

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

Status of this Memo

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

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Abstract

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

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

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1. Introduction

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

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

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

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

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

1.1. Abbreviations

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

2. The Internet-Standard Management Framework

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

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

3. MIB Structure

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

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

```

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

```

The main groups are explained further in the MIB definition.

3.1. SCTP Objects

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

3.1.1. SCTP Statistics

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

In addition Gauge32 is also used.

3.1.1.1. State-Related Statistics

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

3.1.1.2. Statistics for traffic Measurements

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

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

3.1.2. SCTP Parameters

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

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

3.1.3. MIB Tables

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

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

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

3.1.3.1. Association Table

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

The sctpAssoc index is also shared by two more tables:

- sctpAssocLocalAddrTable: to store the local IP address(es).
- sctpAssocRemAddrTable: to store the remote addresses and the per-remote-address related information.

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

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

```

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

```

```

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

```

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

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

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

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

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

3.1.3.2. Reverse Lookup Table

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

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

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

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

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


```

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

```

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

3.2. Conformance

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

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

4. Definitions

SCTP-MIB DEFINITIONS ::= BEGIN

IMPORTS

```

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

```

sctpMIB MODULE-IDENTITY

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DESCRIPTION

"The MIB module for managing SCTP implementations.

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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 }

sctpAbortedds 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 sctpRtoMax'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 retransmission.

The value of this object has to be greater than or equal to
sctpRtoMin'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,
    sctpAssocTlexpireds         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 sysAppElmtRunTable of the SYSAPPL-MIB."

::= { sctpAssocEntry 12 }

-- Association Statistics

sctpAssocTlexpireds 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,
    sctpAssocRemAddrHBAActive 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,
          sctpAborted,
          sctpShutdowns,
          sctpOutOfBlues,
          sctpChecksumErrors,
          sctpOutCtrlChunks,
          sctpOutOrderChunks,
          sctpOutUnorderChunks,
          sctpInCtrlChunks,
          sctpInOrderChunks,
          sctpInUnorderChunks,
          sctpFragUsrMsgs,
          sctpReasmUsrMsgs,
          sctpOutSCTPPacks,
          sctpInSCTPPacks,
          sctpDiscontinuityTime,
          sctpAssocTlexpends,
          sctpAssocT2expends,
          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,
        sctpAssocRemAddrHBAActive,
        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
        { sctpAssocTlexpireds,
          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

- [RFC2578] McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Structure of Management Information Version 2 (SMIV2)", STD 58, RFC 2578, April 1999.
- [RFC2579] McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Textual Conventions for SMIV2", STD 58, RFC 2579, April 1999.
- [RFC2580] McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Conformance Statements for SMIV2", STD 58, RFC 2580, April 1999.
- [RFC2960] Stewart, R., Xie, Q., Morneault, K., Sharp, C., Schwarzbauer, H., Taylor, T., Rytina, I., Kalla, M., Zhang, L., and V. Paxson, "Stream Control Transmission Protocol", RFC 2960, October 2000.

- [RFC3291] Daniele, M., Haberman, B., Routhier, S., and J. Schoenwaelder, "Textual Conventions for Internet Network Addresses", RFC 3291, May 2002.
- [RFC3309] Stone, J., Stewart, R., and D. Otis, "Stream Control Transmission Protocol (SCTP) Checksum Change", RFC 3309, September 2002.

6.2. Informative References

- [RFC1213] McCloghrie, K. and M. Rose, "Management Information Base for Network Management of TCP/IP-based internets:MIB-II", STD 17, RFC 1213, March 1991.
- [RFC2012] McCloghrie, K., "SNMPv2 Management Information Base for the Transmission Control Protocol using SMiv2", RFC 2012, November 1996.
- [RFC3410] Case, J., Mundy, R., Partain, D., and B. Stewart, "Introduction and Applicability Statements for Internet-Standard Management Framework", RFC 3410, December 2002.
- [VANJ] Jacobson, V., "Congestion Avoidance and Control", SIGCOMM 1988, Stanford, California.
- [IPv6ARCH] Deering, S., Haberman, B., Jinmei, T., Nordmark, E., Onoe, A., and B. Zill, "IPv6 Scoped Address Architecture", Work in Progress, December 2002.
- [sctpImplem] Stewart, R., Ong, L., Arias-Rodriguez, I., Caro, A., and M. Tuexen, "Stream Control Transmission Protocol (SCTP) Implementers Guide", Work in Progress, January 2002.
- [TCPMIB] Fenner, B., McCloghrie, K., Raghunarayan, R., and J. Schoenwalder, "Management Information Base for the Transmission Control Protocol (TCP)", Work in Progress, November 2002.
- [UDPMIB] Fenner, B., "Management Information Base for User Datagram Protocol (UDP)", Work in Progress, June 2002.
- [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:

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

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

- o The sctpAssocTable, sctpAssocLocalAddressTable, sctpAssocRemAddressTable and the lookup tables contain objects providing information on the active associations on the device, local and peer's IP addresses, the status of these associations and the associated processes. This information may be used by an attacker to launch attacks against known/unknown weakness in certain protocols/applications.
- o The sctpAssocTable contains objects providing information on local and remote ports objects, that can be used to identify what ports are open on the machine and can thus suggest what attacks are likely to succeed, without the attacker having to run a port scanner.

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

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

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

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

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