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Information technology — Open Distributed Processing — Unified Modeling Language (UML) Version 1.4.2

Technologies de l'information — Traitement distribué ouvert — Langage de modélisation unifié (UML), version 1.4.2

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Preface

The Unified Modeling Language (UML) is a graphical language for visualizing, specifying, constructing, and documenting the artifacts of a software-intensive system. The UML offers a standard way to write a system's blueprints, including conceptual things such as business processes and system functions as well as concrete things such as programming language statements, database schemas, and reusable software components.

The UML represents the culmination of best practices in practical object-oriented modeling. The UML is the product of several years of hard work, in which we focused on bringing about a unification of the methods most used around the world, the adoption of good ideas from many quarters of the industry, and, above all, a concentrated effort to make things simple.

We mean "we" in the most general sense. The three of us started the UML effort at Rational and were its original chief methodologists, but the final product was a team effort among many UML partners under the sponsorship of OMG. All partners came with their own perspectives, areas of concern, and areas of interest; this diversity of experience and viewpoints has enriched and strengthened the final result. We extend our personal thanks to everyone who was a part of making the UML a reality. We would like to thank Rational for giving us the opportunity to work freely so that we might focus on unification, and we want to recognize all the other companies representing the UML partners for seeing the importance of the UML to the industry as a whole and giving their representatives time to work on this project. We must also thank the OMG for providing the framework under which we could bring together many diverse opinions to develop a consensus result. We expect that OMG’s ownership of the UML standard and the public’s free access to it will ensure the widespread use and advancement of UML technology over the coming years.

In an effort that involved so many companies and individuals with so many agendas, one would think that the resulting product would be the software equivalent of a camel: a most dysfunctional-looking animal that appears to have been the work product of an ill-formed committee of misfits. The UML most decidedly is not a random collection of political compromises. If anything, because of the focus we placed upon creating a complete and formal model, the UML is coherent and has harmony of design.

In this context it is also exciting to point out that the UML was developed alongside, and with the full collaboration, of the OMG's Meta-Object Facility (MOF) team. The MOF, which represents the state of the art in distributed object repository architectures, is OMG's adopted technology for modeling and representing metadata (including the UML metamodel) as CORBA objects. The UML and MOF standards are key building blocks of OMG's development environment for building and deploying distributed object systems.

It is a very real sign of maturity of the industry that the UML exists as a standard. At a time when software is increasingly more complex and more central to the mission of companies and countries, the UML comes at the right time to help organizations deal with this complexity. Already, without a lot of the fanfare or hype sometimes associated with programming languages, the UML is in use in hundreds (if not thousands) of projects around the world, a sign that it is part of the mainstream of engineering software.

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO/IEC 19501 was prepared by Technical Committee ISO/IEC/TC JTC1, Information technology, Subcommittee SC 7, Software and System Engineering in collaboration with the Object Management Group (OMG), following the submission and processing as a Publicly Available Specification (PAS) of the OMG Unified Modeling Language (UML) specification Version 1.4.2.

While not limited to this context, the UML standard is closely related to work on the standardization of Open Distributed Processing (ODP), the coordinating framework for which is provided by ITU-T Recommendations X.901-904 | ISO/IEC 10746, the Reference Model of Open Distributed Processing (RM-ODP).

Apart from this Foreword, the text of this International Standard is identical with that for the OMG specification for UML 1.4.2 (OMG reference formal/04-07-02).

Introduction

The Unified Modeling Language (UML) is a general-purpose modeling language with a semantic specification, a graphical notation, an interchange format, and a repository query interface. It is designed for use in object-oriented software applications, including those based on technologies recommended by the Object Management Group (OMG). As such, it serves a variety of purposes including, but not limited to, the following:

- a means for communicating requirements and design intent,
- a basis for implementation (including automated code generation),
- a reverse engineering and documentation facility.

As an international standard, the various components of UML provide a common foundation for model and metadata interchange:

- between software development tools,
- between software developers, and
- between repositories and other object management facilities.

The existence of such a standard facilitates the communication between standardized UML environments and other environments.

While not limited to this context, the UML standard is closely related to work on the standardization of Open Distributed Processing (ODP).

The rapid growth of distributed processing has lead to a need for a coordinating framework for this standardization and ITU-T Recommendations X.901-904 | ISO/IEC 10746, the Reference Model of Open Distributed Processing (RM-ODP) provides such a framework. It defines an architecture within which support of distribution, interoperability and portability can be integrated.

