MTP3/MTP3b/M3UA Test Port for TTCN-3 Toolset with TITAN, Function Specification

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How to Read This Document

This is the Function Specification for the MTP3/MTP3b/M3UA test port. The MTP3/MTP3b/M3UA test port is developed for the TTCN-3 Toolset with TITAN according to the Requirement Specifications [4], [24], [25], [26], [27].

The knowledge of the TITAN TTCN-3 Test Executor [2] and the TTCN-3 language [1] is essential.

The knowledge of the specifications of Signaling System 7 and M3UA created by ITU-T, ANSI, IETF, TTC and MPT ([9]-[19], [23]) is of importance. Knowledge of Ericsson function specifications [20], [21] is useful.

Scope

The purpose of this document is to specify the functionality of the MTP3/MTP3b/M3UA test port. The test port can inter-work with

- SEA by means of MPH [5], [6], [7] and [8]
- Real target through M3UA server or M3UA Daemon

This specification is based on the specifications created by ITU-T, ANSI, TTC, MPT and IETF ([9]-[19], [23]) and the related Ericsson functional specifications ([20] and [21]).

In several nodes the GCP over SCTP is implemented, meaning the M3UA layer is missing. In order to minimize the impact on existing GCP over M3UA test suites new modes are added to MTP3/M3UA Test Port, which simulate the lack of MTP3/M3UA layer:

`MTP3ServiceType='STC'` used for testing with SEA. See chapter Function Specification for Testing with SEA in STC Mode.

`MTP3ServiceType='TargetSTC'` used for testing real target through M3UA Server. See chapter Function Specification for Testing with Real Target in STC Mode.

General

This Test Port is developed for testing higher level protocols over the already tested MTP3 and M3UA protocols.

In STC mode it can be used for testing the MTP3 and M3UA protocols themselves.

The test port implements the MTP3 protocol specified by ITU-T in [9]-[16], by ANSI in [18], by TTC in [19], by MPT in [23] and M3UA specified in [17].

The SUT can be

- Simulator Environment Architecture (SEA) and the software implementation loaded in it
- Real target through M3UA Server or M3UA Daemon

The user of the test port ("MTP3-User") is any next higher level protocol.

The test port communicates with its user by means of Abstract Service Primitives (ASPs), described below. The test port communicates with its peer protocol by means of messages i.e. protocol data units (PDUs).

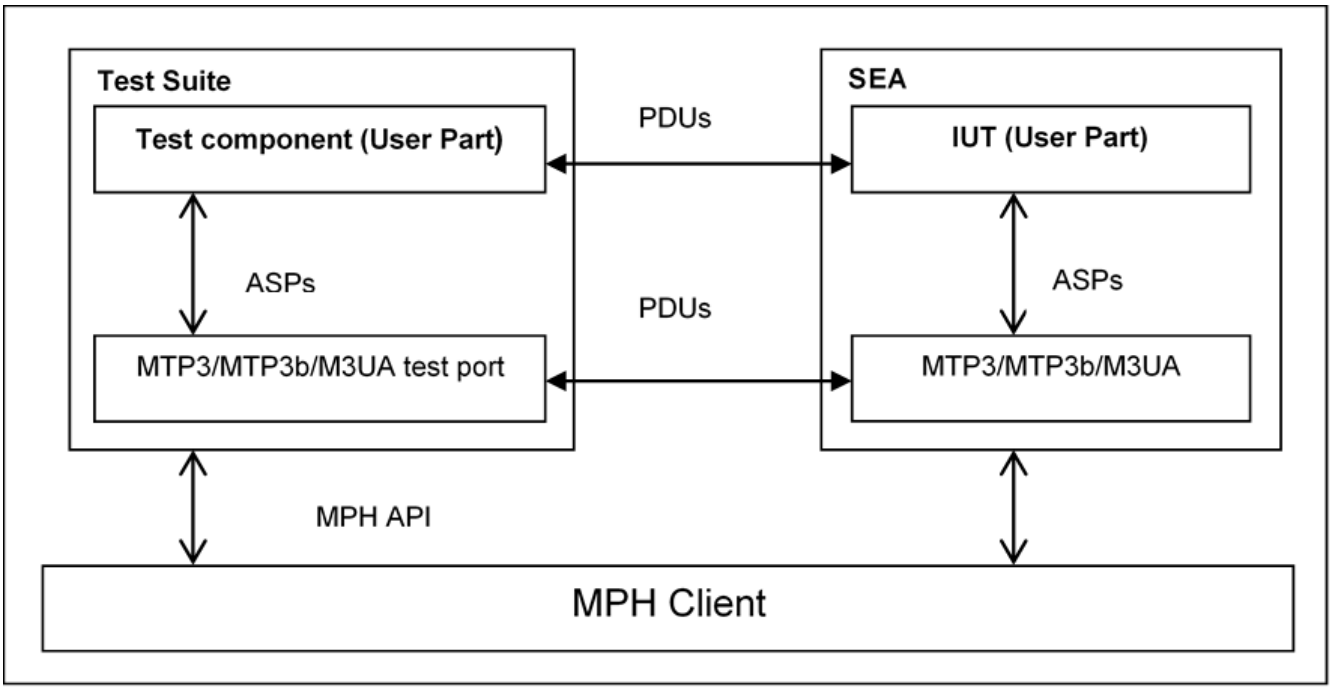
Function Specification for testing with SEA

