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Software and systems engineering — Work product reviews

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee IST/15, Software and systems engineering.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Software and systems engineering — Work product reviews

Ingénierie du logiciel et des systèmes — Revue des produits de travail

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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.

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 document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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).

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

For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and systems engineering*.

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Introduction

The purpose of this document is to provide an International Standard that defines work product reviews, such as inspections, reviews and walkthroughs that can be used at any stage of the software and systems life cycle. It can be used to review any system or software work product. This document defines a generic process for work product reviews that can be configured based on the purpose of the review and the constraints of the reviewing organization. The intent is to describe a generic process that can be applied both efficiently and effectively by any organization to any work product.

The main objectives of reviews are to detect issues, to evaluate alternatives, to improve organizational and personal processes, and to improve work products. When applied early in the life cycle, reviews are typically shown to reduce the amount of unnecessary rework on a project. The work product review techniques presented in this document can be used at various stages of the generic review process to identify defects and evaluate the quality of the work product.

Review documents that are produced during work product reviews are defined in Annex A.

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Software and systems engineering — Work product reviews

1 Scope

This document establishes a generic framework for work product reviews that can be referenced and used by all organizations involved in the management, development, test and maintenance of systems and software. It contains a generic process, activities, tasks, review techniques and documentation templates that are applied during the review of a work product. A work product is any artefact produced by a process. This document defines work product reviews that can be used during any phase of the life cycle of any work product. This document is intended for, but not limited to, project managers, development managers, quality managers, test managers, business analysts, developers, testers, customers and all those involved in the development, testing and maintenance of systems and software.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO/IEC/IEEE 24765, *Systems and software engineering — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC/IEEE 24765 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
ad hoc reviewing
unstructured independent review technique

3.2
author check
informal review performed by the author of the work product

3.3
buddy check
informal review performed independently by a colleague of the author

3.4
checklist-based reviewing
review technique guided by a list of questions or required attributes

3.5
formal review
form of review that follows a defined process with formal documented output

3.6
informal review
form of review that does not follow a defined process and has no formal documented output

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3.7
informal group review
informal review performed by three or more persons

3.8
inspection
formal review of a work product to identify issues, which uses defined team roles and measurement to improve the review process

EXAMPLE Fagan Inspections[7] are a specific type of inspection and code inspections are used to review program source code.

3.9
issue
observation that deviates from expectations

EXAMPLE Potential defect, improvement or point needing clarification.

3.10
milestone review
formal review of a work product and supporting evidence used to determine its acceptability for use in the next stage of development or for delivery

Note 1 to entry: The requirement for this form of review is normally specified in the project plan.

3.11
page-by-page reviewing
technique where reviewers review a work product in a sequential order

3.12
pair review
informal review of a work product performed by two suitably qualified people other than the author working together

3.13
peer desk check
informal review where the author and a colleague walk through a work product

3.14
peer review
review of work products performed by others qualified to do the same work

3.15
perspective-based reading
form of role-based reviewing that uses checklists and involves the creation of prototype deliverables to check the completeness and other quality characteristics of the work product

3.16
role-based reviewing
technique where reviewers review a work product from the perspective of different stakeholder roles

EXAMPLE Typical stakeholder roles include specific user types, such as work product maintainer, tester and developer.

3.17
scenario-based reviewing
technique where the review is guided by determining the ability of the work product to address specific scenarios

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3.18
technical review
formal peer review of a work product by a team of technically-qualified personnel that examines the suitability of the work product for its intended use and identifies discrepancies from specifications and standards

Note 1 to entry: Technical review may also provide recommendations of alternatives and examination of various alternatives.

3.19
walkthrough
formal review in which an author leads members of the review through a work product, and the participants ask questions and make comments about possible issues

3.20
work product
artefact produced by a process

EXAMPLE Project plan, requirements specification, design documentation, source code, test plan, test meeting minutes, schedules, budgets, and incident reports.

Note 1 to entry: A subset of the work products can be baselined to be used as the basis of further work and some will form the set of project deliverables.

4 Conformance

4.1 Intended usage

The normative requirements in this document are contained in Clause 6 and Annex A. It is recognized that particular projects or organizations may not need to use all of the techniques defined by this document. Therefore, implementation of this document typically involves selecting a set of techniques suitable for the project or organization. There are two ways that an organization or individual can claim conformance to the provisions of this document. The organization or individual shall assert whether full or tailored conformance to this document is claimed.

