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Enterprise modelling and architecture — Constructs for enterprise modelling

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee AMT/5, Industrial architectures and integration frameworks.

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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).

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).

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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*.

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;

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— 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.

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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.

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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

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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.

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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.]

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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.

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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.

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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].

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[SOURCE: ISO 19439:2006, 3.40, modified – The field "<enterprise modelling>" has been added and Note 1 to entry has been modified.]

3.44
integrity rule
statement in the *requirements definition phase* (3.65) concerning restrictions on information to ensure conformity to real-world reality

Note 1 to entry: Integrity rules are used to define restrictions in terms of *constraints* (3.11) on *attributes* (3.2) of *Enterprise Objects* (3.33).

3.45
life cycle
set of distinguishable *life cycle phases* (3.46) and steps within phases which an *entity* (3.35) goes through from its creation until it ceases to exist

[SOURCE: ISO 19439:2006, 3.42, modified – The word "phases" has been replaced with "life cycle phases".]

3.46
life cycle phase
distinguishable phases of development of an *entity* (3.35)

[SOURCE: ISO 19439:2006, 3.43, modified – The words "stage of development in the life cycle" have been replaced with "distinguishable phases of development".]

3.47
meta-model
description of modelling elements for use in constructing *models* (3.49) pertaining to a domain

Note 1 to entry: A meta-model is always relative to the model in which its modelling elements appear.

3.48
mission
<enterprise> characterization of the effect that an *enterprise* (3.27) expects to achieve through the fulfilment of functional requests for products or *services* (3.70)

3.49
model
abstract description of an *entity* (3.35) in any form (including mathematical, physical, symbolic, graphical, or descriptive) that presents certain aspects of that entity

[SOURCE: ISO 19439:2006, 3.47, modified – The words "abstract description of reality" have been replaced with "abstract description of an entity" and "presents a certain aspect" has been replaced with "presents certain aspects".]

3.50
modelling language construct
<enterprise modelling> 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 *distinct enterprise entities* (3.35)

3.51
occurrence
<enterprise modelling> single, actual realization of a *modelling language construct* (3.50) that represents a distinct *entity* (3.35) in the real world at the time the *model* (3.49) is used

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3.52
Operational Role
<enterprise modelling> *derived construct* (3.22), a *specialization* (3.73) of *Role* (3.69), which represents a distinct set of operational tasks and the relevant human skills required to perform those operational tasks

3.53
Order
<enterprise modelling> *specialization* (3.73) of the *Enterprise Object* (3.33) *construct* (3.12) that represents all kinds of commissioning and control in the company or organization that are necessary to deliver a product to meet a customer, legal or environmental requirement

Note 1 to entry: This includes the information for order management/administration and planning and control of *Business Processes* (3.4) in an *enterprise* (3.27).

3.54
Organizational Role
<enterprise modelling> *derived construct* (3.22) of *Role* (3.69) that represents the distinct set of organizational tasks and the skill profile required to serve and fulfil the defined organizational responsibilities, consisting of a list of predefined or user-defined human organizational skills

3.55
Organizational Unit
<enterprise modelling> *specialization* (3.72) of the *Enterprise Object* (3.33) *construct* (3.12) that represents an *entity* (3.35) of the organizational structure of an *enterprise* (3.27), which is described by *attributes* (3.2) of the organization and *relationships* (3.64) to both lower and higher-level organizational entities

EXAMPLE Department; division.

3.56
organization view
<enterprise modelling> *enterprise model view* (3.32) that enables the representation and modification of the organizational and decisional structure of the *enterprise* (3.27) and the responsibilities and authorities of the persons and *Organizational Units* (3.55) and *Decision Centres* (3.17) within the enterprise

[SOURCE: ISO 19439:2006, 3.52, modified – The field "<enterprise modelling>" has been added and the words "individuals and organizational units" have been replaced with "persons and Organizational Units and Decision Centres".]

3.57
partial model
model (3.49) used as a reference model in a specific kind of industry segment or industrial activity

Note 1 to entry: A partial model is comprised of *modelling language constructs* (3.50) or other partial models. Partial models also enable a modeller to reuse already existing models built for other *Domains* (3.24).

[SOURCE: ISO 19439:2006, 3.54, modified – The words "specific type" have been replaced with "specific kind".]

3.58
performance indicator
<general> metric or measure for assessing the achievement of an objective

3.59
Performance Indicator
<enterprise modelling> *specialization* (3.73) of the *Enterprise Object* (3.33) *construct* (3.12) that represents a set of *performance indicators* (3.58) by which the completion of processes and the realization of goals can be assessed

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3.60
perspective
<enterprise modelling> orientation of a stakeholder or *model* (3.49) user relative to an identified *Domain* (3.24)

Note 1 to entry: A stakeholder's orientation can be formed by stakeholder concerns, as well as by their training, experience, cultural background, and their motivations.

[SOURCE: ISO 15704:2019, 3.19, modified – The field "<enterprise modelling>" has been added.]

3.61
Person Profile
<enterprise modelling> *derived construct* (3.22), a *specialization* (3.73) of *Role* (3.69), which represents a set of personal skills and responsibilities essential for one or more of an *Organizational Role* (3.54) or an *Operational Role* (3.52), and that a person provides

Note 1 to entry: A Person Profile can be assigned to more than one person and conversely a person can fulfil more than one Person Profile for more than one *Organizational Unit* (3.55) or *Enterprise Activity* (3.28).

3.62
processable model
model (3.49) with specified syntax and semantics that can be processed by a computer for analysis, simulation or execution

3.63
Product
<enterprise modelling> *specialization* (3.73) of the *Enterprise Object* (3.33) *construct* (3.12) that represents the technical information for management/administration and for planning production of an enterprise product

Note 1 to entry: Relevant technical information can be product history, e.g. characteristics, versions or test and qualification data.

3.64
relationship
association between two or more *entities* (3.35) that is significant for some intended purpose

3.65
requirements definition phase
enterprise model phase (3.31) that defines the enterprise operations needed to achieve enterprise objectives and the conditions necessary to enable those operations, both being without reference to implementation options or implementation decisions

[SOURCE: ISO 19439:2006, 3.59, modified – The word "phase" has been added to the term, the words "operations needed" have been replaced with "enterprise operations needed".]

3.66
resource
<general> *enterprise entity* (3.35) that provides some or all of the *capabilities* (3.5) required to execute an *Enterprise Activity* (3.28)

Note 1 to entry: In this document, resource is used in the *system* (3.75) 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 and material process inputs that are required by the various activities (such as raw materials, parts and assemblies). These inputs are identified in the *function view* (3.38), described in the *information view* (3.43), and have the associated management responsibilities identified in the *organization view* (3.56).