Overview

The test port provides the following functionalities:

- Builds a connection to the SUT (see Connection with the SUT).
- Makes a mapping between ASPs (see The User Interface: the Abstract Service Primitives) and messages (PDUs) carried by MPH according different * specifications (see Supported Specifications)
- Implements some management functionalities

See the overview of the test system using MTP3/MTP3b/M3UA test port below:



Supported Specifications

The service type or the "flavor" of the test port defines which specification should be followed. The service type of the test port and its peer should be identical.

These types are:

- MTP3 ITU-T (applies [9]-[15])
- MTP3 ITU-T for IUP
- MTP3 ANSI (applies [18])
- MTP3 TTC and MTP3b TTC (applies [19])
- MTP3 MPT (applies [23])
- M3UA IETF (applies [17])

These are discussed in the following chapters (see chapter The Implemented Protocols).

Interfaces

Connection with the SUT

The Test Port provides two connection modes –determined via configuration parameter- for connection establishment between the executable test suite and the SEA.

In a **semi-static** connection mode the connection is built up whenever a map operation is requested in TTCN-3 and disconnection is issued when an unmap operation is called.

In **dynamic** connection mode the connection is built up only via calling function *f_MTP3_SEA_connect* and disconnection is issued when *f_MTP3_SEA_disconnect* function is called.

The test port opens an MPH channel (see [6] and [7]) and establishes the connection between the MPH Interface of SEA and the test component. The MPH interface is of the "SS7 Signaling Protocol" type (see [8]).

The communication goes on protocol MTP3, MTP3b or M3UA according the variable settings in the configuration file of the test suite.

The User Interface: the Abstract Service Primitives

These ASPs and their behavior rules are identical in MTP3 and M3UA. In other words MTP3 and M3UA are identical from the MTP3-User's point of view.

The ASPs of the test port are a subset of MTP primitives as they specified in [10], [17], [18], [19] and collected in table below.

See Message Transfer Part Service Primitives and their implementation in the table below:

ITU-T, ANSI, IETF and TTC names			Test port
Generic name	**Specific name**	**Parameters**	**ASP Name**
MTP-TRANSFER	Request or indication	OPC, DPC, SLS, SIO, User data	ASP_MTP3_TRANSFERreq, ASP_MTP3_TRANSFERind

ITU-T, ANSI, IETF and TTC names			Test port
MTP-PAUSE	Indication	Affected DPC	Not implemented
MTP-RESUME	Indication	Affected DPC	ASP_MTP3_RESUME
MTP-STATUS	Indication	Affected DPC Cause	Not implemented

The MTP3 User can send message ASP_MTP3_TRANSFERreq and can receive message ASP_MTP3_TRANSFERind and ASP_MTP3_RESUME.