4.2 Full conformance

Full conformance is achieved by demonstrating that all of the requirements (i.e. “shall” statements) of the work product review process defined in Clause 6 and the review documentation annex of this document have been satisfied.

4.3 Tailored conformance

When this document is used as a basis for establishing a review process that does not qualify for full conformance, the subset of activities for which tailored conformance is claimed, is recorded. Tailored conformance is achieved by demonstrating that all of the requirements (i.e. “shall” statements) for the recorded subset of activities have been satisfied.

Where tailoring occurs, justification shall be provided (either directly or by reference), whenever an activity defined in Clause 6 of this document is not followed. All tailoring decisions shall be recorded with their rationale, including the consideration of any applicable risks. Tailoring decisions shall be agreed by the relevant stakeholders.

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5 Work product reviews

5.1 Overview

Work product reviews are performed on many projects, typically as a means of contributing to the early detection of defects, so that these defects can be removed as early as possible thus reducing unnecessary rework. In practice, reviews are performed for a variety of purposes in addition to defect detection (examples are listed in C.1.2.1).

Reviews can be classified in a number of ways. In this document, reviews are classified as either formal or informal. Many review techniques can be used over the course of a review, such as role-based reviewing for individual review and checklist-based reviewing during a review meeting.

The generic process for conducting work product reviews (defined in Clause 6) includes a number of selectable attributes (including review techniques). This allows users to configure their specific review type according to their unique situation. These attributes are described in detail in Annex C. This configuration of the generic process allows users to define reviews that suit their purpose while still conforming to their constraints in the most effective and efficient manner, rather than forcing them to choose a specific named review type that they cannot practically use in full.

Historically in the literature a number of distinct review types have been defined but some differ only in the extent to which a particular attribute is emphasized (these types are listed in 5.3 and the mapping between the characteristics and review types is provided in Annex D). For example, some believe the difference between inspection and technical review simply to be that inspection requires process improvement.

5.2 Review attributes

The following is a list of review attributes that can be used to define the review to be performed. Annex C provides more detail on each of the attributes.

— Purpose (see C.1.2.1);

— Roles (see C.1.2.2);

— Individual review techniques (see C.1.2.3);

— Optional activities (see C.1.2.4);

— Number of reviewers (see C.1.2.5);

— Planned number of reviews (see C.1.2.6);

— Formal reporting (see C.1.2.7);

— Training required (see C.1.2.8);

— Review improvement (see C.1.2.9);

— Entry and exit criteria (see C.1.2.10).

Annex F provides guidelines on the selection of review attributes for different work product types and work product formats.

5.3 Review types

The following is a list of review types commonly referenced in the literature[13] and found in IEEE 1028. Annex E describes the alignment of the activities defined in this document with the procedures of

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IEEE 1028-2008. Annex D provides more detail on each of the types and maps the relevant attributes from 5.2 to the different review types.

— Author check;

— Buddy check;

— Informal group review;

— Inspection;

— Milestone review;

— Pair review;

— Peer desk check;

— Technical review;

— Walkthrough.

Annex G provides examples of how each review type can be used within specific software/systems development life cycle models. Users of this document are not restricted to using the above review types. They can also use hybrid types based on selected attributes applied to the generic review process according to their needs.

6 Work product review process

6.1 Overview

The Work Product Review Process comprises activities for the review of work products (see Figure 1).

The process shown in Figure 1 is not always performed on "complete" work products, but can be performed on parts of work products, and in this situation these activities will typically be invoked a number of times to complete the review for a complete work product. Thus, the process shown in Figure 1 can be applied more than once on a single work product.

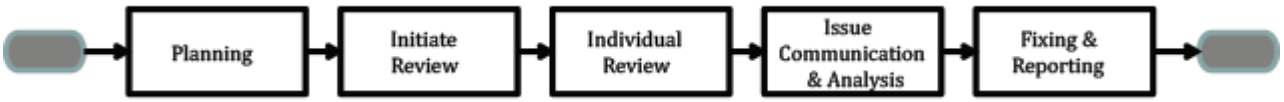

Figure 1 — Work Product Review Process

6.2 Purpose

The purpose of the Work Product Review Process is to provide a structured but flexible framework from which review processes (both formal and informal) may be tailored for specific contexts and purposes.

