INTERNATIONAL STANDARD

ISO 16300-2

First edition
2019-04

Automation systems and integration — Interoperability of capability units for manufacturing application solutions —

Part 2: Capability templates and software unit cataloguing

Systèmes d'automatisation et intégration — Interopérabilité des unités de capacité pour les solutions d'applications industrielles —

Partie 2: Modèles de capacités et cataloguage des unités logicielles

Reference number
ISO 16300-2:2019(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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.

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 ISO documents 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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 184, *Automation systems and integration*, Subcommittee SC 5, *Interoperability, integration, and architectures for enterprise systems and automation applications*.

A list of all parts in the ISO 16300 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The ISO 16300 series addresses requirements of users and suppliers of manufacturing software regarding the interoperability of software in the area of industrial automation.

User interoperability requirements include:

— integrating an automation application system by combining capabilities of a set of software components provided by various sources;

— integrating the capability of a software unit from one resource system platform to another platform;

— validating and verifying the capability of a software unit to meet the automation application system requirements.

Supplier requirements include:

— representing the set of capabilities provided by a software component used in a software unit;

— verifying software component capability as a part of a required software unit capability;

— cataloguing a software unit in terms of its capability for interoperability in an automation application system to support wide distribution.

The ISO 16300 series also addresses software interoperability services, which include:

— access to the description of a software capability to enable interoperability assessment;

— enabling the search and location of candidate software units and components, preferably automatically, using search engines;

— representing the dependencies between software components for an automation application hosted on a particular system platform.

Software capability is first defined as a set of functions and services with a set of criteria for evaluating the performance of a capability provider. It is then expressed and represented as facts about the software, how and what it can do. The ISO 16100 series, which deals with manufacturing software capability profiling for interoperability, was developed with the aim of providing a standardized method to describe capabilities of manufacturing software in terms of the Manufacturing Software Unit (MSU) capability profile. In the ISO 16100 series, the software component is included in the MSU. The ISO 16100 series also provides a way to exchange an MSU's capability as information by means of a capability profile. Software capability profiling is the basis for providing the above-mentioned software interoperability services. The ISO 16100 series is used and applied as the foundation for the ISO 16300 series.

To establish the ISO 16300 series, a number of steps were required. The initial step shows what interoperability services are enabled by using software capability profiles. The subsequent steps develop concrete methods and mechanisms to provide these interoperability services. The resulting output from ISO 16300 is divided into the following parts.

— ISO 16300-1 specifies a framework for describing an automation solution in terms of a set of capabilities provided by a set of MSUs. The framework also defines a set of capability elements and composition rules to represent the interoperability criteria in terms of the automation system capability requirements of an enterprise application.

— This document (ISO 16300-2) specifies the template definition to describe the capability of a software unit of an automation solution that can be mapped to the functional requirements of a target manufacturing application. This document also specifies mapping rules for composing the contents of a software unit catalogue item in terms of the properties of the capability.

— ISO 16300-3 specifies the framework for verifying interoperability of capability units associated with application requirements and system solutions.

— ISO 16300-4 specifies the search methodology for acquiring candidate capability units which satisfy the manufacturing application requirements from the software unit catalogues. It also describes the structure of the report.

Automation systems and integration — Interoperability of capability units for manufacturing application solutions —

Part 2:
Capability templates and software unit cataloguing

1 Scope

This document specifies a set of template definitions to describe the capability of a software unit of an automation solution that can be mapped to the functional requirements of a target manufacturing application.

This document specifies how to develop and manage a software unit catalogue in terms of capability properties and defines mapping rules from capability profiles to a software unit catalogue.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 16100-1:2009, *Industrial automation systems and integration — Manufacturing software capability profiling for interoperability — Part 1: Framework*

ISO 16100-2, *Industrial automation systems and integration — Manufacturing software capability profiling for interoperability — Part 2: Profiling methodology*

ISO 16100-3, *Industrial automation systems and integration — Manufacturing software capability profiling for interoperability — Part 3: Interface services, protocols and capability templates*

ISO 16100-5:2009, *Industrial automation systems and integration — Manufacturing software capability profiling for interoperability — Part 5: Methodology for profile matching using multiple capability class structures*

ISO 16100-6:2018, *Industrial automation systems and integration — Manufacturing software capability profiling for interoperability — Part 6: Interface services and protocols for matching profiles based on multiple capability class structures*

ISO 16300-3, *Automation systems and integration — Interoperability of capability units for manufacturing application solutions — Part 3: Verification and validation of interoperability among capability units*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16100-1, ISO 16100-6 and ISO 16300-3 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
capability
<software> set of functions and services with a set of criteria for evaluating the performance of a capability provider

Note 1 to entry: This definition differs from that given in ISO 15531-1 and ISO 19439, where capability is defined as the quality of being able to perform a given activity. See IEC 62264-1 for a general definition of capability.

