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Second edition
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Information technology — Open Systems Interconnection — Conformance testing methodology and framework —

Part 1:
General concepts

Technologies de l'information — Interconnexion de systèmes ouverts — Cadre général et méthodologie des tests de conformité OSI —

Partie 1: Concepts généraux

Reference number
ISO/IEC 9646-1:1994(E)

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

International Standard ISO/IEC 9646-1 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee 21, *Open Systems Interconnection, data management and open distributed processing*.

This second edition cancels and replaces the first edition (ISO/IEC 9646-1:1991) which has been technically revised. It also consolidates Technical Corrigendum 1.

ISO/IEC 9646 consists of the following parts, under the general title *Information technology — Open Systems Interconnection — Conformance testing methodology and framework*:

- *Part 1: General concepts*
- *Part 2: Abstract Test Suite specification*
- *Part 3: The Tree and Tabular Combined Notation*
- *Part 4: Test realization*
- *Part 5: Requirements on test laboratories and clients for the conformance assessment process*
- *Part 6: Protocol profile test specification*
- *Part 7: Implementation conformance statements*

Annexes A and B of this part of ISO/IEC 9646 are for information only.

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Introduction

The objective of OSI will not be completely achieved until systems can be tested to determine whether they conform to the relevant protocol and profile specifications. The relevant ones can be OSI International Standards, ITU-T Recommendations or International Standardized Profiles.

Standardized Abstract Test Suites should be developed for each International Standard or ITU-T Recommendation which specifies an OSI protocol, for use by suppliers or implementors in self-testing, by users of OSI products, by telecommunications administrations and recognized private operating agencies, or by other third party testing organizations. Standardized Profile Test Specifications should be developed for each OSI profile defined in an International Standardized Profile, or in an International Standard or ITU-T Recommendation, to specify how to combine and select from these Abstract Test Suites for the purpose of testing conformance of systems to that profile. This should lead to comparability and wide acceptance of test results produced by different test laboratories, and thereby minimize the need for repeated conformance testing of the same system.

The standardization of test suites requires international definition and acceptance of a common testing methodology, together with appropriate testing methods and procedures. It is the purpose of ISO/IEC 9646 to define the methodology, to provide a framework for specifying conformance test suites, and to define the procedures to be followed during testing.

Conformance testing involves testing both the capabilities and behaviour of an implementation, and checking what is observed against the conformance requirements in the relevant International Standards or ITU-T Recommendations and if appropriate in the related International Standardized Profiles and against what the implementor states the implementation capabilities are.

Conformance testing does not include assessment of the performance nor the robustness or reliability of an implementation. It cannot give judgements on the physical realization of the Abstract Service Primitives, how a system is implemented, how it provides any requested service, nor the environment of the protocol implementation. It cannot, except in an indirect way, prove anything about the logical design of the protocol itself.

The purpose of conformance testing is to increase the probability that different OSI implementations are able to interwork. However it should be borne in mind that the complexity of most protocols makes exhaustive testing impractical on both technical and economic grounds. Also, testing cannot guarantee conformance to a specification since it detects errors rather than their absence. Thus conformance to a test suite alone cannot guarantee interworking. What it does do is give confidence that an implementation has the required capabilities and that its behaviour conforms consistently in representative instances of communication.

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It should be noted that the OSI basic reference model (ISO 7498: 1984 or CCITT X.200 (1984)) states (in 4.3):

> *"Only the external behaviour of Open Systems is retained as the standard of behaviour of real Open Systems"*

This means that although aspects of both internal and external behaviour are described in OSI International Standards and ITU-T Recommendations, it is only the requirements on external behaviour that have to be met by real open systems. Although some of the methods defined in ISO/IEC 9646-2 do impose certain limitations on the implementor, for example that there be some means of realizing control and observation at one or more Service Access Points, it should be noted that other methods defined herein do not impose such limitations.

However, in the case of partial OSI end-systems which provide OSI protocols up to a specific layer boundary, it is desirable to test not only the external behaviour of the implemented protocol entities, but also the ability of those entities to support correct external behaviour in higher layers.

Detailed investigation of relative benefits, efficiency and limitations of all methods is addressed in various parts of ISO/IEC 9646. However, any organization contemplating the use of test methods defined in ISO/IEC 9646-2 in a context such as certification should carefully consider the limitations on their applicability and the benefits of each.

Testing is voluntary as far as ISO/IEC and ITU-T are concerned. Requirements for testing in procurement and other external contracts are not a matter for standardization.

This part of ISO/IEC 9646 is also to be published by ITU-T as Recommendation X.290 but not as identical text.

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Information technology – Open Systems Interconnection – Conformance testing methodology and framework – Part 1: General concepts

1 Scope

1.1 ISO/IEC 9646 is a multi-part International Standard which specifies a general methodology for testing the conformance of products to OSI specifications which the products are claimed to implement. The methodology applies to testing conformance to

a) the specification of an OSI protocol;

b) the specification of a transfer syntax used in combination with a specific OSI protocol;

c) the specification of an OSI protocol profile, including the testing of conformance to any specified information objects used in combination with one or more of the protocols, as specified in the profile;

d) the specifications of a combination of OSI protocols, possibly used in combination with a specified transfer syntax and/or one or more specified information objects.

The OSI specification to which conformance is tested may be contained in an International Standard, an ITU-T Recommendation, or an International Standardized Profile.

1.2 ISO/IEC 9646 is in principle, applicable to conformance testing for Integrated Services Digital Network (ISDN).

1.3 ISO/IEC 9646 is applicable to conformance testing for those implementations of a protocol or set of protocols that require communication between two or more real open systems to achieve their purpose (*e.g.* Message Handling Service (MHS)), Directory Services, ISDN, Transaction Processing, Routeing, and Systems Management).

1.4 ISO/IEC 9646 is applicable to the different phases of the conformance testing process, these phases being characterized by three major activities. These activities are:

a) the specification of Abstract Test Suites (ATSs) for particular OSI protocols and Profile Test Specifications (PTSs) for particular OSI profiles;

b) realization of a Means of Testing (MOT) able to run an executable form of an Abstract Test Suite;

c) the conformance assessment process carried out by a test laboratory for a specific client on the basis of an Implementation Conformance Statement (ICS), culminating in the production of a System Conformance Test Report (SCTR) and one or more Protocol Conformance Test Reports (PCTR), one for each ATS used; the results are given in terms of the relevant protocol specification(s) and test suite(s) used.

This part is applicable to all three activities, providing tutorial introductory material, together with definitions of common terms and concepts.

NOTE - ISO/IEC 9646-2 deals with the requirements and guidance for the specification of ATSs, independent of test notation. ISO/IEC 9646-3 defines the recommended test notation. ISO/IEC 9646-4 deals with requirements and guidance for realization of the means of testing. ISO/IEC 9646-5 deals with requirements and guidance for test laboratories and their clients for the conformance assessment process. ISO/IEC 9646-6 deals with the requirements and guidance for PTSs based upon ATSs for each of the protocols involved. ISO/IEC 9646-7 deals with the requirements and guidance for ICSs, System Conformance Statements (SCSs), their proformas and Requirements Lists (RLs).

1.5 ISO/IEC 9646 specifies the requirements for and gives guidance on the procedures to be followed in OSI conformance testing.

1.6 ISO/IEC 9646 includes only such information as is necessary to meet the following objectives:

a) to achieve an adequate level of confidence in the tests as a guide to conformance;

b) to achieve comparability between the results of the corresponding tests on a particular OSI implementation applied in different places at different times;

c) to facilitate communication between the parties responsible for the activities described in 1.4 above.

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1.7 This part of ISO/IEC 9646 includes tutorial introductory material which provides

a) an exposition of the meaning of conformance in the context of OSI;

b) a description of the major categories of conformance tests;

c) an introduction to the conformance assessment process;

d) an introduction to the Abstract Test Methods and their applicability;

e) an introduction to the concepts of test suite design.

In addition, this part describes the relationship between the other parts of ISO/IEC 9646 and the activities involved in conformance testing, and introduces the concept of compliance with respect to the other parts of ISO/IEC 9646.

1.8 The following are outside the scope of ISO/IEC 9646:

a) certification, an administrative procedure which may follow conformance testing;

b) requirements for procurement and contracts;

c) testing by means of test methods which are specific to particular applications, protocols or systems;

d) testing by means other than PDU exchange;

NOTE – ISO/IEC 9646 does not apply fully to Physical layer protocols. Nevertheless, many of the concepts apply to all protocols.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 9646. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO/IEC 9646 are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 7498: 1984, *Information processing systems – Open Systems Interconnection – Basic Reference Model.*
(See also CCITT Recommendation X.200 (1984))

ISO/TR 8509: 1987, *Information processing systems – Open Systems Interconnection – Service conventions.*
(See also CCITT Recommendation X.210 (1988))

ISO/IEC 8825:1990, *Information technology – Open Systems Interconnection – Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1).*
(See also CCITT Recommendation X.209 (1988))

ISO/IEC 9646-2: 1994, *Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 2: Abstract Test Suite specification.*
(See also ITU-T Recommendation X.291 -[1])

ISO/IEC 9646-3: 1992, *Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 3: The Tree and Tabular Combined Notation (TTCN).*
(See also ITU-T Recommendation X.292 (1993))

ISO/IEC 9646-3 Amd 1: -[1], *Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 3: The Tree and Tabular Combined Notation - Amendment 1: TTCN extensions.*

ISO/IEC 9646-4: 1994, *Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 4: Test realization.*
(See also ITU-T Recommendation X.293 -[1])

ISO/IEC 9646-5: 1994, *Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 5: Requirements on test laboratories and clients for the conformance assessment process.*
(See also ITU-T Recommendation X.294 -[1])

ISO/IEC 9646-6: 1994, *Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 6: Protocol profile test specification.*
(See also ITU-T Recommendation X.295 -[1]).

ISO/IEC 9646-7: -[1], *Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 7: Implementation Conformance Statements.*
(See also ITU-T Recommendation X.296 -[1]).

1) To be published.

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ISO/IEC TR 10000-1: 1990, *Information technology - Framework and taxonomy of International Standardized Profiles, Part 1 - Framework.*

3 Definitions

3.1 Reference model definitions

This part of ISO/IEC 9646 is based upon the concepts developed in the Basic Reference Model for Open Systems Interconnection (ISO 7498 | CCITT X.200), and makes use of the following terms defined in that International Standard:

a) (N)-entity

b) (N)-layer

c) (N)-protocol

d) (N)-protocol-data-unit

e) (N)-relay

f) (N)-service

g) (N)-service-access-point

h) Application layer

i) Application-service-element

j) Data Link layer

k) Network layer

l) Physical layer

m) Presentation layer

n) real open system

o) real system

p) (N)-service data unit

q) Session layer

r) subnetwork

s) transfer syntax

t) Transport layer

3.2 Terms defined in other International Standards, ITU-T Recommendations and Technical Reports

3.2.1 This part of ISO/IEC 9646 uses the following terms defined in the OSI Service Conventions (ISO/TR 8509 | CCITT X.210):

a) service-user

b) service-provider

c) service primitive

3.2.2 This part of ISO/IEC 9646 uses the following term defined in the Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1) (ISO 8825 | CCITT X.209):

- encoding

3.2.3 This part of ISO/IEC 9646 uses the following terms defined in the Framework and Taxonomy of International Standardized Profiles (ISO/IEC TR 10000-1):

a) International Standardized Profile

b) profile

c) base standard

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NOTES

1 - In ISO/IEC 9646 the term profile is used to mean "protocol profile" as defined in 3.3.82 .

2 - In ISO/IEC 9646 the more general term "base specification" is used with similar meaning to base standard but independent of the status of the specification, as defined in 3.3.10 .

3.3 Conformance testing definitions

For the purposes of this part of ISO/IEC 9646 the following definitions apply:

3.3.1 abnormal (test case) termination: The term used to describe the result of execution of an abstract test case when it has been prematurely terminated by the test system.

3.3.2 abstract (N)-service-primitive [(N)-ASP]: An implementation-independent description of an interaction between a service-user and a service-provider at an (N)-service boundary, as defined in an OSI service definition.

3.3.3 abstract test case: A complete and independent specification of the actions required to achieve a specific test purpose, defined at the level of abstraction of a particular Abstract Test Method, starting in a stable testing state and ending in a stable testing state. This specification may involve one or more consecutive or concurrent connections.

NOTES

1 The specification should be complete in the sense that it is sufficient to enable a test verdict to be assigned unambiguously to each potentially observable test outcome (*i.e.* sequence of test events).

2 The specification should be independent in the sense that it should be possible to execute the derived executable test case in isolation from other such test cases (*i.e.* the specification should always include the possibility of starting and finishing in the "idle" state).

3.3.4 abstract test case error: A test case error resulting from an error in the abstract test case.

3.3.5 (abstract) test method [ATM]: The description of how an IUT is to be tested, given at an appropriate level of abstraction to make the description independent of any particular realization of a Means of Testing, but with enough detail to enable abstract test cases to be specified for this test method.

3.3.6 abstract test suite [ATS]: A test suite composed of abstract test cases.

3.3.7 abstract test suite [ATS] specification: A specification that contains a standardised ATS together with related information.

3.3.8 abstract testing context: Either a Multi-Party or Single-Party Testing context.

3.3.9 abstract testing methodology: An approach to describing and categorizing Abstract Test Methods.

3.3.10 base specification: A specification of a protocol, abstract syntax, encoding rules, or information object.

3.3.11 basic interconnection test [BIT]: A test of an IUT which has limited scope to determine whether or not there is sufficient conformance to the relevant protocol(s) for interconnection to be possible, without trying to perform thorough testing.

3.3.12 behaviour test: A test to determine the extent to which one or more dynamic conformance requirements are met by the IUT.

3.3.13 capability (of an implementation): A set of functions in the relevant protocol(s) which is supported by the implementation.

3.3.14 capability test: A test to verify the existence of one or more claimed capabilities of an IUT.

NOTE – Capability testing involves checking all mandatory capabilities and those optional ones that are stated in the ICS as supported, but not checking those optional ones which are stated in the ICS as not supported by the IUT.

3.3.15 client (of a test laboratory): An organization that submits a system or implementation for conformance testing.

3.3.16 common (sub)profile: A profile or specified subset of a profile which is included by reference within one or more other profiles.

3.3.17 comparability (of results): Characteristic of conformance assessment processes, such that their execution on the same IUT, in different testing environments, leads to the same overall summary of conformance for the specified IUT.

3.3.18 comprehensive testing service: A service, offered to clients by a test laboratory, to perform the conformance assessment process for one or more OSI protocol(s), with a choice of test methods sufficient to make the service applicable to all real open systems that claim to implement the specified protocols.

3.3.19 conformance assessment process: The complete process of accomplishing all conformance testing activities necessary to assess the conformance of an implementation or a system to one or more OSI specifications.

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3.3.20 conformance log: A human-readable record of information produced as a result of a test campaign, which is sufficient to record the observed test outcomes and verify the assignment of test results (including test verdicts).

3.3.21 conformance resolution test: A non-standardized, possibly system-specific test to fulfil a test purpose for which a standardized abstract test case is not defined, in order to investigate the behaviour of an OSI protocol implementation with respect to one or more particular conformance requirements.

3.3.22 (conformance) test suite: A complete set of test cases, possibly combined into nested test groups, that is needed to perform dynamic conformance testing for one or more OSI protocols.

NOTE – It should cover both capability testing and behaviour testing. It may be qualified by the adjectives: abstract or executable, as appropriate. Unless stated otherwise, an "abstract test suite" is meant.

3.3.23 conformance testing: Testing the extent to which an IUT is a conforming implementation.

3.3.24 conformance testing specification: One or more specifications that contain a standardized ATS, together with its related TSS&TP, partial IXIT proforma, and TMP specification, if any.

3.3.25 conforming implementation: An IUT which satisfies both static and dynamic conformance requirements, consistent with the capabilities stated in the ICS(s).

3.3.26 conforming system: A real system which satisfies both static and dynamic conformance requirements consistent with the capabilities stated in the ICS(s) referenced by the SCS.

3.3.27 Coordinated test method: An Abstract Test Method in which the Upper Tester is within the SUT and for which a standardized TMP is defined for the TCP, enabling the control and observation to be specified solely in terms of the Lower Tester activity, including the control and observation of Test Management PDUs.

3.3.28 Distributed test method: An Abstract Test Method in which the Upper Tester is within the SUT and there is a PCO at the upper service boundary of the IUT.

3.3.29 dynamic conformance requirement: One of the requirements which specifies what observable behaviour is permitted by the relevant specification(s) in instances of communication.

3.3.30 embedded testing: Testing specified for a single-protocol within a multi-protocol IUT including the specification of the protocol activity above the one being tested, but without specifying control or observation at service boundaries within the multi-protocol IUT.

NOTE - This definition assumes that the protocols of the IUT are ordered in a continuous adjacent user/provider relationship.

3.3.31 executable test case: A realization of an abstract test case.

3.3.32 executable test case error: A test case error in the realization of an abstract test case.

3.3.33 executable test suite [ETS]: A test suite composed of executable test cases.

3.3.34 fail (verdict): A test verdict given when the observed test outcome either demonstrates nonconformance with respect to (at least one of) the conformance requirement(s) on which the test purpose of the test case is focused, or contains at least one invalid test event, with respect to the relevant specification(s).

3.3.35 foreseen test outcome: An observed test outcome identified in the abstract test case.

NOTE – A foreseen test outcome may include an unidentified test event.

3.3.36 (ICS (proforma)) item: A row in an ICS (proforma) table.

3.3.37 (ICS (proforma)) question: The question to be answered in the intersection of an ICS item and either a support column (*i.e.* "Is this item supported in the context applying to this table and column?") or supported values column (*i.e.* "What values are supported for this item in the context applying to this table and column?") in an ICS proforma table.

3.3.38 idle testing state: A stable testing state in which there is no established connection of the relevant protocol(s) and in which the state of the SUT is independent of any previously executed test cases.

3.3.39 implementation conformance statement [ICS]: A statement made by the supplier of an implementation or system claimed to conform to a given specification, stating which capabilities have been implemented.The ICS can take several forms: protocol ICS, profile ICS, profile specific ICS, and information object ICS.

3.3.40 implementation conformance statement [ICS] proforma: A document, in the form of a questionnaire, which when completed for an implementation or system becomes an ICS.

3.3.41 implementation extra information for testing [IXIT] : A statement made by a supplier or implementor of an IUT which contains or references all of the information (in addition to that given in the ICS) related to the IUT and its

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testing environment, which will enable the test laboratory to run an appropriate test suite against the IUT. An IXIT can take several forms: protocol IXIT, profile IXIT, profile specific IXIT, and information object IXIT, TMP implementation statement.

3.3.42 implementation extra information for testing [IXIT] proforma: A document, in the form of a questionnaire, which when completed for an IUT or SUT becomes an IXIT.

NOTE - A complete IXIT proforma is developed in three stages. Firstly, the test suite specifier produces a "partial IXIT proforma" to accompany the test specification (ATS, PSTS, or PTS). Secondly, the test realizer augments the partial IXIT proforma to produce an "augmented partial IXIT proforma" for the Means of Testing. Thirdly, the test laboratory adds its own questions and information to produce the complete IXIT proforma for a test service. The terms "partial IXIT proforma" and "augmented partial IXIT proforma" are only used within ISO/IEC 9646 to distinguish the different stages of development.

3.3.43 implementation under test [IUT]: An implementation of one or more OSI protocols in an adjacent user/provider relationship, being that part of a real open system which is to be studied by testing.

3.3.44 inconclusive (verdict): A test verdict given when the observed test outcome is such that neither a pass nor a fail verdict can be given.

3.3.45 information object implementation conformance statement [information object ICS]: An ICS for an implementation or system claimed to conform to a given information object specification.

3.3.46 information object implementation extra information for testing [information object IXIT]: An IXIT for an implementation or system claimed to conform to a given information object specification.

3.3.47 initial testing state: The testing state in which a test body starts.

NOTE – This may be either a stable testing state or a transient state.

3.3.48 inopportune test event: A test event which occurs when not allowed to do so by the relevant specification(s) to which conformance is being tested.

3.3.49 invalid test event: A test event that violates at least one conformance requirement of the relevant specification(s) to which conformance is being tested.

NOTE – This term is not to be confused with the term "invalid event" as defined in ISO 7776 (X.25 level 2, High-level Data Link Control (HDLC)).

