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Information technology — Open Distributed Processing — Use of UML for ODP system specifications

Technologies de l'information — Traitement réparti ouvert — Utilisation de l'UML pour les spécifications de système ODP

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Foreword

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

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ISO/IEC 8825-7 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and systems engineering*, in collaboration with ITU-T. The identical text is published as ITU-T X.906 (10/2014).

Introduction

The rapid growth of distributed processing has led to the adoption of the reference model of open distributed processing (RM-ODP), which provides a coordinating framework for the standardization of open distributed processing (ODP). It creates an architecture within which support of distribution, interworking and portability can be integrated. This architecture provides a framework for the specification of ODP systems.

The reference model of open distributed processing is based on precise concepts derived from current distributed processing developments and, as far as possible, on the use of formal description techniques for specification of the architecture. It does not recommend any notation.

The Unified Modeling Language™ (UML®) was developed by the Object Management Group™ (OMG™). It provides a notation for modelling in support of information system design and is widely used throughout the IT industry as the language and notation of choice.

This Recommendation | International Standard refines and extends the definition of how ODP systems are specified by defining the use of the unified modelling language for the expression of ODP system specifications.

0.1 RM-ODP

The RM-ODP consists of:

- Part 1 [Rec. ITU-T X.901 | ISO/IEC 10746-1]: Overview, which contains a motivational overview of ODP, giving scoping, justification and explanation of key concepts, and an outline of the ODP architecture. It contains explanatory material on how the RM-ODP is to be interpreted and applied by its users, who may include standards writers and architects of ODP systems. It also contains a categorization of required areas of standardization expressed in terms of the reference points for conformance identified in Rec. ITU-T X.903 | ISO/IEC 10746-3. This part is informative.
- Part 2 [Rec. ITU-T X.902 | ISO/IEC 10746-2]: Foundations, which contains the definition of the concepts and analytical framework for normalised description of (arbitrary) distributed processing systems. It introduces the principles of conformance to ODP standards and the way in which they are applied. This is only to a level of detail sufficient to support Rec. ITU-T X.903 | ISO/IEC 10746-3 and to establish requirements for new specification techniques. This part is normative.
- Part 3 [Rec. ITU-T X.903 | ISO/IEC 10746-3]: Architecture, which contains the specification of the required characteristics that qualify distributed processing as open. These are the constraints to which ODP standards shall conform. It uses the descriptive techniques from Rec. ITU-T X.902 | ISO/IEC 10746-2. This part is normative.
- Part 4 [Rec. ITU-T X.904 | ISO/IEC 10746-4]: Architectural semantics, which contains a formalization of the ODP modelling concepts defined in Rec. ITU-T X.902 | ISO/IEC 10746-2 clauses 8 and 9. The formalization is achieved by interpreting each concept in terms of the constructs of one or more of the different standardized formal description techniques. This part is normative.

In the same series as the RM-ODP are a number of other standards and recommendations, and, of these, the chief that concerns this Recommendation | International Standard is:

- The Enterprise Language [Rec. ITU-T X.911 | ISO/IEC 15414], which refines and extends the enterprise language defined in Rec. ITU-T X.903 | ISO/IEC 10746-3 to enable full enterprise viewpoint specification of an ODP system.

0.2 UML

The Unified Modelling Language (UML) is a visual language for specifying and documenting the artefacts of systems. It is a general-purpose modelling language that can be used with all major object and component methods and that can be applied to all application domains (e.g., in health, finance, telecommunications, or aerospace) and implementation platforms (e.g., J2EE, CORBA®, .NET).

The version of UML currently adopted as an International Standard (ISO/IEC 19505) is UML 2.4.1. UML version 2 has been structured modularly, with the ability to select only those parts of the language that are of direct interest. It is extensible, so it can be easily tailored to meet the specific user requirements. The UML specification defines thirteen types of diagram, divided in two categories that represent, respectively, the static structure of the objects in a system (structure diagrams) and the dynamic behaviour of the objects in a system (behaviour diagrams). In addition, UML incorporates extension mechanisms that allow the definition of new dialects of UML (managed using UML profiles) to customize the language for particular platforms and domains.

The UML specification is defined using a metamodelling approach (i.e., a metamodel is used to specify the model that comprises UML). That metamodel has been constructed so that the resulting family of UML languages is fully aligned with the rest of the OMG specifications (e.g., MOF™, OCL, XMI®) and to allow the exchange of models between tools.

