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Information technology — Open Distributed Processing — Reference Model: Architectural semantics

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. 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.

International Standard ISO/IEC 10746-4 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 33, *Distributed application services*, in collaboration with ITU-T. The identical text is published as ITU-T Recommendation X.904.

ISO/IEC 10746 consists of the following parts, under the general title *Information technology — Open Distributed Processing — Reference Model:*

— *Part 1: Overview*

— *Part 2: Foundations*

— *Part 3: Architecture*

— *Part 4: Architectural semantics*

Introduction

This Recommendation | International Standard is an integral part of the ODP Reference Model. It contains a formalisation of the ODP modeling concepts defined in ITU-T Rec. X.902 | ISO/IEC 10746-2, clauses 8 and 9. The formalisation is achieved by interpreting each concept in terms of the constructs of the different standardised formal description techniques.

This Recommendation | International Standard is accompanied by an amendment and a technical report. The associated amendment focuses on the formalisation of the computational viewpoint language contained in ITU-T Rec. X.903 | ISO/IEC 10746-3. The associated technical report contains examples on how the formalisation of the ODP Reference Model can be applied to develop specifications.

INTERNATIONAL STANDARD

ITU-T RECOMMENDATION

INFORMATION TECHNOLOGY – OPEN DISTRIBUTED PROCESSING – REFERENCE MODEL: ARCHITECTURAL SEMANTICS

1 Scope

The rapid growth of distributed processing has lead to a need for a coordinating framework for the standardization of Open Distributed Processing (ODP). This Reference Model of ODP provides such a framework. It creates an architecture within which support of distribution, interworking, interoperability and portability can be integrated.

The Basic Reference Model of Open Distributed Processing (RM-ODP), (see ITU-T Recs. X.901 to X.904 | ISO/IEC 10746), 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.

The RM-ODP consists of:

- ITU-T Rec. X.901 | ISO/IEC 10746-1: **Overview**: Contains a motivational overview of ODP giving scooping, justification and explanation of key concepts, and an outline of ODP architecture. This part is not normative.
- ITU-T Rec. X.902 | ISO/IEC 10746-2: **Foundations**: Contains the definition of the concepts and analytical framework and notation for normalized description of (arbitrary) distributed processing systems. This is only to a level of detail sufficient to support ITU-T Rec. X.903 | ISO/IEC 10746-3 and to establish requirements for new specification techniques. This part is normative.
- ITU-T Rec. X.903 | ISO/IEC 10746-3: **Architecture**: Contains the specification of the required characteristics that qualify distributed processing as open. These are the constraints to which ODP standards must conform. It uses the descriptive techniques from ITU-T Rec. X.902 | ISO/IEC 10746-2. This part is normative.
- ITU-T Rec. X.904 | ISO/IEC 10746-4: **Architectural Semantics**: Contains a formalisation of the ODP modeling concepts defined in ITU-T Rec. X.902 | ISO/IEC 10746-2, clauses 8 and 9, and a formalisation of the viewpoint languages of ITU-T Rec. X.903 | ISO/IEC 10746-3. The formalisation is achieved by interpreting each concept in terms of the constructs of the different standardized formal description techniques. This part is normative.

The purpose of this Recommendation | International Standard is to provide an architectural semantics for ODP. This essentially takes the form of an interpretation of the basic modeling and specification concepts of ITU-T Rec. X.902 | ISO/IEC 10746-2 and viewpoint languages of ITU-T Rec. X.903 | ISO/IEC 10746-3, using the various features of different formal specification languages. An architectural semantics is developed in four different formal specification languages: LOTOS, ESTELLE, SDL and Z. The result is a formalization of ODP's architecture. Through a process of iterative development and feedback, this has improved the consistency of ITU-T Rec. X.902 | ISO/IEC 10746-2 and ITU-T Rec. X.903 | ISO/IEC 10746-3.

An architectural semantics provides the additional benefits of:

- assisting the sound and uniform development of formal descriptions of ODP systems; and
- of permitting uniform and consistent comparison of formal descriptions of the same standard in different formal specification languages.

Rather than provide a mapping from all the concepts of ITU-T Rec. X.902 | ISO/IEC 10746-2, this Recommendation | International Standard focuses on the most basic. A semantics for the higher level architectural concepts is provided indirectly through their definition in terms of the basic ODP concepts.

Examples of the use of some of the formal specification languages in this report can be found in TR 10167 (Guidelines for the Application of ESTELLE, LOTOS and SDL).

In the following clauses, the concepts are numbered in accordance with the scheme used in ITU-T Rec. X.902 | ISO/IEC 10746-2.

This Recommendation | International Standard specifies an architectural semantics for ODP. This is required to:

- provide formalisation of the ODP modelling concepts;
- assist sound and uniform development of formal descriptions of standards for distributed systems;
- act as a bridge between the ODP modelling concepts and the semantic models of the specification languages: LOTOS, SDL, ESTELLE and Z;
- provide a basis for uniform and consistent comparison between formal descriptions of the same standard in specification languages that are used to develop an architectural semantics.

This part is normative.

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.

- ISO/IEC 8807:1989, *Information processing systems – Open Systems Interconnection – LOTOS – A formal description technique based on the temporal ordering of observational behaviour.*
- ITU-T Recommendation Z.100 (1993), *CCITT Specification and Description Language (SDL).*
- ISO/IEC TR 10167:1991, *Information technology – Open Systems Interconnection – Guidelines for the application of Estelle, LOTOS and SDL.*
- ISO/IEC 13568[1)], *Information technology – Programming Languages their Environments and System Software Interfaces, Z Specification language.*
- The Z Notation, *A Reference Manual, J.M. Spivey, International Series in Computer Science, Second Edition, Prentice-Hall International,* 1992.
- ISO/IEC 9074:1997, *Information technology – Open Systems Interconnection – Estelle: A formal description technique based on an extended state transition model.*

[1)] Currently at the stage of draft.