TECHNICAL REPORT

ISO/IEC TR 12182

Second edition
2015-05-01

Systems and software engineering — Framework for categorization of IT systems and software, and guide for applying it

Ingénierie des systèmes et du logiciel — Cadre pour la catégorisation des systèmes et du logiciel de la technologie de l'information et guide pour son application

Reference number
ISO/IEC TR 12182:2015(E)

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Contents

Page

Foreword

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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).

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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 WTO principles in the Technical Barriers to Trade (TBT), see the following URL: Foreword — Supplementary information.

The committee responsible for this document is ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and Systems Engineering*.

This second edition cancels and replaces the first edition (ISO/IEC TR 12182:1998), which has been technically revised.

Introduction

This Technical Report has several purposes which are directed to its various intended audiences in the systems and software engineering community, including the developers and users of systems and software engineering standards.

Since ISO/IEC TR 12182:1998 was published, more than 15 years passed with various changes in Information Technology (IT) arena. Those changes include the following:

— IT evolution by hardware advancement, operating systems growth, and communication network changes;

— advent of new type of applications such as entire enterprise applications including ERP (Enterprise Resource Planning), SCM (Supply Chain Management); social systems including online financial systems, healthcare systems, traffic management systems; embedded systems including car electronics; and highly interactive systems handling multi-media and using mobile technologies such as smart phones and tablet computers;

— Internet becoming one of important lifelines;

— emergence of SaaS (software as a service), big data systems and cloud computing services;

— growing impact of the quality of systems and software, in particular safe and secure manner.

By taking these important situational changes, the role and contribution expected for IT industry becomes dramatically increasing, and in order to respond to these expectation, several improvements to the ISO/IEC TR 12182:1998 are made in this revision as follows:

— the scope is enhanced from software to systems and software;

— a framework for describing categorizations is provided in place of a specific set of categorizations;

— relationship to other International Standards available in systems and software engineering area is added.

The categorization of systems and software itself should evolve over time because systems and software engineering is a fast growing field, and therefore this Technical Report does not provide a specific set of categorizations but a framework for categorizations in contrast to the previous one.

For developers and providers of systems and software technologies such as software products, techniques and tools, and research results, this Technical Report will provide the way to define categories of systems and software to which a particular technology can apply. This will help the technology users sort out a right set of technologies, which are applicable (and effective) in the context of their use.

For developers of systems and software engineering standards, this Technical Report will provide ability to position and prioritize specific usage of standards and clauses within the structure of systems and software engineering standards. It is also intended that, wherever applicable, new or on-going projects can identify and use the target categories to provide guidelines on how to apply the standards in different contexts of use. Addressing target categories will not only ease the coordination among projects but also increase the value of standards for their users.

Systems and software engineering — Framework for categorization of IT systems and software, and guide for applying it

1 Scope

This Technical Report specifies the manner in which categorizations of IT systems and software are organized and expressed. It provides the framework for categorizations, and a guide for applying it. This allows any community to clarify their scope of the systems by using their own definition of categories.

The scope of application of the framework is intended to IT systems and software, including services provided by IT systems, where they can be of main targets but not limited to.

The purpose of this Technical Report includes the following:

a) developers of systems and software engineering standards can define their applicability to different categories of target systems and software using annexes or guidelines, so that their users can easily identify relevant standards and clauses that they can apply;

b) suppliers of systems and software engineering tools and methods can clarify the types of target systems and software to which their technologies are applicable or limited so that their users can easily choose the right tools and methods among many candidates for their use;

c) providers of services can define characteristics of their services using classification axes so that they can specify the quality of their services;

d) developers and evaluators of the systems and software can categorize systems and software of similar characteristics by using classification axes so that they can obtain a better estimation and quality evaluation of their target systems and software to be developed;

e) the systems and software engineering community can exchange their research ideas and best practices with defined scope of application.

This Technical Report does not provide a specific set of categorizations but the framework for categorizations and a guide for applying it to achieve the above purposes.

It is important that standards on systems and software engineering are properly applied to the procurement or development of certain kinds of systems. This Technical Report provides a categorization framework and a guide for applying it to assist in (1) defining the area of application of standards, and (2) positioning new standards. The annex of this Technical Report provides descriptive examples for relevant standards, each of which describes the area of application of the standard by using defined categorization.

NOTE Giving guidance on applicability might not be relevant to all standards.

2 Normative references

No normative references are made for the application of this document.

3 Terms and definitions

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

3.1
stakeholder
individual or organization having a right, share, claim, or interest in the target system and its categorization that meet their needs and expectations

[SOURCE: ISO/IEC 15939:2007, 2.37, “system” replaced by “target system”]

3.2
concern
interest in something relevant to one or more of its stakeholders

[SOURCE: ISO/IEC/IEEE 42010:2011, 3.7, “system” replaced by “something”]

3.3
IT system
system which uses information technologies

3.4
target system
system to be categorized, which can be an IT system and software, including service provided by IT system

3.5
categorization
specific way to allocate a target system into a category

3.6
categorization space
universal set of systems and software which has one or more classification axes as its individual dimension, by which stakeholder’s concerns on categorization are expressed

3.7
classification axis
total range of a mapping of systems and software for categorizing them from a particular perspective

3.8
equivalence class
range on a classification axis which has a rule to judge whether a target system is to be mapped to the range or not

3.9
category
subset of categorization space, which the stakeholders are interested in, specified using a combination of one or more equivalence classes