0.3 Overview and motivation

Part 3 of the reference model, Rec. ITU-T X.903 | ISO/IEC 10746-3 defines a framework for the specification of ODP systems comprising

a) five viewpoints, called enterprise, information, computational, engineering and technology, which provide a basis for the specification of ODP systems;

b) a viewpoint language for each viewpoint, defining concepts and rules for specifying ODP systems from the corresponding viewpoint.

This Recommendation | International Standard defines:

– use of the viewpoints prescribed by the RM-ODP to structure UML system specifications;

– rules for expressing RM-ODP viewpoint languages and specifications with UML and UML extensions (e.g., UML profiles).

It allows UML tools to be used to process viewpoint specifications, facilitating the software design process. Currently there is growing interest in the use of UML for system modelling. However, there is no widely agreed approach to the structuring of such specifications. This adds to the cost of adopting the use of UML for system specification, hampers communication between system developers and makes it difficult to relate or merge system specifications where there is a need to integrate IT systems.

The RM-ODP defines essential concepts necessary to specify open distributed processing systems from five prescribed viewpoints and provides a framework for the structuring of specifications for distributed systems. However, the RM-ODP prescribes neither a notation, nor a model development method.

This Recommendation | International Standard provides the necessary framework for ODP system specification using UML. It defines both a UML based notation for the expression of such specifications, and an approach for structuring of them using the notation, thus providing the basis for model development methods.

By defining how UML and UML extensions should be used to express RM-ODP viewpoint specifications, the standard enables the ODP viewpoints and ODP architecture to provide the needed framework for system specification using UML.

This Recommendation | International Standard contains the following annexes:

– Annex A: An example of ODP specifications using UML;

– Annex B: An example of the representation of deontic concepts.

These annexes are not normative.

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ITU-T RECOMMENDATION

Information technology – Open distributed processing – Use of UML for ODP system specifications

1 Scope

This Recommendation | International Standard defines use of the unified modelling language (UML 2.4.1 superstructure specification, ISO/IEC 19505-2, for expressing system specifications in terms of the viewpoint specifications defined by the reference model of open distributed processing (RM-ODP, Rec. ITU-T X.901 to X.904 | ISO/IEC 10746 Parts 1 to 4) and the Enterprise Language (Rec. ITU-T X.911 | ISO/IEC 15414). It covers:

a) the expression of a system specification in terms of RM-ODP viewpoint specifications using defined UML concepts and extensions (e.g., structuring rules, technology mappings, etc.);

b) relationships between the resultant RM-ODP viewpoint specifications.

This Recommendation | International Standard is intended for the following audiences:

– ODP modellers who want to use the UML notation for expressing their ODP specifications in a graphical and standard way;

– UML modellers who want to use the RM-ODP concepts and mechanisms to structure their UML system specifications;

– modelling tool suppliers, who wish to develop UML-based tools that are capable of expressing RM-ODP viewpoint specifications.

2 Normative references

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | 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 Recommendation | 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

– Recommendation ITU-T X.901 (1997) | ISO/IEC 10746-1:1998, *Information technology – Open Distributed Processing – Reference Model: Overview*.

– Recommendation ITU-T X.902 (2009) | ISO/IEC 10746-2:2010, *Information technology – Open Distributed Processing – Reference Model: Foundations*.

– Recommendation ITU-T X.903 (2009) | ISO/IEC 10746-3:2010, *Information technology – Open Distributed Processing – Reference Model: Architecture*.

– Recommendation ITU-T X.904 (1997) | ISO/IEC 10746-4:1998, *Information technology – Open Distributed Processing – Reference Model: Architectural semantics*.

– Recommendation ITU-T X.911 (2012) | ISO/IEC 15414:2013, *Information technology – Open distributed processing – Reference model – Enterprise language*.

– Recommendation ITU-T X.725 | ISO/IEC 10165-7, *Information Technology – Open Systems Interconnection – Structure of Management Information – Part 7: General Relationship Model*

2.2 Additional References

– Recommendation ITU-T X.950 (1997), *Information technology – Open distributed processing – Trading function: Specification.*

– Recommendation ITU-T X.960 (1999), *Information Technology – Open Distributed Processing – Type Repository Function.*

– ISO/IEC 19505-2:2012, *Information Technology – OMG Unified Modeling Language – Superstructure*.