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3.67
Resource
<enterprise modelling> *specialization* (3.73) of the *Enterprise Object* (3.33) *construct* (3.12) that represents the provided *resources* (3.66) available to execute an *Enterprise Activity* (3.28)

Note 1 to entry: The Resource construct does not include human resources.

[SOURCE: ISO 19439:2006, 3.60, modified – The term has been capitalized, the field "<enterprise modelling>" has been added, the words "enterprise entity that provides some or all of the capabilities required to execute an enterprise activity" have been replaced with "specialization of the Enterprise Object construct that represents the provided resources available to execute an Enterprise Activity" and Note 1 to entry has been modified.]

3.68
resource view
<enterprise modelling> *enterprise model view* (3.32) that enables the representation and modification of enterprise *resources* (3.66) and roles

Note 1 to entry: The resource view is articulated as a structure containing *Enterprise Objects* (3.33) representing the set of resources required to execute enterprise operations.

[SOURCE: ISO 19439:2006, 3.61, modified – The field "<enterprise modelling>" has been added, the words "enterprise resources" have been replaced with "enterprise resources and roles" and Note 1 to entry has been added.]

3.69
Role
<enterprise modelling> *specialization* (3.73) of *Enterprise Object* (3.33) that represents the role of a person or thing in a specific context

3.70
service
<general> functionality resulting from interaction between a supplier (provider) and a *User* (3.76), often in the context of a supplied product in use by the User

3.71
Service
<enterprise modelling> *construct* (3.12) that represents a *service* (3.70)

3.72
servitization
process in a manufacturing *enterprise* (3.27) to augment products with *services* (3.70) to satisfy *User* (3.76) needs

3.73
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 1 to entry: Specialization is the inverse of *generalization* (3.41).

Note 2 to entry: When referring to a *class* (3.7), specialization involves the construction of subclasses within a class for a distinct purpose, where the members of each subclass have one or more characteristics [*attributes* (3.2), *relationships* (3.64), behaviour or semantics] in common which are not shared by all other members of the class. When referring to a *model* (3.49), it refers to the progression from generic concepts to *partial models* (3.57) and particular models.

[SOURCE: ISO 19439:2006, 3.62, modified – Note 2 to entry has been added.]

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3.74
Stakeholder
<enterprise modelling> *derived construct* (3.22) of *Role* (3.69) that represents an individual, team, *Organizational Unit* (3.55), or *class* (3.7) thereof, having concerns relative to their *perspective* (3.60) about an *enterprise* (3.27)

Note 1 to entry: Typical enterprise stakeholders include enterprise owners, enterprise customers, and enterprise employees responsible for receiving or delivering either products or *services* (3.70), and those persons or Organizations partnering with the enterprise to achieve its *mission* (3.48).

3.75
system
collection of items arranged and interacting for a given purpose

3.76
User
<enterprise modelling> *derived construct* (3.22), a *specialization* (3.73) of *Role* (3.70), which represents the interests and characteristics of an *entity* (3.35) using a product or *service* (3.70)

4 Abbreviated terms

4.1 General

EBNF	Extended Backus-Naur Form
GRAI	Graphes à Résultats et Activités Interreliés (Graphs of Interrelated Results and Activities)
HTTP	HyperText Transfer Protocol
ICT	Information and Communication Technology
UML	Unified Modelling Language
XML	eXtensible Markup Language

4.2 Construct-specific

BP	Business Process
BRS	Behavioural Rule Set
CA	Capability
CODM	Collaboration Domain
COPR	Co-provider
COPT	Collaboration Point
CPRT	Collaborating Partner
DA	Decision Activity
DC	Decision Centre
DECN	Decision
DFRM	Decision Frame

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DM	Domain
DSTR	Decision Structure
EA	Enterprise Activity
EO	Enterprise Object
EV	Event
FUNC	Functionality
OPR	Operational Role
OR	Order
ORR	Organizational Role
OU	Organizational Unit
OV	Object View
OVPR	Object View Profile
PI	Performance Indicator
PPR	Person Profile
PR	Product
RE	Resource
RO	Role
SRV	Service
STK	Stakeholder
USER	User

5 Representations, relationships, roles and common concepts

5.1 Modelling language constructs, purpose and applicability

Clauses 7 and 8 define, describe and provide templates for generic modelling constructs. As a set, these constructs contribute to a modelling language for creating a wide range of Business Process-based enterprise models. When utilized, each construct shall include the attributes that are pre-defined in this document. Other attributes may be added to meet distinct user needs by a suitable extension of the template (see 8.2, 8.3, Clause B.4 and Clause B.5).

Constructs are often applicable to several model views and are elaborated to different extents at each of the modelling phases. Where the applicability of a construct, as defined in this document, is limited to a certain model view or enterprise model phase, that limitation is noted in remarks.

NOTE Because of the interrelationships and dependencies between constructs, they cannot be described in this document in strict linear sequence (i.e. with no forward reference to not-yet-described constructs). The sequence of text used herein for core constructs (and not intended as a modelling methodology) has been chosen to minimize this forward reference problem and is as follows:

— start with Domain (the scope and boundary of the model);

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— add functionality in terms of Business Processes, Services, Enterprise Activities and Events;

— add information representation in terms of Enterprise Object and Object View, and the specializations Product and Order;

— provide for resourcing with Resource and Capability;

— lastly, address organizational and role issues as subclasses of Role, with Organizational Unit, Decision Centre, Organizational Role, Operational Role and Person Profile.

5.2 Dimensions of enterprise models

5.2.1 Dimension of genericity

Relative to the dimension of genericity defined in ISO 19439, constructs are generic elements for use in constructing partial and particular models. For partial models (e.g. industry or trade specific models), some attribute values may remain undefined for partial model instances (e.g. inputs/outputs for Events for Domains and inputs/outputs for Business Processes), with value definition occurring for the particular model instance. Such missing entries need to be completed for the particular model.

5.2.2 Dimension of enterprise model phase

The dimension of enterprise model phase in ISO 19439 addresses the life cycle of models and model components. The concern of this dimension is the development and evolution of the model of the domain, starting from the identification of the enterprise domain and progressing to a processable model and the decommissioning thereof. Therefore, the specifications of modelling language constructs need to accommodate their intended usage and representation in a distinct model phase. At each phase, all constructs specified at that phase shall be specified to a comparable level of detail. Attributes of modelling language constructs shall be adaptable and selectable for the different model phases according to the envisioned needs.

