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Software and systems engineering — Software testing —

Part 4:
Test techniques

Ingénierie du logiciel et des systèmes — Essais du logiciel —

Partie 4: Techniques des essais

ICS 35.080

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ISO/IEC/IEEE 29119 consists of the following parts, under the general title *Software and systems engineering — Software testing*:

— *Part 2: Test process*

— *Part 3: Test documentation*

The following parts are under preparation:

— *Part 1: Concepts and definitions*

— *Part 3: Test techniques*

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Foreword

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ISO/IEC 29119-4 was prepared by Technical Committee ISO/IEC/TC JTC1, *Information Technology*, Subcommittee SC SC7, *Software and Systems Engineering*.

ISO/IEC 29119 consists of the following parts, under the general title *Software and Systems Engineering — Software Testing*:

— Part 1: Concepts and Definitions

— Part 2: Test Processes

— Part 3: Test Documentation

— Part 4: Test Techniques

Introduction

The purpose of ISO/IEC 29119-4 Test Techniques is to provide an International Standard that defines software test design techniques (also known as test case design techniques or test methods) that can be used during the test design and implementation process that is defined in ISO/IEC 29119-2 Test Processes. ISO/IEC 29119-4 does not prescribe a process for test design and implementation; instead, it describes a set of techniques that can be used within ISO/IEC 29119-2. The intent is to describe a series of techniques that have wide acceptance in the software testing industry.

The test design techniques presented in ISO/IEC 29119-4 can be used to derive test cases that, when executed, can be used to collect evidence that test item requirements have been met and/or that defects are present in a test item (i.e. that requirements have not been met). Risk-based testing could be used to determine the set of techniques that are applicable in specific situations (risk-based testing is covered in ISO/IEC 29119-1 and ISO/IEC 29119-2).

Each technique follows the test design and implementation process that is defined in ISO/IEC 29119-2 and shown below in Figure 1. Of the activities in this process, ISO/IEC 29119-4 provides guidance on how to implement the following activities in detail for each technique that is described:

- Derive Test Conditions (TD2),
- Derive Test Coverage Items (TD3), and
- Derive Test Cases (TD4).

A test condition is a testable aspect of a test item, such as a function, transaction, feature, quality attribute or structural element identified as a basis for testing. This determination can be achieved by agreeing with stakeholders which attributes are to be tested or by applying one or more test design techniques.

NOTE The value of test results and test coverage calculations can be diminished if test conditions do not reflect requirements in enough detail.

EXAMPLE 1 If a test completion criterion for state transition testing was identified that required coverage of all states then the test conditions could be the states the test item can be in. Other examples of test conditions are equivalence classes and boundaries between them or decisions in the code.

Test coverage items are attributes of each test condition that can be covered during testing. A single test condition may be the basis for one or more test coverage items.

EXAMPLE 2 If a specific boundary is identified as a test condition then the corresponding test coverage items could be the boundary itself and immediately either side of the boundary.

A test case is a set of preconditions, inputs (including actions, where applicable) and expected results, developed to determine whether or not the covered part of the test item has been implemented correctly.

Specific (normative) guidance on how to implement the other activities in the test design & implementation process of ISO/IEC 29119-2, including activities TD1 (Identify Feature Sets), TD5 (Assemble Test Sets) and TD6 (Derive Test Procedures) is not included in clauses 5 or 6 of this standard because the process is the same for all techniques.

ISO/IEC TR 19759 (SWEBOK) defines two types of requirements: functional requirements and quality requirements. ISO/IEC 25010 (ISO/IEC 25010:2011) defines eight quality characteristics (including functionality) that can be used to identify types of testing that may be applicable for testing a specific test item. Annex A provides example mappings of test design techniques that apply to testing quality characteristics defined in ISO/IEC 25010.

