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## Enterprise modelling and architecture — Constructs for enterprise modelling

*Modélisation et architecture d'entreprise — Constructions pour la  
modélisation d'entreprise*

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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](http://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](http://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](http://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*.

This second edition cancels and replaces the first edition (ISO 19440:2007), which has been technically revised.

The main changes compared to the previous edition are as follows:

- updates to the terms and definitions to address latest practice and harmonize with ISO 15704 and ISO/IEC/IEEE 42010;
- reorganization of the material into four components (metamodel, core constructs, specializations and model views), as described in [6.1](#);
- separation of the constructs into a slightly smaller number of core constructs in [6.3](#) and [Clause 7](#), and specializations thereof (which can be extended by a model user) in [Clause 8](#);
- introduction of a Service construct as a core construct, with specializations in [8.3](#) to address servitization;
- expansion of the Decision View in [Clause B.4](#) and introduction of a new Collaboration View in [Clause B.5](#) to demonstrate extensibility, i.e. use in other application domains;
- renaming of the construct property 'descriptive' as 'attribute';
- introduction of a Role core construct as a generalization of Organizational Role, Operational Role and Person Profile;
- introduction of a Performance Indicator core construct to support operational monitoring and process improvement;
- allowing an Enterprise Activity to be decomposable into sub-activities;

- elimination of Functional Entity to reduce the number of core constructs and replacing it by ‘active Resource’;
- insertion (in [Clause A.1](#)) of new text explaining why and how behavioural rules need to be constrained;
- deletion of annexes which will be included in a future Technical Report on typical usages of identification and usage of constructs in each model phase.

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](http://www.iso.org/members.html).

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## Introduction

This document defines the generic concepts that are required to enable the creation of enterprise models for industrial and other businesses and to provide support for the use of frameworks by industrial and other enterprises. This document builds upon ISO 19439 and defines and details a set of conformant user-oriented modelling language constructs for manufacturing and related services, which provide common semantics and enable the unification of models developed by different stakeholders in the various phases of model development. Such models are aimed at model-based support of operational decision-making and can be employed for model-based operation monitoring and control.

The modelling language constructs defined in this document can be specialized or assembled or both specialized and assembled into structures for specific purposes, for example for an industry or enterprise sector or for a distinct kind of enterprise concern such as maintenance. In turn, such structures and generic modelling language constructs can be used for developing distinct models for a specific enterprise.

The general requirements that determine the characteristics of the core constructs necessary for computer-supported modelling of enterprises are

- a) the provision of an explicit model of Business Processes, with their dynamics, functions, information, resources, relationships and organizational responsibilities,
- b) sufficient detailing and qualification of enterprise components to allow the creation of a model for a specific enterprise,
- c) support for management of change, and
- d) end-user-oriented representation to enable operational use.

**NOTE** All Unified Modelling Language (UML) class model figures are computer-generated scalable vector graphics (SVG). All generalization-specialization relationships in those class models are coloured red for increased clarity. [Figures B.10](#) and [B.11](#) are line drawings.

The names of terms representing core constructs (see [Clause 7](#)) and derived constructs (see [Clause 8](#)) are capitalized throughout this document to aid the reader in distinguishing them from general usages of the same term, specifically in order to distinguish the constructs Capability, Domain, Enterprise Activity, Event and Resource from general usage of capability, domain (or enterprise domain), enterprise activity, event and resource.



# Enterprise modelling and architecture — Constructs for enterprise modelling

**IMPORTANT** — The electronic file of this document contains colours which are considered to be useful for the correct understanding of the document. Users should therefore consider printing this document using a colour printer.

## 1 Scope

This document identifies and specifies constructs necessary for users that model enterprises in conformance with ISO 19439.

This document focuses on, but is not restricted to, engineering and the integration of manufacturing and related services in the enterprise. The constructs enable the description of structure and functioning of an enterprise for use in configuring or implementing in different application domains. This document specifies an implementation framework in [Clause 6](#) to map model constructs into such domains.

## 2 Normative references

There are no normative references in this document.

## 3 Terms and definitions

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

#### aggregation

<enterprise modelling> process of, or result of, combining *modelling language constructs* ([3.50](#)) and other *model* ([3.49](#)) *components* ([3.9](#)) into a *whole entity* ([3.35](#))

Note 1 to entry: Modelling language constructs and other model components can be part of more than one aggregation.

