ETSI TS 103 374-3 V1.1.1 (2016-05)

Core Network and Interoperability Testing (INT);
Diameter Conformance testing for Rf/Ro interface;
(3GPP™ Release 10);
Part 3: Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PIXIT) pro forma specification

Reference
DTS/INT-00121-3

Keywords
ATS, conformance, diameter, PIXIT

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Contents

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Core Network and Interoperability Testing (INT).

The present document is part 3 of a multi-part deliverable covering the test specifications for the Diameter protocol on the Rf/Ro interface, as identified below:

Part 1: "Protocol Implementation Conformance Statement (PICS)";

Part 2: "Test Suite Structure (TSS) and Test Purposes (TP)";

Part 3: "Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PIXIT) pro forma specification".

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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1 Scope

The present document specifies the Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PIXIT) pro forma for the test specifications for Diameter protocol on the Rf/Ro interface as specified in ETSI TS 132 260 [1] and ETSI TS 132 299 [2] in compliance with the relevant requirements and in accordance with the relevant guidance given in ISO/IEC 9646-7 [7] and ETSI ETS 300 406 [8].

The test notation used in the ATS is TTCN-3 (see ETSI ES 201 873-1 [9]).

The following test specification and design considerations can be found in the body of the present document:

- the overall test suite structure;
- the testing architecture;
- the test methods and port definitions;
- the test configurations;
- TTCN styles and conventions;
- the partial PIXIT pro forma;
- the modules containing the TTCN-3 ATS.

Annex A provides the Partial Implementation Extra Information for Testing (PIXIT) Pro forma.

Annex B provides the Abstract Test Suite (ATS) part of the ATS.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] ETSI TS 132 260 (V10.14.0): "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Telecommunication management; Charging management; IP Multimedia Subsystem (IMS) charging (3GPP TS 32.260 version 10.14.0 Release 10)".

[2] ETSI TS 132 299 (V10.15.0): "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Telecommunication management; Charging management; Diameter charging applications (3GPP TS 32.299 version 10.15.0 Release 10)".

[3] ETSI TS-103 374-1: " Core Network and Interoperability Testing (INT); Diameter Conformance testing for Rf/Ro interface; (3GPP Release 10); Part 1: Protocol Implementation Conformance Statement (PICS)".

[4] ETSI TS 103 374-2: "Core Network and Interoperability Testing (INT); Diameter Conformance testing for Rf/Ro interface; (3GPP Release 10); Part 2: Test Suite Structure (TSS) and Test Purposes (TP)".

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

[6] ISO/IEC 9646-6: "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 6: Protocol profile test specification".

[7] ISO/IEC 9646-7: "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 7: Implementation Conformance Statements".

[8] ETSI ETS 300 406: "Methods for testing and Specification (MTS); Protocol and profile conformance testing specifications; Standardization methodology".

[9] ETSI ES 201 873-1: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

Not applicable.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ISO/IEC 9646-7 [7], ETSI TS 132 260 [1] and ETSI TS 132 299 [2] apply.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in ISO/IEC 9646-1 [5], ISO/IEC 9646-6 [6], ISO/IEC 9646-7 [7], ETSI TS 132 260 [1] and ETSI TS 132 299 [2] apply.

4 Abstract Test Method (ATM)

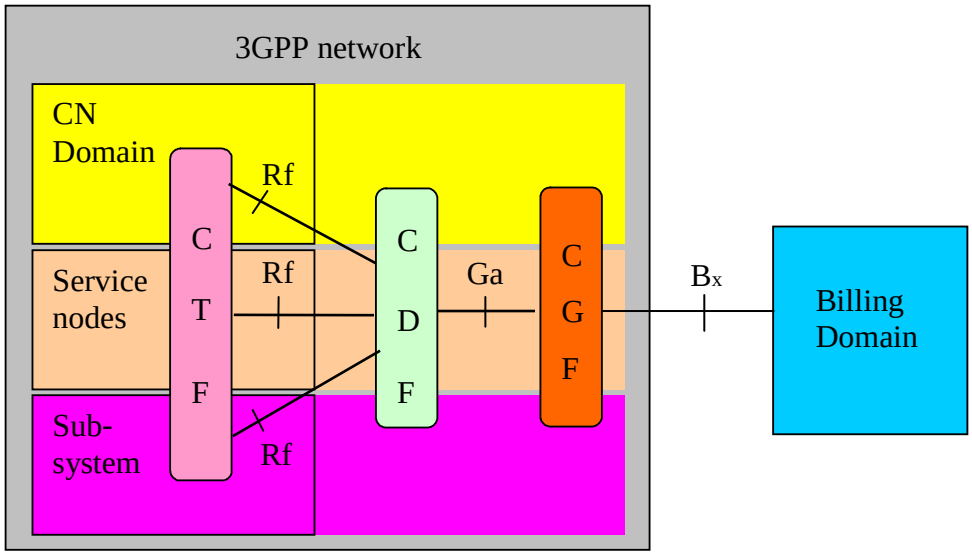
4.1 Introduction

This clause describes the ATM used to test the Diameter protocol on the Rf/Ro interface at the x-CSCF side and at the charging servers (Rf: CTF/CDF, To: OCF/CTF) side.

4.2 Test architecture

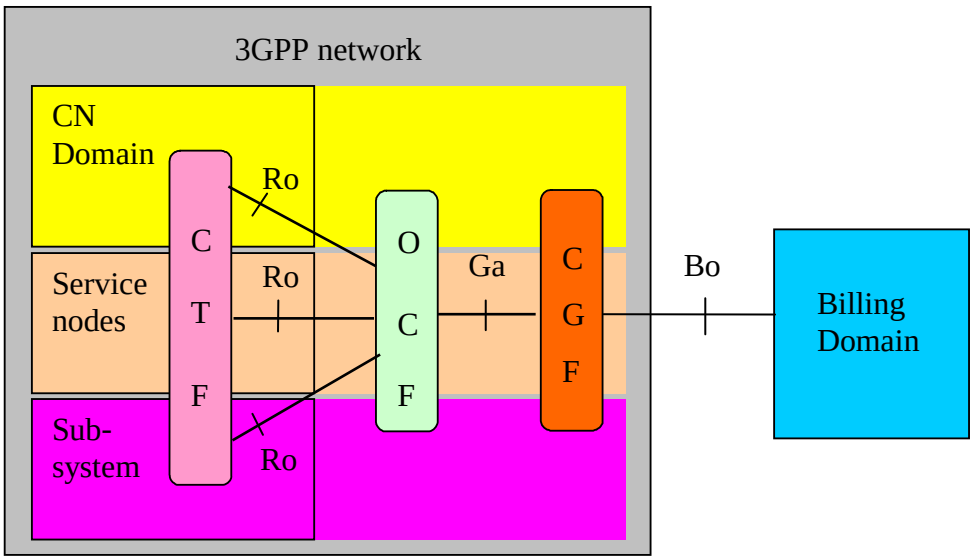
4.2.1 Test method

The Rf and the Ro are reference points from the Charging Trigger Function (CTF) to the Charging Data Function (CDF) and the Online Charging Function (OCF) respectively, and are intended for the transport of charging events. Rf is used for offline charging whereas Ro is used for online charging. The following figures depict the position of the Rf and Ro reference points within the overall 3GPP online and offline charging architecture.



