

INTERNATIONAL STANDARD

ISO/IEC 10040

First edition
1992-11-01

Information technology — Open Systems Interconnection — Systems management overview

iTeh STANDARD PREVIEW

*Technologies de l'information — Interconnexion de systèmes ouverts
(OSI) — Aperçu général de la gestion-système*

ISO/IEC 10040:1992

<https://standards.iteh.ai/catalog/standards/sist/a0242715-47e4-456e-a7e5-9b9a06cfb67c/iso-iec-10040-1992>



Reference number
ISO/IEC 10040:1992(E)

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Printed in Switzerland

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 participate 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 10040 was prepared by the Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in collaboration with CCITT. The identical text is published as CCITT Recommendation X.701.

Annex A forms an integral part of ISO/IEC 10040.

Annex B is for information only.

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INTERNATIONAL STANDARD

CCITT RECOMMENDATION

INFORMATION TECHNOLOGY – OPEN SYSTEMS INTERCONNECTION – SYSTEMS MANAGEMENT OVERVIEW

1 Scope

This Recommendation | International Standard

- provides an overview to the family of systems management standards;
- establishes the basis for partitioning the systems management standards into separate groups, specifying the scope of each group and identifying the principal components within each group;
- gives guidance on the development of systems management standards and identifies the way they relate to each other;
- defines terms for use by other systems management standards.
- is applicable to the definition of all systems management standards and to all aspects of systems management of whatever scale;
- is applicable to situations in which the responsibility for systems management is centralised and those where it is decentralised;
- establishes a model for systems management, identifies several aspects of systems management (i.e., information, functional, communications, and organizational), and further refines the model to clarify these aspects;
- identifies the principles governing conformance requirements and conformance claims to systems management standards.

There are no conformance requirements on the main body of this Recommendation | International Standard, however it does specify requirements on standards claiming compliance to systems management.

Annex A of this Recommendation | International Standard defines an application context for systems management and specifies the rules for negotiating systems management functional units. There are conformance requirements associated with these rules.

2 Normative references

The following CCITT 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 agreement based on this Recommendation | International Standard are encouraged to investigate the possibility of applying the most recent editions of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The CCITT Secretariat maintains a list of the currently valid CCITT Recommendations.

2.1 Identical CCITT Recommendations | International Standards

- CCITT Recommendation X.720 (1992) | ISO/IEC 10165-1:1992, *Information technology – Open Systems Interconnection – Structure of management information: Management information model.*
- CCITT Recommendation X.721 (1992) | ISO/IEC 10165-2:1992, *Information technology – Open Systems Interconnection – Structure of management information: Definition of management information.*
- CCITT Recommendation X.722 (1992) | ISO/IEC 10165-4:1992, *Information technology – Open Systems Interconnection – Structure of management information: Guidelines for the definition of managed objects.*
- CCITT Recommendation X.730 (1992) | ISO/IEC 10164-1:1992, *Information technology – Open Systems Interconnection – Systems Management: Object management function.*
- CCITT Recommendation X.731 (1992) | ISO/IEC 10164-2:1992, *Information technology – Open Systems Interconnection – Systems Management: State management function.*
- CCITT Recommendation X.732 (1992) | ISO/IEC 10164-3:1992, *Information technology – Open Systems Interconnection – Systems Management: Attributes for representing relationships.*
- CCITT Recommendation X.733 (1992) | ISO/IEC 10164-4:1992, *Information technology – Open Systems Interconnection – Systems Management: Alarm reporting function.*
- CCITT Recommendation X.734¹⁾ (1992) | ISO/IEC 10164-5:1992, *Information technology – Open Systems Interconnection – Systems Management: Event report management function.*
- CCITT Recommendation X.735¹⁾ (1992) | ISO/IEC 10164-6:1992, *Information technology – Open Systems Interconnection – Systems Management: Log control function.*
- CCITT Recommendation X.736 (1992) | ISO/IEC 10164-7:1992, *Information technology – Open Systems Interconnection – Systems Management: Security alarm reporting function.*

