
**Information technology —
Eiffel: Analysis, Design and Programming
Language**

*Technologies de l'information — Eiffel: Langage d'analyse, conception
et programmation*

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. 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.

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.

International Standard ISO/IEC 25436 was prepared by Ecma International (as ECMA-367) and was adopted, under a special "fast-track procedure", by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

Introduction

Eiffel was originally designed in 1985 as a method of software construction and a notation to support that method. The first implementation, from Eiffel Software (then Interactive Software Engineering Inc.), was commercially released in 1986. The principal designer of the first versions of the language was Bertrand Meyer. Other people closely involved with the original definition included Jean-Marc Nerson. The language was originally described in Eiffel Software technical documents that were expanded to yield Meyer's book *Eiffel: The Language* in 1990-1991. The two editions of *Object-Oriented Software Construction* (1988 and 1997) also served to describe the concepts. (For bibliographical references on the documents cited see Clause 3) As usage of Eiffel grew, other Eiffel implementations appeared, including Eiffel/S and Visual Eiffel from Object Tools, Germany, EiffelStudio and Eiffel Envision from Eiffel Software, and SmartEiffel from LORIA, France.

Eiffel today is used throughout the world for industrial applications in banking and finance, defense and aerospace, health care, networking and telecommunications, computer-aided design, game programming, and many other application areas. Eiffel is particularly suited for mission-critical developments in which programmer productivity and product quality are essential. In addition, Eiffel is a popular medium for teaching programming and software engineering in universities.

In 2002 Ecma International formed Technical Group 4 (Eiffel) of Technical Committee 39 (Programming and Scripting Languages). The *Eiffel: Analysis, Design and Programming Language* Standard provides a precise definition of the language and ensures interoperability between implementations. The first of these benefits is of particular interest to implementors of Eiffel compilers and environments, who can rely on it as the reference on which to base their work; the second benefit is to Eiffel users, for whom the Standard delivers a guarantee of compatibility between the products of different providers and of trust in the future of Eiffel.

TG4 devised this Standard from June 2002 to April 2005, starting from material from the original and revised versions of the book *Standard Eiffel* (latest revision of *Eiffel: The Language*). During that period, the Technical Group conducted fifteen face-to-face meetings and numerous phone meetings, in addition to extensive technical correspondence. The members of the committee have been: Karine Arnout (ETH, Zurich); Éric Bezault (Axa Rosenberg, Orinda); Paul Cohen (Generic, Stockholm), Dominique Colnet (LORIA, Nancy); Mark Howard (Axa Rosenberg, Orinda); Alexander Kogtenkov (Eiffel Software, Moscow); Bertrand Meyer (Eiffel Software, Santa Barbara, and ETH, Zurich); Christine Mingins (Monash University, Melbourne); Roger Osmond (EMC, Boston); Emmanuel Stapf (Eiffel Software, Santa Barbara); Kim Waldén (Generic, Stockholm).

Observers having attended one or more of the meetings include: Cyril Adrian (LORIA), Volkan Arslan (ETH), Paul Crismer (Groupe S, Brussels), Jocelyn Fiat (Eiffel Software, France), Randy John (Axa Rosenberg), Ian King (Eiffel Software), Philippe Ribet (LORIA), Julian Rogers (Eiffel Software), Bernd Schoeller (ETH), David Schwartz (Axa Rosenberg), Zoran Simic (Axa Rosenberg), Raphael Simon (Eiffel Software), Olivier Zendra (LORIA). The committee acknowledges the contributions of many people, including David Hollenberg, Marcel Satchell, Richard O'Keefe and numerous others listed in the acknowledgments of the book *Standard Eiffel*.

The editor of the Standard is Bertrand Meyer. Emmanuel Stapf is the convener of TG4 (succeeding Christine Mingins, 2002-2003). Karine Arnout is the recording secretary of TG4.

The final version of the document was prepared by Éric Bezault, Mark Howard, Alexander Kogtenkov, Bertrand Meyer and Emmanuel Stapf.

Information technology — Eiffel: Analysis, Design and Programming Language

1 Scope

1.1 Overview

This document provides the full reference for the Eiffel language.

Eiffel is a method of software construction and a language applicable to the analysis, design, implementation and maintenance of software systems. This International Standard covers only the language, with an emphasis on the implementation aspects. As a consequence, the word “Eiffel” in the rest of this document is an abbreviation for “the Eiffel language”.

1.2 “The Standard”

The language definition proper — “the Standard” — is contained in Clause 8 of this document, with the exception of text appearing between markers *Informative text* and *End*; such text only plays an explanatory role for human readers.

1.3 Aspects covered

The Standard specifies:

- the form of legal basic constituents of Eiffel texts, or *lexical* properties of the language;
- the structure of legal Eiffel texts made of lexically legal constituents, or *syntax* properties;
- supplementary restrictions imposed on syntactically legal Eiffel texts, or *validity* properties;
- the computational effect of executing valid Eiffel texts, or *semantic* properties; and
- some requirements on a conforming implementation of Eiffel, such as the ability to produce certain forms of automatic documentation.