3.3.50 IUT component: That part of an IUT which communicates with a specific Lower Tester.

3.3.51 Local test method: An Abstract Test Method in which both the Lower and Upper Testers are located within the test system and there is a PCO at the upper service boundary of the IUT.

3.3.52 lower tester [LT]: The representation in ISO/IEC 9646 of the means of providing, during test execution, indirect control and observation of the lower service boundary of the IUT via the underlying service-provider.

NOTE – The underlying service-provider is immediately beneath the (lowest) protocol which is the focus of testing. It may use one or more OSI layers, or only the Physical medium.

3.3.53 lower tester control function [LTCF]: the means of providing the coordination of Lower Testers and the assignment of the verdict in the MPyT context.

3.3.54 means of testing [MOT] (IUTs): The combination of equipment and procedures that can perform the derivation, selection, parameterization and execution of test cases, in conformance with a reference standardized ATS, and can produce a conformance log.

3.3.55 multi-party testing [MPyT] context: A context in which the IUT is tested as a whole, and is required to communicate with multiple other real open systems concurrently.

3.3.56 multi-protocol testing: Testing of more than one protocol within the IUT by means of test cases which have test purposes which cover conformance requirements that relate to more than one protocol.

3.3.57 multi-specification dependency: A conformance requirement in one specification which specifies a requirement upon the support of another specification within a conforming system.

3.3.58 (observed) test outcome: The sequence of test events, together with associated data and/or parameter values, which occurred during test execution of a specific parameterized executable test case.

3.3.59 parameterized abstract test case: An abstract test case in which all relevant parameters have been supplied with values in accordance with specific ICS(s) and IXIT(s), as appropriate.

3.3.60 parameterized abstract test suite [PATS]: A Selected Abstract Test Suite in which all test cases have been parameterized in accordance with the appropriate ICS(s) and IXIT(s).

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3.3.61 parameterized executable test case: An executable test case, in which all appropriate parameters have been supplied with values in accordance with specific ICS(s) and IXIT(s), as appropriate, and corresponding to a parameterized abstract test case.

3.3.62 parameterized executable test suite [PETS]: A Selected Executable Test Suite, in which all test cases have been parameterized in accordance with the relevant ICS(s) and IXIT(s), as appropriate, and corresponding to a Parameterized Abstract Test Suite.

3.3.63 pass (verdict): A test verdict given when the observed test outcome gives evidence of conformance to the conformance requirement(s) on which the test purpose of the test case is focused, and when no invalid test event has been detected.

3.3.64 point of control and observation [PCO]: A point within a testing environment where the occurrence of test events is to be controlled and observed, as defined in an Abstract Test Method.

NOTE – A PCO is characterized by the set of ASPs and/or PDUs that can occur, according to the ATS, at that PCO.

3.3.65 preliminary result: Information to be recorded in the conformance log and to be used in determining the test verdict.

3.3.66 profile conformance testing: Testing the extent to which an IUT conforms to a profile specification.

3.3.67 profile implementation conformance statement [profile ICS]: An ICS for a system claimed to conform to a given profile, comprising the profile RL, plus the base specification ICSs plus the profile specific ICS, if any.

NOTE - The corresponding ISO/IEC TR 10000-1 term is "ISP Implementation Conformance Statement" (ISPICS).

3.3.68 profile implementation conformance statement [profile ICS] proforma: A profile RL plus the set of ICS proformas which when completed for a system and taken together with the profile RL become a profile ICS.

3.3.69 profile implementation extra information for testing [profile IXIT]: An IXIT related to testing for conformance to a given profile, comprising the profile XRL, plus the base specification IXITs, plus the profile specific IXIT, if any.

3.3.70 profile implementation extra information for testing [profile IXIT] proforma: A profile XRL plus the set of IXIT proformas which when completed for an SUT and taken together with the profile XRL become a profile IXIT.

3.3.71 (profile) IXIT requirements list [XRL]: A specification, within a profile test specification, of constraints on the answers allowed in base specification IXITs that are part of a profile IXIT for a system to be tested for conformance to the relevant profile.

3.3.72 (profile) requirements list [RL]: A specification of profile conformance requirements in the form of modifications to the status entries from the relevant base specification ICS proformas. These requirements specify additional constraints on the answers allowed in base specification ICSs that are part of the profile ICS for a system claimed to conform to the relevant profile.

3.3.73 profile specific implementation conformance statement [profile specific ICS]: An ICS for a system claimed to conform to a given profile, answering questions which are profile-specific and additional to those of the base specification ICS proforma items listed in the profile RL.

3.3.74 profile specific implementation extra information for testing [profile specific IXIT]: An IXIT related to testing conformance to a given profile, answering questions related to the IUT and its testing environment, which are profile-specific and additional to those of the base specification IXITs.

3.3.75 profile specific test specification [PSTS]: A specification which specifies the information necessary to extend and adapt the set of standardised ATSs relevant to the base specifications referenced by a given profile, including test cases for multi-protocol conformance requirements if necessary, in order to provide a complete set of abstract test cases for that profile.

3.3.76 profile test specification [PTS]: A PTS-Summary plus the set of documents referenced by it, including the set of base specification TSS&TP and ATSs plus the PSTS for the given profile.

3.3.77 profile specification: A specification which specifies one or more profiles. A profile specification may be an ISP, International Standard or a ITU-T Recommendation.

3.3.78 profile test specification summary [PTS -Summary] : A specification which references all the documents necessary to completely specify conformance testing for a given profile, including a TSS&TP and at least one ATS for each base specification referenced by the profile, and the PSTS.

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3.3.79 protocol conformance test report [PCTR]: A document produced at the end of a conformance assessment process, giving the details of the testing carried out using a particular ATS. It lists all of the abstract test cases and identifies those for which corresponding executable test cases were run, together with the verdicts assigned.

3.3.80 protocol implementation conformance statement [PICS]: An ICS for an implementation or system claimed to conform to a given protocol specification.

3.3.81 protocol implementation extra information for testing [PIXIT]: An IXIT related to testing for conformance to a given protocol specification.

3.3.82 (protocol) profile: A profile (as defined by ISO/IEC TR 10000-1) which specifies a selection of options from a set of related protocols, possibly together with one or more transfer syntaxes and/or information objects.

NOTES

1 Throughout ISO/IEC 9646 "profile" should be taken to mean "protocol profile". ISO/IEC 9646 in general refers to profiles and profile specifications. An ISP is an example of a profile specification specifying one or more profiles.

2 The profile specification may be in an ISP, an International Standard or ITU-T Recommendation.

3.3.83 PSTS test case replacement list: The list of abstract test cases from base specification ATSs to be deselected for a given profile and replaced by abstract test cases given in the PSTS.

3.3.84 reference (standardized) abstract test suite [reference (standardized) ATS]: The standardized ATS for which a Means of Testing is realized.

3.3.85 Remote test method: An Abstract Test Method in which the control and observation of test events is specified solely in terms of Lower Tester activity, and in which some requirements for TCP may be implied or informally expressed in the ATS, but in which no assumption is made regarding their feasibility or realization.

3.3.86 repeatability (of results): Characteristic of a test case, such that repeated executions on the same IUT under the same conditions lead to the same test verdict, and by extension a characteristic of a test suite.

3.3.87 role (of an implementation in an instance of communication): A major category of operation defined in base or profile specification, which can be used to describe an implementation in an instance of communication.

NOTE - Possible roles are initiator, responder, invoker, performer, manager, agent and the different categories of operation applicable to multi-party protocols.

3.3.88 selected abstract test suite [SATS]: The subset of an ATS selected using the ICS(s) and IXIT(s), relevant to the IUT.

3.3.89 selected executable test suite [SETS]: The subset of an ETS selected using the ICS(s) and IXIT(s), relevant to the IUT.

3.3.90 semantically invalid test event: A test event which is neither inopportune nor syntactically invalid, but which contains a semantic error with respect to the relevant protocol specification (*e.g.* a PDU containing a parameter value outside the negotiated range for that parameter).

3.3.91 single-party testing [SPyT] context: A context in which the IUT is required to communicate with a single other real open system.

3.3.92 single-protocol testing: Testing specified for a single protocol within a single-protocol or multi-protocol IUT.

3.3.93 stable testing state: A testing state which can be maintained, without prescribed Lower Tester behaviour, sufficiently long to span the gap between one test case and the next in a test campaign.

3.3.94 standardized abstract test suite [standardized ATS]: An ATS specified within an ISO/IEC or ITU-T published specification or, in the absence of such a specification, within a publicly available specification which is in the process of being standardized within ISO/IEC or ITU-T, and which has the highest standardization status available, and which has the status of at least a Committee Draft or equivalent.

3.3.95 static conformance requirement: One of the requirements that specify the limitations on the combinations of implemented capabilities permitted in a real open system which is claimed to conform to the relevant specification(s).

3.3.96 static conformance review: A review of the extent to which the static conformance requirements are claimed to be supported by the SUT, by comparing the answers in the ICS(s) and SCS with the static conformance requirements expressed in the relevant specification(s).

3.3.97 status (value): An allowed entry in the status column for an item in an ICS proforma table.

3.3.98 (support) answer: An allowed entry in the support or supported values columns for an item in an ICS, in answer to an ICS question.

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3.3.99 syntactically invalid test event: A test event which is not allowed syntactically by the relevant specification(s) to which conformance is claimed.

3.3.100 system conformance statement [SCS]: A document summarizing which OSI International Standards, ITU-T Recommendations or Profiles are implemented and to which ones conformance is claimed.

3.3.101 system conformance statement [SCS] proforma: A document, in the form of a questionnaire, which when completed for a system becomes an SCS.

3.3.102 system conformance test report [SCTR]: A document produced at the end of the conformance assessment process, giving an overall summary of the conformance of the implementation or system to the set of base or profile specifications for which conformance testing was carried out.

3.3.103 system under test [SUT]: The real open system in which the IUT resides.

3.3.104 template: A part of a proforma which can be used as the basis for developing a complete proforma.

NOTE - Templates may be specified for some ICS proformas, some IXIT proformas, PCTR proformas and SCTR proformas.

3.3.105 test body: The sequences of test events that achieve the test purpose.

3.3.106 test campaign: The process of executing the Parameterized Executable Test Suite for a particular IUT and producing the conformance log.

3.3.107 test case: An abstract or executable test case.

NOTE – In general the use of the word "test" in ISO/IEC 9646 will imply its normal English meaning. Sometimes it may be used as an abbreviation for abstract test case or executable test case. The context should make the meaning clear.

3.3.108 test case error: The term used to describe the result of execution of a test case when an error is detected in the test case itself.

3.3.109 test coordination procedures [TCP]: The rules for cooperation among Lower and Upper Testers, and the LTCF if applicable, during testing.

3.3.110 test event: An indivisible unit of test specification at the level of abstraction of the specification (*e.g.* sending or receiving a single PDU).

3.3.111 test group: A named set of related test cases.

3.3.112 test group objective: A prose description of the common objective which the test purposes within a specific test group are designed to achieve.

3.3.113 test laboratory: An organization that carries out conformance testing. This can be a third party, a user organization, a telecommunications administration or recognised private operating agency, or an identifiable part of a supplier organization.

3.3.114 test management protocol [TMP]: A protocol which is used to realize part or all of the TCP for a particular test suite.

3.3.115 test management protocol [TMP] implementation statement: A statement made by the client of a test laboratory, stating which capabilities of a specified TMP have been implemented in the SUT.

3.3.116 (test) postamble: The sequences of test events from the end of the test body up to the finishing stable testing state(s) for the test case.

3.3.117 (test) preamble: The sequences of test events from the starting stable testing state of the test case up to the initial testing state from which the test body will start.

3.3.118 test purpose: A prose description of a well defined objective of testing, focusing on a single conformance requirement or a set of related conformance requirements as specified in the appropriate OSI specification (*e.g.* verifying the support of a specific value of a specific parameter).

3.3.119 test realization: The process of producing a Means of Testing IUTs.

3.3.120 test realizer: An organization which takes responsibility for providing, in a form independent of the clients of a test laboratory and their IUTs, a Means of Testing IUTs in conformance with an ATS.

3.3.121 testing state: A state encountered during testing, comprising the combination of the states of the SUT, the test system, the protocols for which control and observation is specified in the ATS, and, if relevant, the state of the underlying service.

3.3.122 test step: A named subdivision of a test case, constructed from test events and/or other test steps.

3.3.123 test system: The real system which includes the realization of the Lower Tester.

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NOTE – The same test system can be used as part of several Means of Testing.

3.3.124 (test) verdict: A statement of "pass", "fail" or "inconclusive", as specified in an abstract test case, concerning conformance of an IUT with respect to that test case when it is executed.

3.3.125 transient testing state: Any testing state which is not a stable testing state.

NOTE – Transient testing states include those testing states that are in the middle of a logical exchange of PDUs (*e.g.* to establish a connection or perform negotiation), particularly when a request PDU has been sent (or received) and the corresponding response PDU has not been received (or sent).

3.3.126 unforeseen test outcome: An observed test outcome not specified in the abstract test case.

NOTE – An unforeseen test outcome can only lead to a test case error or an abnormal test case termination.

3.3.127 unidentified test event: A test event which is used to provide for receipt of PDUs and/or ASPs without identifying them explicitly in the test case.

NOTE – In TTCN, the unidentified test event is the Otherwise statement.

3.3.128 upper tester [UT]: The representation in ISO/IEC 9646 of the means of providing, during test execution, control and observation of the upper service boundary of the IUT, as defined by the chosen Abstract Test Method.

3.3.129 valid test event: A test event which is allowed by the protocol specification, being both syntactically and semantically correct, and occurring when allowed to do so by the protocol specification.

4 Abbreviations

For the purposes of this part of ISO/IEC 9646 the following abbreviations apply.

ASN.1: abstract syntax notation one

ASP: abstract service primitive

ATM: abstract test method

ATS: abstract test suite

BIT: basic interconnection test

DTE: data terminal equipment

ETS: executable test suite

ICS: implementation conformance statement

ISDN: integrated services digital network

ISP: international standardized profile

IUT: implementation under test

IXIT: implementation extra information for testing

LT: lower tester

LTCF: lower tester control function

MHS: message handling service

MOT: means of testing

MPyT: multi-party testing

OSI: open systems interconnection

PATS: parameterized abstract test suite

PCO: point of control and observation

PCTR: protocol conformance test report

PDU: protocol data unit

PETS: parameterized executable test suite

PICS: protocol implementation conformance statement

PIXIT: protocol implementation extra information for testing

PSTS: profile specific test specification

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PTS: profile test specification
RL: requirements list
SAP: service-access-point
SATS: selected abstract test suite
SCS: system conformance statement
SCTR: system conformance test report
SETS: selected executable test suite
SPyT: single-party testing
SUT: system under test
TCP: test. coordination procedures
TMP: test management protocol
TSS&TP: test suite structure and test purposes
TTCN: tree and tabular combined notation
UT: upper tester
XRL: IXIT requirements list

5 The meaning of conformance in OSI

5.1 Introduction

In the context of OSI, a real system is said to exhibit conformance if it complies with the requirements of applicable OSI specifications in its communication with other real systems.

Applicable OSI specifications include those that specify protocols or protocol profiles, and those that specify abstract syntaxes and encoding rules or information objects (in so far as they are implemented in conjunction with protocols).

Conformance to a profile specification should always imply conformance to the relevant set of base specifications.

5.2 Conformance requirements

5.2.1 Conformance requirements can be

a) mandatory requirements: these are to be observed in all cases;

b) conditional requirements: these are to be observed if the conditions set out in the specification apply;

c) options: these can be selected to suit the implementation, provided that any requirements applicable to the option are observed; more information on options is provided in annex A.

For example, ITU-T essential facilities are mandatory requirements; additional facilities can be either conditional or optional requirements.

NOTE – The ITU-T terms "essential facilities" and "additional facilities" need to be considered in the context of the scope of the ITU-T Recommendation concerned; for example, in many cases, essential facilities are mandatory for networks but not for Data Terminal Equipment (DTE).

5.2.2 Furthermore, conformance requirements can be stated

a) positively: they state what is required to be done;

b) negatively: they state what is required not to be done.

5.2.3 Finally, conformance requirements fall into two groups:

a) static conformance requirements;

b) dynamic conformance requirements.

These are discussed in 5.3 and 5.4, respectively.

5.3 Static conformance requirements

Static conformance requirements are those that specify the limitations on the combinations of implemented capabilities permitted in a real system which is claimed to conform to the relevant base or profile specification(s). They define the

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allowed minimum capabilities in order to facilitate interworking. They may be specified at a broad level, such as the grouping of Protocol Data Units (PDUs) into functional units or protocol classes, or at a detailed level, such as a range of values that have to be supported for specific parameters or timers.

Static conformance requirements can be of two varieties:

a) those which determine the capabilities to be included in the implementation of a particular base specification;

b) those which determine dependencies on the support of other base specifications (*e.g.* supporting services and protocols). These are likely to be found in profile specifications and upper layer protocol specifications.

NOTE - For more detail, see ISO/IEC 9646-2 for requirements expressed in conformance clauses, and ISO/IEC 9646-7 for requirements expressed in ICS proformas.

5.4 Dynamic conformance requirements

Dynamic conformance requirements are all those requirements which specify what observable behaviour is permitted by the relevant base or profile specification(s) in instances of communication using a particular protocol. They form the bulk of each protocol specification and may also be a major aspect of other base specifications. They define the set of allowable behaviours of an implementation or real system. This set of allowable behaviours implicitly defines the maximum set of capabilities allowed by the relevant specification(s), related to the use of the relevant protocol, that a conforming implementation or real open system can have.

A system exhibits dynamic conformance in an instance of communication if its behaviour is a member of the set of all behaviours permitted by the relevant protocol specification(s), and if appropriate by the other base and/or profile specification(s), in a manner which is consistent with the static conformance requirements.

Dynamic conformance requirements of a protocol specification are those that define the actual protocol: the use and format of its PDUs, state transitions, negotiation rules, *etc.* They are usually structured according to the major capabilities (*e.g.* functional units) that are the subject of the main static conformance requirements.

5.5 Conformance requirements related to transfer syntaxes.

Conformance requirements related to a transfer syntax are to be stated in the conformance requirements of the protocols using the transfer syntax.

When a protocol specification, which defines its PDUs in compliance with Abstract Syntax Notation One (ASN.1), is implemented, the PDUs are required to conform to the specified abstract syntax of these PDUs, and to a defined set of encoding rules, such as one of those defined in ISO/IEC 8825.

NOTE - The application of a set of encoding rules to an abstract syntax constitutes a transfer syntax (conformance to encoding rules is meaningless without a reference to an abstract syntax).

5.6 Implementation Conformance Statements (ICSs)

5.6.1 Introduction

To evaluate the conformance of a particular system, it is necessary to have a statement of the capabilities and options which have been implemented, for each specification which is supported, so that the system can be tested for conformance against relevant requirements, and against those requirements only. Such a statement is called an Implementation Conformance Statement (ICS).

If a set of interrelated specifications has been implemented in a system, an ICS is needed for each specification.

NOTE - See ISO/IEC 9646-7 for full details about the various types of ICS.

5.6.2 Protocol Implementation Conformance Statement (PICS)

An ICS for a single protocol is called a Protocol Implementation Conformance Statement (PICS).

In a PICS there should be a distinction between the following categories of information which it may contain:

a) information related to the mandatory, optional and conditional static conformance requirements of the protocol itself;

b) information related to the mandatory, optional and conditional static conformance requirements for dependencies on supporting services and protocols.

5.6.3 Profile Implementation Conformance Statement (profile ICS)

An ICS for a profile is called a Profile Implementation Conformance Statement.

A profile ICS consists of the set of PICSs for the protocols within the profile, any ICSs for information objects within the scope of the profile, the profile specific ICS, if any, plus the profile Requirements List (RL). The profile RL specifies restrictions on

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answers in each PICS and information object ICS to meet the requirements of the profile specification. The profile specific ICS gives any necessary further statement of capabilities and options implemented, related to the profile but not covered by any of the other ICSs.

Thus, the profile ICS can be described by the following formula:

$$\text{Profile ICS} = \Sigma(\text{PICS}) + [\Sigma\text{Information Object ICS} + \text{Profile Specific ICS}] + \text{Profile RL} \quad (1)$$

5.6.4 System Conformance Statement (SCS)

A summary of the set of ICSs for a system is called a System Conformance Statement (SCS), itemizing all specifications supported by the system for which a distinct ICS is provided. The SCS is also used to provide information on the configurability of the system and to identify which specifications are to be the subject of conformance testing.

