local and remote ports to (1..65535). Value 0 (unknown port number according to RFC2851-update) is not valid in SCTP associations since there is no way of having an assoc with an unknown local or remote port

o sctpAssocRemPrimaryAddressType and sctpAssocRemPrimaryAddress value to be filled in with a zero length string until valid values are received in the INIT or INIT ACK chunk

o sctpAssocRemAddress and sctpAssocLocalAddressIP size upper limit restriction to 36, as TCP MIB

o Change to Counter64 those counters which may wrap in less than an hour

o Change sctpMaxAssoc variable to Integer32 since value ì»1 is allowed for dynamic maximum number of associations

o Added a new column in the association table to give a pointer to the primary system level process which holds the association endpoint(sctpAssocPrimaryProcess)

o Specify in the security section, which object should be handled carefully for security reasons

10.7 Changes from <draft-ietf-sigtran-sctp-mib-06.txt>

o Change of the variable structure to:

MIB-2 {1 3 6 1 2 2}
+--(xxx)sctpMIB
    |      |
    +-(1) sctpObjects
    |      |
    +-(1) sctpStats
New chapter for compilation notes created

References ordered and updated