3.10
architecture
fundamental organization of a system embodied in its components, their relationships to each other, and to the environment, and the principles guiding its design and evolution

[SOURCE: ISO/IEC 15288:2008, 4.5]

3.11
environment
<system> context determining the setting and circumstances of all influences upon a system

[SOURCE: ISO/IEC/IEEE 42010:2011, 3.8]

3.12
developer
individual or organization that performs development activities (including requirements analysis, design, testing through acceptance) during the system or software life cycle process

[SOURCE: ISO/IEC 25000:2014, 4.6]

3.13
acquirer
person or organisation that acquires or procures a system, software product, or software service (which may be part of a system) from a supplier

[SOURCE: ISO/IEC 12207:2008, 4.1, modified]

3.14
supplier
organization or individual that enters into an agreement with the acquirer for the supply of a product or service

[SOURCE: ISO/IEC 12207:2008, 4.47]

3.15
independent evaluator
individual or organization that performs an evaluation independently from developers and acquirers

[SOURCE: ISO/IEC 25040:2011, 4.30]

3.16
quality characteristic
category of software quality attributes that bears on software quality

[SOURCE: ISO/IEC 25000:2014, 4.34]

3.17
quality in use
degree to which a product or system can be used by specific users to meet their needs to achieve specific goals with effectiveness, efficiency, freedom from risk and satisfaction in specific contexts of use

[SOURCE: ISO/IEC 25000:2014, 4.24]

4 Framework for categorization

4.1 General

This clause introduces the framework for categorization of IT systems and software, which can be used for mapping target systems into groups based on different stakeholder perspectives. The framework comprises model for categorization (see 4.2) and structure of classification axes (see 4.3).

4.2 Model for categorization

Figure 1 depicts the model for categorization of systems. The model consists of key concepts and the relationship among them, which can be used to define categorizations of specific systems for different stakeholders.

A stakeholder of a categorization has several concerns to accomplish his/her purpose for using the categorization. Stakeholder's concerns on categorization are expressed by a categorization space, on which categories are defined. A classification axis is a range, which has one or more equivalence classes, into either of which a system can be classified. A categorization space is defined with one or more classification axes. A named category is a subset of categorization space which is specified with a combination of one or more equivalence classes.

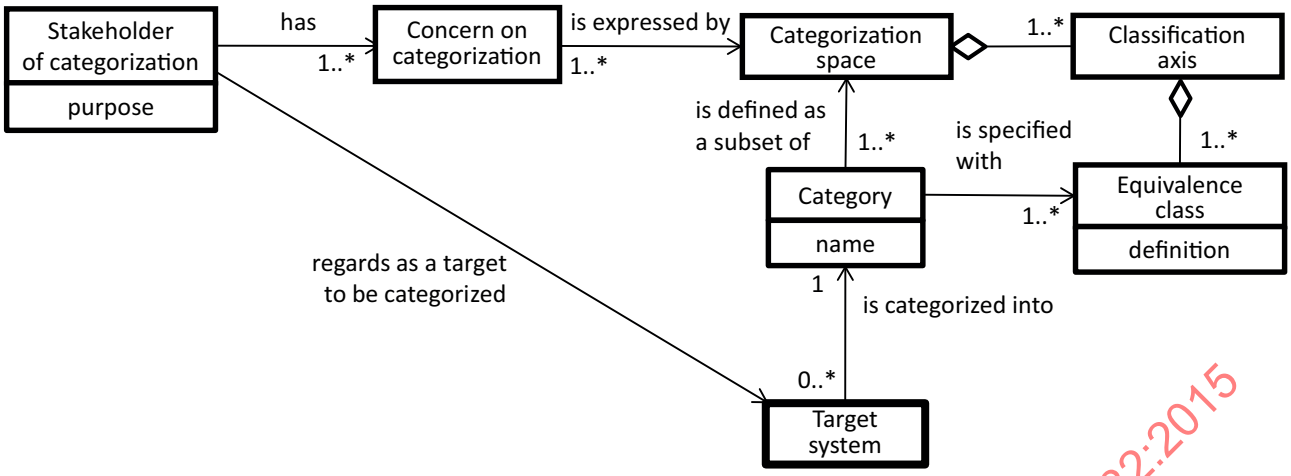


Figure 1 — Model for categorization

For example, if a stakeholder of categorization is interested in "large scale embedded systems" as his/her target category, he/she can define a categorization space with two classification axes: hardware/execution environment and function size, and can specify the target category, as shown in Figure 2.

