INTERNATIONAL STANDARD

ISO 19439

First edition
2006-04-15

Enterprise integration — Framework for enterprise modelling

Entreprise intégrée — Cadre de modélisation d'entreprise

Reference number
ISO 19439:2006(E)

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Published in Switzerland

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Foreword

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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.

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ISO 19439 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 310, *Advanced manufacturing technologies*, in collaboration with Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC 5, *Architecture, communications and integration frameworks*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Introduction

This framework defines and specifies the generic concepts that are required to enable the creation of enterprise models for industrial businesses and to provide support for the use of frameworks by industrial enterprises.

Enterprise modelling consultancies and tool vendors have developed enterprise modelling methodologies and supporting tools that address phases of the enterprise life cycle and various aspects of enterprise modelling. These methodologies and tools support business decision-making (such as process visualization and simulation), enterprise process management, control and monitoring of operational processes (such as workflow) and performance monitoring (such as visualization of work in progress). This framework provides a unified conceptual basis for model-based enterprise engineering that enables consistency, convergence and interoperability of the various modelling methodologies and supporting tools. The framework does not encompass methodological processes; it is neutral in this regard.

ISO 15704:2000, 4.2.2 (see also A.3.1.2) places requirements on the description of the essential roles of humans. In this International Standard, these are described in terms of:

— organizational roles that are specified in the Organization View, which captures the various assigned responsibilities and required capabilities (skills);

— operational roles that are specified in the Resource View, which captures the operational capabilities (skills) and which are then matched to the ones identified in the Function View.

The Annex A contains a general description of the concepts of enterprise models, modelling frameworks and modelling language constructs (as defined in ENV 12204:1996) as background to the normative content of Clauses 5 and 6. Annex B describes with illustrative examples how the enterprise modelling framework can be used by both enterprise model developers and enterprise model tool developers.

Enterprise integration — Framework for enterprise modelling

1 Scope

This International Standard specifies a framework conforming to requirements of ISO 15704, which serves as a common basis to identify and coordinate standards development for modelling of enterprises, emphasising, but not restricted to, computer integrated manufacturing. This International Standard also serves as the basis for further standards for the development of models that will be computer-enactable and enable business process model-based decision support leading to model-based operation, monitoring and control.

In this International Standard, four enterprise model views are defined in this framework. Additional views for particular user concerns can be generated but these additional views are not part of this International Standard. Possible additional views are identified in ISO 15704.

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 15704:2000, *Industrial automation systems — Requirements for enterprise-reference architectures and methodologies*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE Definitions copied verbatim from other standards are followed by a reference in brackets to the source standard. Definitions that have been adapted from other standards are followed by an explanatory note.

3.1
abstraction
shortening in duration or extent with no sacrifice of sense, used to differentiate between a real-world system and a model of the real world

[ISO 14258:1998]

3.2
attribute
piece of information stating a property of an entity

[ISO 15704:2000]

3.3
behaviour
manner in which the whole or part of a system acts and reacts to perform a function

NOTE Adapted from ISO 15704:2000.

3.4
business process
partially ordered set of enterprise activities that can be executed to achieve some desired end-result in pursuit of a given objective of an enterprise or a part of an enterprise

NOTE Adapted from ISO 15704:2000, ENV 12204:1996.

3.5
capability
quality of being able to perform a given activity

[ISO 15531-1]

3.6
component
⟨system⟩ entity, with discrete structure within a system, which interacts with other components of the system, thereby contributing at its lowest level to the system properties and characteristics

[ISO/IEC 15288:2002]

3.7
concept definition
enterprise model phase that defines the business concepts of an enterprise domain to be employed in realizing its business objectives and its operation, including the necessary enterprise domain inputs and outputs

3.8
constraint
restriction or limitation or condition placed upon a system that originates from inside or outside the system under consideration

NOTE Adapted from ISO 14258:1998.