5.2.3 Dimension of enterprise model views

ISO 19439 and ISO 15704 use enterprise model views (often shortened to 'model views') to provide a selective perception of an enterprise that emphasizes some distinct aspect of the matter under consideration and disregards others, thereby reducing complexity of representation. Model views need to be understood as selective views on an integrated enterprise model. This document identifies four mandatory enterprise model views (Function, Information, Resource, Organization) that allow the modelling of the major aspects of an enterprise. Additionally, other views may be defined as needed and supported by the modelling methodology, e.g. economic view, decision view, purpose view and implementation view. In this case, additional attributes may augment the constructs defined in this document or relevant new constructs may be defined. Therefore, the specifications of modelling language constructs should accommodate their intended usage and representation in one or several model views. To assure consistency of constructs that can appear in more than one view, automated tools are usually necessary.

5.3 Construct representation

Modelling language constructs shall be represented in a form that is both understandable by humans and interpretable by digital technology. This means there is the need for

— a visual (graphical, iconic) representation of construct structures for use by model builders and business users,

— a structured information-capturing representation (for which this document uses templates) for use by model builders and business users, and

— a machine-interpretable representation for computer-based model simulation and model-based enterprise operation control and monitoring.

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NOTE 1 Interpretability by digital technology is not the subject of this document but is provided by the modelling tool.

Representation shall be performed in the following four ways:

a) representation by a common structure of the constructs of this document, as specified in 5.4;

b) representation of construct properties by templates to arrange them into a common format, as specified in 5.5;

c) representation of the relationships between these modelling language constructs, as specified in the relationships section of each template and illustrated in the various Unified Modelling Language (UML) class models;

d) representation of dynamic behaviour by behavioural rules, as specified in 7.2.5 and Annex A.

NOTE 2 This document uses class diagrams as examples to illustrate constructs and the relationships between them.

5.4 Common structure for modelling language constructs

To describe a distinct modelling language construct, this document uses a common structure that provides a consistent minimal assignment of properties to each construct. This common structure shall have two constituents

a) a textual description consisting of brief text defining the modelling language construct in terms of a purpose, its description and its intended usage, and

b) a construct template, which arranges and defines the properties for this modelling language construct.

5.5 Template for modelling language constructs

The template is described in an informal manner but using a common form. The construct template shall have the form described below.

a) Header part having the same attributes for each modelling language construct and containing attributes relating to the identity of a construct and to its context in which it is used. It shall be structured as follows:

   1) construct label (a literal string denoting the kind of construct);

   2) identifier (a literal string that is unique for each occurrence of the modelling language construct within the model). The identifier consists of an uppercase construct label, followed by a user defined non-empty string of alphanumeric and separator characters followed by a space. The separator characters are restricted to full stop ('.'), dash ('-'), and underline ('_'), e.g. BP001, SRV.Ordering, EA-welding, OV1.2, RE_6786_A;

      NOTE 1 The characters solidus ('/') and comma (',') are not permitted in an identifier.

   3) name (the name of the instance of the modelling language construct);

   4) authority for model design (i.e. the identifier of the Organizational Unit and Organizational Role responsible for the design and modification of this construct).

   NOTE 2 The Manufacturing-oriented Enterprise specialization of 8.2 also includes Organizational Role and Person Profile (to identify the person currently assigned to an Organizational Role).

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b) Body part containing the distinct properties that are specific to each construct and whose description is derived from the corresponding modelling language construct definition. Body parts shall be structured in two further partitions as follows:

1) attributes, containing descriptive properties that comprise

i) construct-identifying description in textual form,

ii) construct attributes that are predefined,

iii) additional construct attributes that may be defined by the user to meet distinct needs,

iv) attribute qualifications – statements that are made about whether attribute values are mandatory or optional, when they are applicable, etc., and

v) activation priorities – priority is used at run-time to select which process to respond to first when two processes complete within the same interval of observable time;

2) relationships (further described in 5.10), containing relationship properties that can include

i) Specialization-of relationships, representing relationships between a specialization and its generalization,

ii) Part-of relationships, representing relationships between this construct instance and the whole aggregated from such instances,

iii) Consists-of relationships, representing relationships between this construct instance and its constituent parts,

iv) Association relationships for other forms of relationship, either predefined or user-defined (such as provision or usage of a Capability instance by Resource instances), and

v) Operational relationships, representing the responsibility and authority for model operation (i.e. the identifier of the Organizational Unit and Operational Role responsible for the operational usage of this construct or authorized to change its usage).

NOTE 3 For Consists-of relationships and similar dual relationships (see 5.6), it is accepted that Part-of and Consists-of are complementary; depending on the purposes of the modeller, either or both can be used.

Where an attribute or relationship is not applicable for a certain enterprise model phase, that attribute or relationship is omitted in the construct template table instances.

Both attributes and relationships contain general properties and constraints on these and are applicable to enterprise model phases as indicated. Additionally, both attributes and relationships may be grouped as sets having some common characteristics, e.g. inputs/outputs or relationships to organizational concerns.

NOTE 4 In the models of Annex A, Part-of and Consists-of relationships are shown as UML aggregations without labels. UML associations are used to show Operational and Association relationships, and UML generalizations are used to show Specialization-of relationships.

NOTE 5 Version control has a significant impact on design and operation for enactable models.

5.6 Referential integrity

This document considers support for control of modelling language constraints to be a tool-provided responsibility. It is also the responsibility of the tool supporting model development and maintenance to ensure that attributes referred to in constraints and integrity rules are consistent with the attributes as defined for the construct instances involved.

When the value for a construct property is another construct instance, the modeller, and preferably the modelling tool, shall assure that the referred-to construct instance actually exists. This assurance

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can be immediate as modelling occurs or as a distinct process to verify the referential integrity of model contents. In some situations, a reference to a construct instantiated in a later modelling life cycle phase can occur, but all such references need to be resolved to an existing construct instance before the modelling effort is complete.

Several relationships, e.g. 'Part-of construct' and 'Consists-of construct', are dual relationships. Where a construct specifies a dual-of relationship to another construct, depending on the purposes of the modeller, the other construct may specify the corresponding dual relationship – in that case, it is the responsibility of the modelling tool to ensure the consistency of these attributes.

NOTE The dual relationships used in the templates of this document are (where the uppercase codes are construct labels):

— assignedDC <–> controlsDC

— assignedORR <–> assignedToORR

— assignedOU <–> assignedToOU

— assignedToORR <–> assignedORR

— assignedToOU <–> assignedOU

— consistsOf <–> partOf

— controlsDC <–> assignedDC

— partOf <–> consistsOf

— providedCA <–> requiredCA

— providedInfo <–> requiredInfo

— relatedTo <–> relatedTo

— requiredCA <–> providedCA

— requiredInfo <–> providedInfo

— usedBy <–> uses

— usedByDC <–> usesDA

— uses <–> usedBy

— usesBP <–> usedByDM

— usesSRV <–> usedByDM

— whereProvided <–> whereRequired

— whereRequired <–> whereProvided

A modeller can specify other dual relationships, as required.

