



**Dialogic<sup>®</sup> DSI SIGTRAN Stack**  
**SCTP Programmer's Manual**

**December 2013      U01STN**

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## Revision History

| Issue | Date           | Description   |
|-------|----------------|---|
| 6     | December 2013  | Addition of SCTP_MSG_R_STATUS message to read current per-association status and additions to SCTP_MSG_R_STATS for cwnd, srtt and mtu measurements. |
| 5     | November 2013  | Addition of support for IPv6.<br>Ability to add and remove host addresses for an association added.   |
| 4     | February 2008  | Document rebranded and reformatted.   |
| 3     | October 2006   | Support for native SCTP interface layer.  |
| 2     | September 2003 | Additional configuration module options added (CRC32).  |
| 1     | June 2002      | Raised to issue 1.  |

**Note:** The latest release issue of this guide can be found at:  
<http://www.dialogic.com/support/helpweb/signaling>

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# 1 Introduction

The suite of SCTP modules (SCTP, SCTPD and SCTPN) provides access to a software implementation of the Stream Control Transmission Protocol (SCTP).

In addition to the protocol-related functions, the modules contain a number of features to assist you in the development of your application. These features include the ability to trace any primitive message received by, or issued from, the SCTP modules to a management module where it can be recorded or presented to you. In this way, you can debug your application without needing to gain detailed knowledge of the internal working of the SCTP module.

This manual is intended for use by systems integrators and application programmers who will need to use the SCTP modules, but do not need to know the detail of the internal operation of the modules.

There are two separate implementations that provide Stream Control Transmission Protocol (SCTP) services. Both implementations provide the same message interface to other modules through the message passing environment. Both implementations cannot be run concurrently on the same host.

This manual gives an overview of the operation of the SCTP modules and details the structure of all messages which can be sent to, or issued by, the modules and also describes the configuration parameters.

## 1.1 SCTP and SCTPD Modules

The SCTP module is a software implementation of the Stream Control Transmission Protocol (SCTP) as specified in RFC4960 and RFC2960 and includes the checksum change required in RFC3309.

The SCTP implementation provides functionality to implement up to 384 separate associations, each with up to 128 input and output streams. Each association can be configured with up to 4 network addresses to provide multi-homing capabilities.

The SCTP module requires services provided by the SCTPD module, which must also be running. It is intended for use under Windows, for Linux and Solaris based systems SCTPN should be used.

## 1.2 SCTPN Module

The SCTPN module is an interface layer to the SCTP stack that is built into Solaris 10 and most Linux kernels. The SCTPN module provides a GCT message interface compatible with the SCTP module.

The module itself supports up to 384 associations.

**Note:** The SCTPN module does not require the SCTPD module and the SCTPD module must **not** be running.

## 1.3 Compatibility

The following table shows the compatibility of each implementation with various operating systems. This table is not intended to be exhaustive.

|                   | SCTP / SCTPD        | SCTPN           |
|-------------------|---------------------|-----------------|
| Windows           | ✓                   | ✗               |
| Linux             | ✓ (Not Recommended) | ✓ (Recommended) |
| 32-bit Solaris 9  | ✓                   | ✗               |
| 32-bit Solaris 10 | ✗                   | ✓               |
| 64-bit Solaris 9  | ✓                   | ✗               |
| 64-bit Solaris 10 | ✗                   | ✓               |

## 1.4 Abbreviations

|      |                                       |
|------|---------------------------------------|
| IETF | Internet Engineering Task Force.      |
| RFC  | Request for Comments.                 |
| SCTP | Stream Control Transmission Protocol. |

## 1.5 Related Documentation

- [1] *RFC 4960 - Stream Control Transmission Protocol*
- [2] *RFC 2960 - Stream Control Transmission Protocol*
- [3] *Software Environment Programmer's Manual*
- [4] *RFC 3309 - Stream Control Transmission Protocol Checksum Change*

## 1.6 Feature Overview

Key features of the SCTP module include:

- Implementation of RFC 4960 /RFC 2960.
- Configuration options on a per association basis.
- Message-oriented interface.
- Selectable (RFC2960 / RFC3309) module checksum algorithm.

## 2 General Description

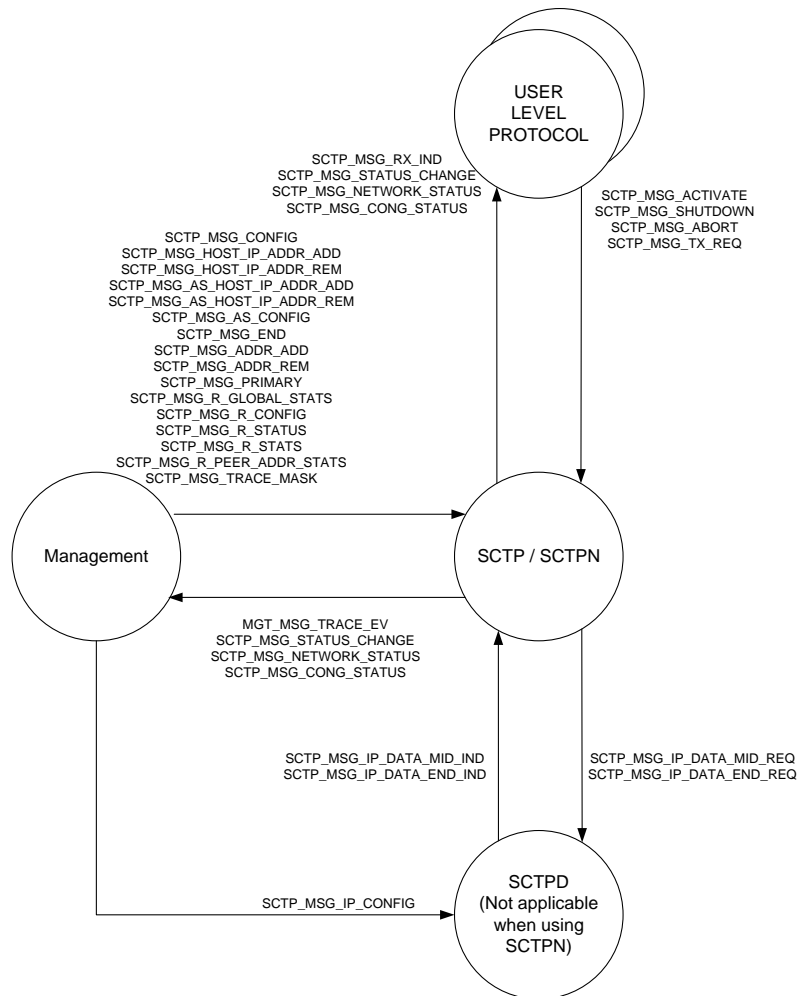
### 2.1 Module Overview

The SCTP module is an implementation of the Stream Control Transmission Protocol as defined in RFC 4960, and the additional checksum change specified in RFC 3309.

The module operates in conjunction with one or more user part modules (eg M3UA, M2PA, SUA), which lie above the SCTP module in the protocol stack, and a network interface module that lies below the SCTP module in the protocol stack.

Management functionality is provided by a management module (typically the s7\_mgt configuration utility), which configures the SCTP module. Event indications and trace messages are sent to a management module (typically s7\_log) for recording to file.

**Figure 1. SCTP Module Context Diagram**



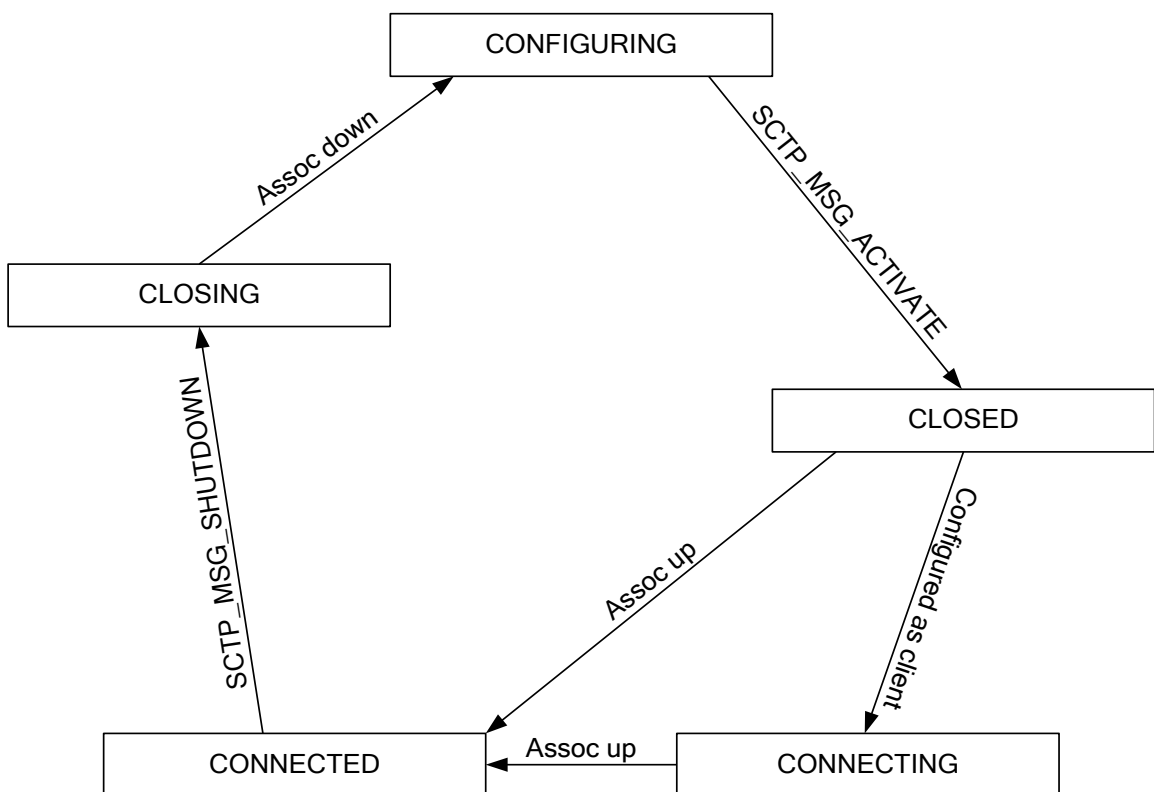


## 2.2 Associations

Within SCTP, connections to a remote node are called Associations. Each association is uniquely identified by an association identifier **assoc\_id**. Assoc\_ids range from 0 to one less than the number of associations supported.

