INTERNATIONAL STANDARD

ISO 16100-2

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Industrial automation systems and integration — Manufacturing software capability profiling for interoperability —

Part 2: Profiling methodology

Systèmes d'automatisation industrielle et intégration — Profil d'aptitude du logiciel de fabrication pour interopérabilité —

Partie 2: Méthodologie d'élaboration de profils

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Contents

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 16100-2 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC 5, *Architecture, communications and integration frameworks*.

ISO 16100 consists of the following parts, under the general title *Industrial automation systems and integration — Manufacturing software capability profiling for interoperability*:

— *Part 1: Framework*

— *Part 2: Profiling methodology*

— *Part 3: Interface protocols and templates*

— *Part 4: Conformance test methods, criteria and reports*

Introduction

The motivation for this International Standard stems from the industrial and economic environment noted in the strategic plan of ISO/TC 184/SC 5, in particular:

a) a growing base of vendor-specific solutions;

b) user difficulties in applying standards;

c) a need to move to modular sets of system integration tools;

d) a recognition that application software and the expertise to apply that software are assets of the enterprise.

ISO 16100 (all parts) is an International Standard for the computer-interpretable and human readable representation of a software capability profile. Its goal is to provide a method to represent the capability of manufacturing software relative to its role throughout the life cycle of a manufacturing application, independent of a particular system architecture or implementation platform.

Industrial automation systems and integration — Manufacturing software capability profiling for interoperability—

Part 2:
Profiling methodology

1 Scope

This part of ISO 16100 specifies a methodology for constructing profiles of manufacturing software capabilities, and is applicable to software products used in the manufacturing domain.

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 16100 (all parts), *Industrial automation systems and integration — Manufacturing software capability profiling for interoperability*

REC-xmlschema-1-20010502, XML Schema Part 1: Structures — W3C Recommendation 02 May 2001

REC-xmlschema-2-20010502, XML Schema Part 2: Datatypes — W3C Recommendation 02 May 2001

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16100-1 and the following apply.

3.1
association
semantic relationship between two or more classifiers that specifies connections among their instances [ISO/IEC 19501-1]

3.2
base specification
base standard or widely accepted and available specification

3.3
capability class
element within the capability profiling method that represents software unit functionality and behaviour with regard to the software units role in a manufacturing activity

3.4
capability profile integration
process in which two or more software units interoperate using equivalent interfaces that are configured in a compatible manner as indicated by their capability profiles

3.5
classifier
mechanism that describes behavioural and structural features [ISO/IEC 19501-1]

NOTE Classifiers include interfaces, classes, data types, and components.

3.6
element
atomic constituent of a model [ISO/IEC 19501-1]

3.7
entity
any concrete or abstract thing of interest [ISO/IEC 10746-2]

3.8
interface
abstraction of the behaviour of an object that consists of a subset of the interactions of that object together with a set of constraints on when they may occur [ISO/IEC 10746-2]

3.9
object
model of an entity [ISO/IEC 10746-2]

NOTE An object is characterized by its behaviour and by its state. An object is distinct from any other object. An object is encapsulated, i.e. any change in its state can only occur as a result of an internal action or as a result of an interaction with its environment. An object interacts with its environment at its interaction points. Depending upon the viewpoint, the emphasis may be placed on behaviour or on state. When the emphasis is placed on behaviour, an object is informally said to perform functions and offer services (an object which makes a function available is said to offer a service). For modeling purposes, these functions and services are specified in terms of the behaviour of the object and of its interfaces. An object can perform more than one function. A function can be performed by the co-operation of several objects.

3.10
profile
set of one or more base specifications and/or sub-profiles, and, where applicable, the identification of chosen classes, conforming subsets, options and parameters of those base specifications, or sub-profiles necessary to accomplish a particular function, activity, or relationship

NOTE This definition is adapted from ISO/IEC TR 10000-1.

3.11
role
named specific behaviour of an entity participating in a particular context [ISO/IEC 19501-1]

NOTE A role may be static (e.g. an association end) or dynamic (e.g. a collaboration role).