For constructs where both constraints and integrity attributes are used, it is accepted that these are also dual relationships; depending on the purposes of the modeller, either or both may be used. In the latter case, it is the responsibility of the modelling tool to maintain consistency.

For Event instances, it is the responsibility of the tool supporting model development and maintenance to ensure that the Event instances listed as Inputs or Outputs are compatible with the Generated-by attributes of Event. It is also necessary to ensure that the Generated-by and Initiates attributes are compatible with the Origin/Destination Event lists of Domain, and the Input/Output lists of Business Process and Enterprise Activity.

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5.7 Representation of attributes

Each attribute shall be defined by its name and predefined data type (numbers, literals, strings, etc.).

NOTE 1 A data type can take on a range of permissible or actual values, such as a single identifier (id = "EO4711"), value range (diameter 10 mm ± 0,05 mm) or value list (colour is yellow, red or green).

NOTE 2 Constructs can use eXtensible Markup Language (XML) schema (see References [9], [10], [11]), EXPRESS (see ISO 10303-11) or other formal modelling specification languages as a means for representing attributes and the related definition of data types, expressions and statements.

5.8 Notation used to describe template contents

Properties are described with a combination of denotations and textual descriptions.

The notation used for this clause is that denotations enclosed in angle brackets are either self-explanatory (e.g. <integer>) or explained in accompanying text (e.g. <item>, where item is …). NIL denotes a blank space. Literals in all upper case denote themselves as in DM, BP, EV, NIL, PHYSICAL, etc. The literal characters comma, forward slash, round brackets and equals are denoted by ':', '/', '(', ')' and '=' respectively.

Where more than one choice is possible for a denotation, these are separated by | (read as or), as in <a> | <b> | <c>. Square brackets '[' and ']' are used for convenience as a grouping container for one or more different items as in [<duration> <qual>] in a list of DURATION attributes of an Enterprise Activity, where <qual> is a code representing one of 'average', 'minimum', 'maximum', 'actual'.

Textual descriptions contain a brief definition of that property and, where appropriate, information providing additional details (shown in italics).

Multiplicities as part of textual descriptions are annotated by:

— [0..*] indicating no instances, a single instance or many instances,

— [1..1 | indicating a single instance,

— [1..*] indicating multiple instances or

— [m..n] indicating m up to n instances.

Comments are contained in a (*…*) bracket pair.

A non-empty list of <item> separated by commas is written as [<item>]+, while a similar possibly empty list is written as [<item>]*. An optional <item> is denoted as [<item>]?. Within a list denotation, <item> may be further decomposed as in

— [<id> <multiplicity>]+ or [<measure> | <metric>]*.

More formally, the syntax for lists is

— list = non-empty list | possibly-empty list;

— non-empty list = item | item, separator, non-empty list ; (* for convenience, abbreviated to [<item>]+ *)

— optional item = item | NIL ; (* for convenience, abbreviated to [<item>]? *)

— separator = ',' ;

— possibly-empty list = NIL | non-empty list ; (* for convenience, abbreviated to [<item>]* *)

EXAMPLE Examples of denotations are:

— From the Domain template (see 7.1.4), a Design Authority with values of Organizational Role and Organizational Unit would be expressed as [<identifier> '/' <name>] ':' [<identifier> '/' <name>]

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— From the Capability template (see 7.14.4), RE_1006453/data_store would be valid for Where_provided <identifier> '/' <name>]+. (NIL would not be valid.)

— From the Enterprise Activity template (see 7.3.4), NIL or max_load = 10Kg; max_temp = 100ºC would be valid for '[<constraint>]* imposed on this Enterprise Activity'.

Some further examples follow where the leading uppercase codes refer to construct labels, followed by a property name, progressing from simpler to more complicated cases.

EO: Nature of Object PHYSICAL | INFORMATION.

CA: Included Capabilities [<Capability>]*

DM: Objectives [<objective>]+, strategic and operational business objectives of the Domain.

EV: Object Views [<origin> ':' <identifier> '/' <name>]* of Object View defining information associated with occurrences of this Event.

EV: Generated_by [<origin> ':' <identifier> '/' <name>]+ of the source of this Event.

BP: Object View Inputs [<origin> ':' <identifier> '/' <name>]+ of Object Views, occurrences of which can be received by a Business Process.

EA: Ending Statuses [<value> <priority>]+, ending status values produced by occurrences of this Enterprise Activity and their significance, where <value> is a mandatory 0-argument predicate and <priority> is an integer in a system-defined range representing the lowest and highest priorities respectively. By default, highest priority.

PR: Related-to [<identifier> '/' <name>]*, defining the Enterprise Objects that are related to this Product, where multiplicity [...]* is one of [0..*] (only for early modelling phases) or [1..1] or [1..n] or [m..n].

5.9 Support for modelling phases

This document aims at modelling of the enterprise supporting all enterprise model phases by modelling relevant language constructs as follows.

— At the domain identification phase, to identify the contents of the domain (its Business Processes) and its inputs and outputs, including Events, in such a way that the domain identification model can be used as the starting point for a derivation of a consistent concept definition model.

— At the concept definition phase, to define the business model of the enterprise with missions, strategies, etc., and in such a way that the concept definition model can be used as the starting point for a derivation of a consistent requirement definition model.

— At the requirements definition phase, to describe the Business Processes, Services and Enterprise Activities of the Domain from a business perspective, in such a way that the requirements definition model can be demonstrated to be sufficient for use as the starting point for the derivation of a consistent design specification model. The modelling process is eased by the availability of model Views (Function, Information, Resource and Organization – other views may be added if needed). These views are supported by a number of information objects (Enterprise, Resource, Organization) representing the many informational aspects of the enterprise operation. The requirements definition model shall also be capable of being verified by simulation.

— At the design specification phase, to specify the Enterprise Activities with all their components from both a business and Information and Communication Technology (ICT) perspective, in such a way that the design specification model can be demonstrated to be sufficient for use as the starting point for a consistent derivation of an implementation description model; therefore the design specification model shall also be capable of being processed for verification. In this phase, constructs shall be derived from those of the requirements definition phase by enriching them with properties that reflect all resources and general ICT interfaces.

— At the implementation description phase, constructs shall reflect the hardware/software platform or technology chosen to be consistent with design specification constructs. This means to describe the Business Processes, Services, and Enterprise Activities with all their components as they are

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implemented in the actual system from both a business and ICT perspective, in such a way that the implementation model can be demonstrated to be sufficient for use in the operation of the enterprise for decision support and Business Process monitoring and control; therefore the implementation model shall also be capable of being processed for final verification and release for operational use.

