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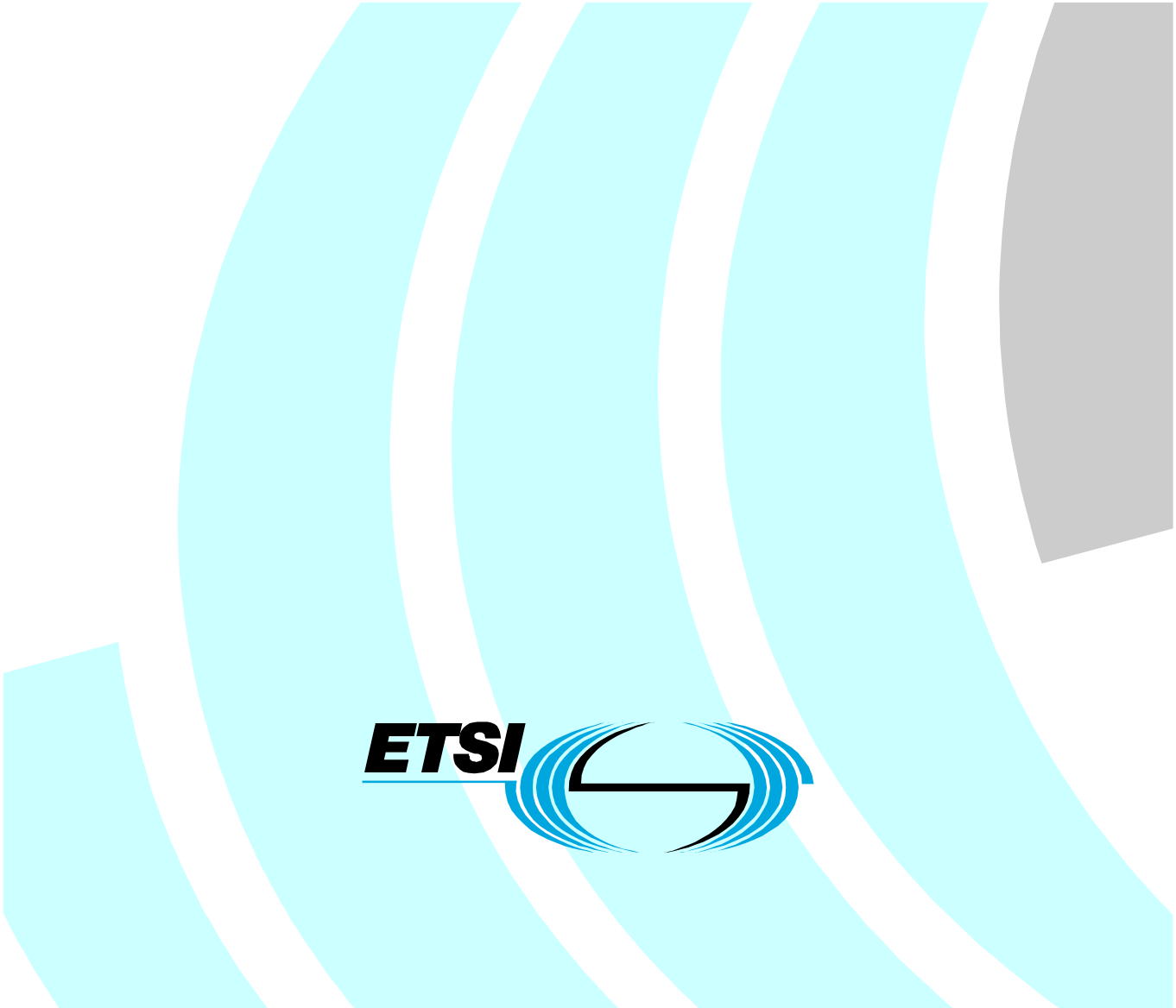
Technical Specification

Methods for Testing and Specification (MTS); Stream Control Transmission Protocol (SCTP); Test Suite Structure and Test Purposes (TSS&TP)



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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Methods for Testing and Specification (MTS).

1 Scope

The present document proposes a Test Suite Structure and Test Purposes (TSS&TP) for the SCTP protocol as described in RFC 2960 [1].

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

[1] IETF RFC 2960: "Stream Control Transmission Protocol".

[2] ISO/IEC 9646-1: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 1: General concepts".

[3] ISO/IEC 9646-2: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 2: Abstract Test Suite specification".

[4] ISO/IEC 9646-3: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 3: The Tree and Tabular Combined Notation (TTCN)".

[5] ETSI TS 102 144: "Services and Protocols for Advanced Networks (SPAN); MTP/SCCP/SSCOP and SIGTRAN (Transport of SS7 over IP); Stream Control Transmission Protocol (SCTP) [Endorsement of RFC2960 and RFC3309, modified]".

[6] draft-ietf-tsvwg-sctpimpguide-10.txt (November 2003): "Stream Control Transmission Protocol (SCTP) Implementer's Guide".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in RFC 2960 [1], ISO/IEC 9646-1 [2], ISO/IEC 9646-2 [3], ISO/IEC 9646-3 [4] and the following apply:

inopportune: tests that handle invalid signalling exchanges of messages

EXAMPLE: Signalling messages that are properly structured and correctly encoded but are used out of sequence.

invalid: tests that handle valid signalling exchanges of messages, which are either not properly structured or incorrectly encoded

SCTP Endpoint: logical sender/receiver of SCTP packets

test purpose: non-formal high-level description of a test, mainly using text

NOTE: This test description can be used as the basis for a formal test specification (e.g. Abstract Test Suite in TTCN). See ISO/IEC 9646-2[3].

valid: tests that handle valid signalling exchanges of messages, which are properly structured and correctly encoded

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

A	Acknowledgement
AS	Association Setup
AT	Association Termination
BDC	Bundling of Data Chunks with control chunks
D	Data
DM	Duplicate Message
E	Error
FH	Fault Handling
I	Invalid behaviour
IMH	Invalid Message Handling
IUT	Implementation Under Test
M	Miscellaneous test cases
MAC	Message Authentication Code
MSB	Most Significant Bit
MTU	Maximum Transmission Unit
O	inOpportune behaviour
RT	Retransmission Timer
RTO	Retransmission Time-Out
rwnd	receiver window
SCTP	Stream Control Transmission Protocol
SUT	System Under Test
TCB	Transmission Control Block
TLV	Type-Length-Value coding format
TP	Test Purposes
TSN	Transmission Sequence Number
TSS	Test Suite Structure
V	Valid behaviour

4 Test Suite Structure (TSS)

4.1 Introduction

4.1.1 SCTP Endpoints

Test purposes have been written for SCTP Endpoints according to the TS 102 144 [5]. The architectural view on an SCTP association is presented in figure 1.

