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

**Part 4:
Reference model**

iTeh STANDARD PREVIEW

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

Partie 4: Modèle de référence

ISO/IEC TR 14143-4:2002

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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 main task of technical committees is to prepare International Standards, but in exceptional circumstances a 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 a technical committee has collected data of a different kind than 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 Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

Technical Reports are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Attention is drawn to the possibility that some of the elements of this part of ISO/IEC 14143 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 14143-4, which is a Technical Report of type 2, was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software engineering*.

ISO/IEC 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*
- *Part 4: Reference model*
- *Part 5: Determination of functional domains for use with functional size measurement*

Annexes A and B form a normative part of this part of ISO/IEC 14143. Annex C is for information only.

Introduction

The user of an FSM Method must establish that the FSM Method is appropriate to quantify the functional size of the software. The conformity to ISO/IEC 14143-1:1998 will be necessary but may not be sufficient. An evaluation process of an FSM Method will have to consider practical evidence of the performance of the FSM Method. Such an evaluation may require benchmarking the chosen FSM Method to compare its results for a collection of known Reference User Requirements (RUR) with those obtained from a Reference FSM Method.

Part 4 of ISO/IEC 14143 provides standard RUR together with guidance on Reference FSM Methods. Figure 0.1 shows how these are used to establish reference results. The FSM Method to be evaluated determines functional size results for a collection of appropriate RUR. The same collection of RUR is measured by one or more Reference FSM Methods and these reference results are then compared with the results obtained from the FSM Method to be evaluated.

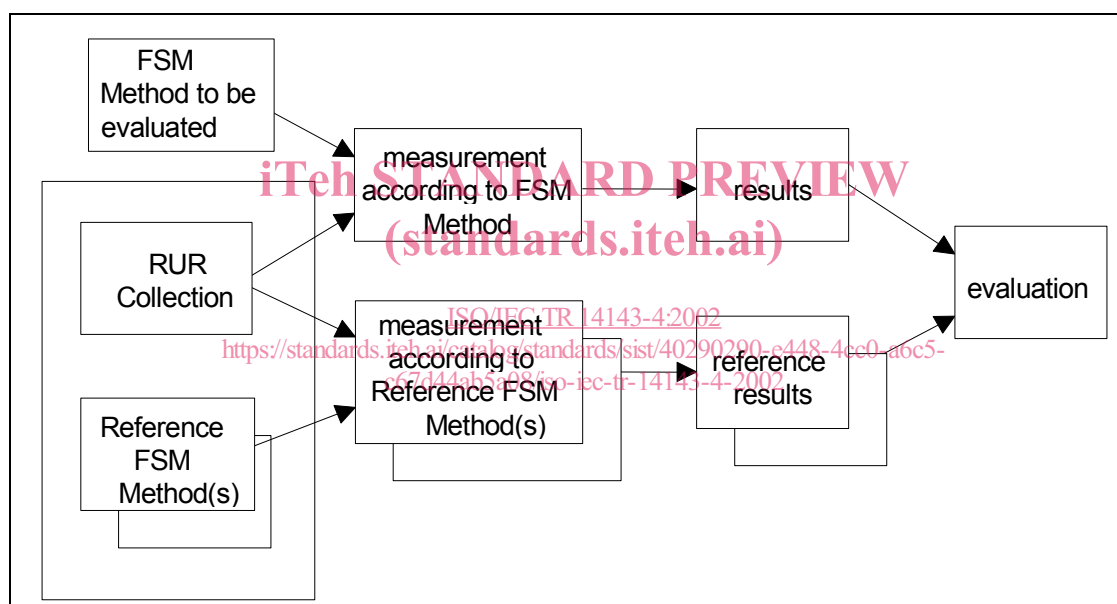


Figure 0.1: Use of RUR and Reference FSM Methods

Clause 5 of this part of ISO/IEC 14143 defines a framework for identifying, classifying and selecting RUR. Annexes A and B provide examples of such RUR in two different domains. While it would be desirable to have an exhaustive set of such RUR, the size of such collection would be prohibitive. Further RUR can be found in the RUR reference list presented in Annex C. Additional appropriate RUR may be constructed according to the basic guidelines stated in clause 5 RUR.