[SOURCE: ISO 16100-1:2009, 3.4]

3.2
capability profile
instance of a *capability template* (3.6) filled with the values corresponding to the target *manufacturing software unit* (3.8)

[SOURCE: ISO 16300-1:2018, 3.4]

3.3
capability profiling
selection of a set of offered services defined by a particular interface within a software interoperability framework

[SOURCE: ISO 16100-1:2009, 3.5]

3.4
capability class
element within the *capability profiling* (3.3) method that represents *capabilities* (3.1) with regard to the software unit's role in a manufacturing activity

3.5
capability class structure
CCS
hierarchy of *capability classes* (3.4)

Note 1 to entry: This structure is intended for modelling capability aggregation hierarchies in the target domains of ISO 16100-1:2009, Figure 2.

[SOURCE: ISO 16100-6:2018, 3.2, modified — The abbreviated term "CCS" has been added.]

3.6
capability template
template
schema representing a *capability class* (3.4)

[SOURCE: ISO 16300-1:2018, 3.6]

3.7
capability template repository
database to store *capability templates* (3.6)

3.8
manufacturing software unit
MSU
class of software resource, consisting of one or more manufacturing software components, performing a definite function or role within a manufacturing activity while supporting a common information exchange mechanism with other units

Note 1 to entry: A software unit can be modelled using UML as a software object.

Note 2 to entry: In this document, "capability unit" stands for "manufacturing software unit (MSU)".

[SOURCE: ISO 16100-1:2009, 3.18, modified — The abbreviated term "MSU" has been added and Note 2 to entry has been added.]

3.9
manufacturing domain data
MDD
information about manufacturing resources, manufacturing activities, or items exchanged among manufacturing resources within a particular manufacturing domain

3.10
capability element
element used to indicate that a particular *capability* (3.1) is supported by the entity or *manufacturing software unit* (3.8) to which the element belongs

[SOURCE: ISO 16300-1:2018, 3.3]

3.11
manufacturing domain model
MDM
particular view of a manufacturing domain, consisting of *manufacturing domain data* (3.9) and relationships among them, corresponding to the domain's applications

[SOURCE: ISO 16100-5:2009, 3.5, modified — The abbreviated term "MDM" has been added.]

3.12
software capability description dictionary
collection of *manufacturing domain data* (3.9) in *capability elements* (3.10) to describe the *capability* (3.1) of software, where all manufacturing domain data are uniquely identified

3.13
software unit catalogue
collection of *capability profiles* (3.2) using the same *capability template* (3.6) representing one or more *manufacturing software units* (3.8) for the same manufacturing activity in the activity tree

3.14
software unit cataloguing
procedure to make a *software unit catalogue* (3.13)

3.15
MSU provider
entity that provides the *manufacturing software units* (3.8) which are registered in the *software unit catalogue* (3.13)

4 Overview of software unit catalogue

4.1 Capability profiling defined in the ISO 16100 series

According to ISO 16100-5, the following four templates are used in MSU capability profiling when there are multiple capability class structures:

- the capability class structure (CCS) template (see ISO 16100-5:2009, 6.2);
- the capability template (see ISO 16100-5:2009, 6.3);
- the manufacturing domain model (MDM) template (see ISO 16100-5:2009, 6.4);
- the manufacturing domain data (MDD) template (see ISO 16100-5:2009, 6.5).

Figure 1 shows the relationship between MDM, MDD (including its relationship with other MDDs), capability class, capability template, capability profile and MSU.

— MDM is a particular view of the specific manufacturing domain, consisting of MDDs and their relationships.

— MDD represents the following items:

  — manufacturing resources (e.g. MSU, equipment, automation devices, personnel, material, work-in process inventory);

  — manufacturing processes (e.g. operations, activities);

  — manufacturing information exchanged (e.g. product data, recipe, manufacturing data, quality data);

  — relationships existing between the resources, processes and information exchanged (e.g. data flow, network configuration, work flow).

— The capability class shall be a capability externally represented as a capability template.

— The capability profile shall be an instance of a capability template filled with the concrete values corresponding to the target MSU.

— Therefore, the capability of MSU is described by MDDs in the capability template.