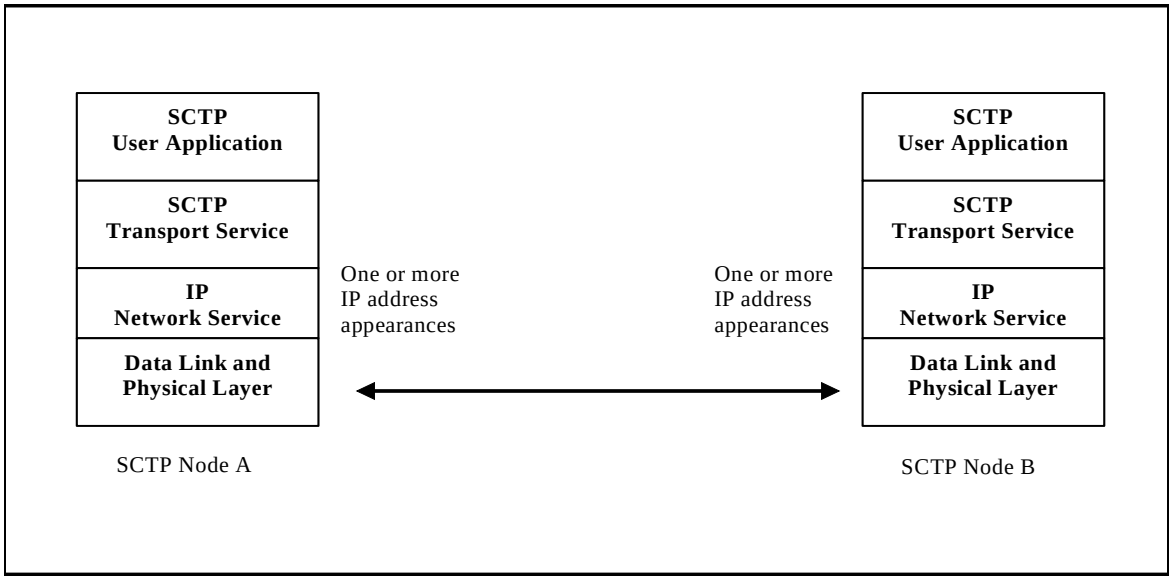

Figure 1: SCTP architectural view

4.1.2 General assumptions

Test purposes have been written for behaviours requested with "MUST" or that appear as obvious in present form. In addition test purposes have been defined for implementation dependent behaviour, where at least one of the implementation options is mandatory.

Test purposes have been written for behaviours requested with "MUST" or that appear as obvious in present form for the following functions provided by SCTP:

- Association startup and takedown.
- Sequenced delivery within streams.
- User data fragmentation.
- Acknowledgement and congestion avoidance.
- Chunk bundling.
- Packet validation.
- Path management.

The verb "discards" in test purpose means that the IUT does not react with an error message and does not take into account the element to be discarded.

4.1.3 System Under Test (SUT)

The System Under Test (SUT) is defined as an SCTP Endpoint with an SCTP user. The term IUT (Implementation Under Test) refers to the SCTP transport entity that resides within the SUT.

4.2 Overview of the Test Suite Structure (TSS)

The Test Suite Structure (TSS) is based on the main functionalities as defined 4.1.3.

Figure 2 shows the Test Suite Structure (TSS).

Last subgroups may be subdivided in three subgroups: Valid behaviour (V), Invalid behaviour (I), inOpportune behaviour (O).

Test suite	Main functionalities	Test group
SCTP	Association Setup	V-I-O
	Association Termination	V
	Invalid Message Handling	I
	Duplicate Message	O
	Fault Handling	V-I-O
	Error	I-O
	Bundling of Data Chunks with control chunks	V-I
	Data	V-I-O
	Acknowledgement	V-O
	Miscellaneous test cases	I
	Retransmission Timer	I

Figure 2: TSS for SCTP

5 Test Purposes (TP)

5.1 Introduction

5.1.1 TP naming convention

Table 1: TP identifier naming convention scheme

Identifier: <**protocol**>_<**main functionality**>_<**type**>_<**nn**>_<**mm**>	
<protocol>	SCTP
<main functionality>	Association Setup (AS), Association Termination (AT), Invalid Message Handling (IMH), Duplicate Message (DM) Fault Handling (FH), Error (E), Bundling of Data Chunks with control chunks (BDC), Data (D), Acknowledgement (A), Miscellaneous test cases (M) Retransmission Timer (RT).
<type>	Valid behaviour (V), Invalid behaviour (I), inOpportune behaviour (O).
<nn>	sequential number (01-99).
<mm> (optional)	sequential number (01-99).

5.1.2 TP structure

Each test purpose is decomposed in five keywords:

- The **"TPId"** gives a unique identifier to each test purpose.
- The **"Status"** specifies whether the test purpose or the group is mandatory or optional according to RFC 2960 [1]. The group status applies to all test purposes belonging to this group. Within the current version of this document only test purposes that are mandatory have been defined.
- The **"Precondition"** determines the initial state of the SUT for the evaluating the test purpose.
- The **"Ref"** outlines the references in RFC 2960 [1] used to create the test purpose.
- The **"Purpose"** describes the objective of the test.

5.2 Test Purposes (TP) for Association Setup (AS)

5.2.1 Valid, invalid and inopportune behaviour

TPId: **SCTP_AS_V_1_1_1**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Configure the IUT to send an INIT to the tester.

Ref: RFC 2960 [1], sections 5.1 and 5.1.6.

Purpose: Ensure that the IUT makes a complete association procedure.

TPId: **SCTP_AS_V_1_1_2**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that INIT is sent to IUT.

Ref: RFC 2960 [1], sections 5.1 and 5.1.6.

Purpose: Ensure that the IUT can establish a complete association after receiving an INIT from the tester.

TPId: **SCTP_AS_I_1_2_1**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Configure the SUT to send an INIT to the tester. Arrange the data at the tester such that INIT-ACK is not sent in response to INIT message.

Ref: RFC 2960 [1], sections 4 and 5.1.6.

Purpose: Ensure that the IUT, if T1-Init timer expires, transmits the INIT message again.

TPId: **SCTP_AS_I_1_2_2**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Configure the SUT to send an INIT to the tester. Arrange the data at the tester such that COOKIE-ACK is not sent in response to COOKIE-ECHO message.

Ref: RFC 2960 [1], sections 4 and 5.1.6.

Purpose: Ensure that the IUT, if T1-Cookie timer expires, transmits the COOKIE-ECHO message again.

TPId: **SCTP_AS _I_1_3_1**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Configure the SUT to send an INIT to the tester. Arrange the data at the tester such that INIT-ACK is never sent in response to INIT message.

Ref: RFC 2960 [1], section 4 (note 2).

Purpose: Ensure that the IUT, if INIT is retransmitted for MAX.INIT.RETRANS times, stops the initialization process.

TPId: **SCTP_AS_I_1_3_2**

Status: Mandatory

Precondition: Association not established between tester and SUT. Configure the SUT to send an INIT to the tester. Arrange the data at the tester such that COOKIE-ACK is never sent in response to COOKIE-ECHO message.

Ref: RFC 2960 [1], section 4 (note 3) and section 5.1.6.

Purpose: Ensure that the IUT, if COOKIE-ECHO message is retransmitted for MAX.INIT.RETRANS times, stops the initialization process.

TPId: **SCTP_AS _I_1_4**

Status: Mandatory

Precondition: Association not established between tester and SUT. Arrange the data at the tester such that COOKIE-ECHO is not sent in response to INIT-ACK message. Also let maximum no of association which SUT can establish is n and n-1 of them are already established. Try to make the nth association.

Ref: RFC 2960 [1], section 5.1 B (note).

Purpose: Ensure that the IUT remains in closed state if COOKIE-ECHO message is not received.

