
**Information technology — Software
measurement — Functional size
measurement —**

Part 5:

**Determination of functional domains for
use with functional size measurement**

*Technologies de l'information — Mesurage du logiciel — Mesurage de
la taille fonctionnelle —*

*Partie 5: Détermination des domaines fonctionnels pour l'usage de
mesurage de la taille fonctionnelle*

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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.

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 14143-5, which is a Technical Report of type 2, was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and system engineering*.

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

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

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

ISO/IEC TR 14143 consists of the following parts, under the general title *Information technology — Software measurement — Functional size measurement*:

- *Part 1: Definition of concepts*

- *Part 2: Conformity evaluation of software size measurement methods to ISO/IEC 14143-1:1998*
- *Part 3: Verification of functional size measurement methods* [Technical Report]
- *Part 4: Reference model* [Technical Report]
- *Part 5: Determination of functional domains for use with functional size measurement* [Technical Report]

The following part is under preparation:

- *Part 6: Guide for use of ISO/IEC 14143 series and related International Standards*

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Introduction

Functional Size Measurement (FSM) is a technique used to measure the size of software by quantifying the Functional User Requirements of the software¹⁾. The first published method to embrace this concept was Function Point Analysis, developed by Allan Albrecht in the late 1970s. Since then, numerous extensions and variations of the original method have been developed. Users of these methods have made various claims regarding the usefulness and limitations of a particular method when applied to different *types* of software. Examples of these *types* of software quoted include, amongst others, Management Information Systems (MIS), Embedded Software, Process Control Software, Decision Support Software, Military Software, Engineering and Real Time Software.

The terms and the phrase “*software types*” have been loosely defined. They are widely used to differentiate between categories of user functions performed by the software (what it does), software performance issues, degrees of internal processing complexity, physical implementation requirements and development environments. There is no universally consistent definition of these terms or of the characteristics of FUR relevant to assessing Functional Size. The consequences of this are:

- a) it is difficult for a potential user of a particular FSM Method to assess the Method’s applicability for measuring the size of a specific set of FUR; and
- b) owners and developers of an FSM Method are not able to describe the Functional Domain(s) to which the FSM Method can be applied.

This Technical Report addresses these difficulties by describing how the characteristics of FUR may be used to determine software types. The phrase “software types” for the purposes of this Technical Report is replaced by the defined term Functional Domain. A Functional Domain is defined in ISO/IEC 14143-1:1998 as “a class of software based on the characteristics of FUR which are pertinent to Functional Size Measurement.”

ISO/IEC 14143-1:1998 requires that an FSM Method shall describe the Functional Domain(s) to which it can be applied. The purpose of this Technical Report is to define how Functional Domains may be defined and to provide example methods that may be used to generate Functional Domains.

To ensure that this Technical Report did not unnecessarily duplicate established Functional Domains, were these to exist in general information technology, a literature search consisting of formal library retrievals, informal library reviews, personal correspondence, conference proceedings and on-line searches was conducted between June 1995 and May 1997 referencing topics pertinent to this project. Over 700 abstracts were reviewed in addition to articles, periodicals, conference presentations and other references as background to this Technical Report.

This Technical Report satisfies the unique needs of FSM, and therefore takes a different approach from ISO/IEC TR 12182. The classification categories of ISO/IEC TR 12182 were considered, and have been mapped in the informative annex.

1) Refer ISO/IEC 14143-1:1998, *Software engineering — Software measurement — Functional size measurement — Part 1: Definition of concepts*.

Information technology — Software measurement — Functional size measurement —

Part 5: Determination of functional domains for use with functional size measurement

1 Scope

This Technical Report describes the characteristics of Functional Domains and the procedures by which characteristics of Functional User Requirements (FUR) can be used to determine Functional Domains. Two example methods for implementing these principles are provided in the Informative Annexes.

Either of the methods may be used directly, or using Functional Domains defined locally by:

- FSM Method to determine if a particular FSM Method is applicable to the Functional Domain(s) represented by their specific FUR;
- Describing, for a given set of FUR, the Functional Domain to which the FUR belong; and
- FSM Method owners and designers describing the Functional Domain(s) to which the FSM Method can be applied, as outlined in ISO/IEC 14143-1:1998.

NOTE Use of the Informative Annexes to specify Functional Domains will allow comparisons of FUR from different sources and comparisons of the applicability of FSM Methods.

