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Automation systems and integration — Object-Process Methodology

Systèmes d'automatisation et intégration — Object-Process Methodology

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Contents

Page

Foreword ... **vi**
Introduction ... **vii**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **1**
4 Symbols ... **8**
5 Conformance ... **10**
6 Object-Process Methodology (OPM) principles and concepts ... **10**
6.1 OPM modelling principles ... 10
6.1.1 Modelling as a purpose-serving activity ... 10
6.1.2 Unification of function, structure, and behaviour ... 11
6.1.3 Identify functional value ... 11
6.1.4 Function versus behaviour ... 11
6.1.5 System boundary setting ... 12
6.1.6 Clarity and completeness trade-off ... 12
6.2 OPM fundamental concepts ... 12
6.2.1 Bimodal representation ... 12
6.2.2 OPM modelling elements ... 12
6.2.3 OPM things: objects and processes ... 13
6.2.4 OPM links: procedural and structural ... 13
6.2.5 OPM context management ... 14
6.2.6 OPM model implementation (informative) ... 14
7 OPM thing syntax and semantics ... **15**
7.1 Objects ... 15
7.1.1 Description ... 15
7.1.2 Representation ... 15
7.2 Processes ... 15
7.2.1 Description ... 15
7.2.2 Representation ... 16
7.3 OPM things ... 16
7.3.1 OPM thing defined ... 16
7.3.2 Object-process test ... 16
7.3.3 OPM thing generic properties ... 17
7.3.4 Default values of thing generic properties ... 17
7.3.5 Object states ... 18
8 OPM link syntax and semantics overview ... **20**
8.1 Procedural link overview ... 20
8.1.1 Kinds of procedural links ... 20
8.1.2 Procedural link uniqueness OPM principle ... 20
8.1.3 State-specified procedural links ... 20
8.2 Operational semantics and flow of execution control ... 20
8.2.1 Event-Condition-Action control mechanism ... 20
8.2.2 Preprocess object set and postprocess object set ... 21
8.2.3 Skip semantics of condition versus wait semantics of non-condition links ... 21
9 Procedural links ... **22**
9.1 Transforming links ... 22
9.1.1 Kinds of transforming links ... 22
9.1.2 Consumption link ... 22
9.1.3 Result link ... 23
9.1.4 Effect link ... 23
9.1.5 Basic transforming links summary ... 23

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9.2 Enabling links ... 24
9.2.1 Kinds of enabling links ... 24
9.2.2 Agent and agent link ... 24
9.2.3 Instrument and instrument link ... 24
9.2.4 Basic enabling links summary ... 25
9.3 State-specified transforming links ... 26
9.3.1 State-specified consumption link ... 26
9.3.2 State-specified result link ... 26
9.3.3 State-specified effect links ... 27
9.3.4 State-specified transforming links summary ... 29
9.4 State-specified enabling links ... 30
9.4.1 State-specified agent link ... 30
9.4.2 State-specified instrument link ... 30
9.4.3 State-specified enabling links summary ... 31
9.5 Control links ... 31
9.5.1 Kinds of control links ... 31
9.5.2 Event links ... 32
9.5.3 Condition links ... 37
9.5.4 Exception links ... 44

10 Structural links ... 45
10.1 Kinds of structural links ... 45
10.2 Tagged structural link ... 45
10.2.1 Unidirectional tagged structural link ... 45
10.2.2 Unidirectional null-tagged structural link ... 45
10.2.3 Bidirectional tagged structural link ... 46
10.2.4 Reciprocal tagged structural link ... 46
10.3 Fundamental structural relations ... 47
10.3.1 Kinds of fundamental structural relations ... 47
10.3.2 Aggregation-participation relation link ... 48
10.3.3 Exhibition-characterization link ... 49
10.3.4 Generalization-specialization and Inheritance ... 52
10.3.5 Classification-instantiation link ... 55
10.3.6 Fundamental structural relation link and tagged structural link summary ... 57
10.4 State-specified structural relations and links ... 58
10.4.1 State-specified characterization relation link ... 58
10.4.2 State-specified tagged structural relations ... 59

