

INTERNATIONAL
STANDARD

ISO/
IEC/IEEE
29119-1

Second edition
2022-01

Software and systems engineering — Software testing —

Part 1: General concepts

*Ingénierie du logiciel et des systèmes — Essais du logiciel —
Partie 1: Concepts généraux*



Reference number
ISO/IEC/IEEE 29119-1:2022(E)

© ISO/IEC 2022
© IEEE 2022



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2022
© IEEE 2022

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO or IEEE at the respective address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Institute of Electrical and Electronics Engineers, Inc
3 Park Avenue, New York
NY 10016-5997, USA

Email: stds.ipr@ieee.org
Website: www.ieee.org

Published in Switzerland

Contents

Page

Foreword	v
Introduction	vii
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Software testing concepts	16
4.1 Introduction to software testing	16
4.1.1 Overview	16
4.1.2 Relationship to quality management	16
4.1.3 Verification and validation	16
4.1.4 Test item	17
4.1.5 Static and dynamic testing	17
4.1.6 Exhaustive testing and sampling	18
4.1.7 Testing as a heuristic	18
4.1.8 Purpose of testing	18
4.1.9 Test basis	19
4.1.10 Test oracle	19
4.1.11 Test independence	19
4.2 Test plans and test strategies	19
4.2.1 General	19
4.2.2 Risks and risk management	20
4.2.3 Risks and requirements as the basis of a test strategy	20
4.2.4 Test approaches	21
4.2.5 Testing in development and maintenance life cycles	22
4.2.6 Domains and system characteristics	23
4.2.7 Test strategy contents	23
4.3 Test frameworks	24
4.3.1 Test processes	24
4.3.2 Test documentation	28
4.3.3 Documentation requirements	30
4.3.4 Configuration management and testing	30
4.3.5 Tool support	30
4.3.6 Process improvement and testing	30
4.3.7 Test metrics	31
4.4 Test design and execution	31
4.4.1 Test model	31
4.4.2 Model-based testing	32
4.4.3 Scripted and exploratory testing	33
4.4.4 Test design techniques	33
4.4.5 Experience-based testing	34
4.4.6 Retesting and regression testing	35
4.4.7 Manual and automated testing	35
4.4.8 Continuous testing	35
4.4.9 Back-to-back testing	35
4.4.10 A/B testing	36
4.4.11 Mathematical-based and fuzz testing	36
4.4.12 Test environments	36
4.4.13 Test data management	37
4.5 Project management and testing	37
4.6 Communication and reporting	37
4.7 Defects and incident management	38
Annex A (informative) System characteristics and testing – examples	39

Annex B (informative) Testing roles	46
Bibliography	47
IEEE Notices and Abstract	48

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO/IEC documents should be noted. This document was drafted in accordance with the rules given in the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

IEEE Standards documents are developed within the IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association (IEEE-SA) Standards Board. The IEEE develops its standards through a consensus development process, approved by the American National Standards Institute, which brings together volunteers representing varied viewpoints and interests to achieve the final product. Volunteers are not necessarily members of the Institute and serve without compensation. While the IEEE administers the process and establishes rules to promote fairness in the consensus development process, the IEEE does not independently evaluate, test, or verify the accuracy of any of the information contained in its standards.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents) or the IEC list of patent declarations received (see <https://patents.iec.ch>).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

ISO/IEC/IEEE 29119-1 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and systems engineering*, in cooperation with the Systems and Software Engineering Standards Committee of the IEEE Computer Society, under the Partner Standards Development Organization cooperation agreement between ISO and IEEE.

This second edition cancels and replaces the first edition (ISO/IEC/IEEE 29119-1:2013), which has been technically revised.

The main changes are as follows:

- Testing terms and their definitions that are not covered within this document have been removed. This has led to this document being renamed from 'Concepts and definitions' to 'General concepts'.
- The coverage of test concepts has been made more concise and re-ordered.
- The concept of test sub-processes has been removed due to its complexity and replaced with additional coverage of the instantiation of test processes.
- The expected content of a test strategy has been clarified.