TPId: **SCTP _AS _V_1_5_1**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that normal association can be established and terminated between tester and SUT.

Ref: RFC 2960 [1], section 5.3.1.

Purpose: Ensure that the IUT on re-establishing an association to a peer, uses a random Initiate-Tag value in the INIT message.

TPId: **SCTP _AS _V_1_5_2**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that normal association can be established and terminated between tester and SUT.

Ref: RFC 2960 [1], section 5.3.1.

Purpose: Ensure that the IUT on re-establishing an association to a peer, uses a random Initiate-Tag value in the INIT-ACK message.

TPId: **SCTP _AS _V_1_6_1**

Status: Optional

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that the listed parameters (Ipv4 Address Parameter, IPv6 Address Parameter, CookiePreservative, Supported Address Type Parameter) are sent in INIT message.

Ref: RFC 2960 [1], section 3.3.2 and TS 102 144 [5], section 4.6.

Purpose: Ensure that the IUT on receipt of an INIT message with the listed parameters accepts this message and responds to it.

TPId: **SCTP _AS _V_1_6_2**

Status: Optional

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that the list parameters (Ipv4 Address Parameter, IPv6 Address Parameter, CookiePreservative) are sent in INIT-ACK message.

Ref: RFC 2960 [1], section 3.3.3 and TS 102 144 [5], section 4.6.

Purpose: Ensure that the IUT on receipt of an INIT-ACK message with the listed parameters accepts this message and responds to it.

TPId: **SCTP_AS _V_1_7_1**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Also let the OutboundStreams of the SUT is Z. Arrange data at the tester such that INIT message is sent from tester with MaximumInboundStreams Y<Z.

Ref: RFC 2960 [1], section 5.1.1.

Purpose: Ensure that the IUT, if there is a mismatch in the Outbound Stream and Inbound Stream parameters in INIT and INIT-ACK message, either aborts the association or settles with minimum of the two parameters.

TPId: **SCTP_AS _I_1_7_2**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange data at the tester such that INIT message with OutboundStreams equal to 0 is sent from tester.

Ref: RFC 2960 [1], section 3.3.2.

Purpose: Ensure that the IUT, if OutboundStreams are found zero in the received INIT message, sends an ABORT message for that INIT. or silently discards the received message.

TPId: **SCTP_AS _V_1_7_3**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Also let the OutboundStreams of the SUT is Z. Arrange data at the tester such that INIT-ACK message is sent from tester with MaximumInboundStreams X<Z.

Ref: RFC 2960 [1], section 5.1.1.

Purpose: Ensure that the IUT, if there is a mismatch in the Outbound Stream and Inbound Stream parameters in INIT and INIT-ACK message, either aborts the association or settles with minimum of the two parameters.

TPId: **SCTP_AS _I_1_7_4**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Also let the OutboundStreams of the SUT is Z. Arrange data at the tester such that INIT-ACK message with OutboundStreams equal to 0 is sent from tester.

Ref: RFC 2960 [1], section 3.3.3.

Purpose: Ensure that the IUT, if OutboundStreams is found zero in the received INIT-ACK message, destroys its TCB and may send an ABORTmessage for that INIT-ACK. Further message exchanges between tester and IUT need to take place to verify the TCB removal from outside the SUT.

TPId: **SCTP_AS _V_1_7_5**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange data at the tester such that INIT message is sent from tester with OutboundStreams and MaximumInboundStreams set to 2.

Ref: TS 102 144 [5], section 4.2.

Purpose: Ensure that the IUT supports at least 2 incoming streams and 2 outgoing streams.

TPId: **SCTP_AS _I_1_8_1**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange data at the tester such that a datagram with undefined parameter type and MSB two bits in the parameter type equal to 11 is sent to tester.

Ref: RFC 2960 [1], section 3.3.3.1.

Purpose: Ensure that the IUT on receipt of unrecognized TLV parameters in received INIT message fills them in the Unrecognized Parameters of the INIT-ACK and continues on processing of further parameters.

TPId: **SCTP_AS _I_1_8_2**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange data at the tester such that a datagram with undefined parameter type and MSB two bits in the parameter type equal to 00 is sent to the IUT.

Ref: RFC 2960 [1], section 3.3.3.1.

Purpose: Ensure that the IUT on receipt of an unrecognized parameter in the INIT-chunk does not process any further parameters and does not report it.

TPId: **SCTP_AS _I_1_8_3**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange data at the tester such that a datagram with undefined parameter type and MSB two bits in the parameter type equal to 01 is sent to the IUT.

Ref: RFC 2960 [1], section 3.3.3.1.

Purpose: Ensure that the IUT on receipt of an unrecognized parameter in the INIT-chunk does not process any further parameters and report it using an Unrecognized Parameters field.

TPId: **SCTP_AS _I_1_8_4**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange data at the tester such that a datagram with undefined parameter type and MSB two bits in the parameter type equal to 10 is sent to the IUT.

Ref: RFC 2960 [1], section 3.3.3.1.

Purpose: Ensure that the IUT on receipt of an unrecognized parameter in the INIT-chunk skips this parameter and does process any further parameters.

TPId: **SCTP_AS _O_1_9_1**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that INIT message is sent for making an association with SUT using the same IP addresses.

Ref: RFC 2960 [1], section 5.2.2 and draft ietf [6], section 2.6.

Purpose: Ensure that the IUT on receipt of an INIT message for starting association with transport addresses which are already in association, responds with an INIT-ACK message.

TPId: **SCTP_AS _O_1_9_2**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that INIT message is sent for establishing an association with SUT. The additional transport addresses should contain a new, not yet used, IP address.

Ref: RFC 2960 [1], section 5.2.2 and draft ietf, section 2.6 [6]

Purpose: Ensure that the IUT on receipt of an INIT message for starting an association with transport addresses which are not the same as the already established , responds with an ABORT message with error "Restart of an association with new addresses".

TPId: **SCTP_AS _V_1_10_1**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that no IP addresses are sent in INIT.

Ref: RFC 2960 [1], section 5.1.2 A.

Purpose: Ensure that the IUT on receipt of an INIT message with no IP addresses sends an INIT-ACK message to the source IP address from where INIT was received.

TPId: **SCTP_AS _V_1_10_2**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that no IP addresses are sent in INIT-ACK optional IP address field.

Ref: RFC 2960 [1], section 5.1.2 A.

Purpose: Ensure that the IUT on receipt of an INIT-ACK message with no optional IP addresses sends an COOKIE_ECHO message to the source IP address from which INIT-ACK was received.

TPId: **SCTP_AS _V_1_11_1**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that one or more IP addresses are sent in INIT message.

Ref: RFC 2960 [1], section 5.1.2 C.

Purpose: Ensure that the IUT on receipt of an INIT message with one or more IP addresses sends an INIT-ACK message to the source IP addresses from where INIT was received and uses all of these IP address plus the IP address from where INIT comes combined with the SCTP source port number as the destination transport address.

TPId: **SCTP_AS _V_1_11_2**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that one or more IP addresses are sent in INIT-ACK message.

Ref: RFC 2960 [1], section 5.1.2 B.

Purpose: Ensure that the IUT on receipt of an INIT-ACK message with one or more IP addresses uses all of these IP addresses plus the IP address from where INIT-ACK comes combined with the SCTP source port number as the destination transport address and sends an COOKIE-ECHO message to one of the transport addresses.

