INTERNATIONAL STANDARD

ISO/IEC 10164-2

First edition
1993-06-15

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

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

Reference number
ISO/IEC 10164-2:1993(E)

Contents

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 10164-2 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.731.

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*.

INTERNATIONAL STANDARD

CCITT RECOMMENDATION

INFORMATION TECHNOLOGY – OPEN SYSTEMS INTERCONNECTION – SYSTEMS MANAGEMENT: STATE 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 purpose of systems management as defined by CCITT Rec. X.700 | ISO/IEC 7498-4. This Recommendation | International Standard defines the state management function and consists of service and generic definitions. It is positioned in the application layer of CCITT Rec. X.200 | ISO/IEC 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 state management function;
- establishes models that relate the service and generic definitions provided by this function to user requirements;
- defines the services provided by the function;

- defines generic attribute types, 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 the service and management operations and notifications;
- specifies compliance requirements placed on other standards that makes use of these generic definitions;
- defines relationships with other systems management functions;
- specifies conformance requirements.

This Recommendation | International Standard does not

- define the nature of any implementation intended to provide the state management function;
- specify the manner in which management is accomplished by the user of the state management function;
- define the nature of any interactions that result in the use of the state 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 management 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.732 (1992) | ISO/IEC 10164-3:1993, *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.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.*
- 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.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 terms defined in CCITT Rec. X.200 | ISO 7498:

a) open system;

b) systems management.

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

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:

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).

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

5 Conventions

This Recommendation | International Standard defines services for the state 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 examine and be notified of changes in state, to monitor overall operability and usage of resources in a consistent manner, and to control the general availability of specific resources.

This Recommendation | International Standard defines the generic attributes and operations that can be part of any managed object definition in order to provide a standardized OSI management technique for dealing with management states.

The state management provides for

- the reporting of changes in the state attributes;
- reading the state attributes;
- changing the state attributes.

7 Model

The management state of a managed object represents the instantaneous condition of availability and operability of the associated resource from the point of view of management. Different classes of managed object have a variety of state attributes that express and control aspects of the operation of their associated resource that are peculiar to each class. However, the management state is expected to be common to a large number of resources and for this reason is standardized; it expresses key aspects of their usability at any given time. Its purpose is to control the general availability of a resource and to make visible information about that general availability.

7.1 Generic states

Three primary factors affect the management state of a managed object with regard to its corresponding resources' availability. Some managed objects may not be affected by all three of these factors. These are

- operability: whether or not the resource is physically installed and working, if applicable;
- usage: whether or not the resource is actively in use at a specific instant, and if so, whether or not it has spare capacity for additional users at that instant. A resource is said to be "in use" when it has received one or more requests for service that it has not yet completed or otherwise discharged, or when some part of its capacity has been allocated, and not yet reclaimed, as a result of a previous service request;
- administration: permission to use or prohibition against using the resource, imposed through the management services.

The state of a managed object does not affect its ability to respond to management operations.

7.1.1 Operational state

The operability of a resource is described by the operational state attribute, which has two possible values: disabled and enabled. These are described in 8.1.1.1.

Some classes of managed object exhibit only a constant enabled value for the operational state. When a resource has no visible dependencies on other resources, and no components that can develop visible defects, the managed object may not exhibit the disabled operational state. Likewise, managed objects that cease to exist when the resource becomes inoperable do not exhibit the disabled operational state during their existence. When a resources ceases to exist, but there is still a managed object maintaining state attributes about that resource, then the operational state will be disabled. The set of operational state values supported is specified in each individual managed object class definition.

When a managed object is unable to reflect the operational state of its associated resource and the unknown status attribute defined in 8.1.2.6 is supported, the unknown status attribute value will be true.

It is the natural operation of the resource that causes operational state transitions to occur, and therefore, management cannot request a managed object to change from one operational state to another. Management can only gather information about the operational state of a managed object; i.e. the operational state is read-only in nature.

Specific events associated with the resource cause specific transitions from one operational state value to the other. These events and transitions are summarised in Figure 1, and are described below.