A simplified state transition diagram for each Association is detailed below.

**Figure 2. Per-Association Simplified State Diagram**



## 2.2 Timer Operation

In order to provide internal implementation of the SCTP protocol timers the SCTP/SCTPD module needs to receive a periodic timer tick message. This is usually achieved using the Timer module supplied in the DSI Development Package. The format of these messages is described in the *Software Environment Programmer's Manual*. The SCTPN module does not require timer ticks.

## 3 Interface from User Layer to SCTP

The user layer protocol (eg M3UA, M2PA, SUA) conceptually sits above SCTP and makes use of the services provided by SCTP to achieve reliable data exchange with remote nodes. The user layer protocol is responsible for requesting activation (and optional deactivation) of an SCTP association.

The user layer protocol communicates with the Stream Control Transmission Protocol (SCTP) module using the following primitives, based on those present in RFC4960.

|                    |   |
|--------------------|---|
| <b>AS_ACTIVATE</b> | Make an association available for client or server connections. |
| <b>AS_SHUTDOWN</b> | Shutdown a currently active association.                        |
| <b>AS_ABORT</b>    | Abort a currently active association.                           |
| <b>AS_DATA_REQ</b> | Send a packet of data to a peer.                                |

### 3.1 SCTP Status Codes

The following status codes will be returned within requested confirmation messages from SCTP.

| Mnemonic        | Value | Description                                     |
|-----------------|-------|---|
| none            | 0     | Success.  |
| SCTPE_BAD_ID    | 1     | Inappropriate or invalid id in request message. |
| SCTPE_BAD_MSG   | 5     | Inappropriate or unrecognized message type.     |
| SCTPE_BAD_PARAM | 6     | Invalid parameters contained in message.        |

### 3.2 Association Activate Request

#### Synopsis

Move the association from the Configuration State into the active state.

#### Message Format

| Message Header  |                                |
|-----------------|--------------------------------|
| Field Name      | Meaning                        |
| <b>type</b>     | SCTP_MSG_ACTIVATE (0x728a)     |
| <b>id</b>       | Association ID                 |
| <b>src</b>      | Originating Module ID          |
| <b>dst</b>      | SCTP Module                    |
| <b>rsp_req</b>  | Used to request a confirmation |
| <b>hclass</b>   | 0                              |
| <b>status</b>   | Non zero on error              |
| <b>err_info</b> | 0                              |
| <b>len</b>      | 0                              |

**Description**

The association is moved from the configuration state into the active state, allowing the association to accept incoming or start outgoing connection procedures with its peer.

The module sending the message should request a response and check that all configuration information was accepted and that the activation has succeeded.

At least **one** peer IP address must be configured prior to activation.

Once the association has been activated, if the host port is zero it is configured to an ephemeral port.

If the association has been configured with a peer port (set to non-zero), the association will attempt to initiate an association with its peer. This will be indicated by an association status change message detailing a state of CONNECTING.

If the association has been configured without a peer port (set to zero), the activated association will await an incoming association from the configured peer.

Established associations are indicated by an association status message detailing a state of CONNECTED.

### 3.3 Association Shutdown Request

**Synopsis**

Attempt to shutdown an association after all outstanding data has been acknowledged.

**Message Format**

| Message Header  |                                |
|-----------------|--------------------------------|
| Field Name      | Meaning                        |
| <b>type</b>     | SCTP_MSG_SHUTDOWN (0x728b)     |
| <b>id</b>       | Association ID                 |
| <b>src</b>      | Originating Module ID          |
| <b>dst</b>      | SCTP Module                    |
| <b>rsp_req</b>  | Used to request a confirmation |
| <b>hclass</b>   | 0                              |
| <b>status</b>   | Non zero on error              |
| <b>err_info</b> | 0                              |
| <b>len</b>      | 0                              |

**Description**

Once shutdown starts, the status of the connection will be indicated to the user via the Sctp\_Msg\_Assoc\_Status message.

Once a request has been received to shutdown the association, all further attempts to send data on this association will be rejected.

Once the shutdown has completed, SCTP will issue an association status message with a status of CLOSED and will re-enter the un-configured state.

## 3.4 Association Abort Request

**Synopsis**

Initiates the termination of an association with the loss of all outstanding data.

**Message Format**

| Message Header |                                |       |
|----------------|--------------------------------|-------|
| Field Name     | Meaning                        |       |
| type           | SCTP_MSG_ABORT (0x728c)        |       |
| id             | Association ID                 |       |
| src            | Originating Module ID          |       |
| dst            | SCTP Module                    |       |
| rsp_req        | Used to request a confirmation |       |
| hclass         | 0                              |       |
| status         | Non zero on error              |       |
| err_info       | 0                              |       |
| len            | 2                              |       |
| Parameter Area |                                |       |
| Offset         | Size                           | Name  |
| 0              | 2                              | error |

**Parameters****error**

Error code sent to the peer to indicate the reason for the abort. See *RFC4960 section 3.3.10* for a detailed description of error codes. This parameter is supported by SCTP/SCTPD but is ignored by SCTPN (and should be set to zero).

**Description**

Once an association is aborted, then no new data will be accepted for transmission and all outstanding data will be lost.

Once the association has shutdown, SCTP will issue an association status message with a status of closed and will re-enter the un-configured state.

## 3.5 Association Data Transfer Request

**Synopsis**

Queue a data packet for transmission on an association.

**Message Format**

| Message Header |                                |        |
|----------------|--------------------------------|--------|
| Field Name     | Meaning                        |        |
| type           | SCTP_MSG_TX_REQ (0xc280)       |        |
| id             | Association ID                 |        |
| src            | Originating Module ID          |        |
| dst            | SCTP Module                    |        |
| rsp_req        | Used to request a confirmation |        |
| hclass         | 0                              |        |
| status         | 0                              |        |
| err_info       | 0                              |        |
| len            | data len + 8                   |        |
| Parameter Area |                                |        |
| Offset         | Size                           | Name   |
| 0              | data len                       | data   |
| data len       | 2                              | flags  |
| data len + 2   | 2                              | stream |
| data len + 4   | 4                              | ppid   |

**Parameters****data**

Octets of data for transmission.

**flags**

SCTP transmission flags.

| Status         | Value  | Description  |
|----------------|--------|--|
| SCTP_UNBUNDLED | 0x0001 | Do not bundle the packet for first transmission. (This option is not supported by the SCTPN module). |
| SCTP_UNORDERED | 0x0002 | Use un-sequenced delivery  |

**stream**

SCTP stream number for transmission.

**ppid**

SCTP Payload Protocol Identifier.

**Description**

Data packets will be rejected if the association is not currently established or an invalid stream ID is used.

If a response message has been requested, it is returned when either the packet is rejected (see above) or the packet has been queued for transmission. There is no method to determine when its peer has acknowledged a specific data packet.

If the user layer attempts to send data faster than the peer will accept, SCTP will buffer the data. If the amount of data exceeds a predetermined amount, a congestion status message is generated indicating that congestion has occurred. Once the amount of buffered data drops to a lower predetermined level, then a second congestion status message is issued indicating congestion has abated. If the user layer continues to send more data whilst an association is congested and a second threshold is passed a further indication is generated to indicate that data is being discarded.

## 4 Interface from SCTP to User Layer

The Stream Control Transmission Protocol (SCTP) module communicates with the user layer protocol using the following primitives, based on those present in RFC2960 and RFC4960.

|                          |   |
|--------------------------|---|
| <b>AS_DATA_IND</b>       | A packet of data has been received from the peer.       |
| <b>AS_STATUS_CHANGE</b>  | A change in the status of the association has occurred. |
| <b>AS_NETWORK_STATUS</b> | A change in the status of a peer address has occurred.  |
| <b>AS_CONG_STATUE</b>    | A change in the congestion status has occurred.         |

### 4.1 Association Data Transfer Indication

#### Synopsis

Indicates the arrival of a data packet from the peer.

#### Message Format

| Message Header  |                          |        |
|-----------------|--------------------------|--------|
| Field Name      | Meaning                  |        |
| <b>type</b>     | SCTP_MSG_RX_IND (0x8281) |        |
| <b>id</b>       | Association ID           |        |
| <b>src</b>      | Originating Module ID    |        |
| <b>dst</b>      | SCTP Module              |        |
| <b>rsp_req</b>  | 0                        |        |
| <b>hclass</b>   | 0                        |        |
| <b>status</b>   | 0                        |        |
| <b>err_info</b> | 0                        |        |
| <b>len</b>      | data len + 8             |        |
| Parameter Area  |                          |        |
| Offset          | Size                     | Name   |
| 0               | data len                 | data   |
| data len        | 2                        | flags  |
| data len + 2    | 2                        | stream |
| data len + 4    | 4                        | ppid   |

#### Parameters

##### data

Actual octets of data received.

**flags**

Combinable SCTP transmission flags.

| Status         | Value  | Description                       |
|----------------|--------|-----------------------------------|
| SCTP_UNORDERED | 0x0002 | Packet used un-sequenced delivery |

**stream**

SCTP stream number for transmission.

**ppid**

SCTP Payload Protocol Identifier.

**Description**

Sent to the user when data is received from the network.

## 4.2 Association Status Change

**Synopsis**

A change in the association status has occurred.

**Message Format**

| Message Header  |                                 |           |
|-----------------|---------------------------------|-----------|
| Field Name      | Meaning                         |           |
| <b>type</b>     | SCTP_MSG_STATUS_CHANGE (0x028d) |           |
| <b>id</b>       | Association ID                  |           |
| <b>src</b>      | Originating Module ID           |           |
| <b>dst</b>      | User Application                |           |
| <b>rsp_req</b>  | 0                               |           |
| <b>hclass</b>   | 0                               |           |
| <b>status</b>   | status                          |           |
| <b>err_info</b> | 0                               |           |
| <b>len</b>      | 4                               |           |
| Parameter Area  |                                 |           |
| Offset          | Size                            | Name      |
| 0               | 2                               | i_streams |
| 2               | 2                               | o_streams |



**Parameters****status**

| Status            | Value | Description  |
|-------------------|-------|--|
| STATUS_CLOSED     | 0     | Association has entered the closed state.  |
| STATUS_CONNECTING | 1     | Association is attempting to connect to a peer.  |
| STATUS_CONNECTED  | 2     | Association is available for data transfer.  |
| STATUS_CLOSING    | 3     | Association is attempting a graceful shutdown.   |
| STATUS_RESTART    | 4     | The peer has restarted the association. Data queued by the association before it was restarted will be lost. |

**i\_streams**

Number of SCTP streams allocated for peer-to-host data transfer.