TPId: **SCTP_AS _V_1_12_1**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that Host Name address is sent to SUT with no other IP address in INIT message.

Ref: TS 102 144 [5], section 4.6.

Purpose: Ensure that the IUT on receipt of an INIT message with Host Name address and no other IP address sends an ABORT message with error Unresolvable Address.

TPId: **SCTP_AS _I_1_12_2**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that Host Name address is sent to SUT with no other IP address in INIT-ACK message.

Ref: TS 102 144 [5], section 4.6.

Purpose: Ensure that the IUT on receipt of an INIT-ACK message withHost Name address and no other IP address sends an ABORT message with error Unresolvable Address.

TPId: **SCTP_AS _V_1_13_1**

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that Supported Address field is sent in INIT. Also the SUT is capable of using the address type mentioned in Supported Address field.

Ref: RFC 2960 [1], section 5.1.2.

Purpose: Ensure that the IUT on receipt of an INIT message with Supported address field sends an INIT-ACK message with the address of the type contained in the Supported address field in the received INIT.

TPId: **SCTP_AS _I_1_13_2**

Status: Optional

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that Supported address type field IPv6 is sent to SUT in INIT message (Supported address type IPv4 should not be sent). Also receiver i.e. SUT is not capable of using supported address type, i.e. only IPv4.

Ref: RFC 2960 [1], section 5.1.2.

Purpose: Ensure that the IUT on receipt of an INIT message with Supported address type which the receiver is incapable of using sends an ABORT message with cause Unresolvable Address.

TPId: **SCTP_AS _I_1_14_1**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that Initiate-tag field equal to zero is sent to SUT in INIT message.

Ref: RFC 2960 [1], section 3.3.2.

Purpose: Ensure that the IUT on receipt of an INIT message with Init-Tag equal to zero destroys the TCB and may send an ABORT.

TPId: **SCTP_AS _I_1_14_2**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that Initiate-tag field equal to zero is sent to SUT in INIT-ACK message.

Ref: RFC 2960 [1], section 3.3.3 and draft ietf [6], section 2.22.

Purpose: Ensure that the IUT on receipt of an INIT-ACK message with Init-Tag equal to zero destroys the TCB and may send an ABORT.

TPId: **SCTP_AS _I_1_15**

Status: Optional

Precondition: Tester is preconfigured to be multi-homed with two addresses X and Y. Association is not established between tester and SUT. Arrange the data at the tester such that no INIT-ACK message is sent to SUT in response to an INIT.

Ref: TS 102 144 [5], section 4.4.

Purpose: Ensure that the IUT uses all configured addresses for association establishment.

5.3 Test Purposes (TP) for Association Termination (AT)

5.3.1 Valid, invalid and inopportune behaviour

TPId: **SCTP_AT _V_2_2**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that an ABORT message is sent to SUT in it.

Ref: RFC 2960 [1], section 9.1.

Purpose: Ensure that the IUT on receipt of an ABORT removes the association. Further message exchanges between tester and IUT need to take place to verify the removal of the association from outside the SUT.

TPId: **SCTP_AT _I_2_3**

Status: OptionalPrecondition: Association is established between tester and SUT and DATA is sent from SUT to the tester. Arrange the data in SUT such that Terminate primitive is received from upper layers.

Ref: RFC 2960 [1], section 9.2.

Purpose: Ensure that the IUT on receipt of an Terminate primitive will send a SHUTDOWN message to its peer only when all the outstanding DATA has been acknowledged by the tester.

TPId: **SCTP_AT _I_2_4**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that no SHUTDOWN-ACK or DATA is sent in response to SHUTDOWN.

Ref: RFC 2960 [1], section 9.2.

Purpose: Ensure that the IUT starts the T2-Shutdown timer and after its expiry a SHUTDOWN message is sent again.

TPId: **SCTP_AT _I_2_5**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that in response to SHUTDOWN no SHUTDOWN-ACK or DATA message is sent.

Ref: RFC 2960 [1], section 9.2 and draft ietf [6], section 2.12.2.

Purpose: Ensure that the IUT after retransmitting SHUTDOWN message for ASSOCIATION.MAX.RETRANS or timeout occurs for T5-shutdown-gueard timer, removes the association and optionally sends an ABORT. Further message exchanges between tester and IUT need to take place to verify the removal of the association from outside the SUT.

TPId: **SCTP_AT _V_2_6**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that SHUTDOWN-ACK is sent in response to SHUTDOWN message.

Ref: RFC 2960 [1], section 8.5.1 C.

Purpose: Ensure that the IUT on receipt of SHUTDOWN-ACK message in Shutdown Sent state sends a SHUTDOWN COMPLETE message and terminates the association.

TPId: **SCTP_AT _I_2_7_1**

Status: Optional

Precondition: Association is established between tester and SUT. Arrange the data in SUT such that upper layers send data to transmit when it is in Shutdown sent state.

Ref: RFC 2960 [1], section 9.2.

Purpose: Ensure that the IUT, if it is in Shutdown sent state and receives data for transmission from upper layer, does not send this new data.

TPId: **SCTP_AT _I_2_7_2**

Status: Optional

Precondition: Association is established between tester and SUT. Arrange the data in SUT such that upper layers send data to transmit when it is in Shutdown receive state.

Ref: RFC 2960 [1], section 9.2.

Purpose: Ensure that the IUT, if it is in Shutdown receive state and receives data for transmission from upper layer, does not send this new data.

TPId: **SCTP_AT _I_2_7_3**

Status: Optional

Precondition: Association is established between tester and SUT. Arrange the data in SUT such that upper layers send data to transmit when it is in Shutdown pending state.

Ref: RFC 2960 [1], section 9.2.

Purpose: Ensure that the IUT, if it is in Shutdown pending state and receives data for transmission from upper layer, does not send this new data.

TPId: **SCTP_AT _I_2_7_4**

Status: Optional

Precondition: Association is established between tester and SUT. Arrange the data in SUT such that upper layers send data to transmit when it is in Shutdown-Ack sent state.

Ref: RFC 2960 [1], section 9.2.

Purpose: Ensure that the IUT, if it is in Shutdown-Ack sent state and receives data for transmission from upper layer, does not send this new data.

TPId: **SCTP_AT _I_2_8**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that after receiving SHUTDOWN message, DATA message is sent to SUT.

Ref: RFC 2960 [1], section 9.2.

Purpose: Ensure that the IUT, if it is in Shutdown sent state and receives data, acknowledges the message and restarts the T2-Shutdown timer.

TPId: **SCTP_AT _I_2_9**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that DATA is sent to SUT after sending SHUTDOWN message. Also in SUT there is outstanding DATA for which SACK has not come from tester.

Ref: RFC 2960 [1], section 9.2.

Purpose: Ensure that the IUT, if it is in Shutdown Receive state and receives data, discards the data.

TPId: **SCTP_AT _I_2_10**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that it sends SHUTDOWN message to IUT. The SHUTDOWN should not acknowledge the last used DATA of the SUT, i.e. that in IUT there is still outstanding DATA which has not been acknowledged. Then a second SHUTDOWN has to be sent which again does not acknowledge the last used DATA of the IUT.

Ref: RFC 2960 [1], section 9.2.