— At the domain operation phase, the released model is used for operational purposes such as decision support, monitoring and control.

— At the decommission definition phase, to identify future use of the Business Process and Service components, in such a way that the decommission definition model can be used, as appropriate, as the starting point for reuse at any model phase.

However, this does not mean there will be a different set of modelling language constructs required for each model phase. Constructs are carried forward to subsequent model phases by providing an enhanced attribute list to capture additional needed information for representing and describing the enterprise entities at those model phases or by mapping onto different construct representations.

5.10 Representation of relationships

The purpose of a relationship is to model time-varying and other associations between run-time instances of modelling language constructs. Reflexive relationships shall be permitted, i.e. a relationship can be created between an instance and itself.

EXAMPLE 1 Relationships between entities can be those between a part and the machine which is used to produce it, or those between a worker and the production order to which he or she has been assigned, as in: Produced_by (part, machine), Works_at (worker, order). Such relationships are represented through assignments as inputs and outputs.

EXAMPLE 2 Illustrative relationships between constructs are those between a Domain and its Business Processes or those between a Business Process and its sub-processes and activities.

The concept of a user-defined relationship is dependent on the concept of Enterprise Object described in 7.6 and on the model entities derived from that Enterprise Object (Resource, Product, Order, Organizational Unit, Decision Centre). A user-defined relationship is used to describe domain-dependent relationships as perceived and defined by the users, and to describe the way in which they group structuring and behavioural constructs in terms of their utilization within the enterprise. User-defined relationships can be expressed by Related-to lists in Enterprise Objects, Products, Orders and Object Views on Enterprise Objects, or by additional user-defined properties.

5.11 Specializations

Depending on the purpose of modelling, it can be helpful and necessary for the modeller to define specializations of the constructs defined in this document. Additionally, this document predefines several normative specializations in Clause 8, Derived constructs.

Specialization can be achieved by

— specializing the most appropriate construct (and corresponding template) and adapting the header information accordingly,

— adding a new ‘Specialization-of’ relationship at the appropriate model phases(s),

— assigning appropriate values for the ‘Specialization-of’ property and listing the construct (or, exceptionally, constructs) of which it is a specialization,

— assigning or constraining values for existing properties as appropriate, and

— adding additional properties as required and assigning model-unique names for these.

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Each construct can be further specialized into constructs of the same kind; for example, an Enterprise Object can be specialized into distinct kinds of Enterprise Object, Resource into further kinds of Resource, etc. A relationship 'Specialization-of' is introduced to hold these specialization relationships.

This document predefines several such specializations in Clause 7. Eight constructs (Capability, Decision Centre, Organizational Unit, Performance Indicator, Product, Order, Resource, and Role) are specializations of the Enterprise Object construct. These specializations can occur because the attributes and relationships of Enterprise Object exist whenever the object exists, even if some of those attributes and relationships are not shown as applicable to a relevant modelling phase.

NOTE The concept of specialization used in this document is less constrained than the specialization concept found in the domain of programming languages and object-oriented modelling.

5.12 Complementary concepts

The construct templates make use of several terms for conceptual representations that are not themselves constructs but are complementary and have a distinct significance and semantics for the purposes of enterprise modelling. These complementary concepts are as follows

— behavioural rule (see 7.2.5);

— constraint;

— declarative rule;

— integrity rule; and

— objective.

6 Conceptual structure

6.1 The four-component model

The classes underpinning this document are organized in terms of a meta-model and three sets of constructs – the core constructs, the derived constructs and the views. The Metamodel, Core and Derived components are normative sets (represented as packages in the illustrative UML class model of Figure 1) and the views are informative (represented as package View component).

NOTE There are many ways in which this conceptual structure can be represented, but this document uses UML class diagrams[9] as a notation that is well specified and widely accepted. Attributes and relationships are defined and normative within the normative parts of this document. They are illustrated using UML in informative figures and can be rendered in different ways in other modelling languages. UML is not necessarily intended as the basis of engineered instantiations, or as a starting point for the development of tools.

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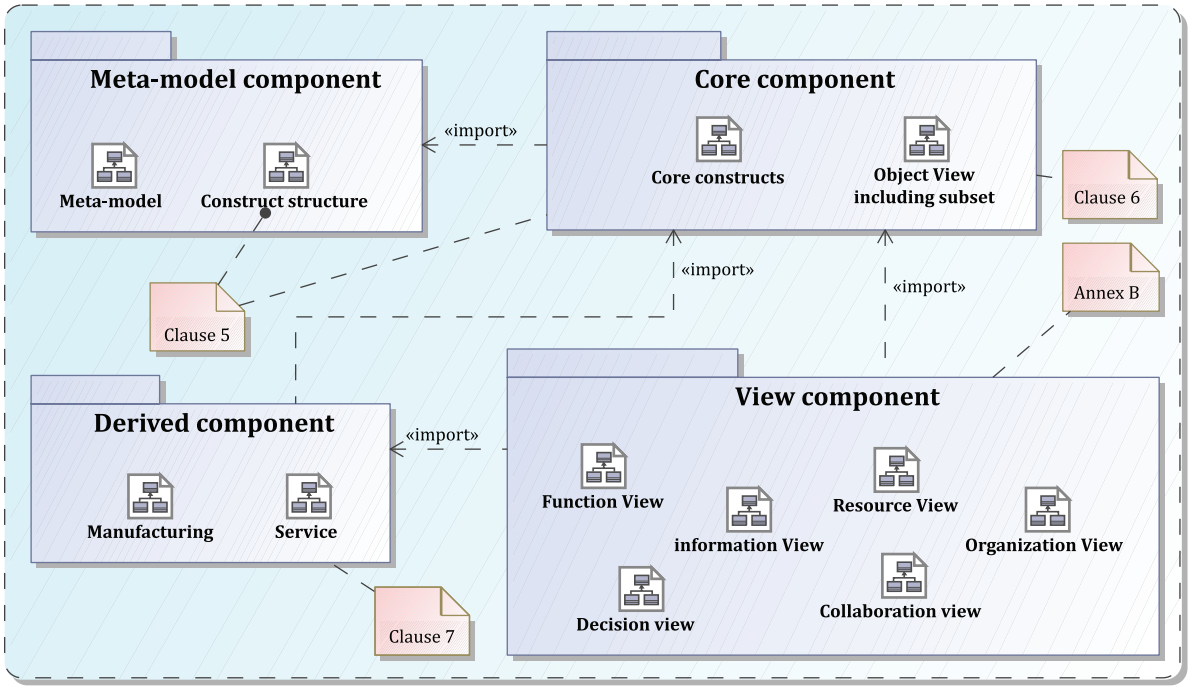
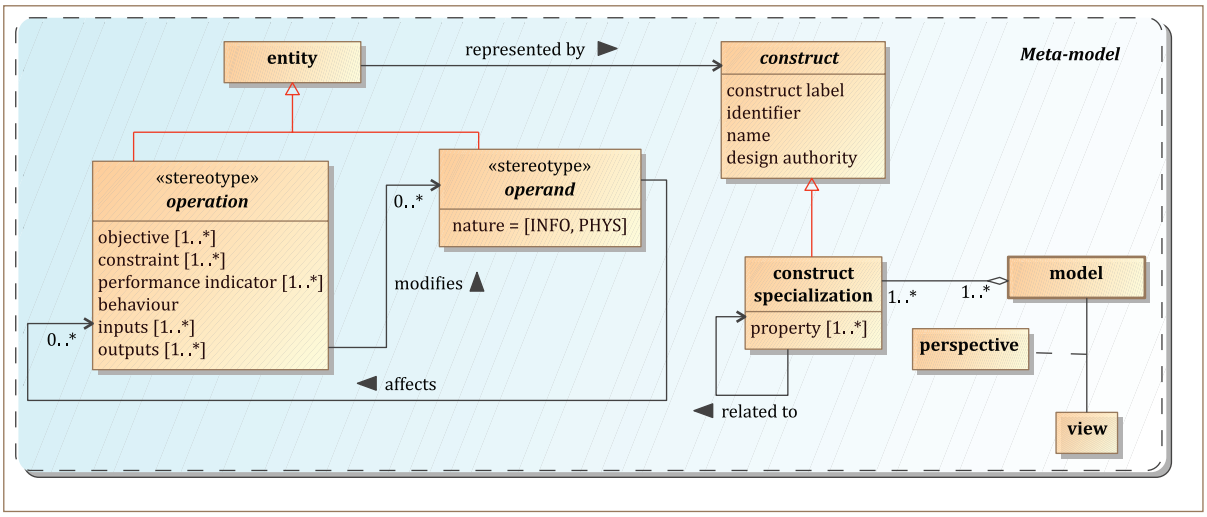


