INTERNATIONAL STANDARD

ISO/IEC 10165-9

First edition
2000-11-01

Information technology — Open Systems Interconnection — Structure of management information: Systems management application layer managed objects

Technologies de l'information — Interconnexion de systèmes ouverts (OSI) — Structure de l'information de gestion: Objets gérés de couche d'application de gestion-systèmes

Reference number
ISO/IEC 10165-9:2000(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

Printed in Switzerland

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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.

Attention is drawn to the possibility that some of the elements of this part of ISO/IEC 10165 may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

International Standard ISO/IEC 10165-9 was prepared by ITU-T (as ITU-T Recommendation X.727) and was adopted, under a special "fast-track procedure", by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

ISO/IEC 10165 consists of the following parts, under the general title *Information technology — Open Systems Interconnection — Structure of management information*:

— *Part 1: Management Information Model*

— *Part 2: Definition of management information*

— *Part 4: Guidelines for the definition of managed objects*

— *Part 5: Generic management information*

— *Part 6: Requirements and guidelines for implementation conformance statement proformas associated with OSI management*

— *Part 7: General relationship model*

— *Part 8: Managed objects for supporting upper layers*

— *Part 9: Systems management application layer managed objects*

Annex A forms a normative part of this part of ISO/IEC 10165.

INTERNATIONAL STANDARD

ITU-T RECOMMENDATION

INFORMATION TECHNOLOGY – OPEN SYSTEMS INTERCONNECTION – STRUCTURE OF MANAGEMENT INFORMATION: SYSTEMS MANAGEMENT APPLICATION LAYER MANAGED OBJECTS

1 Scope

This Recommendation | International Standard defines systems management protocol machine managed objects, thus allowing the use of the Common Management Information Protocol (CMIP), as defined in ITU-T Rec. X.711 | ISO/IEC 9596-1, to manage CMISE and SMASE application service elements and invocations.

This Recommendation | International Standard:

- establishes a model for supporting systems management application service elements;
- provides generic and formal definitions for supporting systems management application service element managed objects.

This Recommendation | International Standard does not:

- define new management functions;
- specify a framework or methodology for conformance tests.

In the context of this Recommendation | International Standard, the term *systems management* is used to refer to SMASE, CMISE, and ROSE.

2 Normative References

The following Recommendations and International Standards contain provision 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 Telecommunications Standardization Bureau of the ITU maintains a list of currently valid ITU-T Recommendations.

2.1 Identical Recommendations | International Standards

- ITU-T Recommendation X.200 (1994) | ISO/IEC 7498-1:1994, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model.*
- ITU-T Recommendation X.287 (1999) | ISO/IEC 10165-8:2000, *Information technology – Open Systems Interconnection – Structure of management information: Managed objects for supporting upper layers.*
- ITU-T Recommendation X.701 (1997) | ISO/IEC 10040:1998, *Information technology – Open Systems Interconnection – Systems management overview.*
- ITU-T Recommendation X.710 (1997) | ISO/IEC 9595:1998, *Information technology – Open Systems Interconnection – Common management information service.*
- ITU-T Recommendation X.711 (1997) | ISO/IEC 9596-1:1998, *Information technology – Open Systems Interconnection – Common management information protocol: Specification.*
- 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.*
- ITU-T Recommendation X.723 (1993) | ISO/IEC 10165-5:1994, *Information technology – Open Systems Interconnection – Structure of management information: Generic management information.*
- CCITT Recommendation X.734 (1992) | ISO/IEC 10164-5:1993, *Information technology – Open Systems Interconnection – Systems Management: Event Report Management Function.*
- ITU-T Recommendation X.750 (1996) | ISO/IEC 10164-16:1997, *Information technology – Open Systems Interconnection – Systems Management: Management knowledge management function.*

2.2 Paired ITU-T Recommendations | International Standards equivalent in technical content

- CCITT Recommendation X.208 (1988), *Specification of Abstract Syntax Notation One (ASN.1).*