In addition, the SCS should identify the transfer syntaxes to which conformance is claimed. Details of transfer syntax support may be included in the PICS for the relevant protocol.

NOTE - See ISO/IEC 9646-7 for full details about the SCS.

5.7 A conforming system

5.7.1 When referring to a set of related protocols and transfer syntaxes, a conforming system is one which satisfies both static and dynamic conformance requirements, consistent with the capabilities stated in the PICS, for each protocol referenced by the SCS. The conformance requirements of a protocol may depend on the requirements of another protocol.

5.7.2 When referring to one or more protocol profiles, a conforming system is one which satisfies both static and dynamic conformance requirements of the base specifications referenced by the profile(s), consistent with the capabilities stated in the profile ICS, the whole set being referenced by the SCS.

5.8 Interworking and conformance

5.8.1 The primary purpose of conformance testing is to increase the probability that different implementations are able to interwork.

5.8.2 While conformance is a necessary condition, it is not on its own a sufficient condition to guarantee interworking capability. Even if two implementations conform to the same protocol specification, they may fail to interwork fully. Trial interworking is therefore recommended.

5.8.3 Successful interworking of two or more real open systems is more likely to be achieved if they all conform to the same profile(s) than if they do not.

In order to prepare two or more systems for successful interworking, it is recommended that a comparison be made of the SCSs and ICSs of these systems.

If the ICSs indicate that different profiles, or different subsets or versions of the base specifications, have been implemented, the nature of the differences and their implications for interworking need to be determined. This study should be undertaken both for the options in the base specifications themselves, and for the combined use of the base specifications in the real open systems.

5.8.4 Further information to assist interworking between two real open systems can be obtained by comparing other relevant information, including test reports and IXITs (see 6.2). The comparison can focus on:

a) additional mechanisms claimed to work around known ambiguities or deficiencies not yet corrected in the specifications or in other real open systems with which interworking is desired, *e.g.* the solution of multi-protocol problems;

b) selection of optional capabilities which are not constrained by the static conformance requirements of the base or profile specifications (*i.e.* where the implementor has a free choice, *e.g.* the provision of an inactivity timer of a specific duration).

NOTE - The comparison can be made between two individual systems, between two or more types of product, or, for the ICS comparison only, between two or more specifications for procurement, permissions to connect, *etc.*

5.8.5 ISO/IEC 9646-5: 1994, annex A, specifies a System Conformance Test Report proforma which includes an appropriate warning, stating the limits of conformance testing with respect to interworking.

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6 Conformance and testing

6.1 Objectives of conformance testing

6.1.1 Introduction

Conformance testing as discussed in ISO/IEC 9646 is focused on testing for conformance to specifications of protocols. However, it also applies to testing for conformance to specifications which include non-protocol conformance requirements (e.g for transfer syntax or information objects) to the extent that these can be tested by testing in combination with a protocol. Testing for non-protocol requirements in isolation is specifically excluded.

In principle, the objective of conformance testing is to establish whether the Implementation Under Test (IUT)conforms to the relevant specification(s). Practical limitations make it impossible to be exhaustive, and economic considerations may restrict testing still further.

Therefore, ISO/IEC 9646 distinguishes four types of testing, according to the extent to which they provide an indication of conformance:

a) **basic interconnection tests**, which provide *prima facie* evidence that an IUT conforms;

b) **capability tests**, which check that the observable capabilities of the IUT are in accordance with the static conformance requirements and the capabilities claimed in the ICS(s);

c) **behaviour tests**, which endeavour to provide testing which is as comprehensive as possible over the full range of dynamic conformance requirements of the relevant specification(s), within the capabilities of the IUT and, if relevant, within the restrictions of the profile;

d) **conformance resolution tests**, which probe in depth the conformance of an IUT to particular requirements, to provide a definite yes/no answer and diagnostic information in relation to specific conformance issues; such tests are not standardized.

NOTE – As a by-product of conformance testing, errors and deficiencies in protocol specifications may be identified.

6.1.2 Basic Interconnection Tests

6.1.2.1 Basic Interconnection Tests (BITs) provide limited testing of an IUT in relation to the main features in a base or profile specification, to establish that there is sufficient conformance for interconnection to be possible, without trying to perform thorough testing.

6.1.2.2 BITs are appropriate

a) for detecting severe cases of non-conformance;

b) as a preliminary step to decide whether or not to run further capability and behaviour tests;

c) for checking addressing and other matters concerned with the testing environment;

d) for use by users of implementations, to determine whether the implementations appear to be usable for communication with other conforming implementations, *e.g.* as a preliminary to data interchange.

6.1.2.3 BITs are inappropriate

a) when taken on their own, as a basis for claims of conformance by the supplier of an implementation;

b) as a means to determine causes for communications failure.

6.1.2.4 Standardized BITs are always drawn from the set of capability and behaviour tests comprising a standardized Abstract Test Suite (standardized ATS). A list of which tests are appropriate may optionally be included. To provide additional tests in the standardized ATS for this purpose would contravene the requirements stated in ISO/IEC 9646-2.

6.1.3 Capability tests

6.1.3.1 Capability tests provide limited testing of each of the static conformance requirements in one or more base specifications and if appropriate a profile specification, to ascertain which capabilities stated in the ICS(s) can be observed, and to check that those observable capabilities are valid with respect to the static conformance requirements.

6.1.3.2 Capability tests are appropriate

a) to check that the capabilities of the IUT are consistent with the static conformance requirements;

b) to check as far as possible the consistency of the ICS(s) with the IUT;

c) when taken together with behaviour tests, as a basis for claims of conformance.

6.1.3.3 Capability tests are inappropriate

a) on their own, as a basis for claims of conformance by the supplier of an implementation;

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b) for testing in detail the behaviour associated with each capability which has been implemented or has not been implemented;

c) for resolution of problems experienced during live usage or where other tests indicate possible nonconformance even though the capability tests have been satisfied.

6.1.3.4 Capability tests are standardized within a standardized ATS, and may be executed either as a separate test group or together with the behaviour tests.

6.1.4 Behaviour tests

Behaviour tests test an implementation as thoroughly as is practical, over the full range of dynamic conformance requirements specified in one or more base specifications and, if relevant, within the restrictions of a profile.

6.1.4.1 Behaviour tests are appropriate, when taken together with capability tests, as a basis for the conformance assessment process.

6.1.4.2 Behaviour tests are inappropriate for resolution of problems experienced during live usage or where other tests indicate possible nonconformance even though the behaviour tests have been satisfied.

6.1.4.3 Behaviour tests are standardized as the major part of a standardized ATS.

6.1.4.4 Behaviour tests include tests for valid behaviour by the IUT in response to relevant valid and invalid behaviour by the Lower Tester.

6.1.5 Conformance resolution tests

6.1.5.1 Conformance resolution tests are non-standardized, possibly system-specific, tests to fulfil test purposes for which standardized abstract test cases are not defined. They may be used to complement the standardized tests used in the conformance assessment process, in order to investigate the behaviour of an IUT with respect to particular conformance requirements.

6.1.5.2 The test architecture and test method will normally be chosen specifically for the requirements to be tested, and need not be ones that are generally useful for other requirements. They may even be ones that are regarded as being unacceptable for standardized ATSs, *e.g.* involving implementation-specific methods using, say, the diagnostic and debugging facilities of the specific operating system.

6.1.5.3 In particular, conformance resolution tests may include SUT-specific means of controlling the occurrence of internal events and states (*e.g.* internally generated reset or the "busy" state) in order to test aspects of the protocol which are untestable using a standardized ATS.

6.1.5.4 Conformance resolution tests are appropriate

a) to fulfil test purposes that are identified in the relevant standardized test purposes, but for which no test cases can be included in the standardized ATS because of limitations of the chosen test method or the general untestability of the conformance requirement;

b) for providing a yes/no answer in a strictly confined and previously identified situation (*e.g.* during implementation development, to check whether a particular feature has been correctly implemented, or during operational use, to investigate the cause of problems).

c) to investigate the problems encountered in the execution of a standardized ATS.

6.1.5.5 Conformance resolution tests are inappropriate as a basis for judging whether or not an implementation conforms overall.

6.1.5.6 Conformance resolution tests are not standardized.

6.2 Extra information for testing

6.2.1 Implementation Extra Information for Testing (IXIT)

In order to test an IUT, the test laboratory will require information relating to the IUT and its testing environment in addition to that provided by the ICS. This Implementation eXtra Information for Testing (IXIT) will be provided by the client submitting the implementation for testing, as a result of completing, in consultation with the test laboratory, the IXIT proforma supplied by the test laboratory.

The IXIT should not conflict with the related ICS.

There are one or more IXITs for each ATS to be run against an IUT. The ATS specifier, test realizer and test laboratory all contribute to the development of the IXIT proforma.

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6.2.2 Protocol Implementation Extra Information for Testing (PIXIT)

An IXIT related to a specific protocol is called a Protocol IXIT (PIXIT).

The PIXIT may contain the following:

a) information about the System Under Test (SUT) which is needed by the test laboratory in order to be able to run the appropriate test suite against that SUT (*e.g.* addressing information, information related to the realization of the Upper Tester within the SUT, *etc.*);

b) information which adds precision to the information given in the PICS (*e.g.* if the PICS states that a range of values is supported for a particular parameter or timer, the PIXIT can give a specific value which is to be used in all relevant test cases other than those that are designed to test different values for the same parameter or timer);

c) information to help determine which capabilities, stated in the PICS as being supported, are testable and which are untestable;

d) other administrative information (*e.g.* IUT identification information, reference to the related PICS, *etc.*).

6.2.3 Profile Implementation Extra Information for Testing (profile IXIT)

For profile conformance testing, the extra information required by the test laboratory is called a profile Implementation eXtra Information for Testing (profile IXIT).

A profile IXIT consists of the set of PIXITs for the ATSs to be used for each of the protocols within the profile, plus if necessary information object IXITs for the information objects within the profile, plus the profile IXIT Requirements List (profile XRL) and the profile specific IXIT, if any, for the Profile Test Specification (PTS). The profile XRL specifies restrictions on answers in each of the PIXITs and information object IXITs to meet the requirements of the PTS. The profile specific IXIT gives any necessary further information for testing related to the profile, but which is inappropriate to be included in any of the PIXITs or information object IXITs.

NOTES

1 Information concerned with how to configure an IUT to restrict its operation to the relevant profile may need to be specified in a profile specific IXIT.

2 Although information objects are tested in conjunction with protocols, and thus extra information for testing them could be included in the related PIXIT, it may be useful to use an information object IXIT to keep the information that is specific to an information object separate from the protocol related information.

Thus, the profile IXIT can be described by the following formula:

$$\text{Profile IXIT} = \Sigma(\text{PIXIT}) + [\Sigma\text{information object IXIT} + \text{profile specific IXIT}] + \text{profile XRL} \qquad (2)$$

6.3 Conformance assessment process overview

6.3.1 The conformance assessment process is the complete process of accomplishing all conformance testing activities necessary to enable the conformance of an implementation or system to one or more base or profile specifications to be assessed.

The conformance assessment process involves three phases:

a) preparation for testing;

b) test operations;

c) test report production.

6.3.2 The preparation for testing phase involves

a) production of the SCS, ICSs and IXITs, as relevant;

b) choice of Abstract Test Methods and ATSs, based on those documents and, for profile testing, the PTS-Summary;

c) preparation of the SUT and Means of Testing.

6.3.3 The test operations phase involves

a) a static conformance review, conducted by analysing the ICS(s) and SCS with respect to the relevant static conformance requirements, and checking the consistency of the IXIT(s);

b) test selection and parameterization based on the ICSs and IXITs;

c) one or more "test campaigns".

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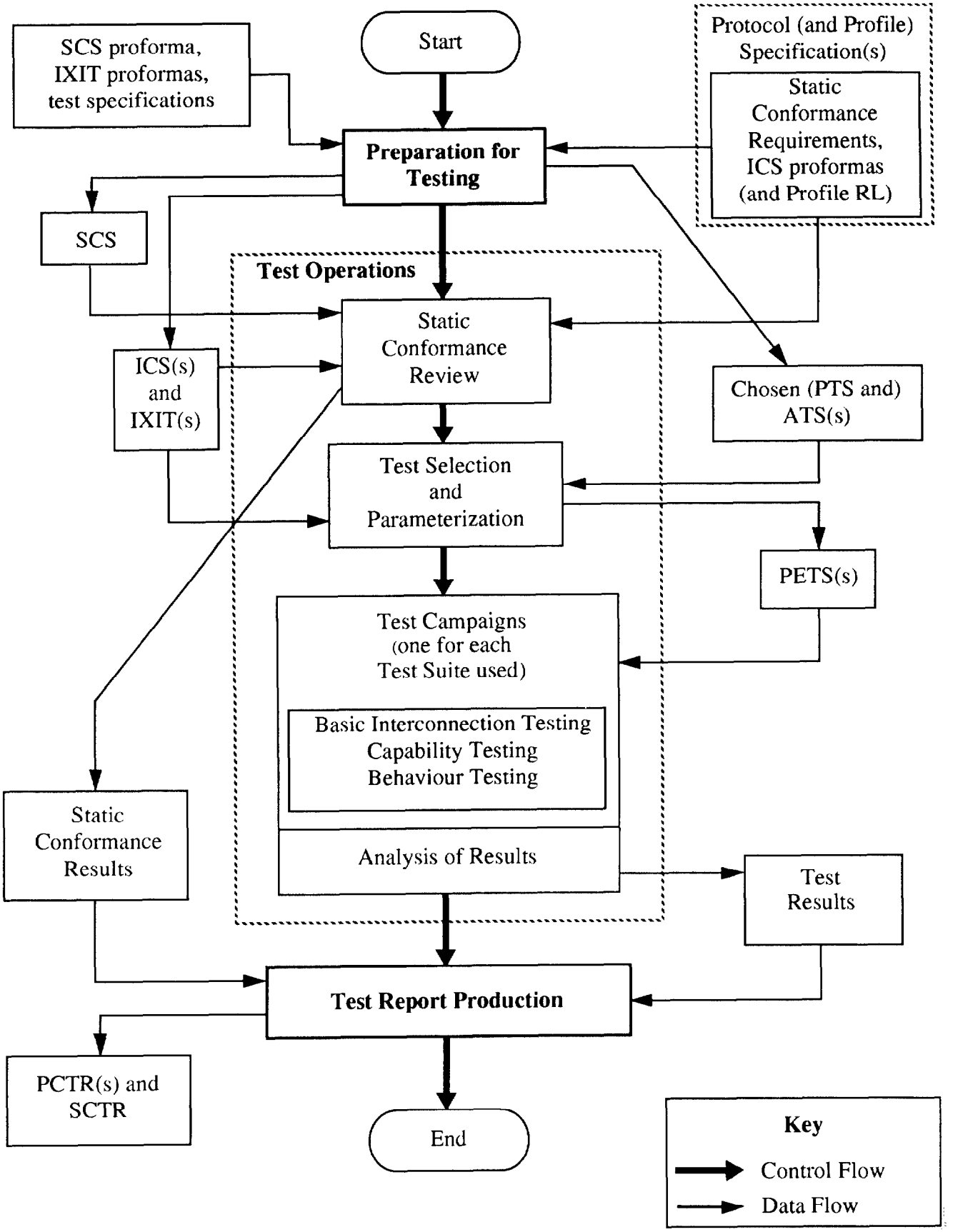

Figure 1 - Conformance assessment process overview

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A test campaign is the process of executing the Parameterized Executable Test Suite (PETS) derived from a single ATS, as a result of the test selection and parameterization steps, and recording the observed sequences of test events and any other relevant information in a conformance log. Thus, there will be one test campaign per ATS used.

A test campaign involves the use of a configuration of equipment allowing protocol exchanges to take place between the SUT and a test system, such exchanges being controlled by the test system. A test campaign includes the following three types of test: Basic Interconnection Tests (optional); capability tests; and behaviour tests.

NOTE – These tests need not be performed in separate test groups.

The test operations phase culminates in the analysis of results and this leads on to the test report production phase. These activities are discussed in 6.5.

6.3.4 The overview of the conformance assessment process, given above, is illustrated in figure 1.

The requirements to be met by the test laboratory and its client during the conformance assessment process are specified in ISO/IEC 9646-5.

6.4 Use of Basic Interconnection Tests and capability tests in the test campaign

6.4.1 If the ATS identifies a list of tests to be used as Basic Interconnection Tests, the test laboratory can use them as a preliminary filter in the test campaign for that ATS. This is decided by agreement between the test laboratory and client prior to the start of the test campaign.

6.4.2 It is optional whether the capability tests are executed as a separate test group or as part of the behaviour tests. This should be decided by agreement between the test laboratory and client prior to the start of the test campaign.

6.5 Analysis of results

6.5.1 Test outcomes and test verdicts

6.5.1.1 The test outcome is the series of events which occurred during execution of a test case; it includes all input to and output from the IUT at the Points of Control and Observation (PCOs).

6.5.1.2 A foreseen test outcome is one which has been defined by the abstract test case; *i.e* the events which occurred during execution of the test case matched a sequence of test events defined in the abstract test case. A foreseen test outcome may include unidentified test events, and always results in the assignment of a test verdict to the test case.

6.5.1.3 The test verdict will be pass, fail or inconclusive:

a) **pass** means that the observed test outcome gives evidence of conformance to the conformance requirement(s) on which the test purpose of the test case is focused, and is valid with respect to the relevant specification(s);

b) **fail** means that the observed test outcome either demonstrates nonconformance with respect to (at least one of) the conformance requirement(s) on which the test purpose of the test case is focused, or contains at least one invalid test event, with respect to the relevant specification(s);

c) **inconclusive** means that the observed test outcome is such that neither a pass nor a fail verdict can be given.

In a Single-Party Testing (SPyT) context, the verdict is determined by the Lower Tester. In a Multi-Party Testing (MPyT) context, the verdict is determined by the Lower Tester Control Function (LTCF).

6.5.1.4 An unforeseen test outcome is one which has not been identified by the abstract test case; *i.e.* the events which occurred during execution of the test case did not match any sequence of test events defined in the abstract test case. An unforeseen test outcome always results in the recording of a test case error or an abnormal test case termination for the test case.

6.5.1.5 A test case error is recorded if an error is detected in either the abstract test case itself (*i.e* an abstract test case error) or in its realization (*i.e* an executable test case error).

6.5.1.6 An abnormal test case termination is recorded if the execution of the test case is prematurely terminated by the test system for reasons other than test case error.

6.5.1.7 The results of executing the relevant individual test cases will be recorded in an overall summary for the IUT.

6.5.2 Conformance test reports

The results of conformance testing will be documented in a set of conformance test reports. These reports will be of two types: a System Conformance Test Report (SCTR) and a Protocol Conformance Test Report (PCTR). When a system is tested for support of several profiles, a separate SCTR shall be produced for each profile tested.

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The SCTR, which is always provided, gives a summary of the conformance status of the SUT, including a summary of the verdicts assigned during the conformance assessment process. A template for the SCTR can be found in ISO/IEC 9646-5: 1994, annex A.

The PCTR, one of which is be issued for each ATS used, documents all of the results of the test cases giving a reference to the conformance log(s) which contain(s) the observed test outcomes. The PCTR also gives reference to all necessary documents relating to the conduct of the test campaign for that ATS.

A template proforma for the PCTR can be found in ISO/IEC 9646-5: 1994, annex B. The order of presenting the results of the test cases in the PCTR is specified in the relevant ATS specification.

6.5.3 Repeatability of results

In order to achieve the objective of credible conformance testing, it is clear that the result of executing a test case on an IUT should be the same whenever it is performed. Experience shows that it may not be possible to execute a complete conformance test suite and observe test outcomes which are identical to those obtained on another occasion.

Nevertheless, at the test case level, it is very important that every effort is made by the test specifiers and test laboratories to minimize the possibility that a test case produces different test outcomes on different occasions.