The Implemented Protocols

The classical protocol: the Message Transfer Part

Overview of MTP

This chapter is valid for test port implementation of MTP ITU-T ([10]-[15]), MTP ANSI [18], MTP TTC [19] and MTP MPT [23]. They differ from each other only in the size of certain fields, therefore their description and implementation can be performed together.

SS7 is a general purpose common channel signaling (CCS) system. According to the layered architecture described in Q.700 its 3 lower layers constitute the Message Transfer Part (MTP).

"The overall function of the Message Transfer Part is to serve as a transport system providing reliable transfer of signaling messages between the locations of communicating user functions.""

MTP level 1 (MTP1) or "Signaling data link functions" "defines the physical, electrical and functional characteristics of a signaling data link and the means to access it" (see 2.2.2/Q.700 in [9])

MTP level 2 (MTP2) or "Signaling link functions "defines the functions and procedures for the transfer over one individual signaling data link. It defines and handles the Signaling Unit Formats (see Figure A.1/Q.703 in [12]. From our point of view only the basic Message Signal Unit (MSU) is relevant and implemented to a certain extent.

MTP level 3 (MTP3) or "Signaling network functions and messages" (see Q.704) defines network routing, network managing, network testing and message transferring functions. It uses only SIO and SIF (see below).

See the Message Signal Unit Format according ITU-T Q.703, T.1.111.3-2001 and JT-Q704 below:

F Flag (8bits)	CKcheck bits(16bits)	SIF=Signaling information field (8n bits, n>=2)	SIO(8bits)	BSN, BIB, FIB etc.(48 bits)	Flag >(8bits

SIO (service information octet) is discussed in 14.2/ Q.704 in [13]. It defines the type of the message if it is a user part signal (for example, ISUP or SCCP) or if the message is a management or a testing signal. It also contains the network type information (e.g. national, international).

SIF (service information field) contains the label and in particular the routing label (see Figure

3/Q.704 in [13].

The only difference from the test point of view is the length of the SIF.

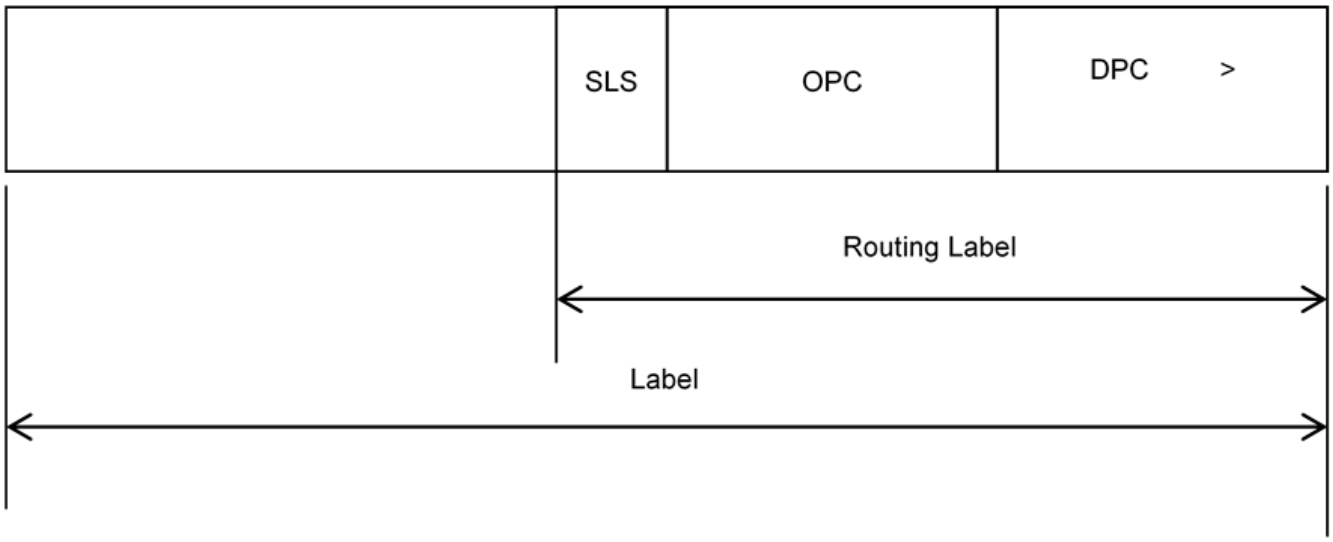
See the length of the SIF below:

Specification	Length of the SIF in MSU (octets)	Reference
MTP3 ITU-T, TTC, MPT	2...272	2.3.8/Q.703
MTP3 ANSI	2...272	4.3.4/T1.11.12.3.8/T1.111.3

In the SEA simulation the MTP 1-2 are implemented hidden from the Test Port and only the SIO and SIF fields are defined and transferred.

SIF contains the label. The structure of the label is shown in figure below, according to 2.2/Q.704 in [13].

See the routing label structure (> shows the first bit transmitted) below:



OPC

Originating Point Code

DPC

Destination Point Code

SLS

Signalling Link Selection

Specifications ANSI, TTC and MPT are "intended to be compatible with ITU-T Recommendations Q.701 through 710" (see [9]-[15]). The main difference, *from the test point of view*, is the size of the fields.

The next table summarizes the size of the fields in different national standards. A good comparison is given in the Ericsson function specification [20].

See size of fields in the different national standards in the table below:

	Length in bits				
Field	**ITU-T**	**ITU-T for IUP**	**ANSI**	**TTC national***	**MPT national****
SIO	8	8	8	8	8
DPC	14	14	24	16	24
OPC	14	14	24	16	24
SLS	4	12***	8	4	4

*: If `SIO sub-service field>=2.`, otherwise TTC international is the same as ITU-T
**: MPT international is the same as ITU-T
***: This is the CIC field instead of SLS

NOTE	In case of service type MTP3b TTC (ATM TTC National) an additional Priority Octet can be found at the beginning of the message, which is transparently sent back in the next answer message by the test port. In the first message this additional octet is `0`.

The message signal units (MSUs) transport information:

a. between MTP3-Users

b. between MTP3 levels as inner testing, maintenance and routing information.

Case 'a' is performed by mapping the information between the ASPs and MSUs.

Case 'b' is invisible for the User Part and discussed in following chapters.

Supported MTP functions

The test port implements only a subset of the functionality specified by ITU-T, ANSI, TTC and MPT. The reasons of the restrictions are:

- MTP level 1 and level 2 are only simulated as described in section The Implemented Protocols.
- There is only one signaling link between the test port/suite and the SUT.
- Test port is simplified for testing purposes (e.g. only a subset of the ASPs are implemented)

Signaling Data Link Functions (level 1)

These functions specified in Q.702 [11], [18] and JT-Q702 cannot be implemented because of a/3.4.1.2. Data transfer is performed.

Signaling Link Functions (level 2)

These functions specified in Q.703, [18] and Q.703 and JT-Q701 cannot be implemented because of a/3.4.1.2. Data transfer is performed.

Signaling Network Functions (level 3)

- Signaling network functions can be divided into two basic categories:
- Signaling message handling
- Signaling network management

Here is the list of functions and their implementation status:

Name	Reference	Status of implementation	Reason(cf. 3.4.1.2)	Remark
Signaling message handling/ Message routing	1.2.3/Q.704 2.3/Q.704	Not applicable	b	
Signaling message handling/ Message discrimination	1.2.3/Q.704 2.4/Q.704	Partially	b, c	Implemented as filtering which can be switched off
Signaling message handling/ message distribution	1.2.3/Q.704 2.4/Q.704	Not implemented	c	Only one user can be applied at the same time.
Signaling network management/ signaling traffic management (changeover, changeback, forced rerouting, controlled rerouting and MTP restart)	1.3.3/Q.704	Partially	b	Answer for request is a must and implemented, see Handling of Network Management Messages by MTP3.
Signaling network management/ signaling link management (restoration, activation, inactivation, link set activation, automatic allocations)	1.3.4/Q.704 12/Q.704	Partially	b	Answer for request is a must and implemented, see Handling of Network Management Messages by MTP3.
Signaling network management/ signaling route management (transfer-prohibited, transfer-allowed, transfer restricted)	1.3.5/Q.704 13/Q.704	Partially	c	Answer for request is a must and implemented, see Handling of Network Management Messages by MTP3.