Note 2 to entry: Both Part-of and Consists-of are used in the aggregation *relationships* ([3.64](#)) described in [7.16](#).

### 3.2

#### attribute

piece of information stating a property of an *entity* ([3.35](#))

[SOURCE: ISO 19439:2006, 3.2]

### 3.3

#### behavioural rule

<enterprise modelling> description of the logical sequencing *relationships* ([3.64](#)) of constituent activities used in the specification of *Business Process* ([3.4](#)) and *Service* ([3.71](#)) behaviour

### 3.4

#### **Business Process**

<enterprise modelling> *construct* (3.12) that represents a partially ordered set of Business Processes, Services and Enterprise Activities that when executed, achieves some desired end-result in pursuit of a given objective of an *enterprise* (3.27) or a part of an enterprise

### 3.5

#### **capability**

<general> ability to perform a specified activity

### 3.6

#### **Capability**

<enterprise modelling> *specialization* (3.73) of the *Enterprise Object* (3.33) *construct* (3.12) that represents the collection of *capability* (3.5) characteristics [expressed as *capability attributes* (3.2)] of either a *Resource* (3.67) (its provided Capability) or an *Enterprise Activity* (3.28) (its required Capability)

### 3.7

#### **class**

abstraction representing and encapsulating properties, *relationships* (3.64) and behaviour, which distinguish a collection of similar phenomena

Note 1 to entry: Class is used in a very general sense without any connotation for implementation or for use with a specific methodology.

### 3.8

#### **complementary concept**

conceptual representation that is not itself a *construct* (3.12), but that has a distinct significance and semantics for the purposes of enterprise modelling

Note 1 to entry: Many *construct templates* (3.14) use complementary concepts, which are listed in 5.12.

### 3.9

#### **component**

<system> *entity* (3.35), with discrete structure within a *system* (3.75), which interacts with other components of the system, thereby contributing to the system properties and characteristics

[SOURCE: ISO 19439:2006, 3.6, modified – The words “at the lowest level” have been deleted after “contributing”.]

### 3.10

#### **concept definition phase**

*enterprise model phase* (3.31) that defines the business concepts of an *enterprise domain* (3.29) to be employed in realizing its business objectives and its operation, including the necessary enterprise domain inputs and outputs

[SOURCE: ISO 19439:2006, 3.7, modified – The word “phase” has been added to the term.]

### 3.11

#### **constraint**

restriction or limitation or condition placed upon a *system* (3.75) that originates from inside or outside the system under consideration

[SOURCE: ISO 19439:2006, 3.8]

### 3.12

#### **construct**

<enterprise modelling> abstraction devised as an element of a modelling language to represent a generic concept in the *Domain* (3.24)

Note 1 to entry: This document addresses the domain of manufacturing, related services and collaborating enterprises.

**3.13****construct label**

literal string defined for each *construct template* (3.14), identifying the kind of *construct* (3.12)

Note 1 to entry: Construct labels are listed in 4.2.

**3.14****construct template**

common structure that allows the identification and description of distinct *modelling language constructs* (3.50) and the assignment of their properties

**3.15****Co-provider**

<enterprise modelling> *derived construct* (3.22), a *specialization* (3.73) of *Role* (3.69), which represents a person or an organization associated with another in providing a *Service* (3.71)

**3.16****core construct**

<enterprise modelling> dominant *construct* (3.12) that is distinguished from normal usage of the term by capitalizing the first letter of each word

Note 1 to entry: Core constructs are explained in [Clause 7](#).

EXAMPLE *Domain* (3.24); *Business Process* (3.4); *Enterprise Activity* (3.28); *Service* (3.71); *Event* (3.36); *Enterprise Object* (3.33); *Enterprise Object View* (3.34); *Organizational Unit* (3.55); *Decision Centre* (3.17); *Role* (3.69); *Product* (3.63); *Order* (3.53); *Capability* (3.6); *Performance Indicator* (3.59).