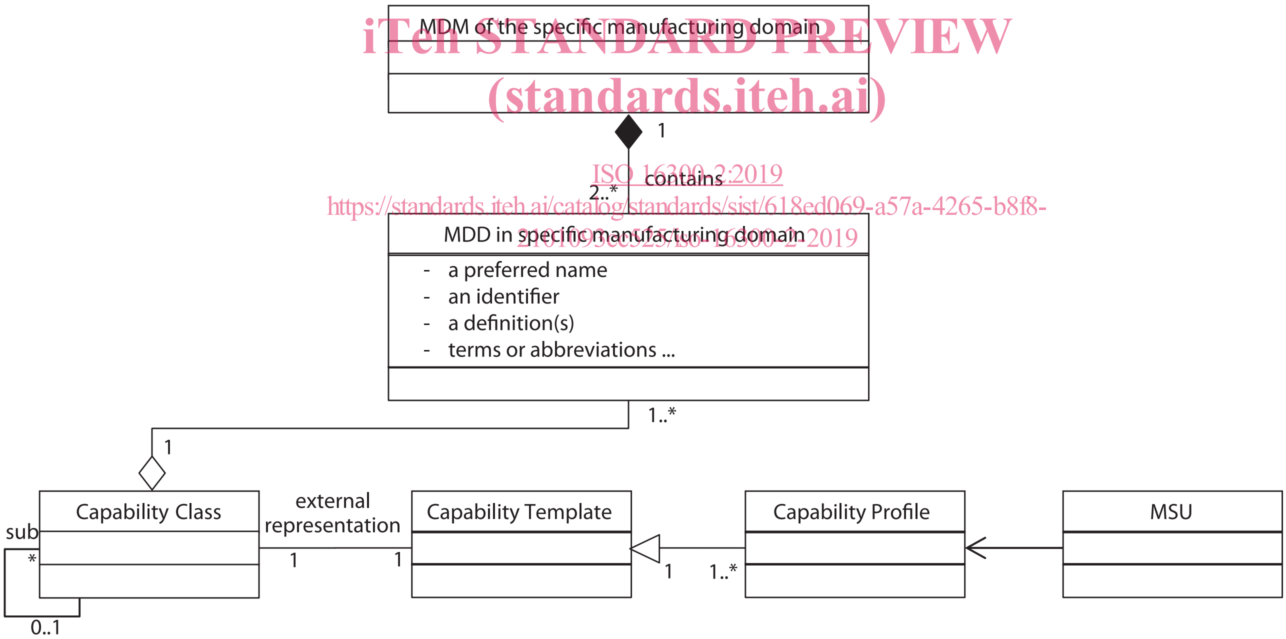

Figure 1 — Relationship between MDM, MDD, capability template and capability profile

Figure 2 shows an example of capability profiling for MSU using MDD. In Figure 2, MSU (*x*) and MSU (*y*) of MSU provider A and MSU provider B are profiled using the same capability template using MDD. Therefore, there exists only one profile for each MSU and this provides the manufacturing software reusability and the interoperability of the application integrated through the selected MSUs.

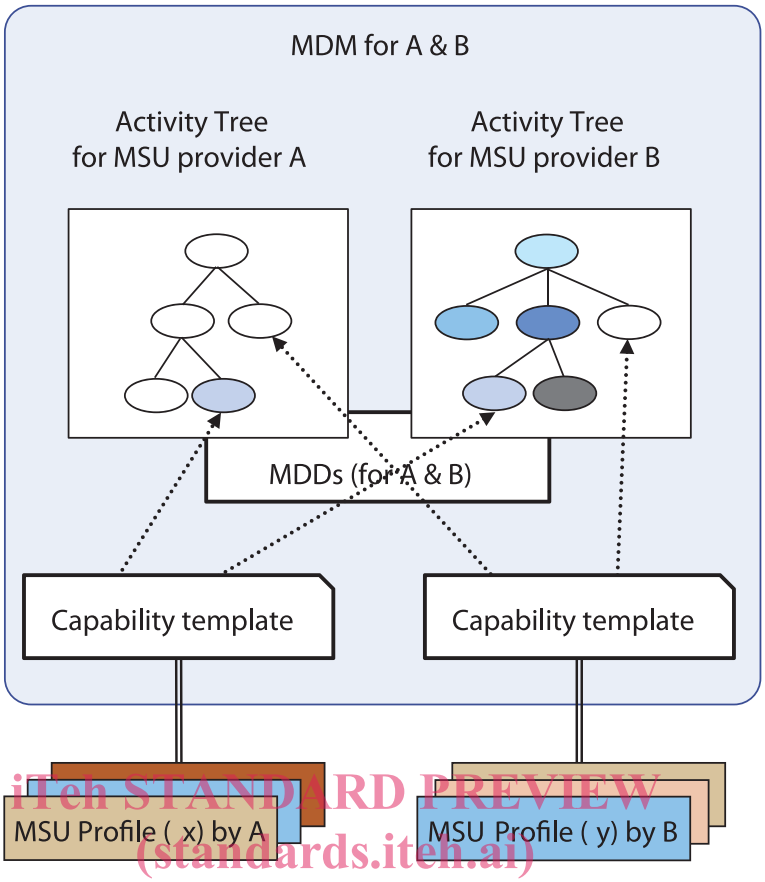

Figure 2 — Capability profiling using MDD

4.2 Objectives of the software unit catalogue

Even if MDD-based capability profiling provides the manufacturing software reusability and the interoperability of the applications, inconsistent capability profiling for the same MSU can still exist.

Figure 3 shows an example of the inconsistent capability profiling of MSU (*x*) where capability template *Cx* provided by MSU provider C resides in a different place from MDM of MSU provider A and MSU provider B.

In Figure 3, different capability templates *ABx* and *Cx* are used to profile MSU (*x*) that provides the same capability, and this results in different profiles for the same capability.

Capability template *ABx* for MSU (*x*) provides the manufacturing software reusability and the interoperability of the applications in MDM for only MSU provider A and MSU provider B, as explained in 4.1.

Considering MSU provider C, there are different capability templates for the capability [MSU (*x*)] and this can break the rule of only one profile for the same capability.

The objectives of the software unit catalogue are:

— to enhance the manufacturing software reusability and the interoperability of the applications;

— to provide a mechanism for creating one capability profile of the same MSUs on the same manufacturing activity in the activity tree using the same capability template.