6.3 Outcomes

As a result of the successful implementation of the Work Product Review Process:

a) defects/issues in the work product are identified;

b) quality characteristics of the work product are evaluated;

NOTE A list of quality characteristics can be found in the ISO/IEC 25000 series of standards.

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c) reviewers have gained knowledge about the work product;

d) consensus on decisions made has been reached;

e) new ideas have been generated;

f) updates to the work product are made;

g) participants have identified potential improvements in their working practices.

6.4 Activities and tasks

The person(s) responsible for the work product review shall implement the following activities and tasks in accordance with applicable organization policies and procedures with respect to the Work Product Review Process.

6.4.1 Planning

This activity consists of the following tasks:

a) The scope of the review, which comprises the purpose, the work product to be reviewed, quality characteristics to be evaluated, areas to focus on, exit criteria, supporting information such as standards, effort and the timeframes for the review, shall be defined.

NOTE 1 The work product to be reviewed can be part of a larger work product.

EXAMPLE 1 Areas to focus on can be specific features, non-functional attributes or selected pages.

b) The review characteristics shall be identified and agreed.

EXAMPLE 2 Review characteristics can include review activities, roles, effort, individual review techniques and checklists.

NOTE 2 The responsibility for identifying and agreeing the review characteristics usually involves roles such as the review leader, management and reviews coordinator as defined in C.1.2.2.

c) The review participants, along with their expected roles, shall be identified and agreed.

6.4.2 Initiate review

This activity consists of the following tasks:

a) Required review materials shall be distributed to review participants.

EXAMPLE Review materials can include, but are not limited to, the work product, checklists, review guidelines and the baseline specification.

b) The review leader shall communicate the scope and characteristics of the review to the review participants.

c) The review leader shall communicate the roles, responsibilities and focus to each review participant.

d) The author (or a suitably qualified person) may describe the work product under review.

NOTE 1 Tasks b), c), and d) can be performed at an overview meeting.

NOTE 2 The decision to hold an overview meeting typically depends on factors such as whether the reviewers:

— have previously participated in or been trained in formal reviews;

— know and understand the review process to be used;

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— understand its objectives (e.g. documenting issues versus proposing resolutions);

— are familiar with the concept of assigned roles, the requirements of their specific roles, the classification system for issues and the forms and tools (see Annex I) to be used in the process;

— require additional background information about the work product or its context.

e) Training for reviewers may be arranged.

6.4.3 Individual review

This activity consists of the following tasks:

a) Each reviewer shall perform a review to identify issues with the work product.

NOTE 1 Issues will typically be documented in an Issue Log (as described in A.2) and will be classified in terms of severity.

NOTE 2 Issues can be supported by proposed changes.

6.4.4 Issue communication and analysis

This activity consists of the following tasks:

a) Identified issues shall be communicated.

NOTE 1 If a review meeting is held, then issues can be voiced at the meeting or can be sent for collation and prioritization prior to the meeting.

NOTE 2 If a review meeting is not held, then issues are typically sent to the individual performing the analysis.

b) Previously identified issues, and any new issues identified during this activity, shall be analysed to assign them a status based on the subsequent action to be taken on them.

EXAMPLE 1 Typical examples of issue status are “rejected”, “issue to be noted but no action” and “issue to be addressed”.

c) Issues shall be assigned to an appropriate individual or team based on their status.

NOTE 3 In an informal review the assignment and status of an issue do not need to be documented.

EXAMPLE 2 This can include the assignment of issues to work product authors or individuals (or teams) external to the review (where an issue relates to supporting documentation, such as an organization-wide standard).

d) The quality characteristics of the work product under review shall be evaluated and, along with other relevant criteria, used to make the review decision.

EXAMPLE 3 Relevant criteria used to make the review decision can include the time or budget available.

EXAMPLE 4 Review decision outcomes typically include whether the reviewed work product will be “used as is”, “updated based on the identified issues and used”, “reworked and re-reviewed” or “discarded”. In the event that the review decision is to discard the work product, then the status of all issues would need to be suitably updated.

NOTE 4 Tasks in this activity can be performed by an individual (such as the author of the work product under review), a reviewer, a number of reviewers, or they can be performed as part of a review meeting.

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6.4.5 Fixing and reporting

This activity consists of the following tasks:

a) Incident reports for those issues that require changes to artefacts other than the work product shall be created and communicated to the assigned person or team.