**3.17****Decision Centre**

<enterprise modelling> *specialization* (3.73) of the *Enterprise Object* (3.33) *construct* (3.12) that represents a set of decision-making activities that are characterized by having the same time horizon and planning period and belonging to the same kind of *decision function category* (3.18)

Note 1 to entry: The terminology used to describe aspects of Decision Centre is found in CEN/TS 14818, which defines (time) horizon as “the part of the future taken into account by a decision, i.e. the horizon is six months when a decision is taken on a time interval of six months” and (planning) period as “the time that passes between a decision and when this decision shall be re-evaluated”.

**3.18****decision function category**

<enterprise modelling> set of decision activities or *Decision Centres* (3.17) handling the same kinds of decision-making activities and concerning the same kinds of subjects

EXAMPLE Manage resources; manage products; plan production.

**3.19****declarative rule**

set of objectives and *constraints* (3.11), possibly combined with a set of requirements expressed as text

Note 1 to entry: Declarative rules can be imposed on *Business Processes* (3.4) and *Services* (3.71).

**3.20****decommission definition phase**

*enterprise model phase* (3.31) that defines the final state of a decommissioned operational *system* (3.75), all its *components* (3.9) for a specific *enterprise domain* (3.29) and the processes employed to conduct the decommissioning, so enabling reuse or disposition of those components

[SOURCE: ISO 19439:2006, 3.11, modified – The word “phase” has been added to the term, and the word “particular” has been replaced with “specific” in the definition.]

### 3.21 derivation

<enterprise modelling> process of elaborating *enterprise models* (3.30) at successive *enterprise model phases* (3.31) from the *models* (3.49) established at preceding phases, reusing the available contents and extending them according to the needs expressed for a model phase

### 3.22 derived construct

<enterprise modelling> *construct* (3.12) that is specialized from an *Enterprise Object* (3.33) and that is distinguished from normal usage of the term by capitalizing the first letter of each word

Note 1 to entry: Derived constructs are explained in [Clause 8](#).

EXAMPLE *Organizational Role* (3.54); *Operational Role* (3.52); *Person Profile* (3.61); *Stakeholder* (3.74); *User* (3.76); *Co-provider* (3.15); *Functionality* (3.40).

### 3.23 design specification phase

*enterprise model phase* (3.31) that specifies the *Business Processes* (3.4), together with *Enterprise Activities* (3.28) and rules, that are to be performed to achieve the requirements

[SOURCE: ISO 19439:2006, 3.13, modified – The word “phase” has been added to the term, the words “Business Processes” have been capitalized and the word “capabilities” has been replaced with “Enterprise Activities”.]

### 3.24 Domain

<enterprise modelling> *construct* (3.12) that represents the portion of an *enterprise* (3.27) to be modelled providing for identification of the relevant information

### 3.25 domain identification phase

*enterprise model phase* (3.31) that identifies the *enterprise domain* (3.29) to be modelled with respect to its business objectives, the enterprise domain inputs and outputs and their respective origins and destinations

[SOURCE: ISO 19439:2006, 3.15, modified – The word “phase” has been added to the term.]

### 3.26 domain operation phase

*enterprise model phase* (3.31) that encompasses the operational use of the *Domain* (3.24) *model* (3.49)

[SOURCE: ISO 19439:2006, 3.16, modified – The word “phase” has been added to the term.]

### 3.27 enterprise

<enterprise modelling> human undertaking or venture that has definite *mission* (3.48), goals and objectives to offer products or *services* (3.70), or to achieve a desired project outcome or business outcome

### 3.28 Enterprise Activity

<enterprise modelling> *construct* (3.12) that represents all or some part of the most detailed extent of enterprise functionality required by *Business Process* (3.4) objectives, that defines the task or tasks to undertake and that identifies the inputs needed for its execution and the outputs created as a result

Note 1 to entry: The necessary inputs and *resources* (3.66) are identified in the Enterprise Activity template.

**3.29****enterprise domain**

part of the *enterprise* (3.27) with a given set of business objectives and *constraints* (3.11) for this *enterprise model* (3.30)

Note 1 to entry: In this document, “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.