CTF: **C**harging **T**rigger **F**unction
CDF: **C**harging **D**ata **F**unction
CGF: **C**harging **G**ateway **F**unction
BD: **B**illing **D**omain. This may also be a billing mediation device / post-processing system.

Figure 1: Logical ubiquitous offline charging architecture



CTF: **C**harging **T**rigger **F**unction
OCF: **O**nline **C**harging **F**unction
CGF: **C**harging **G**ateway **F**unction
BD: **B**illing **D**omain. This may also be a billing mediation device / post-processing system.

Figure 2: Logical ubiquitous online charging architecture

The test method chosen is the remote test method. Remote test method means that the test tool (the test machine + the executable test suite) shall behave as an x-CSCF when the IUT is a charging server and shall behave as a charging server when the IUT is an x-CSCF. As the exchange between the test system and the IUT is at the diameter message level, the lower layers of the test machine shall be totally conformant with the corresponding lower layers specifications to use the remote test method.

4.2.2 Test machine configuration

4.2.2.1 Test configurations using Rf interface

The Rf interface is located between a CTF equipment hosted by an x-CSCF or a SIP AS and the CDF.

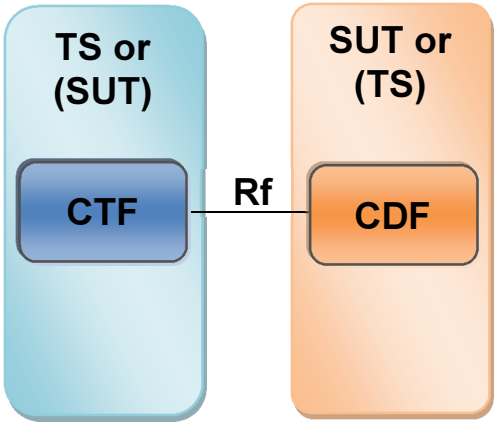


Figure 3: Test configuration CF_1Rf

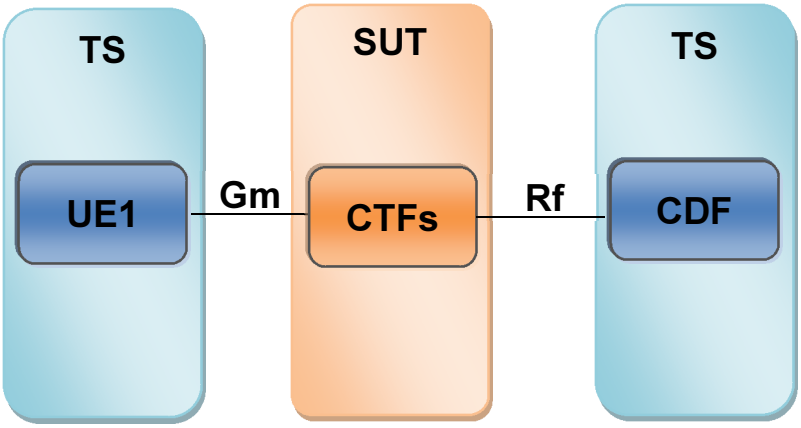


Figure 4: Test configuration CF_1Rf1Gm

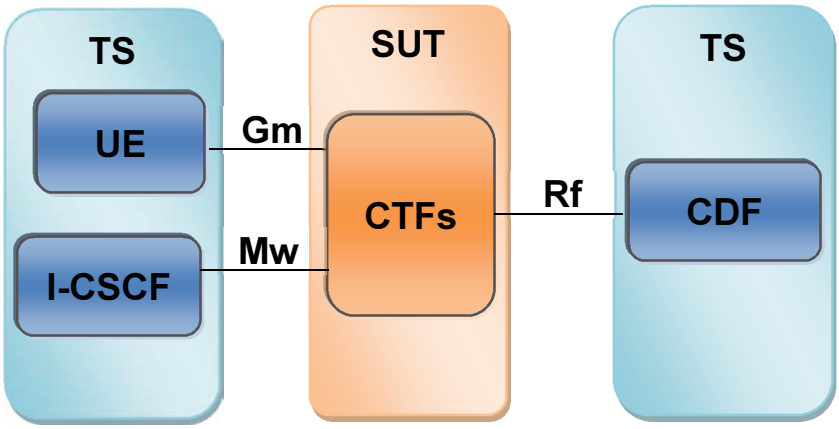


Figure 5: Test configuration CF_1Rf1Gm1Mw

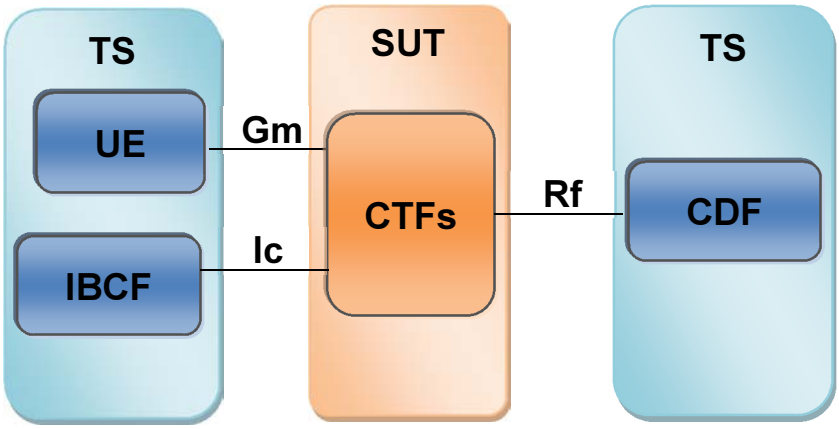


Figure 6: Test configuration CF_1Rf1Gm1Ic

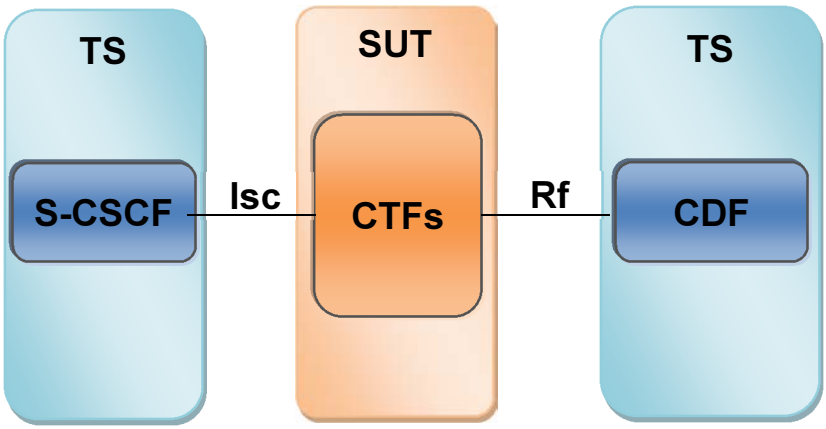


Figure 7: Test configuration CF_1Rf1Isc

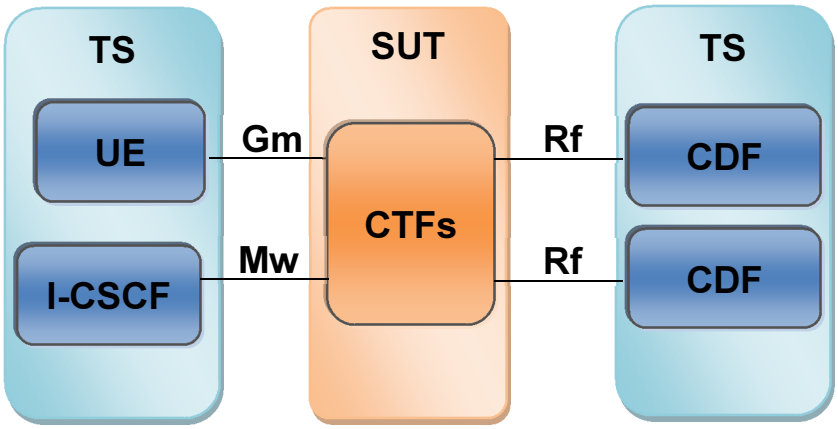


Figure 8: Test configuration CF_2Rf1Gm1Mw

4.2.2.2 Test configurations using Ro interface

The Ro interface is located between a CTF equipment hosted by an MRFC or a SIP AS or an IMS GW and the OCF.