EXAMPLE 1 If the work product under review is a design specification, then incident reports on supporting documentation, such as the requirements specification and organizational design standards, can be raised.

b) Issues with a status of requiring a change to the work product shall be actioned.

NOTE 1 This task is normally performed by the author of the work product.

EXAMPLE 2 This task can include further analysis of an issue, implementation of a solution, or a decision not to change the work product.

c) The completion of review actions on the work product shall be confirmed; otherwise their status shall be updated.

NOTE 2 In an informal review the change of status does not need to be documented.

NOTE 3 Review actions or changes to status can require agreement of the comment originator.

d) The reviewed work product shall be accepted when the review decision outcome has been satisfied.

NOTE 4 When the review decision outcome has not been satisfied, steps b) and c) will normally be repeated.

NOTE 5 Depending on the level of risk, a meeting of relevant stakeholders might be held to determine the outcome of the review.

e) The results of the review shall be reported.

6.5 Information items

As a result of carrying out this process, the following information items shall be produced:

a) Issue Log (see A.2);

b) Incident Report (see A.3);

c) Review Report (see A.4).

NOTE 1 Formal documentation (Issue Log, Incident Reports and Review Report) is not always required and verbal reports can be produced in some situations. Formal documentation is rarely required for the following review types: informal group reviews, author check, buddy check, pair review and peer desk check.

NOTE 2 Issue descriptions or a reference to the Issue Log are typically included in the Review Report.

7 Review techniques

7.1 Overview

This document defines a number of review techniques associated with the various activities that were defined in the generic review process that was described in Clause 6, including techniques for individual reviewing (7.2) and issue analysis (7.3).

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7.2 Individual reviewing techniques

7.2.1 Overview

The techniques associated with the "Individual Reviewing" activity in 6.4.3 are used to identify issues (which might be defects) in the work product under review.

7.2.2 Ad hoc reviewing

Ad hoc reviewing is a very common approach to issue detection by reviewers; it is completely unstructured. Each reviewer is expected to find as many defects as possible of any type, but are provided with little or no guidance on how this task should be performed. Reviewers often read the work product sequentially, on a page-by-page basis, identifying and documenting issues, as they encounter them in the work product. This approach is highly dependent on reviewer skills and often leads to the same issues being identified by different reviewers.

7.2.3 Checklist-based reviewing

Checklist-based reviewing is a systematic approach to identifying issues that is based on checklists. If different reviewers are assigned different checklists, then this provides wider coverage overall and helps prevent the duplication inherent in the ad hoc approach. One disadvantage of using checklists is that some reviewers limit themselves to only considering the checklist entries and ignore other potential issues with the work product under review. Care should be taken to make reviewers aware that they have a wider responsibility than simply following the checklist.

Typically, review checklists take the form of a set of questions based on potential defects, which may be derived from experience within the project, the organization or across the industry as a whole. Checklists should be specific to the type of work product under review. A checklist for a requirements document will be different to one for a design document or a test plan, and may be specific to the methodology used to develop the work product (e.g. there may be different checklist questions for requirements in the form of plain text to those in the form of use cases or user stories). Checklists may also be specific to the application domain of the work product (e.g. a checklist for a banking work product may be based on banking regulations while a checklist for an avionics work product would be based on avionics standards).

Typical problems with checklists are that they are too long and never change. The ideal checklist should be constrained to about 10 entries and regularly updated; as entries become stale and find fewer issues (hopefully because the authors have learned and improved) then they should be replaced with newer entries reflecting issues missed in the recent past. It is possible to enhance the checklist-based approach by using risk information to ensure that those defects that have the highest impact on the business and have the highest probability of occurring are included in the checklists and so are explicitly looked for during the reviews.

7.2.4 Scenario-based reviewing

With scenario-based reviewing, reviewers are provided with structured guidelines on how to read through the work product under review. Where requirements, designs or tests are documented in a suitable format (e.g. use cases) then a scenario-based approach supports reviewers in performing "dry runs" on the work product based on expected usage of the work product. Another form of scenario-based reviewing is based on detecting specific defect types (as with checklist-based reviewing), this is also known as defect-based reading. When used to identify specific defect types, these scenarios provide reviewers with structured reading guidelines on how to identify different fault types, which are more detailed than simple checklist entries.

There is a danger that if this form of review is used in isolation, and thus is constrained to the documented scenarios, other defects that are not specifically targeted by the scenarios will be missed, such as defects of omission, where required functionality is not included in the work product under review.

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