Purpose: Ensure that the IUT, if there is still outstanding DATA, does not send a SHUTDOWN-ACK on reception of a SHUTDOWN (even received multiple times).

TPId: **SCTP_AT _I_2_11**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that no SHUTDOWN COMPLETE is sent in response to SHUTDOWN-ACK.

Ref: RFC 2960 [1], section 9.2.

Purpose: Ensure that the IUT, after expiry of T2-Shutdown timer, sends a SHUTDOWN-ACK message again.

TPId: **SCTP_AT _I_2_12**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that in response to SHUTDOWN-ACK, no SHUTDOWN COMPLETE message is sent.

Ref: RFC 2960 [1], section 9.2.

Purpose: Ensure that the IUT, after retransmitting SHUTDOWN-ACK message for ASSOCIATION.MAX.RETRANS times, removes the association and optionally sends an ABORT.

TPId: **SCTP_AT _I_2_13**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that SHUTDOWN COMPLETE is sent in response to SHUTDOWN-ACK message.

Ref: RFC 2960 [1], section 9.2.

Purpose: Ensure that the IUT, if it is in Shutdown-Ack Sent state, accepts a SHUTDOWN COMPLETE message and removes the association.

TPId: **SCTP_AT _V_2_14**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that there is still outstanding DATA in IUT which has not been acknowledged by SACK and that the tester sends SHUTDOWN message to IUT that acknowledges this DATA.

Ref: RFC 2960 [1], section 6.2 and draft ietf [6], section 2.12.

Purpose: Ensure that the IUT, if there is still outstanding DATA, receives a SHUTDOWN that acknowledges the outstanding DATA, sends a SHUTDOWN-ACK.

5.4 Test Purposes (TP) for Invalid Message Handling (IMH)

5.4.1 Invalid behaviour

TPId: **SCTP_IMH_I_3_1**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that INIT message is sent to SUT with message length less than the length of all mandatory parameters.

Ref: RFC 2960 [1], section 5.1.

Purpose: Ensure that the IUT on receipt of an invalid INIT message with message length < length of all mandatory parameters, discards the message or may send an ABORT message.

TPId: **SCTP_IMH_I_3_2**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that INIT-ACK message is sent to SUT with message length less than the length of all mandatory parameters.

Ref: RFC 2960 [1], section 5.1.

Purpose: Ensure that the IUT on receipt of an invalid INIT-ACK message with message length < length of all mandatory parameters, discards the message or may send an ABORT message.

TPId: **SCTP_IMH_I_3_3**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that COOKIE-ECHO message with a different verification tag (Different from what received in INIT-ACK) is sent in response to INIT-ACK.

Ref: RFC 2960 [1], section 8.5 and draft ietf [6], section 2.35.2.

Purpose: Ensure that the IUT on receipt of a COOKIE-ECHO message with invalid verification tag, discards the COOKIE-ECHO message.

TPId: **SCTP_IMH_I_3_4**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange data at the tester such that it sends INIT message to SUT with wrong CRC-32c checksum.

Ref: RFC 2960 [1], section 6.8 (2).

Purpose: Ensure that the IUT on receipt of an INIT message with wrong CRC-32c checksum, discards the INIT message.

TPId: **SCTP_IMH_I_3_5**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that COOKIE-ECHO message is sent with cookie different from received cookie in INIT-ACK.

Ref: RFC 2960 [1], section 5.1.5 (1 and 2).

Purpose: Ensure that the IUT on receipt of a COKIE-ECHO message with other cookie than sent in INIT_ACK, discards the message.

TPId: **SCTP_IMH_I_3_6**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that COOKIE-ECHO message is sent after life time of the received cookie in INIT-ACK message has expired.

Ref: RFC 2960 [1], section 5.1.5 (3).

Purpose: Ensure that the IUT on receipt of a COKIE-ECHO message after lifetime received in INIT-ACK message has expired, should send an ERROR with cause "Stale Cookie Error".

TPId: **SCTP_IMH_I_3_7**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that ABORT message is sent to SUT with incorrect verification tag.

Ref: RFC 2960 [1], section 8.5.1 B.

Purpose: Ensure that the IUT on receipt of an ABORT message with incorrect verification tag, discards the message.

TPId: **SCTP_IMH_I_3_8**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that chunk length is greater than the length of the message being sent to other SUT.

Ref: RFC 2960 [1], section 5.1.

Purpose: Ensure that the IUT on receipt of an INIT message with a packet length smaller then the Chunk length defined, sends an ABORT message or discards the message.

TPId: **SCTP_IMH_I_3_9**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that SHUTDOWN-ACK message with invalid verification tag is sent to SUT in Shutdown Sent state.

Ref: RFC 2960 [1], section 8.5.1 C.

Purpose: Ensure that the IUT on receipt of an SHUTDOWN-ACK message with invalid verification tag, discards the message.

TPId: **SCTP_IMH_I_3_10**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that SHUTDOWN COMPLETE message with invalid verification tag is sent to SUT in Shutdown Ack Sent state.

Ref: RFC 2960 [1], section 8.5.1 C.

Purpose: Ensure that the IUT on receipt of an SHUTDOWN-COMPLETE message with invalid verification tag, discards the message.

5.5 Test Purposes (TP) for Duplicate Messages (DM)

5.5.1 Inopportune Behaviour

TPId: **SCTP_DM_O_4_1**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that INIT message is sent to SUT upon reception of an INIT from the SUT.

Ref: RFC 2960 [1], section 5.2.1.

Purpose: Ensure that the IUT on receipt of an INIT message after sending an INIT message on its own, sends an INIT-ACK message.

TPId: **SCTP_DM_O_4_2_1**

Status: Mandatory

Precondition: Arrange the data at the tester such that an INIT message is sent to SUT when association is established between tester and SUT. Also source IP address , destination IP address and port numbers are same as in the established association.

Ref: RFC 2960 [1], section 5.2.2.

Purpose: Ensure that the IUT on receipt of an INIT message when association is already established, sends an INIT-ACK message and existing association is not disturbed.

TPId: **SCTP_DM_O_4_2_2**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that after receiving SHUTDOWN-ACK message, INIT message is sent to SUT.

Ref: RFC 2960 [1], section 9.2.

Purpose: Ensure that the IUT on receipt of an INIT message, after sending a SHUTDOWN-ACK message, discards the INIT message and retransmits the SHUTDOWN-ACK message.

TPId: **SCTP_DM_O_4_3**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that the same INIT-ACK message is sent to SUT after receiving COOKIE-ECHO message.

Ref: RFC 2960 [1], section 5.2.3.

Purpose: Ensure that the IUT on receipt of an duplicate INIT-ACK message, after sending a COOKIE-ECHO message, discards the INIT-ACK message.

TPId: **SCTP_DM_O_4_4**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that COOKIE-ACK message is retransmitted to SUT after association is established between tester and SUT.

Ref: RFC 2960 [1], section 5.2.5.

Purpose: Ensure that the IUT on receipt of a COOKIE-ACK message, after association is established, discards the COOKIE-ACK message.

TPId: **SCTP_DM_O_4_5**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that SHUTDOWN message is sent after receiving SHUTDOWN message from the other end.

Ref: RFC 2960 [1], section 9.2.