1.4 Aspects not covered

The Standard does not specify:

- the requirements that a computing environment must meet to support the translation, execution and other handling of Eiffel texts;
- the semantic properties of an Eiffel text if it or its data exceed the capacity of a particular computing environment;
- the mechanisms for translating Eiffel texts into a form that can be executed in a computing environment;
- the mechanisms for starting the execution of the result of such a translation; and
- other mechanisms for handling Eiffel texts and interacting with users of the language.

The specification of Clause 8 consists of precise specification elements, originating with the book *Standard Eiffel* where these elements are accompanied by extensive explanations and examples. The elements retained are:

- definitions of technical terms and Eiffel concepts;
- syntax specifications;

- validity constraints (with their codes, such as **VVBG**); and
- semantic specifications.

2 Conformance

2.1 Definition

An implementation of the Eiffel language is **conformant** if and only if in its default operating mode, when provided with a candidate software text, it:

- can, if the text and all its elements satisfy the lexical, syntax and validity rules of the Standard, execute the software according to the semantic rules of the Standard, or generate code for a computing environment such that, according to the specification of that environment, the generated code represents the semantics of the text according to these rules;
- will, if any element of the text violates any lexical, syntactical or validity rule of the Standard, report an error and perform no semantic processing (such as generating executable code, or directly attempting to execute the software).

2.2 Compatibility and non-default options

Implementations may provide options that depart in minor ways from the rules of this Standard, for example to provide compatibility with earlier versions of the implementation or of the language itself. Such options are permitted if and only if:

- per 2.1, they are not the default;
- the implementation includes documentation that states that all such options are nonconformant.

2.3 Departure from the Standard

Material reasons, such as bugs or lack of time, may lead to the release of an implementation that supports most of the Standard but misses a few rules and hence is not yet conformant according to the definition of 2.1. In such a case, the implementation shall include documentation that:

- states that the implementation is not conformant;
- lists all the known causes of non-conformance;
- provides an estimate of the date or version number for reaching full conformance.

3 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

3.1 Earlier Eiffel language specifications

Bertrand Meyer: *Eiffel: The Language*, Prentice Hall, second printing, 1992 (first printing: 1991).

Bertrand Meyer: *Standard Eiffel* (revision of preceding entry), ongoing, 1997-present, at <http://www.inf.ethz.ch/~meyer/ongoing/etl>.

Bertrand Meyer: *Object-Oriented Software Construction*, Prentice Hall: first edition, 1988; second edition, 1997.

3.2 Eiffel Kernel Library

The terms “ELKS” and “Kernel Library”, as used in this Standard, refer to the latest version of the Eiffel Library Kernel Standard. A preliminary version is available from the NICE consortium:

NICE consortium: *The Eiffel Library Kernel Standard, 2001 Vintage*.

The Standard assumes that ELKS includes at least the following classes:

- Classes representing fundamental language-related concepts: *ANY, DISPOSABLE, NONE, TYPE, TYPED_POINTER*;
- Classes representing basic types and strings: *BOOLEAN, CHARACTER, CHARACTER_8, CHARACTER_32, INTEGER, INTEGER_8, INTEGER_16, INTEGER_32, INTEGER_64, NATURAL, NATURAL_8, NATURAL_16, NATURAL_32, NATURAL_64, POINTER, REAL, REAL_32, REAL_64, STRING, STRING_8, STRING_32*;
- Classes representing fundamental data structures: *ARRAY, TUPLE*;
- Agent-related classes: *FUNCTION, PREDICATE, PROCEDURE, ROUTINE*;
- Exception-related classes: *ASSERTION_VIOLATION, ATTACHED_TARGET_VIOLATION, EXCEPTION, INSPECT_RANGE_VIOLATION, INVARIANT_ENTRY_VIOLATION, INVARIANT_EXIT_VIOLATION, MEMORY_ALLOCATION_FAILURE, OLD_VIOLATION, POSTCONDITION_VIOLATION, PRECONDITION_VIOLATION, ROUTINE_FAILURE*.

The clauses referring to these classes list the features they need.

3.3 Floating point number representation

IEC 60559:1989, *Binary floating-point arithmetic for microprocessor systems* (previously designated IEC 559:1989). Also known as ANSI/IEEE Standard 754-1985, *IEEE Standard for Binary Floating-Point Arithmetic*.

3.4 Character set: Unicode

The Unicode Consortium: *The Unicode Standard*, Version 4.1, at <http://www.unicode.org/versions/Unicode4.1.0/>.

3.5 Character set: ASCII

ISO 14962:1997: *Space data and information transfer systems — ASCII encoded English*.

3.6 Phonetic alphabet

International Phonetic Association: *International Phonetic Alphabet* (revised 1993, updated 1996).