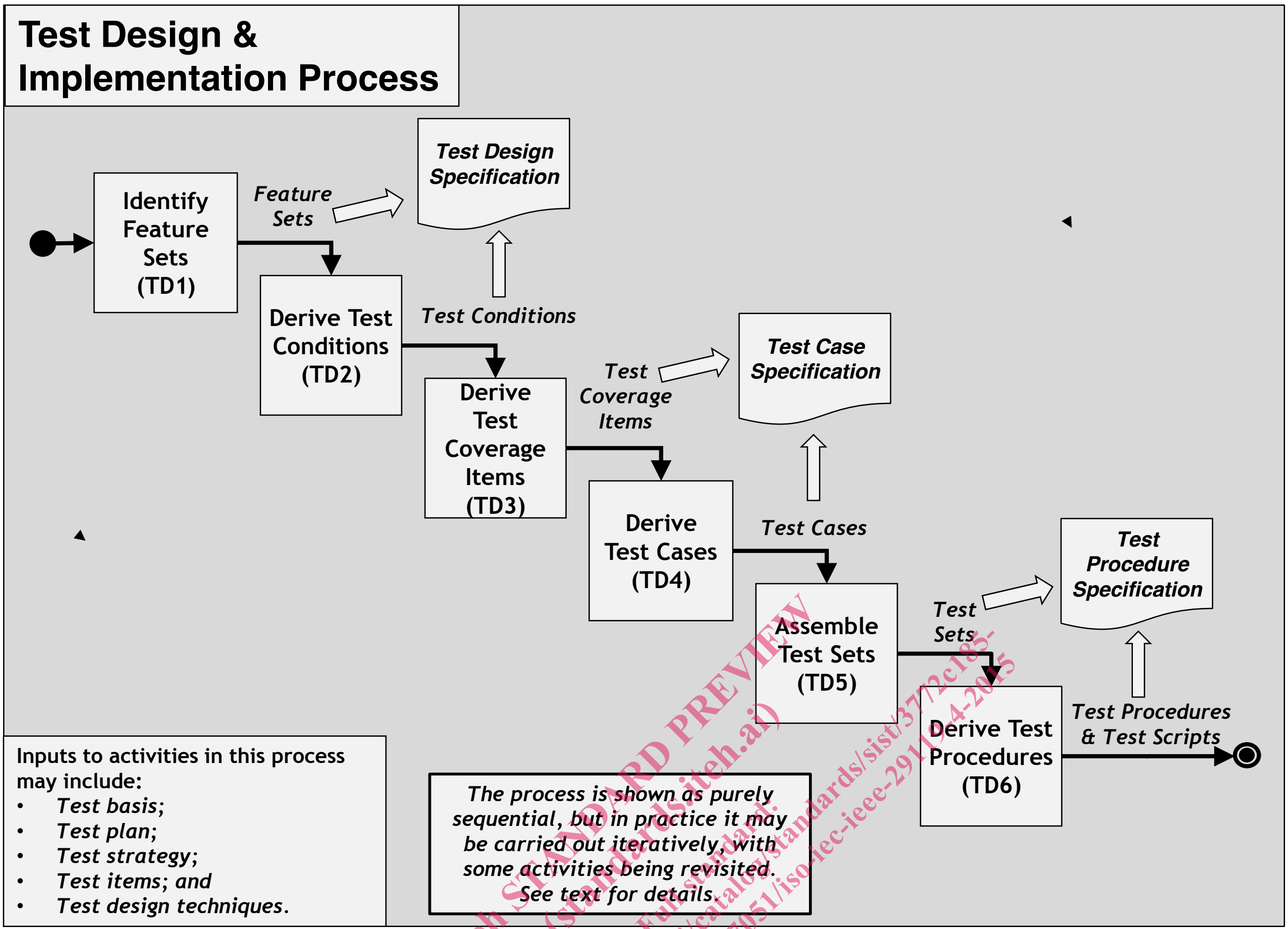

Figure 1 – ISO/IEC 29119-2 Test Design and Implementation Process

Experience-based testing practices like exploratory testing and other test practices such as model-based testing are not defined in ISO/IEC 29119-4 because this standard only describes techniques for designing test cases. Test practices such as exploratory testing are described in ISO/IEC 29119-1.

Templates and examples of test documentation that are produced during the testing process are defined in ISO/IEC 29119-3 Test Documentation. The test techniques in ISO/IEC 29119-4 do not describe how test cases should be documented (e.g. they do not include information or guidance on assigning unique identifiers, test case descriptions, priorities, traceability or pre-conditions). Information on how to document test cases can be found in ISO/IEC 29119-3.

This standard aims to provide stakeholders with the ability to perform software testing in any organization.

Software and Systems Engineering — Software Testing — Part 4: Test Techniques

1 Scope

ISO/IEC 29119-4 defines test design techniques that can be used during the test design and implementation process that is defined in ISO/IEC 29119-2.

This document is intended for, but not limited to, testers, test managers and developers, particularly those responsible for managing and implementing software testing.

2 Conformance

2.1.1 Intended Usage

The normative requirements in ISO/IEC 29119-4 are contained in clauses 5 and 6. It is recognized that particular projects or organizations may not need to use all of the techniques defined by this standard. Therefore, implementation of this standard typically involves selecting set of techniques suitable for the project or organization. There are two ways that an organizations or individual can claim conformance to the provisions of this standard. The organization shall assert whether it is claiming full or tailored conformance to this standard.