RM-ODP Part 2 (ISO/IEC 10746-2) defines the foundational concepts and modeling framework for describing distributed systems. The scopes and objectives of the RM-ODP Part 2 and the UML, while related, are not the same and, in a number of cases, the RM-ODP Part 2 and the UML specification use the same term for concepts which are related but not identical (e.g., interface). Nevertheless, a specification using the Part 2 modeling concepts can be expressed using UML with appropriate extensions (using stereotypes, tags and constraints).

RM-ODP Part 3 (ISO/IEC 10746-3) specifies a generic architecture of open distributed systems, expressed using the foundational concepts and framework defined in Part 2. Given the relation between UML as a modeling language and Part 2 of the RM ODP standard, it is easy to show that UML is suitable as a notation for the individual viewpoint specifications defined by the RM-ODP.

Structure of this standard

Chapters 1-3: Scope, Normative References, and **General Information**.

Chapter 4: UML Semantics - Specifies semantics for structural and behavioral object models. Structural models (also known as static models) emphasize the structure of objects in a system, including their classes, interfaces, attributes and relations.

Chapter 5: UML Notation Guide - Describes the notation for the visual representation of the Unified Modeling Language (UML). This notation document contains brief summaries of the semantics of UML constructs, but the UML Semantics chapter must be consulted for full details.

Chapter 6: UML Example Profiles - Contains these examples: Example 1: UML Profile for Software Development Processes and Example 2 - UML Profile for Business Modeling.

Chapter 7: UML Model Interchange - UML model interchange is based on the Metaobject Facility (MOF) 1.3 Specification. The UML Semantics abstract syntax is mapped to a set of MOF packages called the UML Interchange Metamodel.

Chapter 8: Object Constraint Language Specification - Introduces and defines the Object Constraint Language (OCL), a formal language used to express constraints.

Annex A: UML Standard Elements

Annex B: Standard Legal Information

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1 Scope

This standard specifies the Unified Modeling Language (UML) with the objective of providing system architects working on object analysis and design with one consistent language for specifying, visualizing, constructing, and documenting the artifacts of software systems, as well as for business modeling.

This standard represents the convergence of best practices in the object-technology industry. UML is the proper successor to the object modeling languages of three previously leading object-oriented methods (Booch, OMT, and OOSE). The UML is the union of these modeling languages and more, since it includes additional expressiveness to handle modeling problems that these methods did not fully address.

One of the primary goals of UML is to advance the state of the industry by enabling object visual modeling tool interoperability. However, in order to enable meaningful exchange of model information between tools, agreement on semantics and notation is required. UML meets the following requirements:

- Formal definition of a common object analysis and design (OA&D) metamodel to represent the semantics of OA&D models, which include static models, behavioral models, usage models, and architectural models.
- IDL specifications for mechanisms for model interchange between OA&D tools. This document includes a set of IDL interfaces that support dynamic construction and traversal of a user model.
- A human-readable notation for representing OA&D models. This document defines the UML notation, an elegant graphic syntax for consistently expressing the UML's rich semantics. Notation is an essential part of OA&D modeling and the UML.

2 Normative references

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid.

All Recommendations and Standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The Telecommunication Standardization Bureau of the ITU maintains a list of currently valid ITU-T Recommendations.

2.1 Identical Recommendations | International Standards

- ITU-T Recommendation X.902 (1995) | ISO/IEC 10746-2:1995, OpenDistributed Processing - Reference Model: Foundations
- ITU-T Recommendation X.903 (1995) | ISO/IEC 10746-3:1995, OpenDistributed Processing - Reference Model: Architecture
- ISO/IEC 15474-1:2002(E): Information technology - CDIF framework - Part 1: Overview

- ISO/IEC 15474-2:2002(E): Information technology - CDIF framework - Part 2: Modelling and extensibility
- ISO/IEC 15475-1:2002(E): Information technology - CDIF transfer format - Part 1: General rules for syntaxes and encodings
- ISO/IEC 15475-2:2002(E): Information technology - CDIF transfer format - Part 2: Syntax SYNTAX.1
- ISO/IEC 15475-3:2002(E): Information technology - CDIF transfer format - Part 3: Encoding ENCODING.1
- ISO/IEC 15476-1:2002(E): Information technology - CDIF semantic metamodel - Part 1: Foundation
- ISO/IEC 15476-2:2002(E): Information technology - CDIF semantic metamodel - Part 2: Common
- ISO/IEC 15476-3 (under development): Information technology - CDIF semantic metamodel - Part 3: Data Definition
- ISO/IEC 15476-4 (under development): Information technology - CDIF semantic metamodel - Part 4: Data Models
- ISO/IEC 15476-5 (under development): Information technology - CDIF semantic metamodel - Part 5: Data Flow Models
- ISO/IEC 15476-6 (under development): Information technology - CDIF semantic metamodel - Part 5: State/Event Models