Handling of Network Management Messages by MTP3

The implementation is based on 12/Q.704 and restricted only for giving an answer for `an_y_` request without any other activities. All messages can be found in Table 1/15.3/Q.704 [13].

In case of management messages the service indicator (SI) field of SIO is 1.

Implemented answering rules are collected in table below. For the listed messages an answer should be sent back. Other messages are logged only. For details see 15.3/Q.704 in [13].

See Handling of management messages in the table below:

H0/H1	Meaning	Answer
0x51	CBD	CBA (0x61)
0x26 (! Not implemented)	MIM/LUN	MIM/LUA (0x46)
0x16	MIM/LIN	MIM/LID (0x56)

CBD

Change-back declaration signal

CBA

Change-back acknowledgement signal

MIM

Management inhibit messages

LIN

Link inhibit signal

LID

Link inhibit denied signal

LUN

Link uninhibit signal

LUA

Link uninhibit acknowledgement signal

Handling of Test and Maintenance Messages by MTP3

All signaling nodes may periodically send SLTM messages to check if its neighbors are alive. It expects an answer SLTA for it. Therefore the test port sends SLTA for SLTM. In case of SLTA message reception a TRA message is replied. Other messages are logged only. For details see 5/Q.707 in [14]

See the handling test and maintenance messages by the test port below:

H0/H1	Meaning	Answer
0x11	SLTM	SLTA (0x21)
0x21	SLTA	TRA (0x17)
0x84	SRA (only in TTC)	Log only

SLTM

Signaling Link Test Message

SLTA

Signaling Link Test Acknowledge message

SRA

Signaling Routing Test Acknowledge message

The M3UA protocol

Signal unit formats in M3UA

The M3UA protocol is specified by IETF in its M3UA RFC 3332 [17]. "This protocol is specified for supporting the transport of any SS7 MTP3-User signaling (e.g. ISUP, BICC and SCCP messages) over IP using the services of the SCTP. Also, provision is made for protocol elements that enable a seamless operation of the MTP3-User peers in the SS7 and IP domains"- summarizes the Ericsson document [21].

"M3UA messages consist of a Common Header followed by zero or more variable length parameters, as defined by the message type. All the parameters contained in a message are defined in a Tag Length-Value format as shown below" (see RFC 3332 [17]):

See the M3UA message below:

Octet0	Octet1	Octet2	Octet3
Version	Reserved	Message Class	Message Type
Message length			
Message parameters			

The version is always 1.

The message parameter in the M3UA message has the general form described in the table below:

Octet0	Octet1	Octet2	Octet3
Parameter tag		Parameter Length	
Parameter value			

The received messages can be transferred to the user if the message class is Transfer "message" (=1) and the message type is "Payload data (DATA)" (=1). The DATA message contains the M3UA "Protocol data" (parameter) which is defined as follows:

Octet0	Octet1	Octet2	Octet3
Protocol data		Length	
Originating Point Code (OPC)			
Destination Point Code (DPC)			
SI	NI	MP	SLS

The MTP3/MTP3b/M3UA user can send messages in the same manner. From the MTP3-User point of view all MTP-TRANSFER primitives can be transmitted.

General description can be found in [17] and in [21].

M3UA can handle all kinds of messages (Management, transfer, traffic maintenance etc) but only the mentioned Transfer message should be transformed up/down as an MTP-TRANSFER primitive to/from the MTP3-User. If all MTP primitives were implemented, more messages should be

transformed to/from the next upper level. Messages different from Transfer message are received and answered only by the real M3UA layer, or in our case by the test port.