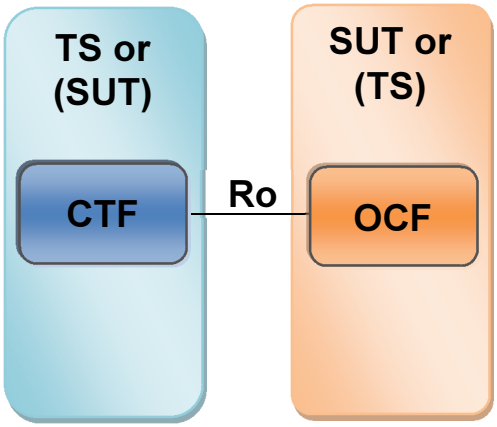


Figure 9: Test configuration CF_1Ro

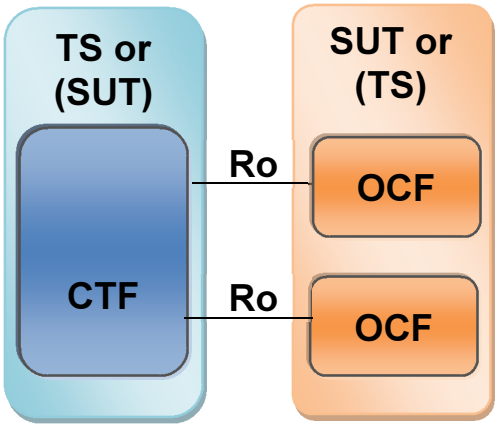


Figure 10: Test configuration CF_2Ro

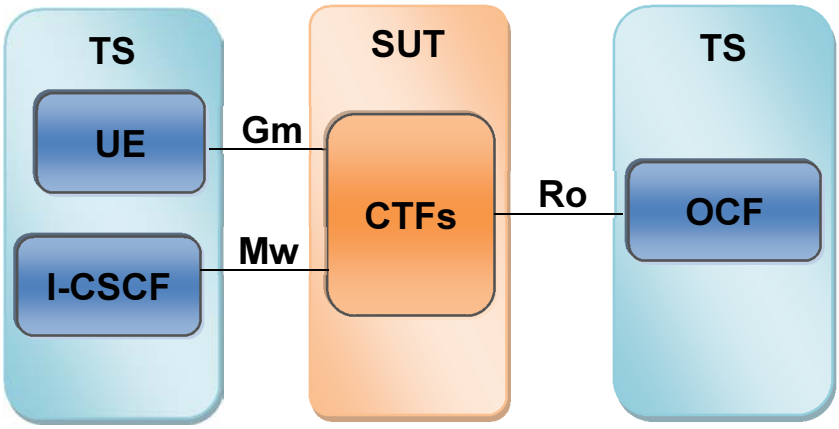


Figure 11: Test configuration CF_1Ro1Gm1Mw

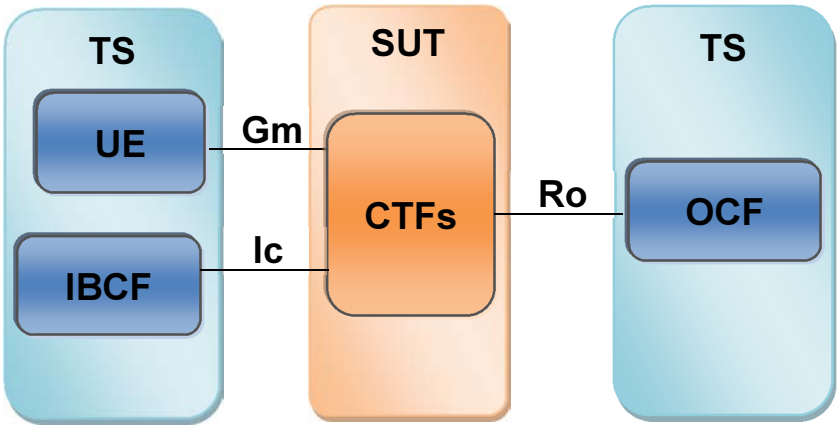


Figure 12: Test configuration CF_1Ro1Gm1Ic

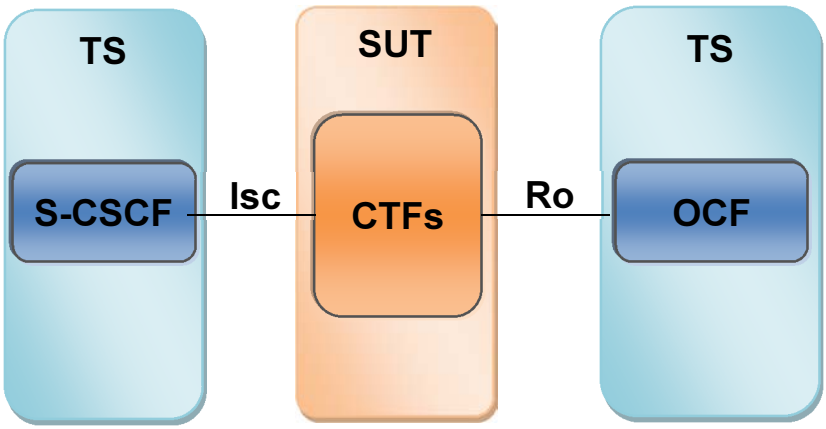


Figure 13: Test configuration CF_1Ro1Isc

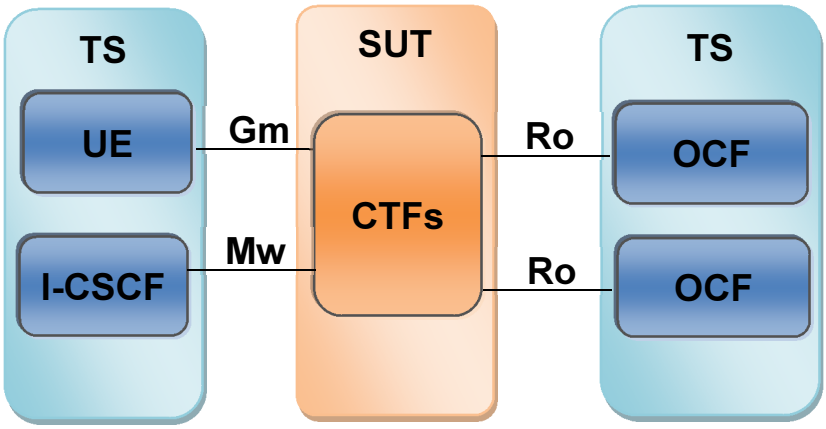


Figure 14: Test configuration CF_2Ro1Gm1Mw

4.2.3 Interconnection of TS and SUT

4.2.3.1 Rf interface

4.2.3.1.1 CDF Role