Purpose: Ensure that the IUT on receipt of a SHUTDOWN message, after sending a SHUTDOWN message on its own, sends a SHUTDOWN-ACK message.

TPId: **SCTP_DM_O_4_6_1**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that SHUTDOWN message is sent to SUT after receiving INIT message from it.

Ref: RFC 2960 [1], section 9.2.

Purpose: Ensure that the IUT on receipt of a SHUTDOWN message, after sending an INIT message on its own, discards the SHUTDOWN message.

TPId: **SCTP_DM_O_4_6_2**

Status: Mandatory

Precondition: Arrange the data at the tester such that SHUTDOWN message is sent to SUT which is in closed state.

Ref: RFC 2960 [1], section 9.2.

Purpose: Ensure that the IUT on receipt of a SHUTDOWN message in closed state, sends an ABORT message.

TPId: **SCTP_DM_O_4_6_3**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data in SUT such that terminate primitive is received from ULP to terminate the association. Arrange data at the tester such that SHUTDOWN message is sent to SUT.

Ref: RFC 2960 [1], section 9.2.

Purpose: Ensure that the IUT on receipt of a SHUTDOWN message in Shutdown Sent state, sends a SHUTDOWN-ACK message and restarts T2-Shutdown Timer.

TPId: **SCTP_DM_O_4_7_1**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that SHUTDOWN-ACK message is sent to SUT after receiving INIT message.

Ref: RFC 2960 [1], sections 8.4 (1) and 8.5.1 E.

Purpose: Ensure that the IUT on receipt of a SHUTDOWN-ACK message in Cookie Wait state, sends a SHUTDOWN-COMPLETE message and current state is not disturbed.

TPId: **SCTP_DM_O_4_7_2**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that SHUTDOWN-ACK message is sent to SUT with correct verification tag.

Ref: RFC 2960 [1], section 8.5.1 E.

Purpose: Ensure that the IUT on receipt of a SHUTDOWN-ACK message in Established state discards the message or sends an ABORT.

TPId: **SCTP_DM_O_4_7_3**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that SHUTDOWN message is sent to SUT. Also SHUTDOWN-ACK message is sent to SUT after receiving SHUTDOWN-ACK message.

Ref: RFC 2960 [1], section 9.2.

Purpose: Ensure that the IUT on receipt of a SHUTDOWN-ACK message in SHUTDOWN-ACK sent state, sends a SHUTDOWN-COMPLETE message and closes the association.

TPId: **SCTP_DM_O_4_8**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that COOKIE-ECHO message with invalid Message Authentication Code (MAC) is sent to SUT.

Ref: RFC 2960 [1], section 5.2.4.

Purpose: Ensure that the IUT on receipt of a COOKIE-ECHO message in Established state, discards the message and current state is not disturbed.

TPId: **SCTP_DM_O_4_9**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that SHUTDOWN COMPLETE message is sent to SUT after receiving INIT message from it.

Ref: RFC 2960 [1], section 9.2.

Purpose: Ensure that the IUT on receipt of a SHUTDOWN COMPLETE message in Cookie wait state, discards the message.

TPId: **SCTP_DM_O_4_10**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that Shutdown message is sent to SUT. Also DATA message is sent from tester to SUT.

Ref: RFC 2960 [1], section 6.

Purpose: Ensure that the IUT on receipt of a data message in Shutdown-Ack sent state, discards the message and may send an ABORT.

5.6 Test Purposes (TP) for Fault Handling (FH)

5.6.1 Valid, invalid and inopportune behaviour

TPId: **SCTP_FH_I_5_1_1**

Status: Mandatory

Precondition: Association is established between tester and SUT. The tester is multihomed. Arrange the data at the tester such that no SACK is sent in response to DATA received from SUT.

Ref: RFC 2960 [1], section 8.1 and draft ietf [6], section 2.10.2.

Purpose: Ensure that the IUT, when total number of consecutive retransmissions to a peer exceeds the Association.Max.Retrans, closes the association and may send an ABORT.

TPId: **SCTP_FH_I_5_1_2**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that SACK is sent in response to DATA received from SUT only when the DATA has been retransmitted for two to three times.

Ref: RFC 2960 [1], section 8.1.

Purpose: Ensure that the IUT on receipt of a SACK from the tester, for a DATA which has been retransmitted, resets the counter which counts the total retransmission to an endpoint.

TPId: **SCTP_FH_V_5_2**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that HEARTBEAT message is sent to the SUT.

Ref: RFC 2960 [1], section 8.3.

Purpose: Ensure that the IUT on receipt of a HEARTBEAT message, sends a HEARTBEAT-ACK message with the information carried in the HEARTBEAT message.

TPId: **SCTP_FH_O_5_3_1**

Status: Mandatory

Precondition: No association exists between tester and SUT. Arrange the data at the tester such that DATA is sent to SUT.

Ref: RFC 2960 [1], section 8.4 (1).

Purpose: Ensure that the IUT on receipt of a DATA message from a transport address corresponding to which there is no association, sends an ABORT message.

TPId: **SCTP_FH_O_5_3_2**

Status: Mandatory

Precondition: No association exists between tester and SUT. Arrange the data at the tester such that ABORT is sent to SUT.

Ref: RFC 2960 [1], section 8.4 (2).

Purpose: Ensure that the IUT on receipt of an ABORT message from a transport address corresponding to which there is no association, discards the message.

TPId: **SCTP_FH_O_5_3_3**

Status: Mandatory

Precondition: No association exists between tester and SUT. Arrange the data at the tester such that SHUTDOWN-ACK is sent to SUT.

Ref: RFC 2960 [1], section 8.4 (5).

Purpose: Ensure that the IUT on receipt of a SHUTDOWN-ACK message from a transport address corresponding to which there is no association, sends a SHUTDOWN COMPLETE message with T_Bit set.

TPId: **SCTP_FH_O_5_3_4**

Status: Mandatory

Precondition: No association exists between tester and SUT. Arrange the data at the tester such that SHUTDOWN COMPLETE is sent to SUT.

Ref: RFC 2960 [1], section 8.4 (1).

Purpose: Ensure that the IUT on receipt of a SHUTDOWN COMPLETE message from a transport address corresponding to which there is no association, discards the message.

TPId: **SCTP_FH_O_5_3_5**

Status: Mandatory

Precondition: No association exists between tester and SUT. Arrange the data at the tester such that COOKIE ECHO is sent to SUT with non unicast source address.

Ref: RFC 2960 [1], section 8.4 (1).

Purpose: Ensure that the IUT on receipt of a COOKIE ECHO message from a non-unicast address where there is no association between them, discards the message.

5.7 Test Purposes (TP) for Error

5.7.1 Invalid and inopportune behaviour

TPId: **SCTP_E_O_6_1**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that ERROR message with cause stale cookie error is sent in response to COOKIE-ECHO message.

Ref: RFC 2960 [1], section 5.2.6.

Purpose: Ensure that the IUT on receipt of ERROR message with cause Stale Cookie Error in Cookie Echoed state, takes one of the following actions depending on the implementation:

1) Sends a new INIT message to the tester to generate a new cookie and reattempt the setup procedure.
2) Discards the TCB and changes the state to closed.
3) Sends a new INIT message to the tester adding a cookie preservative parameter requesting the extension on lifetime of cookie.

TPId: **SCTP_E_O_6_2**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that ERROR message with cause stale cookie error is sent.