**o\_streams**

Number of SCTP streams allocated for host-to-peer data transfer.

**Description**

Sent to user application and to the management module to indicate a change in state of the association.

## 4.3 Association Network Status

**Synopsis**

Indicates a status change has occurred on a network address within the association.

**Message Format**

| Message Header  |                                  |
|-----------------|----------------------------------|
| Field Name      | Meaning                          |
| <b>type</b>     | SCTP_MSG_NETWORK_STATUS (0x028e) |
| <b>id</b>       | Association ID                   |
| <b>src</b>      | Originating Module ID            |
| <b>dst</b>      | User Application                 |
| <b>rsp_req</b>  | 0                                |
| <b>hclass</b>   | 0                                |
| <b>status</b>   | status                           |
| <b>err_info</b> | 0                                |
| <b>len</b>      | 17                               |

| Parameter Area |      |         |
|----------------|------|---------|
| Offset         | Size | Name    |
| 0              | 1    | ip_type |
| 1              | 16   | ip_addr |

## Parameters

### status

| Status                | Value | Description   |
|-----------------------|-------|---|
| SCTP_ADDRESS_INACTIVE | 0x00  | Network address has been marked inactive.                       |
| SCTP_ADDRESS_ACTIVE   | 0x01  | Network address has been marked as available for data transfer. |

### ip\_type & ip\_addr

The IP address format and IP address of the affected remote network address within the association. Refer to Section 8 on page 53.

### Description

This indicates that either a network address that was previously available has now been marked as inactive, or vice versa. The definition of an inactive address is one that has failed to respond to a configurable number of sequential heartbeat requests. Sent to user application and to the management module to indicate a change in state of the remote address.

## 4.4 Association Congestion Status

### Synopsis

Indicates a status change has occurred with regards to transmit congestion on an association.

### Message Format

| Message Header  |                               |
|-----------------|-------------------------------|
| Field Name      | Meaning                       |
| <b>type</b>     | SCTP_MSG_CONG_STATUS (0x028f) |
| <b>id</b>       | Association ID                |
| <b>src</b>      | Originating Module ID         |
| <b>dst</b>      | User Application              |
| <b>rsp_req</b>  | 0                             |
| <b>hclass</b>   | 0                             |
| <b>status</b>   | Status                        |
| <b>err_info</b> | 0                             |
| <b>Len</b>      | 0                             |

### Parameters

#### status

| Status               | Value | Description  |
|----------------------|-------|--|
| SCTP_TX_CONG_ABATE   | 0     | Transmission queue is free to accept more messages   |
| SCTP_TX_CONG_ONSET   | 1     | Transmission queue is experiencing congestion  |
| SCTP_TX_CONG_DISCARD | 2     | Transmission queue has been filled to capacity and has started to discard messages queued for transmission |

### Description

Sent to user application and the management module to indicate the level of congestion on the association has changed.

If the user receives an SCTP\_TX\_CONG\_ONSET message then it should reduce the rate at which messages are sent to SCTP. If the congestion clears then an SCTP\_TX\_CONG\_ABATE message is sent and user application can continue as before. However if the level of congestion rises after a SCTP\_TX\_CONG\_ONSET message has been sent, the system will send the user application an SCTP\_TX\_CONG\_DISCARD message. At this point, SCTP will discard any data messages sent by you until the level of congestion has dropped to a safe level, at which time an SCTP\_TX\_CONG\_ABATE message will be sent.

## 5 Sctp Management Requests

The management layer communicates with the SCTP module using the following primitives.

| Primitive                     | Description   |
|-------------------------------|---|
| SCTP_MSG_CONFIG               | Configure global options within the SCTP module.  |
| SCTP_MSG_HOST_IP_ADDR_ADD     | Add an IP address to the list of valid IP addresses available for the host.                         |
| SCTP_MSG_HOST_IP_ADDR_REM     | Remove a IP address from the list of valid IP addresses available for the host.                     |
| SCTP_MSG_AS_CONFIG            | Configure association.  |
| SCTP_MSG_AS_ADDR_ADD          | Add a peer network address to an association.   |
| SCTP_MSG_AS_ADDR_REM          | Remove a peer address from an association.  |
| SCTP_MSG_AS_PRIMARY           | Designate a peer address as the primary address.  |
| SCTP_MSG_TRACE_MASK           | Define which events generate trace messages to the trace module.                                    |
| SCTP_MSG_R_GLOBAL_STATS       | Read the global statistics for the SCTP module.   |
| SCTP_MSG_R_STATUS             | Read per-association status.  |
| SCTP_MSG_R_STATS              | Read the statistics for a particular association.   |
| SCTP_MSG_R_AS_PEER_ADDR_STATS | Read the statistics for a particular peer network address for a particular association.             |
| SCTP_MSG_AS_HOST_IP_ADDR_ADD  | Add an IP address to the list of valid IP addresses available for the host for an association.      |
| SCTP_MSG_AS_HOST_IP_ADDR_REM  | Remove an IP address from the list of valid IP addresses available for the host for an association. |

## 5.1 Module Configuration Request

### Synopsis

Configure system parameters for the SCTP module.

### Message Format

| Message Header  |                                |                        |
|-----------------|--------------------------------|------------------------|
| Field Name      | Meaning                        |                        |
| <b>type</b>     | SCTP_MSG_CONFIG (0x7282)       |                        |
| <b>id</b>       | 0                              |                        |
| <b>src</b>      | Originating Module ID          |                        |
| <b>dst</b>      | SCTP Module                    |                        |
| <b>rsp_req</b>  | Used to request a confirmation |                        |
| <b>hclass</b>   | 0                              |                        |
| <b>status</b>   | Non zero on error              |                        |
| <b>err_info</b> | 0                              |                        |
| <b>len</b>      | 20                             |                        |
| Parameter Area  |                                |                        |
| Offset          | Size                           | Name                   |
| 0               | 1                              | mngt_id                |
| 1               | 1                              | trace_id               |
| 2               | 1                              | ip_id                  |
| 3               | 2                              | max_assocs             |
| 5               | 2                              | max_i_streams          |
| 7               | 2                              | max_o_streams          |
| 9               | 2                              | ms_per_tick            |
| 11              | 2                              | options                |
| 13              | 7                              | reserved – set to zero |

### Parameters

#### **mngt\_id**

Module ID of the management module.

#### **trace\_id**

Module ID of the message trace module.

**ip\_id**

Module ID of the IP daemon.

**Note:** This parameter is ignored when using the SCTPN module.

**max\_assocs**

Maximum number of associations the module will be required to handle.

**max\_i\_streams**

Maximum number of input streams for each association the module must be able to handle.

**max\_o\_streams**

Maximum number of output streams for each association the module must be able to handle.

**ms\_per\_tick**

Number of milliseconds between each system tick message.

**options**

Bitmap of options.

| Bit | Mnemonic                    | Description  |
|-----|-----------------------------|--|
| 0   | SCTP_CFG_OPT_CRC32          | If set to 1 SCTP will use CRC32 as the checksum. If set to zero SCTP will use Adler32 (RFC2960) checksums.<br>For SCTPN this option must be set to 1.  |
| 1   | SCTP_CFG_OPT_NO_ABORT_INIT  | If set to 1, SCTP will ignore rather than abort incoming connection attempts for non-present SCTP ports.<br>For SCTPN this option must be set to zero. |
| 4   | SCTP_CFG_OPT_PATH_PERSIST   | For SCTP only (SCTPN – this is always the behavior), forces retransmits of the data on the same path until is considered inactive                      |
| 5   | SCTP_CFG_OPT_PATH_PREFERRED | If set the SCTP module will use the preferred path if available. The preferred path uses the first host address set for the association.               |

**Description**

First message sent to the SCTP module to start the module and configure general parameters.

The module sending the message should request a response and check the returned status to ensure the configuration message has been accepted by SCTP.

## 5.2 Add Host Network Address Request

### Synopsis

Add an IP network address to the list of those available for SCTP.

### Message Format

| Message Header |                                    |         |
|----------------|------------------------------------|---------|
| Field Name     | Meaning                            |         |
| type           | SCTP_MSG_HOST_IP_ADDR_ADD (0x7283) |         |
| id             | 0                                  |         |
| src            | Originating Module ID              |         |
| dst            | SCTP Module                        |         |
| rsp_req        | Used to request a confirmation     |         |
| hclass         | 0                                  |         |
| status         | Non zero on error                  |         |
| err_info       | 0                                  |         |
| len            | 17                                 |         |
| Parameter Area |                                    |         |
| Offset         | Size                               | Name    |
| 0              | 1                                  | ip_type |
| 1              | 16                                 | ip_addr |

### Parameters

#### ip\_type & ip\_addr

The IP address format and IP address. Refer to Section 8 on page 53.

### Description

Sent to the SCTP module to add a network address to the list of host network addresses supplied by SCTP, during association initialization.

The module sending the message should request a response and check the returned status to ensure the IP address has been accepted by SCTP.

Added addresses will only be available for use by associations that are initiated after the address has been added.

Added addresses will not be available for use by restarted associations.

Addresses added are NOT checked for validity on the host.

## 5.3 Remove Host Network Address Request

### Synopsis

Remove an IP network address from the list of those available for SCTP.

### Message Format

| Message Header  |                                    |         |
|-----------------|------------------------------------|---------|
| Field Name      | Meaning                            |         |
| <b>type</b>     | SCTP_MSG_HOST_IP_ADDR_REM (0x7284) |         |
| <b>id</b>       | 0                                  |         |
| <b>src</b>      | Originating Module ID              |         |
| <b>dst</b>      | SCTP Module                        |         |
| <b>rsp_req</b>  | Used to request a confirmation     |         |
| <b>hclass</b>   | 0                                  |         |
| <b>status</b>   | Non zero on error                  |         |
| <b>err_info</b> | 0                                  |         |
| <b>len</b>      | 17                                 |         |
| Parameter Area  |                                    |         |
| Offset          | Size                               | Name    |
| 0               | 1                                  | ip_type |
| 1               | 16                                 | ip_addr |

### Parameters

#### ip\_type & ip\_addr

The IP address format and IP address. Refer to Section 8 on page 53.