11 Relationship cardinalities ... 64
11.1 Object multiplicity in structural and procedural links ... 64
11.2 Object multiplicity expressions and constraints ... 66
11.3 Attribute value and multiplicity constraints ... 68

12 Logical operators: AND, XOR, and OR ... 68
12.1 Logical AND procedural links ... 68
12.2 Logical XOR and OR procedural links ... 70
12.3 Diverging and converging XOR and OR links ... 71
12.4 State-specified XOR and OR link fans ... 73
12.5 Control-modified link fans ... 74
12.6 State-specified control-modified link fans ... 74
12.7 Link probabilities and probabilistic link fans ... 75

13 Execution path and path labels ... 77

14 Context management with Object-Process Methodology (OPM) ... 79
14.1 Completing the system diagram (SD) ... 79
14.2 Achieving model comprehension ... 79
14.2.1 OPM refinement-abstraction mechanisms ... 79
14.2.2 Control (operational) semantics within an in-zoomed process context ... 83
14.2.3 OPM fact consistency principle ... 94
14.2.4 Abstraction ambiguity resolution for procedural links ... 95

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Annex A (normative) **Object-Process Language (OPL) formal syntax in Extended Bachus-Naur form (EBNF)** **98**
Annex B (informative) **Guidance for Object-Process Methodology (OPM)** **114**
Annex C (informative) **Modelling OPM using OPM** **117**
Annex D (informative) **OPM dynamics and simulation** **151**
Bibliography **157**

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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

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

This first edition cancels and replaces ISO/PAS 19450:2015, which has been technically revised.

The main changes are as follows:

— document designation from PAS to International Standard (this document);

— clarified several defined terms and added term cross references;

— added introduction statement for all figures and tables;

— clarified use of “may” or “can” as appropriate;

— corrected identified errors in figures and tables.

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

Object-Process Methodology (OPM) is a compact conceptual approach, language, and methodology for modelling and knowledge representation of automation systems. The application of OPM ranges from simple assemblies of elemental components to complex, multidisciplinary, dynamic systems. OPM is suitable for implementation and support by tools using information and computer technology. This document specifies both the language and methodology aspects of OPM in order to establish a common basis for system architects, designers, and OPM-compliant tool developers to model all kinds of systems.

OPM provides two semantically equivalent modalities of representation for the same model: graphical and textual. A set of hierarchically structured, interrelated Object-Process-Diagrams (OPDs) constitutes the graphical model, and a set of automatically generated sentences in a subset of the English language constitutes the textual model expressed in the Object-Process Language (OPL). In a graphical-visual model, each OPD consists of OPM elements, depicted as graphical symbols, sometimes with label annotation. The OPD syntax specifies the consistent and correct ways to manage the arrangement of those graphical elements. Using OPL, OPM generates the corresponding textual model for each OPD in a manner that retains the constraints of the graphical model. Since OPL's syntax and semantics are a subset of English natural language, domain experts easily understand the textual model.

OPM notation supports the conceptual modelling of systems with formal syntax and semantics. This formality serves as the basis for model-based systems engineering in general, including systems architecting, engineering, development, life cycle support, communication, and evolution. Furthermore, the domain-independent nature of OPM opens system modelling to the entire scientific, commercial and industrial community for developing, investigating and analysing manufacturing and other industrial and business systems inside their specific application domains, thereby enabling companies to merge and provide for interoperability of different skills and competencies into a common intuitive yet formal framework.

OPM facilitates a common view of the system under construction, test, integration, and daily maintenance, providing for working in a multidisciplinary environment. Moreover, using OPM, companies can improve their overall, big-picture view of the system's functionality, flexibility in assignment of personnel to tasks, and managing exceptions and error recovery. System specification is extensible for any necessary detail, encompassing the functional, structural and behavioural aspects of a system.

One particular application of OPM is in the drafting and authoring of technical standards. OPM helps sketch the implementation of a standard and identify weaknesses in the standard to reduce, thereby significantly improving the quality of successive drafts. With OPM, even as the model-based text of a system expands to include more details, the underlying model keeps maintaining its high degree of formality and consistency.