2.2 Paired Recommendations | International Standards equivalent in technical content

- CCITT Recommendation X.200 (1988), *Reference Model of Open Systems Interconnection for CCITT Applications.*
<https://standards.iso.org/standards/10040-1992>
 ISO 7498:1984, *Information processing systems – Open Systems Interconnection – Basic Reference Model.*
- CCITT Recommendation X.700¹⁾, *Management Framework Definition for Open Systems Interconnection (OSI) for CCITT Applications.*
 ISO/IEC 7498-4:1989, *Information processing systems – Open Systems Interconnection – Basic Reference Model – Part 4: Management framework.*
- CCITT Recommendation X.209 (1988), *Specification of basic encoding rules for abstract syntax notation one (ASN.1).*
 ISO/IEC 8825:1990, *Information technology – Open Systems Interconnection – Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1).*
- CCITT Recommendation X.217 (1988), *Association control service definition for Open Systems Interconnection for CCITT Applications.*
 ISO 8649:1988, *Information processing systems – Open Systems Interconnection – Service definition of the Association Control Service Element.*
- CCITT Recommendation X.227 (1988), *Association Control Protocol Specification for Open Systems Interconnection for CCITT Applications.*
 ISO 8650:1988, *Information processing systems – Open Systems Interconnection – Protocol specification for the Association Control Service Element.*
- CCITT Recommendation X.219 (1988), *Remote Operations: model, notation and service definition.*
 ISO/IEC 9072-1:1989, *Information processing – Text communication – Remote Operations – Part 1: Model, notation and service definition.*

¹⁾ Presently at state of draft Recommendation.

- CCITT Recommendation X.229 (1988), *Remote Operations: Protocol specification*.
ISO/IEC 9072-2:1989 Information processing systems – Text communication – Remote Operations – Part 2: *Protocol specification*.
- CCITT Recommendation X.290 (1992), *OSI Conformance testing Methodology and Framework for Protocol Recommendations for CCITT Applications – General Concepts*.
ISO/IEC 9646-1:1991, *Information technology – Open Systems Interconnection – Conformance testing methodology and framework – Part 1: General concepts*.
- CCITT Recommendation X.710 (1991), *Common management information service definition for CCITT applications*.
ISO/IEC 9595:1991, *Information technology – Open Systems Interconnection – Common management information service definition*.
- CCITT Recommendation X.711 (1991), *Common management information protocol specification for CCITT applications*.
ISO/IEC 9596-1:1991, *Information technology – Open Systems Interconnection – Common management information protocol – Part 1: Specification*.

2.3 Additional references

- ISO/IEC 8571:1989, *Information processing systems – Open Systems Interconnection – File Transfer, Access and Management*.
- ISO/IEC 9545:1989, *Information technology – Open Systems Interconnection – Application Layer structure*.
- ISO/IEC 10026: ...²⁾, *Information technology – Open Systems Interconnection – Distributed Transaction Processing*.

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3 Definitions

3.1 Basic reference model definitions

ISO/IEC 10040:1992

<https://msc1188541/standards/sist/a0242715-47e4-456e-a7e5-9b9a06cfb67c/iso-iec-10040-1992>

This Recommendation | International Standard is based on the concepts in the Basic Reference Model for Open Systems Interconnection and makes use of the following terms defined in CCITT Rec. X.200 | ISO 7498:

- a) application service element;
- b) systems management.

3.2 Management framework definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Rec. X.700 | ISO/IEC 7498-4:

- a) managed object;
- b) management information base;
- c) systems management application entity.

3.3 CMISE definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Rec. X.710 | ISO/IEC 9595:

- a) attribute (of managed object);
- b) common management information service element;
- c) common management information services.

²⁾ To be published.

3.4 Management information model definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Rec. X.720 | ISO/IEC 10165-1:

- a) attribute type;
- b) naming tree;
- c) managed object boundary.

3.5 OSI conformance testing methodology and framework definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Rec. X.290 | ISO/IEC 9646-1:

- a) protocol implementation conformance statement (PICS);
- b) PICS proforma;
- c) system conformance statement.

3.6 Systems management overview definitions

For the purposes of this Recommendation | International Standard, the following definitions apply:.

3.6.1 agent: An MIS-User, which for a particular systems management interaction, has taken an agent role.