3.9
decision
result of choosing between different courses of action

3.10
decisional
relating to those processes that are concerned with making choices

3.11
decommission definition
enterprise model phase that defines the final state of a decommissioned operational system, all its components for a particular enterprise domain and the processes employed to conduct the decommissioning, so enabling re-use or disposition of those components

3.12
decomposition
breaking an entity into its constituent parts as appropriate to the purpose of the modeller

3.13
design specification
enterprise model phase that specifies the business processes, together with capabilities and rules, that are to be performed to achieve the requirements

3.14
detailing
addition of content, attributes and operations, that more precisely identify the intent of modelling language constructs and partial models

3.15
domain identification
enterprise model phase that identifies the enterprise domain to be modelled with respect to its business objectives, the enterprise domain inputs and outputs and their respective origins and destinations

3.16
domain operation
enterprise model phase that encompasses the operational use of the domain model

3.17
enactment
computer processing of models to facilitate the development of more responsive and coherent enterprises, in particular the use of a model to monitor and control the execution of the business processes of the enterprise

NOTE Adapted from Vernadat [23].

3.18
enterprise
one or more organizations sharing a definite mission, goals and objectives to offer an output such as a product or service

[ISO 15704:2000]

NOTE In this International Standard, a goal is the target resulting from the intention of the enterprise to achieve its mission and objective.

3.19
enterprise activity
all, or part, of process functionality that consists of elementary tasks performed in the enterprise that consume inputs and allocate time and resources to produce outputs

NOTE Adapted from ISO 15704:2000.

3.20
enterprise domain
domain
part of the enterprise considered relevant to a given set of business objectives and constraints for which an enterprise model is to be created

NOTE In this International Standard, *enterprise domain* is abbreviated to *domain* whenever it is used as a qualifier in such terms as *domain identification phase* and *domain model*. Other usages of *domain* have the normal dictionary meaning.

3.21
enterprise engineering
discipline applied in carrying out any efforts to establish, modify or reorganize any enterprise

[ISO 15704:2000]

3.22
enterprise integration
process of ensuring the interaction between enterprise entities necessary to achieve enterprise domain objectives

3.23
enterprise model
abstraction of an enterprise domain that represents enterprise entities, their interrelationships, their decomposition and detailing to the extent necessary to convey what it intends to accomplish and how it operates

3.24
enterprise model phase
life cycle phase of an enterprise model

3.25
enterprise model view
selective perception or representation of an enterprise model that emphasizes some particular aspect and disregards others

NOTE Adapted from ENV 40003:1990.

3.26
enterprise modelling
act of developing an enterprise model

3.27
enterprise object
piece of information in the enterprise domain that describes a generalized or a real or an abstract entity, which can be conceptualized as being a whole

3.28
enterprise operation
execution of business processes to achieve enterprise objectives

3.29
entity
any concrete or abstract thing in the domain under consideration

3.30
environment
surroundings external to the enterprise domain which influence its development and behaviour, and which are not controllable by the enterprise itself

3.31
framework
structure expressed in diagrams, text and formal rules which relates the components of a conceptual entity to each other

NOTE Adapted from ISO 15704:2000.

3.32
function view
enterprise model view that enables the representation and modification of the processes of the enterprise, their functionalities, behaviours, inputs and outputs

3.33
functionality
qualities of a process that enable it to achieve the purpose for which the process exists

3.34
generalization
specific concept modified for a more general extent, use or purpose or:
act of removing or modifying detail from a specific concept to produce a generalization thereof

NOTE Generalization is the inverse of specialization.

3.35
generic
property of being a generalization from a number of distinguishable entities based on their shared characteristics

3.36
generic level
collection of generic modelling language constructs for expressing descriptions that can be used to generate models at the partial and particular levels

3.37
genericity
extent to which a concept is generic

3.38
implementation description
enterprise model phase that describes the final set of processes, resources and rules implemented to achieve the desired operational performance for execution of the business processes and enterprise activities specified in the design specification phase

3.39
information technology component
component that is required to collect, process, distribute, store and verify data for enterprise activities in the enterprise

3.40
information view
enterprise model view that enables the representation and modification of the enterprise information as identified in the function view

NOTE It is organized as a structure containing enterprise objects that represent the information-related entities of the enterprise (material and information).