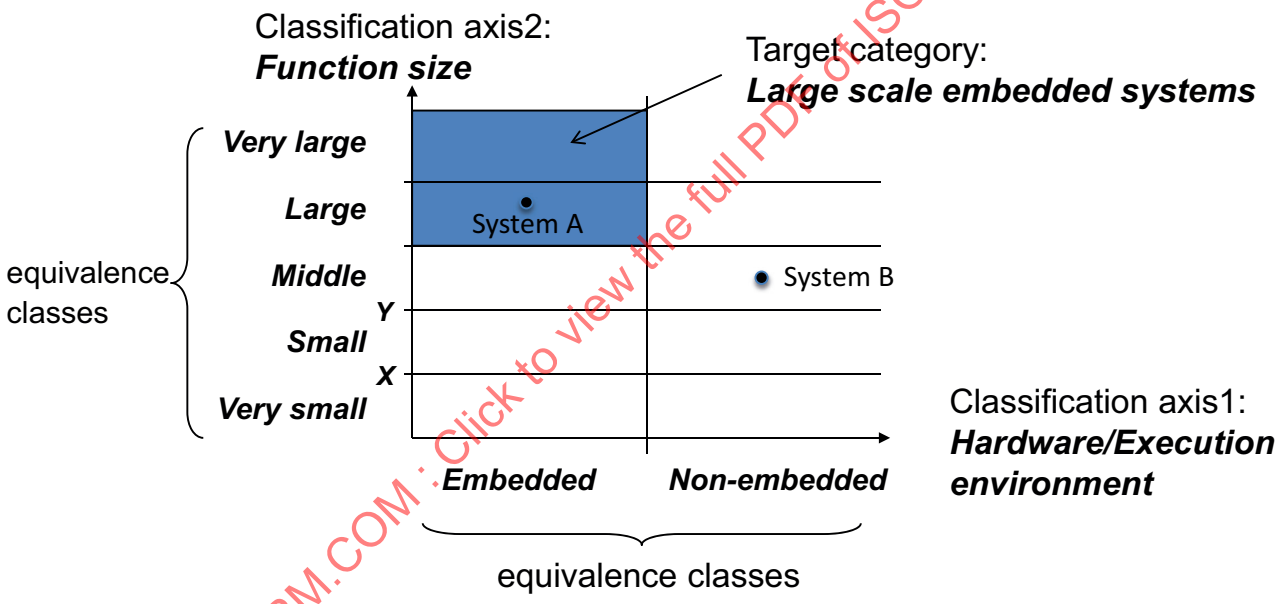


Figure 2 — Example of defining a category using two classification axes

The hardware/execution environment axis has two equivalence classes: Embedded and Non-embedded, each of which has a rule that classify the target system into the class. The rule of the equivalence class "Embedded" can be defined like: the target system must be classified into "Embedded" if it has one or more computers on which software runs for handling specific machines or devices, and that of "Non-embedded" is as the negation of it. On the other hand, the function size axis has continuous ranges and the rule of each equivalence class is defined as an interval on the axis. For example, the equivalence class "Small" can be defined like: the target system is classified into "Small" if its functional size is in the interval X to Y.

In Figure 2, system A is in "Embedded" on the hardware/execution environment axis and is in "Large" on the function size axis, and as a result is classified into the target category "Large scale embedded system", while system B are not. In this manner, any target system can be classified into either of categories on a categorization space.

4.3 Structure of classification axes

This subclause provides the structure of classification axes, which can be used to define specific categories. Figure 3 shows the concepts related to target systems, which can be considered when identifying classification axes.

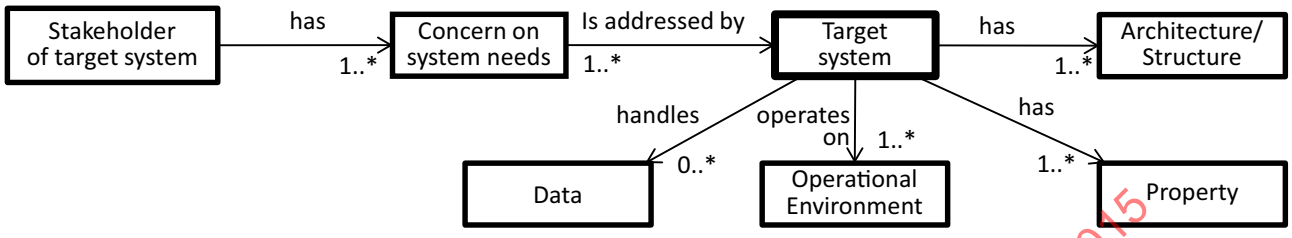


Figure 3 — Concepts related to systems which lead to classification axes

Target systems address stakeholder concerns. Target systems also have their own architectures/structures and properties, operates on some operational environments, and handles data. These aspects have (both external and internal) contribution to the classification axes related to target systems.

NOTE The stakeholder of a target system may be the same as the stakeholder of a categorization.

Classification axes are hierarchically organized, as described in Figure 4.

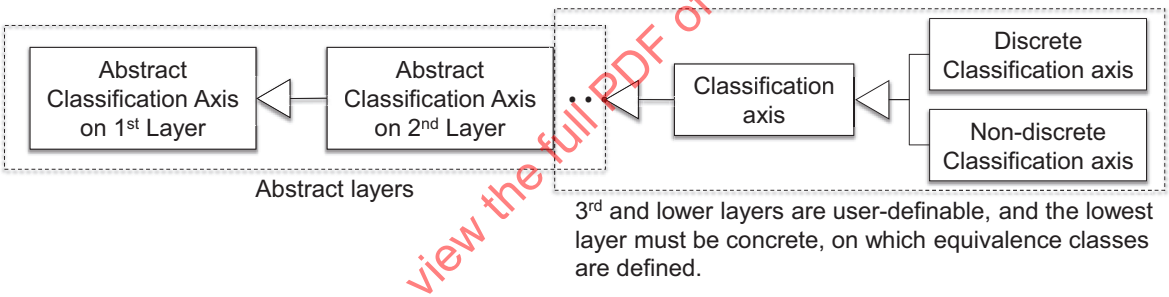


Figure 4 — Hierarchy of classification axes

Classification axes on the first layer are intended to cover possible classification axes for categorizing target systems. Axes on this layer are abstract in the sense that they can be used only for categorizing classification axes; i.e., they do not have equivalence classes and therefore cannot be used directly for creating a categorization space.

Table 1 defines the classification axes on the first layer, which are originated from the concepts in Figure 3.