Clause 6 of this part of ISO/IEC 14143 introduces the general requirements for Reference FSM Methods. The reference FSM Methods provide reference points, against which other FSM Methods can be compared.

Information technology — Software measurement — Functional size measurement —

Part 4: Reference model

1. Scope

Part 4 of ISO/IEC 14143 defines the reference model (Figure 0.1) to be used when verifying a Functional Size Measurement (FSM) method.

The reference model consists of two components:

- a classification framework of Reference User Requirements (RUR) which can be sized using an FSM Method. Included are examples of such RUR as well as references to further publications of User Requirements (UR) which can be used for RUR, and
- guidance on selecting Reference FSM Methods, against which an FSM Method can be compared.

The reference model is an input to the evaluation process of an FSM Method. The formulation and execution of evaluation tests and the interpretation of their results is outside the scope of this Technical Report.

The RUR and additional references contained in this Technical Report only represent examples of UR in some domains and situations. Additional RUR and RUR for domains and situations not covered by Annex A, B, or C may be generated with the assistance of the framework described in this Technical Report.

The requirements for Reference FSM Methods may assist in selecting Reference FSM Methods.

2. Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 14143. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO/IEC 14143 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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

ISO/IEC 9126:1991, *Information technology — Software product evaluation — Quality characteristics and guidelines for their use*.

3. Terms and definitions

For the purposes of this Technical Report, the terms and definitions given in the normative references and the following apply. Figure 3.1 describes the composition of User Requirements, RUR, and RUR Collection.

3.1

Functional User Requirements (FUR)

A sub-set of the User Requirements. The Functional User Requirements represent the users practices and procedures that the software must perform to fulfil the users' needs. They exclude Quality Requirements and any Technical Requirements.

NOTE As defined by ISO/IEC 14143-1:1998.

3.2

Quality Requirements (QR)

Any requirements relating to software quality as defined in ISO/IEC 9126.

NOTE As defined by ISO/IEC 14143-1:1998. Quality Requirements are a subset of the User Requirements.

3.3

Reference FSM Method

An FSM Method to be used for comparison reasons when verifying the Functional Size Measurement results. It conforms to the requirements as specified in 6.1.

3.4

Reference User Requirements (RUR)

A standard set of User Requirements which conforms to the requirements as specified in 5.1.1.

NOTE Figure 3.1 shows the relationship of UR and RUR.

3.5

Reference User Requirement Collection (RUR Collection)

A subset of RUR which is selected to match the purpose in a specific evaluation. The selection requirements are specified in 5.1.2.

NOTE Figure 3.1 shows the relationship of RUR and RUR Collection.

3.6

Technical Requirements (TR)

Requirements relating to the technology and environment, for the development, maintenance, support and execution of the software.

NOTE As defined by ISO/IEC 14143-1:1998. Technical Requirements are a subset of the User Requirements.

3.7

User Requirements (UR)

The complete description of the set of user needs for the software to be provided. User Requirements include Functional User Requirements, Technical Requirements and Quality Requirements.