Figure 1 — Four component model

The <<import>> relations between the packages indicate that classes and relations in the meta-model are inherited by the core constructs and in turn those are both inherited by derived constructs and views.

6.2 Meta-model component

The normative components of the meta-model are illustrated as a UML diagram in Figure 2.



NOTE The inheritance relationships are coloured red to make them more visually distinguishable from other relationships.

Figure 2 — Meta-model

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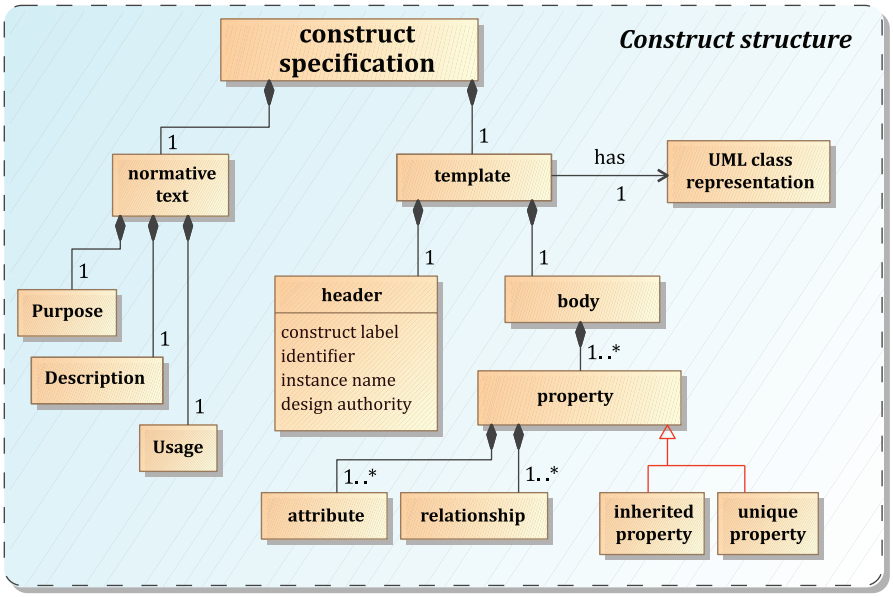
Any entity in the enterprise domain is extended by being stereotyped as either an operation seeking to achieve certain objectives by modifying and in turn being affected by operands, or as an operand having properties that are changed by the behaviour of the operation.

NOTE In UML, "stereotypes" refer to how an existing meta-class can be extended so allowing an additional notation to be used.

An entity can be represented by a construct, which can be specialized. Collections of these constructs and specializations can be combined into an enterprise model. A model can be simplified by using a perspective to produce a View that represents selected portions of that model to reflect an orientation relative to an identified domain of interest. (Views are defined in ISO 15704.)

A construct has a structure that is illustrated in Figure 3.



NOTE The UML class representation is not normative.

Figure 3 — Construct structure

A construct is specified in terms of normative text and a template defining its properties and immediate relationships with other constructs. The template contains a header that is common to all constructs and a body containing the attribute and relationship properties. Properties can either be inherited from generalizations or stereotypes of that construct or be unique to that construct.

6.3 Core component

The set of fifteen core constructs is illustrated in Figure 4.

The meta-model class labelled as "construct" is specified as being an abstract element (denoted by italicization in Figure 4), meaning that only instances of construct are defined as core constructs in this document. A model user cannot create new core constructs, although existing constructs may be specialized and construct properties may be modified, over-ridden or extended to meet new modelling requirements. Each core construct is specified in Clause 7.