The figures below show the interconnection of TS and SUT in terms of signalling message flows. Diameter messages a

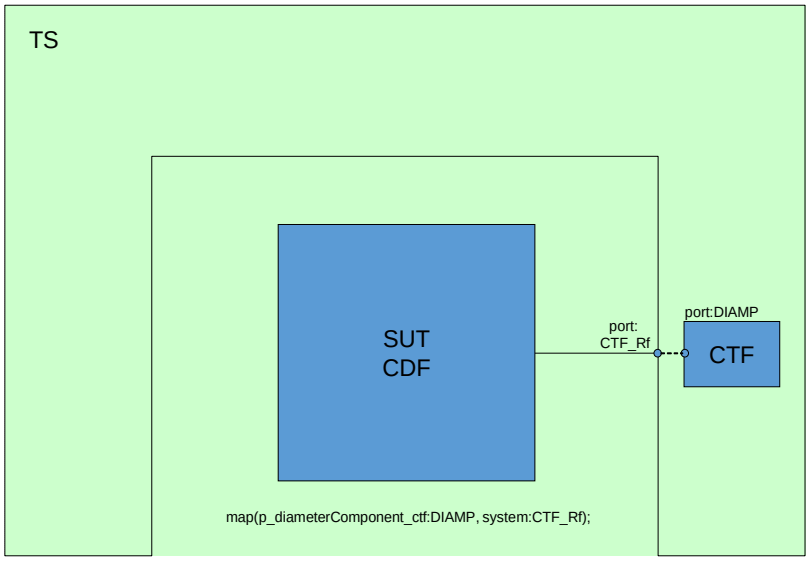


Figure 15: Interconnection for CDF role

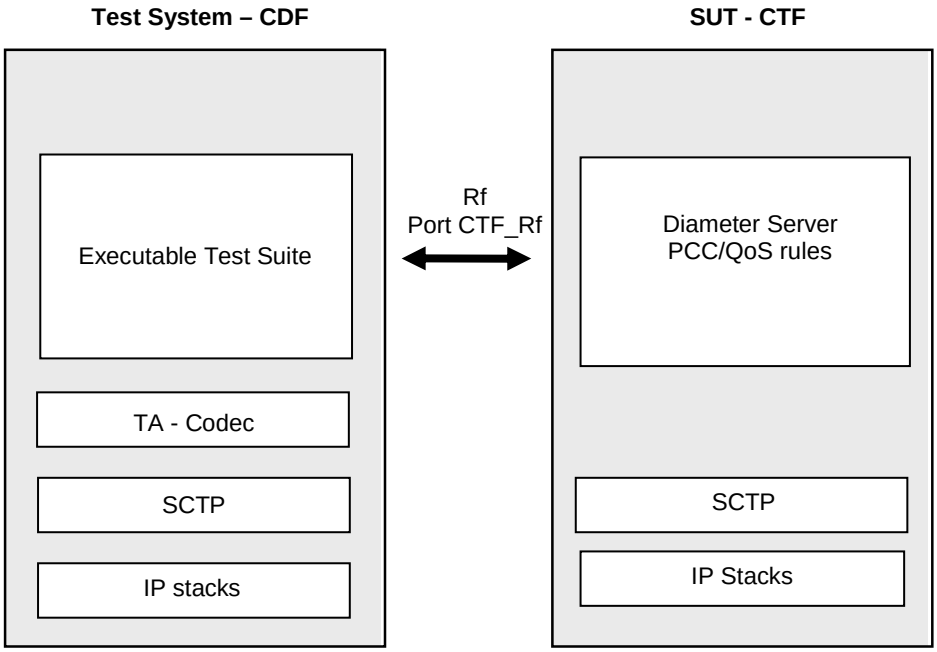


Figure 16: Interconnection for CDF role

4.2.3.1.2 CTF Role

The figures below show the interconnection of TS and SUT in terms of signalling message flows. Diameter messages are transferred over the DIAMP port. Some tests may require additional triggering via the Gm or Mw ports. The configuration can be enabled or disabled by using PIXIT parameter "SIPsupport".