3.12
taxonomy
classification scheme for referencing profiles or sets of profiles unambiguously [ISO/IEC TR 10000-1]

4 Abbreviated terms

CORBA	Common Object Request Broker Architecture
IDL	Interface Definition Language
OMG	Object Management Group
PSL	Process Specification Language
UML	Unified Modeling Language
XML	eXtensible Markup Language

5 Capability profiling method

5.1 Capability profiling concept

The main focus of ISO 16100 is manufacturing software interoperability. Figure 1 depicts the use of a capability profile concept to integrate interoperable software.

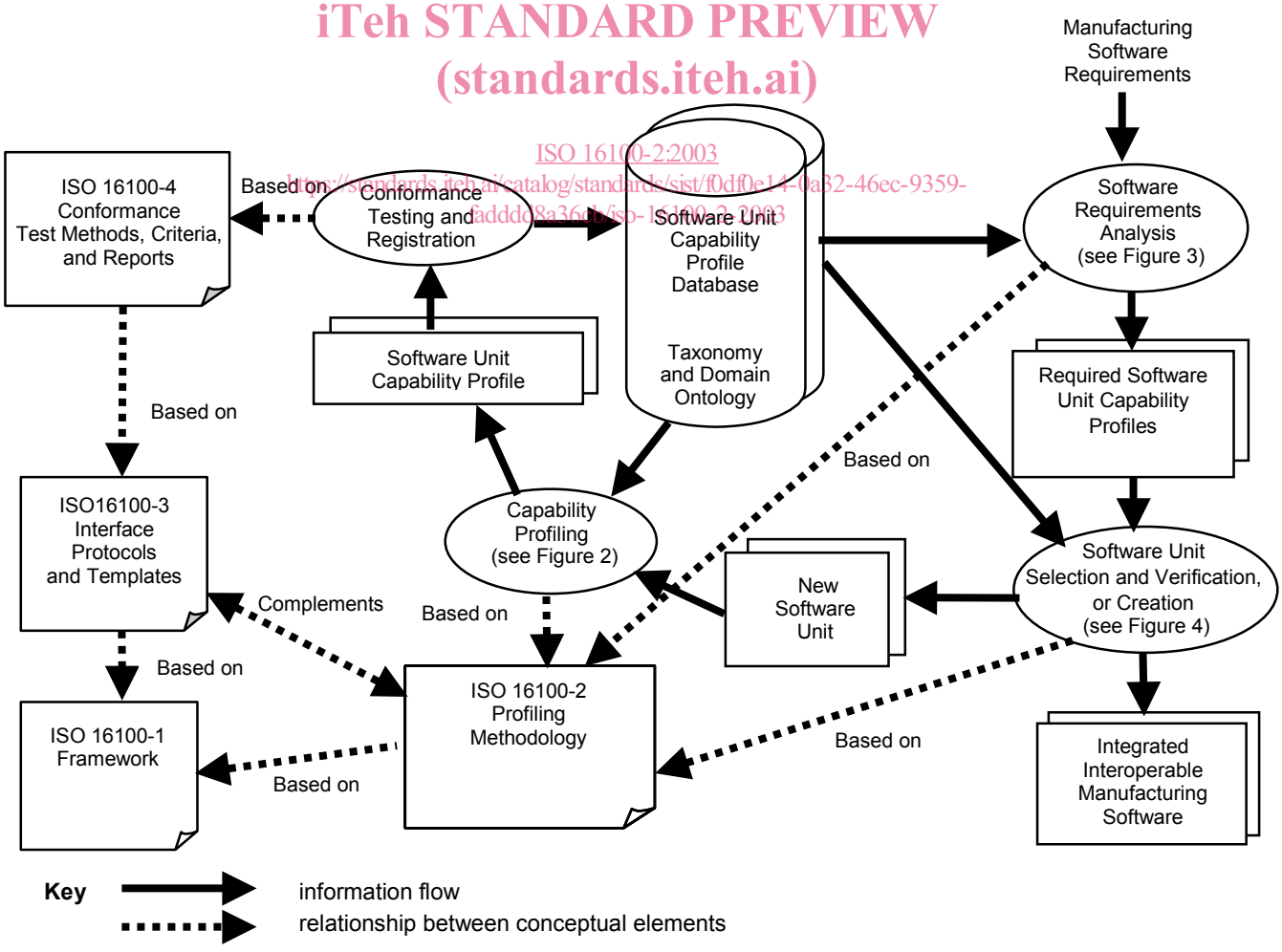


Figure 1 — Concept of capability profile for software interoperability

The interoperability of software units can be described in terms of their capabilities that are associated with the aspects of functionality, interface and structure. These aspects, based on the framework and domain specific application system model defined in ISO 16100-1, are defined in Clauses 5 and 6, and are further detailed in ISO 16100-3.

A manufacturing process has a structure that is both nested and hierarchical. At each level, the manufacturing software requirements can be modelled as a set of capability classes organized in a similar structure. Manufacturing software requirements are met by the integration of several manufacturing software units.

In this methodology, manufacturing software requirements shall be expressed in terms of software unit capability profiles. The profiling of a software unit involves the generation of a concise statement of manufacturing capabilities enabled by the software unit in terms of the functions performed, the interfaces provided, and the protocols supported as required by the target manufacturing capability.