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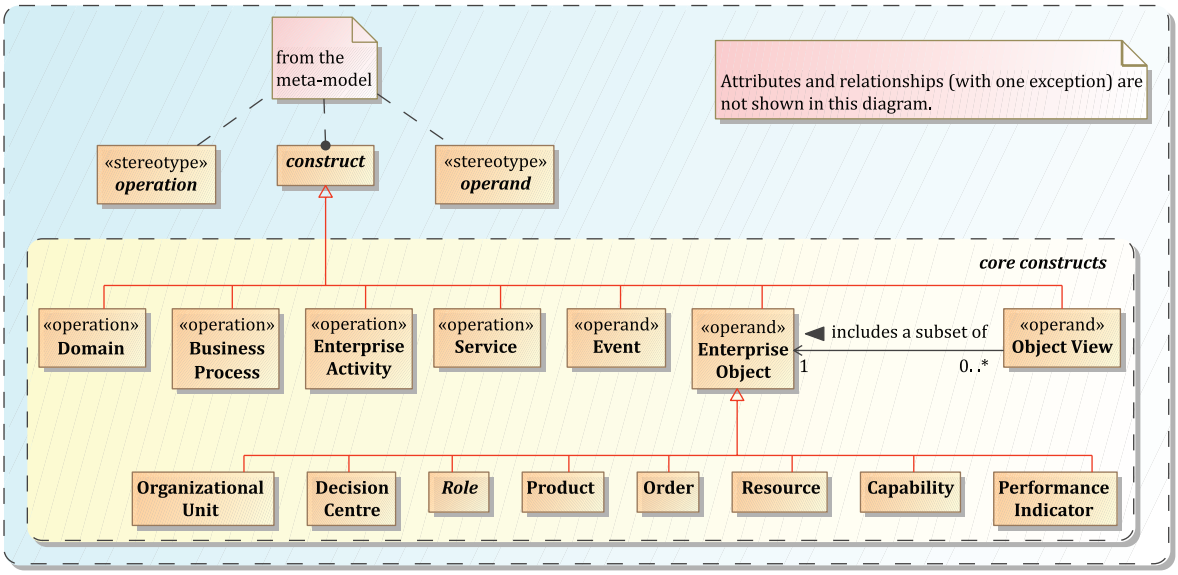

Figure 4 — Core constructs

Domain, Business Process and Service are stereotyped as operations having behaviour, inputs and outputs. Event, Enterprise Object and Object View are generated or modified by operations and so are stereotyped as operands. An Enterprise Object is specialized into Organizational Unit, Decision Centre, Role, Order, Product, Capability, Resource. and Performance Indicator.

NOTE Inherited properties are not shown explicitly in these UML diagrams.

Figure 4 omits construct attributes – those are shown in Figure 7. With one exception, Figure 4 also omits relationships between core constructs – those are shown in Figure B.1. The exception, the relationship between Enterprise Object and Object View, is because 'includes a subset of' is somewhat similar to a 'kind-of' inheritance relationship but not the same, since only some of the properties are inherited.

Since an Object View is a specialization of an Enterprise Object, a purpose-specific Object View is possible for any other specialization of an Enterprise Object as well, i.e. each specialization of an Enterprise Object may have specialized Object Views.

An Object View is created for a specific modelling purpose and suppresses the inherited attributes and relationships of the parent Enterprise Object that are not necessary for the intended purpose of the Object View. The Object View construct is illustrated in Figure 5.

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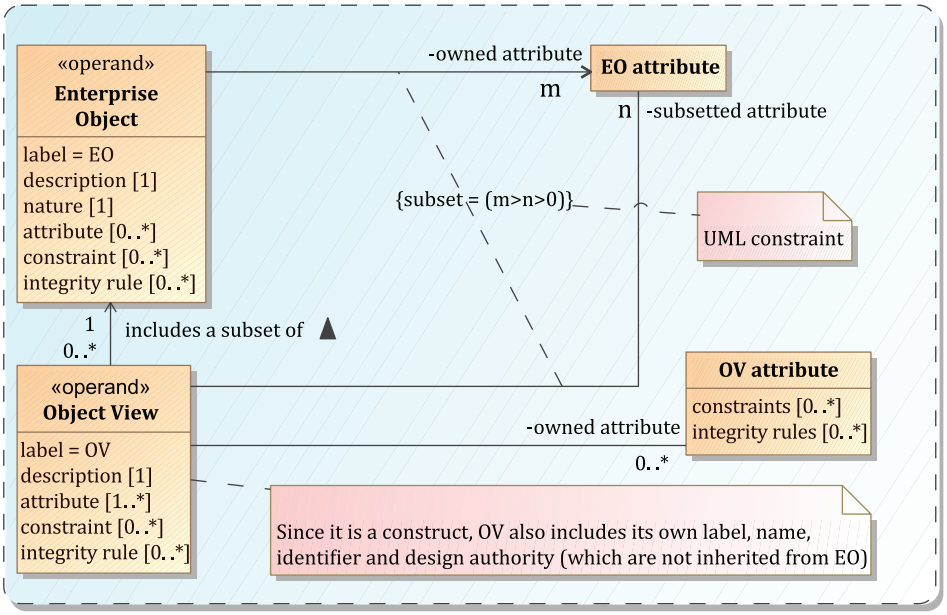

Figure 5 — Object View includes a subset of Enterprise Object

6.4 Derivations component

The set of core constructs can be further specialized as illustrated in Figure 6, and combined to form constructs, e.g. for application domains or distinct modelling purposes. In this document, such constructs are termed derived constructs and those for manufacturing- and service-oriented enterprises are specified in 8.2 and 8.3.

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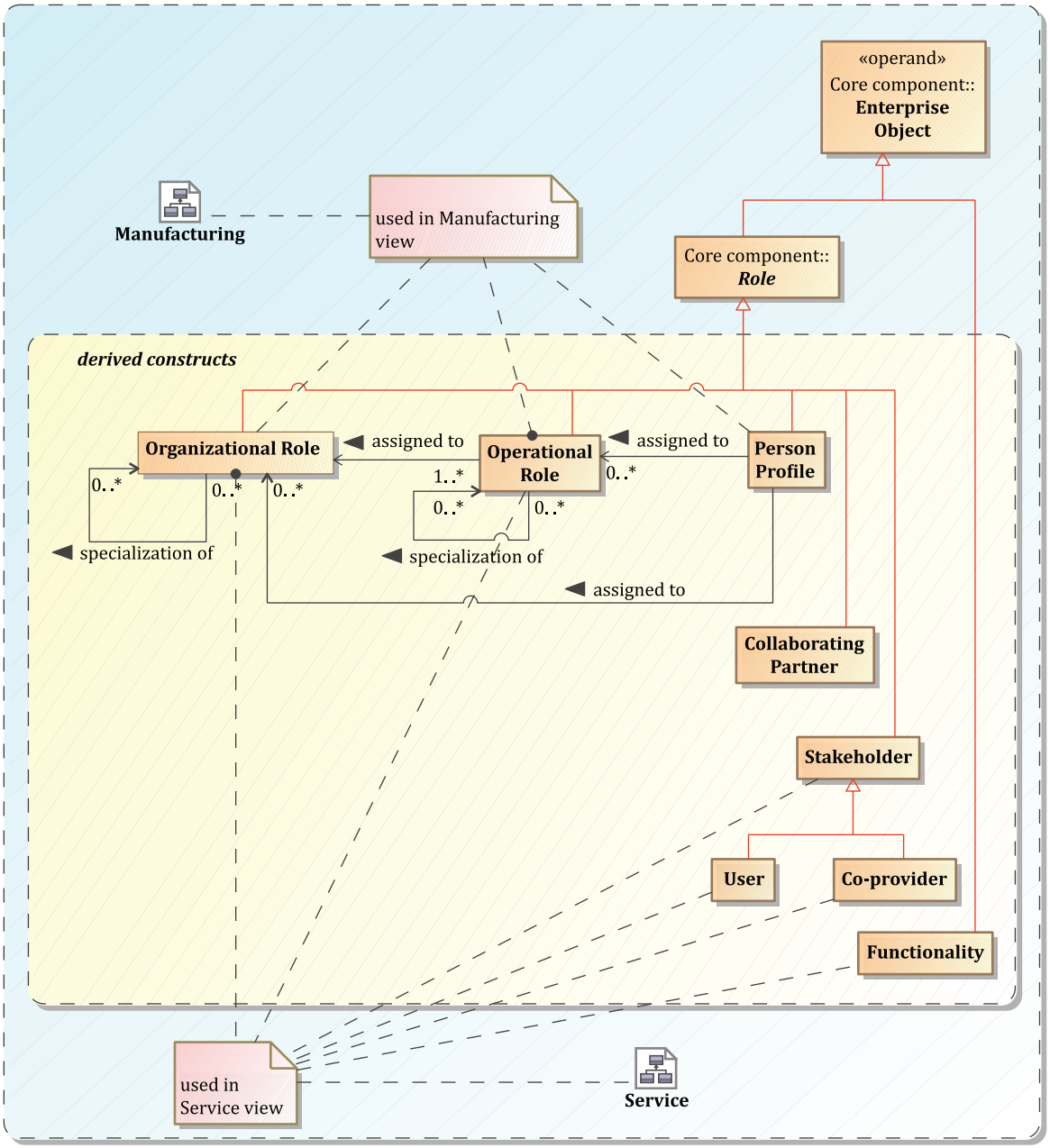

