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Information technology — Open Systems Interconnection — Systems Management: Object Management Function

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Technologies de l'information — Interconnexion de systèmes ouverts (OSI) — Gestion-systèmes: Fonction de gestion d'objets

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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.

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International Standard ISO/IEC 10164-1 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in collaboration with the CCITT. The identical text is published as CCITT Recommendation X.730.

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ISO/IEC 10164 consists of the following parts, under the general title *Information technology – Open Systems Interconnection – Systems Management*:

- *Part 1 : Object Management Function*
- *Part 2 : State Management Function*
- *Part 3 : Attributes for representing relationships*
- *Part 4 : Alarm reporting function*
- *Part 5 : Event report management function*
- *Part 6: Log control function*
- *Part 7: Security alarm reporting function*
- *Part 8: Security audit trail function*
- *Part 9: Objects and attributes for access control*
- *Part 10: Accounting meter function*
- *Part 11: Workload monitoring function*
- *Part 12: Test management function*
- *Part 13: Summarization function*
- *Part 14: Confidence and diagnostic test categories*

Introduction

ISO/IEC 10164 is a multipart Standard developed according to ISO 7498 and ISO/IEC 7498-4. ISO/IEC 10164 is related to the following International Standards:

ISO/IEC 9595:1990, *Information technology – Open Systems Interconnection – Common management information service definition*;

ISO/IEC 9596:1990, *Information technology – Open Systems Interconnection – Common management information protocol*;

ISO/IEC 10040:1992, *Information technology – Open Systems Interconnection – Systems management overview*;

ISO/IEC 10165:1992, *Information technology – Open Systems Interconnection – Structure of management information*.

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INTERNATIONAL STANDARD

CCITT RECOMMENDATION

INFORMATION TECHNOLOGY – OPEN SYSTEMS INTERCONNECTION – SYSTEMS MANAGEMENT: OBJECT MANAGEMENT FUNCTION

1 Scope

This Recommendation | International Standard defines a systems management function which may be used by an application process in a centralized or decentralized management environment to interact for the purposes of systems management, as defined by CCITT Rec. X.700 | ISO/IEC 7498-4. This Recommendation | International Standard defines the object management function that consists of services, functional units, and generic definitions. It is positioned in the application layer of CCITT Rec. X.200 | ISO 7498 and is defined according to the model provided by ISO/IEC 9545. The role of systems management functions are described by CCITT Rec. X.701 | ISO/IEC 10040.

This Recommendation | International Standard

- establishes user requirements for the object management function;
- establishes a model that relates the services and generic definitions provided by this function to user requirements;
- defines the services provided by the function;
- defines generic notification types and parameters documented in accordance with CCITT Rec. X.722 | ISO/IEC 10165-4;
- specifies the protocol that is necessary in order to provide the services;
- defines the relationship between these services and management operations and notifications;
- specifies compliance requirements placed on other Standards that make use of these generic definitions;
- defines relationships with other systems management functions;
- specifies conformance requirements.

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This Recommendation | International Standard does not

- define the nature of any implementation intended to provide the object management function;
- specify the manner in which management is accomplished by the user of the object management function;
- define the nature of any interactions which result in the use of the object management function;
- specify the services necessary for the establishment, normal and abnormal release of a management association;
- preclude the definition of further notification types;
- define managed objects.

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 agreements based on this Recommendation | International Standard are encouraged to investigate the possibility of applying the most recent editions of the Recommendations and Standards indicated 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 Recommendations | International Standards

- CCITT Recommendation X.701 (1992) | ISO/IEC 10040:1992, *Information technology – Open Systems Interconnection – Systems managemet overview.*
- CCITT Recommendation X.720 (1992) | ISO/IEC 10165-1:1993, *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.733 (1992) | ISO/IEC 10164-4:1992, *Information technology – Open Systems Interconnection – Systems Management: Alarm reporting function.*
- CCITT Recommendation X.734 (1992) | ISO/IEC 10164-5:1993, *Information technology – Open Systems Interconnection – Systems Management: Event report management function.*
- CCITT Recommendation X.735 (1992) | ISO/IEC 10164-6:1993, *Information technology – Open Systems Interconnection – Systems Management: Log control 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.*

  ISO 7498:1984, Information processing systems – Open Systems Interconnection – Basic Reference Model.

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- CCITT Recommendation X.209 (1988), *Specification of basic encoding rules for Abstract Syntax Notation One (ASN.1).*

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  ISO/IEC 8825:1990, Information technology – Open Systems Interconnection – Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1).

- CCITT Recommendation X.210 (1988), *Open Systems Interconnection. Layer Service Definition Conventions.*

  ISO/TR 8509:1987, Information processing systems – Open Systems Interconnection – Service conventions.

- 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.700 (1992), *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.710 (1991), *Common Management Information Service Definition for CCITT applications.*

  ISO/IEC 9595:1991, Information technology – Open Systems Interconnection – Common management information service definition.