### Description

Sent to the SCTP module to remove a network address from the list of host network addresses supplied by SCTP, during association initialization.

The module sending the message should request a response and check the returned status to ensure the IP address has been removed by SCTP.

The removed IP address will still be used by currently active associations until such time as they are shut down.



## 5.4 Add Association Host Network Address Request

### Synopsis

Adds an IP Network Address for to the list of those available for a SCTP association. If an association has a specific host network address then this overrides the global host network address list.

### Message Format

| Message Header  |                                       |         |
|-----------------|---------------------------------------|---------|
| Field Name      | Meaning                               |         |
| <b>type</b>     | SCTP_MSG_AS_HOST_IP_ADDR_ADD (0x729a) |         |
| <b>id</b>       | 0                                     |         |
| <b>src</b>      | Originating Module ID                 |         |
| <b>dst</b>      | SCTP Module                           |         |
| <b>rsp_req</b>  | Used to request a confirmation        |         |
| <b>hclass</b>   | 0                                     |         |
| <b>status</b>   | Non zero on error                     |         |
| <b>err_info</b> | 0                                     |         |
| <b>len</b>      | 17                                    |         |
| Parameter Area  |                                       |         |
| Offset          | Size                                  | Name    |
| 0               | 1                                     | ip_type |
| 1               | 16                                    | ip_addr |

### Parameters

#### ip\_type & ip\_addr

The IP address format and IP address. Refer to Section 8 on page 53.

### Description

Sent to the SCTP module to add a network address for a specific association used during association initialization.

The module sending the message should request a response and check the returned status to ensure the IP address has been accepted by SCTP.

Added addresses will not be available for use by restarted associations.

Addresses added are NOT checked for validity on the host.

## 5.5 Remove Association Host Network Address Request

### Synopsis

Remove an IP network address to the list of those available for a SCTP association. If all network addresses for an association have been removed then the association will use the global host network addresses.

### Message Format

| Message Header  |                                       |         |
|-----------------|---------------------------------------|---------|
| Field Name      | Meaning                               |         |
| <b>type</b>     | SCTP_MSG_AS_HOST_IP_ADDR_REM (0x729b) |         |
| <b>id</b>       | 0                                     |         |
| <b>src</b>      | Originating Module ID                 |         |
| <b>dst</b>      | SCTP Module                           |         |
| <b>rsp_req</b>  | Used to request a confirmation        |         |
| <b>hclass</b>   | 0                                     |         |
| <b>status</b>   | Non zero on error                     |         |
| <b>err_info</b> | 0                                     |         |
| <b>len</b>      | 17                                    |         |
| Parameter Area  |                                       |         |
| Offset          | Size                                  | Name    |
| 0               | 1                                     | ip_type |
| 1               | 16                                    | ip_addr |

### Parameters

#### ip\_type & ip\_addr

The IP address format and IP address. Refer to Section 8 on page 53.

### Description

Sent to the SCTP module to remove a network address to the list of host network addresses supplied by SCTP for an association during association initialization.

The module sending the message should request a response and check the returned status to ensure the IP address has been removed by SCTP.

The removed IP address will still be used by currently active associations until such time as they are shut down.

## 5.6 Configure Association Request

### Synopsis

Configure an association for use by SCTP.

### Message Format

| Message Header |                                |                                  |
|----------------|--------------------------------|----------------------------------|
| Field Name     | Meaning                        |                                  |
| Type           | SCTP_MSG_AS_CONFIG (0x7286)    |                                  |
| id             | Association ID                 |                                  |
| src            | Originating Module ID          |                                  |
| dst            | SCTP Module                    |                                  |
| rsp_req        | Used to request a confirmation |                                  |
| hclass         | 0                              |                                  |
| status         | Non zero on error              |                                  |
| err_info       | 0                              |                                  |
| len            | 80                             |                                  |
| Parameter Area |                                |                                  |
| Offset         | Size                           | Name                             |
| 0              | 2                              | peer_port                        |
| 2              | 2                              | host_port                        |
| 4              | 2                              | max_i_streams                    |
| 6              | 2                              | max_o_streams                    |
| 8              | 4                              | rto_min                          |
| 12             | 4                              | rto_max                          |
| 16             | 4                              | rto_init                         |
| 20             | 4                              | cookie_life                      |
| 24             | 4                              | heartbeat                        |
| 28             | 2                              | max_retx_init                    |
| 30             | 2                              | max_retx_cookie                  |
| 32             | 2                              | max_retx_shutdown                |
| 34             | 2                              | max_retx_heartbeat               |
| 36             | 2                              | max_retx_data                    |
| 38             | 4                              | T1_init                          |
| 42             | 4                              | T2_init (not supported by SCTPN) |
| 46             | 2                              | cong_abate                       |
| 48             | 2                              | cong_onset                       |
| 50             | 2                              | cong_discard                     |

|    |    |                                   |
|----|----|-----------------------------------|
| 52 | 4  | rx_window                         |
| 56 | 2  | options                           |
| 58 | 4  | Sack delay (SCTPN and linux only) |
| 58 | 22 | Reserved for expansion            |

## Parameters

### **peer\_port**

SCTP port of peer (zero to allow connection from any peer port).

### **host\_port**

SCTP port of host (zero to allow connection to any host port).

### **max\_i\_streams**

Association-specific maximum number of SCTP streams that the peer can request for data transmission to the host.

### **max\_o\_streams**

Association-specific maximum number of SCTP streams that the host will request for data transfer to the peer.

### **rto\_min**

Minimum RTO in milliseconds.

### **rto\_max**

Maximum RTO in milliseconds.

### **rto\_init**

Initial RTO in milliseconds.

### **cookie\_life**

Cookie lifetime in milliseconds.

### **heartbeat**

Minimum time between heartbeats in milliseconds.

### **max\_retx\_init**

Maximum number of times an INIT message is re-transmitted before the association attempt is aborted.

### **max\_retx\_cookie**

Maximum number of times a COOKIE\_ECHO message is re-transmitted before the association attempt is aborted.

**max\_retx\_shutdown**

Maximum number of times a SHUTDOWN message is re-transmitted before the association is closed.

**max\_retx\_heartbeat**

Maximum number of times a HEARTBEAT message is lost before the network address marked failed.

**max\_retx\_data**

Maximum number of times a data chunk will be retransmitted before the association is aborted.

**T1\_init**

Starting timeout of an INIT chunk.

**T2\_init**

Starting timeout of a SHUTDOWN chunk.

**Note:** This parameter is not supported by the SCTPN module.

**cong\_abate**

Number of internal message buffers in the transmission queues that indicate the abatement of congestion.

**cong\_onset**

Number of internal message buffers in the transmission queues that indicate the onset of congestion.

**cong\_discard**

Number of internal message buffers in the transmission queues that indicate the discarding of messages due to congestion.

**rx\_window**

The size of the associations receive window, in octets.

**options**

Bitmap of options.

| Bit | Mnemonic                        | Value  | Description  |
|-----|---------------------------------|--------|--|
| 0   | SCTP_AS_CNF_OPT_SERVER          | 0x0001 | When set to 1, association will be a server and will await a connection. When set to zero the association will be a client and will initiate the connection. |
| 1   | SCTP_AS_CNF_OPT_NO_RESTART      | 0x0002 | Association will ABORT if a restart is detected  |
| 2   | SCTP_AS_CNF_OPT_KEEP_ALIVE      | 0x0004 | Association will not shutdown on excess heartbeat loss   |
| 3   | SCTP_AS_CNF_OPT_FULL_CFG        | 0x0008 | Association must be fully configured with all the peer's network addresses   |
| 4   | SCTP_AS_CNF_OPT_PART_CFG        | 0x0010 | Association must be partially configured with the peer's network addresses   |
| 5   | SCTP_AS_CNF_OPT_CONG_KILOBYTES  | 0x0020 | Congestion abatement limit specified in kilobytes and onset/discard are specified in numbers of messages above the abatement limit                           |
| 6   | SCTP_AS_CNF_OPT_SACK_DELAY      | 0x0040 | Association will have the SACK delay configured by the user (SCTPN only)   |
| 7   | SCTP_AS_CNF_OPT_NO_INIT_BACKOFF | 0x0080 | Disable exponential backoff during connect   |

**sack\_delay**

The sack delay in milliseconds

**Note:** This parameter is not supported by the SCTP module or Solaris.

**Description**

Sent by the user module to configure the parameters of an SCTP association.

The module sending the message should request a response and check the returned status to ensure the SCTP configuration has been accepted by SCTP.

An association can only be configured when it is in the configuring state.

## 5.7 Add Peer Network Address Request

### Synopsis

Add an IP network address to those available on which to contact the peer.

### Message Format

| Message Header  |                                |         |
|-----------------|--------------------------------|---------|
| Field Name      | Meaning                        |         |
| <b>type</b>     | SCTP_MSG_ADDR_ADD (0x7287)     |         |
| <b>id</b>       | Association ID                 |         |
| <b>src</b>      | Originating Module ID          |         |
| <b>dst</b>      | SCTP Module                    |         |
| <b>rsp_req</b>  | Used to request a confirmation |         |
| <b>hclass</b>   | 0                              |         |
| <b>status</b>   | Non zero on error              |         |
| <b>err_info</b> | 0                              |         |
| <b>len</b>      | 17                             |         |
| Parameter Area  |                                |         |
| Offset          | Size                           | Name    |
| 0               | 1                              | ip_type |
| 1               | 16                             | ip_addr |

### Parameters

#### ip\_type & ip\_addr

The IP address format and the IP address. Refer to Section 8 on page 53.

### Description

Sent to the SCTP module to add a network address to the list of valid peer IP addresses for this association.

The module sending the message should request a response and check the returned status to ensure the IP address has been added by SCTP.

Addresses can only be added when the association is in the Configuration State.

For a server application, the IP addresses configured are the addresses from which SCTP will accept association creation requests. Wildcard addresses (consisting of a zero IP address) are valid only if no other addresses have been specified.

For a client application, the IP addresses configured are the addresses that SCTP uses when attempting to create an association. Wildcard addresses are NOT valid.