M3UA messages

The M3UA messages are listed in the following table. User Part doesn't see most of them. They remain on level 3. (MTP3/) M3UA test port processes them according to the next table:

Message Class	Message Name	Abbrev.	sent	received	answer
Management (MGMT)	Error	ERR	yes	yes	Log
	Notify	NTFY	not applicable 1)		Log
Transfer	Payload Data	DATA	yes	yes	Transform and transfer to/from level4
SS7 Signaling Network Management (SSNM)	Destination Unavailable	DUNA	yes	yes	Log
	Destination Available	DAVA	yes	yes	Log
	Destination State Audit	DAUD	yes	yes	DUNA/DAVA
	Signaling Congestion	SCON	yes	yes	Log
	Destination User Part Unavailable	DUPU	yes	yes	Log
	Destination Restricted	DRST	not applicable 1)		Log
ASP State Management (ASPSM)	ASP Up	ASPUP	yes	yes	ASPUPAck
	ASP Down	ASPDN	yes	yes	ASPDNAck
	Heartbeat	BEAT	no	yes	BEAT_Ack
	ASP Up Ack	ASPUP_Ack	yes	yes	ASPAC
	ASP Down Ack	ASPDN_Ack	yes	yes	Log, status ch
	Heartbeat Ack	BEAT_Ack	yes	no	Log
ASP Traffic Maintenance (ASPTM)	ASP Active	ASPAC	yes	yes	ASPAC_Ack
	ASP Inactive	ASPIA	yes	yes	ASPIA_Ack
	ASP Active Ack	ASPAC_Ack	yes	yes	Log,status ch
	ASP Inactive Ack	ASPIA_Ack	yes	yes	Log
Routing Key Management (RKM)	Registration Request	REG_REQ	not applicable 2)		Log
	Registration Response	REG_RSP	not applicable 2)		Log
	Deregistration Request	DEREG_REQ	not applicable 2)		Log
	Deregistration Response	DEREG_RSP	not applicable 2)		Log

Additional services

Loopback

The test port is able to work in `loopback` mode. In that case each signal unit to be sent out will be immediately sent back to the handler of received signals instead of the "real" peer in the SEA. The OPC and DPC aren't changed. A good test suite can achieve a conversation between two test-driven parts if the loopback is switched on.

This functionality can be switched on/off by setting a parameter in the configuration file.

Filtering

The user (the tester) can select what kinds of signals are received. Signal is received if and only if the OPC, DPC are identical with the values, which are set in the configuration file.

Capacity and Limitation

In this mode the test port cooperates only with SEA. It is not applicable for testing real SS7 Signaling points.

Sequence control is not supported, because only SIO and SIF are implemented.

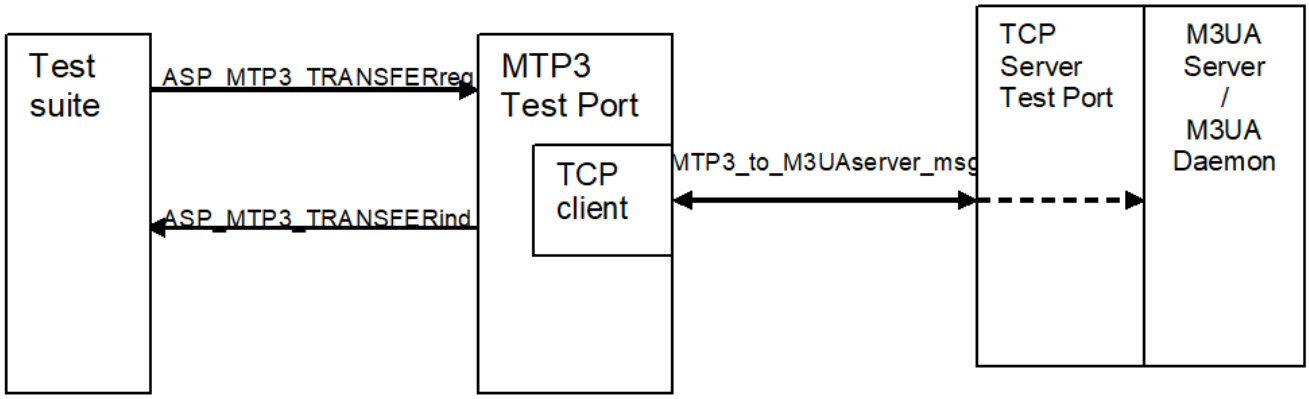
Error detection is not supported because only SIO and SIF are implemented.

Other limitations are discussed in previous chapters.