  ISO/IEC 8824:1990, *Information technology – Open Systems Interconnection – Specification of Abstract Syntax Notation One (ASN.1).*
- ITU-T Recommendation X.290 (1995), *OSI conformance testing methodology and framework for protocol Recommendations for ITU-T applications – General concepts.*

  ISO/IEC 9646-1:1994, *Information technology – Open Systems Interconnection – Conformance testing methodology and framework – Part 1: General concepts.*
- CCITT Recommendation X.700 (1992), *Management framework 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.*

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 ITU-T Rec. X.200 | ISO/IEC 7498-1.

a) open system;

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) systems management application-entity.

3.3 CMIS definitions

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

a) attribute;

b) Common Management Information Service Element;

c) Common Management Information Service.

3.4 Systems management overview definitions

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

a) agent;
b) agent role;
c) generic definitions;
d) managed object class;
e) managed (open) system;
f) manager;
g) manager role;
h) MIS-User;
i) notification;
j) notification type;
k) systems management application protocol;
l) systems management functional unit.

3.5 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) containment hierarchy.

3.6 Guidelines for the definition of managed objects definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Rec. X.722 | ISO/IEC 10165-4:

– template.

3.7 Event report management function definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Rec. X.734 | ISO/IEC 10164-5:

– event forwarding discriminator.

3.8 OSI conformance testing definitions

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

– system conformance statement.

4 Symbols and abbreviations

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

AO	Associated Object
ASE	Application Service Element
ASO	Application Service Object
CMIS	Common Management Information Service
CMISE	Common Management Information Service Element
COPM	Connection Oriented Protocol Machine
DN	Distinguished Name

GMI	Generic Management Information
Id	Identifier
MAPDU	Management Application Protocol Data Unit
MO	Managed Object
OSI	Open Systems Interconnection
PDU	Protocol Data Unit
RDN	Relative Distinguished Name
Req	Request
ROSE	Remote Operations Service Element
SAP	Service Access Point
SMAE	Systems Management Application Entity
SMAPM	Systems Management Application Protocol Machine
SMASE	Systems Management Application Service Element
SMI	Structure of Management Information
UL	Upper Layer
ULMO	Upper Layer Managed Object

5 Requirements

This clause describes the requirements for this Recommendation | International Standard.

- Provide Generic MOs Class definitions so that common management information is available for implementation of application service elements (i.e. CMISE and SMASE) for OSI systems management. These definitions should not duplicate the MOs for the transport layer, lower layers, and specific applications. Additional managed objects may be defined to support other application service elements.
- Monitor the resources (e.g. number of PDUs, numbers of associations) used by Systems Management Application Service Elements CMISE and SMASE.
- Distinguish between management of the static aspects of Systems Management application service elements for CMISE and SMASE and dynamic aspects related to management associations (e.g. per invocation).
- Identify the PDUs that are supported in management protocol for CMISE and SMASE.

6 Managed object class definitions

This clause contains managed object class definitions for the management of systems management. The definitions have been documented "in-line" with the exception of the attribute definitions which are to be found in clause 8.

The following managed object class definitions are used from ITU-T Rec. X.287 | ISO/IEC 10165-8 which defines generic managed objects for upper layers:

- "Rec. X.287 | ISO/IEC 10165-8":aso;
- "Rec. X.287 | ISO/IEC 10165-8":asoInvocation.

The inheritance tree that applies to the managed object classes defined in this section is shown in Figure 1.

6.1 SMASE Managed Object Class

This subclass of "Rec. X.287 | ISO/IEC 10165-8":aso represents the capabilities of SMASE application service element.

It specializes by adding the following attributes:

- SMASE functional units supported (same syntax as SMASE functional unit packages);
- Application context names supported ("Rec. X.287 | ISO/IEC 10165-8": applContextNameSupport).