The capability profiling methodology shall be defined in terms of the rules and elements provided in Clause 6. The methodology shall make use of the domain-specific attributes and methods associated with each specific software unit to describe capability profiles in terms of unit name, manufacturing functions, and other needed class properties.

The required profiles are compared to existing profiles in the database. When a match occurs, the software unit being profiled shall be considered to be ready for integration. When no match occurs, a new software unit with the required capabilities shall be developed, profiled, and registered in the capability profile database.

The software units capability profile definition shall be registered in an appropriate database after passing the conformance test which will be provided with the conformance test methodology and its abstract test suites to be defined in ISO 16100-4.

The profile database shall have a set of taxonomies for use in describing the capability profiles.

5.2 *Capability profiling* process

The part of the concept of capability profile for software interoperability shown in Figure 1 related to the *capability profiling* process is detailed in Figure 2.

A software unit to be profiled shall be analyzed in terms of the supported paths within the capability class structure, the concept for which is described in 6.2.1. The structure itself is defined in ISO 16100-3.

The supported paths shall then be used in the search for a matching template from the database. When a matching template is found, the fields of the template shall be filled to make a profile. When no matching template is found, a new template shall be formed using the set of capability classes.

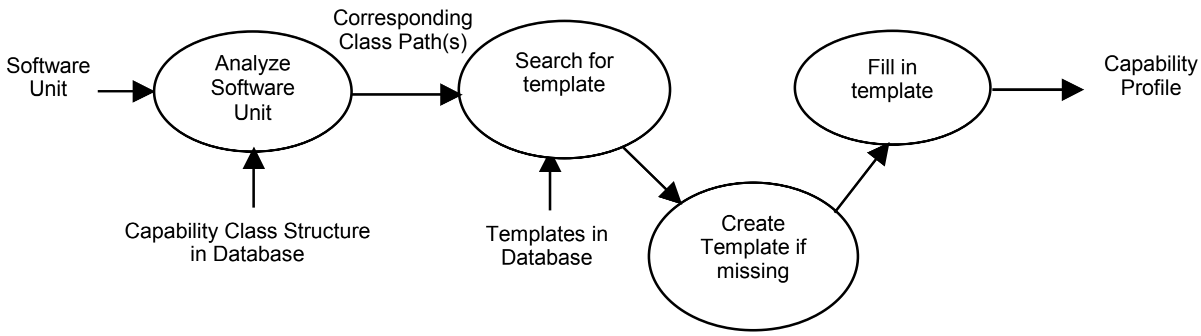


Figure 2 — *Capability profiling* process

5.3 *Software requirements analysis* process

The part of the concept of capability profile for software interoperability shown in Figure 1 related to the *software requirements analysis* process is detailed in Figure 3.