Table 1 — Definition of classification axes in the first layer

Axis in the first layer	Definition
Architecture/Structure	Axes from the viewpoint of system architecture/structure. In case that the target system is one of the components composing a larger system, the axes are identified from the relations among the components.
Property	Axes from the viewpoint of the properties of the system. The axes are identified from the attributes or computational styles that the system itself or its software has.
Operational environment	Axes from the viewpoint of the operational environment on which the system operates
Data (Property of data)	Axes from the viewpoint of the data that the system mainly handles. The axes are identified from the type, property or variety of the data.

Table 1 *(continued)*

Axis in the first layer	Definition
Stakeholder of target system	Axes from the viewpoint of each stakeholder's role of the system Example of stakeholder's role (defined in ISO/IEC 25010): Primary user/ Secondary user (Content provider/System manager/Administrator/ Security manager/Maintainer/Analyzer/Porter)/Indirect user

Classification axes on the second layer are also abstract, and is intended to be an exhaustive set of classification axes for IT systems and software, but not limited to defined in Table 2; i.e., the stakeholder can define his/her new axes.

Table 2 — Definition of classification axes in the second layer

Axis in the first layer	Axis in the second layer	Definition
Architecture/ Structure	Static structure	Axes based on concepts identified from code-level software components or modules and relationships among them
	Dynamic structure	Axes based on concepts identified from executable components such as processes and tasks and relationships among them
	Deployment structure	Axes based on concepts identified from the execution environment of the system and its positioning on them
Property	Function	Axes based on the function that the system has
	Applied technology	Axes based on the technology that system applies and uses
	Type of information processing	Axes based on the style in which system processes information
	Quality characteristic	Axes based on the level of the quality attribute that the system has
	Size	Axes based on the level of the size of the system
Operational environment	Application domain	Axes based on the domain where the system is used
	Place to use	Axes based on the condition imposed on the place where the system is used
	Mission criticality	Axes based on the level of damage on the users and the environments when the system failure occurs
	Aspect of provision/ acquisition	Axes based on the form of selling and distribution of the system
Data (Property of data)	Media	Axes based on media relating to presentation, communication and store
	Property of storage	Axes based on property of storage for data
	Life	Axes based on level of duration of data's being effective
	Volume	Axes based on level of amount of data
	Criticality	Axes based on level of impact and influence on stakeholders and environment caused by the system due to inaccuracy or loss of data
Stakeholder of target system	Context of use	Axes based on the purpose or scenarios of usage
	Property of users	Axes based on the attributes of the user such as role and proficiency
	Aspect of interaction	Axes based on characteristics of interaction with the user
	Quality in use characteristics	Axes based on the level of quality in use characteristic for the stakeholder's role

The third layer or lower layers can be used for stakeholders of categorization to define classification axes for their own purpose. Table 3 lists typical examples of classification axes on the third layer, which are widely known or used, and equivalence classes on the axes without definitions.

There are two types of concrete axis: discrete and non-discrete, which is differentiated by its domain of equivalence classes. Discrete means that there are no continuous values but subsets in its domain, each of which is defined by a mapping rule. For example, "Hardware/execution environment" is a discrete axis, which has two equivalence classes: "Embedded" and "Non-embedded". On the other hand, non-discrete means that there is a kind of continuous values in its domain to define the equivalence classes. For example, "Function size" is a non-discrete axis, which has continuous domain, on which "Very small/Small/Medium/Large/Very large" are defined as its intervals. Table 3 shows the type of each concrete classification axis.

Table 3 — Examples of classification axes on the third layer and equivalence classes

Classification axis				Examples of equivalence classes for classification axis
First layer	**Second layer**	**Third layer [definition]**	**D/N**	
Architecture/ Structure	Static structure	Layer structure of program [Axes based on allow-to-use relationship between module groups or layers]	D	Driver/OS/Middleware/Application layer
	Dynamic structure	Tier [Axes based on call relationship between executable components]	D	DB/Business Logic/User interface tier
	Deployment structure	Hardware/Execution environment [Axes based on the execution environment to which the target software is deployed]	D	Embedded/Non-embedded (Enterprise, etc)
		System hierarchy [Axes based on system boundary on the system hierarchy composing machines, network and human roles]	D	Human-computer system/Information system/Computer system/ Software/ Software component (from system hierarchy model defined in the SQuaRE series)
		Network transparency [Axes based on the degree of the network-wide transparency of deployed software and data]	D	Floating/Fixed site/Fixed node
Property	Function	Principal function	D	Communication/Information retrieval/ Document editing/Equipment control/etc
	Applied technology	Use of knowledge-based technology	D	Knowledge-based/Non-knowledge-based
		Use of web-based technology	D	Web-based/Non-web-based
	Type of information processing	Problem frame [Jackson's problem frame]	D	Required-behavior/ Commanded-behavior/ Information display/ Simple workpieces/ Transformation
		Style of information exchange	D	Machine-to-machine/Machine-to-human
		Style of computing	D	Centralized/Distributed/Client-server/Stand-alone

NOTE 1 D/N D: discrete, N: non-discrete.

NOTE 2 The axes listed above are just examples, and users of this TR can define their own axes for emerging technologies.

