INTERNATIONAL STANDARD

ISO/IEC 10165-8

First edition
2000-11-01

Information technology — Open Systems Interconnection — Structure of management information: Managed objects for supporting upper layers

Technologies de l'information — Interconnexion de systèmes ouverts (OSI) — Structure de l'information de gestion: Objets gérés pour supporter les couches supérieures

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Reference number
ISO/IEC 10165-8:2000(E)

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ISO/IEC 10165-8:2000
https://standards.iteh.ai/catalog/standards/sist/fae3ed75-f37f-4193-ac3f-
d6b1c7182faa/iso-iec-10165-8-2000

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 10165-8 was prepared by ITU-T (as ITU-T Recommendation X.287) 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*

Annexes A and B form a normative part of this part of ISO/IEC 10165.

INTERNATIONAL STANDARD

ITU-T RECOMMENDATION

INFORMATION TECHNOLOGY – OPEN SYSTEMS INTERCONNECTION – STRUCTURE OF MANAGEMENT INFORMATION: MANAGED OBJECTS FOR SUPPORTING UPPER LAYERS

1 Scope

This Recommendation | International Standard defines generic upper-layer managed objects.

This Recommendation | International Standard:

–   establishes a model for common supporting upper layer objects;

–   provides generic and formal definitions for common supporting upper layer information (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 *Supporting Upper Layers* is used to refer to ACSE, Presentation, and Session layers.

2 Normative references

The following ITU-T 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 current valid International Standards. The Telecommunication Standardization Bureau of the ITU maintains a list of the currently valid ITU-T Recommendations.

2.1 Identical ITU-T 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.207 (1993) | ISO/IEC 9545:1994, *Information technology – Open Systems Interconnection – Application layer structure.*

–   ITU-T Recommendation X.217 (1995) | ISO/IEC 8649:1996, *Information technology – Open Systems Interconnection – Service definition for the association control service element.*

–   ITU-T Recommendation X.226 (1994) | ISO/IEC 8823-1:1994, *Information technology – Open Systems Interconnection – Connection-oriented presentation protocol: Protocol specification.*

–   ITU-T Recommendation X.227 (1995) | ISO/IEC 8650-1:1996, *Information technology – Open Systems Interconnection – Connection-oriented protocol for the association control service element: Protocol specification.*

–   ITU-T Recommendation X.283 (1997) | ISO/IEC 10733:1998, *Information technology – Elements of management information related to the OSI Network layer.*

–   ITU-T Recommendation X.284 (1997) | ISO/IEC 10737:1998, *Information technology – Elements of management information related to the OSI Transport layer.*

–   ITU-T Recommendation X.501 (1997) | ISO/IEC 9594-2:1998 *Information technology – Open Systems Interconnection – The Directory: Models.*

–   ITU-T Recommendation X.650 (1996) | ISO/IEC 7498-3:1997, *Information techology – Open Systems Interconnection – Basic reference model: Naming and addressing.*

–   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.*

–   ITU-T Recommendation X.727 (1999) | ISO/IEC 10165-9:2000 *Information technology – Open Systems Interconnection – Structure of management information: Systems management application layer managed objects.*

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).*

–   CCITT Recommendation X.290 (1995), OSI *conformance testing methodology and framework for protocol Recommendations for ITU-T applications – General concepts.*

ISO 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.*

2.3   Additional references

–   ITU-T Recommendation M.3100 (1995), *Generic network information model.*

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 Remote Operations definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Rec. X.219 | ISO/IEC 13712-1:

a) invoker;

b) performer.

3.5 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.

3.6 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.

3.7 Guidelines for the definition of managed objects definitions

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

– template.

4 Symbols and abbreviations

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

ACSE	Association Control Service Element
AE	Application Entity
AEI	Application Entity Invocation
ALS	Application Layer Structure
AP	Application Process
API	Application Process Invocation
ASE	Application Service Element
ASO	Application Service Object
CL	Connectionless
CMISE	Common Management Information Service Element
CO	Connection Oriented
DN	Distinguished Name
FU	Functional Unit
GMI	Generic Management Information
OSI	Open Systems Interconnection
PDU	Protocol Data Unit
PM	Protocol Machine
PPDU	Presentation Layer PDU
PSA	Presentation Layer SAP
RDN	Relative Distinguished Name
ROSE	Remote Operations Service Element
SAP	Service Access Point
SMASE	Systems Management Application Service Element
SSAP	Session Layer SAP
TSAP	Transport Layer SAP
TSDU	Transport Service Data Unit
UL	Upper Layer

5 Conventions

This Recommendation | International Standard makes use of the template notation defined in CCITT Rec. X.722 | ISO/IEC 10165-4 as the notation for defining managed object classes and the abstract syntax notation defined in CCITT Rec. X.208 | ISO/IEC 8824 as the means of defining ASN.1 data types associated with the use of template notation.