- A simplified test design process is described, with the derivation of test cases now based on test models rather than on test conditions.
- The coverage of metrics and measures has been moved from an annex into the body of the document.
- The annex explaining how testing fits into different life cycle models has been removed.
- A new annex providing examples of how systems from different domains are associated with certain characteristics and test approaches has been added.

A list of all parts in the ISO/IEC/IEEE 29119 series can be found on the ISO and IEC websites.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

Introduction

The purpose of the ISO/IEC/IEEE 29119 series is to define an internationally agreed set of standards for software testing that can be used by any organization when performing any form of software testing and using any life cycle.

It is recognized that there are many different types of software, software organizations, and methodologies. Software domains include information technology (IT), personal computers (PC), embedded, mobile, scientific and many other classifications. Software organizations range from small to large, co-located to world-wide, and commercial to those providing a public service. Software development methodologies include object-oriented, traditional, agile and DevOps. These and other factors influence software testing. The ISO/IEC/IEEE 29119 series can support testing in many different contexts.

This document facilitates the use of other parts in the ISO/IEC/IEEE 29119 series by introducing the general concepts on which the ISO/IEC/IEEE 29119 series is built.

A general introduction to software testing is provided. The role of software testing in quality management and as part of verification and validation is described; and its implementation in the form of both static and dynamic testing is defined. The impracticality of exhaustive testing and the need for sampling are explained; and the importance of the test basis and test oracle are described. The benefits of test independence are introduced.

Test plans and test strategies are described in the context of risk-based testing, which is the recommended approach to strategizing and managing testing that underlies the ISO/IEC/IEEE 29119 series and provides the basis for test prioritization and focus. Test levels, test types and test design techniques (and corresponding measures) are described in the context of their inclusion as part of the test strategy.

Various test frameworks are presented, including test processes (and test process improvement), test metrics, test documentation, configuration management and tool support.

The performance of test design and execution based on the use of a test model is described. Several of the most important test design and execution choices are considered, including scripted and exploratory testing approaches, the importance of test design techniques for the creation of test cases, test patterns, retesting and regression testing, manual and automated testing, back-to-back and A/B testing.

Several activities that directly support test design and executions are introduced, including test environments, test data management, communications and reporting and defect and incident management.

[Annex A](#) briefly describes a number of system characteristics and suggested associated test approaches. If a tester can identify which of the system characteristics apply to the system they are testing, then they should consider whether the specialized testing listed for the characteristic is appropriate for inclusion in their test strategy.

[Annex B](#) introduces several generic testing roles and briefly describes their responsibilities.

The test process model that the ISO/IEC/IEEE 29119 series is based on is defined in detail in ISO/IEC/IEEE 29119-2. ISO/IEC/IEEE 29119-2 covers the software testing processes at the organizational level, test management level and for dynamic test levels. Testing is the primary approach to risk treatment in software development. This document defines a risk-based approach to testing.

Templates and examples of test documentation that are produced during the testing process are defined in ISO/IEC/IEEE 29119-3. Software testing techniques that can be used during testing are defined in ISO/IEC/IEEE 29119-4.

While this document is informative, ISO/IEC/IEEE 29119-2, ISO/IEC/IEEE 29119-3 and ISO/IEC/IEEE 29119-4 are normative, meaning that they include requirements for anyone wanting to claim conformance to these standards. Users who want to use the standards but have good reasons

for not following every requirement (e.g. for someone following an agile approach to development and testing) can claim tailored conformance as long as the level of tailoring and its rationale are described and agreed. Specific details of conformance are provided in the relevant conformance clause in each of the standards.

The ISO/IEC/IEEE 29119 series can be used in isolation or can be used as part of a larger set of standards that cover other aspects of the software life cycle. For instance, some users use ISO/IEC/IEEE 12207 to define software system life cycle models appropriate to their products and services (and some may use the corresponding systems engineering standard, ISO/IEC/IEEE 15288), and reference the ISO/IEC/IEEE 29119 series for their software testing needs.

Together, the ISO/IEC/IEEE 29119 series aims to provide stakeholders with the ability to manage and perform software testing in any organization.

Software and systems engineering — Software testing —

Part 1: General concepts

1 Scope

This document specifies general concepts in software testing and presents key concepts for the ISO/IEC/IEEE 29119 series.

2 Normative references

There are no normative references in this document.