TECHNICAL REPORT

First edition
2009-12-15

Information technology — Systems and software engineering — Guide for requirements engineering tool capabilities

Technologies de l'information — Ingénierie des systèmes et du logiciel — Guide pour les capacités d'outil d'ingénierie des exigences

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO/IEC TR 24766:2009
https://standards.iteh.ai/catalog/standards/sist/524cd63a-214c-4682-a95a-
d6db86e67b8a/iso-iec-tr-24766-2009

Contents

Page

iTeh STANDARD PREVIEW
(standards.itch.ai)

ISO/IEC TR 24766:2009
https://standards.iteh.ai/catalog/standards/sist/92-4cd65a-214c-4682-a95a-
d6db86e67b8a/iso-iec-tr-24766-2009

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 24766, 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 systems engineering*.

Introduction

Requirements engineering (RE) is a major activity within the systems and software engineering life cycles. This activity must be carried out in a comprehensive manner to ensure that a complete set of user needs and requirements is captured. These user needs and requirements are transformed into a validated set of technical requirements and managed throughout the life cycle using the RE process activities. RE tools are used to support many RE and related life cycle activities. RE processes are identified in ISO/IEC 15288:2008, *Systems and software engineering — System life cycle processes* and ISO/IEC 12207:2008, *Systems and software engineering — Software life cycle processes*.

ISO/IEC 15288:2008 and ISO/IEC 12207:2008 describe a set of RE processes, activities and tasks to be performed when acquiring or developing systems and software. However, these documents do not address the RE tool capabilities users can expect in order to support an RE process and other related life cycle activities.

Many RE processes are human activities that, in the current state of the practice, tools cannot perform, and that might never be able to be performed by a tool. But wherever possible, a tool should support these human activities through the facilitation of documentation capture, content management, distribution, discussion forums, and decision support tools.

This Technical Report describes capabilities of RE tools to benefit the groups of people that acquire, supply, develop, operate, and maintain an RE process.

This Technical Report will help RE personnel involved in the execution of one or more RE activities to

- obtain a better understanding of the relationship between the activities in which they are involved and RE tool capabilities,

- identify processes or activities that can be improved through better support by an RE tool, and

- have an objective basis for a better comparison, evaluation and assessment of RE tools.

This Technical Report will help people involved in the purchase of RE tools to

- review RE services that can contribute to RE process improvement, and

- identify criteria for selecting RE tools.

This Technical Report will help RE tool vendors to

- provide RE tools consistent with ISO/IEC 15288:2008, ISO/IEC 12207:2008, ISO/IEC 15940:2006, and ISO/IEC 14102:2008.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

Information technology — Systems and software engineering — Guide for requirements engineering tool capabilities

1 Scope

Requirements engineering (RE) is an essential process of the systems and software engineering life cycles. RE has been established as an ISO/IEC standard life cycle process in both ISO/IEC 15288:2008, *Systems and software engineering — System life cycle processes* and ISO/IEC 12207:2008, *Systems and software engineering — Software life cycle processes*.

This Technical Report provides guidance on desirable capabilities of RE tools. It supplements ISO/IEC 14102:2008, *Information technology — Guideline for the evaluation and selection of CASE tools*, which details a set of evaluation criteria for CASE tools without referencing a specific activity or service area.

2 Normative references

iTeh STANDARD PREVIEW

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.

ISO/IEC 12207:2008, *Systems and software engineering — Software life cycle processes*

ISO/IEC 15288:2008, *Systems and software engineering — System life cycle processes*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
activity
set of actions that consume time and resources and whose performance is necessary to achieve, or contribute to, the realization of one or more outcomes

3.2
manage
provide storing and editing capabilities, tracking history of edition, versioning, author identification, change management, time stamping, user notification for content changes, security rights control

3.3
management
provision of storing and editing capabilities, tracking history of edition, versioning, author identification, change management, time stamping, user notification for content changes, security rights control

3.4
functional requirement
requirement that specifies a function that a system or system component must be able to perform

[ISO/IEC 25000:2005]

3.5
quality requirement
non-functional requirement
capability of a product to satisfy the stated and implied needs when used under specific conditions

3.6
process
set of interrelated or interacting activities which transforms inputs into outputs

[ISO/IEC 12207:2008 and ISO/IEC 15288:2008]

3.7
requirements attributes
set of properties associated with requirements

3.8
stakeholder
party having a right, share, or claim in a system or in its possession of characteristics that meet that party's needs and expectations

[ISO/IEC 25000:2005]

3.9
stakeholder equity
degree of the share or claim a stakeholder has in the system of interest or a portion of the system of interest

3.10
user requirements
expression of perceived need from individual or group that benefits from a system during its utilization

NOTE   User requirements are requirements issued by a user.