6 Overview

This Recommendation | International Standard defines Managed Objects that represent OSI Management's view of those elements of an Open System which support the OSI Session, Presentation and Application Layer services subject to OSI management operations.

The defined objects are of four different kinds:

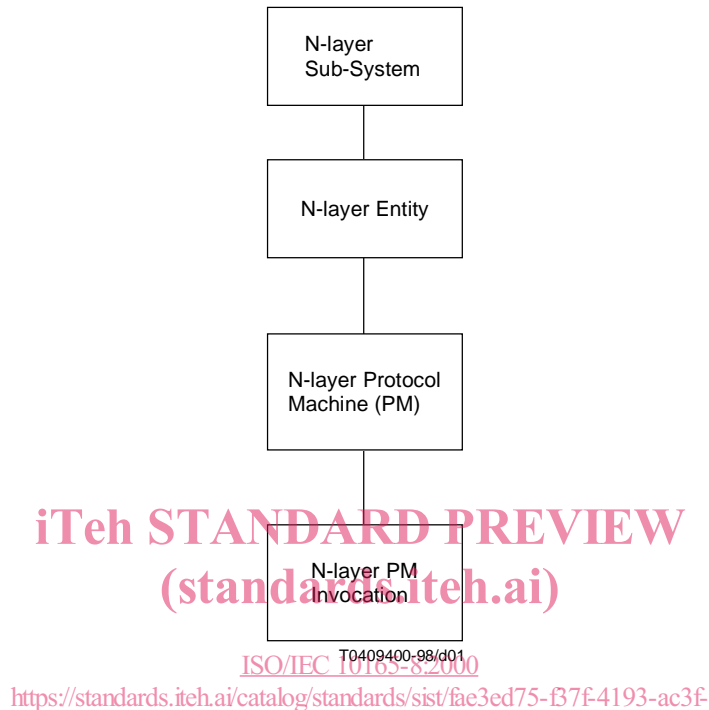– Communication Entities representing active functional elements which perform communication processing functions within a system.

– Protocol Machines performing communications functions within an entity.

– Service AccessPoints at which services are provided by an entity to the user entity.

– Connections and Associations established between entities for the transfer of service or protocol data.

The first three kinds of objects are of a static nature, and the last kind is of a more dynamic nature.

6.1 Upper Layer Model

The relationship between the Upper Layer object at each layer follows the structure as defined in the lower layers. This structure of objects in the lower layers, as defined by ITU-T Rec. X.283 | ISO/IEC 10733, Elements of management information related to the OSI Network layer and ITU-T X.284 | ISO/IEC 10737, Elements of management information related to the OSI Transport layer, is as illustrated in Figure 1.

Figure 1 – Generic OSI Layer Containment Hierarchy

N-Layer subsystems are subclasses of the managed object class "Rec. X.723 | ISO/IEC 10165-5:1994":subsystem. This managed object class is used as a common containment point for managed objects in a system that relates to the operation on the N-layer.

N-layer entities are subclasses of the managed object class "Rec. X.723 | ISO/IEC 10165-5:1994":communicationsEntity. This managed object class is used to represent the active functional elements which perform communications processing functions within a system, e.g. Network Entity, Transport Entity, etc. The localSapNames attribute contains a set of distinguished names of layer $(N-1)$ SAPs or ports at which services are provided to the entity.

N-layer protocol machines are subclasses of either "Rec. X.723 | ISO/IEC 10165-5:1994":clProtocolMachine or "Rec. X.723 | ISO/IEC 10165-5:1994":coProtocolMachine. These represent the protocol machine performing communications (connectionless-mode or connection-mode, respectively) within an entity. The information represented may include the information across all invocations initiated by this protocol machine. A protocol machine includes the mechanism for both the establishment and data-transfer phases of the communications.

N-layer invocations are subclasses of "Rec. X.723 | ISO/IEC 10165-5:1994":singlePeerConnection and represent an association or a connection established between N-layer entities for the transfer of service or protocol data (using an N-layer protocol of the N-layer protocol machine). The underlyingconnectionNames attribute contains the distinguished names of the managed objects that represent the underlying connections or physical media used by the connection (i.e. supporting service invocation).