6.5.4 Comparability of results

The standardization of all of the procedures concerned with conformance testing should result in comparable test reports being accorded to the IUT, whether the testing is done by the supplier, a user or a third-party test laboratory. There are a large number of factors to be considered to achieve this, of which some of the more important are

a) careful design and unambiguous specification of the test cases to give flexibility where appropriate, but showing which requirements have to be met, and how the verdicts are to be assigned;

b) careful specification of the Means of Testing which should be used to run the test suite; this specification should give flexibility where appropriate, but should meet the requirements of the test suite, including any requirements on Test Coordination Procedures (TCP);

c) careful specification of the procedures to be followed by test laboratories regarding the repetition of a test case before recording a verdict for that test case;

d) a proforma for a conformance test report;

e) careful specification of the procedures necessary when reviewing results and preparing test reports.

6.5.5 Auditability of results

It may be necessary to review the observed test outcomes from the execution of a conformance test suite in order to make sure that all procedures have been correctly followed. Whether or not analysis of results is carried out in a manual or automatic mode, it is essential that all inputs, outputs, and other test events are logged, for each test case being run. It is the responsibility of the test laboratory to retain sufficient information to be able to produce a conformance log for each test campaign, for future reference.

7 Test methods

7.1 Introduction

Real systems that contain OSI protocol implementations come in a wide variety of configurations and vary in the ways in which their behaviour can be controlled and observed during testing. A range of test methods is, therefore, defined, to correspond to the range of possibilities for control and observation of the System under Test (SUT).

This clause first characterizes the features of the SUT which are to be taken into consideration, next defines the possible test methods in abstract terms, and finally provides guidance on their applicability to real systems.

7.2 Classification of real open systems and IUTs for conformance testing

7.2.1 Classification of SUTs

7.2.1.2 The following configurations of systems have been identified for the purposes of conformance testing, as illustrated in figures 2 to 4. In each case, the SUT provides support for one or more OSI services which can underlie the IUT and which are provided over a Physical medium. Configurations 1 to 3 are the basic configurations of SUTs:

a) **Configuration 1:** Complete open system (end-system)

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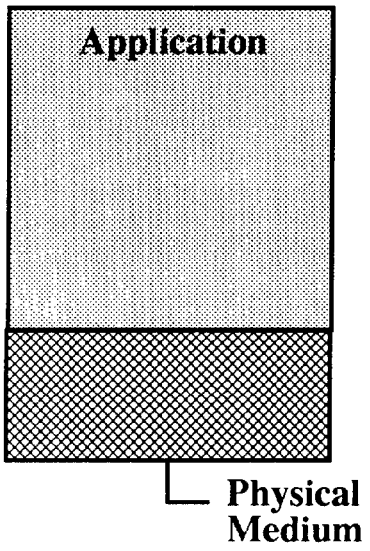

Figure 2 - Configuration 1: complete open system

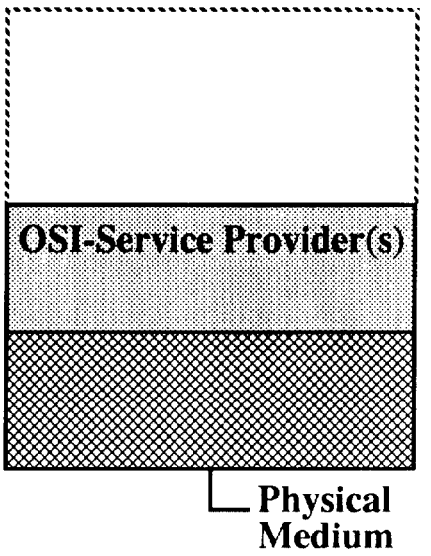

Figure 3 - Configuration 2: partial open system

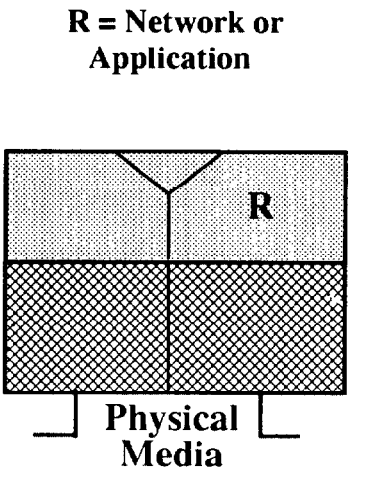

Figure 4 - Configuration 3: open-relay system

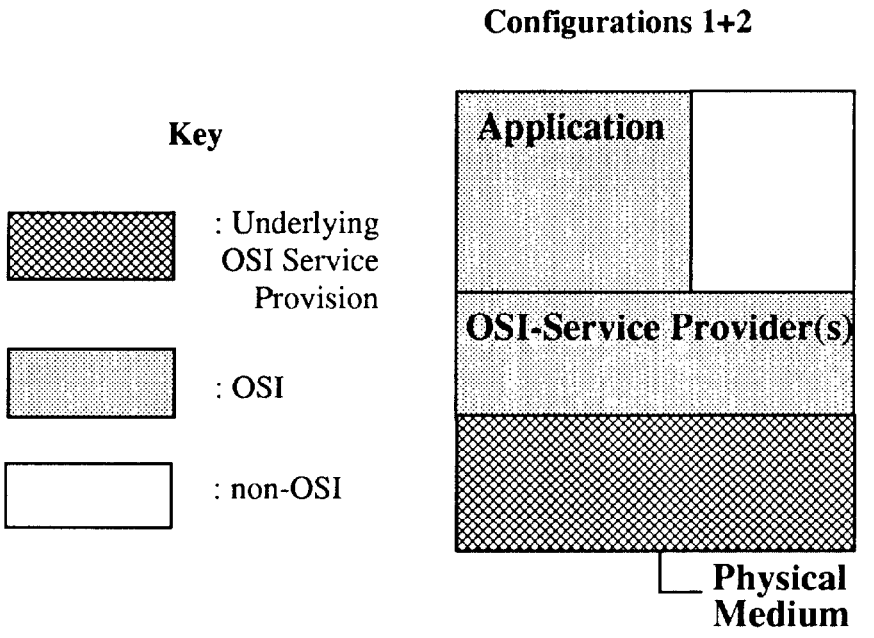

Figure 5 - Combination of complete and partial open systems

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These systems use OSI standardized protocols within the IUT and if relevant above the IUT, up to and including one or more Application protocols.

b) **Configuration 2:** Partial open system (end-system)

These systems use OSI standardized protocols, within the IUT and if relevant above the IUT, to provide one or more OSI services.

c) **Configuration 3**: Open relay-systems

These use OSI standardized protocols to provide the relaying function in Network relay-systems or Application relay-systems.

7.2.1.3 Other configurations can be derived from the basic configurations.

An SUT can be a combination of basic configurations 1 and 2, allowing the alternative of using OSI and non-OSI protocols above an OSI service (see figure 5).

7.2.2 Identification of the IUT

7.2.2.1 An IUT is that part of the SUT, which is subject to conformance testing.

7.2.2.2 When the SUT is required by the protocol(s) to communicate with a single other real open system then the IUT can be tested in an SPyT context. When the SUT is required by the protocol(s) to communicate with multiple other real open systems concurrently then the SUT can be tested in an MPyT context.

7.2.2.3 In an end-system (configurations 1 and 2 of the SUT), the IUT is an implementation of one or more OSI protocols. It may be a single-protocol IUT in a single OSI layer (e.g. Session). It may also be a multi-protocol IUT, i.e a set of several protocols in an adjacent user/provider relationship, defined in one or more OSI layers (*e.g.* MHS), and to be tested in combination.

7.2.2.4 In an open relay system (configuration 3 for the SUT), the IUT is an implementation of at least the protocol entity which provides the relay function. That protocol entity is a user (in the OSI sense) of at least two service providers. Therefore, the IUT containing the relay function is a multi-party IUT.

7.2.2.5 When OSI and non-OSI protocols exist in a system, the IUT(s) are defined to encompass only one or more OSI protocols. Testing non-OSI protocols is in general outside the scope of ISO/IEC 9646, although the concepts may be applicable to testing some non-OSI protocols.

7.2.2.6 The part of the SUT to be considered as the IUT is subject to the agreement of the test laboratory and the client.

7.3 Abstract testing methodology

7.3.1 General

Test methods need to refer to an abstract testing methodology, based upon the OSI reference model. Considering end-systems (complete or partial open systems) and single protocol IUTs within these systems, Abstract Test Methods are described in terms of what outputs from the IUT are observed and what inputs to it can be controlled. More specifically, an Abstract Test Method is described by identifying the points closest to the IUT at which control and observation are to be exercised.

The OSI protocol specifications define allowed behaviour of a protocol implementation (*i.e.* the dynamic conformance requirements) in terms of the PDUs and the Abstract Service Primitives (ASPs) both above and below that implementation.

If an IUT comprises more than one protocol entity, the required behaviour can be defined in terms of the ASPs above and below the IUT, including the PDUs of the protocols in the IUT.

If the IUT is a multi-party IUT, the required behaviour needs to be defined in terms of ASPs above and below the IUT, including the PDUs of the protocol in the IUT, as many times as required by the number of parties. If the SUT is a relay system, the required behaviour of the IUT is defined in terms of the ASPs below the IUT, including the incoming and outgoing PDUs to be relayed, on each side of the relay.

The Abstract Test Methods are defined in two contexts, further explained in ISO/IEC 9646-2: the Single-Party Testing context and Multi-Party Testing context, to test IUTs of corresponding nature. When the two contexts differ, the differences are outlined in what follows.

The starting point for developing Abstract Test Methods is the conceptual testing architecture, illustrated in figure 6. It is a "black-box" active testing architecture, based on the definition of behaviour required of the IUT.

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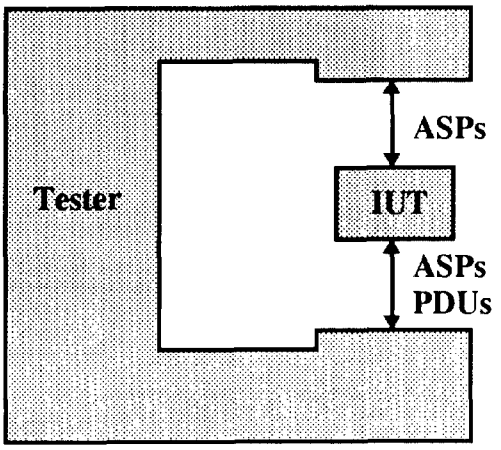

Figure 6 - Conceptual testing architecture

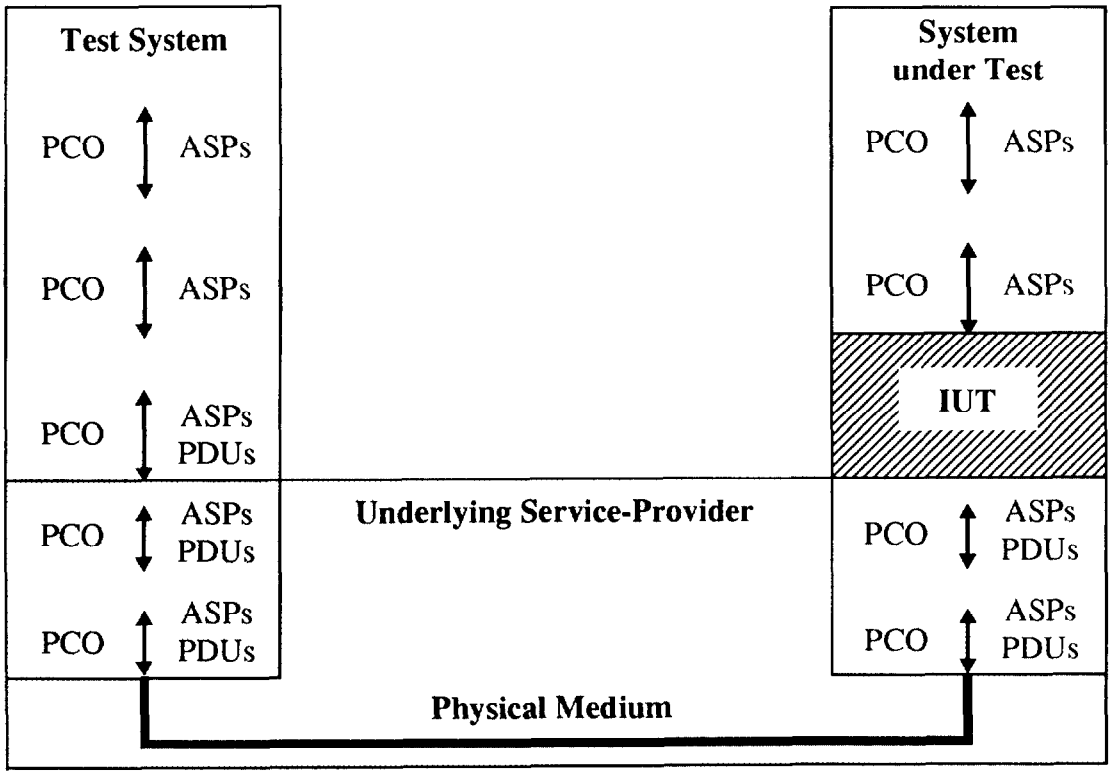

Figure 7 - Possible PCOs for testing

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7.3.2 Points of Control and Observation (PCOs)

7.3.2.1 The action of the conceptual tester(s) shown in figure 6 involves two sets of interactions: one above and one below the IUT. These can, in theory, be observed and controlled from several different points.

7.3.2.2 Each possible PCO is identified by three factors:

a) a service boundary at which the test events are controlled and observed; this boundary may or may not be at an OSI layer boundary;

b) the set of test events (ASPs or PDUs) that are controlled and observed at this point;

c) whether they are controlled and observed within the SUT or in the test system.

7.3.2.3 Possible PCOs are illustrated in figure 7. It can be seen from these figures that there is theoretically a multiplicity of possible PCOs, which offer different degrees of control and observation of IUT behaviour. ISO/IEC 9646 makes a selection from this set of possible PCOs, and defines for use in standardized ATSs a limited number of Abstract Test Methods using these PCOs.

7.3.2.4 If control and observation is specified in terms of ASPs, it will include control and observation of the PDUs carried by those ASPs; but if it is specified solely in terms of PDUs then the underlying ASPs are not considered to be controlled or observed.

7.3.2.5 The PCOs can be modelled as two queues:

a) one output queue for control of test events to be sent towards the IUT; and

b) one input queue for the observation of test events received from the IUT.

7.3.2.6 The ASP activity below the IUT can be observed and controlled by the peer activity in a test system via an underlying service-provider. It is assumed that the underlying service offered is sufficiently reliable for control and observation to take place remotely.

It is possible that the ASP activity above the IUT might not be controllable nor observable, in which case this activity is said to be hidden.

NOTE – There are no PCOs above an IUT which includes the actual relay part of an open-relay system.

7.3.2.7 SUTs are not required to provide access to service boundaries. However, the possible provision of such access and the possible positions of such boundaries with respect to the protocol(s) of the IUT are factors to be taken into consideration in the definition of the Abstract Test Methods, which may take advantage of this access to define the ATSs in terms of the corresponding ASPs. It does not matter whether the accessible boundaries are accessed via Service-Access-Points (SAPs) or via some other PCOs.

7.4 Abstract testing functions.

The definition of an Abstract Test Method makes use of four abstract testing functions, named the Lower Tester, the Lower Tester Control Function, the Upper Tester and the Test Coordination Procedures.

The **Lower Tester** is the representation of the means of providing, during test execution, indirect control and observation of the lower service boundary of the IUT via the underlying service-provider. The underlying service-provider is, as illustrated in figure 7, beneath the (lowest) protocol which is the focus of testing. It may use one or more OSI layers, or the Physical medium only.

The **Lower Tester Control Function** is the representation of the means of providing, when in an MPyT context, the coordination of the Lower Testers and the assignment of the test verdict.

The **Upper Tester** is the representation of the means of providing, during test execution, control and observation of the upper service boundary of the IUT, as defined by the chosen Abstract Test Method.

NOTE – There is no Upper Tester for testing an open-relay system.

In the SPyT context, the **Test Coordination Procedures** define explicitly and implicitly the rules for cooperation between the Lower Tester and the Upper Tester. In the MPyT context the **Test Coordination Procedures** define explicitly and implicitly the rules for cooperation among the LTCF, the Lower Testers and Upper Testers.

The ATSs for different Abstract Test Methods will vary in the way that they specify requirements on the TCP among the Upper and Lower Testers. In some cases, it is possible to define a Test Management Protocol (TMP) to provide the coordination rules. In other cases, it is not possible to specify what mechanisms might be used; it is possible only to describe the requirements to be met by the TCP.

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In the MPyT context, there are additional needs for cooperation among the Lower Testers, between the Lower Testers and the LTCF, among the Upper Testers, and between the Upper Testers and the LTCF, if applicable.The rules for such cooperation are also called TCP (see ISO/IEC 9646-2: 1994, 11.2.3 and 11.5.4).

7.5 Overview of Abstract Test Methods

7.5.1 End-system IUTs in the Single-Party Testing context

In the SPyT context, for the IUTs defined within end-system SUTs (configurations 1 and 2 in figures 2 and 3) four Abstract Test Methods are defined: two that use a PCO between the Upper Tester and the IUT (the Local and Distributed test methods) and two that use only the single PCO beneath the Lower Tester (the Coordinated and Remote test methods).

All test methods use control and observation of ASPs below the IUT and PDUs exchanged with the IUT, by means of a Lower Tester separated from the SUT, possibly together with control and observation of ASPs above the IUT.

7.5.2 The Local and Distributed test methods

In both the **Local** and **Distributed** test methods, there are two PCOs: one beneath the Lower Tester and the other at the upper service boundary of the IUT.

In the Local test method, the Upper Tester is located within the test system; whereas in the Distributed test method, the Upper Tester is located within the SUT.

The Local test method requires the upper service boundary of the IUT to be a standardized hardware interface; the Distributed test method requires it to be either a human user interface or a standardized programming language interface. In both methods access to this interface is required for testing purposes.

In the Local test method, the TCP are realized entirely within the test system. In both methods the requirements for the TCP are specified, but the procedures themselves are not.

These test methods are illustrated in figures 8 a) and b).

7.5.3 The Coordinated and Remote test methods

In both the **Coordinated** and **Remote** test methods, there is only one PCO: beneath the Lower Tester. Neither method requires access to the upper service boundary of the IUT.

In the Coordinated test method, the TCP are realized by means of standardized **Test Management Protocols.** The Upper Tester is an implementation of the relevant TMP. This method is illustrated in figure 8 (c).

In the Remote test method, some requirements for TCP may be implied or informally expressed in the ATS, but no assumption is made regarding their feasibility or realization. There is no Upper Tester as such, but some Upper Tester functions may be performed by the SUT. This method is illustrated in figure 8 (d), the dotted lines indicating that only the desired effects of the TCP are described in the ATS.

7.5.4 Variants of abstract test methods

Each of the four SPyT Abstract Test Methods can be used to test single-protocol IUTs or multi-protocol IUTs as a whole. Each of the test methods also has an embedded variant which can be used for testing one or more protocols embedded within a multi-protocol IUT.

The four SPyT Abstract Test Methods and their embedded variants are fully specified in ISO/IEC 9646-2: 1994, clause 11.

7.5.5 IUTs in the Multi-Party Testing context

A generalization of the abstract testing methodology is defined to provide for the MPyT context. This generalization allows for multiple Lower Testers, each representing one of the real open systems with which the IUT needs to communicate. In addition there is an LTCF and there may be zero or multiple Upper Testers. Any configuration of LTCF, one or more Lower Testers, zero or more Upper Testers and the appropriate TCP may be used as an MPyT Abstract Test Method.

The requirements on the LTCF, Lower Testers, Upper Testers and TCP in the MPyT context are specified in ISO/IEC 9646-2: 1994, 11.5.

7.6 Applicability of test methods to real open systems

The architecture and stage of development of a real open system determines the applicability of test methods to it.

Local test methods are applicable only to testing SUTs that have two hardware interfaces (*e.g.* transceivers).

Distributed test methods are applicable only to testing IUTs that have an upper interface accessible either to a human user or to a software Upper Tester with a standardized programming language interface.