**3.30****enterprise model**

representation of an *enterprise* (3.27) as well as *entities* (3.35) within an enterprise, their interrelationships, their decomposition and detailing to the extent necessary to convey what the enterprise intends to accomplish and how it operates

Note 1 to entry: An enterprise model, which is used to improve the effectiveness and efficiency of the enterprise, identifies and specifies essential *components* (3.9) and elements to any necessary extent of detail, including any subsystems and constituent *models* (3.49) of the enterprise, e.g. an enterprise architecture model.

[SOURCE: ISO 15704:2019, 3.6]

**3.31****enterprise model phase**

*life cycle* (3.45) phase of an *enterprise model* (3.30)

[SOURCE: ISO 19439:2006, 3.24]

**3.32****enterprise model view****model view****view**

selective perception or representation of an *enterprise model* (3.30) that emphasizes some distinct aspect and disregards others

[SOURCE: ISO 19439:2006, 3.25, modified – The additional terms “model view” and “view” have been added, and the word “particular” has been replaced with “distinct” in the definition.]

**3.33****Enterprise Object**

<enterprise modelling> *construct* (3.12) that represents information in the *enterprise* (3.27) describing a generalized or a real or an abstract *entity* (3.35) conceptualized as being a whole

Note 1 to entry: All other constructs in this document represent entities that have specific semantics requiring distinct properties and additional descriptions.

[SOURCE: ISO 19439:2006, 3.27, modified – The term “Enterprise Object” has been capitalized, the field “<enterprise modelling>” has been added, the words “piece of information in the enterprise domain that describes” have been replaced with “construct that represents information in the enterprise describing”, the words “which can be” have been deleted before “conceptualized” and Note 1 to entry has been added.]

**3.34****Enterprise Object View****Object View**

<enterprise modelling> *construct* (3.12) that represents a collection of *attributes* (3.2) selected from an *Enterprise Object* (3.33) for some distinct purpose

Note 1 to entry: The collection is defined by a selection of attributes and possibly *constraints* (3.11) on those attributes.

**3.35**  
**entity**

concrete or abstract thing in the *Domain* (3.24) under consideration

[SOURCE: ISO 15704:2019, 3.8]

**3.36**  
**Event**

<enterprise modelling> *construct* (3.12) that represents a solicited or unsolicited fact indicating a state change in the *enterprise* (3.27) or its environment

Note 1 to entry: An event can be associated with an Object View containing information related to the Event.

**3.37**  
**exception**

<enterprise modelling> *Event* (3.36) that is raised as the result of either an abnormal termination of a previously initiated *Business Process* (3.4), *Enterprise Activity* (3.28) or *Service* (3.71), or by a special external mechanism such as a watchdog timer

**3.38**  
**function view**

<enterprise modelling> *enterprise model view* (3.32) that enables the representation and modification of the processes of the *enterprise* (3.27), their functionalities, behaviours, inputs and outputs

[SOURCE: ISO 19439:2006, 3.32, modified – The field “<enterprise modelling>” has been added.]

**3.39**  
**functional category**

grouping of *entities* (3.35) for expression of a common purpose or *capability* (3.5)

**3.40**  
**Functionality**

<enterprise modelling> *derived construct* (3.22), a *specialization* (3.73) of *Role* (3.69), which represents some aspect of what a product or *service* (3.70) can or cannot do for a *User* (3.76)

**3.41**  
**generalization**

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

Note 1 to entry: Generalization is the inverse of *specialization* (3.73).

[SOURCE: ISO 19439:2006, 3.34]

**3.42**  
**implementation description phase**

*enterprise model phase* (3.31) that describes the final set of processes, *resources* (3.66) and rules implemented to achieve the desired operational performance for execution of the *Business Processes* (3.4), *Services* (3.71) and *Enterprise Activities* (3.28) specified in the *design specification phase* (3.23)

[SOURCE: ISO 19439:2006, 3.38, modified – The word “phase” has been added to the term, the words “Business Processes” and “Enterprise Activities” have been capitalized and the word “Services” has been added.]

**3.43**  
**information view**

<enterprise modelling> *enterprise model view* (3.32) that enables the representation and modification of the enterprise information as identified in the *function view* (3.38)

Note 1 to entry: The information view is articulated as a structure containing *Enterprise Objects* (3.33) that represent the information-related *entities* (3.35) of the enterprise [organization, *resources* (3.66) and information].