Software Product Quality

Introduction

Process quality is a key objective for most software organisations however interest is gradually shifting to improving and evaluating the quality of software products. In a published international standard (ISO/IEC 9126: 1991) the following definitions appear:

software product :	A software entity designated for delivery to a user
software quality :	The totality of features and characteristics of a software product that bear on its ability to satisfy stated or implied needs.

The difficulty lies in defining and evaluating software product quality. There have been several European and International attempts to provide assistance in this area. The International Standardization Organization (ISO) has been developing a framework that will assist both the developer and the user in this evaluation process.

ISO/IEC 9126

At the end of 1991 the first in a set of standards on product quality was issued jointly by the International Standardization Organization (ISO) and the International Electrotechnical Commission (IEC), ISO/IEC 9126 "Information technology - Software product evaluation - Quality characteristics and guidelines for their use".

The standard defined six product quality characteristics:

Functionality :	*a set of attributes that bear on the existence of a set of functions and their specified properties. The functions are those that satisfy stated or implied needs.*
Reliability :	*a set of attributes that bear on the capability of software to maintain its level of performance under stated conditions for a stated period of time.*
Usability :	*a set of attributes that bear on the effort needed for its use, and on the individual assessment of such use, by a stated or implied set of users.*
Efficiency :	*a set of attributes that bear on the relationship between the level of performance of the software and the amount of resources used, under stated conditions.*
Maintainability :	*a set of attributes that bear on the effort needed to make specified modifications.*
Portability :	*a set of attributes that bear on the ability of the software to be transferred from one environment to another.*

In 1994 it was felt that developments in other Standards being produced necessitated the revision of 9126. The new version of 9126 will be called, Information technology - Software Product Quality - Part1: Quality Model, and should be published this year. The six characteristics listed above have been maintained in the new version but their definitions have been improved and clarified. The concept of Quality in Use has been introduced as the user's view of the quality of the software product.

The six characteristics cannot be measured directly and so each must be broken down into sub-characteristics. A set of sub-characteristics is defined in ISO 9126 and are detailed below:

Functionality	- *suitability, accuracy, interoperability, security, compliance*
Reliability	- *maturity, fault tolerance, recoverability, compliance*
Usability	- *understandability, learnability, operability, attractiveness, compliance*
Maintainability	- *analysability, changeability, stability, testability, compliance*
Efficiency	- *time behaviour, resource utilisation, compliance*
Portability	- *adaptability, installability, co-existence, replaceability, compliance*

In a change from the original standard *compliance* has been made a sub-characteristic of all characteristics.

Three other documents are being prepared to support the application of the definitions given in 9126-1.

9126-2 Part2 : External Metrics	-	Examples of metrics derived from the behaviour of a system during testing or operation
9126-3 Part 3: Internal Metrics	-	Examples of metrics that can be applied during design and coding
9126-4 Part4 : Quality in use metrics	-	Examples of metrics that can be applied to measure the users view of the quality of a system.

ISO/IEC 14598

Another multi-part standard has been developed, to be used in conjunction with the new version of ISO/IEC 9126-1. This standard, ISO/IEC 14598 consists of six parts and provides methods for measurement, assessment and evaluation.

14598-1 Part 1: General Overview

14598-2 Part 2: Planning and management

14598-3 Part 3: Process for developers

14598-4 Part 4: Process for acquirers

14598-5 Part 5: Process for evaluators

14598-6 Part 6: Documentation of evaluation modules

Part1 introduces the other parts and explains the relationship between 14598 and 9126-1. Parts 3,4 and 5 explain the evaluation process from three different viewpoints:

- organisations planning to develop or enhance a product
- organisations planning to acquire or re-use an existing product
- independent assessment of a software product

Parts 2 and 6 can be used in any of the above three scenarios to provide support information for the evaluation process.

ESSI-SCOPE

ESSI-SCOPE was an EU funded project that aimed to raise awareness of quality issues in software products and to introduce some of the work associated with product evaluation which assists in improving the quality of products. The project provided information about all aspects of software product quality under the seven topics listed below:

- Software as a Corporate Asset
- Software Product Quality Characteristics
- Relevant Standards
- Evaluation Approaches
- Software Process Improvement
- Evaluation Results in Europe
- Technologies and Tools

More information is available on the ESSI-SCOPE website at:

http://www.cse.dcu.ie/essiscope

At the conclusion of the project some of the partners decided to continue to work together to develop SCOPEmark. This work is ongoing.

SCOPEmark

SCOPEmark is the certification of quality of a software product on a maturity scale. This is achieved through the measurement of the quality of the product by a SCOPE accredited evaluator using the SCOPEmark methodology.

SCOPE Maturity Model

The SCOPE Maturity Model represents a framework within which software products exist at differing levels of maturity. While a lower level may be appropriate to many software products, the higher levels apply to software in safety-critical, security-critical and mission-critical systems.

Market for SCOPEmark

Certification is of interest to, and may be requested by, producers of software products, distributors, and value-added resellers. It is also of interest to specialist groups representing software suppliers and software users in an industry sector or application domain.

Benefits

The developers of the SCOPEmark certification scheme expect that:

- it will provide the supplier of the software product with a marketing advantage
- that developers and suppliers of software will have an opportunity to achieve improvement in their product by moving up a ladder of quality
- the purchaser and user of a product will have more confidence in the level of quality in a product with SCOPEmark certification. This may also influence the comparison and selection of a product.

Further Information:

All Standards and draft standards are available from the NSAI. Relevant software standards can be viewed at the CSE Library.

For information on SCOPEmark, contact: Michael O'Duffy, michael@cse.dcu.ie

Books and Websites

http://www.cse.dcu.ie/essiscope

Achieving Software Product Quality, Editors: Erik van Veenendaal and Julie McMullan on behalf of the ESSI-SCOPE project, 1997, ISBN 90-72194-527

Software Metrics for Product Assessment, Bache & Bazzana, 1994, ISBN 0-07-707923-X

Software Evaluation for Certification, Rae, Robert, Hausen, 1995, ISBN 0-07-709042-X

Technical Briefing Notes are issued on a range of software engineering topics as an aid to software developers, project leaders and managers. The intention is to provide a 'status report' on the state of the art (and/or the state of practice) in relation to particular aspects of software engineering. In addition they aim to highlight, where appropriate, a likely roadmap on a time horizon for future developments of the technology.

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