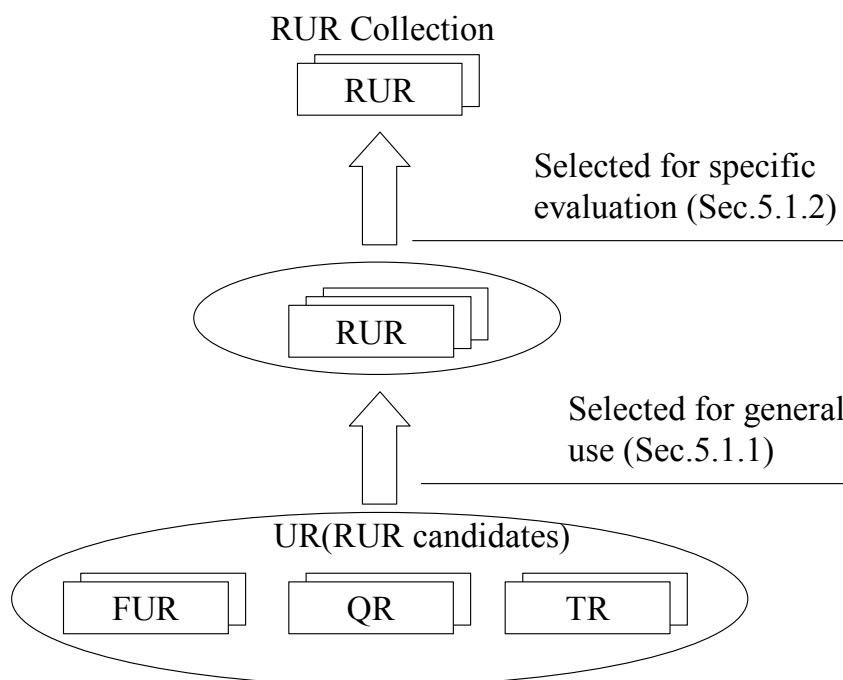


Figure 3.1: Composition of User Requirements and RUR (informative)
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4. Abbreviated terms

FSM	Functional Size Measurement
FUR	Functional User Requirements
QR	Quality Requirements
RUR	Reference User Requirements
TR	Technical Requirements
UR	User Requirements

5. Reference User Requirements

5.1. General requirements

To be acceptable for the evaluation of an FSM Method, the RUR Collection shall consist of RUR complying with 5.1.1 and which are selected according to the rules stated in 5.1.2.

5.1.1. RUR requirements

Individual RUR shall:

- a) be documented in such a form that they can be understood by a human user specialised in the area addressed by the RUR,

NOTE The RUR should be representative of the user requirements. Acceptable presentation formats include textual and graphical descriptions of the functionality, acceptable to the users in the particular Functional Domain. Examples of unacceptable forms of documentation are technical design documentation, computer program listings, or terminology representative of Information Technology.

- b) represent a complete and self contained user practice or procedure, and

NOTE The RUR should provide all requirements necessary to perform a user practice or procedure but need not provide a complete set of requirements as would be needed for a practical system. Different FSM Methods will have different methods of identifying Base Functional Components. RUR containing only a subset of a user practice or procedure may therefore distort the results. An example of partial FUR would be the data entity requirements only (A.1.3) for the Hotel Accommodation System in RUR A1, or the screen layout of the RES function in A.1.2.2.1 of RUR A1.

- c) be tested and be free of ambiguities and inconsistencies.

NOTE Acceptable compliance with this requirement would be that the RUR has been successfully implemented as a software product, been published in a refereed textbook or journal, or been used successfully in an Functional Size Measurement.

5.1.2. RUR Collection selection requirements

RUR selected for a RUR Collection shall:

- a) be representative of the Functional Domain for which the FSM Method is evaluated,

NOTE The RUR should represent the Functional Domain(s) selected for evaluation of the FSM Method. The functionality should be consistent with the characteristics of the Functional Domain.

- b) not biased to a particular FSM Method or evaluation process;

NOTE The RUR should be constructed or selected without any bias. They should not favour, or discriminate against, a particular FSM Method or evaluation process.

- c) include example FUR with equal, unequal, and significantly unequal Functional Size,

NOTE The RUR should have example functions of different Functional Sizes to enable an FSM Method to distinguish between small and large functionality. In the absence of an absolute Functional Size indicator such distinctions can only be rough and at the order of magnitude level. Selection criteria could be user perception or any quantifiable functional characteristic such as number of data fields, decision alternatives, business rules or data references.

- d) include User Requirements not restricted to Functional User Requirements as defined in ISO/IEC 14143-1:1998,

NOTE Some RUR should include requirements such as Quality Requirements or Technical Requirements. Examples of non-functional requirements include reliability, cost, development time, or computer architecture constraints.

