

9126-2

First edition
2003-07-01

Software engineering — Product quality —

Part 2: External metrics

Génie du logiciel — Qualité des produits —

Partie 2: Métrologie externe

Reference number
ISO/IEC TR 9126-2:2003(E)



This is a preview of "ISO/IEC TR 9126-2:20...". [Click here to purchase the full version from the ANSI store.](#)

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

© ISO/IEC 2003

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

This is a preview of "ISO/IEC TR 9126-2:20...". [Click here to purchase the full version from the ANSI store.](#)

Contents

Page

Foreword.....	vi
Introduction	vii
1 Scope.....	1
2 Conformance	2
3 Normative references.....	2
4 Terms and definitions	2
5 Abbreviated terms	2
6 Use of software quality metrics	3
7 How to read and use the metrics tables	4
8 Metrics tables.....	4
8.1 Functionality metrics.....	5
8.1.1 Suitability metrics	5
8.1.2 Accuracy metrics	5
8.1.3 Interoperability metrics.....	5
8.1.4 Security metrics.....	5
8.1.5 Functionality compliance metrics	6
8.2 Reliability metrics	14
8.2.1 Maturity metrics.....	14
8.2.2 Fault tolerance metrics	14
8.2.3 Recoverability metrics	14
8.2.4 Reliability compliance metrics.....	14
8.3 Usability metrics	25
8.3.1 Understandability metrics	25
8.3.2 Learnability metrics	25
8.3.3 Operability metrics	26
8.3.4 Attractiveness metrics.....	26
8.3.5 Usability compliance metrics.....	26
8.4 Efficiency metrics	41
8.4.1 Time behaviour metrics	41
8.4.2 Resource utilization metrics	41
8.4.3 Efficiency compliance metrics.....	41
8.5 Maintainability metrics	52
8.5.1 Analysability metrics	52
8.5.2 Changeability metrics	52
8.5.3 Stability metrics.....	52
8.5.4 Testability metrics	52
8.5.5 Maintainability compliance metrics.....	52
8.6 Portability metrics.....	60
8.6.1 Adaptability metrics	60

This is a preview of "ISO/IEC TR 9126-2:20...". Click here to purchase the full version from the ANSI store.

8.6.2	Installability metrics	60
8.6.3	Co-existence metrics.....	60
8.6.4	Replaceability metrics.....	60
8.6.5	Portability compliance metrics.....	60
Annex A (informative)	Considerations When Using Metrics	68
A.1	Interpretation of measures	68
A.1.1	Potential differences between test and operational contexts of use	68
A.1.2	Issues affecting validity of results	69
A.1.3	Balance of measurement resources	69
A.1.4	Correctness of specification.....	69
A.2	Validation of Metrics	69
A.2.1	Desirable Properties for Metrics	69
A.2.2	Demonstrating the Validity of Metrics	70
A.3	Use of metrics for estimation (judgement) and prediction (forecast)	71
A.3.1	Quality characteristics prediction by current data	71
A.3.2	Current quality characteristics estimation on current facts	71
A.4	Detecting deviations and anomalies in quality problem prone components	72
A.5	Displaying measurement results	72
Annex B (informative)	Use of Quality in Use, External & Internal Metrics (Framework Example)	73
B.1	Introduction	73
B.2	Overview of Development and Quality Process	73
B.3	Quality Approach Steps	74
B.3.1	General.....	74
B.3.2	Step #1 Quality requirements identification	74
B.3.3	Step #2 Specification of the evaluation.....	75
B.3.4	Step #3 Design of the evaluation	77
B.3.5	Step #4 Execution of the evaluation	77
B.3.6	Step #5 Feedback to the organization	77
Annex C (informative)	Detailed explanation of metric scale types and measurement types	78
C.1	Metric Scale Types	78
C.2	Measurement Types.....	79
C.2.1	Size Measure Type.....	79
C.2.2	Time measure type	82
C.2.2.0	General.....	82
C.2.3	Count measure type	83
Annex D (informative)	Term(s).....	85
D.1	Definitions.....	85
D.1.1	Quality.....	85
D.1.2	Software and user.....	85
D.1.3	Measurement.....	85
Table 8.1.1	Suitability metrics	7
Table 8.1.2	Accuracy metrics	9
Table 8.1.3	Interoperability metrics	10
Table 8.1.4	Security metrics	11

This is a preview of "ISO/IEC TR 9126-2:20...". [Click here to purchase the full version from the ANSI store.](#)