If the association has been configured with the `SCTP_AS_CNF_OPT_FULL_CFG` flag, the host MUST supply all the IP network addresses of the peer; otherwise the association initiation will fail.

## 5.8 Remove Peer Network Address Request

### Synopsis

Remove an IP network address from those available to contact the peer on.

### Message Format

| Message Header  |                                |         |
|-----------------|--------------------------------|---------|
| Field Name      | Meaning                        |         |
| <b>type</b>     | SCTP_MSG_ADDR_REM (0x7288)     |         |
| <b>id</b>       | Association ID                 |         |
| <b>src</b>      | Originating Module ID          |         |
| <b>dst</b>      | SCTP Module                    |         |
| <b>rsp_req</b>  | Used to request a confirmation |         |
| <b>hclass</b>   | 0                              |         |
| <b>status</b>   | Non zero on error              |         |
| <b>err_info</b> | 0                              |         |
| <b>len</b>      | 17                             |         |
| Parameter Area  |                                |         |
| Offset          | Size                           | Name    |
| 0               | 1                              | ip_type |
| 1               | 16                             | ip_addr |

### Parameters

#### ip\_type & ip\_addr

The IP address format and IP address. Refer to Section 8 on page 53.

### Description

Sent to the SCTP module to remove a network address from the list of valid peer IP addresses for this association.

The module sending the message should request a response and check the returned status to ensure the IP address has been removed by SCTP.

Addresses can only be removed when the association is in the Configuration State.



## 5.9 Set Primary Address Request

### Synopsis

Indicate the primary address of the peer.

### Message Format

| Message Header  |                                |         |
|-----------------|--------------------------------|---------|
| Field Name      | Meaning                        |         |
| <b>type</b>     | SCTP_MSG_PRIMARY (0x7289)      |         |
| <b>id</b>       | Association ID                 |         |
| <b>src</b>      | Originating Module ID          |         |
| <b>dst</b>      | SCTP Module                    |         |
| <b>rsp_req</b>  | Used to request a confirmation |         |
| <b>hclass</b>   | 0                              |         |
| <b>status</b>   | Non zero on error              |         |
| <b>err_info</b> | 0                              |         |
| <b>len</b>      | 17                             |         |
| Parameter Area  |                                |         |
| Offset          | Size                           | Name    |
| 0               | 1                              | ip_type |
| 1               | 16                             | ip_addr |

### Parameters

#### ip\_type & ip\_addr

The IP address format and IP address. Refer to Section 8 on page 53.

### Description

Configure the association to use the indicated address as the primary destination address of the association.

An address will be accepted but not used if it is currently not reachable.

Until the primary address is selected via this message, the first peer address present in the SCTP association initialization message will be used.

## 5.10 Global Statistics Request

### Synopsis

Retrieve global statistical information for the module.

### Message Format

| Message Header |                                  |                   |
|----------------|----------------------------------|-------------------|
| Field Name     | Meaning                          |                   |
| type           | SCTP_MSG_R_GLOBAL_STATS (0x6290) |                   |
| id             | 0                                |                   |
| src            | Originating Module ID            |                   |
| dst            | SCTP Module                      |                   |
| rsp_req        | Used to request a confirmation   |                   |
| hclass         | 0                                |                   |
| status         | Reset Flag                       |                   |
| err_info       | 0                                |                   |
| len            | 46                               |                   |
| Parameter Area |                                  |                   |
| Offset         | Size                             | Name              |
| 0              | 2                                | est_current       |
| 2              | 4                                | est_client        |
| 6              | 4                                | est_server        |
| 10             | 4                                | aborted           |
| 14             | 4                                | shutdown          |
| 18             | 4                                | OOB               |
| 22             | 4                                | chunks_tx         |
| 26             | 4                                | chunks_rx         |
| 30             | 4                                | chunks_retx       |
| 34             | 4                                | chunks_unorder_tx |
| 38             | 4                                | chunks_unorder_rx |
| 42             | 4                                | bad_checksum      |

### Parameters

#### Reset Flag

If set to 1 then the statistics are reset.

**est\_current**

Number of associations currently in either ESTABLISHED or SHUTDOWN\_RECEIVED states.

**est\_client**

Total number of associations established from this host.

**est\_server**

Total number of associations established from a peer.

**aborted**

Total number of associations ended by ABORT.

**shutdown**

Total number of associations ended gracefully.

**OOB**

Total number of out of the blue packets received.

**Note:** This parameter is not supported by the SCTPN module.

**chunks\_tx**

Total number of chunks transmitted (not re-transmits).

**chunks\_rx**

Total number of chunks received.

**chunks\_retx**

Total number of chunks re-transmitted.

**Note:** This parameter is not supported by the SCTPN module.

**chunks\_unorder\_tx**

Total number of unordered chunks sent.

**chunks\_unorder\_rx**

Total number of unordered chunks received.

**bad\_checksum**

Total number of chunks that failed the checksum.

**Note:** This parameter is not supported by the SCTPN module.

**Description**

If the statistics are not read before their maximum values are reached, then the counts will wrap.

## 5.11 Read Association Configuration Request

### Synopsis

Read configuration options for an individual association.

### Message Format

| Message Header |                                |   |
|----------------|--------------------------------|---|
| Field Name     | Meaning                        |   |
| type           | SCTP_MSG_R_CONFIG (0x6291)     |   |
| id             | Association ID                 |   |
| src            | Originating Module ID          |   |
| dst            | SCTP Module                    |   |
| rsp_req        | Used to request a confirmation |   |
| hclass         | 0                              |   |
| status         | 0                              |   |
| err_info       | 0                              |   |
| len            | 85                             |   |
| Parameter Area |                                |   |
| Offset         | Size                           | Name  |
| 0              | 80                             | Parameters as defined for SCTP_ASSOC_CONFIG |
| 80             | 1                              | state                                       |
| 81             | 2                              | i_streams                                   |
| 83             | 2                              | o_streams                                   |

### Parameters

#### state

Current state of the association.

| Value | Status           | Description  |
|-------|------------------|--|
| 0     | CONFIGURING      | Association is being configured.   |
| 1     | CLOSED           | Association is active but unused.  |
| 2     | COOKIE_WAIT      | Association has attempted to initially contact the peer.                                     |
| 3     | COOKIE_ECHOED    | Association peer has responded and we are waiting for confirmation of the established state. |
| 4     | ESTABLISHED      | Association is available for data transfer.  |
| 5     | SHUTDOWN_PENDING | Host has indicated an association should be gracefully closed.                               |
| 6     | SHUTDOWN_SENT    | Host is attempting to gracefully close an association.                                       |

| Value | Status              | Description  |
|-------|---------------------|--|
| 7     | SHUTDOWN_RECEIVED   | Peer has indicated an association should be gracefully closed. |
| 8     | SHUTDOWN_ACK_SENT   | Association is shutting down.                                  |
| 9     | SHUTDOWN_CONG_DELAY | Shutdown delayed until congestion cleared                      |

**Note:** The COOKIE\_ECHOED, SHUTDOWN\_ACK\_SENT, SHUTDOWN\_RECEIVED and SHUTDOWN\_SENT status values are never returned by the SCTPN module.

#### **i\_streams**

Number of input streams in the current association (contains valid value only for associations in the ESTABLISHED state).

#### **o\_streams**

Number of output streams in the current association (contains valid value only for associations in the ESTABLISHED state).

#### **Description**

Retrieves the parameters used to configure the association.

## **5.12 Read Association Statistics Request**

#### **Synopsis**

Gets association statistical information for the association.

#### **Message Format**

| Message Header  |                                |
|-----------------|--------------------------------|
| Field Name      | Meaning                        |
| <b>type</b>     | SCTP_MSG_R_STATS (0x6292)      |
| <b>id</b>       | Association ID                 |
| <b>src</b>      | Originating Module ID          |
| <b>dst</b>      | SCTP Module                    |
| <b>rsp_req</b>  | Used to request a confirmation |
| <b>hclass</b>   | 0                              |
| <b>status</b>   | Reset Flag                     |
| <b>err_info</b> | 0                              |
| <b>len</b>      | 49                             |

| Parameter Area |      |                     |
|----------------|------|---------------------|
| Offset         | Size | Name                |
| 0              | 4    | est_client          |
| 4              | 4    | est_server          |
| 8              | 4    | aborted             |
| 12             | 4    | shutdown            |
| 16             | 4    | chunks_tx           |
| 20             | 4    | chunks_rx           |
| 24             | 4    | chunks_retx.        |
| 28             | 4    | chunks_unordered_tx |
| 32             | 4    | chunks_unordered_rx |
| 36             | 2    | t1_expires.         |
| 38             | 2    | t2_expires.         |
| 40             | 1    | peer_addr           |
| 41             | 4    | period              |
| 45             | 4    | time_oos            |

## Parameters

### Reset Flag

If set to 1 then the statistics are reset.

### est\_client

Total number of associations established from this host on this association.

### est\_server

Total number of associations established from a peer on this association.

### aborted

Total number of associations ended by ABORT on this association.

### shutdown

Total number of associations ended gracefully on this association.

### chunks\_tx

Total number of chunks transmitted (not re-transmits) on this association.

### chunks\_rx

Total number of chunks received on this association.

**chunks\_retx**

Total number of chunks retransmitted on this association.

**Note:** This parameter is not supported by the SCTPN module.

**chunks\_unordered\_tx**

Total number of unordered chunks sent on this association.

**chunks\_unordered\_rx**

Total number of unordered chunks received on this association.

**t1\_expires**

Number of times T1 expired during INIT phases on this association.

**Note:** This parameter is not supported by the SCTPN module.

**t2\_expires**

Number of times T2 expired during SHUTDOWN phases on this association.

**Note:** This parameter is not supported by the SCTPN module.

**peer\_addr**

Number of peer network addresses present for this association (set to zero in associations **not** in the ESTABLISHED state).

**period**

Number of timer ticks that have passed since the statistics were last reset.

**time\_oos**

Number of timer ticks that the association has been out of service since the last reset.

**Description**

If the statistics are not read before their maximum values are reached, then the counts will wrap.

## 5.13 Read Per-Association Status

### Synopsis

Message for retrieving current status for a specific SCTP association.