Function Specification for Testing with Real Target

If the configuration parameter shows, that the test port is working in target mode, then the test port establishes a connection towards a TCP server. This TCP server should be connected to M3UA Server, which ensures the connection towards the target SUT. In this case the test port just forwards the information (configuration parameters, ASPs) to the remote functionality over the TCP connection. In case of testing target MSC the M3UA functionalities over the TCP are implemented in M3UA Server or in M3UA Daemon.

See overview of the possible test system in case of testing target MSC below:



See list of messages sent in `MTP3_to_M3UAserver_msg` below:

Byte number	1.	2 3 4 5	6	7 8 9 10	11 12 13 14	15.	16.-n.
TRANSFERind	0	length	sio	opc	dpc	sls	Data
TRANSFERreq	1	length	sio	opc	dpc	sls	Data
REGISTER	2	length	ni	sut_pc	tester_pc	m3ua_ver	system port name
UNREGISTER	3	length	0				
STATUS	4	length	st				
PAUSE	5	length	0				
RESUME	6	length	0				

Map Operation

By calling map operation, the test port creates a TCP client and connects to the TCP server (whose location is determined via test port parameters) via using Abstract Socket.

Over the established TCP connection the parameters of the SUT are sent in `REGISTER` message. If the connection towards the SUT is established a `STATUS` message with `'REGISTER successful'` value is received and the map operation finishes. If the `STATUS` received with another value or not received, then the mapping is unsuccessful and the test port stops with an error message.

Data Transfer

The ASPs are collected in table below. They are similar to the ones described in chapter The User Interface: the Abstract Service Primitives. However, the test port can receive `ASP_MTP3_PAUSE`, `ASP_MTP3_RESUME` and `ASP_MTP3_STATUS` too.

If an `ASP_MTP3_TRANSFERreq` received from the test suite, then it is packed into the `MTP3_to_M3UAserver_msg` – TRANSFERreq message and sent over the TCP connection.

If an `MTP3_to_M3UAserver_msg – TRANSFERind` message is received over the TCP connection then this message is mapped into an `ASP_MTP3_TRANSFERind` and sent to the test suite.

`ASP_MTP3_PAUSE` is received when the M3UA instance is not active in the M3UA server. `ASP_MTP3_RESUME` indicates that the M3UA instance has become active again. `ASP_MTP3_STATUS` is received on unsuccessful sending of M3UA messages.

See MTP Service Primitives and their implementation for testing with real target below:

ITU-T, ANSI, IETF and TTC names			Test port
Generic name	**Specific name**	**Parameters**	**ASP Name**
MTP-TRANSFER	Request or indication	OPC, DPC, SLS, SIO, User data	ASP_MTP3_TRANSFERreq, ASP_MTP3_TRANSFERind
MTP-PAUSE	Indication		ASP_MTP3_PAUSE
MTP-RESUME	Indication		ASP_MTP3_RESUME
MTP-STATUS	Indication		ASP_MTP3_STATUS

Unmap Operation

By calling unmap operation, the test port sends UNREGISTER message over the TCP connection and waits until "UNREGISTER successful" is received in STATUS message. The received TRANSFERind messages are ignored. (If something else or nothing is received, then the test port stops with error.) After reception of "UNREGISTER successful" the test port closes the TCP connection through the Abstract Socket.

Error Situations

The MTP3 Test Port can receive ASP_MTP3_PAUSE, ASP_MTP3_RESUME and ASP_MTP3_STATUS from the M3UA server to handle the case when the M3UA instance is not active in the M3UA server. For more information see section Data Transfer.

Capacity and Limitations

None.

Function Specification for Testing with SEA in STC Mode

Connection Establishment

By map operation an MPH connection is established towards the SEA entity determined via the Test Port Parameters. See [5], [6], [7], [8].

Data Transfer

The same ASPs are used as in other modes, but only the 'data' field is used. Every other field is filled with `0`.

When `ASP_MTP3_TRANSFERreq` is received from TTCN, then the 'data' field is forwarded to the SEA without any modification.