This same model essentially applies to all the layers in the OSI model. However, at the application layer, the protocol machine is actually composed of different protocol modules or components called Application Service Objects (ASOs). These components represent the different establishment (and termination) and data transfer phases of communication.

Generally, ACSE (a subclass of ASO) will be the ASO that provides the establishment phase with one or more other ASOs composing the data transfer phase. Although the ASOs are often referred to as protocol machines themselves, they actually represent only a component. While it is true that certain ASOs may have a state machine (e.g. CMISE PM, SMASE PM, ACSE PM), it is only the combination of ASOs and ACSE that constitutes a protocol machine in the same sense as the lower layers, i.e. containing both the establishment and data transfer phases.

As a result, in this Application Layer Model, it may be necessary to show the "structure" of the "constructed" PM in terms of its ASOs. This same "structure" is also reflected in the PM's invocations of the ASOs. The relationship between a PM and its ASOs (i.e. its "structure") is represented by naming. Naming may also be used to show the relationship between the invocation of an application layer PM and its component ASO. If naming is used to represent the components of a PM and its invocation, the naming structures of an application layer PM and that of its invocation should be isomorphic. (See Figures 7 and 8.)

Because the Application Layer PM is a composition, it is not modelled as a separate object from its entity, the Application Entity. Rather, only the component PMs, the ASOs, are represented as managed objects. Therefore, in the application layer, the application layer entity and its PM are modelled as one object, called the Application Entity (AE). This object then contains or is related to the objects that represent the modules or components of the PM; these objects are ASOs or subclasses of ASO. Also in order to represent the structure of the component invocations in the same configuration as the components themselves the invocation of this application Layer PM, called Application Entity Invocation, is modelled as a separate object in order to represent the structure of the component invocations (e.g. it can be used as the "container" of the component invocations).

In the lower layers as seen above, the PM invocations are contained in their respective PMs. Unlike the lower layers, however, the Application Layer models the components of the protocol machine and its invocations. Therefore, in the application layer model, an invocation has a relationship to both its corresponding PM component and its superior invocation. The relationship between a component invocation and its containing invocation object is represented by naming, in which the component invocations are named with respect to the application layer invocation object and represent the structure of the invocation. Each component invocation has a pointer to its corresponding PM component. This relationship is represented by the attribute invocationOfPointer. If the structure of the PM is simple enough, this relationship may be represented by naming. See Figure 4 for possible name bindings.

For the Application Layer Structure (ALS) defined in ITU-T Rec. X.227 | ISO/IEC 8650-1, the concept of an Application Service Object (ASO) and its recursive structure also needs to be modelled. An ASO is an element within an AE representing a set of capabilities; it contains two or more ASOs combined with a Control Function (CF) that controls the interactions among its components.

The term ASE is used to refer to specialized ASOs that cannot be decomposed, that is, they cannot be composed of other ASOs.

Specific ASEs are modelled as subclasses of ASO.

An ASO that contains an Establishment ASE (e.g. ACSE) and at least one data transfer ASE is called an ASO Entity. An AE is a specialized ASO Entity that includes an Establishment ASE (e.g. ACSE) among its ASO(s) and/or ASE(s); it is always the outermost ASO Entity in an Application Layer which refers to a PSAP. An AE can also contain the following: ASO Entities which include ACSE (ASOEs); ASOs which do not contain ACSE; and ASEs.

With respect to specialized ASEs, only the management of ACSE is standardized in this Recommendation | International Standard. Management of other ASEs, like CMISE, ROSE, SMASE etc. might be specified in other standards.
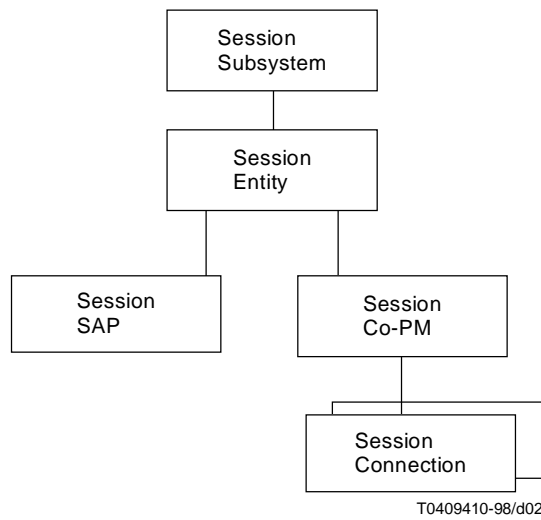
6.2   Managed Object Hierarchy

6.2.1   Session Layer Managed Object Classes

The following managed object classes are defined for the session layer:

    a)   Session Entity;

    b)   Session Connection-oriented Protocol Machine;

    c)   S (Session) SAP;

    d)   Session Connection;

    e)   Session Subsystem.