**Note:** *This message is not supported by the SCTP module.*

### Message Format

| Message Header  |                                |              |
|-----------------|--------------------------------|--------------|
| Field Name      | Meaning                        |              |
| <b>type</b>     | SCTP_MSG_R_STATUS (0x629f)     |              |
| <b>id</b>       | Association ID                 |              |
| <b>src</b>      | Originating Module ID          |              |
| <b>dst</b>      | SCTP Module                    |              |
| <b>rsp_req</b>  | Used to request a confirmation |              |
| <b>hclass</b>   | 0                              |              |
| <b>status</b>   | Non zero on error              |              |
| <b>err_info</b> | 0                              |              |
| <b>len</b>      | 29                             |              |
| Parameter Area  |                                |              |
| Offset          | Size                           | Name         |
| 0               | 1                              | num_addr     |
| 1               | 1                              | state        |
| 2               | 4                              | rwnd         |
| 6               | 2                              | data_unacked |
| 8               | 2                              | data_pend    |
| 10              | 1                              | primary      |
| 11              | 1                              | ip_type      |
| 12              | 16                             | ip_addr      |
| 28              | 1                              | Reserved     |

### Parameters

#### num\_addr

Number of peer addresses in use for the association.

#### state

The current state of the association.



**rwmd**

Current receive window size of the peer.

**data\_unacked**

Number of unacknowledged data chunks.

**data\_pend**

Number of pending data chunks.

**primary**

Index of the current primary peer address.

**ip\_type & ip\_addr**

The IP address of the remote end for the given path. Formatted as shown in Section 8 on page 53.

**Description**

This message is used to retrieve the current status of the association.

## 5.14 Read Association Peer Address Statistics

### Synopsis

Message for retrieving status for a specific peer address within an SCTP association.

### Message Format

| Message Header  |   |  |
|-----------------|---|--|
| Field Name      | Meaning   |  |
| <b>type</b>     | SCTP_MSG_R_PEER_ADDR_STATS (0x6293)   |  |
| <b>id</b>       | Association ID  |  |
| <b>src</b>      | Originating Module ID   |  |
| <b>dst</b>      | SCTP Module   |  |
| <b>rsp_req</b>  | Used to request a confirmation  |  |
| <b>hclass</b>   | 0   |  |
| <b>status</b>   | Set to 0 to read measurements<br>Set to 1 to read and reset measurements<br>(see below for details of which measurements can be reset). |  |
| <b>err_info</b> | 0   |  |
| <b>len</b>      | 31 (when using SCTP/SCTPD)<br>43 (when using SCTPN)   |  |
| Parameter Area  |   |  |
| Offset          | Size  | Name                                     |
| 0               | 1   | addr_num (Input)                         |
| 1               | 1   | ip_type                                  |
| 2               | 16  | ip_addr                                  |
| 18              | 1   | status                                   |
| 19              | 4   | rto (ms)                                 |
| 23              | 4   | lost_heartbeat (supported for SCTP only) |
| 27              | 4   | lost_data (supported for SCTP only)      |
| 31              | 4   | cwnd (supported for SCTPN only)          |
| 35              | 4   | srtt (ms) (supported for SCTPN only)     |
| 39              | 4   | mtu (ms) (supported for SCTPN only)      |

### Parameters

#### addr\_num

Supplied by the originating module to specify the index of the network addresses for which statistics are to be read.

**ip\_type & ip\_addr**

The IP address of the remote end for the given path. Formatted as shown in Section 8 on page 53.

**status**

The current status of the specified remote address as follows:

| Value | Status                   | Description  |
|-------|--------------------------|--|
| 0     | SCTP_ADDRESS_INACTIVE    | Peer address is marked inactive.                                     |
| 1     | SCTP_ADDRESS_ACTIVE      | Peer address is available for data transfer.                         |
| 2     | SCTP_ADDRESS_INVALID     | Peer address provided at configuration time but currently not in use |
| 3     | SCTP_ADDRESS_UNCONFIRMED | Peer address not yet confirmed as valid.                             |

**rto**

The current retransmission timeout value for the peer address in milliseconds.

**lost\_heartbeat**

Number of lost heartbeat messages for the peer address since the measurements were last reset. (This parameter is always set to zero when using SCTPN).

**lost\_data**

Number of lost data chunks for the peer address since the measurements were last reset. (This parameter is always set to zero when using SCTPN)

**cwnd**

The current congestion window for the peer address.

**srtt**

The current calculated smoothed round-trip time for the peer address in milliseconds.

**mtu**

The current Path MTU for the peer address. This is the number of bytes available in an SCTP packet for chunks.

**Description**

Information is reset when the association transitions into the established state.

In the event that addr\_num refers to a non-existent entry (one that has not been configured or received in response from the far end) the ip\_type field in the response message will be set to ADR\_NONE.

## 5.15 Trace Mask Configuration Request

### Synopsis

Configure SCTP to trace the specified messages and events.

### Message Format

| Message Header |                                |             |
|----------------|--------------------------------|-------------|
| Field Name     | Meaning                        |             |
| type           | SCTP_MSG_TRACE_MASK (0x5285)   |             |
| id             | 0                              |             |
| src            | Originating Module ID          |             |
| dst            | SCTP Module                    |             |
| rsp_req        | Used to request a confirmation |             |
| hclass         | 0                              |             |
| status         | 0                              |             |
| err_info       | 0                              |             |
| len            | 12                             |             |
| Parameter Area |                                |             |
| Offset         | Size                           | Name        |
| 0              | 4                              | op_evt_mask |
| 4              | 4                              | ip_evt_mask |
| 8              | 4                              | reserved    |

### Parameters

#### op\_evt\_mask

The output event mask. This is a 32 bit value with bits set to 1 to cause a trace message to be sent to the system management module whenever a message is issued by SCTP for the event indicated.

| Bit Number | Mnemonic   | Description                       |
|------------|------------|-----------------------------------|
| 0          | DATA_IND   | SCTP_MSG_RX_IND                   |
| 1          | STATUS_CHG | SCTP_MSG_STATUS_CHANGE            |
| 2          | NET_CHG    | SCTP_MSG_NETWORK_STATUS           |
| 3          | CONG_CHG   | SCTP_MSG_CONG_STATUS              |
| 4          | DATA_REQ   | SCTP_MSG_IP_DATA_XXX_REQ          |
| 5-31       | Reserved   | Reserved - Should be set to zero. |

**Note:** The DATA\_REQ bit is not supported by the SCTPN module.

**ip\_evt\_mask**

The input event mask. This is a 32 bit value with bits set to 1 to cause a trace message to be sent to the system management module whenever a message is received by SCTP for the event indicated.

| Bit Number | Mnemonic  | Description                      |
|------------|-----------|----------------------------------|
| 0          | ACT_ASSOC | SCTP_MSG_ACTIVATE                |
| 1          | SHUT_REQ  | SCTP_MSG_SHUTDOWN                |
| 2          | ABORT_REQ | SCTP_MSG_ABORT                   |
| 3          | DATA_REQ  | SCTP_MSG_TX_REQ                  |
| 4          | PRI_ADDR  | SCTP_MSG_PRIMARY                 |
| 5          | DATA_REQ  | SCTP_MSG_IP_DATA_xxx_IND         |
| 6-31       | Reserved  | Reserved - Should be set to zero |

**reserved**

Currently reserved. MUST be set to zero.

**Description**

Can be used to debug user-level applications by detailing the exact information exchanged on the USER/SCTP interface.

## 6 SCTP Management Indications

### 6.1 SCTP Event Indication

#### Synopsis

Sends events that have occurred in the SCTP stack to the management interface

#### Message Format

| Message Header |                             |              |
|----------------|-----------------------------|--------------|
| Field Name     | Meaning                     |              |
| type           | SCTP_MSG_EVENT_IND (0x029e) |              |
| id             | Association id              |              |
| src            | SCTP ID                     |              |
| dst            | Management Module           |              |
| rsp_req        | 0                           |              |
| hclass         | 0                           |              |
| status         | Event Type                  |              |
| err_info       | 0                           |              |
| len            | 8                           |              |
| Parameter Area |                             |              |
| Offset         | Size                        | Name         |
| 0              | 4                           | Data Value 1 |
| 4              | 4                           | Data Value 2 |

#### Parameters

##### event\_type

Value indicating the type of event that has occurred from the following table:

| Event type           | Value | Description  |
|----------------------|-------|--|
| SCTP_EVT_UNEXP_EVENT | 1     | The retransmission list is invalid for the association |
| SCTP_EVT_HIGH_TSN    | 2     | Invalid SACK received with a TSN out of range          |
| SCTP_EVT_LOW_TSN     | 3     | Invalid SACK received with a TSN out of range          |

**evt\_val1, evt\_val2**

Event value depending on event type

| Event type | evt_val1     | evt_val2        | Description           |
|------------|--------------|-----------------|-----------------------|
| 0          | Event        | Additional Data | Unexpected Event Data |
| 1          | Incoming TSN | Expected TSN    | Invalid TSN in SACK   |
| 2          | Incoming TSN | Expected TSN    | Invalid TSN in SACK   |

**Description**

Signals an unusual event has occurred in the operation of SCTP. These events include errors with the incoming SCTP packets.

## 6.2 Management Event Indication

### Synopsis

Message is issued by SCTP module to notify system management of general software events that under normal operating conditions should not occur. These events may be due to lack of system resources or errors within the software.

### Message Format

| Message Header  |                                   |
|-----------------|-----------------------------------|
| Field Name      | Meaning                           |
| <b>type</b>     | MGT_MSG_EVENT_IND (0x0008)        |
| <b>id</b>       | 0                                 |
| <b>src</b>      | SCTP ID                           |
| <b>dst</b>      | Management Module                 |
| <b>rsp_req</b>  | 0                                 |
| <b>hclass</b>   | 0                                 |
| <b>status</b>   | Management event code (see below) |
| <b>err_info</b> | 0                                 |
| <b>len</b>      | 0                                 |

### Management event code

The **Management event code** contained in the **status** field of the message indicates the type of event. Possible values are listed in the following table:

| Management Event Code |      | Description   |
|-----------------------|------|---|
| 240                   | 0xf0 | SCTP Discards Incoming Message<br>(SCTP/SCTPD Only)   |
| 241                   | 0xf1 | The internal message buffer has been exhausted. If this event occurs, then correct operation of the SCTP module is not guaranteed.<br>(SCTP/SCTPD Only) |
| 242                   | 0xf2 | An attempt to send an oversize message has failed.<br>(SCTPN Only)  |
| 243                   | 0xf3 | An attempt to send a message has failed and the message is discarded<br>(SCTPN Only)  |
| 244                   | 0xf4 | An attempt to send a message has failed as due to invalid stream<br>(SCTPN Only)  |



## 7 SCTP to SCTPD Interface

The following are used by the message-based interface between SCTP and the SCTP daemon SCTPD. Except for the configuration message, these messages are internal to SCTP / SCTPD and are shown here for reference only. These messages are not used by the SCTPN module.