3.6.2 agent role: A role taken by an MIS-User in which it is capable of performing management operations on managed objects and of emitting notifications on behalf of managed objects.

3.6.3 dependent conformance: Conformance to the elements of protocol associated with a set of services, as specified by a system conformance statement.

3.6.4 general conformance: Conformance to the elements of protocol associated with the kernel set of services, and any additional functional units, as required by the Recommendation | International Standard.

3.6.5 generic definitions: Definitions of managed object classes, attribute types, notification types or management operation types, made available for general use.

3.6.6 (management) interaction: A single management operation or a single notification or an identified set of logically related management operations and notifications during which the manager and agent role do not change.

3.6.7 managed object class: A named set of managed objects sharing the same (named) sets of attributes, notifications, management operations (packages), and which share the same conditions for presence of those packages.

NOTE 1 – The following two definitions are aligned with the corresponding definitions in OSI Conformance Testing Methodology and Framework CCITT Rec. X.290 | ISO/IEC 9646-1 for PICS and PICS proforma.

3.6.8 managed object conformance statement (MOCS): A statement made by a supplier of a managed object implementation, stating the capabilities and options which have been implemented, and any features which have been omitted.

3.6.9 MOCS proforma: A document, in the form of a questionnaire, designed by the managed object definer or conformance test suite specifier, which when completed for a managed object implementation becomes the MOCS.

3.6.10 managed (open) system: A real open system containing an MIS-User which can take the agent role.

3.6.11 management domain: A set of managed objects, to which a common systems management policy applies.

3.6.12 management information: The information within an open system which may be transferred by OSI management protocols.

3.6.13 management support object: A systems managed object defined specifically to support a systems management function (e.g. log, discriminator).

3.6.14 manager: An MIS-User, which for a particular systems management interaction, has taken a manager role.

3.6.15 manager role: A role taken by an MIS-User in which it is capable of issuing management operations and of receiving notifications.

- 3.6.16 managing (open) system:** A real open system containing an MIS-User which can take the manager role.
- 3.6.17 MIS-User:** An application making use of systems management services.
- 3.6.18 notification:** Information emitted by a managed object relating to an event that has occurred within the managed object.
- 3.6.19 notification type:** A named data-type defining a specific kind of notification.
- 3.6.20 (N)-layer managed object:** A managed object specific to the (N)-layer.
- 3.6.21 (N)-layer management protocol:** A (N)-layer protocol for the exchange of (N)-layer management information supported solely by protocols of the layers (N-1) and below.
- NOTE 2 – This Recommendation | International Standard neither specifies nor requires the use of (N)-layer management protocols. The definition is included here for the sake of completeness.
- 3.6.22 (systems management) operation:** An operation on a managed object to effect systems management.
- 3.6.23 systems managed object:** A managed object relevant to more than one layer, to the system as a whole, or to specific management functions.
- 3.6.24 systems management application process:** An application process participating in systems management.
- 3.6.25 systems management application service element:** An application service element providing systems management services.
- 3.6.26 systems management function:** A part of systems management activities which satisfy a set of logically related user requirements.
- 3.6.27 systems management functional area:** A category of systems management user requirements.
- 3.6.28 systems management functional unit:** A named non-empty set of systems management services defined for the purpose of identifying specific sets of functionality where there is a requirement to establish or negotiate the use of such functionality between end systems or for reference purposes in other standards.
- 3.6.29 systems management functional unit package:** A named non-empty set of systems management functional units, defined for the purposes of negotiation of functional units on an association.
- 3.6.30 systems management (application) protocol:** An application layer protocol supporting systems management services.
- 3.6.31 systems management service:** A named set of service primitives that provide a service for use in systems management.

