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

Part 1: Interoperability criteria of capability units per application requirements

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

Partie 1: Critères d'interopérabilité des unités de capacité basés sur les exigences liées aux applications

Reference number
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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).

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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.

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Introduction

ISO 16300 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;

— substituting another software component in a software unit to provide an equivalent capability required by the automation application system;

— 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.

ISO 16300 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 on 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 ISO 16100, the software component is included in the MSU. ISO 16100 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. ISO 16100 is used and applied as the foundation for ISO 16300.

To establish ISO 16300, a number of steps were required. The initial step shows what interoperability services are enabled by using software capability profiles. The following steps develop concrete methods and mechanisms to provide these interoperability services.

This document (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.

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. It also specifies mapping rules for composing the contents of a software unit catalogue item in terms of the properties of the capability.

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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 and also describes the structure of the report as an outcome of the search indicating the extent to which the candidates from the software unit catalogues correspond to the manufacturing application requirements.

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

Part 1: Interoperability criteria of capability units per application requirements

1 Scope

This document specifies a framework for describing an automation solution in terms of a set of capabilities provided by a set of manufacturing software units.

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.

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 16100-2:2003, *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 16100-4, *Industrial automation systems and integration — Manufacturing software capability profiling for interoperability — Part 4: Conformance test methods, criteria and reports*

ISO 16100-5, *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, *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*

3 Terms and definitions

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

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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 class
element within the *capability profiling* (3.5) method that represents software unit functionality and behaviour with regard to the software unit's role in a manufacturing activity

[SOURCE: ISO 16100-2:2003, 3.3]

3.3
capability element
element used to indicate that a particular *capability* (3.1) is supported by the entity or *manufacturing software unit* (3.9) to which the element belongs

3.4
capability profile
instance of a *capability template* (3.6) filled with the values corresponding to the target *manufacturing software unit* (3.9)

3.5
capability profiling
selection of a set of offered services defined by a particular interface within a software *interoperability* (3.8) framework

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

3.6
capability template
template
schema representing a *capability class* (3.2)

3.7
capability unit
unit of a type intended to support the execution of a particular task

Note 1 to entry: Examples of types include mechanical, electrical, electronic, hardware and software.

3.8
interoperability
capability (3.1) of two or more entities to exchange items in accordance with a set of rules and mechanisms implemented by an interface in each entity, in order to perform their respective tasks

Note 1 to entry: Examples of entities include devices, equipment, machines, people, processes, applications, software units, systems and enterprises.

Note 2 to entry: Examples of items include information, material, energy, control, assets and ideas.

[SOURCE: ISO 18435-1:2009, 3.12]

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3.9
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.

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

4 Interoperability and integration views for automation applications

4.1 Interoperability concepts for an automation system

The concept of interoperability involves two or more entities that can exchange or share certain items in order to perform their respective activities. The entities can be devices, machines, people, software units, systems, applications or even enterprises. The items being exchanged or shared can be material, information, energy or assets. Items are exchanged according to a set of rules and mechanisms implemented by an interface in each entity.

The rules and mechanisms to perform the exchanges or sharing are characterized by interfaces that are enabled by the entities. The entities have a common understanding of the properties of the items exchanged. Figure 1 shows the interoperability of two automation entities.

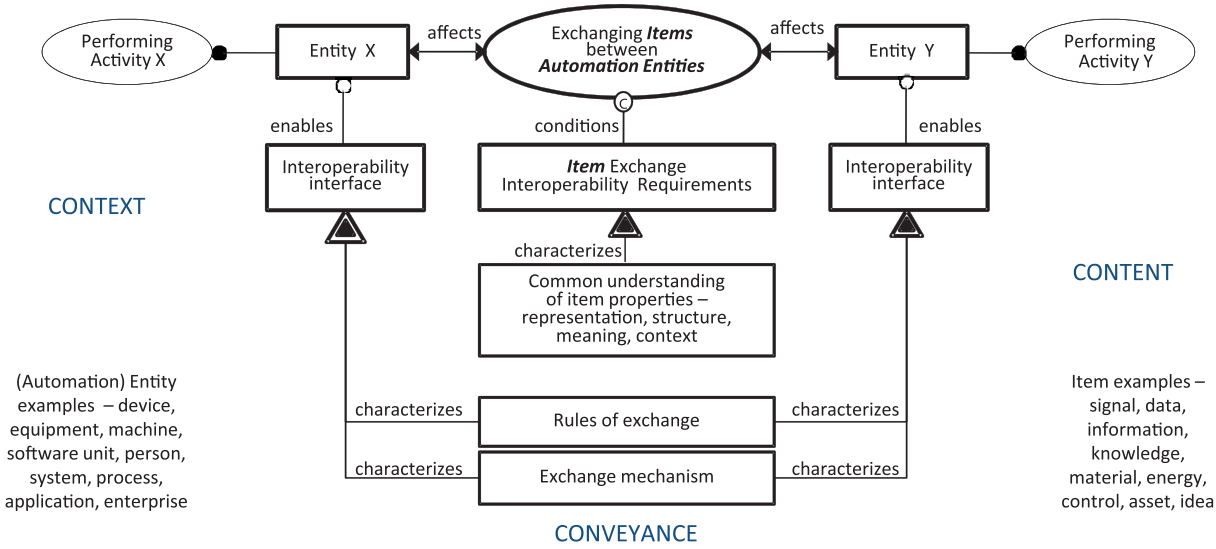


Figure 1 — Interoperability of two automation entities

EXAMPLE Three historian servers each have a different operating system: Windows, Mac OS X, Linux. All can exchange data items among their respective historian servers using a messaging interface (on some TCP/IP/Ethernet link) based on Open Platform Communications Unified Architecture (OPC-UA) as a conveyance. The historian servers are interoperable and non-interfering.

This document focuses on the cases where MSUs are used to represent entities.

4.2 Integration concepts for a manufacturing application of an automation system

The concept of integration involves two or more component entities that form a system or a single entity performing a certain activity. Each component entity has a structure, a behaviour and a boundary that is distinct from the structure, behaviour and boundary exhibited by the system. An integrated system is perceived to perform an activity as a single entity; however, its component entities collaborate,

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