3.41
instantiation
creation of instances of modelling language constructs or partial models and the possible assignment of values to some or all attributes

NOTE A fully instantiated modelling language construct or model is one for which values have been assigned to all attributes.

3.42
life cycle
set of distinguishable phases and steps within phases which an entity goes through from its creation until it ceases to exist

3.43
life cycle phase
stage of development in the life cycle of an entity

3.44
manufacturing technology component
component that is required to control, transform, transport, store and verify raw materials, parts, (sub-)assemblies and end-products

3.45
methodology
set of instructions (e.g. provided through text, computer programs, tools) that is a step-by-step aid to the user

NOTE This formal definition is from ISO 15704:2000. More generally a methodology can be regarded as a systematic procedure for achieving some desired end-result.

3.46
mission
characterization of the business in which an enterprise describes the customer product or service function that it intends to fulfil

3.47
model
abstract description of reality in any form (including mathematical, physical, symbolic, graphical or descriptive) that presents a certain aspect of that reality

NOTE Adapted from ISO 15704:2000.

3.48
model development process
process of deriving and instantiating models at the different enterprise model phases

NOTE This is done by:

a) deriving and instantiating models for implemented components from the domain identification, concept definition, requirements definition, design specification and implementation description phases of enterprise modelling;

b) releasing the implementation description model as a domain operation model;

c) developing decommission definition models from domain operation models.

3.49
modelling language construct
textual or graphical part of a modelling language devised to represent, in an orderly way, the diverse information on common properties and elements of a collection of phenomena

NOTE Adapted from ENV 12204:1996. A modelling language construct is a basic architectural entity at the generic level that is designed to be re-used in a wide range of applications. As a part of a modelling language, it models common features of structure and/or behaviour in a modelled domain.

3.50
objective
statement of preference about possible and achievable future situations that influences the choices within some behaviour

NOTE Adapted from ISO/IEC 15414:2002.

3.51
operational
pertaining to the execution of the set of processes used to achieve enterprise objectives

3.52
organization view
enterprise model view that enables the representation and modification of the organizational and decisional structure of the enterprise and the responsibilities and authorities of the individuals and organizational units within the enterprise

3.53
partial level
collection of partial models

3.54
partial model
model used as a reference model in a specific type of industry segment or industrial activity

NOTE A partial model is comprised of modelling language constructs and/or other partial models. Partial models also enable a modeller to re-use already existing models built for other enterprise domains.

3.55
particular level
level at which a model is described for a particular, specific enterprise domain

3.56
particular model
model of a particular, specific enterprise domain

3.57
particularization
process of specialization and instantiation by which more specific model components can be derived from more generic ones

3.58
process
partially ordered set of activities that can be executed to achieve some desired end-result in pursuit of a given objective

3.59
requirements definition
enterprise model phase that defines the operations needed to achieve enterprise objectives and the conditions necessary to enable those operations, both being without reference to implementation options or implementation decisions

3.60
resource
enterprise entity that provides some or all of the capabilities required to execute an enterprise activity

[ISO 15704:2000]

NOTE In this International Standard, resource is used in the system theory sense of entities that provide capabilities required by the system and are an essential part of the system itself. The resource description includes the identification and description of consumables (such as energy, air, coolant) that are required to be present in sufficient quantities to operate the resource. In contrast, material is reserved for process inputs that are required by the various processes such as raw materials, parts and assemblies. These inputs are identified in the function view, described in the information view, and have the associated management responsibilities identified in the organization view.

3.61
resource view
enterprise model view that enables the representation and modification of enterprise resources

3.62
specialization
general concept modified for a more limited extent, specific use or purpose, or the act of adding or modifying details to a general concept to produce a specialization thereof

NOTE Specialization is the inverse of generalization.

3.63
stakeholder
interested party having a right, share or claim in the system or in the system's possession of qualities that meets their needs

NOTE Adapted from ISO/IEC 15288:2002.

3.64
system
collection of real-world items organized for a given purpose

[ISO 15704:2000]