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

Part 3: The Tree and Tabular Combined Notation (TTCN)

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Technologies de l'information — Interconnexion de systèmes ouverts — Essais de conformité — Méthodologie générale et procédures —
Partie 3: Notation combinée arborescente et tabulaire (TTCN)

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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.

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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.

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International Standard ISO/IEC 9646-3 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.

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 (TTCN)*
- *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: Implementaion conformance statement — Requirements and guidance on ICS and ICS proformas*

Annexes A, B and C form an integral part of this part of ISO/IEC 9646. Annexes D, E, F, G and H are for information only.

Introduction

This part of ISO/IEC 9646, one of a multi-part International Standard defines an informal test notation, called the Tree and Tabular Combined Notation (TTCN), for use in the specification of OSI abstract conformance test suites.

In constructing a standardized abstract test suite, a test notation is used to describe abstract test cases. The test notation can be an informal notation (without formally defined semantics) or a formal description technique (FDT). TTCN is an informal notation with clearly defined, but not formally defined, semantics.

TTCN is designed to meet the following objectives:

a) to provide a notation in which abstract test cases can be expressed in standardized test suites;

b) to provide a notation which is independent of test methods, layers and protocols;

c) to provide a notation which reflects the abstract testing methodology defined in ISO/IEC 9646.

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In the abstract testing methodology a test suite is looked upon as a hierarchy ranging from the complete test suite, through test groups, test cases and test steps, down to test events. TTCN provides a naming structure to reflect the position of test cases in this hierarchy. It also provides the means of structuring test cases as a hierarchy of test steps culminating in test events. In TTCN the basic test events are sending and receiving Abstract Service Primitives (ASPs), Protocol Data Units (PDUs) and timer events.

Two forms of the notation are provided: a human-readable tabular form, called TTCN.GR, for use in OSI conformance test suite standards; and a machine-processable form, called TTCN.MP, for use in representing TTCN in a canonical form within computer systems and as the syntax to be used when transferring TTCN test cases between different computer systems. The two forms are semantically equivalent.

This part of ISO/IEC 9646 is also to be published by CCITT as Recommendation X.292 (1992).

Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 3: The Tree and Tabular Combined Notation (TTCN)

1 Scope

This part of ISO/IEC 9646 defines an informal test notation, called the Tree and Tabular Combined Notation (TTCN), for OSI conformance test suites, which is independent of test methods, layers and protocols, and which reflects the abstract testing methodology defined in ISO/IEC 9646-1 and ISO/IEC 9646-2.

It also specifies requirements and provides guidance for using TTCN in the specification of system-independent conformance test suites for one or more OSI standards. It specifies two forms of the notation: one, a human-readable form, applicable to the production of conformance test suite standards for OSI protocols; and the other, a machine-processable form, applicable to processing within and between computer systems.

This part of ISO/IEC 9646 applies to the specification of conformance test cases which can be expressed abstractly in terms of control and observation of protocol data units and abstract service primitives. Nevertheless, for some protocols, test cases may be needed which cannot be expressed in these terms. The specification of such test cases is outside the scope of this part of ISO/IEC 9646, although those test cases may need to be included in a conformance test suite standard.

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NOTE 1 - For example, some static conformance requirements related to an application service may require testing techniques which are specific to that particular application.

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This part of ISO/IEC 9646 specifies requirements on what a test suite standard may specify about a conforming realization of the test suite, including the operational semantics of TTCN test suites.

NOTE 2 - ISO/IEC 9646-4 specifies requirements concerning test realization including ETS derivation.

This part of ISO/IEC 9646 applies to the specification of conformance test suites for OSI protocols in OSI layers 2 to 7, specifically including Abstract Syntax Notation One (ASN.1) based protocols. The following are outside the scope of this part of ISO/IEC 9646:

a) the specification of conformance test suites for multi-peer or Physical layer protocols;

b) the relationship between TTCN and formal description techniques;

c) the specification of test cases in which more than one behaviour description is to be run concurrently;

NOTE 3 - Use of parallel trees and synchronization between them is to be covered by a future amendment to this part of ISO/IEC 9646.

d) the means of realization of executable test suites (ETS) from abstract test suites.