Table 3 *(continued)*

Classification axis				Examples of equivalence classes for classification axis
First layer	**Second layer**	**Third layer [definition]**	**D/N**	
	Quality characteristic	(for each of quality characteristics and sub-characteristics defined in ISO/IEC 25010)	N	High/Middle/Low
	Size	Function size	N	Very large/Large/Medium/Small/ Very small
		Source code size	N	Very large/Large/Medium/Small/ Very small
Operational environment	Application domain	Industrial domain [Axes based on the industrial domain where the system is used]	D	Automotive/Ship/Train/Medical/ Finance/ Retail/Transport/Steel/Chemical/ Nuclear/ Space/Airplane/Telecommunication/etc
	Place to use	Area to be used	D	Domestic/International
		Mobile readiness [Axes based on the degree of mobility of the system]	D	Mobile/Non-mobile
	Mission criticality	Criticality level	D	National safety/Human life/ Social environment/Corporate management/ Health of users/ Money of users
	Aspect of provision/ acquisition	Type of provision/acquisition [Axes based on the form of selling and distribution of the system]	D	Custom-made/Commercial off the shelf (Ready to use software product)/Embedded in commercial goods/Service (Software as a service)
Data (Property of data)	Media	Form of recording	D	Analog/Digital
		Type of media	D	Multi-media/Audio/Video/Photo/ Movie/Game/ etc
	Property of storage	Expected time duration of storage	N	Very long/Long/Not long/Temporary
	Life	Effective life of data [Axes based on the level of duration of data's being effective]	N	Very long/Long/Not long/Temporary
	Volume	Volume of data [Axes based on the level of amount of data that the system handles]	N	Big data / Non-big data
	Criticality	Criticality of data [Axes based on level of impact and influence on stakeholders and environment caused by the system due to inaccuracy or loss of data]	N	Very critical / Critical / Not-critical
Stakeholder of target system	Context of use	Type of use NOTE Software categorization used by Vector, a popular Japanese on-line software supplier	D	Text editing/Internet & communication/ Utility/Visual & Sound/ Business/Personal/ Home & hobby/Learning & education/Game/Amusement/Programing

NOTE 1 D/N D: discrete, N: non-discrete.

NOTE 2 The axes listed above are just examples, and users of this TR can define their own axes for emerging technologies.

Table 3 *(continued)*

Classification axis				Examples of equivalence classes for classification axis
First layer	**Second layer**	**Third layer [definition]**	**D/N**	
	Property of users	Specificity of users [Axes based on the degree to which system users are limited]	D	For specified users/For general users
		Number of users [Axes based on the level of numbers of concurrent users]	N	One/Few/Many/Myriad
		Degree of user's proficiency [Axes based on the level of proficiency of users]	D	For novices/ For experts
		Disability [Axes based on the varieties and level of disability of users]	D	For non-disabled/ For disabled (audio, visual, motor, cognitive)
	Aspect of interaction	Interactiveness [Axes based on the amount of interaction with the user]	D	Interactive/Non-interactive
	Quality in use characteristics	(for each of the quality in use attributes defined in ISO/IEC 25010)	N	High/Middle/Low

NOTE 1 D/N D: discrete, N: non-discrete.

NOTE 2 The axes listed above are just examples, and users of this TR can define their own axes for emerging technologies.

5 Guide for applying the framework for categorization

5.1 Description table for categorization

The description table for categorization is used for defining a categorization, which is defined in Table 4. The description table has a tabular form, but is equivalence to the model for categorization in Figure 1.

Table 4 — Description table for a categorization

Element	Definition
Stakeholders of categorization	role of individuals, teams, organizations, or classes thereof, having an interest in categorization of target systems
Purpose	stakeholder's intention to use this categorization
Concerns on categorization	interest in a target system relevant to one or more of its stakeholders
Categorization space	a set of systems and software, which is defined with one classification axis or a combination of multiple classification axes and is partitioned by equivalence classes on each axis. Classification axes and their equivalence classes can be selected from Table 3.
Categories	the subsets of the categorization space, each of which consists of name and definition, by tabular form or diagram

5.2 Procedure for categorization

This is an exemplar procedure for defining a categorization, which produces a description table in Table 4, comprises the following steps:

S1) Define stakeholders of categorization that use the categorization.

S2) Describe stakeholder's purpose for using the categorization.

S3) Analyse stakeholder's concerns and purpose to identify perspectives needed for categorization.

S4) Define information needs on target systems based on the concerns to select abstract classification axes in the first and second layers matched with the needs, in Tables 1 and 2. If not found there, define new abstract classification axes.

S5) Select (concrete) classification axes in Table 3 which are best fit to stakeholder's information needs. If not found there, define new classification axes with equivalence classes.

S6) For each classification axis, add definitions to all the equivalence classes of the axis, by which any target system can be unambiguously classified into either of the equivalence classes.

S7) Determine target categories and give names to them. The categories are subsets of the categorization space, each of which is defined by the combination of particular equivalence classes on all the axes.

5.3 Example of defining categorization

An example of defining a categorization is presented in this subclause, in order to explain how to apply the description table in 5.1 and the procedure in 5.2. This example is in the case that software developers want to obtain a better effort-estimation (or quality evaluation) using project profiling with categories of the target software.

At first, stakeholder to use this categorization is specified as "developers" (S1), and their purpose to use it is described as "to categorize target software for better effort-estimation and/or quality evaluation" (S2). And then, stakeholder's concern to achieve the purpose is analysed as "influence to development by dependency to specific hardware" (S3), presumably having a fact that hardware platforms have a large impact to productivity and quality of the software development in this organization.

This concern is translated into an abstract classification axis: "Deployment structure" in the second layer, which is "Architecture/Structure" in the first layer (S4), and then a (concrete) classification axis "Hardware/execution environment" is selected from Table 3 as an appropriate one (S5).