2.3 Additional references

- ISO/IEC 9545:1989, *Information technology – Open Systems Interconnection – Application layer structure.*

3 Definitions

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

3.1 Basic reference model definitions

This Recommendation | International Standard makes use of the following term defined in CCITT Rec. X.200 | ISO 7498:

a) open system;

b) systems management;

c) layer management.

d) OSI environment;

3.2 Management framework definitions

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

managed object

3.3 CMIS definitions

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

attribute

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3.4 Systems management overview definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Rec. X.701 | ISO/IEC 10040:

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a) agent;

b) agent role;

c) dependent conformance;

d) general conformance;

e) generic definitions;

f) managed object class;

g) manager;

h) manager role;

i) notification;

j) systems management functional unit;

k) systems management function;

l) systems management application protocol;

m) (systems management) operation.

3.5 Management information model definitions

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

managed object boundary

3.6 Service conventions definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Rec. X.210 | ISO/TR 8509:

a) confirm (primitive);

b) confirmed-service;

c) indication (primitive);

d) non-confirmed-service;

e) request (primitive);

f) response (primitive);

g) service-user;

h) service-provider.

3.7 OSI conformance testing definitions

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

system conformance statement

4 Abbreviations

ASN.1	Abstract Syntax Notation One
CMIS	Common Management Information service
Conf	Confirmation
Ind	Indication
MAPDU	Management application protocol data unit
OSI	Open systems interconnection
Req	Request
Rsp	Response
SMAPM	Systems management application protocol machine
SMI	Structure of management information

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5 Conventions

This Recommendation | International Standard defines services for the object management function following the descriptive conventions defined in CCITT Rec. X.210 | ISO/TR 8509. In clause 9, the definition of each service includes a table that lists the service parameters. For a given service primitive, the presence of each parameter is described by one of the following values.

M the parameter is mandatory;

(=) the value of the parameter is equal to the value of the parameter in the column to the left;

U the use of the parameter is a Service-user option;

– the parameter is not present in the interaction described by the primitive concerned;

C the parameter is conditional;

P the parameter is subject to the constraints imposed by CCITT Rec. X.710 | ISO/IEC 9595.

NOTE – The parameters that are marked "P" in service tables of this Recommendation | International Standard are mapped directly onto the corresponding parameters of the CMIS service primitive, without changing the semantics or syntax of the parameters. The remaining parameters are used to construct an MAPDU.

6 Requirements

The MIS-User needs the ability to

- create and delete managed objects;
- examine and modify the value of attributes of managed objects;
- be made aware of changes in the configuration of managed objects.

7 Model

7.1 Introduction

Each resource that is subject to systems management is represented by a managed object. These are described in CCITT Rec. X.720 | ISO/IEC 10165-1.

Managed objects can be created and deleted, and values of attributes of managed objects can be changed, in one or more of three distinct ways

- through configuration processes in the local system environment that are outside the scope of OSI;
- through the (N)-layer operation and/or the layer management of an open system, as described in those (N)-layer standards;
- through the OSI systems management services.

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Object management describes services for

- the reporting of creation and deletion of managed objects;
- the reporting of changes to attribute values of managed objects.

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Object management describes pass-through services for

- the creation and deletion of managed objects;
- performing actions upon managed objects;
- attribute changing;
- attribute reading;
- event reporting.

7.2 Pass-through services

Where different parts of systems management functions define operations or notifications, then they do so independently of their mapping onto an underlying communications service. This enables this Recommendation | International Standard to be used across a range of underlying communications services by other systems management functions or managed objects. When a systems management function defines specific systems management services, then these services shall map directly onto the CMIS services.

In order to achieve this objective it is necessary for one of the systems management Recommendations | International Standards to detail the mapping between the operations and notifications that apply across a managed object boundary and the underlying communications services. This Recommendation | International Standard is used to document such mapping.

Currently, only the mapping onto CMIS are defined by this Recommendation | International Standard through the use of pass-through services.

Except where this Recommendation | International Standard describes specific services, the management operations and notifications that apply across a managed object boundary shall map onto the pass-through services of this Recommendation | International Standard as shown in Table 1.

The management operations are described in CCITT Rec. X.720 | ISO/IEC 10165-1.

Table 1 – Mapping of pass-through services

SMI	Pass-through
Create	PT-CREATE
Delete	PT-DELETE
Action	PT-ACTION
Replace	PT-SET
Add	PT-SET
Remove	PT-SET
Replace-with-Default	PT-SET
Get	PT-GET
Notification	PT-EVENT-REPORT

8 Generic definitions

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The set of generic notifications, parameters and semantics defined by this Recommendation | International Standard provide the detail for the following general parameters of the M-EVENT-REPORT service as defined by CCITT Rec. X.710 | ISO/IEC 9595:

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- event type;
- event information;
- event reply.