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 ISO and IEC maintain registers of currently valid International Standards.

ISO 646 : 1991, *Information technology - ISO 7-bit coded character set for information interchange.*

ISO 7498 : 1984, *Information processing systems - Open Systems Interconnection - Basic Reference Model.* (See also CCITT Recommendation X.200 : 1988.)

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

ISO/IEC 8824 : 1990, *Information technology - Open Systems Interconnection - Specification of Abstract Syntax Notation One (ASN.1).*
(See also CCITT Recommendation X.208 : 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 9646-1 : 1991, *Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 1: General concepts.*
(See also CCITT Recommendation X.290 : - [1])

ISO/IEC 9646-2 : 1991, *Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 2: Abstract test suite specification.*
(See also CCITT Recommendation X.291 : - [1])

ISO/IEC 9646-4 : 1991, *Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 4: Test realization.*
(See also CCITT Recommendation X.293 : - [1])

ISO/IEC 9646-5 : 1991, *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 CCITT Recommendation X.294 : - [1])

ISO/IEC 10646-1 : - [1], *Information technology - Multiple-Octet Coded Character Set - Part 1: Architecture and Basic Multilingual Plane.*

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3 Definitions

3.1 Basic terms from ISO/IEC 9646-1

The following terms defined in ISO/IEC 9646-1 apply:

a) abstract service primitive
b) abstract testing methodology
c) abstract test case
d) abstract test method
e) abstract test suite
f) conformance log
g) conformance test suite
h) coordinated test method
i) distributed test method
j) executable test case
k) executable test case error
l) executable test suite
m) fail verdict
n) idle testing state
o) implementation under test
p) inconclusive verdict
q) invalid test event
r) local test method

1) To be published.

s) lower tester
t) means of testing
u) pass verdict
v) PICS proforma
w) PIXIT proforma
x) protocol implementation conformance statement
y) protocol implementation extra information for testing
z) point of control and observation
aa) remote test method
ab) stable testing state
ac) standardized abstract test suite
ad) static conformance requirements
ae) syntactically invalid test event
af) system under test
ag) test body
ah) test case
ai) test case error
aj) test coordination procedures
ak) test event
al) test group
am) test group objective
an) test laboratory
ao) test management protocol
ap) test outcome
aq) (test) postamble
ar) (test) preamble
as) test purpose
at) test realization
au) test realizer
av) test step
aw) test suite
ax) test system
ay) upper tester
az) (test) verdict
ba) testing state

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3.2 Terms from ISO 7498

The following terms defined in ISO 7498 apply:

a) application layer
b) protocol data unit
c) service access point
d) session layer
e) subnetwork

f) transfer syntax

g) transport layer

3.3 Terms from ISO/TR 8509

The following terms defined in ISO/TR 8509 apply:

a) service-provider

3.4 Terms from ISO/IEC 8824

The following terms defined in ISO/IEC 8824 apply:

a) bitstring type

b) characterstring type

c) enumerated type

d) external type

e) object identifier

f) octetstring type

g) real type

h) selection type

i) sequence type

j) sequence-of type

k) set type

l) set-of type

m) subtype

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NOTE - Where there may be ambiguity with TTCN terms these terms are prefixed with the term ASN.1.

3.5 Terms from ISO/IEC 8825

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The following term defined in ISO/IEC 8825 applies:

encoding

3.6 TTCN specific terms

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

3.6.1 attach construct: A TTCN statement which attaches a Test Step to a calling tree.

3.6.2 base constraint: Specifies a set of default values for each and every field in an ASP or PDU type definition.

3.6.3 base type: The type from which a type defined in a test suite is derived.

3.6.4 behaviour line: An entry in a dynamic behaviour table representing a test event or other TTCN statement together with associated label, verdict, constraints reference and comment information as applicable.

3.6.5 behaviour tree: A specification of a set of sequences of test events, and other TTCN statements.

3.6.6 blank entry: In a modified compact constraint table a blank entry in a constraint parameter or field denotes that a constraint value is to be inherited.