Figure 6 — Derived constructs

Figure 6 omits construct attributes – those are shown in Figure B.2.

6.5 Views component

While the Enterprise Object View construct supports creation of a construct containing a portion of the attributes and relationships of a particular Enterprise Object, the modelling concept of an enterprise model view does not create a new construct instance. Rather, an enterprise modelling view manifests selected content from several constructs, including both attributes and relationships, as a fragment of the source model from which they arise. If model content is compatible, an enterprise model view may span several source models.

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The open-ended set of views described in Annex B contains a view-based analysis of a manufacturing-oriented enterprise and example decision and collaboration views which also contain further constructs.

7 Core constructs

7.1 Domain

7.1.1 Purpose

The purpose of the domain construct is to represent the portion of an enterprise to be modelled, providing for identification of the relevant information. The information describes the boundary and the content of an enterprise or a portion of an enterprise for which the model will be created.

7.1.2 Description

A Domain construct shall describe the parts of the enterprise to model and the relationships with the external environment from a high-level management-oriented perspective. The model is subject to the business model of the enterprise, usually expressed by a given set of strategic and operational business objectives and constraints, and the purpose for which the model is created. The relations between strategic and operational objectives should be made visible as much as possible. The Domain inputs and outputs and their origins and destinations define the domain boundaries and the relations between inputs and outputs identify the required functionalities – the Business Processes and Services of the domain.

7.1.3 Usage

All model life cycle phases use the Domain construct. The Domain template shall enable

a) the capturing of all inter- and intra-organizational-related information relevant for strategic planning and decision support, and

b) its presentation in a form that is understandable by both humans and interpretable by digital technology.

The extent of attribute and relationship specification detail should be appropriate for the enterprise model phase applicable to the Domain construct's usage. The inclusion of an Event or Object View implies that the Event or associated Enterprise Object is also defined at the same model phase and level of detail.

7.1.4 Construct template for Domain

Table 1 — Domain template

Header	
Construct label	<Model-unique abbreviation> DM
Identifier	<Model-unique string> Modeller-assigned alphanumeric code in the form of a construct label, followed by an extended alphanumeric string (see 5.5), e.g. DM.1-2.
Name	[<adjective>]? <noun> Name of Domain, where <noun> indicates the scope of the Domain, and <adjective> optionally qualifies the Domain.
Design Authority	[<identifier> '/' <name>] ':' [<identifier> '/' <name>] Organizational Unit and Organizational Role respectively, having authority to design or maintain this Domain.

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Table 1 *(continued)*

Body	
Attributes relevant for domain identification and later phases	
Description	<string> Short textual description of the Domain.
Domain Inputs	[<name> [<short textual description>]?]+ Name and optionally short description of the main Domain inputs.
Domain Outputs	[<name> [<short textual description>]?]+ Name and optionally short description of the main Domain outputs.
Main Processes	[[<identifier>'/'<name>] [<functionality text>]?]+ List of Business Process and Services, each followed by an optional description of its functionality. The functionality text is a short description of the main functionality needed to transform Domain inputs into Domain outputs. The list of identified Business Processes or Services is restricted to those that are required to achieve the Domain objectives.
Objectives	[<objective>]+ Strategic and operational business objectives of this Domain.
Constraints	[<constraint>]* Constraints imposed on this Domain.
Attributes applicable at concept definition and later phases	
Domain Business Model	['Mission: ' <mission text>] ';' ['Vision: ' <vision text>] ';' ['Values: ' [<value text>]+] Short textual description of the domain's mission, vision and values.
Domain Operation	['Strategies: ' <strategy> text]* ';' ['Policies: ' <policy text>]* ';' ['Operational Concepts: ' [<operational concept]* ';' ['Business Plans: ' [<business plan]* Short textual description of the various strategies, policies, etc.
Decision Function Category	[[<verb>]? <noun>]* Name of the decision function categories that belong to the Domain.
Relationships relevant for domain identification and later phases	
Inputs/Outputs	
Object View Inputs	[<origin> ':' <identifier> '/' <name>]+ Identifiers and names of origins and Object Views which are available for this Domain at the boundary to the external environment.
Event Inputs	[<origin>] ':' <identifier> '/' <name>]+ Events, which can be received by this Domain from the external environment.
Object View Outputs	[<destination> ':' <identifier> '/' <name>]+ Object Views, which are made available by this Domain at the boundary to the external environment.
Event Outputs	[<destination> ':' <identifier> '/' <name>]+ Events which can be generated by this Domain for the external environment.
Relationships applicable at requirements definition and later phases	
Uses Business Processes	[<identifier> '/' <name>]* Business Processes used in this Domain.
Uses Services	[<identifier> '/' <name>]* Services used in this Domain.
Uses Performance Indicators	[<identifier> '/' <name>]+ Performance Indicators which are available for this Domain. *Performance indicators identify the required value or method by which achievement of the objectives can be assessed.*
Relationships applicable at design specification and later phases	
Operational Relationships	

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