- e) when assessing an FSM Method for independence from technology or implementation techniques include different versions of the same user requirement with different:
 1. implementation technologies,
 2. development methodologies, or
 3. documentation levels,

NOTE The RUR should enable the FSM Method to demonstrate its independence from implementation technology and development methodology and its coverage at various stages of software development.

and

- f) include examples of changes of requirements when assessing an FSM Method for software enhancement measurement.

5.2. Examples

Annexes A and B include examples of RUR for the areas of business application and real time / control. Annex C provides references to published User Requirements, which in addition could be used as RUR. The references in Annex C, however, have not been formally checked against the rules stated in 5.1.1.

5.2.1. Business application

Annex A lists 8 RUR: RUR A1 to RUR A8. The first 6 RUR describe part of a hotel reservation system but do so in different forms and functionality. As such they provide an example for the requirements 5.1.1.a) (documentation), 5.1.1.b) (completeness), 5.1.1.c) tested and unambiguous, 5.1.2.c) (range of functional size), 5.1.2.e) (implementation independence) and 5.1.2.f) changed requirements:

- RUR A1 includes a detailed specification of the layout of the user interfaces,
- RUR A2 provides a more general description of the same requirement, but lacks some of the details shown in RUR A1,
- RUR A3 has the same user interface as RUR A1 but only simulates the business functions rather than executing the business logic of the operations,
- RUR A4-A6 describe several modifications to RUR A1, and
- RUR A7 and RUR A8 are examples of complex RUR, describing sections of actual requirements used by a financial organisation.

5.2.2. Real Time /control

Annex B contains several RUR of different size and implementation. These RUR provide examples for the requirements 5.1.1.b) (completeness), 5.1.2.c) (range of functional size), and 5.1.2.d) (non-functional requirements):

- RUR B1 sets the baseline for RUR B2 to B7,
- RUR B2 should have a substantially larger functional size compared with RUR B1 since it contains three times the number of functions of RUR B1. RUR B3 again should be larger in functional size when compared with RUR B2 since additional functions are performed,
- RUR B4, RUR B5, and RUR B6 describe three different non-functional technical or implementation requirements for RUR B3,
- RUR B7 describes a different use for the requirement of RUR B3,
- RUR B8 addresses a process control application, which continuously monitors and controls a communication line,
- RUR B9 describes a valve control application, and
- RUR B10 is an example of a complex RUR for a communication control system.

6. Reference FSM Method

Reference FSM Methods in combination with RUR can be used to establish a known baseline of results (see figure 0.1). This will then allow a benchmark to be performed for an FSM Method (see figure 0.1). Compared with results of a Reference FSM Method, an FSM Method can establish its position relative to that Reference FSM Method.

A Reference FSM Method may be valid for only some Functional Domains. It will provide a reference point for the relative evaluation of a chosen FSM Method for a specific situation.

6.1. General requirements

A Reference FSM Method itself shall:

- a) conform to ISO/IEC 14143-1:1998 according to ISO/IEC 14143-2,
- b) cover the same Functional Domain as that described within the FSM Method to be assessed,
- c) be publicly available, and
- d) be verified for its minimum effectiveness to the purpose of the evaluation.

6.2. Example Use of Reference FSM Methods

Using several different Reference FSM Methods will provide a range of references in relation to which FSM Methods can be positioned. Suitable Reference FSM Methods for the creation of such a range of reference results would be a superficial Reference FSM Method at one end of the range and a comprehensive Reference FSM Method at the other end.

6.2.1. Superficial Reference FSM Method

A superficial Reference FSM Method would formally conform to ISO/IEC 14143-1:1998. Verification according to PDTR 14143-3, however, should reveal a very limited capability of measuring Functional Size. Such a superficial Reference FSM Method could be the starting point of an evaluation scale.

6.2.2. Comprehensive Reference FSM Method

A comprehensive Reference FSM Method would have an enhanced capability of identifying Functional Size in a wide range of instances. Compared with a superficial Reference FSM Method, its performance parameters, as established by PDTR 14143-3, should be substantially improved.