### 7.1 SCTPD Configuration Request

#### Synopsis

Sent to the SCTP module at startup to configure various parameters.

#### Message Format

| Message Header  |                                |          |
|-----------------|--------------------------------|----------|
| Field Name      | Meaning                        |          |
| <b>type</b>     | SCTP_MSG_IP_CONFIG (0x7295)    |          |
| <b>id</b>       | 0                              |          |
| <b>src</b>      | Originating Module ID          |          |
| <b>dst</b>      | IP Module                      |          |
| <b>rsp_req</b>  | Used to request a confirmation |          |
| <b>hclass</b>   | 0                              |          |
| <b>status</b>   | 0                              |          |
| <b>err_info</b> | 0                              |          |
| <b>len</b>      | 12                             |          |
| Parameter Area  |                                |          |
| Offset          | Size                           | Name     |
| 0               | 1                              | mngt_id  |
| 1               | 1                              | trace_id |
| 2               | 1                              | sctp_id  |
| 3               | 9                              | reserved |

#### Parameters

##### **mngt\_id**

Module ID of the management module.

##### **trace\_id**

Module ID of the message trace module.

##### **sctp\_id**

Module ID of the SCTP module.

**reserved**

Reserved. This must be set to zero.

**Description**

The module sending the message should request a response and check the returned status to ensure the configuration message has been accepted by SCTPD.

## 7.2 IP Data Transmission Request

**Synopsis**

Request sending data via IP.

**Message Format**

| Message Header  |  |         |
|-----------------|--|---------|
| Field Name      | Meaning  |         |
| <b>type</b>     | SCTP_MSG_IP_DATA_MID_REQ (0x7296)<br>SCTP_MSG_IP_DATA_END_REQ (0x7297) |         |
| <b>id</b>       | 0  |         |
| <b>src</b>      | Originating Module ID  |         |
| <b>dst</b>      | Module_id of SCTPD module  |         |
| <b>rsp_req</b>  | Used to request a confirmation   |         |
| <b>hclass</b>   | 0  |         |
| <b>status</b>   | 0  |         |
| <b>err_info</b> | 0  |         |
| <b>len</b>      | 17 + data len  |         |
| Parameter Area  |  |         |
| Offset          | Size   | Name    |
| 0               | 1  | ip_type |
| 1               | 16   | ip_addr |
| 17              | data len   | data    |

**Parameters****ip\_type & ip\_addr**

The IP address format and IP address. Refer to Section 8 on page 53.

**data**

Data to be transmitted via IP.

**Description**

Used by SCTP to transfer data to the network layer of the underlying operating system.

The network layer buffers all the SCTP\_MSG\_IP\_DATA\_MID\_REQ information until a SCTP\_MSG\_IP\_DATA\_END\_REQ message is received. At this point all the data is sent via the IP network to the network address supplied in the final message.

## 7.3 IP Data Reception Indication

**Synopsis**

Indicates reception of a data packet from IP.

**Message Format**

| Message Header  |  |         |
|-----------------|--|---------|
| Field Name      | Meaning  |         |
| <b>type</b>     | SCTP_MSG_IP_DATA_MID_IND (0x7298)<br>SCTP_MSG_IP_DATA_END_IND (0x7299) |         |
| <b>id</b>       | 0  |         |
| <b>src</b>      | Originating Module ID  |         |
| <b>dst</b>      | SCTP Module  |         |
| <b>rsp_req</b>  | Used to request a confirmation   |         |
| <b>hclass</b>   | 0  |         |
| <b>status</b>   | 0  |         |
| <b>err_info</b> | 0  |         |
| <b>len</b>      | 17 + data len  |         |
| Parameter Area  |  |         |
| Offset          | Size   | Name    |
| 0               | 1  | ip_type |
| 1               | 16   | ip_addr |
| 17              | data len   | data    |

**Parameters****ip\_type & ip\_addr**

The IP address format and IP address. Refer to Section 8 on page 53.

**data**

Data to be transmitted via IP.

**Description**

Used by the network layer to transfer data to SCTP.

SCTP buffers all the SCTP\_MSG\_IP\_DATA\_MID\_IND information until a SCTP\_MSG\_IP\_DATA\_END\_IND message is received. At this point, all the data is processed.

## 8 Network Address Representation

The SCTP module supports both IPv4 and IPv6 addresses. In messages on the management interface to the SCTP module the IP address is represented using two fields: a single octet Address Type (which details whether the address is IPv4 or IPv6) followed by a sixteen octet Address Value (which details the actual address).

The address type is coded as shown in the following table

| Address Type | Value | Description                             |
|--------------|-------|---|
| ADR_NONE     | 0     | Invalid / not present network addresses |
| ADR_IPV4     | 1     | IPv4 network addresses                  |
| ADR_IPV6     | 2     | IPv6 network addresses                  |

The following sections detail the format of the three types of address.

### 8.1 Network Address type NONE

When a Network Address is either not present or invalid the following coding is used:

| Field         | Description     | Offset | Example |
|---------------|-----------------|--------|---------|
| Address Type  | ADR_NONE = 0x00 | 0      | 0x00    |
| Address Value | Undefined       | 1      |         |
|               | Undefined       | 16     |         |

### 8.2 Network Address type IPv4

An IPv4 Network Addresses is coded in the following manner. The example IP address shown in the table is 192.168.0.1.

| Field         | Description                 | Offset | Example    |
|---------------|-----------------------------|--------|------------|
| Address Type  | ADR_IPV4 = 0x01             | 0      | 0x01       |
| Address Value | MSB of IPv4 Network Address | 1      | 192 (0xc0) |
|               |                             | 2      | 168 (0xa8) |
|               |                             | 3      | 0 (0x00)   |
|               | LSB of IPv4 Network Address | 4      | 1 (0x01)   |
|               | Undefined                   | 5      |            |
|               | Undefined                   | 16     |            |

### 8.3 Network Address type IPv6

An IPv6 Network Addresses is coded in the following manner. The example IP address shown in the table is 2001:DB8::c0a8:1.

| Field         | Description                 | Offset | Example |
|---------------|-----------------------------|--------|---------|
| Address Type  | ADR_IPV6 = 0x02             | 0      | 0x02    |
| Address Value | MSB of IPv6 Network Address | 1      | 0x20    |
|               |                             | 2      | 0x01    |
|               |                             | 3      | 0x0d    |
|               |                             | 4      | 0xb8    |
|               |                             | 5      | 0x00    |
|               |                             | 6      | 0x00    |
|               |                             | 7      | 0x00    |
|               |                             | 8      | 0x00    |
|               |                             | 9      | 0x00    |
|               |                             | 10     | 0x00    |
|               |                             | 11     | 0x00    |
|               |                             | 12     | 0x00    |
|               |                             | 13     | 0xc0    |
|               |                             | 14     | 0xa8    |
|               |                             | 15     | 0x00    |
|               | LSB of IPv6 Network Address | 16     | 0x01    |

## 9 Module Command Line Interface

### 9.1 SCTP

```
sctp [-v -m<module_id> -b<buffers>]
```

Where:

- **-v** displays the module version and command line option information.
- **-m<module\_id>** sets to configure the module id to be used by the module.
- **-b<buffers>** sets the number of message buffers sctp should use.

### 9.2 SCTPD

```
sctpd [-v -m<module_id>]
```

Where:

- **-v** displays the module version and command line option information.
- **-m<module\_id>** sets to configure the module id to be used by the module.

### 9.3 SCTPN

```
sctpn [-v -m<module_id>]
```

Where:

- **-v** displays the module version and command line option information.
- **-m<module\_id>** sets to configure the module id to be used.

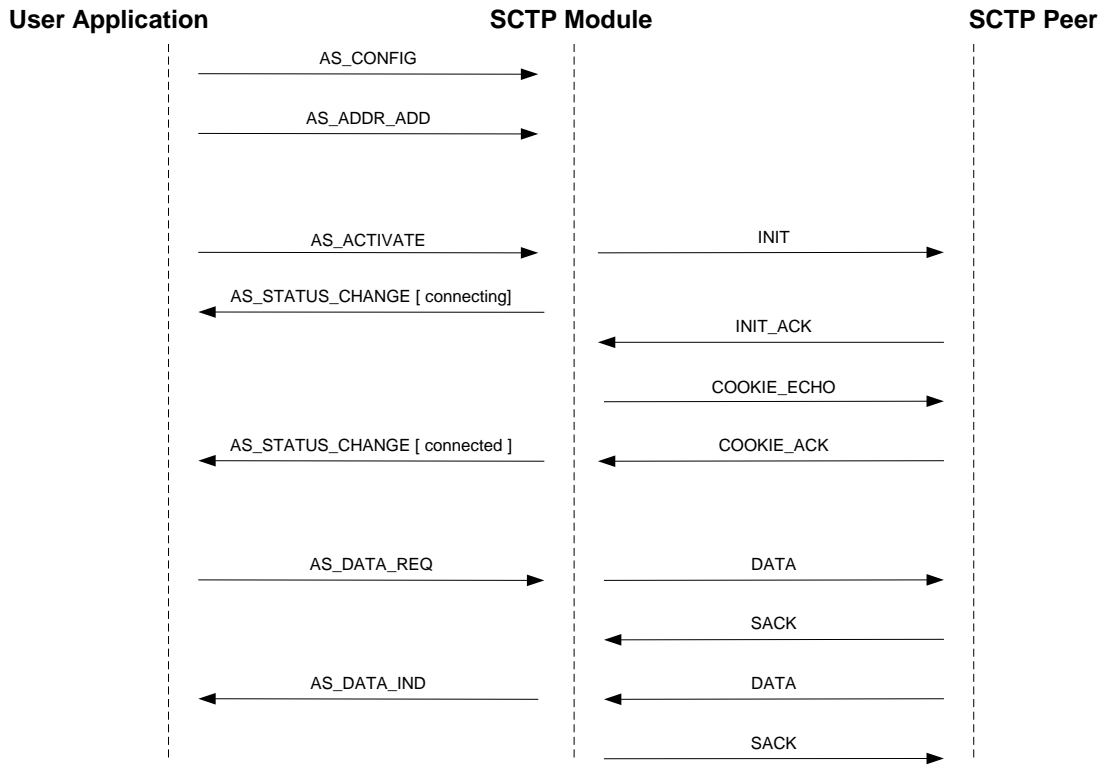
# 10 Example SCTP Message Flows

The following diagrams show the flow of messages between the user application and SCTP module for the following general situations.