2.1.2 Full Conformance

Full conformance is achieved by demonstrating that all of the requirements (i.e. shall statements) of the chosen (non-empty) set of techniques have been satisfied.

EXAMPLE An organization could choose to conform only to one technique, such as boundary value analysis. In this scenario, the organization would only be required to provide evidence that they have met the requirements of that one technique in order to claim conformance to ISO/IEC 29119-4.

2.1.3 Tailored Conformance

Tailored conformance is achieved by demonstrating that the chosen subset of requirements from the chosen (non-empty) set of techniques have been satisfied. Where tailoring occurs, justification shall be provided whenever the normative requirements of a technique defined in clauses 5 and 6 are not followed completely (either directly or by reference). All tailoring decisions shall be recorded with their rationale, including the consideration of any applicable risks. Tailoring shall be agreed by the relevant stakeholders.

Any alternate test design technique that an organization wishes to claim conformance to (that is not already defined in this standard) shall satisfy the following criteria:

— The technique shall be freely available in the public domain.

— A source reference shall be provided.

— The technique shall be documented in the same manner as the other test techniques in clause 5.

— Associated test measurement techniques shall be documented in accordance with clause 6.1.1, if technically feasible.

3 Normative References

ISO/IEC 29119-4 does not require the use of any external normative references (i.e. there are no external standards or other referenced documents cited within “shall” statements of this standard that make them indispensable for the application of this standard). Standards useful for the implementation and interpretation of ISO/IEC 29119-4 are listed in the bibliography.

4 Terms and Definitions

For the purposes of this document, the terms and definitions given in ISO/IEC/IEEE 24765 *Systems and software engineering — Vocabulary* and the following apply.

NOTE Use of the terminology in ISO/IEC 29119-4 is for ease of reference and is not mandatory for conformance with the standard. The following terms and definitions are provided to assist with the understanding and readability of ISO/IEC 29119-4. Only terms critical to the understanding of ISO/IEC 29119-4 are included. This clause is not intended to provide a complete list of testing terms. The systems and software engineering vocabulary ISO/IEC/IEEE 24765 can be referenced for terms not defined in this clause. All terms defined in this clause are also intentionally included in ISO/IEC 29119-1, as that standard includes all terms that are used in ISO/IEC 29119 parts 1, 2, 3, 4 and 5.

4.1
Backus-Naur Form
formal metalanguage used for defining the syntax of a formal language

4.2
base choice
see base value

4.3
base value
input parameter value used in ‘base choice testing’ that is normally selected based on being a representative or typical value for the parameter. Also called base choice

4.4
c-use
see computation data use

4.5
computation data use
where the value of a variable is read in any statement other than a conditional expression. Also called c-use

4.6
condition
Boolean expression containing no Boolean operators

EXAMPLE “A < B” is a condition but “A and B” is not.

[SOURCE: BS 7925-1:1998, 3.45, modified — added quotation marks to example and removed “a” from start of definition]

4.7
control flow
abstract representation of all possible sequences of events in a test item’s execution

[SOURCE: BS 7925-1:1998, 3.50, modified — replaced “program’s” with “test item’s” and removed “an” from start of definition]

4.8
control flow sub-path
sequence of executable statements within a test item

4.9
data definition
see variable definition

4.10
data definition c-use pair
data definition and computation data use, where the data use uses the value defined in the data definition

[SOURCE: BS 7925-1:1998, 3.59, modified — removed “a” from start of definition]

4.11
data definition p-use pair
data definition and predicate data use, where the data use uses the value defined in the data definition

[SOURCE: BS 7925-1:1998, 3.61, modified — removed “a” from start of definition]

4.12
data definition-use pair
data definition and data use, where the data use uses the value defined in the data definition

[SOURCE: BS 7925-1:1998, 3.63, modified — removed “a” from start of definition]

4.13
data use
executable statement where the value of a variable is accessed

[SOURCE: BS 7925-1:1998, 3.67, modified — removed “an” from start of definition]

4.14
decision
point in a test item at which the control flow has two or more alternative routes

[SOURCE: BS 7925-1:1998, 3.69, modified — replaced “program point” with “point in a test item” and removed “a” from start of definition]

4.15
decision outcome
result of a decision (which therefore determines the control flow alternative taken)

[SOURCE: BS 7925-1:1998, 3.72, modified — removed “the” from start of definition]

4.16
decision rule
combination of conditions (also known as causes) and actions (also known as effects) that produce a specific outcome in decision table testing and cause-effect graphing.