For the axis "Hardware/execution environment", the definitions of two equivalence classes "Embedded/Non-embedded" are given, in order to unambiguously categorize all the software developed in this organization (S6), and they are given names: "Embedded" and "Non-embedded" (S7).

Table 5 shows the result of conducting this procedure.

Table 5 — Example of Embedded/Non-embedded categorization

Element	Definition		Procedure
Stakeholder of categorization	Developer		— S1
Purpose	To categorize target software for better effort-estimation and/or quality evaluation		— S2
Concerns on categorization	Influence to development by dependency to specific hardware		— S3
Categorization space	Hardware/execution environment		— S4,S5
Categories	**Name**	**Definition**	— S6,S7
	Embedded	software that runs specific machines or devices	
	Non-embedded	software that is not embedded	

5.4 Example of using categorization

5.4.1 Applicability of technologies

The most typical case of using categorizations would be to determine the applicability and appropriateness of specific technologies and standards to target systems. As shown in Figure 5, such technologies/standards include international standards, elemental technologies, tools and methods, (estimation) models, and so on.

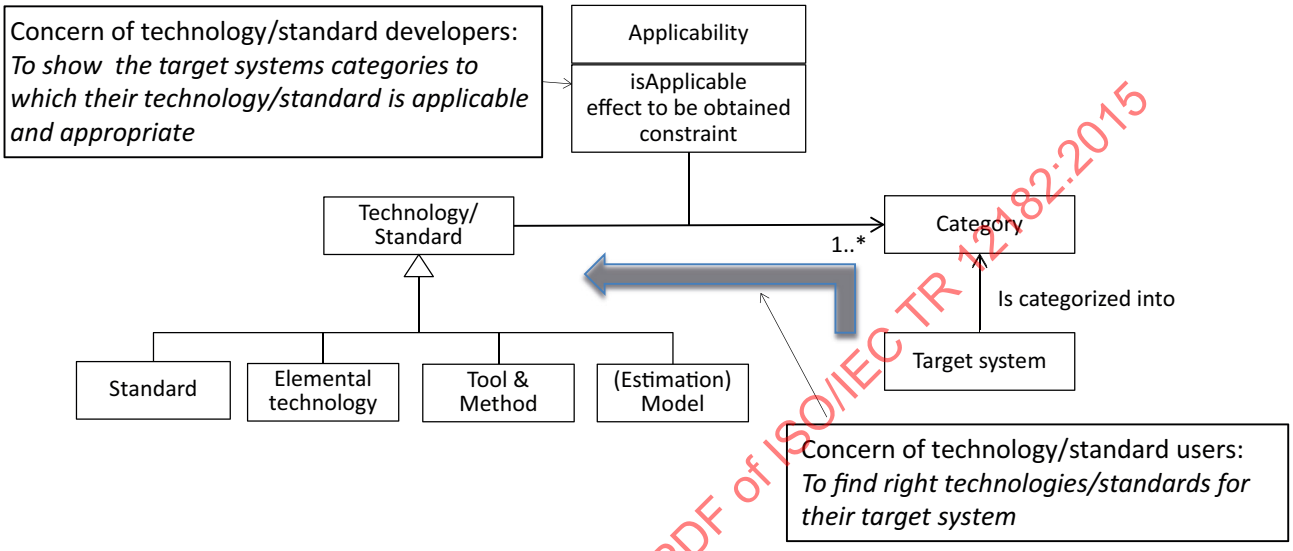


Figure 5 — Model of using categorization for the applicability of technologies/standards

If the stakeholders of categorization are the developers of a technology, their concern may be to show the target systems for the technology, where they define some categories and applicability of their technologies to each category. Such applicability may include whether it be applicable or not, its effects to be obtained, and constraints on its application.

If the stakeholders of categorization are the users of technologies, their concern may be to find the right technologies for their target systems, where they use the applicability of their candidate technologies to find their right ones by determining which category their target systems are in and checking out its applicability data of the technologies.

In this case, the stakeholders can define the applicability of the technologies/standards with the applicability table using the defined categories, which is illustrated in Figure 6.