Ref: RFC 2960 [1], sections 5.2.6 and 8.4 (7).

Purpose: Ensure that the IUT on receipt of ERROR message with cause Stale Cookie Error in state other than Cookie Echoed state, discards the message and association is not disturbed.

TPId: **SCTP_E_I_6_3**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that a DATA is sent to SUT on a stream which is not existing for the association.

Ref: RFC 2960 [1], section 3.3.10.1.

Purpose: Ensure that the IUT on receipt of DATA message to a non existing stream, sends an ERROR message with cause Invalid Stream Identifier or aborts the association.

TPId: **SCTP_E_I_6_4**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that INIT-ACK is sent to SUT without Cookie parameter.

Ref: RFC 2960 [1], section 3.3.10.2.

Purpose: Ensure that the IUT on receipt of INIT-ACK message without a Cookie parameter, sends an ERROR message with cause Missing Mandatory Parameter or may send an ABORT or no message at all.

TPId: **SCTP_E_I_6_5**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that INIT-ACK is sent to SUT with an unknown TLV parameter.

Ref: RFC 2960 [1], section 3.3.10.8.

Purpose: Ensure that the IUT on receipt of INIT-ACK message with an unknown TLV parameter, sends an ERROR message with cause Unrecognized Parameters.

TPId: **SCTP_E_I_6_6**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that COOKIE-ECHO bundled with ERROR (cause = Unrecognized Parameters) is sent to SUT.

Ref: RFC 2960 [1], section 3.3.10.8.

Purpose: Ensure that the IUT on receipt of a COOKIE-ECHO message bundled with error (cause = Unrecognized Parameter), continues to establish the association.

5.8 Test Purposes (TP) for Bundling of Data Chunks with control chunks

5.8.1 Valid and invalid behaviour

TPId: **SCTP_BDC_I_7_1**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that data chunks are bundled with INIT message.

Ref: RFC 2960 [1], sections 5.1 and 6.10 and draft ietf [6], section 2.11.

Purpose: Ensure that the IUT on receipt of any DATA chunks bundled with INIT chunk discards this packet.

TPId: **SCTP_BDC_I_7_2**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that data chunks are bundled with INIT-ACK message.

Ref: RFC 2960 [1], section 6.10.

Purpose: Ensure that the IUT on receipt of any DATA chunks bundled with INIT-ACK chunk discards this packet or sends an ABORT or accepts the INIT-ACK but ignores the DATA chunks.

TPId: **SCTP_BDC_I_7_3**

Status: Mandatory

Precondition: Association is established between tester and SUT is in SHUTDOWN-ACK sent state. Arrange the data at the tester such that DATA chunks are multiplexed with SHUTDOWN COMPLETE chunk with SHUTDOWN-COMPLETE as the first chunk.

Ref: RFC 2960 [1], section 6.10.

Purpose: Ensure that the IUT on receipt of any DATA chunks bundled with SHUTDOWN-COMPLETE chunk discards this packet and remains in SHUTDOWN-ACK sent state or sends an ABORT or accepts the SHUTDOWN-COMPLETE but ignores the DATA chunks.

TPId: **SCTP_BDC_V_7_4**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that DATA chunks are bundled with COOKIE-ECHO chunk with COOKIE-ECHO as the first chunk.

Ref: RFC 2960 [1], sections 5.1.5 (6) and 6.10.

Purpose: Ensure that the IUT on receipt of COOKIE-ECHO chunk bundled with DATA chunks, accepts the packet and responds with a COOKIE-ACK bundled with a SACK or a single COOKIE-ACK and then a SACK.

TPId: **SCTP_BDC_V_7_5**

Status: Mandatory

Precondition: Association is not established between tester and SUT. Arrange the data at the tester such that DATA chunks are bundled with COOKIE-ACK chunk with COOKIE-ACK as the first chunk.

Ref: RFC 2960 [1], sections 5.1.5 (5) and 6.10.

Purpose: Ensure that the IUT on receipt of COOKIE-ACK chunk bundled with DATA chunks, accepts the COOKIE-ACK and responds with a SACK.

TPId: **SCTP_BDC_V_7_6**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that SACK is bundled with SHUTDOWN message and that there is no outstanding data.

Ref: RFC 2960 [1], sections 9.2 and 6.10

Purpose: Ensure that the IUT on receipt of SHUTDOWN chunk bundled with a SACK, accepts the packet and responds with a SHUTDOWN-ACK.

TPId: **SCTP_BDC_V_7_7**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that SACK bundled with DATA chunks is sent to SUT.

Ref: RFC 2960 [1], section 9.2.

Purpose: Ensure that the IUT on receipt of a SACK bundled with DATA chunks accepts the packet and responds with a SACK for the received DATA chunks.

TPId: **SCTP_BDC_V_7_8**

Status: Mandatory

Precondition: Association is established between tester and SUT and SUT is in SHUTDOWN-SENT state. Arrange the data at the tester such that DATA is bundled with SHUTDOWN-ACK message.

Ref: RFC 2960 [1], section 6.10.

Purpose: Ensure that the IUT on receipt of a SHUTDOWN-ACK bundled with DATA chunks discards the packet and remains in Shutdown sent state or sends an ABORT or accepts the SHUTDOWN-ACK but ignores the DATA chunks, which would mean that the IUT has to send a SHUTDOWN-COMPLETE.

5.9 Test Purposes (TP) for Data (D)

5.9.1 Valid, invalid and inopportune behaviour

TPId: **SCTP_D_V_8_1**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data from user part such that size of the resolving SCTP packet is less then or equal to MTU size and smaller than the maximum supported size of user data.

Ref: RFC 2960 [1], sections 3.3 and 6.10.

Purpose: Ensure that the IUT is able to send Unsegmented user message, if resolving SCTP packet is less then or equal to MTU size.

TPId: **SCTP_D_V_8_2**

Status: Optional

Precondition: Association is established between tester and SUT. Arrange the large size data from user part such that size exceeding MTU.

Ref: RFC 2960 [1], sections 3.3 and 6.9.

Purpose: Ensure that the IUT is able perform data segmentation and transmission.

TPId: **SCTP_D_V_8_3**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the segmented data such that SUT receive first , middle and end peace of a segmented data.

Ref: RFC 2960 [1], sections 3.3 and 6.9.

Purpose: Ensure that the IUT is able receive segmented data.

TPId: **SCTP_D_V_8_4**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that SACK is sent in response of DATA message.

Ref: RFC 2960 [1], sections 6.1, 6.3.2 and 6.3.3.

Purpose: Ensure that the IUT on receipt of a SACK cancels the timer T3-rtx and does not increase it.

TPId: **SCTP_D_I_8_5**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that no SACK is sent in response to a DATA message.

Ref: RFC 2960 [1], sections 6.1, 6.3.2 and 6.3.3.

Purpose: Ensure that the IUT after expiry of the timer T3-rtx sends the DATA message again.

TPId: **SCTP_D_O_8_6**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that it will send duplicate DATA to SUT.

Ref: RFC 2960 [1], sections 3.3.4 and 3.3.4.

Purpose: Ensure that the IUT on receipt of duplicate DATA chunks should report this in a SACK and number of duplicate TSN count should be reset once reported in SACK.