Table 8.1.5 Functionality compliance metrics.....	13
Table 8.2.1 Maturity metrics	15
Table 8.2.2 Fault tolerance metrics	19
Table 8.2.3 Recoverability metrics	21
Table 8.2.4 Reliability compliance metrics	24
Table 8.3.1 Understandability metrics	27
Table 8.3.2 Learnability metrics.....	30
Table 8.3.3 Operability metrics a) Conforms with operational user expectations	32
Table 8.3.3 Operability metrics b) Controllable	33
Table 8.3.3 Operability metrics c) Suitable for the task operation.....	34
Table 8.3.3 Operability metrics d) Self descriptive (Guiding).....	35
Table 8.3.3 Operability metrics e) Operational error tolerant (Human error free)	36
Table 8.3.3 Operability metrics f) Suitable for individualisation	37
Table 8.3.4 Attractiveness metrics	39
Table 8.3.5 Usability compliance metrics	40
Table 8.4.1 Time behaviour metrics a) Response time	42
Table 8.4.1 Time behaviour metrics b) Throughput	44
Table 8.4.1 Time behaviour metrics c) Turnaround time	45
Table 8.4.2 Resource utilisation metrics a) I/O devices resource utilisation.....	47
Table 8.4.2 Resource utilisation metrics b) Memory resource utilisation.....	48
Table 8.4.2 Resource utilisation metrics c) Transmission resource utilisation	49
Table 8.4.3 Efficiency compliance metrics	51
Table 8.5.1 Analysability metrics.....	53
Table 8.5.2 Changeability metrics	55
Table 8.5.3 Stability metrics	57
Table 8.5.4 Testability metrics	58
Table 8.5.5 Maintainability compliance metrics	59
Table 8.6.1 Adaptability metrics	61
Table 8.6.2 Installability metrics	63
Table 8.6.3 Co-existence metrics	65
Table 8.6.4 Replaceability metrics.....	66
Table 8.6.5 Portability compliance metrics	67
Table B.1 Quality Measurement Model	73
Table B.2 User Needs Characteristics & Weights	74
Table B.3 Quality measurement tables	75
Table B.4 Measurement plan.....	77

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.

In exceptional circumstances, the joint technical committee may propose the publication of a Technical Report of one of the following types:

- type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;
- type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;
- type 3, when the joint technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

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.

ISO/IEC TR 9126-2:2003, which is a Technical Report of type 2, was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and system engineering*.

This document is being issued in the Technical Report (type 2) series of publications (according to the Procedures for the technical work of ISO/IEC JTC 1) as a "prospective standard for provisional application" in the field of external metrics for quantitatively measuring external software because there is an urgent need for guidance on how standards in this field should be used to meet an identified need.

This document is not to be regarded as an "International Standard". It is proposed for provisional application so that information and experience of its use in practice may be gathered. Comments on the content of this document should be sent to the ISO Central Secretariat.

A review of this Technical Report (type 2) will be carried out not later than three years after its publication with the options of: extension for another three years; conversion into an International Standard; or withdrawal.

ISO/IEC 9126 consists of the following parts, under the general title *Software engineering — Product quality*:

- *Part 1: Quality model*
- *Part 2: External metrics*
- *Part 3: Internal metrics*
- *Part 4: Quality in use metrics*

This is a preview of "ISO/IEC TR 9126-2:20...". [Click here to purchase the full version from the ANSI store.](#)

Introduction

This Technical Report provides external metrics for measuring attributes of six external quality characteristics defined in ISO/IEC 9126-1. The metrics listed in this Technical Report are not intended to be an exhaustive set. Developers, evaluators, quality managers and acquirers may select metrics from this Technical Report for defining requirements, evaluating software products, measuring quality aspects and other purposes. They may also modify the metrics or use metrics which are not included here. This Technical Report is applicable to any kind of software product, although each of the metrics is not always applicable to every kind of software product.

ISO/IEC 9126-1 defines terms for the software quality characteristics and how these characteristics are decomposed into subcharacteristics. ISO/IEC 9126-1, however, does not describe how any of these subcharacteristics could be measured. ISO/IEC TR 9126-2 defines external metrics, ISO/IEC TR 9126-3 defines internal metrics and ISO/IEC 9126-4 defines quality in use metrics, for measurement of the characteristics or the subcharacteristics. Internal metrics measure the software itself, external metrics measure the behaviour of the computer-based system that includes the software, and quality in use metrics measure the effects of using the software in a specific context of use.

This Technical Report is intended to be used together with ISO/IEC 9126-1. It is strongly recommended to read ISO/IEC 14598-1 and ISO/IEC 9126-1, prior to using this Technical Report, particularly if the reader is not familiar with the use of software metrics for product specification and evaluation.

Clauses 1 to 7 and Annexes A to D are common to ISO/IEC TR 9126-2, ISO/IEC TR 9126-3, and ISO/IEC 9126-4.