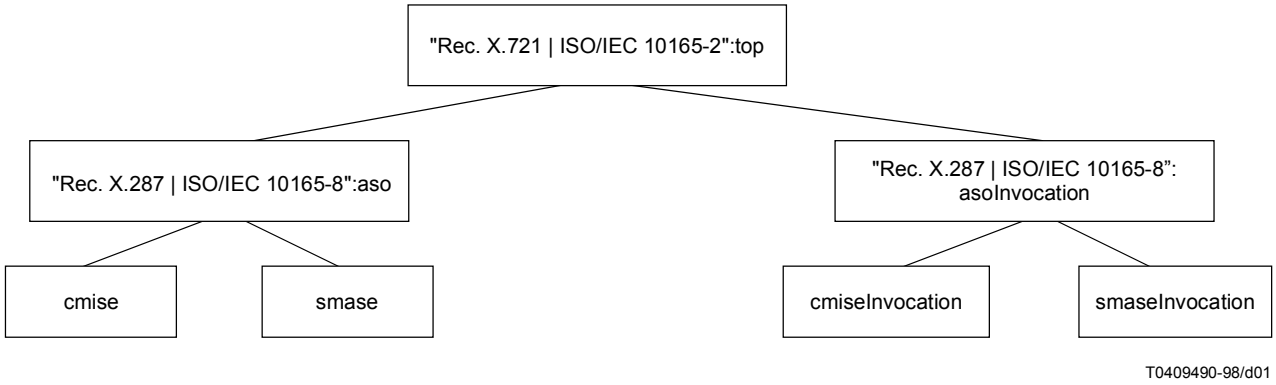

Figure 1 – Inheritance Hierarchy of Systems Management Application Layer Managed Objects

6.2 CMISE Managed Object Class

This subclass of "Rec. X.287 | ISO/IEC 10165-8":aso represents the capabilities of CMISE application service element.

The functionality of ROSE is included in the CMISE managed object class and is not modelled as a separate managed object class. Even though ROSE is used by several OSI applications, including Directory and MHS, the nature of ROSE is that it provides a common protocol-based way to "wrap" an operation and to correlate its responses and errors. As such, its management needs are probably modest, and it is recommended that it be included in the definitions of the specific applications.

It specializes by adding the following attributes:

- CMIP functional units supported (same syntax as SMASE functional unit packages);
- CMIP PDU sending support (syntax SET OF CmipPduType -- Named number list in WG4 1533);
- CMIP PDU receiving support (syntax SET OF CmipPduType);
- Protocol versions supported;
- "Rec. X.750 | ISO/IEC 10164-16":supported Cmip Profiles.

6.3 SMASE Invocation Managed Object Class

This subclass of "ITU-T Rec. X.287 | ISO/IEC 10165-8":asoInvocation represents the SMASE invocation's view of the association. The underlying connections attribute is used to point to the ACSE invocation MO used by the SMASE invocation to carry the data transfer information.

It specializes by adding the following attributes:

- SMASE functional units selected;
- Systems Management User Information Sent (NULL if nothing is sent in the SMASE-A-ASSOCIATE);
- Systems Management User Information Received (NULL if nothing is received in SMASE-A-ASSOCIATE).

6.4 CMISE Invocation Managed Object Class

This subclass of "Rec. X.287 | ISO/IEC 10165-8":asoInvocation represents the CMISE invocation's view of the association. The underlying connections attribute is used to point to the ACSE invocation MO used by the CMISE invocation to carry the data transfer information.

It specializes by adding the following attributes:

- CMISE functional units selected (syntax imported CMIP);
- invokeIds outstanding (SET OF INTEGER) – set of invoke ids sent in confirmed mode for which a confirmation has not been received;
- invokeIds performing (SET OF INTEGER) – set of invoke ids received in confirmed mode for which a confirmation has not been sent.

7 Attributes

This clause defines attributes types that are referenced by the managed object class definitions contained in this Recommendation | International Standard.