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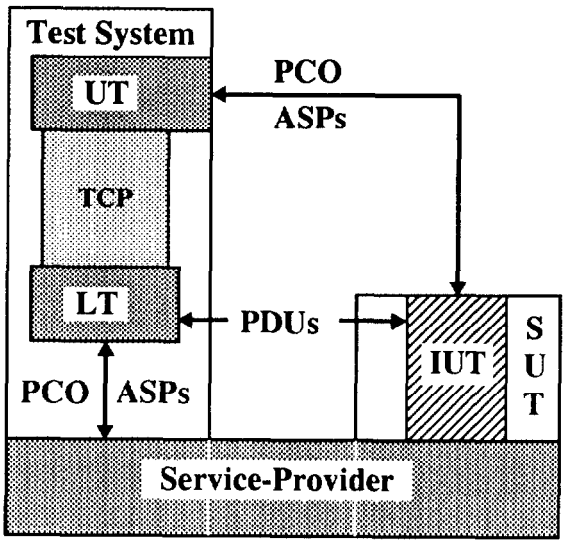
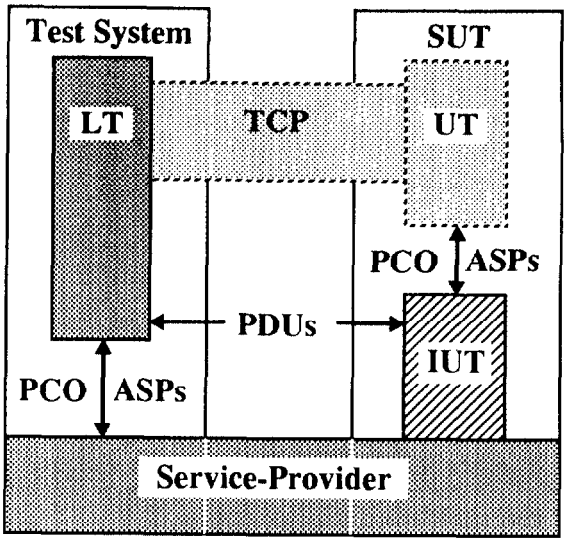
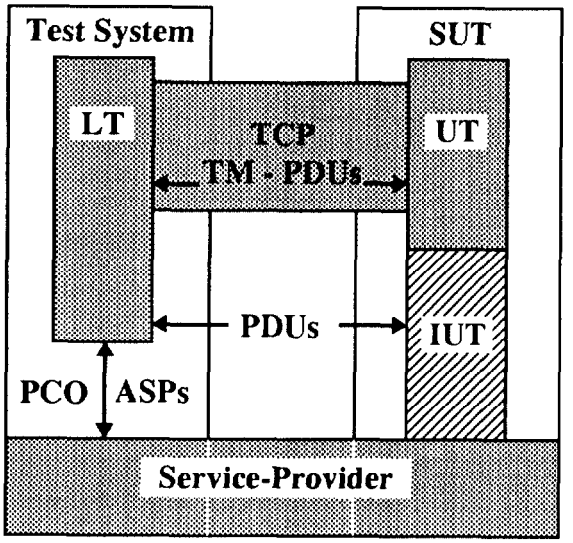


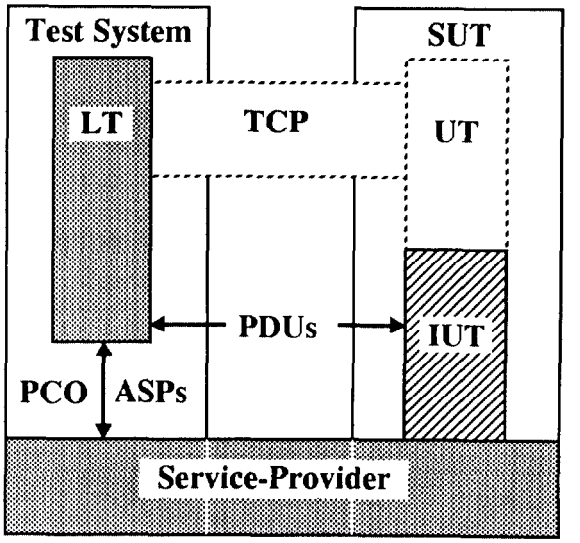
(a) The Local test methods



(b) The Distributed test methods



(c) The Coordinated test methods



(d) The Remote test methods

Figure 8 - Overview of Abstract Test Methods

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Coordinated test methods apply where it is possible to implement a standardized TMP in an Upper Tester in the SUT, above the IUT.

Remote test methods apply when it is possible to make use of some functions of the SUT to control the IUT during testing, instead of using a specific Upper Tester.

The SPyT single-protocol test methods are the most appropriate for testing the majority of the protocol conformance requirements.

The embedded variants permit the application of single-protocol testing to all protocols of a multi-protocol IUT.

The SPyT test methods and their embedded variants may also be used to test more than one protocol at once when this is required.

For complete open systems, not using multi-party protocols, the preferred test methods are the appropriate single-protocol embedded test methods, used incrementally, with the following PCOs:

a) the upper interface of the Application layer as provided by the complete open system, when applicable;

b) successively, each SAP below the protocol which is the focus of the testing, as controlled and observed in the Lower Tester, starting from the lowest protocol of the IUT and working upwards.

The use of MPyT allows IUTs that support multi-party protocols to be tested with respect to their behaviour when communicating with more than one real open system. MPyT should only be used after all the single-party aspects of the IUT have been tested.

7.7 Applicability of the test methods to OSI protocols and layers

ISO/IEC 9646-2: 1994, annex A, provides guidance on the applicability of test methods to particular protocols and layers.

8 Test suites

8.1 Structure

Test suites have a hierarchical structure (see figure 9) in which an important level is the **test case**. Each test case has a specified test purpose, such as that of verifying that the IUT has a certain required capability (*e.g.* the ability to support certain packet sizes) or exhibit a certain required behaviour (*e.g.* behave as required when a particular event occurs in a particular state).

Within a test suite, nested **test groups** are used to provide a logical ordering of the test cases. Test groups may be nested to an arbitrary depth. They may be used to aid planning, development, understanding or execution of the test suite.

Associated with each test group may be a **test group objective**. When such objectives exist, the complete test group objective for a given test group is formed by the concatenation of the given test group objective with those of any higher level test groups containing the given test group. Likewise, complete test purposes are formed by concatenating the appropriate complete test group objective with the individual test purposes.

Test cases may be modularized by using named subdivisions called **test steps**.

For practical reasons, common test steps may be grouped together into test step libraries (analogous to subroutine or procedure libraries in programming languages). Test step libraries may be structured into nested sets of test steps, to any depth of nesting. Test step libraries may be associated with the whole test suite or with a particular test group.

Test events are indivisible units of specification within a test step (*e.g.* the transfer of a single PDU or ASP to or from the IUT). All test steps are specified as an ordering of test events or other (smaller) test steps. All test steps are, therefore, equivalent to an ordering of test events.

8.2 Abstract and executable test cases

8.2.1 An abstract test case is derived from a test purpose (possibly covering a set of related conformance requirements, as defined by the test suite specifier) and from the relevant specifications.

In the SPyT context, an abstract test case

a) specifies all sequences of foreseen test events necessary in order to achieve the test purpose; these test events comprise the **test body;**

b) specifies, if the initial testing state required by the test body is not the desired starting stable state of the test case, at least one sequence of test events to put the IUT into the initial testing state for the test body; these test events comprise the **test preamble**;

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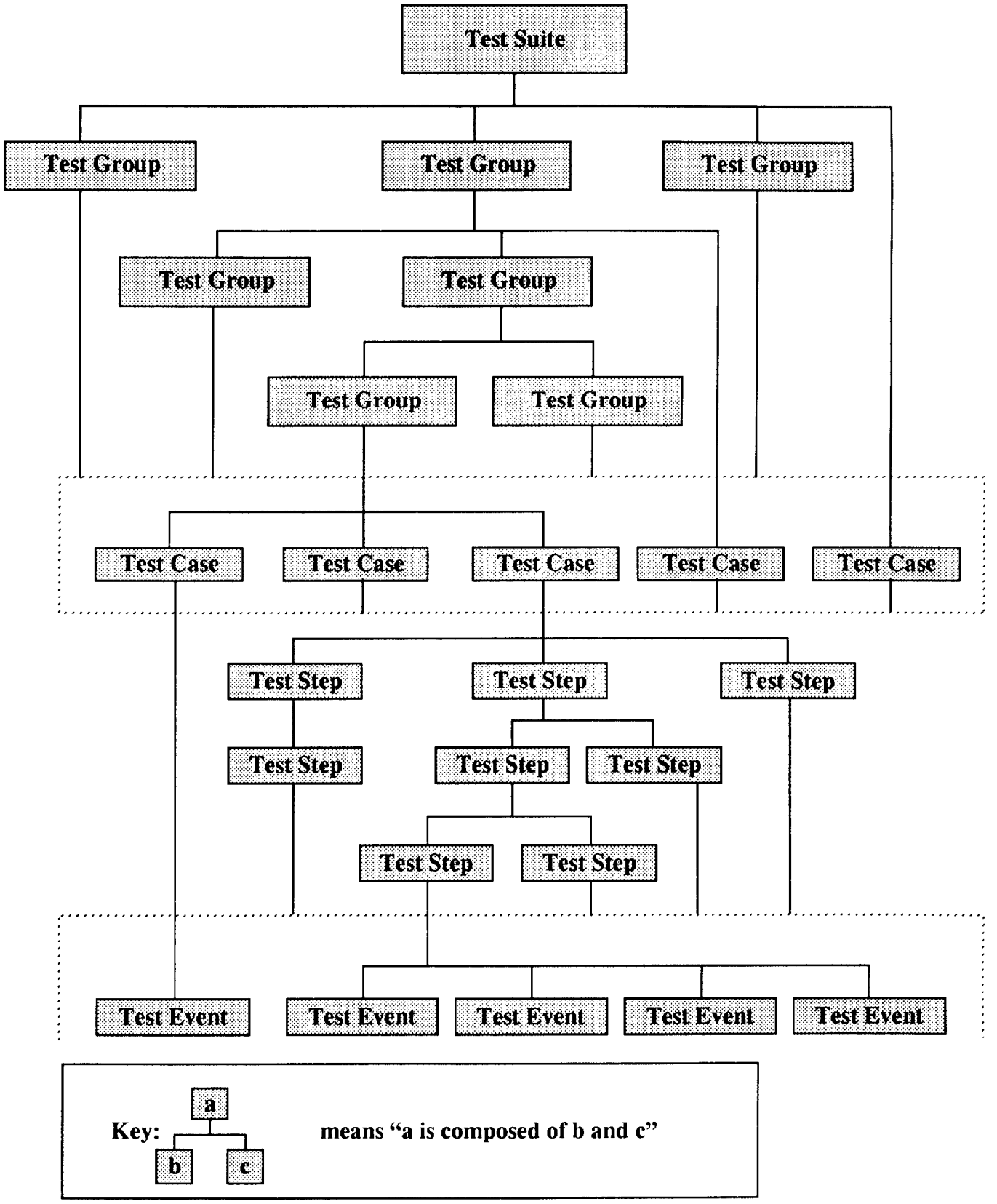

Figure 9 - Test suite structure

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c) specifies, if the test body can end without the IUT being returned to the desired stable testing state, at least one sequence of test events to return the IUT to the desired stable testing state; these test events comprise the **test postamble**;

d) uses a single SPyT test method to define the configuration of the Lower Tester, Upper Tester, TCP and PCOs to be used in the specification of all sequences of test events;

e) specifies the verdict to be assigned to each foreseen test outcome.

8.2.2 In the MPyT context, an abstract test case

a) specifies the test steps of a Lower Tester and if necessary the corresponding Upper Tester for each IUT component, including the test preamble, test body and test postamble as appropriate;

b) uses a single MPyT test method in the specification of the behaviour of each Lower Tester and its corresponding Upper Tester, if any, and TCP;

c) specifies the assignment of a preliminary result by each Lower Tester;

d) specifies an LTCF which assigns the test verdict dependent upon the preliminary results.

8.2.3 In both SPyT and MPyT contexts, an abstract test case

a) uses a standardized test notation for the specification of all sequences of test events;

b) may be constructed from test steps, each of which is a set of sequences of test events.

8.2.4 The test preamble and postamble may be specified in different ways depending on the degree of control and observation provided by the test method used, or on the variety of different possible stable testing states from which the derived abstract test case can start and in which it can end. The resulting abstract test cases are simply different ways of achieving the same test purpose.

8.2.5 An executable test case is derived from an abstract test case, and is in a form which allows it to be executed by the test system, in combination with the SUT.

8.2.6 The adjectives "abstract" and "executable" are used to describe test suites which comprise abstract and executable test cases, respectively.

8.3 Base specification conformance testing specifications

Standardized ATSs to be used in conformance testing for a base specification or a combination of base specifications are issued in a multi-part conformance testing specification which includes:

a) an initial part providing the Test Suite Structure and Test Purposes (TSS&TP) applicable to the ATS(s);

b) appropriate parts for the standardized ATS(s);

c) a part specifying the TMP, if applicable (see ISO/IEC 9646-2: 1994, clause 13).

8.4 Profile Test Specifications (PTS)

"Profile Test Specification" is the term given to the complete set of documents needed to specify conformance testing for a given profile. A Profile Test Specification (PTS) is a library of standardized documents rather than a single standardized document. Nevertheless there is a single standardized document which provides the complete set of references to all the other documents in the PTS; this is called the Profile Test Specification Summary (PTS-Summary). The PTS-Summary is itself a part of the PTS.

PTSs are based on the standardized ATSs for the relevant base specifications. If, however, the profile references one or more base specifications for which there is no standardized ATS then an ATS needs to be developed at least for the subset of the base specification used by the profile, in compliance with the TSS&TP for that base specification. Then this ATS needs to be submitted to the appropriate organisation for standardization. If the TSS&TP is also not yet standardized, then it too needs to be developed at least for the appropriate subset of the base specification and submitted to the appropriate organisation for standardisation.

Once an appropriate set of ATSs has been assembled, they will need to be parameterized for the profile and some of the test cases may need to be replaced by others tailored specially to the needs of the profile. In addition, some extra abstract test cases may be needed to cover profile specific conformance requirements, including the following:

a) test cases for additional test purposes for a specific base specification (extending the coverage of its TSS&TP);

b) test cases for conformance requirements that concern more than one base specification (*i.e.* multi-protocol test cases or test cases for a protocol together with an information object).

All this information, needed to extend and adapt the set of standardized ATSs to meet the needs of conformance testing for the profile, should be standardized in a document called a Profile Specific Test Specification.

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9 Relationships between parts, concepts and roles

Figure 10 is a pictorial representation of the relationship between the various parts of ISO/IEC 9646 and the processes of producing abstract and executable test suites and test reports.

This part of ISO/IEC 9646 provides general concepts and definitions which underpin the other parts. It is, therefore, for use by all users of ISO/IEC 9646.

ISO/IEC 9646-2 concerns the production of testable protocol specifications and conformance testing specifications. It is, therefore, for use by OSI protocol defining groups and test suite specifiers.

ISO/IEC 9646-3 concerns a standardized test notation for ATS specification. It is, therefore, for use by test suite specifiers.

ISO/IEC 9646-4 concerns the realization of the Means of Testing. It is, therefore, for use by test realizers.

ISO/IEC 9646-5 concerns the roles of a test laboratory and its client in the conformance assessment process, which culminates in test report production. It is, therefore, for use by test laboratories and their clients.

ISO/IEC 9646-6 concerns the production of testable profile specifications and PTSs. It is, therefore, for use by profile defining groups and test suite specifiers.

ISO/IEC 9646-7 concerns the requirements and guidance for ICSs and SCSs, their proformas, and profile RLs. It is, therefore, for use by ICS proforma specifiers, suppliers and test laboratories.

10 Compliance

In ISO/IEC 9646, compliance refers to meeting the requirements specified in one or more of the parts. This word is used in an attempt to eliminate confusion between compliance to one or more parts of ISO/IEC 9646 and conformance of an implementation to relevant International Standards, ITU-T Recommendations or ISPs.

ISO/IEC 9646-2 to 9646-7 contain compliance requirements, appropriate to the various activities addressed. These, if met, will achieve the objectives of conformance testing, as described in the Introduction of this part of ISO/IEC 9646.

This part of ISO/IEC 9646 contains no compliance requirements.

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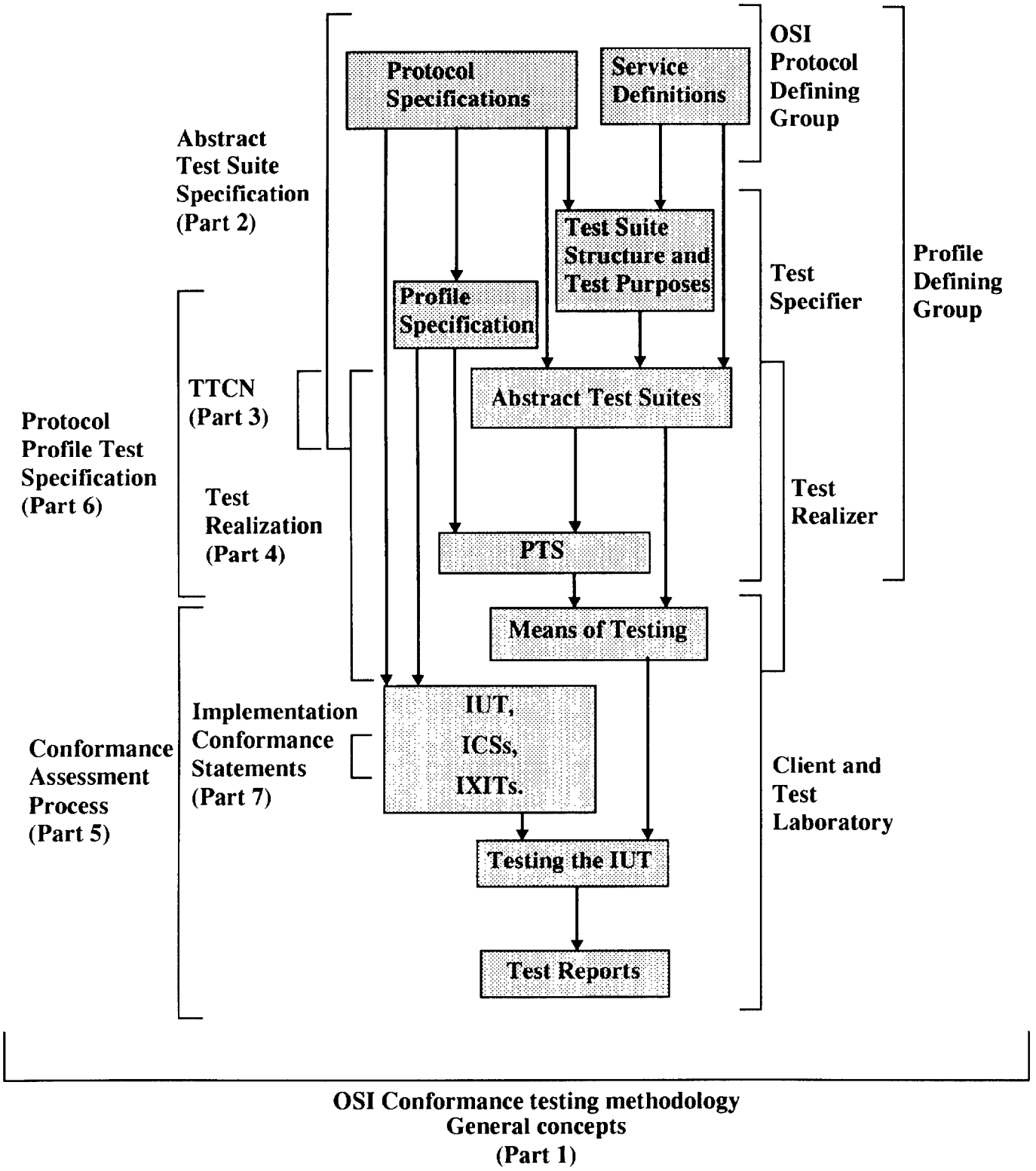

Figure 10 - Relationships between parts, concepts and activities

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Annex A
(informative)

Options

A.1 Options are those items in a specification for which the implementor or implementation may make a choice (*e.g.* to suit the purpose of the implementation).

A.2 Such a choice is not truly free. There are requirements which specify the conditions under which the option applies and the limitations of the choice.

Conversely, there may be mandatory or conditional requirements, or prohibitions, in a specification which are dependent on the choice made or on a combination of the choices already made.

A.3 The following are examples of options and associated requirements; the list is not exhaustive:

a) "Boolean" options: the option is "do or do not do"; the requirement is "if do, then do as specified.";

b) mutually exclusive options: the requirement is to do just one of *n* actions, the option is which one of them to do; these options could also be considered to be alternative mandatory features;

c) selectable options: the option is to do any *m* out of *n* actions, with a requirement to do at least one action ($1 <= m <= n$ and $n >= 2$).