Annex A (normative)

Business application RUR

A.1 RUR A1: Hotel Accommodation System (Reservation)

A.1.1 Overview

The hotel reservation system is part of an accommodation system of a general hotel system. This section provides an overview of the requested system. The detailed functionality of the hotel reservation system together with the navigation to reach it within the hotel system will be described in the next section.

The reservation system supports the following business functions related to the letting of hotel rooms:

- maintain reservations
- confirm reservations

Room data used relates to room type, price, and description (in Dutch, English, French, or German), and anyone can make a reservation for a room type. The System confirms a reservation in either English, Dutch, German or French. It is possible to cancel a reservation.

The system uses a number of general data entities, which are maintained by other parts of the hotel accommodation system:

- HOTEL, data includes: name, address, telephone, telex, fax, hotel manager name,
- COUNTRY, data includes country code and country name, and
- ROOM and ROOM TYPE, describe a hotel room and the various room classes.

The hotel reservation system ensures consecutive numbering by storing the last issued reservation number in a file called "PARAMETERS."

The following general requirements apply to all parts of the hotel accommodation system:

- help information must be available on screen level and field level,
- error messages are standard on Line 24 of the screen.

A.1.2 Detailed specifications

To identify the type of data entered into the accommodation system the menu layouts in this specification use a string of "9" to denote numeric and a string of "x" to denote alphanumeric data.

A.1.2.1 Navigation

A.1.2.1.1 Main menu of hotel system

The main menu of the hotel system offers two choices: accommodation and invoice & payment. The reservation system is part of the accommodation system.

Screen layout for the main menu:

< Hotel name > **HOTEL SYSTEM**

1 ACCOMMODATION
2 INVOICE & PAYMENT

Choice: < S> F10
End

Functions:

F10 : Exit application

Screen elements:

Menu choice, Hotel name

A.1.2.1.2 Accommodation menu selections

Screen layout for the accommodation menu:

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< Hotel name > **ACCOMMODATION SYSTEM**

1 RESERVATION
2 CHECK-IN
3 CHECK-OUT
4 CANCEL RESERVATION
5 MAINTAIN ROOM DATA

Choice: <S> F10
MENU

Function:

F10 : Return to Main menu

Screen elements:

Menu choice, Hotel name

NOTE The reservation system functions are reached via the first option: Reservation.

A.1.2.2 Functions

A.1.2.2.1 Function: RES Reservation

A reservation request can be entered using the screen RES. All data except the reservation number is entered. When changing the reservation data using screen RES, the reservation number can be found by name, or part of a name. All data, except reservation number, can be changed. If there is more than one reservation with the same name, the selection - screen (SEL- RES) is shown.

The system further checks if the stated quantity of rooms for the desired room type is available in the desired period (not occupied or not reserved). "Being occupied" is checked on the basis of the data: room type, start date, number of days, and quantity of reserved rooms.

If necessary more room types can be stored for the same period. Only room type and quantity of rooms can be entered.

If the request can be met, the acceptance screen ACP-RES stores the reservation and a confirmation of the reservation (CON-RES) is produced for the billing address. If the request cannot be met, room type report (RT-REP) is called to look up an alternative choice.

Used screens: RES (request for reservation), SEL-RES (selection reservations), ACP-RES (accept reservation), RT-REP (room type report), CON-RES (confirmation of reservation).

Screen layout for RES(ervation) function:

< Hotel name > **RESERVATION PREVIEW**

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Reservation number: 999999

Arrival date: DD/MM/YYYY

Number of days: 99

Room type & quantity: xx 99

Name: xxxxxxxxxxxxxxxxxxxxxxxxxxxx

Street & number: xxxxxxxxxxxxxxxxxxxxxxxxxxxx 999

Post code, City, Country: 99999 xxxxxxxxxxxxxxxxxxxxxxxx xx

Telephone number: 999999999999

Language code: xx

F1	F2	F3	F10
Continue	Confirm	Change	Menu

Functions:

- F1 : Continue reservation for the same period
- F2 : Confirm reservation
- F3 : Change reservation data (except reservation number) of this reservation number
- F10: Return to previous menu