3.6.7 calling tree: The behaviour tree to which a Test Step is attached.

3.6.8 compact constraint table: Declaration of a set of constraints for an ASP, PDU or Structured Type arranged in a single table.

3.6.9 compact test case table: Declaration of a set of Test Cases for a given Test Group arranged in a single table.

3.6.10 constraints part: That part of a TTCN test suite concerned with the specification of the values of ASP parameters and PDU fields being sent to the IUT, and conditions on ASP parameters and PDU fields received from the IUT.

3.6.11 constraints reference: A reference to a constraint, given in a behaviour line.

3.6.12 declarations part: That part of a TTCN test suite concerned with the definition and/or declaration of all non-

predefined components that are used in the test suite.

3.6.13 default behaviour: The events, and other TTCN statements, which may occur at any level of the associated tree, and which are indicated in the Default behaviour proforma.

3.6.14 default group: A named set of default behaviours.

3.6.15 default group reference: A path specifying the logical location of a Default in the Default Library.

3.6.16 default identifier: A unique name for a Default.

3.6.17 default library: The set of the Default behaviours in a test suite.

3.6.18 default reference: A reference to a Default in the Default Library from a Test Case or Test Step table.

3.6.19 derivation path: An identifier, consisting of a base constraint identifier concatenated with one or more modified constraint identifiers, separated by dots and finishing with a dot.

3.6.20 dynamic chaining: The linking from constraint declarations of an ASP parameter or PDU field to the constraint declaration of another PDU by means of parameterization. Which PDUs are chained is specified in the constraints reference of a behaviour line.

3.6.21 dynamic part: That part of a TTCN test suite concerned with the specification of Test Case, Test Step and Default dynamic behaviour descriptions.

3.6.22 implicit send event: A mechanism used in Remote Test Methods for specifying that the IUT should be made to initiate a particular PDU or ASP.

3.6.23 level of indentation: Indicates the tree structure of a behaviour description. It is reflected in the behaviour description by indentation of text.

3.6.24 local tree: A behaviour tree defined in the same proforma as its calling tree.

3.6.25 modified constraint: A constraint defined for an ASP or a PDU that already has a base constraint, and which makes modifications on that base constraint.

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3.6.26 operational semantics: Semantics explaining the execution of a TTCN behaviour tree.

3.6.27 otherwise event: The TTCN mechanism for dealing with unforeseen test events in a controlled way.

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3.6.28 overview part: That part of a TTCN test suite concerned with presenting an overview of the structure of the test suite, the structure (if any) of the Test Step Library, the structure (if any) of the Default Library and the association of selection expressions (if any) with Test Cases and/or Test Groups. This part also provides indexes to Test Cases, Test Steps and Defaults.

3.6.29 preliminary result: A result recorded before the end of a test case indicating whether the associated part of the test case passed, failed or was inconclusive.

3.6.30 pseudo-event: A pseudo-event is a TTCN expression or Timer operation appearing on a statement line in the behaviour description without any associated event.

3.6.31 qualified event: An event that has an associated Boolean expression.

3.6.32 receive event: The receipt of an ASP or PDU at a named or implied PCO.

3.6.33 root tree: The main behaviour tree of a Test Case, occurring at the level of entry into the Test Case.

3.6.34 send event: The sending of an ASP or PDU to a named or implied PCO.

3.6.35 set of alternatives: TTCN statements coded at the same level of indentation and belonging to the same predecessor node. They represent the possible events, pseudo-events and constructs which are to be considered at the relevant point in the execution of the Test Case.

3.6.36 single constraint table: Declaration of a constraint for a single ASP or PDU of a given type arranged in a single table.

3.6.37 snapshot semantics: A semantic model to eliminate the effect of timing on the execution of a Test Case, defined in terms of snapshots of the test environment, during which the environment is effectively frozen for a prescribed period.

3.6.38 specific value: A value in TTCN which does not contain any matching mechanism or unbound variable.

3.6.39 static chaining: The linking from constraint declarations of an ASP parameter or PDU field to the constraint declaration of another PDU by explicitly referencing a constraint as its value.