A.4 Options may apply to anything within the scope of a specification (*e.g.* static or dynamic aspects, use or provision of a service, actions to be taken, presence/absence or form of parameters, *etc.*).

A.5 In a wider context, the choice may be determined by conditions which lie outside the scope of the specification (*e.g.* other specifications which apply to the implementation, the other base specifications used, the intended application, conditions of procurement, target price for the implementation, *etc.*). However, these have no bearing on conformance to the specification in which the option appears.

NOTE - Optional static conformance requirements are more fully discussed in ISO/IEC 9646-7.

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Annex B
(informative)

Index of ISO/IEC 9646 Parts 1, 2, 4, 5, 6 and 7

B.1 Introduction

This annex presents an alphabetical index of terms and acronyms with references to their uses in ISO/IEC 9646 (1994) parts 1, 2, 4, 5, 6 and 7references are in terms of clause, figure and table numbers, grouped by part, with each group prefixed by the part number in square brackets. The significance of each reference is indicated as follows:

a) definitions of the terms are in **bold**;

b) major uses of the term or acronym are in *italics*;

c) other uses are in normal font.

B.2 The Index

Abnormal test case termination:
[1] **3.3.1**, 3.3.126, 6.5.1.4, 6.5.1.6
[4] 6.4
[5] 7.6.2.4, 8.3.1

Abstract service primitive:
[1] **3.3.2**, 7.3.1, Figure 6, Figure 7, 7.3.2.4, 7.3.2.6, 7.5.1, Figure 8
[2] 11.2.2.2, 11.3, 11.4.1, 13
[4] 6.4, A.1.2, A.1.3, A.4.3
[5] 6.2.1.2.1, 6.2.1.3, C.2(5)

Abstract syntax:
[1] 5.1, 5.5
[2] 6.3.1, 12.1
[4] 6.4
[5] 6.4.2.1
[7] 6.1, 6.6, 8.5.5, 8.5.9, G.1

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[1] **3.3.4**, 6.5.1.5
[4] 6.4
[5] 7.6.2.4

Abstract test case:
[1] **3.3.3**, 6.1.5.1, 6.5.1, *8.2*, 8.4
[2] 8.2, 10.3.2, 10.3.3, 10.4, *12.3*, 12.4, 14
[4] 5.2, 5.3, 6.2.2, 6.3.3, 6.4, 6.6, A.1.2, A.1.5, A.3, A.4.3
[5] 7.6.2.4, 8.3.1, B.2(6), C.2(5), C.2(7.2.4), C.2(8.2.2)
[6] 7.2, 9, 10.4.2

Abstract test method:
[1] **3.3.5**, 6.3.2, 7.3.1, 7.3.2.3, 7.3.2.7, 7.4, *7.5*, Figure 8
[2] 8, 10.5, *11*, 12.3.1
[4] 6.2.5, A.1.2, A.1.3
[5] 6.2.1.1, Figure 1, 6.3.1.2, 6.3.1.3, 6.4.6.1, 8.2.1, A.2(1.8), A.2(2.n), B.2(1.3), C.2(2)
[6] 7.4, 8.2.5, 10.3.2, 10.3.3

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[2] 5.2, 11.3.4, 11.6.2, 12, 13, 14, 15
[4] 5.2, 6.2, 6.3.2, 6.3.3, 6.6, A.2.2, A.2.3, A.4.3, A.4.5
[5] 6.2.1.4.2, 6.2.1.5.1, 6.3.1, 6.3.2, 6.4.1, 6.4.6, 7.1, 7.3.1, 7.5, 8.2.1, A.2(2.n), B.1, B.2(1.3), B.2(6), C.2(2)
[6] 8.2.5, 9, 10.3, A.2(4)

Abstract test suite:
[1] **3.3.6**, Figure 10
[2] 5.3, 6.1, *8*, 9, 10, *12*, 14, *15*
[4] 5, 6.2, 6.3.3, 6.3.4, 6.4, 6.5, A.1.3, A.1.7, A.1.8, A.2.1
[5] Figure 1, 7.6.2.4, A.2(1.8), C.1, C.2(2)
[6] 7.2, 8.2.5, 9
[7] A.6.3, A.8.2.3

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[1] **3.3.8**

Abstract testing methodology:
[1] **3.3.9**, *7.3*, 7.5.5
[2] *11*, C.2

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[5] 6.3.1.2, A.2(2.n), B.2(1.1), C.2(3)

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[2] 4, A.6.2, A.6.4, C.2

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[5] 7.2.1
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[1] **3.1**, 7.6
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[1] **3.1**
[2] A.5, A.6
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[1] 2, 3.2, 4, 5.5
[2] 2, 4
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[2] 4, 11.2.2.2, 11.3, 11.4.1, 13
[4] 4, 6.4, A.1.2, A.1.3, A.4.3
[5] 4, 6.2.1.2.1, 6.2.1.3, C.2(5)
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[2] 4, 8, 10.5, *11*, 12.3.1
[4] 4, 6.2.5, A.1.2, A.1.3
[5] 4, 6.2.1.1, Figure 1, 6.3.1.2, 6.3.1.3, 6.4.6.1, 8.2.1, A.2(1.8), A.2(2.n), B.2(1.3), C.2(2)
[6] 4, 7.4, 8.2.5, 10.3.2, 10.3.3
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[2] 11.3.4, 11.6.2, 12, 13, 14, 15
[4] 5.2, 6.2, 6.3.2, 6.3.3, 6.6, A.2.2, A.2.3, A.4.3, A.4.5
[5] 6.2.1.4.2, 6.2.1.5.1, 6.3.1, 6.3.2, 6.4.1, 6.4.6, 7.1, 7.3.1, 7.5, 8.2.1, A.2(2.n), B.1, B.2(1.3), B.2(6), C.2(2)
[6] 8.2.5, 9, 10.3, 10.4.2, A.2(4)
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[7] 6.7.1
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[4] 4, 5, 6.2, 6.3.3, 6.3.4, 6.4, 6.5, A.1.3, A.1.7, A.1.8, A.2.1
[5] 4, Figure 1, Figure 4, 7.6.2.4, A.2(1.8), C.1, C.2(2)
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[7] 4.1, A.6.3, A.8.2.3
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[2] 10.2.3, 12.1, 14.2
[4] 6.2.3
[5] 5.3, 7.3.2, 7.6.2.3, 7.6.3.3, 8.3.1
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[1] **3.3.12**, 6.1.1, 6.1.2, 6.1.3, *6.1.4*
[2] 10.1.3, 10.2, 14.2
[4] 6.2.3, A.4.5
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[4] 4, 6.2.3
[5] 4, 5.3, 7.3.2, 7.6.2.3, 7.6.3.3, 8.3.1

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[4] A.4.5
[5] 5.3, 7.4.1.2
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[1] **3.3.13**, *6.1.3*, 8.1
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[7] 6.3.1, 6.7.2.3, 8.5.1, 8.5.3, 8.7.5, 9.2.1, 9.3.1, 9.3.2, 9.6, A.1.1, A.1.4, A.3.1.1, A.3.2.1, A.3.2.3, A.4.1, A.4.2.1, A.4.2.2, A.4.4, A.5.1, A.5.2, A.6.1, A.7.1, A.7.3, A.8.1, A.8.2, B.2, B.3, D.1.2, D.1.3, D.1.4
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[1] **3.3.15**, 6.2.1, 6.3.4, 6.4, 7.2.2.6, Figure 10
[4] 6.5, 6.6, A.4.4
[5] 3, 5.2, 5.3, 6.1, 6.2.1, Figure 1, 6.3.1, 6.3.2.2, 6.4, 7.2.1, 7.2.2, 7.3.2, 7.4.2, 7.6.2.3, 7.6.2.4, 7.6.2.5, 7.6.3, 7.7.2, 7.7.3, 8.2.1, 8.2.2, 8.2.3, 8.3.2, 9.2, A.1, A.2(1.3), A.2(1.7), A.2(1.9), B.2(1.4), B.2(1.5), C.1, C.2(1), C.2(4), C.2(5), C.2(6), C.2(7.2.2)
[7] 6.1, 7, 8.3
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[5] 6.2.1, 6.3.1.3, 6.3.2.2, 6.4.2.3, 6.4.3.3, 6.4.4.3, 6.4.5.3, 6.4.6.3, 7.2.2, 7.3.2, 7.4.2, 7.6.3, 7.7.3, 8.2.2, 8.3.2, 9.2
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[7] 6.5.4, 6.7.1, 7, 8.7.3, 8.7.4
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[1] **3.3.17**, *6.5.4*
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[1] 5.5, 8.4, 10
[2] 5, 6.3.3, 6.4, 10.5
[4] 6.2.2, 6.6, 7
[5] 6.3.1.2, 6.3.1.3, 9
[6] 5, 7.2
[7] 5, 6.3.3, 8.2.3, G.1
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[5] A.2(2)

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Comprehensive testing service:
[1] **3.3.18**
[2] 11.6.2
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[5] 6.3.1.2, 6.3.2.2, 9.1
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[2] B.5
[7] 9.2.1, 9.2.4, 9.2.5, 9.3.2, 9.3.3, 9.5, C.1
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[1] 5.2.1, A.2
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[7] 9.2.5, A.5.4, G.1
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[7] 6.7.2.3, A.6.1, A.7.1, A.7.3
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[5] 7.2.1.2
[7] 9.2.5.5, A.5, Figure 29
Conditional status:
[7] 8.3.7.3, 9.2.5.4, Figure 23, 9.3.2, A.5.2, A.5.3, A.8.1.1, H.2
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[7] 7, *9.3.2*, Figure 25, 9.3.3, A.2
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[1] **3.3.19**, 6.1.4.1, 6.1.5.1, *6.3*, Figure 1, 6.5.2, 9, Figure 10
[2] 14.2
[4] 5.3, 6.4
[5] 3.1, 3.3, 3.5, *5*, 6.1, 6.3.1.2, 6.3.1.3, 6.3.2.1, 6.3.2.3, 6.3.3, 6.4.4.2, 7.2.1.5, 7.7, 8.1, 8.2.1, 8.3.1, A.1, B.1
[6] 7.1
[7] 6.1, 6.7.2.1, 6.7.2.3, 7, A.2
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[2] 6.3, 6.4, 7, 12.5, B.5
[6] 6.2.2, 8.2, 9, 10.2, A.2(4)
[7] 5, 8.1, 8.2.6, 8.5.4, 8.5.9, I.2
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[1] **3.3.20**, 6.3.3, 6.5.2, 6.5.5
[4] 5.2, 5.3, 6.1, 6.2.6, *6.4*, 6.6, 7, A.3, Figure 2, A.4.3, A.4.5
[5] 7.6.1, 7.6.2.1, 7.6.2.4, 7.6.2.5, 7.7.2, 7.7.3, 8.1, 8.3.1, 8.3.2, B.2(1.3), B.2(6)
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[1] **3.3.23**, 5.6.4, 5.8.1, 5.8.5, 6.1.1, 6.2.3, 6.3, 6.5.2, 6.5.3, 6.5.4, 7.2, 8.3, 8.4, 9, 10, Figure 10
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[5] 3.2, 3.4, 6.3.1.2, 7.7.4, 8.2.1, 9.1, A.2(1.6), B.1
[6] 7.5, 8.1
[7] 6.7.2.1, 6.7.2.2, 8.5.2, 9.1, 9.2.1, A.3.1.3, A.3.2.3, A.4.1.1, A.4.1.3, A.4.2.3, A.5.3, A.6.3, A.7.3, A.8.1.3, A.8.2.3
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[7] I.2
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[1] **3.3.25**, 5.4, 6.1.2.2
[7] A.3.1.2, A.3.1.4, A.3.2.2, H.1
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[1] **3.3.26**, 5.7
[7] 6.1, 8.5.9, D.1.2
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[2] 11.1.8, Figure 3, *11.3.4*, 13, A.1, A.2, A.5
[4] 6.2
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[2] *12.7*
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[1] **3.1**
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[5] 7.6.2.4, 8.3.1
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[5] 7.7.2, 8.1
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[1] **3.3.28**, 7.5.1, *7.5.2*, 7.6, Figure 8
[2] *11.3.3*, Figure 2, 11.6.2, Figure 11, A.4, A.5, A.6.2, A.6.5
[4] 11.1.8, 6.2
[5] *6.2.1.3*
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[7] *D.1*
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[6] 7.3.2
[7] 8.5.5, A.1.1, A.1.2
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[1] **3.3.29**, 5.2.3, *5.4*, 5.7, 6.1.1, 6.1.4, 7.3.1
[2] 6.2.1, 6.3.2, B.4.2
[6] 6.2.5
[7] 6.1, 8.5.1, 8.5.4, 8.5.5, A.1.3

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[5] B.2(4)
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[7] D.1.3
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[7] 6.1, 6.6
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[7] A.3.1.1, B.1, B.2, D.1.1, D.1.2, D.1.4

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[2] 12.1, 12.2.2, 12.3.2, A.1, A.2
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[1] **3.3.30**
[2] 11.4.1
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[2] 6.3, 12.1, A.6.3
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[5] 6.4.2.1
[7] 6.1, 6.6, 8.5.5, 8.5.9, G.1
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[1] **3.2.2**
[2] 10.2.1, 10.2.2, 10.3.1, 10.4, B.6.1, B.6.8, B.6.10
[5] 7.4.1.1
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[1] 7.2.1.2, 7.2.2.3, 7.3.1, *7.5.1*
[2] 11.3.1, A.3
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[5] 4, 7.3.1, 8.3.1, B.2(6)
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[1] **3.3.32**, 6.5.1.5
[4] 6.4
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[1] **3.3.31**, 6.5.1.5, 8.2, 8.2.5
[4] 5.3, 6.1, 6.2.2, 6.3.3, 6.4, A.1.2.1, A.3
[5] 8.3.1
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[1] **3.3.33**, 9
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[4] 5.3, 5.5, 6.3, 6.4, 6.6, A.2, A.4.2, A.4.5
[5] 7.3.1, 8.3.1, B.2(6)
[6] 7.1, 9
[7] 6.7.2.1

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[1] **3.3.34**, 3.3.124, *6.5.1.3*
[2] 12.4.1
[5] 7.6.2.4, 7.6.3.4, 7.6.4.3, 8.3.1, A.2(2.n), B.2(2), B.2(4), B.2(6)
[6] 7.3.2
[7] A.8.2.1
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[2] 4, 10.3.1, 12.6, B.3.1, *B.8*
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[1] **3.3.35**, *6.5.1.2*, 8.2.1
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[2] 10.3.1, 12.6, B.3.1, *B.8*
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[2] 10.4

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[1] **3.3.36**
[5] 7.2.1.2, 7.2.1.3
[7] 6.3.1, Figure 1, Figure 3, 8.5, 9.2.1, D.1.3
ICS proforma item:
[1] **3.3.36**
[5] 7.2.1.2, 7.2.1.3
[7] 6.3.1, Figure 1, Figure 3, 8.5, 9.2.1, D.1.3
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[1] **3.3.37**
[4] 6.3.3, 6.3.4
[6] 10.4.2, 10.4.3
[7] 6.3.1, 6.3.3, 6.4, 6.5.1, 6.5.4, 7, 8.3.7.2, 8.5.2, 8.5.5, 8.7.2, 8.7.4, 9.1, 9.3.1, 9.5, 10, A.3.1.2, A.4.1.1, A.4.1.2, A.8.1.1, A.8.1.2, B.3, B.4, D.1.2, D.1.3, D.1.4, D.1.5, D.2, H.1
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[7] **3.1**, *8*, 9.5, I.2
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[1] **3.3.40**, 5.3, Figure 1, 9
[2] 6.3.3, 6.4, 7, 8.2, 9, 10.5, 14, B.1, B.5
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[6] 6.2.4, 8.2.2, 8.2.4.3, 9, 10.2, 10.4.3, 10.6.2
[7] 5, *6.3*, 6.4, 6.5, 6.7.1, *8*, *9*, A.1.3, A.1.5, A.3.2.1, A.4.1.1, A.4.4, A.5.2, A.6.3, I.1, I.2
ICS question:
[1] **3.3.37**
[4] 6.3.3, 6.3.4
[6] 10.4.2, 10.4.3
[7] 6.3.1, 6.3.3, 6.4, 6.5.1, 6.5.4, 7, 8.3.7.2, 8.5.2, 8.5.5, 8.7.2, 8.7.4, 9.1, 9.3.1, 9.5, 10, A.3.1.2, A.4.1.1, A.4.1.2, A.8.1.1, A.8.1.2, B.3, B.4, D.1.2, D.1.3, D.1.4, D.1.5, D.2, H.1
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[7] **3.2**, I.1, I.2
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[1] **3.3.39**, 4, *5.6*, 5.8.3, 5.8.4, 6.1.1, 6.1.3, 6.2.1, 6.3, Figure 1, 9, Figure 10
[2] 4, 6.3.3, 7, 8.2, 10.4, 14, 14.1
[4] 4, 5.3, 5.5, A.1.7, A.4.3, A.4.5
[5] 4, 5.2, 5.3, 6.1, 6.3.1.2, 6.4.1, *6.4.2*, 6.4.3.3, 6.4.4.2, 6.4.5.1, 7.1, 7.2.1, Figure 2, Figure 3, Figure 4, 7.3.1,

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[6] 4, 6.2.5, 7.5, 9
[7] 4.1, 5, 6.1, 6.2, 6.3.1, 6.5.1, 6.5.2, 6.5.5, 6.5.6, 6.6, 6.7, 6.7.2, 7, 8.2.2, 8.2.5, 8.2.6, 8.2.7, 8.3.3, 8.3.4, 8.3.7.2, 8.7.2, 8.7.3, 9.1, 9.3.2, *10*, A.5.2, A.6.4, F.2, G.2, I.1, I.2

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[1] **3.3.38**
[2] 12.3.1, 12.3.4

Implementation conformance statement:
[1] **3.3.39**, *5.6*, 5.8.3, 5.8.4, 6.1.1, 6.1.3, 6.2.1, 6.3, Figure 1, 9, Figure 10
[2] 6.3.3, 7, 8.2, 10.4, 14, 14.1
[4] 5.3, 5.5, A.1.7, A.4.3, A.4.5
[5] 5.2, 5.3, 6.1, 6.3.1.2, 6.4.1, *6.4.2*, 6.4.3.3, 6.4.4.2, 6.4.5.1, 7.1, 7.2.1, 7.3.1, 7.4.1.1, 8.3.1, A.1, B.1, B.2(1.2), B.2(2), B.2(3), B.2(5), B.2(6), C.1, C.2(5), C.2(8.1), C.2(8.2)
[6] 6.2.5, 7.5, 9
[7] 5, 6.1, 6.2, 6.3.1, 6.5.1, 6.5.2, 6.5.5, 6.5.6, 6.6, 6.7, 6.7.2, 7, 8.2.2, 8.2.5, 8.2.6, 8.2.7, 8.3.3, 8.3.4, 8.3.7.2, 8.7.2, 8.7.3, 9.1, 9.3.2, *10*, A.5.2, A.6.4, F.2, G.2

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[1] **3.3.41**, 5.8.4, *6.2*, 6.3, Figure 1, Figure 10
[2] 8.2, 11.3.5
[4] 5.3, 6.1, 6.2.5, 6.5, A.1.7, A.1.8, A.2.2, A.4.3, A.4.5
[5] 5.2, 5.3, 6.1, Figure 1, 6.2.1.5, 6.3.1.2, 6.4.1, *6.4.4*, 7.1, 7.2.1.4, Figure 2, Figure 3, Figure 4, 7.3.1, 7.4.1.1, 8.3.1, A.1, A.2(1.7), A.2(2.n), B.1, B.2(1.3), B.2(1.4), B.2(6), C.1
[6] 6.3, 7.2, 7.5
[7] *10*, Annex E