2 Normative references

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 14143-1:1998, *Information technology — Software measurement — Functional size measurement — Part 1: Definition of concepts*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 14143-1:1998 and the following apply.

3.1

characteristic of FUR

a distinctive property of the FUR that is important for identifying the Functional Domain to which a specific set of FUR belongs

3.2
Functional Domain Categorization (FDC)
a process for identifying Functional Domains that conforms to the requirements of 5.3 of this part of ISO/IEC 14143

4 Abbreviations

FDC functional domain categorization

5 Requirements

5.1 General requirements for Functional Domains

A Functional Domain shall be

- distinct from all other Functional Domains, and
- described in terms of a set of characteristics that are relevant to functional size.

A Functional Domain should be named using Information Technology industry recognized terms, extended as appropriate to indicate their local origin, e.g. 'Organization X Real-Time'. This allows the Functional Domains to gain acceptability within the context of FSM (and potentially other software areas where the requirement for software classifications exists, such as for software development and maintenance).

NOTE The explicit use of industry terms such as: real time, MIS and process control, without further qualification in the titles of the sample Functional Domains has been avoided to this point, because their use (or misuse) in the Information Technology industry generally includes quality and technical considerations in addition to FUR. An explicit statement may need to be made to reinforce that technical and quality characteristics of the software are not part of a defined Functional Domain. For example, the term "real time" in industrial use may imply timing constraints (technical or qualitative), specific hardware (technical), immediate feedback (quality), communication with non-human users (software/hardware), safety criticality and reliability (quality), fault tolerance (quality), plus actual FUR (e.g., position control of flight surface in an aircraft).

A set of FUR may be categorized as belonging to more than one Functional Domain.

5.2 General requirements for characteristics of Functional Domains

A Characteristic of a Functional Domain shall:

- a) inherit all of the characteristics of Functional Size, as defined in ISO/IEC 14143-1:1998,
- b) be exhibited by Functional User Requirements,
- c) be independent of methods to develop software, and
- d) be independent of quality and technical requirements.

5.2.1 Requirements for an FDC method

An FDC method should:

- a) be repeatable;
- b) be consistent;
- c) result in descriptions of Functional Domains that have the same meaning at some future time as when they were derived;

- d) be structured to facilitate understanding; and
- e) define characteristics of a Functional Domain.

NOTE Annexes A and B show examples of FDC methods. Other methods may be possible.

6 Procedures

6.1 Determining the Functional Domain for a given set of FUR

To determine the Functional Domain for a set of FUR:

- a) identify the sets of characteristics that the set of FUR exhibits, using an FDC method;
- b) match the sets of characteristics against the sets of characteristics in reference Functional Domains, as defined using the selected FDC method;
- c) determine the Functional Domain(s) applicable to the set of FUR.

6.2 Determining the applicability of an FSM Method to a particular Functional Domain

To determine the applicability of an FSM Method to a particular Functional Domain:

- a) identify the characteristics that the FDC method defines for the particular Functional Domain;
- b) for the selected FSM Method, for each BFC Type, identify which of the above characteristics are recognized;
- c) compare the characteristics of the Functional Domain with those recognized by the FSM Method; and
- d) if the characteristics exhibited by the Functional Domain:
 - 1) are a subset of characteristics that the FSM Method recognizes, then the FSM Method is applicable to the Functional Domain,
 - 2) are superset of characteristics that the FSM Method recognizes, then the FSM Method is partially applicable to the Functional Domain, or
 - 3) do not correspond to any characteristics that the FSM recognizes, then the FSM Method is not applicable to the Functional Domain.

7 Example FDC methods

Based on the procedures described in clause 6, the Informative Annexes are examples of separate and self-contained FDC methods that show different approaches to determining Functional Domains. Either of these methods, or any other structured method that conforms to clause 5.3 of this part of ISO/IEC 14143, may be used to help determine the Functional Domains for which an FSM Method is applicable.

ISO/IEC 14143-1:1998 requires that an FSM Method describe the Functional Domain(s) to which it can be applied. Owners of such FSM Methods should describe the Functional Domain(s) to which they apply using the concepts of the methods of the Informative Annexes or another comparable structured method. Alternately, owners of an FSM Method may use these methods to generate locally defined and named Functional Domains.