4   Requirements engineering process

4.1   Overview

A requirements engineering (RE) tool should facilitate and support the systematic managing of requirements throughout the project life cycle. The tool should also support the related activities in the context of the RE process. The following sub-topics characterize the processes that an RE tool would need to address.

4.1.1   Requirements elicitation

Requirements elicitation is the process of seeking, uncovering, acquiring, and elaborating requirements. Requirements are elicited rather than just captured or collected. This implies there are discovery, emergence, and development elements to the elicitation process. Requirements elicitation is an iterative activity and benefits from continuous communication and validation with stakeholders.

4.1.2   Requirements analysis

Requirements analysis involves refining the requirements by decomposing high level requirements into details, building prototypes, evaluating feasibility, analyzing overlaps or conflicts between requirements, and negotiating priorities. The goal is to develop requirements of sufficient quality and detail to reflect the stakeholders' needs.

4.1.3   Requirements specifications

Requirements specification deals with documenting the requirements in a consistent and reviewable way. Documentation includes the functions and capabilities that a system must provide and the constraints that a system must respect. Requirements specification is the basis for all subsequent software and system life cycle activities including project planning, design, and production, as well as the foundation for system testing and user documentation.

4.1.4   Requirements and product validation

Validation is the process of evaluating a system or software to determine whether it meets stakeholder requirements. It is performed by examination and through the provision of objective evidence that the requirements for a specific intended use or application have been fulfilled.

4.1.5   Requirements and product verification

Verification is the process of evaluating a system or software to determine whether it properly reflects the specified requirements. It is performed by examination and through the provision of objective evidence that specified requirements have been fulfilled.

4.1.6   Requirements management

Requirements management in conjunction with change management ensures that the requirements remain aligned with the developed product. Requirements management concerns the collection, analysis, and validation and verification of requirements with all the communications and negotiations inherent in working with people.

5   Requirements engineering tool capabilities

5.1   Overview

RE tools allow requirements engineering and management actions to be automated, reducing the cognitive load on the stakeholder. This section provides a list of required capabilities for an RE tool. The capabilities are organized according to the system and software requirements activities listed in ISO/IEC 12207:2008, ISO/IEC 15288:2008, and ISO/IEC TR 19759 (SWEBOK).

This list can be used for:

- Evaluating and choosing an RE tool

- Matching process to specific RE tool capabilities

5.2   Requirements elicitation

5.2.1   Overview

The requirements expressed in the project scope must address all essential business and user needs. The RE tool should be able to support in identifying stakeholder, capturing and tracing of the business/user requirements, functional requirements, and the quality requirements during elicitation work.

5.2.2   Requirements capture

The RE tool should support requirements capture by allowing the user to:

- Storing and managing the documentation from interviews, workshops, and observation

- Storing and managing stakeholder information (e.g., contact lists, comments, and etc.)

- Tracing requirements and generating trace reports

- Creating hierarchical relationships between requirements

- Including design rationale information directly associated with any hierarchical link

- Importing text and graphics from applications (e.g., open text formats)

- Updating existing linked documents from new or changed versions of the source documents without having to re-establish traceability links

- Storing and managing attributes for classifying or categorizing requirements during identification

- Storing and managing attributes in a variety of formats (e.g., text, enumerated, binary, graphics, descriptions, attachments), that can be associated with each requirements

- Using tool generated inherent attributes (e.g., unique requirement identification, author, time date, requirements change history)

- Using flexible search options for requirements by word or attributes (e.g., requirements identifier, words in text files, user and tool generated attributes)

- Managing the replacement or updating requirements by manual or electronic import

- Using flexible user programming language to develop reports for display or generating documents from the tool

5.2.3 Capturing "as-is" and "to-be" system elements

Requirements expressed in the project scope must not exclude any essential business, user, functional, and quality requirements. The RE tool should support capturing "as-is" and the "to-be system elements as follows:

- Storing and managing graphics and text (e.g., architecture, functional decomposition, Work Breakdown Structure (WBS))

- Storing and managing user definable attributes and additional information associated with a given requirement (e.g., stakeholders, business process, activity, tasks, policy, constraints)