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[1] **3.3.43**, 6.1, 6.5.1, 6.5.3, 6.5.4, 7.2, 7.3.1, Figure 6, Figure 7, *7.3.2*, 7.4, 7.5, 7.6, Figure 8, 8.1, 8.2, Figure 10
[2] 10.2.1, 10.2.2, 11, Figure 2, Figure 3, Figure 4, Figure 1, Figure 5, Figure 6, Figure 7, Figure 8, Figure 9, 12.4.3, 13, 14.1, A.1, A.2, A.3, Figure 10, Figure 11, Figure 12, Figure 13, Figure 14, A.6.6, Figure 15, Figure 16
[4] 5.1, 5.3, 6.2.2, 6.3.3, 6.3.4, 6.4, 6.5, A.1.2.1, A.1.3, A.1.4, A.1.7, A.1.8, A.2.1, A.4.2, A.4.3
[5] 6.2.1.1, 6.2.1.2.1, 6.2.1.3.1, 6.3.1.1, 6.3.1.3, 6.3.2.1, 6.3.2.2, 6.3.2.3, 6.4.1, 6.4.2.3, 6.4.3.3, 6.4.5.1, 7.1, 7.2.1.1, 7.3.1, 7.6.1, 7.6.3.1, 7.6.3.4, 7.6.4.2, 7.6.4.3, 8.2.1, 8.3.1, 9.1, A.2(1.7), A.2(1.8), A.2(2.n), B.2(1.2), B.2(1.4), B.2(2), B.2(3), B.2(6), C.1, C.2(5), *C.2(7.2), C.2(8.2)*
[6] 7.3.4, 7.3.5, 7.5, 10.3.3
[7] 6.1, 8.5.2, 10, A.1.1, A.2, A.3.1.3, A.3.2.3, B.3, D.1.4

Inconclusive verdict:
[1] **3.3.44**, 3.3.124, *6.5.1.3*
[2] 12.4.1
[5] 7.6.2.4, 7.6.4.3, 8.3.1, A.2(2.n), B.2(4), B.2(6)

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[6] 8.2.4.3, A.2(2N)
[7] 5, 6.3.3, 6.4, 6.5.1, 6.5.4, 8.1, 8.6, 8.7.4, F.2

Information object ICS:
[1] **3.3.45**
[5] 6.4.2.1, 6.4.2.3
[7] 6.2, 6.5.5, 6.7.2.1, 8.2.5, F.2

Information object IXIT proforma:
[5] C.2(8), C.2(8.1)

Information object IXIT:
[1] **3.3.46**, 6.2.3

Information object specification:
[2] 6.4
[5] 6.4.2.1, A.2(2.n), B.2(1.2), C.2(2)
[6] 8.2.4.3
[7] 6.1, 6.2, 6.3.3, 6.5.3, G.1

Information object:
[4] A.1.7
[5] 6.4.2.3
[6] 10.2
[7] 6.3.3, 6.5.1, 6.6, 6.7.2.1, 8.3.6, 8.7.4, F.1, F.2

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[1] **3.3.47**, 8.2.1
[2] 12.3.4

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[1] **3.3.48**
[2] 10.2.1, 10.2.2

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[1] 5.3, *5.8*
[5] 8.2.1, A.2(1.6)
[6] 6.1
[7] 6.7.2.2, A.4.1.4, B.4, D.1.2

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[1] **3.3.49**, 6.1.4.4, 6.5.1.3
[2] 10.2.1, 10.2.2, 10.3.2, 10.4, A.6, B.6.3, B.6.4, B.6.6, B.6.7, B.7.4
[4] A.1.2.2

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[6] 4
[7] 4.1

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[1] 1.2, 1.3, 4

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[6] 4, 10.5
[7] 4.1, D.1.4

ISPICS:
[6] 4
[7] 4.1

ISPIXIT:
[6] 4
[7] 4.1

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[1] **3.3.36**
[5] 7.2.1.2, 7.2.1.3
[7] 6.3.1, Figure 1, Figure 3, 8.5, 9.2.1, D.1.3

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[1] **3.3.50**, 8.2.2
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[4] A.2.2, A.4.4
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[1] **3.3.43**, 4, 6.1, 6.5.1, 6.5.3, 6.5.4, 7.2, 7.3.1, Figure 6, Figure 7, *7.3.2*, 7.4, 7.5, 7.6, Figure 8, 8.1, 8.2, Figure 10
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[4] 4, 5.1, 5.3, 6.2.2, 6.3.3, 6.3.4, 6.4, 6.5, A.1.2.1, A.1.3, A.1.4, A.1.7, A.1.8, A.2.1, A.4.2, A.4.3
[5] 4, 6.2.1.1, 6.2.1.2.1, 6.2.1.3.1, 6.3.1.1, 6.3.1.3, 6.3.2.1, 6.3.2.2, 6.3.2.3, 6.4.1, 6.4.2.3, 6.4.3.3, 6.4.5.1, 7.1, 7.2.1.1, 7.3.1, 7.6.1, 7.6.3.1, 7.6.3.4, 7.6.4.2, 7.6.4.3, 8.2.1, 8.3.1, 9.1, A.2(1.7), A.2(1.8), A.2(2.n), B.2(1.2), B.2(1.4), B.2(2), B.2(3), B.2(6), C.1, C.2(5), *C.2(7.2)*, *C.2(8.2)*
[6] 4, 7.3.4, 7.3.5, 7.5, 10.3.3
[7] 4.1, 6.1, 8.5.2, 10, A.1.1, A.2, A.3.1.3, A.3.2.3, B.3, D.1.4
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[4] 6.3.3, 6.3.4
[6] 10.4.2, 10.4.3
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[1] **3.3.42**, 6.2.1, Figure 1
[2] 10.5, 14, 14.1
[4] 6.1, 6.3.3, 6.5, A.2.2
[5] 5.2, Figure 1, 6.3.1.2, 6.3.1.2, *6.4.4*
[6] 8.2.2, 8.2.5, 10.4.3
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[1] **3.3.71**, 6.2.3
[5] 6.4.4.2, 6.4.4.4, 8.3.1, B.2(1.3)
[6] 8.2.2, 9
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[5] 6.4.4.1
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[2] 4, 8.2, 11.3.5
[4] 4, 5.3, 6.1, 6.2.5, 6.5, A.1.7, A.1.8, A.2.2, A.4.3, A.4.5
[5] 4, 5.2, 5.3, 6.1, Figure 1, 6.2.1.5, 6.3.1.2, 6.4.1, *6.4.4*, 7.1, 7.2.1.4, Figure 2, Figure 3, Figure 4, 7.3.1, 7.4.1.1, 8.3.1, A.1, A.2(1.7), A.2(2.n), B.1, B.2(1.3), B.2(1.4), B.2(6), C.1
[6] 4, 6.3, 7.2, 7.5
[7] 4.1, 10, Annex E
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[1] **3.3.51**, 7.5.1, *7.5.2*, 7.6, Figure 8
[2] *11.3.2*, Figure 1, 11.6.2, A.1, A.2
[4] 11.1.8, 6.2, A.1.6.4
[5] 6.2.1.2, 7.5.2, 7.5.3
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[1] **3.3.53**, 6.5.1.3, 7.4, 7.5.5, 8.2.2
[2] 11.1, *11.5.2*, 11.5.4, 12.2.2, 12.4.2
[4] 6.2, 6.4, A.1.1, A.1.5, A.1.6.2, A.1.6.3, A.1.6.5, A.4.3, A.4.5
Lower tester:
[1] **3.3.52**, 3.3.123, 6.1.4.4, 6.5.1.3, *7.4*, 7.6, 8.2.1, 8.2.2
[2] 8.2, *11.2.2*, 11.3.2, 11.3.3, Figure 5, Figure 6, Figure 7, Figure 8, Figure 9, 13, A.4.1, A.6.4, A.6.6
[4] 6.2, 6.4, A.1.1, A.1.2, A.1.4, A.1.5, A.1.6.1, A.1.6.2, A.1.6.3, A.1.6.5, A.4.2, A.4.3, A.4.4, A.4.5
[5] 6.2.1.1, 6.3.1.2, 7.5.2, 7.6.2.4, 7.6.4.2, C.1, C.2(3), C.2(7.2.1)
[6] 7.3.5, 10.3.3
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[1] **3.3.52**, 3.3.123, 4
[2] 4, *11.2.2*, 11.3.2, 11.3.3, Figure 5, Figure 6, Figure 7, Figure 8, Figure 9, 13, A.4.1, A.6.4, A.6.6
[4] 4, A.1.6.2
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[1] **3.3.53**, 4, 6.5.1.3, 7.4, 7.5.5, 8.2.2
[2] 4, 11.1, *11.5.2*, 11.5.4, 12.2.2, 12.4.2
[4] 4, 6.2, 6.4, A.1.1, A.1.5, A.1.6.2, A.1.6.3, A.1.6.5, A.4.3, A.4.5

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[2] 7.2, 10.2.1, 10.2.2
[5] 7.3.1
[7] 6.3.1, 8.3.7.2, 8.3.7.3, 9.6, A.3.1.1
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[1] 5.2.1, 5.6.2, A.2
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[7] A.3
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[7] 4.2, 6.1, 6.6, Figure 10, 7, F.2, I.1, I.2, I.3
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[1] 3.3.5, **3.3.54**, 3.3.84, 3.3.119, 6.3.2, 6.5.4, Figure 10
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[1] **3.1**, 5.4, 5.8.3, 5.8.4, *7.2*, 7.5.5, *7.6*
[2] 11.1.3, 11.1.5, 11.1.6, 11.5.1, 11.6.3
[5] 8.2.1, A.2(1.6)
[7] 6.1
Real system:
[1] **3.1**, 5.1, 5.3, 5.4, 7.1
[2] 11.6.4, A.6.1
[4] A.1.2.1.1
Reconfiguration:
[6] 7.5
[7] 6.1, 6.6, 7, 8.5.7, 9.3.2
Reference ATS:
[4] 5.2, 6.2.1, 6.2.3, 6.2.5, 6.3.2, 6.3.3, 6.6, A.2.2, A.2.3, A.4.3, A.4.5
[5] 6.3.2.1, 6.4.4.2, 7.3.1, 7.4.1.1, 7.6.4.2, 8.2.1
Reference standardized ATS:
[1] **3.3.84**
[4] 5.2, 6.2.1, 6.2.3, 6.2.5, 6.3.2, 6.3.3, 6.6, A.2.2, A.2.3, A.4.3, A.4.5
[5] 6.3.2.1, 6.4.4.2, 7.3.1, 7.4.1.1, 7.6.4.2, 8.2.1
Relay system:
[1] *7.2.1.2*, Figure 4, Figure 5, 7.2.2.4, 7.3.1, 7.3.2.6, 7.4
[2] 11.5.1, 11.5.5, Figure 9, 11.6.3, A.3
[4] A.1.6.3
[5] 6.4.5.1
[7] 6.1, 8.5.2, 8.5.4, 8.5.5, A.1.3
Remote test method:
[1] **3.3.85**, 7.5.1, *7.5.3*, 7.6, Figure 8
[2] 11.1.8, Figure 4, *11.3.5*, 11.6.2, A.1, A.2, A.4, A.5, A.6.2
[4] A.1.3, A.4.3
[5] 6.2.1.5, C.2(5), C.2(7.2.4)
Repeatability of results:
[1] **3.3.86**, *6.5.3*
Requirements list:
[1] **3.3.72**, 5.6.3, Figure 1
[5] 6.4.3, 7.2.1.1, 7.2.1.2, 8.3.1, B.2(1.2)
[6] 8.2.2, 10.2, 10.4.3, 10.6.2
[7] 5, 6.4, Annex C
Re-running test cases:
[5] 7.6.2.2, 7.6.2.4, 7.6.3.2, 7.6.3.4, 7.6.4.1, 7.6.4.3
RL:
[1] **3.3.72**, 4, 5.6.3, Figure 1
[5] 4, 6.4.3, 7.2.1.1, 7.2.1.2, 8.3.1, B.2(1.2)
[6] 4, 8.2.2, 10.2, 10.4.3, 10.6.2
[7] 4.1, 5, 6.4, Annex C
Role:
[1] **3.3.87**, 9
[2] 10.2.1, 10.2.2, 12.2.2, A.6.5, A.6.6, B.5
[5] 6.4.2.1, 6.4.3.1, 6.4.4.1, 6.4.5.1, 6.4.6.1, 9.1.1, 9.1.3, 9.2
[6] 6.3, 10.3.3
[7] 6.3.2, 8.3.7.1, 8.5.1, 8.5.2, 8.5.4, 8.5.5, A.1, A.3.1, A.4.1, A.4.2.1, A.4.2.3, A.4.4, A.5, A.6, A.7, A.8, B.2, B.3, D.1.2
RTS:
[2] 4, Figure 12

SAP:
[1] 4, 7.3.2.7, 7.6
[2] 4, 11.5.5, A.6.4
SATS:
[1] **3.3.88**, 4
[4] 4, 5.4, 6.3.4, Figure 1
[5] 4, 7.4.1.2, 7.6.2.4
SCS proforma:
[1] **3.3.101**, Figure 1
[5] Figure 1, 6.3.1.2, 6.4.5.2
[6] 8.2.2, A.2(1)
[7] 6.1, 6.6, 7

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SCS:
[1] **3.3.100**, 4, 5.6, *5.6.4*, 5.7, 5.8.3, 6.3.2, 6.3.3, Figure 1
[5] 4, 5.2, Figure 1, 6.3.1.2, 6.4.1, 6.4.4.2, 6.4.5, 7.2.1.4, Figure 2, Figure 3, 8.2.1, A.1, A.2(1.4), A.2(1.7), B.1, C.2(5)
[5} 6.1
[6] 4, 7.5
[7] 4.1, 6.1, 6.2, 6.6, Figure 10, 6.7, 7, 9.3.2, F.2
SCTR proforma:
[1] 5.8.5
[5] 8.2, A.1, A.3
[6] 9
SCTR template:
[5] 8.2, A.1, A.2
SCTR:
[1] **3.3.102**, 4, Figure 1, *6.5.2*
[5] 4, 5.4, 6.3.2.3, 7.6.2.2, 7.7.2, Figure 5, 8.1, 8.2, 8.3.1, A.1, B.1
[7] 4.1, 6.1, 6.6, Figure 10, 7
Selected abstract test suite:
[1] **3.3.88**
[4] 5.4, 6.3.4, Figure 1
[5] 7.4.1.2, 7.6.2.4
Selected executable test suite:
[1] **3.3.89**
[4] 5.4, 5.5, 6.3.1, Figure 1
[7] A.3.2.3
Selection:
[1] 3.3.54, 5.8.4, 6.3.3, Figure 1, 7.3.2.3
[2] 8.2, 10.5, B.4.7
[4] 5.2, 5.3, 6.2.2, 6.2.3, 6.2.4, 6.3.4, 6.3.5, A.1.7, A.2.1, A.4.3, A.4.5
[5] 5.3, 6.3.2, 7.1, Figure 2, Figure 4, 7.3, 7.4.1.1, 8.2.1, 9.1, B.2(6)
[6] 6.2.2, 9, 10.3.1, 10.4.2, 10.4.3
Semantically invalid test event:
[1] **3.3.90**
[2] 10.2.1, 10.2.2, 10.4
Service access point:
[1] **3.1**, 7.3.2.7, 7.6
[2] 11.5.5, A.6.4
[5] C.2(7.2.1)
Service primitive:
[1] **3.2**
[5] 6.2.1.3.1, *6.2.1.4*
Service-provider:
[1] **3.2**, Figure 7, 7.3.2.6, 7.4, Figure 8
[2] 11.2.2.1, 11.2.2.2
Service-user:
[1] **3.2**
Session layer:
[1] **3.1**
SETS:
[1] **3.3.89**, 4
[4] 4, 5.4, 5.5, 6.3.1, Figure 1
Single profile:
[5] A.1
[6] 8.2.7, 9, 10.6.2
[7] 6.7.2.3, 8.7.3, 9.3.2
Single-party testing context:
[1] **3.3.91**, 6.5.1.3, 7.2.2.2, 7.3.1, 7.4, *7.5.1*, 7.5.4, 7.6, 8.2.1, 8.2.3
[2] 11.1, 11.2, *11.3*, 11.4.1, 11.5.1, 11.5.3, 11.5.4, 11.6.2, 12.1, 12.3.1, 13, A.3, A.6.2, A.6.6
[4] 6.2.1, A.1.2.1.1, A.1.3, A.4.3
[5] 6.2.1.1, 6.4.6.1, 7.5.3, B.2(1.3)
[7] 8.5.2
Single-protocol testing:
[1] **3.3.92**
SPyT:
[1] **3.3.91**, 4, 6.5.1.3, 7.2.2.2, 7.3.1, 7.4, *7.5.1*, 7.5.4, 7.6, 8.2.1, 8.2.3
[2] 4, 11.1, 11.2, *11.3*, 11.4.1, 11.5.1, 11.5.3, 11.5.4, 11.6.2, 12.1, 12.3.1, 13, A.3, A.6.2, A.6.6
[4] 4, 6.2.1, A.1.2.1.1, A.1.3, A.4.3
[5] 4, 6.2.1.1, 6.4.6.1, 7.5.3, B.2(1.3)
Stable testing state:
[1] **3.3.93**, 8.2.1, 8.2.4
[2] 12.3.1, 12.3.4
Standardized abstract test suite:
[1] **3.3.94**, 6.1.2.4, 6.1.3.4, 6.1.4.3, 6.1.5, 7.3.2.3, 8.3
[2] 14
[5] 7.3.2
Standardized ATS:
[1] **3.3.94**, 6.1.2.4, 6.1.3.4, 6.1.4.3, 6.1.5, 7.3.2.3, 8.3
[2] 14
Static conformance requirements:
[1] **3.3.95**, 5.2.3, *5.3*, 5.4, 5.6.2, 5.8.4, 6.1.1, 6.1.3, 6.3.3, Figure 1
[2] 6.2.1, 6.3, 7.3, *9*, 10.2.1, B.4.5, B.5
[5] 7.2.1.1, 7.2.1.2, 8.3.1, B.2(2), B.2(3), B.2(5)
[6] 6.2.2, 6.2.3, 6.2.4
[7] 6.1, 6.2, 6.3.1, 6.5.1, 8.3.7.1, 8.3.7.3, 8.5.1, 8.5.3, 8.5.9, 8.7.5, D.1.2, D.1.4
Static conformance review:
[1] **3.3.96**, 6.3.3, Figure 1
[5] 5.3, 7.1, *7.2*, Figure 2, Figure 3, 8.3.1, B.2(5)
[7] 6.3.1, 6.7.2.1, 8.2.5, 8.5.10
Status column:
[2] B.5
[7] 8.3.7.3, *9.2*, 9.2.1, 9.2.5, 9.3.1, 9.3.4, D.2
Status value:
[1] **3.3.97**
[5] 7.2.1.2
[7 A.3.1
[7] 6.3.1, 6.4, 6.5.1, 6.5.4, 8.3.7.1, 8.3.7.3, 8.5.2, 8.5.4, 8.7.3, 9.1, 9.2.1, 9.2.5.5, 9.3.1, 9.3.4, 9.6, Figure 28, A.1, A.2, A.3.2.4, A.4, A.5, A.6, A.7, A.8, D.2, Figure 39