The session layer containment hierarchy is illustrated in Figure 2.
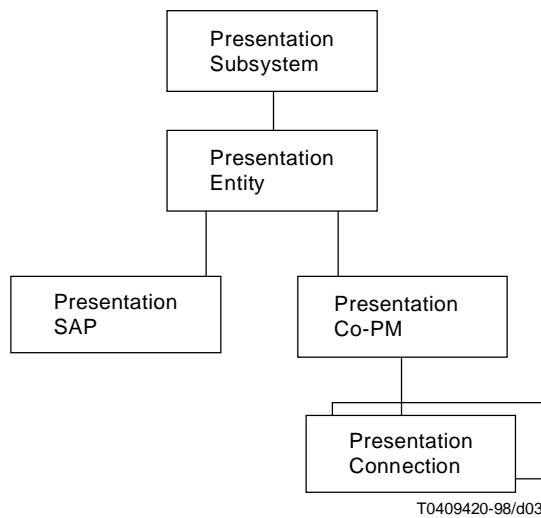

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Figure 2 – Session Layer Containment Hierarchy

6.2.2 Presentation Layer Managed Object Classes

The following managed object classes are defined for the presentation layer:

 f) Presentation Entity;

 g) Presentation Connection-oriented Protocol Machine;

 h) P (Presentation) SAP;

 i) Presentation Connection;

 j) Presentation Subsystem.

The presentation layer containment hierarchy is illustrated in Figure 3.

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Figure 3 – Presentation Layer Containment Hierarchy

6.2.3   Application Layer Managed Object Classes

The following managed objects are defined for the application layer:

      k)   Application Entity;

      l)   Application Entity Invocation;

      m)   ACSE;

      n)   ACSE Association;

      o)   Application Subsystem;

      p)   AP (Application Process) Invocation;

      q)   ASO Entity;

      r)   ASO;

      s)   ASO Invocation.

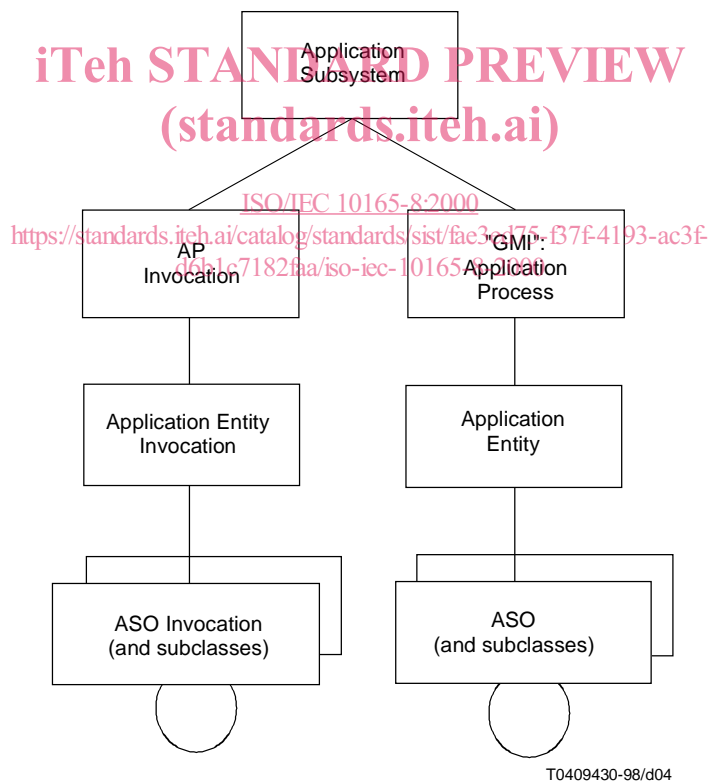A generic application layer containment hierarchy is illustrated in Figure 4.

Figure 4 – Generic Application Layer Containment Hierarchy