All notifications are potential entries in a systems management log and this Recommendation | International Standard defines three managed object classes for this purpose. CCITT Rec. X.721 | ISO/IEC 10165-2 defines a generic event log record object class from which all entries are derived, the additional information being specified by the event information and event reply parameters.

8.1 Event type

This parameter defines the type of the event. The following three event types are defined in this Recommendation | International Standard:

- object creation: An indication that a managed object instance has been created. Where a managed object class is required to report the creation of a managed object instance, then that managed object class shall import the object creation notification type. The creation of a managed object within an open system can be as a result of a PT-CREATE service, or a local operation within the open system;
- object deletion: An indication that a managed object instance has been deleted. Where a managed object class is required to report the deletion of a managed object instance, then that managed object class shall import the object deletion notification type. The deletion of a managed object within an open system can be as a result of a PT-DELETE service, or a local operation within the open system;
- attribute value change: An indication that the attribute value(s) of a managed object has changed. This notification type is used to report one or more of the following:
  a) the addition of one or more new members to one or more set-valued attributes;
  b) the removal of one or more members from one or more set-valued attributes;

c) the replacement of the value of one or more attributes;

d) the changing of the value of one or more attributes to their default value(s);

through either the internal operation of the resource or via management operation. This notification type shall not be used for conveying attribute value changes which have specific notification types already defined.

It is the role of the managed object class definer to fully detail the requirements that a managed object class has for generating one or more of the above notification types. For the attribute value change notification, this includes identifying which attributes, and which value changes to those attributes, are significant enough to warrant the notification being emitted.

8.2 Event information

The following parameters constitute the notification specific event information.

8.2.1 Object creation notification parameters

The following parameters are defined for the object creation notification.

8.2.1.1 Source Indicator

This parameter, when present, indicates the source of the operation that led to the generation of this notification type. It can have one of the following values:

- resource operation: The notification was generated in response to a creation effected through the internal operation of the resource;
- management operation: The notification was generated in response to a creation effected through an SMI management operation applied across the managed object boundary external to the managed object;
- unknown: It is not possible to determine the source of the operation.

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8.2.1.2 Attribute list

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This parameter, when present, contains a list of attributes and their values at the time the managed object was created. The managed object class definition may specify which attributes are to be included in the list. If the attribute list is not specified by the managed object class definition and the parameter is present in the notification, then all the attributes of the created managed object shall be included in the list.

8.2.1.3 Other information

The following parameters are also utilised. These parameters are defined by CCITT Rec. X.733 | ISO/IEC 10164-4:

- Additional information;
- Additional text;
- Correlated notifications;
- Notification identifier.

8.2.2 Object deletion notification parameters

The following parameters are defined for the object deletion notification.

8.2.2.1 Source Indicator

This parameter, when present, indicates the source of the operation that led to the generation of this notification type. It can have one of the following values:

- resource operation: The notification was generated in response to a deletion effected through the internal operation of the resource;
- management operation: The notification was generated in response to a deletion effected through an SMI management operation applied across the managed object boundary external to the managed object;
- unknown: It is not possible to determine the source of the operation.

8.2.2.2 Attribute list

This parameter, when present, contains a list of attributes and their values just before the managed object was deleted. The managed object class definition may specify which attributes are to be included in the list. If this is not specified by the managed object class definition and the parameter is present in the notification, then all the attributes of the managed object shall be included in the list.

8.2.2.3 Other information

The following parameters are also utilised. These parameters are defined by CCITT Rec. X.733 | ISO/IEC 10164-4:

- Additional information;
- Additional text;
- Correlated notifications;
- Notification identifier.

8.2.3 Attribute value change notification parameters

The following parameters are defined for attribute value change notification.

8.2.3.1 Source indicator

This parameter, when present, indicates the source of the operation that led to the generation of this notification type. It can have one of the following values:

- resource operation: The notification was generated in response to an attribute value change effected through the internal operation of the resource;
- management operation: The notification was generated in response to a an attribute value change effected through an SMI management operation applied across the managed object boundary external to the managed object;
- unknown: It is not possible to determine the source of the operation.

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8.2.3.2 Attribute identifier list

This parameter, when present, identifies the set of attributes whose value changes are being reported.

8.2.3.3 Attribute value change definition

This parameter set consists of a set of sequences of the three parameters: Attribute identifier, Old attribute value and New attribute value described below. Each individual sequence describes a single attribute value change. At least one new attribute value shall be present in this list.

8.2.3.3.1 Attribute identifier

This parameter identifies the attribute whose value change is being reported.

8.2.3.3.2 Old attribute value

This parameter, when present, identifies the old value of the attribute.

8.2.3.3.3 New attribute value

This parameter identifies the current value of the attribute.

8.2.3.4 Other information

The following parameters are also utilised. These parameters are defined by CCITT Rec. X.733 | ISO/IEC 10164-4:

- Additional information;
- Additional text;
- Correlated notifications;
- Notification identifier.