7.1 CMIP PDU Receiving Support

This attribute identifies the set of CMIP PDU Types supported for receiving.

7.2 CMIP PDU Sending Support

This attribute identifies the set of CMIP PDU Types supported for sending.

7.3 CMISE Functional Units Selected

This attribute identifies the selected CMISE Functional Units.

7.4 CMISE Functional Units Supported

This attribute identifies the supported CMISE Functional Units.

7.5 Invoke Identifiers Outstanding

This attribute identifies lists the set of invoke Ids that have been issued in the confirmed mode but for which there has not been a confirmation response.

7.6 Invoke Identifiers Performing

This attribute identifies the set of invoke Ids that have been received in the confirmed mode but for which no confirmation response has yet been sent.

7.7 Protocol Versions Supported

Protocol version as defined in ITU-T Rec. X.711 | ISO/IEC 9596-1, imported from CMIP-A-ASSOCIATE, with integer values equal to version number (e.g. 1 = version 1, 2 = version 2).

7.8 SMASE Functional Units Selected

This attribute identifies the selected SMASE Functional Units.

7.9 SMASE Functional Units Supported

This attribute identifies the supported SMASE Functional Units.

7.10 Systems Management User Information Received

This attribute identifies the systems management user information received.

7.11 Systems Management User Information Sent

This attribute identifies the systems management user information sent.

Annex A

Management Information Definitions

(This annex forms an integral part of this Recommendation | International Standard)