NOTE 1 The concepts of existing FSM Methods may or may not correspond exactly to the concepts of the methods of the Informative Annexes, as many FSM Methods were designed and defined before these methods were developed.

Informative Annex A gives an example of a 'top-down,' pragmatic approach to determine Functional Domains based on extensive literature research of categorizations used within and outside of the software engineering world, in alliance with software engineering concepts used to distinguish what is normally understood by Functional Domain.

Informative Annex B gives an example of a 'bottom-up' approach using established software engineering concepts to define a set of BFC Types (as defined in ISO/IEC 14143-1:1998) to determine Functional Domains.

NOTE 2 Informative Annex B gives an example of a 'bottom-up' approach using established software engineering concepts to define a set of BFC Types (as defined in ISO/IEC 14143-1:1998) to determine Functional Domains.

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Annex A (informative)

CHAR Method to determine Functional Domains

A.1 Purpose

The purpose of this Informative Annex is to:

- a) define an FDC method,
- b) use this method to generate example definitions of various specific Functional Domains, and
- c) test the method against examples of FUR and some existing candidate FSM Methods.

ISO/IEC 14143-1:1998 requires that:

- a) FSM Methods measure Functional Size by identifying the 'Base Functional Component Types (or 'BFC Types') that they recognize within the FUR and assigning values that are used to calculate the Functional Size,
- b) a BFC Type is a defined category of 'elementary units of FUR defined by and used by an FSM Method for measurement purposes', and
- c) FSM Methods shall describe the Functional Domains to which they can be applied.

This Informative Annex:

- a) can be used to describe or to define various practical Functional Domains from FUR, and
- b) can be used by the designers of FSM Methods to state which characteristics are recognized by the BFC types of their FSM Method.

Each test request in the list of test requests shall

- a) be numbered so that it can be uniquely identified,
- b) identify the corresponding statement within the FSM Method, if applicable,
- c) identify the performance property to which the test refers,
- d) state the verification method to be used for the verification test, and

NOTE Verification methods are described in Annex B.

- e) be precisely described in accordance with the provisions of A.2.

A.2 Definitions

A.2.1 CHARs

Specific characteristics of FUR selected for the Informative Annex A method.

A.2.2 CHAR Group

A collection of related CHARs that is used to determine a distinctive Functional Domain.

A.3 Characteristics of FUR relevant to FSM (CHARs)

A.3.1 Background

Based on the CHAR Group method, there are three CHAR Groups that distinguish Functional Domains. Through the evaluation and rating described in A.3.2, a set of FUR can be evaluated to find its specific Functional Domain.

A.3.1.1 The CHAR Group model

There are three groups of CHARs, each of which contains a variable number of CHARs. Each CHAR can only belong to one CHAR Group and is evaluated separately:

a) Control- and Communication-Rich

The FUR dictate that the software must operate concurrently with or control the users of its external world. The CHARs are:

- 1) Response: The requirements of the software contain timing constraints that translate into FUR.
- 2) Interfaces: Software interfaces to control or communicate with external objects or other external software are critical.
- 3) System Management: Software manages external environments to detect out of bounds / emergency data values, upon which its processing sequence can be adjusted (e.g. high priority stimulus can interrupt or alter processing of services).

NOTE Whether the software monitors the external environment or the external environment provides the stimulus for data monitoring, are two ways of implementing the same Functional User Requirement.

b) Data-Rich

The data architecture, relationship requirements, persistence of the data beyond the completion of a transaction prescribed by the FUR is a dominant consideration for the software. The CHARs include:

- 1) Complex Data: Complex data or control relationships/interdependencies requirements are an important part of the FUR.
- 2) Persistence: The persistence, or logical storage, of data is an important part of the FUR.

NOTE Data persistence in this Informative Annex refers to the requirement(s) that entered/pollled data be retained over a period of time it strictly considers whether or not data must be retained beyond the single, completed transaction.

c) Manipulation- and Algorithm-Rich

The FUR specify that the software must perform particular types of algorithmically intensive services and / or complex operations. The CHARs include:

- 1) Manipulation: High manipulation of data (e.g. dominance of different logical functions operating on simple data).
- 2) Scientific/engineering: Scientific/engineering, mathematical or logical algorithms required (e.g. involves precision and accuracy, statistical analysis, etc.).