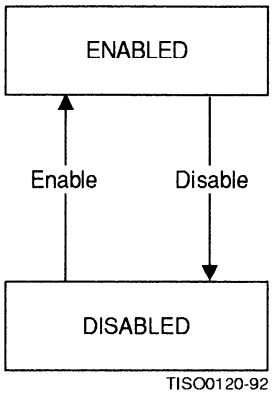

Figure 1 – Operational state diagram

7.1.1.1 Enable

This event consists of action being taken to render the resource partially or fully operable. This event can occur only if the managed object's operational state is disabled. The enable event causes a transition to the enabled operational state.

7.1.1.2 Disable

This event consists of some occurrence that renders the resource totally inoperable. The disable event causes a transition to the disabled operational state.

7.1.2 Usage state

The usage of a resource is described by the usage state attribute, which has three possible values: idle, active and busy. These are described in 8.1.1.2. The set of usage state values supported is specified in each individual managed object class definition.

Some classes of managed object exhibit only a subset of the possible usage state values. Managed objects whose associated resource supports only one user do not exhibit the active usage state, being either idle or busy. Managed objects whose resource has no practical limit on the number of users do not exhibit the busy usage state.

When a managed object is unable to reflect the usage state of its associated resource and the unknown status attribute defined in 8.1.2.6 is supported, the unknown status attribute value will be true.

It is the natural operation of the resource that causes usage state transitions to occur, and therefore management cannot request a managed object to change from one usage state to another. Management can only gather information about the usage state of a managed object; the usage state is read-only in nature.

Specific events associated with the resource cause transitions from one usage state value to another. These events and transitions are summarised in Figure 2 and are described below.

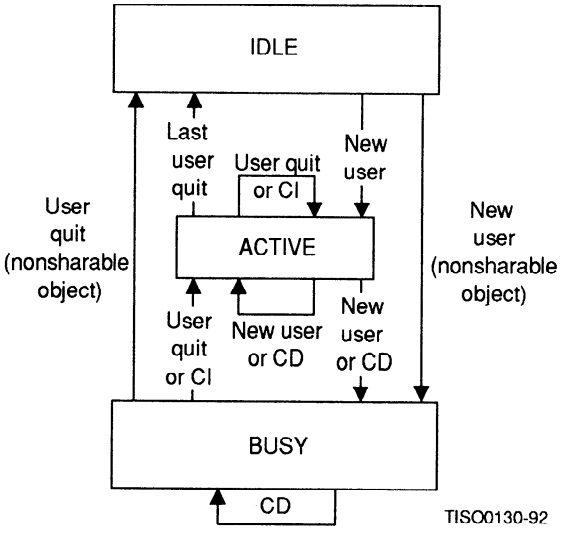

Figure 2 – Usage state diagram

7.1.2.1 New user

This event consists of some agency commencing to use the resource. It can occur only if the managed object's operational state is enabled and its usage state is either idle or active. The new user event causes a transition as follows:

- if, after the event, the resource still has sufficient operating capacity to provide for additional users, the usage state becomes or remains active;
- if, after the event, the resource has no operating capacity to spare for additional users, the usage state becomes busy.

7.1.2.2 User quit

This event consists of an existing user of the resource terminating its use. It can occur only if the managed object's usage state is either active or busy. It can result from a change of operational state from enabled to disabled. The user quit event causes a transition as follows:

- if, after the event, the resource still has existing users, the usage state becomes or remains active;
- if, after the event, the resource has no users, the usage state becomes idle.

7.1.2.3 Capacity increase (CI)

This event consists of an increase in the maximum operating capacity of the resource. It is significant only if the managed object's usage state is busy. The capacity increase event causes a transition to the active state if the managed object was in the busy state.

7.1.2.4 Capacity decrease (CD)

This event consists of a decrease in the maximum operating capacity of the resource. It is significant only if the managed object's usage state is active. The capacity decrease event causes a transition as follows:

- if, after the event, the resource still has spare operating capacity, the usage state remains active;
- if, after the event, the resource has no spare operating capacity, the usage state becomes busy;
- if the managed object is in the busy state when a capacity decrease occurs, the managed object will continue to reside in the busy state until either a capacity increase or a user quit event occurs.