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Status:
[1] **3.3.97**
[5] 7.2.1.2
[7] 6.3.1, 6.4, 6.5.1, 6.5.4, 8.3.7.1, 8.3.7.3, 8.5.2, 8.5.4, 8.7.3, 9.1, 9.2.1, 9.2.5.5, 9.3.1, 9.3.4, 9.6, Figure 28, A.1, A.2, A.3.1, A.3.2.4, A.4, A.5, A.6, A.7, A.8, D.2, Figure 39
Subnetwork:
[1] **3.1**
[2] 11.5.5, Figure 9, A.2, A.3
Support answer:
[1] **3.3.98**, 6.2.3, 7
[5] 7.2.1
[7] 6.3.1, 6.4, 6.5.1, 6.5.5, 6.7.2.3, 8.3.7.3, 8.5.2, 8.7.3, 9.1, 9.2.2, *9.3*, 9.5, A.2, A.3.1.2, A.3.1.4, A.3.2.2, A.4.1.2, A.4.2.2, A.5.2, A.6.2, A.7.2, A.8.2.2, C.2, C.3
SUT operator:
[5] **3.4**, 6.2.1.3.2, 6.2.1.5.2, 6.3.1.2, 7.6.3.1
SUT:
[1] **3.3.103**, 4, 6.2.2, 6.3.2, 6.5.2, 7.1, *7.2.1*, 7.2.2, 7.3.1, Figure 7, 7.3.2.2, 7.3.2.7, 7.5.1, 7.5.2, 7.5.3, 7.6, Figure 8, 8.2.5
[2] 4, 11.1.7, 11.2.1, 11.2.2.2, 11.2.3, 11.2.4, 11.3, 11.5.3, 11.6.2, 11.6.3, 12.3.3, A.1, A.2, A.3, A.6.5
[4] 4, 6.2.1, A.1.2.1.1, A.1.3, A.1.6.4, A.4.4
[5] 3.4, 4, 5.2, 6.1, 6.2, Figure 1, 6.3.1.2, 6.3.1.3, 6.3.2.2, 6.4.1, 6.4.4.2, 6.4.5.1, 6.4.5.2, 7.3.1, 7.5.1, 7.5.3, 7.6.2.2, 7.6.3.1, 7.6.3.2, 7.6.4.1, 8.2.1, 9.1, 9.2, A.1, *A.2(1.4)*, A.2(1.6), A.2(1.7), A.2(1.8), A.2(2.n), B.1, C.1, *C.2(5)*, C.2(6), C.2(7.2.1), C.2(7.2.4), C.2(8.2.2), C.2(9.2), C.2(9.2.1)
[6] 4, 7.5, 10.3.3
[7] 4.1, 6.1
Syntactically invalid test event:
[1] **3.3.99**
[2] 10.2.1
System conformance statement proforma:
[1] **3.3.101**, Figure 1
[5] 6.3.1.2, 6.4.5.2
[6] 8.2.2, A.2(1)
[7] 6.1, 6.6, 7
System conformance statement:
[1] **3.3.100**, *5.6.4*, 5.7, 5.8.3, 6.3.2, 6.3.3, Figure 1
[5] 5.2, 6.1, Figure 1, 6.3.1.2, 6.4.1, 6.4.4.2, 6.4.5, 7.2.1.4, Figure 2, Figure 3, 8.2.1, A.1, A.2(1.4), A.2(1.7), B.1, C.2(5)
[6] 7.5
[7] 6.1, 6.2, 6.6, Figure 10, 6.7, 7, 9.3.2, F.2
System conformance test report proforma:
[1] 5.8.5
[5] A.1, A.3
[6] 9
System conformance test report:
[1] **3.3.102**, 5.8.5, Figure 1, *6.5.2*
[5] 5.4, 6.3.2.3, 7.6.2.2, 7.7.2, 8.1, 8.2, 8.3.1, A.1, B.1
[7] 6.1, 6.6, Figure 10, 7
System under test:
[1] **3.3.103**, 6.2.2, 6.3.2, 6.5.2, 7.1, *7.2.1*, 7.2.2, 7.3.1, Figure 7, 7.3.2.2, 7.3.2.7, 7.5.1, 7.5.2, 7.5.3, 7.6, Figure 8, 8.2.5
[2] 11.1.7, 11.2.1, 11.2.2.2, 11.2.3, 11.2.4, 11.3, 11.5.3, 11.6.2, 11.6.3, 12.3.3, A.1, A.2, A.3, A.6.5
[4] 6.2.1, A.1.2.1.1, A.1.3, A.1.6.4, A.4.4
[5] 3.4, 5.2, 6.1, 6.2, Figure 1, 6.3.1.2, 6.3.1.3, 6.3.2.2, 6.4.1, 6.4.4.2, 6.4.5.1, 6.4.5.2, 7.3.1, 7.5.1, 7.5.3, 7.6.2.2, 7.6.3.1, 7.6.3.2, 7.6.4.1, 8.2.1, 9.1, 9.2, A.1, *A.2(1.4)*, A.2(1.6), A.2(1.7), A.2(1.8), A.2(2.n), B.1, C.1, *C.2(5)*, C.2(6), C.2(7.2.1), C.2(7.2.4), C.2(8.2.2), C.2(9.2), C.2(9.2.1)
[6] 10.3.3
[7] 6.1

TCP:
[1] **3.3.109**, 4, 6.5.4, *7.4*, 7.5.2, 7.5.3, 7.5.5, Figure 8, 8.2.1, 8.2.2
[2] 4, 8.2, 11.1, 11.2.4, *11.3*, 11.4.2, 11.5.4, 11.5.5, Figure 6, 12.1, 13, 14.1, A.6.6
[4] 4, 6.2.1, 6.4, 6.6, A.1.1, A.1.2.1.1, A.1.4, A.1.6, A.2.2, A.4.3, A.4.4, A.4.5
[5] 4, 6.2.1.1, 6.2.1.2.2, 6.2.1.3.2, 6.2.1.5.1, 6.2.1.5.2, 6.3.1.3, 7.1, Figure 2, 7.5
Technical Corrigenda:
[2] 12.1
[4] 6.6
[6] 8.2.4.2, 8.2.5, 9
[7] 8.3.2, 8.3.6, 8.4
Test body:
[1] **3.3.105**, 8.2.1, 8.2.2
[2] 12.3.1, 12.3.4, 12.3.5
Test campaign:
[1] **3.3.106**, 6.3.3, Figure 1, 6.5.2, 6.5.5
[2] 14.1
[4] 5.3, 6.4, Figure 2, A.4.5
[5] 5.3, 6.1, 6.3.1.2, 7.1, Figure 2, 7.3.2, 7.5.1, 7.5.3, *7.6*, *7.7*, 8.2.1, 8.3.1, 9.1.3, A.1, B.1, B.2(4), *B.2(6)*, C.2(9.2)
[6] 7.5
[7] A.1.1, A.3.1.1
Test case error:
[1] **3.3.108**, 3.3.126, *6.5.1*, 6.5.1.5, 6.5.1.6
[4] 6.4
[5] 7.6.2.4, 8.3.1
Test case:
[1] **3.3.107**, 6.1.5.1, 6.1.5.4, 6.2.2, 6.5, 8.1, 8.2.1, Figure 9, 8.4
[2] 8.2, 8.5, 10.1.2, 10.1.3, 10.2.1, 10.3.3, 10.3.4, 10.4, 10.5, 11.1, 11.3.4, 11.5.2, 11.5.4, 11.6.1, 12.1, 12.2, 12.3, 12.4.2, 12.4.3, 13, 14, A.6.5
[4] 5.3, 5.5, 6.2.2, 6.2.3, 6.3.3, 6.3.4, 6.4, 6.6, A.1.2.1.1, A.1.2.2, A.1.7, A.1.8, A.4.3, A.4.5
[5] 6.3.2.1, 7.3.1, 7.4.1.1, 7.4.1.2, 7.5.3, 7.6.2, 7.6.3.1, 7.6.3.2, 7.6.3.4, 7.6.4, 7.7, 8.2.1, 8.3.1, A.2(1.6),

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A.2(2.n), B.1, B.2(1.4), B.2(4), B.2(6)
[6] 7.3.2, 7.3.3, 7.3.4, 8.2.5, 8.2.7, 9, 10.3.1, 10.4.1, 10.4.2, A.2(2N), A.2(3)
[7] A.3.1.3, A.3.2.3, A.6.3, A.7.3, D.1.5

Test coordination procedures:
[1] **3.3.109**, 6.5.4, *7.4*, 7.5.2, 7.5.3, 7.5.5, Figure 8, 8.2.1, 8.2.2
[2] 8.2, 11.1, 11.2.4, *11.3*, 11.4.2, 11.5.4, 11.5.5, Figure 6, 12.1, 13, 14.1, A.6.6
[4] 6.2.1, 6.4, 6.6, A.1.1, A.1.2.1.1, A.1.4, A.1.6, A.2.2, A.4.3, A.4.4, A.4.5
[5] 6.2.1.1, 6.2.1.2.2, 6.2.1.3.2, 6.2.1.5.1, 6.2.1.5.2, 6.3.1.2, 6.3.1.3, 7.1, Figure 2, 7.5

Test event:
[1] **3.3.110**, 3.3.122, 3.3.127, 3.3.129, 6.3.3, 6.5.1, 6.5.5, 7.3.2.2, 7.3.2.5, *8.1*, 8.2, Figure 9
[2] 10.2, 10.4, 11.1.7, 11.2.2.2, 11.2.3, 11.3, 11.4.1, 12.3.1, 12.4.1, 12.4.3, A.1
[4] 6.3.3, 6.4, A.1.2.1.1, A.1.2.1.2, A.3
[5] 6.2.1.5.2, 7.6.2.4, 8.3.1

Test group objective:
[1] **3.3.112**, *8.1*
[2] 8.2, 10.3

Test group:
[1] **3.3.111**, 3.3.112, 6.1.3.4, 6.3.3, 6.4.2, *8.1*, Figure 9
[2] 8.2, 10.1.2, 10.2.1, 10.2.2, 10.2.3, 10.3, 10.4, 10.5, 11.1.10, 12, 14.1
[4] 6.3.3
[5] B.2(4)
[6] 10.3.2

Test laboratory and client:
[5] 3.3, 5.3, 6.1, 6.3, 6.4.1, 7.6.4.1, 7.6.4.2, 7.6.4.3, 7.7.1, 7.7.2, 8.2.3, 8.3.3, C.2(7)

Test laboratory checklist:
[5] **3.5**, 6.3.1, 6.3.2.2

Test laboratory manager:
[5] **3.6**, 6.4.4.2, 7.6.4.2, A.2(1.1), B.2(1.1), C.2(3)

Test laboratory role:
[5] 6.3.1.2, 6.3.2.1, 6.4.2.2, 6.4.3.2, 6.4.4.2, 6.4.5.2, 6.4.6.2, 7.2.1, 7.3.1, 7.4.1, 7.5.2, 7.6.2, 7.7.2, 8.2.1, 9.1

Test laboratory:
[1] **3.3.113**, 6.2, 6.3.4, 6.4, 6.5.4, 6.5.5, 7.2.2.6, Figure 10
[2] 10.4, 12.1, 12.4.3, 14.1
[4] 6.2.5, 6.3.5, 6.5, 6.6, A.1.8, A.2.1, A.3, A.4.1, A.4.4, A.4.5
[5] 3, 3.5, 3.6, 3.7, 5.2, 5.3, *6*, Figure 1, 6.3.1.2, 6.3.2.1, 6.4.2.2, 6.4.5.2, 6.4.6.2, 7.2.1, 7.3.1, 7.4.1, 7.5.2, 7.5.3, 7.6.2, 7.6.3, 7.6.4, 7.7.1, 7.7.2, 8.1, 8.2, 8.3, 9.1, A.1, A.2(1.2), A.2(1.7), A.2(1.9), B.1, B.2(1.1), B.2(1.4), B.2(1.5), B.2(4), B.2(6), C.1, C.2(1), C.2(2), C.2(3), C.2(4), C.2(6), C.2(7.1)
[7] 6.1, 6.6, 6.7.2.3, 7, 8.3.3, A.3.1.3, A.3.2.3

Test management protocol:
[1] **3.3.114**, 7.4, 7.5.3, 7.6, 8.3
[2] 8.3, 11.3.4, 12.1, *13*, 14.1, Figure 14, A.6.6
[4] 6.2.1, A.1.4, A.1.6.2, A.4.4
[5] 6.2.1.4.1, 6.2.1.4.2, 6.3.2.1, 6.4.1, 6.4.6, 7.5.3
[6] 7.2, 8.2.5, 9, 10.3.1, A.2(2N)

Test method:
[1] *7.6*

Test notation:
[1] 8.2.3
[2] 5.2, 5.3, 8.2, 12.1, 12.2, 12.3.1, A.1
[4] 6.2.2, A.4.3

Test operations:
[1] *6.3*, Figure 1
[4] 6.6, A.2.1
[5] 5.1, 5.2, *5.3*, 5.4, 6.1, 6.3.1.2, 7, Figure 2, Figure 3, 9.1

Test operator:
[4] A.1.5
[5] **3.7**, 6.2.1.3.2, 6.2.1.5.2, 7.6.2.1

Test outcome:
[1] 3.3.35, **3.3.58**, 3.3.63, 3.3.126, 6.5, 8.2.1
[4] 6.4
[5] 7.6.2.5

Test postamble:
[1] **3.3.116**, *8.2.1*, 8.2.2, 8.2.4
[2] 12.3.1, 12.3.4, 12.3.5

Test preamble:
[1] **3.3.117**, *8.2.1*, 8.2.2, 8.2.4
[2] 12.3.1, 12.3.4, 12.3.5

Test preparation:
[4] 6.3.5, A.2.1, A.4.5
[5] 3.1, 3.5, 5.2, 6.1, 6.2.1.5.1, 6.3.1, 6.4.1

Test purpose:
[1] **3.3.118**, 6.1.5, 6.5.1.3, *8.1*, 8.2.1, Figure 9, 8.2.4, 8.3, 8.4, Figure 10
[2] 8.2, 10.1, 10.2.3, *10.3*, 10.4, 10.5, 11.1.2, 11.1.3, 11.4.1, 11.6.2, 12.3.1, 12.3.3, 12.4.1, A.3, A.6.6
[4] 6.3.3
[6] 7.2, 8.2.4.4, 8.2.7, 9, 10.3.1, 10.3.2, 10.4.1, 10.4.2, A.2(3)

Test realization:
[1] **3.3.119**, Figure 10
[4] 5.1, 6.1, 7, A.2.1

Test realizer:
[1] **3.3.120**, 6.2.1, Figure 10
[2] 10.4, 12.1, 12.4.3, 12.5, 14.1
[4] 6.2.1, 6.2.5, 6.3.4, 6.5, 6.6, A.2.2, A.2.3, A.4.2, A.4.4, A.4.5
[6] 7.1, 9, A.2(4)

Test report:
[1] 5.8.4, 6.3, Figure 1, *6.5.2*, 6.5.4, Figure 10
[4] 6.4
[5] 5.1, *5.4*, 6.3.1.2, 6.4.5.1, 7.6.2.4, 7.7.2, Figure 5, *8*, 9.1, 9.1.1, A.2(1.7), B.2(1.4)
[6] 10.3.3

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Test selection:
[1] 6.3.3, Figure 1
[4] 6.3.4
[5] 5.3, 7.1, Figure 2, Figure 4, 7.3, 7.4.1.1, 9.1.3
[7] 6.7.2.1
Test step:
[1] **3.3.122**, *8.1*, Figure 9, 8.2.2, 8.2.3
[2] 8.2, 12.1, 12.3.5
[4] A.4.5
Test suite specifier:
[1] 8.2.1
[2] 8, 9, 10.1.3, 10.2, 10.3, 10.4, 11.3.4, 11.6.2, 11.6.3, 12.2, 12.3.2, 12.3.4, 12.3.5, 12.4, 12.6, 12.7, 14, 15
[5] 9.1.2
[6] 7.3.4
Test suite structure:
[1] Figure 10
[2] 8.3, 10, 12.1
[6] 7.2, A.2(3)
Test suite:
[1] **3.3.22**, 6.2.2, 6.5.3, 6.5.4, 6.5.5, *8*, Figure 9
[2] 5.2, 10.2.1, 10.4, 10.5, 11.2.4, 11.3.2, 11.3.3, 11.3.4, 11.5.3, 11.6.2, 11.6.3, 12.1, 12.2.2, 14.1, 15
[5] 7.3.1, B.1
[7] 6.7.1, A.8.2.3
Test system:
[1] **3.3.123**, 6.3.3, 6.5.1.6, Figure 7, 7.3.2.2, 7.3.2.6, 7.5.2, Figure 8, 8.2.5
[2] 11.1.7, 11.3.2
[4] 6.2.1, 6.3.3, A.1.2.1.1, A.1.5, A.1.6.2, A.1.6.3, A.4.2
[5] 6.2.1.2.1, 8.3.1
Test verdict:
[1] 3.3.34, 3.3.44, 3.3.63, **3.3.124**, *6.5.1*, 6.5.2, 6.5.4, 7.4, 8.2.1, 8.2.2
[2] 11.1.5, 11.1.6, 11.3.4, 11.5.1, 11.5.2, 12.3.1, 12.4.1, 12.4.2, 14.2
[4] 6.3.3, 6.4, A.1.2.1.1, A.1.5
[5] 7.6.2.2, 7.6.2.4, 7.6.3.2, 7.6.3.4, 7.6.4.3, 7.7.1, 8.3.1, B.2(2), B.2(4), *B.2(6)*
[6] 7.3.2
Testing state:
[1] **3.3.121**, 3.3.125, 8.2.1, 8.2.4
[2] 12.3.1, 12.3.4
Tick box:
[7] 9.3.3, Figure 26, Figure 27, 9.3.4
Timers:
[1] 5.3, 5.8.4, 6.2.2
[2] 7.2, 10.2.1, 10.2.2, 10.4
[5] 7.4.1.1, C.2(6), C.2(7.2), C.2(7.2.3)
[7] 8.5.1, 8.5.6, A.4.2.4
TMP:
[1] **3.3.114**, 4, 7.4, 7.5.3, 7.6, 8.3
[2] 4, 8.3, 11.3.4, 12.1, *13*, 14.1, Figure 14, A.6.6
[4] 4, 6.2.1, A.1.4, A.1.6.2, A.4.4
[5] 4, 6.2.1.4.1, 6.2.1.4.2, 6.3.2.1, 6.4.1, 6.4.6, 7.5.3
[6] 4, 7.2, 8.2.5, 9, 10.3.1, A.2(2N)
TM-PDU:
[2] 4, Figure 3, 11.3.4, 13
[4] 4, A.1.2.1.1
Transfer syntax:
[1] **3.1**, 5.5, 5.6.4, 5.7, 6.1.1
[2] A.6.2, A.6.3
[5] 6.4.2.1
[7] 8.5.5
Transient testing state:
[1] **3.3.125**
[2] 12.3.4
Transport layer:
[1] **3.1**
Tree and tabular combined notation:
[1] Figure 10
[2] 5.3, 11.6.2, 12.2,
[4] 3, 6.4, A.4.3
[5] 2, C.2(7.2.4)
[7] 9.2.3, 9.2.5.4
TSS&TP compliance clause:
[2] 10.5
TSS&TP:
[1] 4, 8.3, 8.4
[2] 4, 8.3, 8.5, 10
[5] 4, B.2(6)
[6] 4, 7.2, 8.2.4.4, 9, 10.3.1, 10.3.2, A.2(2N)
TTCN:
[1] 4, Figure 10
[2] 4, 5.3, 11.6.2, 12.2,
[4] 3, 4, 6.4, A.4.3
[5] 2, 4, C.2(7.2.4)
[7] 4.1, 9.2.3, 9.2.5.4

Unforeseen test outcome:
[1] **3.3.126**, *6.5.1.4*
Unidentified test event:
[1] **3.3.127**, 6.5.1.2
[2] 12.4.1
[5] 7.6.2.4
Upper tester:
[1] **3.3.128**, 6.2.2, *7.4*, 7.5, 7.6, Figure 8, 8.2.1, 8.2.2
[2] 8.2, 11.2.3, 11.2.4, 11.3, 11.4.2, *11.5*, Figure 7, Figure 8, Figure 9, 13, 14.1, A.1, A.2, A.4.1, A.6.6
[4] 6.2.1, 6.4, 6.6, A.1, A.4
[5] 6.2.1, 6.3.1.2, 6.4.4.2, 7.5.3, 7.6.4.2, C.2(5)
[6] 7.3.5, 10.3.3
UT:
[1] **3.3.128**, 4, Figure 8
[2] 4, 8.2, 11.2.3, 11.2.4, 11.3, 11.4.2, *11.5*, Figure 7, Figure 8, Figure 9, 13, 14.1, A.1, A.2, A.4.1, A.6.6
[4] 4, 6.2.1, 6.4, 6.6, A.1, A.4

Valid test event:
[1] 3.3.63, **3.3.129**
[2] 10.2.1, 10.2.2, 12.4.1, B.6.7
Verdict:
[1] 3.3.34, 3.3.44, 3.3.63, **3.3.124**, *6.5.1*, 6.5.2, 6.5.4,

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7.4, 8.2.1, 8.2.2
[2] 11.1.5, 11.1.6, 11.3.4, 11.5.1, 11.5.2, 12.3.1, 12.4.1, 12.4.2, 14.2
[4] 6.3.3, 6.4, A.1.2.1.1, A.1.5
[5] 7.6.2.2, 7.6.2.4, 7.6.3.2, 7.6.3.4, 7.6.4.3, 7.7.1, 8.3.1, B.2(2), B.2(4), *B.2(6)*
[6] 7.3.2

XRL:
[1] **3.3.71**, 4, 6.2.3
[5] 4, 6.4.4.2, 6.4.4.4, 8.3.1, B.2(1.3)
[6] 4, 8.2.2, 9
[7] 4.1, Annex E

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