Capability profiles for each manufacturing software unit shall be derived from manufacturing software requirements in the software requirements analysis process. As a first step, manufacturing software requirements shall be decomposed into several primitive requirements which are fulfilled by capability classes that are selected from the database. When a template that corresponds to the class exists, the template shall be filled with specific requirements in order to generate a required capability profile. When such a template does not exist, a new template shall be created based on rules for template creation described in 6.3.

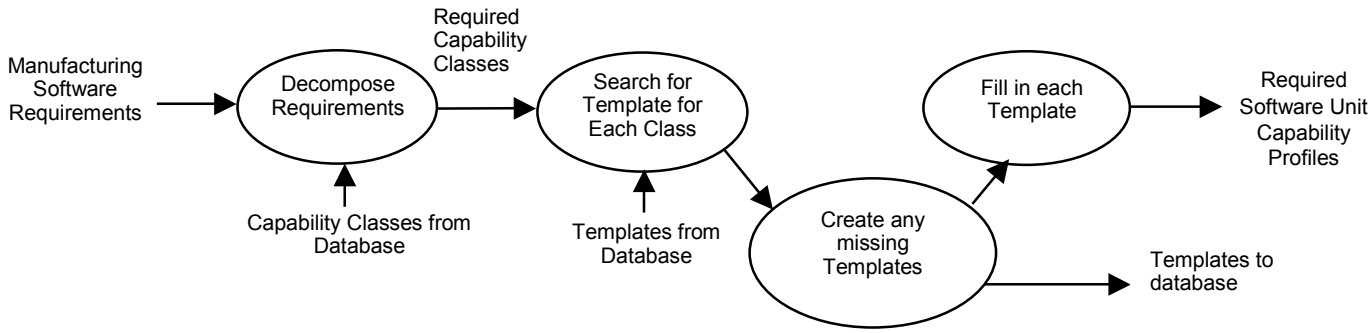
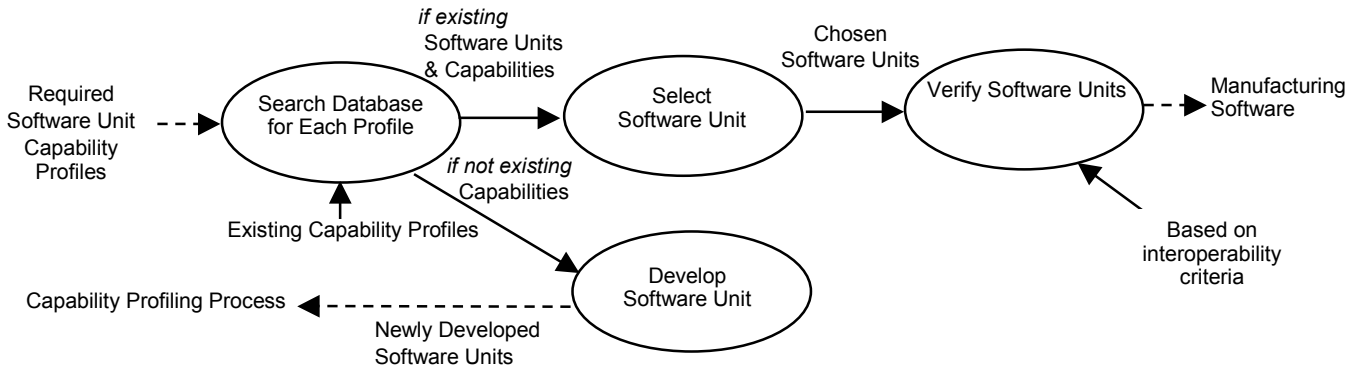


Figure 3 — *Software requirements analysis* process

5.4 *Software unit selection and verification, or creation* process

The part of the capability profile integration related to the *software unit selection and verification, or creation* process shown in Figure 1 is detailed in Figure 4.



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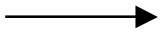

flow within the process

flow entering from, or leaving to, another process within the capability profiling concept of Figure 1

Figure 4 — *Software unit selection and verification, or creation* process