4 Abbreviations

ASN.1	Abstract Syntax Notation One
ACSE	association control service element
ASE	application service element
B-ISDN	broadband integrated services digital network
CMIP	common management information protocol
CMIPDU	common management information protocol data unit
CMIS	common management information service
CMISE	common management information service element
CSPDN	circuit switched public data network
FTAM	file transfer, access and management
Id	identifier
ISDN	integrated services digital network
LAN	local area network
MAPDU	management application protocol data unit

MHS	message handling system
MOTIS	message oriented text interchange system
MIB	management information base
MIS	management information service
MOCS	managed object conformance statement
OSI	open systems interconnection
PICS	protocol implementation conformance statement
PSPDN	packet switched public data network
ROSE	remote operations service element
SACF	single association control function
SMAE	systems management application entity
SMAPM	systems management application protocol machine
SMASE	systems management application service element
SMFA	systems management functional area
SMFU	systems management functional unit
SMI	structure of management information
TMN	telecommunication management network
TP	transaction processing
VT	virtual terminal
WAN	wide area network

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5 Systems management

ISO/IEC 10040:1992

Systems management provides mechanisms for the monitoring, control and coordination of resources within the OSI environment and OSI protocol standards for communicating information pertinent to those resources. In order to describe management operations on resources in the OSI environment, the resources are viewed as managed objects with defined properties. Information required for systems management purposes in any open system may be provided through local input, may result from input from other open systems through systems management (application layer) communication or may be a result of lower layer protocol exchanges.

In particular, systems management applies to but is not limited to, (e.g. use of CCITT Rec. M.30 TMN is also considered a valid application of systems management)

- OSI Layer 1 (Dedicated lines/leased lines, satellite connections);
- OSI Layer 2 (LAN, WAN, etc.);
- OSI Layer 3 (CSPDN, PSPDN, ISDN, B-ISDN, CCITT Rec. X.300 subnetwork, etc.);
- OSI Layer 4 (Transport Layer Entities);
- OSI Layer 5 (Session Layer Entities);
- OSI Layer 6 (Presentation layer Entities);
- OSI Layer 7 (MHS | MOTIS, FTAM, VT, TP, Directory).

NOTE – While the principal impetus for the development of these standards has been the need to managed OSI resources, they also have broader applicability. Furthermore, it is possible that in the future, standards development may be undertaken to specifically address additional areas.

Systems management is applicable to a wide range of distributed processing and communications environments. These environments range from local area networks interconnecting small systems, to interconnected corporate and national networks on a global scale. Small scale environments may be managed by appropriate small scale management systems, consisting of a single manager capable of controlling and coordinating the open communication environment through a number of agents. The standards and concepts are also applicable to large scale environments supporting multiple managers.

There are three main groupings within the set of systems management standards. They are

- a) a set of standards specifying systems management functions;
- b) a set of standards relating to the specification of managed objects;
- c) a set of application layer service and protocol standards for communicating information relating to management functions.

The requirements to be satisfied by systems management activities can conveniently be grouped into five areas, each of which gives rise to one or more standards covering one or more functions. These areas as defined by the OSI Management Framework (CCITT Rec. X.700 | ISO/IEC 7498-4) are

- fault management;
- configuration management;
- accounting management;
- performance management;
- security management.

However, many items of information, their associated management operations and the communication protocols are known to be common to more than one area. And, in performing management activities, sets of management functions may be combined to effect a particular management policy.

For these reasons, systems management standards form a closely interrelated set of standards.

6 Systems management model

6.1 Introduction

This clause identifies a number of concepts of systems management and provides a model to clarify these concepts and their relationships.

The following subclauses describe the various aspects of the systems management model:

- information aspects;
- functional aspects;
- OSI communications aspects;
- organizational aspects.

Management of a communications environment is an information processing application. Because the environment being managed is distributed, the individual components of the management activities are themselves distributed. Management applications perform the management activities in a distributed manner, by establishing associations between systems management application entities.

As shown in Figure 1 the interactions which take place between systems management application entities are abstracted in terms of management operations and notifications issued by one entity to the other; these are communicated using systems management services and protocols.

Management activities are effected through the manipulation of managed objects. For the purposes of systems management, management applications are categorised as MIS-Users. Each interaction takes place between two MIS-Users, one taking the manager role, the other the agent role.

An MIS-User taking the role of an agent is that part of a distributed application that manages the managed objects within its local system environment. An agent performs management operations on managed objects as a consequence of management operations communicated from a manager. An agent may also forward notifications emitted by managed objects to a manager.

An MIS-User taking the role of a manager is that part of a distributed application which has responsibility for one or more management activities, by issuing management operations and receiving notifications.