**Note** For simplicity AS\_NETWORK\_STATUS messages are not shown.

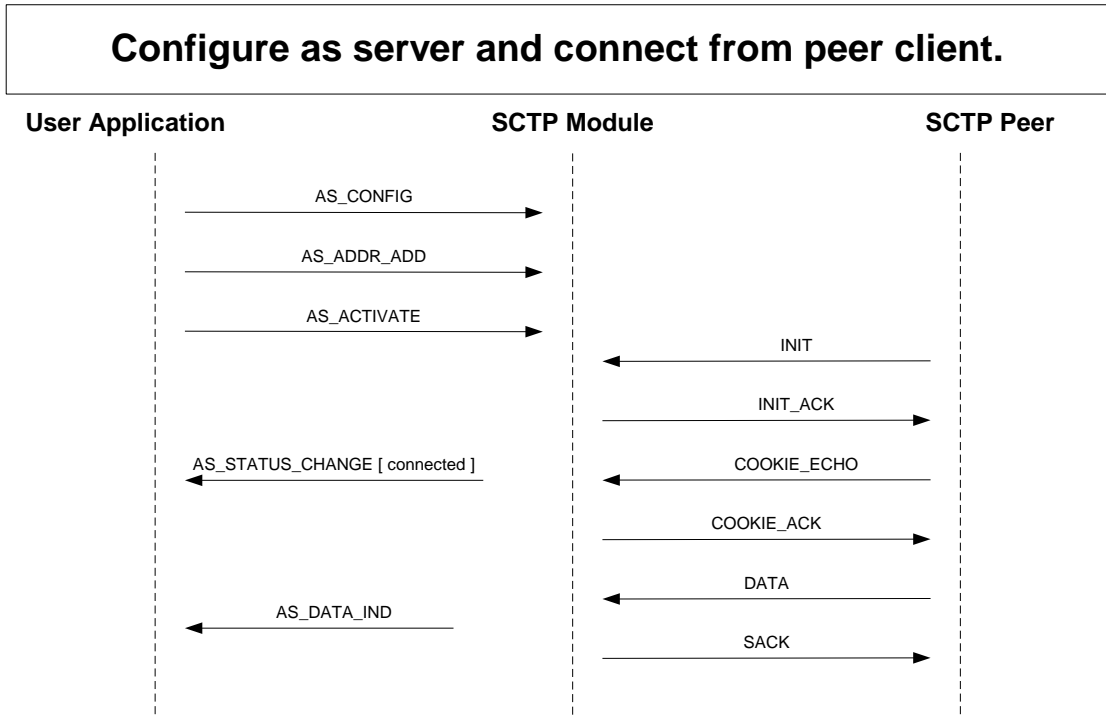
**Figure 3. Example SCTP Message Flows: Configure as Client and Connect to Peer Server**

**Configure as client and connect to peer server.**

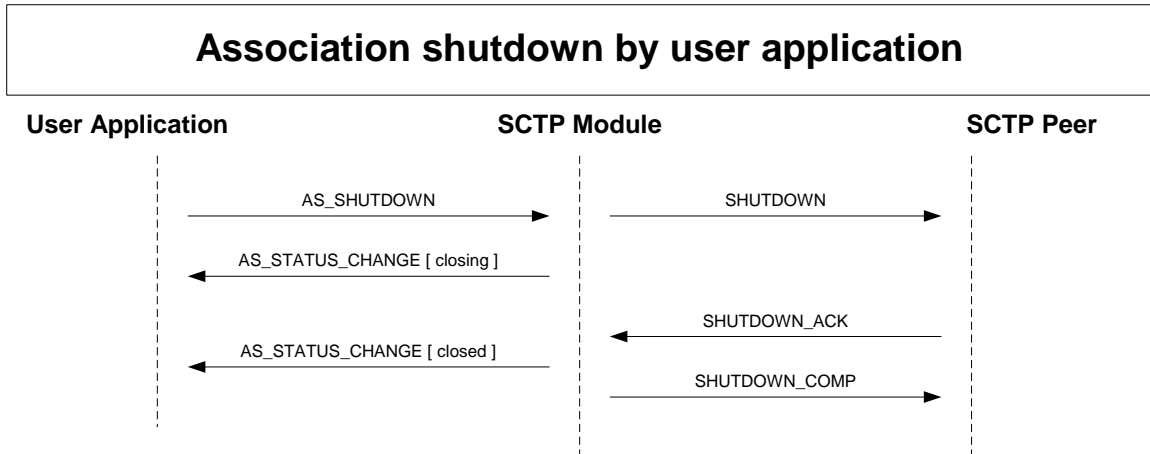




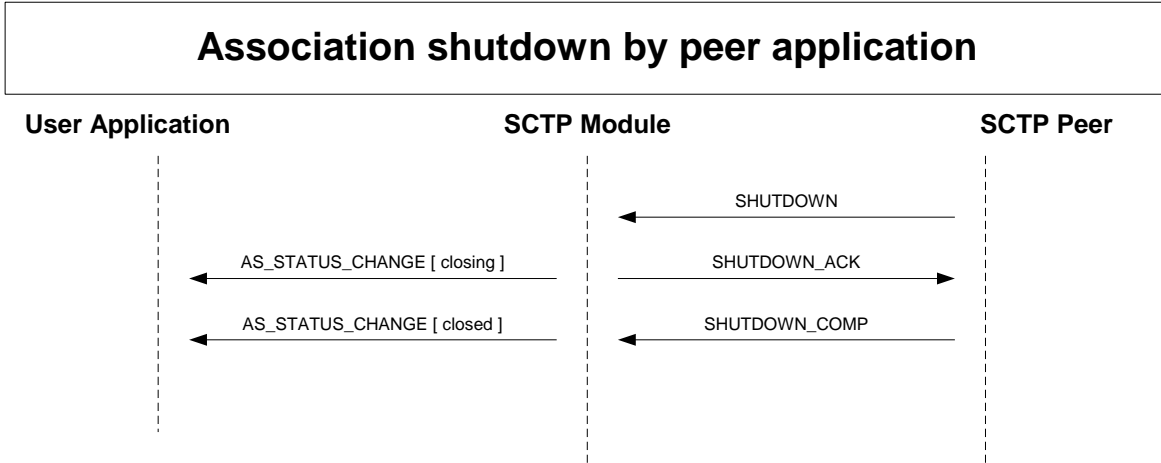
**Figure 4. Example SCTP Message Flows: Configure as Server and Connect from Peer Client**



**Figure 5. Example SCTP Message Flows: Association Shutdown by User Application**



**Figure 6. Example SCTP Message Flows: Association Shutdown by Peer Application**



## Appendix A

### A.1 Message Type Table

The following table lists, by message type, all the messages described in this manual.

| Message Type | Mnemonic                   | Description  |
|--------------|----------------------------|--|
| 0x028d       | SCTP_MSG_STATUS_CHANGE     | Indicates the association has changed state                            |
| 0x028e       | SCTP_MSG_NETWORK_STATUS    | Indicates a network address has changed state                          |
| 0x028f       | SCTP_MSG_CONG_STATUS       | Indicates the congestion status of an association has changed          |
| 0x5285       | SCTP_MSG_TRACE_MASK        | Set trace options for the SCTP module                                  |
| 0x6290       | SCTP_MSG_R_GLOBAL_STATS    | Reads the global statistics for the SCTP module                        |
| 0x6291       | SCTP_MSG_R_CONFIG          | Reads the configuration for an association                             |
| 0x6292       | SCTP_MSG_R_STATS           | Read the per association statistics                                    |
| 0x6293       | SCTP_MSG_R_PEER_ADDR_STATS | Read the statistics on an associations network interface               |
| 0x629f       | SCTP_MSG_R_STATUS          | Read per-association status  |
| 0x7282       | SCTP_MSG_CONFIG            | Configure the SCTP module  |
| 0x7283       | SCTP_MSG_HOST_IP_ADDR_ADD  | Add an IP address for the host   |
| 0x7284       | SCTP_MSG_HOST_IP_ADDR_REM  | Remove an IP address from the host                                     |
| 0x7286       | SCTP_MSG_AS_CONFIG         | Configure an SCTP association  |
| 0x7287       | SCTP_MSG_ADDR_ADD          | Add a peer IP address to an association                                |
| 0x7288       | SCTP_MSG_ADDR_REM          | Remove a peer address from an association                              |
| 0x7289       | SCTP_MSG_PRIMARY           | Designate a peer IP address as the primary                             |
| 0x728a       | SCTP_MSG_ACTIVATE          | Attempt activation of an SCTP association                              |
| 0x728b       | SCTP_MSG_SHUTDOWN          | Shutdown an association after all data has been transferred            |
| 0x728c       | SCTP_MSG_ABORT             | Abort an association losing all data currently in transit              |
| 0x7295       | SCTP_MSG_IP_CONFIG         | Configure the IP daemon  |
| 0x7296       | SCTP_MSG_IP_DATA_MID_REQ   | Data transmission request with more data packet fragments to follow    |
| 0x7297       | SCTP_MSG_IP_DATA_END_REQ   | Data transmission request marking the end of the data packet           |
| 0x7298       | SCTP_MSG_IP_DATA_MID_IND   | Indicates the reception of a data packet with more fragments to follow |
| 0x7299       | SCTP_MSG_IP_DATA_END_IND   | Indicates the end of a received data packet                            |
| 0x8281       | SCTP_MSG_RX_IND            | Indication of data reception   |
| 0xc280       | SCTP_MSG_TX_REQ            | Request data transmission  |