- Flexible tracing (e.g. forward and backward tracing, one to many and many to one, bi-directional tracing of text to text, text to graphics, graphics to graphics, elements within graphics, tables and cells within a table)

- Bi-directional tracing of additional requirements and link between them (e.g., requirements to requirements, requirements to derived requirements

- Bi-directional tracing of requirements to system elements

- Bi-directional tracing the allocation of requirements to system elements

- Bi-directional tracing of rationale, assignments, criticality, test and validation to the requirements, allocation, and system elements

5.2.4 Stakeholder and requirements traceability

All functional and quality requirements should be traceable back to specific user, stakeholder, and business requirements. The RE tool should support traceability between them as follows:

- Storing and managing the identification and documentation of stakeholders and their roles and responsibilities

- Flexible searching and reporting of inconsistencies such as unlinked requirements or system elements (e.g., orphans)

- Bi-directional tracing of user needs and requirements

- Tracing user defined attributes for requirements that was fulfilled, how it was done, and who was responsible

- Displaying of traceability in graphical and textual form

- Flexible exporting of traceability matrix in both textual and graphical forms (e.g. Comma Separated Value (CSV), open text format, eXtensible Markup Language (XML), and etc..)

5.2.5 Goal-oriented scenarios and high-level modeling

Scenarios, models, and simulations can be used to describe the specific interaction between a user and a system to accomplish the goal of requirement. The RE tool should support goal-oriented scenarios and modeling as follows:

- Storing and managing user defined or tool provided templates for goal-oriented scenarios (e.g., simulations and modeling business scenarios, strategic issues)

- Storing and managing user defined scenarios

- Evaluating requirements based on business goals

5.2.6 Elicitation templates and checklists

Templates and checklists provide a consistent structure for recording the requirements descriptions and other requirements related information. The RE tool should support elicitation templates and checklists as follows:

- Storing and managing user defined or tool provided templates for elicitation (e.g. Quality Function Deployment (QFD) or Goal Question Metric (GQM))

- Storing and managing user defined or tool provided elicitation checklists

- Storing and managing user defined or tool provided prioritization forms

5.2.7 Prototyping

Prototyping can be used to explore and validate requirements. The RE tool should support prototyping as follows:

- Presenting information in a graphical user interface (GUI)

5.2.8 Importing and exporting to and from other sources

Requirements should be imported from, or interfaced to users, hardware, and other software systems. The RE tool should support Importing and exporting to and from other sources as follows:

- Importing and exporting to and from other tools (e.g. verification, design, spreadsheets, project management, documents)

- Importing and exporting to and from various standard file formats (e.g., Comma Separated Value (CSV), eXtensible Markup Language (XML))

5.2.9 Elicitation documentation

The output from the entire requirements elicitation tasks should be stored, retrieved, and edited in various formats. The RE tool should support elicitation documentation as follows:

- Storing and managing non-textual requirements in the specified format (e.g., bit-mapped graphics, vector graphics, tables, equations, or formal logic notations)

- Storing and managing textual requirements statements using basic text processor and spell checker

5.3 Requirements analysis

5.3.1 Overview

Requirements analysis includes decomposing high-level requirements into details by building prototypes, evaluating feasibility, and negotiating priorities. The RE tool should be able to support in decomposing requirements into functional and quality requirements, and in analyzing requirements feasibility and risk.

5.3.2 Functional requirements analysis

Functional requirements are a statement of required functionality or a behavior that a system will exhibit under specific conditions. The RE tool should support functional requirements analysis as follows:

- Storing and bi-directional tracing of identified user requirements to functional requirements

- Hierarchical structuring and identification scheme for the elaboration of requirements

- Checking spells and grammars on requirements statements (e.g. word spelling check, passive vs. active voice)

- Bi-directional tracing of requirements analysis to system implementation (e.g., architecture design, Work Breakdown Structure (WBS))

5.3.3 Quality requirements analysis

Quality requirements analysis involves significant architectural and design decisions. The RE tool should support quality requirements analysis as follows:

- Storing and managing quality requirements in quality attributes, policies, or constraints

- Hierarchical structuring and identification scheme for the elaboration of requirements

- Bi-directional tracing of quality requirements to source requirements or user requirement

- Checking spells and grammars on requirements statements (e.g. word spelling check, passive vs. active voice)

- Bi-directional tracing of requirements analysis to system implementation (e.g., architecture design, Work Breakdown Structure (WBS))

- Storing and managing the results or the rationale of quality attributes trade-off