At reception of any message from SEA the message is put into the 'data' field of `ASP_MTP3_TRANSFERind` and every other field is filled with `0`.

Disconnection

At `unmap` operation the MPH connection towards SEA is closed.

Function Specification for Testing with Real Target in STC Mode

The function specification described in Function Specification for Testing with Real Target is valid for this case with the following modifications:

- `sio`, `opc`, `dpc`, `sls`, `ni`, `sut_pc`, `tester_pc` fields are unused and are always `0`.
- `m3ua_ver` field is `0`, which shows to the M3UA Server / M3UA Daemon that the received registration belongs to a user in STC mode.

Terminology

MTP3 MTP level 3 the signaling network layer of SS7

MTP3-User Any protocol normally using the services of the SS7 MTP3 or M3UA (e.g. `ISUP`, SCCP, TUP, etc).

M3UA MTP3 User Adaptation Layer. M3UA is a protocol supporting the transport of any SS7. MTP3-User signaling over IP using the services of the SCTP protocol. (See [17])

Test Port An adaptation between the TTCN-3 Test Executor and the SUT.

`SEA` Simulator Environment Architecture, provides the possibility to have simulated `AXE` nodes running on a Unix workstation.

`STC` Mode In this mode the implementation of `MTP3` layer or the `M3UA` layer is missing. It was introduced to be able to test `GCP` over `SCTP` with the same test cases as `GCP` over M3UA, but it can be used also to test the `MTP3` layer or the `M3UA` layer itself.

Abbreviations

ANSI

American National Standards Institute

ASP

Abstract Service Primitive

ATM

Asynchronous Transfer Mode

BICC

Bearer Independent Call Control

DPC

Destination Point Code

IETF

Internet Engineering Task Force

IP

Internet Protocol

ISUP

ISDN User Part

ITU

International Telecommunication Union

ITU-T

Telecommunication Standardization Sector of ITU

IUP

Interconnect User Part

IUT

Implementation Under Test

MPH

Message Protocol Handler

MPT

Ministry of Post and Telecommunications (People’s Republic of China)

MSU

Message Signal Unit

MTP3
: Message Transfer Part level 3

MTP3b
: MTP3 adaptation for Q.2140

M3UA
: SS7 MTP3 User Adaptation Layer

NI
: Network Indicator

OPC
: Originating Point Code

PDU
: Protocol Data Unit

RFC
: Request For Comments

SEA
: Simulator Environment Architecture

SIF
: Service Information Field

SIO
: Service Information Octet

SPC
: Signaling Point Code

SS7
: Signaling System No 7

SCTP
: Stream Control Transmission Protocol

SUT
: System Under Test

TTCN-3
: Testing and Test Control Notation version 3

TTC
: Telecommunications Technology Committee (Standardization body of Japan)

References

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Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language

[2] User Guide for TITAN TTCN-3 Test Executor

[3] Installation Guide for TITAN TTCN-3 Test Executor

[4] PDU CNES – TTCNV3 Requirement Specification

[5] SEA homepage:
http://tcs.uab.ericsson.se/products/aps/ste/products/sea/sea_index.html

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[7] Interwork Description for MPH (Message Protocol Handler) libraries
http://tcs.uab.ericsson.se/products/aps/ste/products/sea/docs/iwd_latest/IWD_MPHclient.html

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[9] ITU-T Recommendations Q.700 (03/93)
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[10] ITU-T Recommendations Q.701 (03/93)
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[11] ITU-T Recommendations Q.702 (Blue book)
Specifications of Signaling System No. 7 (SS7)
Signaling Data Link

[12] ITU-T Recommendations Q.703 (07/96)
Specifications of Signaling System No. 7 (SS7)
Signaling Link

[13] ITU-T Recommendations Q.704 (07/96)
Specifications of Signaling System No. 7 (SS7)
Signaling Network functions and messages

[14] ITU-T Recommendations Q.707 (Blue Book)
Specifications of Signaling System No. 7 (SS7)
Testing and Maintenance

[15] ITU-T Recommendations Q.710 (Blue Book)
Specifications of Signaling System No. 7 (SS7)

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[16] ITU-T Recommendations Q.2210 (07/96)
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