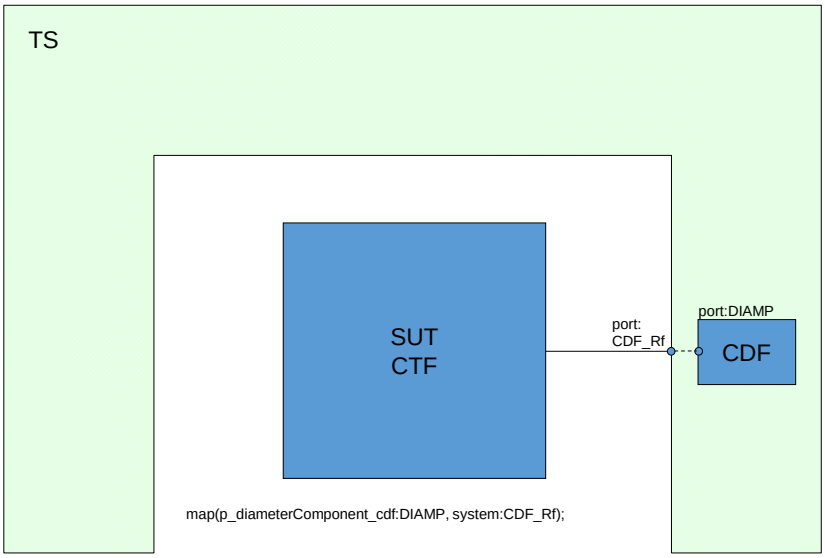


Figure 17: Interconnection for CTF role

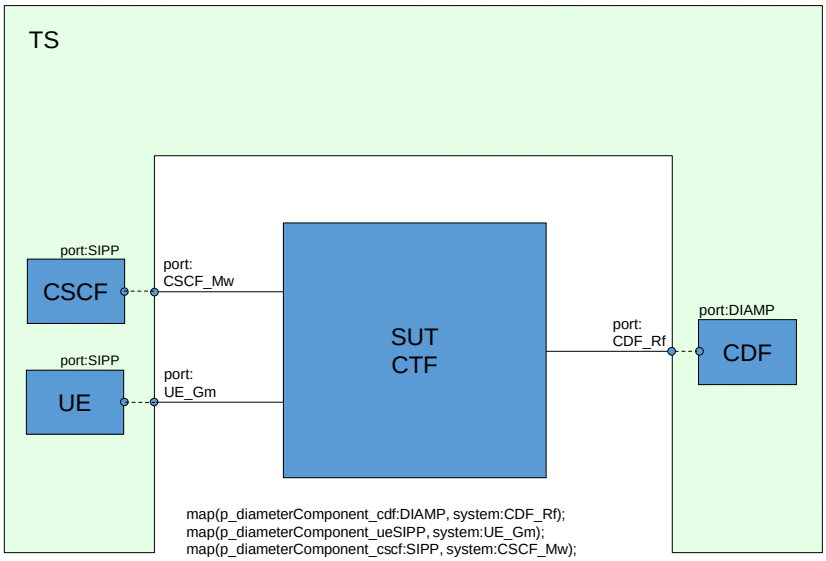


Figure 18: Interconnection for CTF role with Gm and Mw interfaces

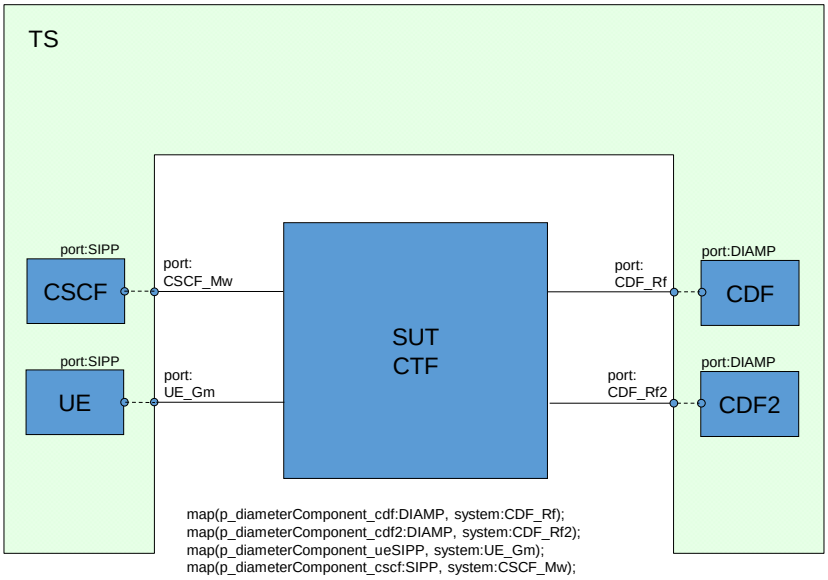


Figure 19: Interconnection for CTF role with Gm and Mw interfaces and a secondary CDF

4.2.3.2 Ro interface

4.2.3.2.1 OCF role

The figures below show the interconnection of TS and SUT in terms of signalling message flows. Diameter messages are transferred over the DIAMP port.

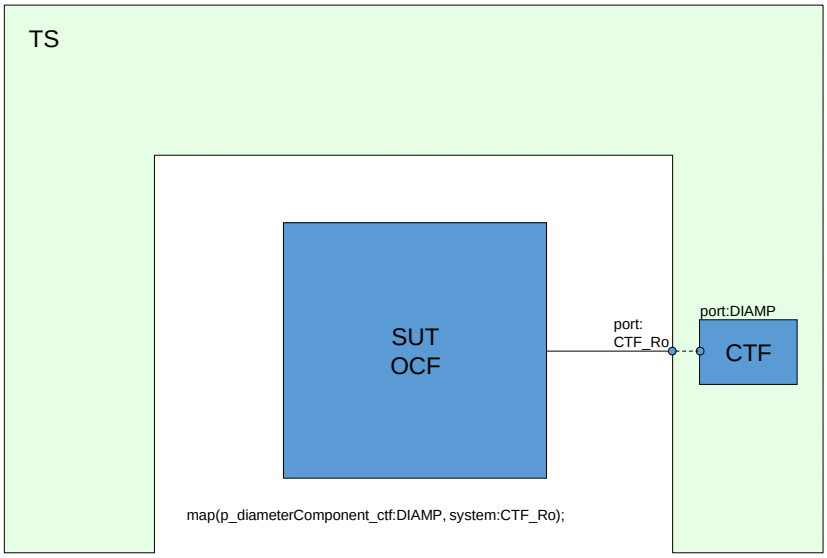


Figure 20: Interconnection for OCF role

4.2.3.2.2 CTF role

The figures below show the interconnection of TS and SUT in terms of signalling message flows. Diameter messages are transferred over the DIAMP port. Some tests may require additional triggering via the Gm or Mw ports. The configuration can be enabled or disabled by using PIXIT parameter "SIPsupport".