The concept of a manager is not limited to applications participating solely in systems management; other applications needing access to management information may use management information services.

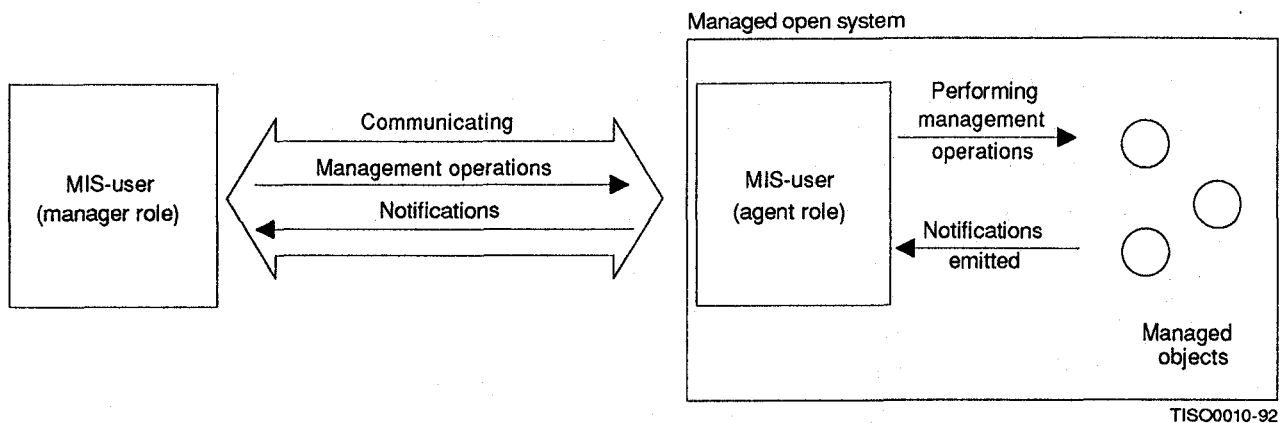


Figure 1 – Systems management interactions

Roles are not permanently assigned to MIS-Users. Some MIS-Users can be restricted to only taking an agent role, some to only taking a manager role while other MIS-Users are allowed to take an agent role in one interaction and to take a manager role in a separate interaction.

NOTE 1 – When a management interaction between open systems pertains to more than one managed object, the specification of how the agent distributes the management operation amongst its managed objects is not subject to standardization.

NOTE 2 – A managed object can itself represent a resource outside of the managed system. The relationship between the managed system and the outside resource may also be one of manager/agent. If the communication between these systems follows OSI Management standards, then management operations on a managed object in the original managed system might result in further manager/agent exchanges, operating on a "remote" managed object. No limits are imposed upon the number of such cascaded management operations that are permitted.

It is important to recognise that this Recommendation | International Standard only establishes a conceptual model that describes the structure and contents of the information actually communicated by the use of standardized management information services. Whenever management information is communicated, it is done in terms of this model.

Whether, where and how systems represent and store the real data from which the management information is derived is a local matter, and therefore not subject to standardization.

NOTE 3 – Figure 2 represents a particular way of viewing certain aspects of the system management model and is given for information only. The figure has been of value during the development of this specification. In particular it differentiates the mapping to standardized communication (following the rules introduced in 6.2) from local mapping, which illustrates that a method of viewing the real management information in terms of the model must exist within the systems management application process. Furthermore, the method exists in the local environment and is therefore an implementation matter not subject to standardization.

Figure 2 does not show the complete model, nor does it show all the details in full. In particular it does not imply that there is necessarily only one subtree of the naming tree related to a specific layer, nor does it imply that the term "systems management information model space" is a defined term.

6.2 Information aspects

This subclause introduces the information aspects of the systems management model. The definitive specification of the information model is given in CCITT Rec. X.720 | ISO/IEC 10165-1. It refines the concept of Managed Objects defined in CCITT Rec. X.700 | ISO/IEC 7498-4. It deals with their attributes, the management operations that may be performed upon them, and the notifications that they may emit. The set of managed objects in a system, together with their attributes, constitutes that system's Management Information Base (MIB).