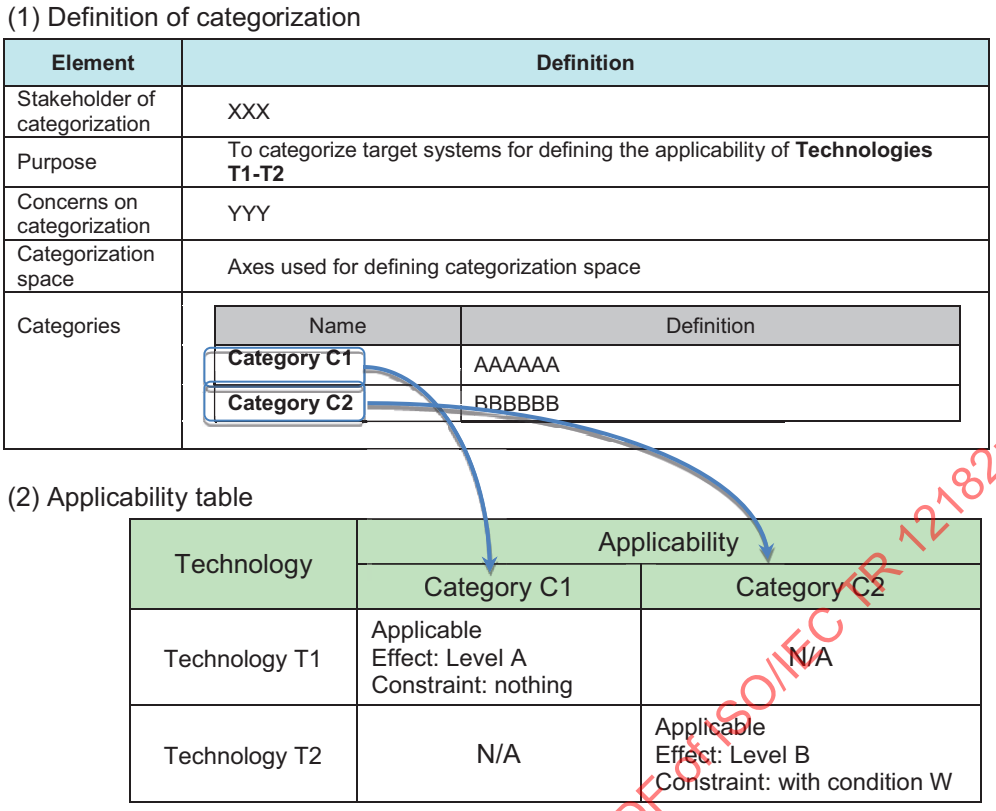


Figure 6 — Defining the applicability of technologies/standards by using categorization

Table 6 shows typical examples of the case, describing stakeholders, their purpose and concerns on categorization of systems, and recommended classification axes, where the stakeholders of categorization include developers, acquirers, (direct/indirect) users, independent evaluators and consultants.

Table 6 — Examples of using categorizations for the applicability of technologies/standards

Stakeholder of categorization	Scenario/Purpose	Concern on categorization	Recommended classification axes
Developer, Acquirer, User, and Independent Evaluator (Users of ISO/IEC 25000)	[Scenario] Analyzing requirements or evaluating quality [Purpose of use] To determine whether the quality model of ISO/IEC 25000- series is applicable to the target system	What is the system categories targeted by the quality model of ISO/IEC 25000- series? Is the model applicable to the target system?	* System hierarchy
Developer (Users of ISO/IEC 29110 VSE)	[Scenario] Establishing standards of organizational development processes [Purpose] To judge whether ISO/IEC 29110 is applicable to the organization	Are the systems to be developed in the organization suitable to apply the process of ISO/IEC 29110?	* Size
Technology developer (Supplier of tools and methods for software development)	[Scenario] Define the target systems of their product/service at business planning [Purpose] To clarify the target system categories that their tools and methods are applicable to and have good effects on	Which axes are the most suitable to state applicability, effects and limitations of their tools and methods to the target systems?	* Static/dynamic/deployment structure * Applied technology * Type of information processing * Quality characteristic * Property of data

Table 6 *(continued)*

Stakeholder of categorization	Scenario/Purpose	Concern on categorization	Recommended classification axes
Developer (Project managers and engineers)	[Scenario] Selecting suitable tools and methods at the planning phase [Purpose] To determine what are the most effective tools and methods for their target systems	Are candidate tools and methods applicable to their target systems, and how much effect do they have?	same as above
Developer (Software engineering process group)	[Scenario] Estimating and evaluating productivity and quality data of system development projects [Purpose] To use it as a profile information to get good estimates for each group of similar systems	Which axes are the most influential to the QCD of development?	* System hierarchy * Size * Quality characteristics * Type of information processing * Interactiveness * Mission criticality
	[Scenario] Establishing standards of organizational development processes [Purpose] To use it as a profile information to determine which level of process management be applied	Which axes are the most influential to the level of process management?	same as above
Consultant	[Scenario] Processing a large amount of data on system development projects statistically [Purpose of use] To group the data per system category in order to use data to obtain good estimation	Which axes are the most influential to the QCD of development?	same as above

5.4.2 Supporting IT decisions

Some stakeholders may need a suggestion for making a good IT decision on the target system based on its categorizations. For this purpose, the decision table is a good tool, where a set of classification axes are listed in the condition entry and a set of recommended actions are in the action entry.

Table 7 describes an example of the decision table, where CASE1 says that action 1 should be taken since system A is classified into non-embedded in hardware/execution environment and very large in function size, and so on.

Table 7 — Decision table using classification axes as conditions for determining actions

Entry		CASE1 System A	CASE2 System B	CASE3 System C
Condition (Classification axis)	Hardware/Execution environment	Non-embedded	Embedded	Embedded
	Function size	Very large	Small	Large
Action	Action 1	X		
	Action 2		X	X
	Action 3			X

Table 8 shows typical examples of the case, describing stakeholders, their purpose and concerns on categorization, and recommended classification axes, where the stakeholders of categorization include developers, acquirers, and independent evaluators.