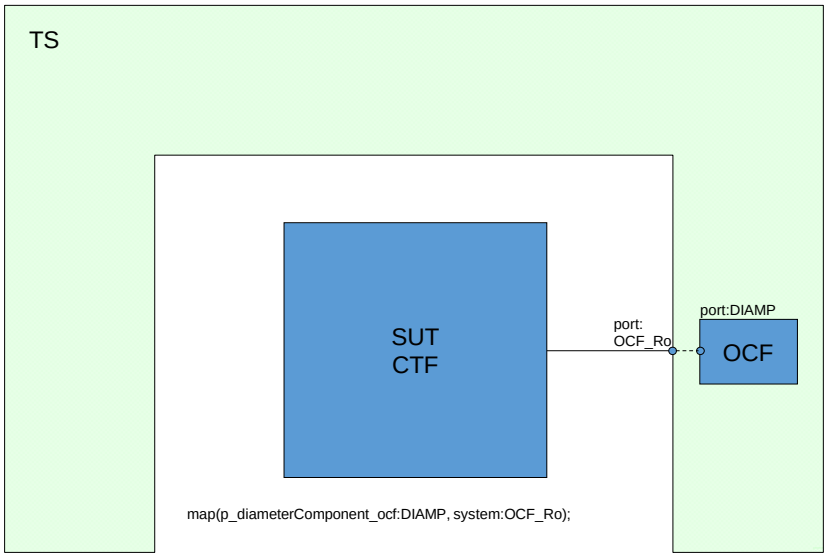


Figure 21: Interconnection for CTF role

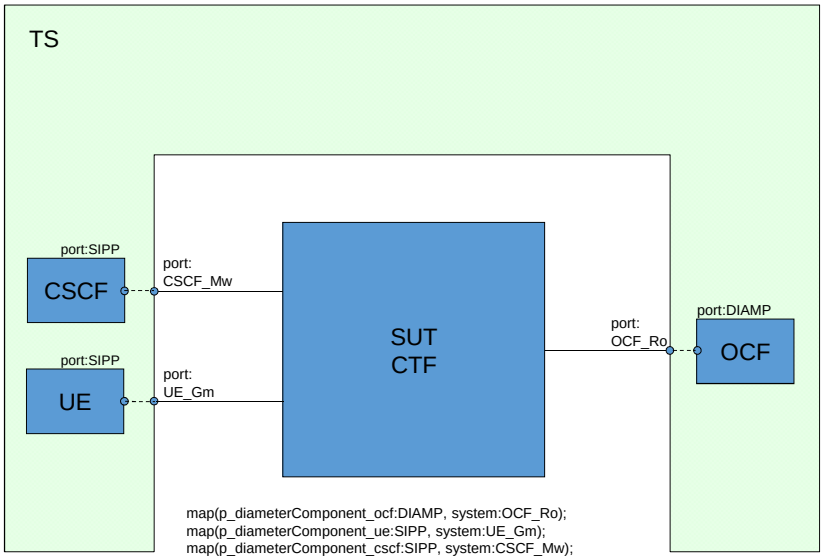


Figure 22: Interconnection for CTF role with Gm and Mw interfaces

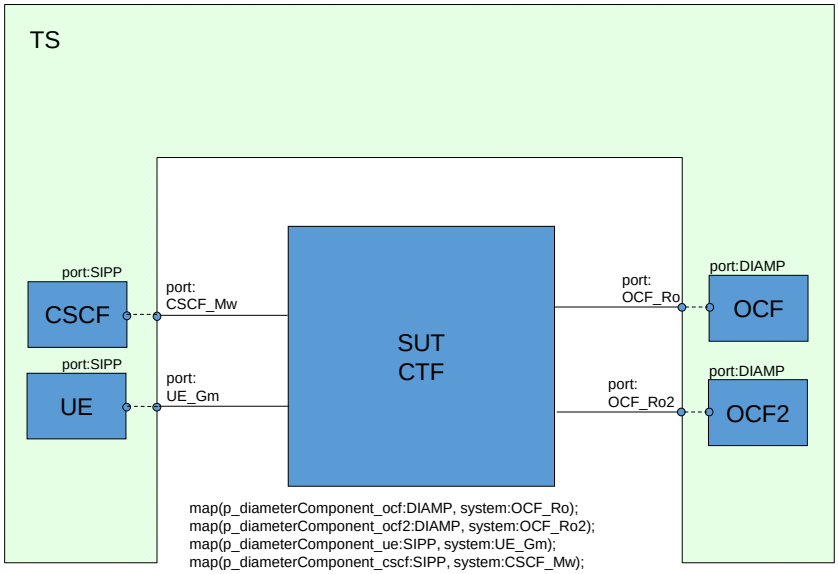


Figure 23: Interconnection for CTF role with Gm and Mw interfaces and a secondary OCF

4.2.3.3 Test Adapter

For execution of the tests the Test Adapter (TA) shall be developed. There are two possibilities to communicate over TA:

- ATS provides only Diameter messages; or
- ATS provides Diameter messages and LL primitives.

5 ATS conventions

5.1 Introduction

The ATS conventions are intended to give a better understanding of the ATS but they also describe the conventions made for the development of the ATS. These conventions shall be considered during any later maintenance or further development of the ATS.

The ATS conventions contain two clauses, the testing conventions and the naming conventions. The naming conventions describe the structure of the naming of all ATS elements.

To define the ATS, the guidelines of the document ETSI ETS 300 406 [8] were considered.

5.2 Testing conventions

5.2.1 Test cases Preamble and Postamble

As described in the test method clause the test tool shall behave as an x-CSCF when the IUT is a charging server and shall behave as a charging server when the IUT is an x-CSCF. For that reason the test case preambles and postambles are named as follows:

IUT is a Rf/CTF (example TC_RF_CTF_MS_01)

`f_preamble_Rf_CDF`

`f_postamble_Rf_CDF`

NOTE 1: The tester also behaves as a Diameter Server.

IUT is a Rf/CDF (example TC_RF_CDF_MS_01)

`f_preamble_Rf_CTF`

`f_postamble_Rf_CTF`

NOTE 2: The tester also behaves as a Diameter Client.