--<GDMO.Document "ITU-T Rec. X.727 (03/99) | ISO/IEC 10165-9 : 2000"
--{joint-iso-ccitt ms(9) smi(3) part9(9) }>--
--<GDMO.Version 1.3 "ITU-T Rec. X.727 (03/99) | ISO/IEC 10165-9 : 2000" >--

```
cmise MANAGED OBJECT CLASS
  DERIVED FROM "Rec. X.287 | ISO/IEC 10165-8":aso;
  CHARACTERIZED BY
    cmisePkg PACKAGE
      BEHAVIOUR
        cmiseBeh BEHAVIOUR
          DEFINED AS
            !This subclass of "Rec. X.287 | ISO/IEC 10165-8":aso managed object class holds
             reference information pertaining to the capabilities of CMISE application service element.!;;
      ATTRIBUTES
        cmiseFunctionalUnitsSupported GET,
        cmipPduSendingSupport GET,
        cmipPduReceivingSupport GET,
        protocolVersionSupported GET,
        "Rec. X.750 | ISO/IEC 10164-16":supportedCmipProfiles GET;;;
REGISTERED AS {CMISE-ROSE-SMASE-ASN1Module.crsMObjectClass 1};

cmiseInvocation MANAGED OBJECT CLASS
DERIVED FROM    "Rec. X.287 | ISO/IEC 10165-8":asoInvocation;
CHARACTERIZED BY
    cmiseInvocationPkg PACKAGE
      BEHAVIOUR
        cmiseInvocationBeh BEHAVIOUR
          DEFINED AS
            !This subclass of "Rec. X.287 | ISO/IEC 10165-8":asoInvocation holds reference information
              pertaining to the CMISE invocation's view of the association.!;;
      ATTRIBUTES
        cmiseFunctionalUnitsSelected GET,
        invokeIdsOutstanding GET,
        invokeIdsPerforming GET;;;
REGISTERED AS {CMISE-ROSE-SMASE-ASN1Module.crsMObjectClass 3};

smaseInvocation MANAGED OBJECT CLASS
DERIVED FROM  "Rec. X.287 | ISO/IEC 10165-8":asoInvocation;
  CHARACTERIZED BY
    smaseInvocationPkg PACKAGE
      BEHAVIOUR
        smaseInvocationBeh BEHAVIOUR
          DEFINED AS
            !This subclass of "Rec. X.287 | ISO/IEC 10165-8:
             asoInvocation holds reference information
             pertaining to the SMASE invocation's view of the
             association. The underlying connections attribute is used
             to point to the ACSE Invocation MO used by the SMASE
             Invocation to carry the data transfer information.!;;
        ATTRIBUTES
          smaseFunctionalUnitsSelected GET,
          smUserInfoSent GET,
          smUserInfoReceived GET;;;
REGISTERED AS {CMISE-ROSE-SMASE-ASN1Module.crsMObjectClass 2};
```

```
smase MANAGED OBJECT CLASS
DERIVED FROM   "Rec. X.287 | ISO/IEC 10165-8":aso;
  CHARACTERIZED BY
    smasePkg PACKAGE
      BEHAVIOUR
        smaseBeh BEHAVIOUR
          DEFINED AS
              !This subclass of "Rec. X.287 | ISO/IEC 10165-8”:aso holds reference information
               pertaining to the capabilities of a SMASE.!;;
      ATTRIBUTES
        smaseFunctionalUnitsSupported GET,
        "Rec. X.287 | ISO/IEC 10165-8":applContextNameSupport GET;;;
REGISTERED AS {CMISE-ROSE-SMASE-ASN1Module.crsMObjectClass x};

cmipPduReceivingSupport ATTRIBUTE
  WITH ATTRIBUTE SYNTAX    CMISE-ROSE-SMASE-ASN1Module.CmipPduReceivingSupport;
  MATCHES FOR EQUALITY;
  BEHAVIOUR
    cmipPduReceivingSupportBeh BEHAVIOUR
      DEFINED AS
          !This attribute identifies the set of CMIP PDU Types supported
          for receiving.!;;
REGISTERED AS {CMISE-ROSE-SMASE-ASN1Module.crsAttribute 1};

cmipPduSendingSupport ATTRIBUTE
  WITH ATTRIBUTE SYNTAX    CMISE-ROSE-SMASE-ASN1Module.CmipPduSendingSupport;
  MATCHES FOR EQUALITY;
  BEHAVIOUR
    cmipPduSendingSupportBeh BEHAVIOUR
      DEFINED AS
          !This attribute identifies the set of CMIP PDU Types supported
          for sending.!;;
REGISTERED AS {CMISE-ROSE-SMASE-ASN1Module.crsAttribute 2};

cmiseFunctionalUnitsSelected ATTRIBUTE
  WITH ATTRIBUTE SYNTAX     CMISE-ROSE-SMASE-ASN1Module.CmiseFunctionalUnitsSelected;
  MATCHES FOR EQUALITY;
  BEHAVIOUR
    cmiseFunctionalUnitsSelectedBeh BEHAVIOUR
      DEFINED AS
          !This attribute identifies the selected CMISE Functional Units.!;;
REGISTERED AS {CMISE-ROSE-SMASE-ASN1Module.crsAttribute 3};

cmiseFunctionalUnitsSupported ATTRIBUTE
  WITH ATTRIBUTE SYNTAX     CMISE-ROSE-SMASE-ASN1Module.CmiseFunctionalUnitsSupported;
  MATCHES FOR EQUALITY;
  BEHAVIOUR
    cmiseFunctionalUnitsSupportedBeh BEHAVIOUR
      DEFINED AS
          !This attribute identifies the supported CMISE Functional Units.!;;
REGISTERED AS {CMISE-ROSE-SMASE-ASN1Module.crsAttribute 4};

invokeIdsOutstanding ATTRIBUTE
  WITH ATTRIBUTE SYNTAX    CMISE-ROSE-SMASE-ASN1Module.InvokeIdsOutstanding;
  MATCHES FOR EQUALITY;
  BEHAVIOUR
    invokeIdsOutstandingBeh BEHAVIOUR
      DEFINED AS
          !This attribute identifies lists the set of invoke Ids that have
          been issued in the confirmed mode but for which there has not
          been a confirmation response.!;;
REGISTERED AS {CMISE-ROSE-SMASE-ASN1Module.crsAttribute 5};
```