Table 8 — Examples of using categorizations for making IT decisions

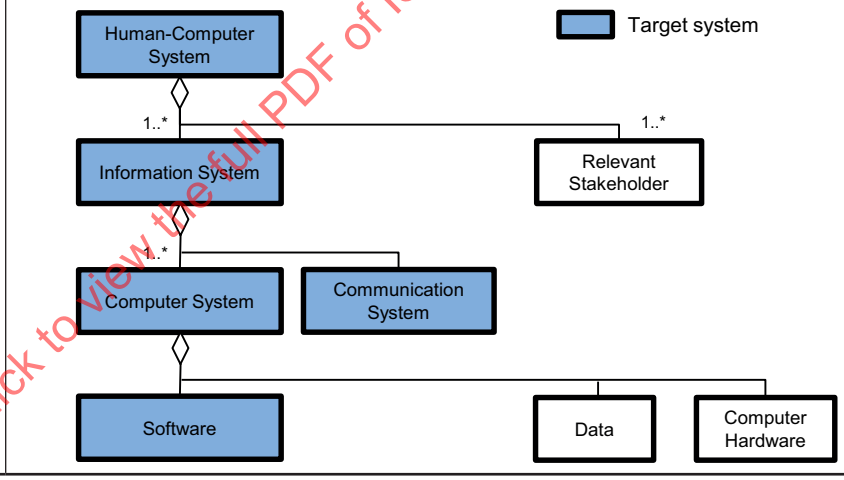
Stakeholder of categorization	Scenario/Purpose	Concern on categorization	Recommended form of decision table
Developer	[Scenario] Planning quality management of the target system [Purpose] To determine adequate level of reliability or security for the target system	Which axes are the most influential to determining the level of reliability or security?	[Condition] axes such as: * Architecture/structure * Application domain * Context of use * Specificity of users * Place to use * Criticality of data * Interactiveness * Mission criticality [Action] suggested levels to be achieved for reliability and security
Acquirer	[Scenario] Defining requirements for the target system before acquiring it [Purpose] To identify functional and quality requirements normally needed for a certain type of systems	Which axes are the most influential to determining the requirements of the target system?	(1) Quality requirements [Condition] axes influential to quality [Action] suggested level to be achieved for each quality characteristics (2) Functional requirements [Condition] axes such as: * Application domain * Context of use [Action] functions to be needed
	[Scenario] Evaluating the target system when acquiring it [Purpose] To assess the target system based on the normally required quality	Which axes are the most influential to determining the benchmark of the quality that the target system must/should have?	[Condition] axes influential to quality [Action] suggested level to be achieved for each quality characteristics
Independent evaluator	[Scenario] Exploiting new customers [Purpose] To collect information on the target system and to determine if this case can be handled for themselves	Which axes are the most influential to test case design for the target system?	[Condition] axes influential to designing test cases such as: * Architecture/structure * Function * Type of information processing * Quality characteristics * Operational Environment [Action] suggested test case design methods

Annex A
(informative)

Examples of defining applicability of Systems and Software Engineering Standards using categorizations

(1) Standards on Quality model

Definition of categorization

Element	Definition
Stakeholder of categorization	ISO/IEC 25000 (SQuaRE) series user
Purpose	To determine whether the quality models of SQuaRE series are applicable to target systems or not
Concern on categorization	Applicability and importance of the quality models of SQuaRE series and associated quality characteristics
Categorization space	System hierarchy (see below)
Categories	

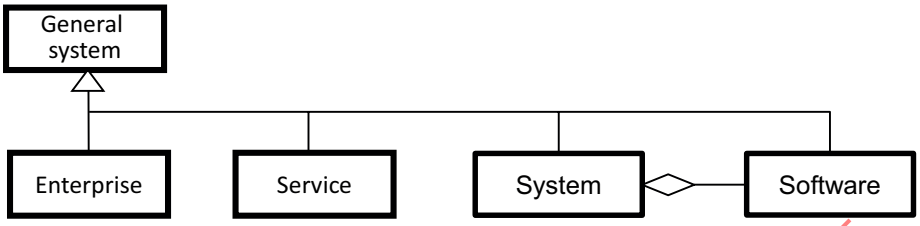
Applicability table: Target system category definition of ISO/IEC 25000- series

Quality Model	Applicability				
	Software	Data	Computer System	Information System	Human-Computer System
Product Quality (25010)	Measurable		Measurable		
Data Quality (25012)		Measurable			
Quality in Use (25010)	(influenced)	(influenced)	(influenced)	(influenced)	Measurable

(2) Standards on Architecture

Definition of categorization

Element	Definition
Stakeholder of categorization	ISO/IEC 420XX developers
Purpose	To show to what system categories the international standards related to architecture (420XX) are applicable

Element	Definition
Concern on categorization	System scope whose architecture 420XX can deal with
Categorization space	Structure of general systems
Categories	 Enterprise: the organization that performs specified tasks [SOUECE:ISO/IEC 15288:2002] Service: performance of activities, work, or duties associated with a product [SOUECE:ISO/IEC 12207:2008] System: combination of interacting elements organized to achieve one or more stated purposes [SOUECE:ISO/IEC 26514:2008] Software: program or set of programs used to run a computer [SOUECE:ISO/IEC 26514:2008]

Applicability table: Target system category definition of ISO/IEC 420XXs

Standards	Applicability			
	Enterprise	Service	System	Software
Architecture description (42010)	X	X	X	X

(3) Standards on Very Small Entities (VSEs)

Definition of categorization

Element	Definition	
Stakeholder of categorization	Developer (ISO/IEC 29110 user)	
Purpose	To establish a cost-effective development of management system using ISO/IEC 29110	
Concern on categorization	Applicability of ISO/IEC 29110 to address aspects of development	
Categorization space	Functional Size	
Categories	**Name**	**Definition**
	Very small	Function Point size < 30
	Small	Function Point size >= 30 <100
	Medium	Function Point size >= 100 <1000
	Large	Function Point size >=1000 >3000
	Very Large	Function Point size >=3000

Applicability table: Target system category definition of ISO/IEC 29110 (informative)

Standards	Applicability				
	Very small	Small	Medium	Large	Very large
VSE (29110)	X	X			