IUT is a Ro/CTF (example TC_RO_CTF_MS_01)

`f_preamble_Ro_OCF`

`f_postamble_Ro_OCF`

NOTE 3: The tester also behaves as a Diameter Server.

IUT is a Ro/OCF (example TC_RO_OCF_MS_01)

`f_preamble_Ro_CTF`

`f_postamble_Ro_CTF`

NOTE 4: The tester also behaves as a Diameter Client.

5.3 Naming conventions

5.3.1 General guidelines

The naming conventions are based on the following underlying principles:

- In most cases, identifiers should be prefixed with a short alphabetic string (specified in table 1) indicating the type of TTCN-3 element it represents.
- Suffixes should not be used except in those specific cases identified in table 2.
- Prefixes and suffixes should be separated from the body of the identifier with an underscore ("_"):

EXAMPLE 1: `c_sixteen, t_wait_max`.

- Only module names, data type names and module parameters should begin with an upper-case letter. All other names (i.e. the part of the identifier following the prefix) should begin with a lower-case letter.
- The start of second and subsequent words in an identifier should be indicated by capitalizing the first character. Underscores should not be used for this purpose.

EXAMPLE 2: `f_authenticateUser`.

Table 1 specifies the naming guidelines for each element of the TTCN-3 language indicating the recommended prefix, suffixes (if any) and capitalization.

Table 1: TTCN-3 naming convention

Language element	Naming convention	Prefix	Suffix	Example	Notes
Module	Use upper-case initial letter	DiameterRfRo_	*none*	DiameterRfRo_Steps	
TSS grouping	Use all upper-case letters	*none*	*none*	TP_RF_CTF_TC	
Message template	Use lower-case initial letter	m_	none	m_authApplicationId	
Message template with wildcard or matching expression	Use lower-case initial letters	mw_	none	mw_subscriptionId	
Port instance	Use upper-case initial letter	*none*	*none*	DiameterPort	
Constant	Use lower-case initial letter	c_	*none*	c_maxRetransmission	
Function	Use lower-case initial letter	f_	*none*	f_authentication()	
Altstep	Use lower-case initial letter	a_	*none*	a_receive()	
Variable	Use lower-case initial letter	v_	*none*	v_basicId	
PICS values	Use all upper case letters	*PICS_*	*none*	PICS_RF_CDF_IUT	Note
PIXIT values	Use all upper case letters	*PX_*	*none*	PX_RO_CTF_CCFH_	Note
Parameterization	Use lower-case initial letter	p_	*none*	p_macId	
Enumerated Value	Use lower-case initial letter	e_	*none*	e_synCpk	
NOTE: In this case it is acceptable to use underscore as a word delimiter.					

5.3.2 Test case grouping

The ATS structure is based on the Test Purposes for the Diameter protocol on the RfRo interface as defined in ETSI TS 103 374-2 [4].

5.3.3 Test case identifiers

The test cases have been divided according to the functionalities into several groups.

The test case names are built up according to the following scheme.

Table 2: TC identifier naming convention scheme

Identifier: "<tc>"_"<iut >"_"<scope >"_"<number>"			
<tc>	=	Test Case:	fixed to "TC"
<interface>	=	type of interface:	RF or RO
<iut>	=	type of IUT:	CDF, CTF or OCF
<scope>	=	group	MS Message syntax
			TC Type of Charging
			EC Error Cases
			CH Tariff Changes
			RE Re-authorization
			FH Failure Handling
			FA Failover
			CP Credit Pooling
			OP Other procedures ([2] Clause 6.5)
<number>	=	sequential number	(01-99)

NOTE: This naming scheme results into a one-to-one correspondence between the test purpose identifiers as defined in ETSI TS 103 374-2 [4] and the test case identifiers.
The TP identifier of the test case TC_xxx_01 is TP_xxx_01.

Annex A (normative): DIAMETER Rf/Ro Partial PIXIT pro forma

A.1 The right to copy

Notwithstanding the provisions of the copyright clause related to the text of the present document, ETSI grants that users of the present document may freely reproduce the Partial PIXIT pro forma in this annex so that it can be used for its intended purposes and may further publish the completed Partial PIXIT.

The PIXIT Pro forma is based on ISO/IEC 9646-6 [6]. Any additional information which may be needed can be found in this international standard document.

A.2 Identification summary

Table A.1

PIXIT Number:	
Test Laboratory Name:	
Date of Issue:	
Issued to:	

A.3 ATS summary

Table A.2

Protocol Specification:	ETSI TS 132 260 [1] (3GPP TS 32.260 version 10.14.0 Release 10) ETSI TS 132 299 [2] (3GPP TS 32.299 version 10.15.0 Release 10)
Protocol to be tested:	
ATS Specification:	ETSI TS 103 374-2 [4]
Abstract Test Method:	ETSI TS 103 374-3, clause 4

A.4 Test laboratory

Table A.3

Test Laboratory Identification:	
Test Laboratory Manager:	
Means of Testing:	
SAP Address:	

A.5 Client identification

Table A.4

Client Identification:	
Client Test manager:	
Test Facilities required:	

A.6 SUT

Table A.5

Name:	
Version:	
SCS Number:	
Machine configuration:	
Operating System Identification:	
IUT Identification:	
PICS Reference for IUT:	
Limitations of the SUT:	
Environmental Conditions:	

A.7 Protocol layer information

A.7.1 Protocol identification

Table A.6

Name:	ETSI TS 132 260 [1] (3GPP TS 32.260 version 10.14.0 Release 10) ETSI TS 132 299 [2] (3GPP TS 32.299 version 10.15.0 Release 10)
Version:	
PICS References:	ETSI TS 103 374-1 [3]

A.8 PIXIT items

A.8.1 Introduction

Tables in this clause need to be filled by the IUT Manufacturer to specify how the IUT needs to be configured with IUT specific values or describe IUT specific procedures required for complete testing of the IUT.

Each PIXIT item corresponds to a Module Parameter of the ATS.