TPId: **SCTP_D_O_8_7**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that rwnd =0 is sent in SACK in response to DATA message.

Ref: RFC 2960 [1], section 6.1 and draft ietf [6], section 2.15.

Purpose: Ensure that the IUT, if its peers rwnd indicates that the peer has no buffer space, does not transmit more than one DATA.

TPId: **SCTP_D_O_8_8**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that rwnd =0 is sent in SACK in response to DATA message. Data should be in large size so it will be transmitted in segments.

Ref: RFC 2960 [1], section 6.1 and draft ietf [6], section 2.15.

Purpose: Ensure that the IUT, if its peers rwnd indicates that the peer has no buffer space, does not transmit DATA, until it receives a SACK, where the rwnd indicates that the peer has buffer space again.

TPId: **SCTP_D_V_8_9**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data such that tester ignores TSN 3 and sends SACK with gap in DATA.

Ref: RFC 2960 [1] sections 6.1 and 6.2.

Purpose: Ensure that the IUT, before it sends new DATA chunks, first transmits any outstanding DATA chunks, which are marked for retransmission.

TPId: **SCTP_D_V_8_10**

Status: Mandatory

Precondition: Tester is multihomed. Arrange data at the tester such that on reception of a packet containing a DATA chunk, the packet containing the corresponding SACK chunk is sent with a source address different from the destination address of the received packet containing the DATA chunk.

Ref: RFC 2960 [1], section 6.6.

Purpose: Ensure that the IUT, if it sends DATA to a multihomed endpoint on one address and receives a SACK from the alternate address in that host, accepts the SACK.

TPId: **SCTP_D_I_8_11**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange data at the tester such that DATA chunk with no user data is sent to SUT.

Ref: RFC 2960 [1] section 6.2.

Purpose: Ensure that the IUT on receipt of a DATA chunk with no user data, sends an ABORT with cause "No User Data".

TPId: **SCTP_D_O_8_12**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange data at the tester such that SACK chunk with cumulative TSN less than the cumulative TSN ack point of SUT is sent to SUT.

Ref: RFC 2960 [1], section 6.2.

Purpose: Ensure that the IUT on receipt of a SACK that contains Cumulative TSN field less than the current Cumulative TSN Ack point, discards the SACK.

TPId: **SCTP_D_V_8_13**

Status: Optional

Precondition: Association is established between tester and SUT. Arrange data at the tester such that DATA chunk with size of data equal to the maximum user data size of the SUT is sent to SUT.

Ref: RFC 2960 [1], section 6.2. and TS 102 144 [5], section 4.8.

Purpose: Ensure that the IUT can receive DATA equal to maximum User Data size defined by the upper layer.

TPId: **SCTP_D_V_8_14**

Status: Optional

Precondition: Association is established between tester and SUT. Arrange data from user part such that size is equal to the maximum User Data size defined by the upper layer.

Ref: RFC 2960 [1], section 6.2. and TS 102 144 [5], section 4.8.

Purpose: Ensure that the IUT can send DATA equal to maximum User Data size defined by the upper layer.

TPId: **SCTP_D_V_8_15**

Status: Optional

Precondition: Association is established between tester and SUT. Arrange data at the tester such that DATA chunk with size of data larger than user data size of the SUT is sent to SUT.

Ref: RFC 2960 [1], section 6.2. and TS 102 144 [5], section 4.8.

Purpose: Ensure that the IUT on receipt of DATA larger than own User Data size, sends an ABORT with cause "Out of Resources".

5.10 Test Purposes (TP) for Acknowledgement (A)

5.10.1 Valid and inopportune behaviour

TPId: **SCTP_A_V_9_1**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data such that tester sends the first DATA and wait for SACK.

Ref: RFC 2960 [1], section 5.1.

Purpose: Ensure that the IUT sends a SACK for the first DATA chunk it receives immediately.

TPId: **SCTP_A_V_9_2**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the Tester such that it sends multiple DATA chunks bundled in one SCTP packet.

Ref: RFC 2960 [1], section 6.2.

Purpose: Ensure that the IUT can acknowledge the reception of multiple DATA chunks.

TPId: **SCTP_A_O_9_3**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data such that SUT receive gap in DATA.

Ref: RFC 2960 [1], section 6.2.1.

Purpose: Ensure that the IUT, if it detects a gap in the received data chunk sequence, sends a SACK immediately where it reports the missing TSN in the GAP ACK block.

5.11 Test Purposes (TP) for Miscellaneous Test Cases (M)

5.11.1 Invalid behaviour

TPId: **SCTP_M_I_10_1**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that a datagram with reserved chunk type is sent to IUT bundled with DATA chunk and higher two bits are set to 11.

Ref: RFC 2960 [1], section 3.2.

Purpose: Ensure that the IUT on receipt of an unrecognized chunk type with highest order 2 bits set to 11, sends an ERROR with cause "Unrecognized Chunk Type" and a SACK for the DATA chunk.

TPId: **SCTP_M_I_10_2**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that a datagram with reserved chunk type is sent to IUT bundled with DATA chunk and higher two bits are set to 00.

Ref: RFC 2960 [1], section 3.2.

Purpose: Ensure that the IUT on receipt of an unrecognized chunk type with highest order 2 bits set to 00, discards this SCTP packet and does not process the DATA chunk.

TPId: **SCTP_M_I_10_3**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that a datagram with reserved chunk type is sent to IUT bundled with DATA chunk and higher two bits are set to 01.

Ref: RFC 2960 [1], section 3.2 and draft ietf [6], section 2.1.2.

Purpose: Ensure that the IUT on receipt of an unrecognized chunk type with highest order 2 bits set to 01, discards this SCTP packet and does not process the DATA chunk. Additionally it has to send an ERROR with cause "Unrecognized Chunk Type".

TPId: **SCTP_M_I_10_4**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that a datagram with reserved chunk type is sent to IUT bundled with DATA chunk and higher two bits are set to 10.

Ref: RFC 2960 [1], section 3.2. and draft ietf [6], section 2.1.2.

Purpose: Ensure that the IUT on receipt of an unrecognized chunk type with highest order 2 bits set to 10, discards this chunk and sends a SACK for the DATA chunk.

5.12 Test Purposes (TP) for Retransmission Timer (RT)

5.12.1 Invalid behaviour

TPId: **SCTP_RT_I_11_1**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that SACK is not sent for the data received from SUT.

Ref: RFC 2960 [1], section 6.3.3.

Purpose: Ensure that the IUT, if timer T3-rtx expires on a destination address, increases value of RTO for that address, i.e. increases the T3-rtx timer.

TPId: **SCTP_RT_I_11_2**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that SACK is not sent for the data received.

Ref: RFC 2960 [1], section 6.3.3.

Purpose: Ensure that the IUT, if timer T3-rtx expires on a destination address, increases value of RTO for that address.

TPId: **SCTP_RT_I_11_3**

Status: Mandatory

Precondition: Association is established between tester and SUT. Arrange the data at the tester such that SACK is not sent for the data received. Before sending the DATA note the T3-rtx value corresponding to both IP addresses.

Ref: RFC 2960 [1], section 6.3.3.

Purpose: Ensure that the IUT, if it retransmits DATA to an alternate address, uses the RTO value of that address and not that of the previous address.

History

Document history		
V1.1.1	November 2004	Publication