This document provides a baseline for system architects and designers, who can use it to model systems concisely and effectively. OPM tool vendors can utilise this document as a formal standard specification for creating software tools to enhance conceptual modelling.

This document provides a presentation of the normative text that follows the Extended Bachus Naur Form (EBNF) specification of the language syntax. All elements are presented in Clause 6 to 13 with only minimal reference to methodological aspects, Clause 14 presents the context management mechanisms related to in-zooming and unfolding.

NOTE OPM is an established modelling paradigm with a 15-year history of use in international commerce. As such, several conventions for its use and presentation already exist in the literature and practice.

This document uses the presentation conventions for the expression of OPM related constructs found in the originating and current literature for OPM. Using a different set of conventions, or simply applying the ISO/IEC Directives, Part 2 drafting guidelines for these terms and presentations, creates a discontinuity between this document and the supporting references and practice, and can cause confusion in application of this document to existing and future practice.

This document applies the following conventions for the presentation of OPM elements and terminology:

— The phrases and associated abbreviations “Object-Process Methodology (OPM)”, “Object-Process Diagram (OPD)” and “Object-Process Language (OPL)” are terms of art associated with the OPM paradigm and appear as specified with the hyphen and capitalization of each word in the phrase.

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— In OPD and OPL text, the object name and process name appear in Cambria bold font text with capitalization of each word to distinguish the object and process from the other OPD and OPL text. The same convention for object and process name bold capitalization is carried into the text of this document as well to indicate that in the text, the word or phrase corresponds to an OPM object or process.

— In OPD and OPL text, the object state label and attribute value label appear in Cambria bold font text in lowercase, and somewhat smaller font in OPD figures, to distinguish the object state label and attribute value label from the other OPD and OPL text. The same convention for object state label and attribute value label in bold font lowercase is carried into the text of this document as well to indicate that in the text, the word or phrase corresponds to an OPM object state label or attribute value label.

— In OPD and OPL text, link tags that are not user-specified appear in Cambria lowercase, and somewhat smaller font in OPD. Link tags that are user-specified appear as entered by the user in Cambria bold font text, and somewhat smaller font in OPD.

— In OPL, the first letter of the first word of a sentence is capitalized.

— Some of these conventions are repeated in the text as appropriate to remind the reader of the distinctions. Some OPD figures contain colour to help distinguish OPM modelling element type distinctions.

Most figures contain both a graphical image, the OPD portion, and a textual equivalent, the OPL portion of the figure. Because this is a language specification, the precise use of term definitions is essential and several terms in common use have particular meaning when using OPM. In addition to those listed above as OPM presentation conventions, Annex B explains other conventions for the use of OPM.

Annex A presents the formal syntax for OPL, in EBNF form.

Annex B presents conventions and patterns commonly used in OPM applications.

Annex C presents aspects of OPM as OPM models.

Annex D summarizes the dynamic and simulation capabilities of OPM.

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Automation systems and integration — Object-Process Methodology

1 Scope

This document specifies Object-Process Methodology (OPM) with detail sufficient for enabling practitioners to utilise the concepts, semantics, and syntax of OPM as a modelling paradigm and language for producing conceptual models at various extents of detail, and for enabling tool vendors to provide application modelling products to aid those practitioners.

While this document presents some examples for the use of OPM to improve clarity, it does not attempt to provide a complete reference for all the possible applications of OPM.

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 terminology databases for use in standardization at the following addresses:

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

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

Note 1 to entry To facilitate a term search, terms are in alphabetical sequence.

3.1
abstraction, noun
outcome of an *abstraction process* (3.2)

3.2
abstraction process
decreasing the extent of detail and system model *completeness* (3.9) in order to achieve better comprehension

3.3
affectee
transformee (3.79) that is affected by a *process* (3.59) occurrence, i.e. its *state* (3.69) changes

Note 1 to entry: An affectee can only be a stateful object. A stateless object can only be created or consumed, but not affected.

3.4
agent
enabler (3.18) that is a human or a group of humans

3.5
attribute
object (3.40) that characterizes a *thing* (3.77) other than itself

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