A.8.2 Port and Address items

Table A.7: Test system ports and addresses

It.	Identifier	Type	Description
1	PX_DIAMETER_RF_ETS_IPADDR	Charstring	Rf IP address of the test system
2	PX_DIAMETER_RF_ETS_PORT	Integer	Rf Port number of the test system
3	PX_DIAMETER_RF_ETS_IPADDR2	Charstring	Rf IP address of the 2nd test system
4	PX_DIAMETER_RF_ETS_PORT2	Integer	Rf Port number of the 2nd test system
5	PX_DIAMETER_RO_ETS_IPADDR	Charstring	Ro IP address of the test system
6	PX_DIAMETER_RO_ETS_PORT	Integer	Ro Port number of the test system
7	PX_DIAMETER_RO_ETS_IPADDR2	Charstring	Ro IP address of the 2nd test system
8	PX_DIAMETER_RO_ETS_PORT2	Integer	Ro Port number of the 2nd test system
9	PX_DIAMETER_GM_ETS_UE_IPADDR	Charstring	IP address of the test system UE
10	PX_DIAMETER_GM_ETS_UE_PORT	Integer	Port number of the test system UE
11	PX_DIAMETER_MW_ETS_CSCF_IPADDR	Charstring	IP address of the test system SCSF
12	PX_DIAMETER_MW_ETS_CSCF_PORT	Integer	Port number of the test system SCSF

Table A.8: SUT ports and addresses

It.	Identifier	Type	Description
1	PX_DIAMETER_RF_SUT_IPADDR	Charstring	Rf IP address of the system under test
2	PX_DIAMETER_RF_SUT_PORT	Integer	Rf Port number of the system under test
3	PX_DIAMETER_RO_SUT_IPADDR	Charstring	Ro IP address of the system under test
4	PX_DIAMETER_RO_SUT_PORT	Integer	Ro Port number of the system under test
5	PX_DIAMETER_GM_SUT_PCSCF_IPADDR	Charstring	PCSCF IP address of the system under test
6	PX_DIAMETER_GM_SUT_PCSCF_PORT	Integer	PCSCF Port number of the system under test
7	PX_DIAMETER_MW_SUT_CSCF_IPADDR	Charstring	CSCF IP address of the system under test
8	PX_DIAMETER_MW_SUT_CSCF_PORT	Integer	CSCF Port number of the system under test

A.8.3 Rf/Ro interface items

Table A.9: Rf/Ro interface

It.	Identifier	Type	Description
1	PX_SessionID	UTF8String	The Session-Id
2	PX_OriginHost	Charstring	The Origin-Host
3	PX_OriginHost_2nd	Charstring	The second Origin-Host
4	PX_OriginRealm	Charstring	The Origin-Realm
5	PX_DestinationHost	Charstring	The Destination-Host
6	PX_DestinationRealm	Charstring	The Destination-Realm
7	PX_CC_TIME_VALUE	UInt32	The CC-Time AVP value
8	PX_CC_TIME_VALUE_USED	UInt32	The CC-Time AVP value
9	PX_SERVICE_CONTEXT_ID	UTF8String	The Service Context Identifier
10	PX_TRIGGER_TYPE	Enumerated	The Trigger-Type AVP value
11	PX_REDIRECT_ADDRESS_TYPE	Enumerated	The Redirect-Address-Type AVP value (e.g. IPv4)
12	PX_REDIRECT_SERVER_ADDRESS	UTF8String	The Redirect-Server-Address AVP value
13	PX_TIME_QUOTA_TYPE	Enumerated	The Time-Quota-Type AVP value
14	PX_SECONDARY_OCF_ADDRESS	UTF8String	The secondary OCF IP address
15	PX_REPORTING_REASON_TYPE_TABLE4	Enumerated	The Reporting-Reason AVP value
16	PX_REPORTING_REASON_TYPE_TABLE5	Enumerated	The Reporting-Reason AVP value
17	PX_TIME_QUOTA_TYPE_TABLE6	Enumerated	The Time-Quota AVP value
18	PX_TIME_QUOTA_TYPE_TABLE7	Enumerated	The Time-Quota AVP value
19	PX_VA	Integer	The variant selection
20	PX_SIPsupport	Boolean	boolean indicator that is true if the Gm interface (SIP protocol) is accessible to trigger Diameter events at the Rf/Ro interface

A.8.4 LibSip items

Table A.10: PIXIT for LibSip

It.	Identifier	Type	Description
1	PX_SIP_SDP_USER_NAME	Charstring	SDP user name
2	PX_SIP_SDP_SESSION_ID	Charstring	SDP session identifier
3	PX_SIP_SDP_DYN	Charstring	SDP dynamic port
4	PX_SIP_SDP_B_MODIFIER	Charstring	SDP bandwidth modifier
5	PX_SIP_SDP_B_BANDWIDTH	Integer	SDP bandwidth value
6	PX_SIP_SDP_ENCODING	Charstring	SDP media attribute encoding supported by the IUT
7	PX_SIP_SDP_CLOCKRATE	Charstring	SDP media attribute encoding clockrate supported by the IUT
8	PX_MB_LENGTH_FROM_ENCVAL	Boolean	MessageBody length calculation based on encvalue operation result
9	PX_USE_FX_FOR_XML_LENGTH	Boolean	MessageBody length calculation to be performed by external function
10	PX_SIP_TRANSPORT	Charstring	Used Transport in upper case "UDP"/"TCP"
11	PX_SIP_REGISTRATION	Boolean	the SIP user if it have to register itself before executing a test case
12	PX_AUTH_ALGORITHM	Charstring	PX_AUTH_ALGORITHM security algorithm Possible values: MD5 or AKAv1-MD5
13	PX_SIP_REGISTER_AUTHENTICATION_ENABLED	Boolean	option controlling if authentication is enabled/disabled for REGISTER messages
14	PX_SIP_INVITE_AUTHENTICATION_ENABLED	Boolean	option controlling if authentication is enabled/disabled for INVITE messages
15	PX_SIP_TWAIT	Float	TWait default value for waiting an operator action
16	PX_SIP_TACK	Float	TAck default value for waiting an acknowledgement
17	PX_SIP_TRESP	Float	TResp default value for waiting for a response from the IUT
18	PX_SIP_TNOACT	Float	TNoAct default value for waiting no message from the IUT Value given for PX_TNOACT should be less than value of SHORT_REGISTRATION constant (which is currently "3" (seconds))
19	PX_SIP_MIME_BOUNDARY	Charstring	Delimiter value used in mime multipart message to separate message body parts

A.8.5 LibCommon items

Table A.11: PIXIT for LibCommon

It.	Identifier	Type	Description
1	PX_TSYNC_TIME_LIMIT	Float	Default time limit for a sync client to reach a synchronization point
2	PX_TSHUT_DOWN_TIME_LIMIT	Float	Default time limit for a sync client to finish its execution of the shutdown default

Annex B (normative): DIAMETER Rf/Ro Abstract Test Suite (ATS)

B.1 The TTCN-3 Module

This ATS has been produced using the Testing and Test Control Notation (TTCN-3) according to ETSI ES 201 873-1 [9].

The TTCN-3 library modules corresponding to the ATS are contained in archive ts_10337403v101010p0.zip which accompanies the present document.

History

Document history		
V1.1.1	May 2016	Publication