INTERNATIONAL STANDARD

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Information technology — Open Systems Interconnection — Systems Management: Management knowledge management function

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

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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 10164-16 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 21, *Open systems interconnection, data management and open distributed processing*, in collaboration with ITU-T. The identical text is published as ITU-T Recommendation X.750.

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: Usage metering function for accounting purposes*
- *Part 11: Metric objects and attributes*
- *Part 12: Test Management Function*
- *Part 13: Summarization Function*
- *Part 14: Confidence and diagnostic test categories*
- *Part 15: Scheduling function*
- *Part 16: Management knowledge management function*
- *Part 17: Change over function*
- *Part 18: Software management function*

— *Part 19: Management domain and management policy management functions*

— *Part 20: Time management function*

— *Part 21: Command sequencer*

— *Part 22: Response time monitoring function*

Annexes A to F form an integral part of this part of ISO/IEC 10164. Annexes G and H are for information only.

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INTERNATIONAL STANDARD

ITU-T RECOMMENDATION

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

1 Scope

This Recommendation | International Standard defines the Management knowledge management function. The Management knowledge management function is 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 the OSI Management framework, CCITT Rec. X.700 and ISO/IEC 7498-4. This Recommendation | International Standard defines a function which consists of generic definitions and services. This function is positioned in the application layer of the OSI reference model, ITU-T Rec. X.200 | ISO/IEC 7498-1, and is defined according to the model provided by ITU-T Rec. X.207 | ISO/IEC 9545. The role of systems management functions is described by CCITT Rec. X.701 | ISO/IEC 10040.

This Recommendation | International Standard:

- identifies the set of requirements satisfied by the function;
- provides a model for the behaviour of management knowledge objects;
- specifies the management requirements of the function and how these are realized by specification of managed objects and their behaviour or by specification of Directory objects;
- specifies the mapping of these services onto the CMIS services;
- specifies the abstract syntax of the parameters of the MAPDUs that will be used to refer to managed objects and their characteristics.

This Recommendation | International Standard does not:

- define the nature of any implementation intended to provide the Management knowledge management function;
- specify the manner in which management is to be accomplished by the user of the Management knowledge management function;
- define the nature of any interactions which result in the use of the Management knowledge management function;
- specify the services necessary for the establishment, normal and abnormal release of a management association;
- define the interactions which result by the simultaneous use of several management functions;
- define connection establishment or authorization requirements for the use of these functions or for any associated activity;
- preclude the definition of further management knowledge object classes.

2 Normative references

The following 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 currently valid International Standards. The Telecommunication Standardization Bureau of the ITU maintains a list of 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.210 (1993) | ISO/IEC 10731:1994, *Information technology – Open Systems Interconnection – Basic Reference Model – Conventions for the definition of OSI services.*
- 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.501 (1993) | ISO/IEC 9594-2:1995, *Information technology – Open Systems Interconnection – The Directory: Models.*
- ITU-T Recommendation X.511 (1993) | ISO/IEC 9594-3:1995, *Information technology – Open Systems Interconnection – The Directory: Abstract service definition.*
- ITU-T Recommendation X.520 (1993) | ISO/IEC 9594-6:1995, *Information technology – Open Systems Interconnection – The Directory: Selected attribute types.*
- ITU-T Recommendation X.521 (1993) | ISO/IEC 9594-7:1995, *Information technology – Open Systems Interconnection – The Directory: Selected object classes.*
- ITU-T Recommendation X.680 (1994) | ISO/IEC 8824-1:1995, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation.*
- ITU-T Recommendation X.681 (1994) | ISO/IEC 8824-2:1995, *Information technology – Abstract Syntax Notation One (ASN.1): Information object specification.*
- ITU-T Recommendation X.682 (1994) | ISO/IEC 8824-3:1995, *Information technology – Abstract Syntax Notation One (ASN.1): Constraint specification.*
- ITU-T Recommendation X.683 (1994) | ISO/IEC 8824-4:1995, *Information technology – Abstract Syntax Notation One (ASN.1): Parameterization of ASN.1 specifications.*
- ITU-T Recommendation X.690 (1994) | ISO/IEC 8825-1:1995, *Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER).*
- 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.*
- ITU-T Recommendation X.724 (1993) | ISO/IEC 10165-6:1994, *Information technology – Open Systems Interconnection – Structure of management information: Requirements and guidelines for implementation conformance statement proformas associated with OSI management.*
- ITU-T Recommendation X.725 (1995) | ISO/IEC 10165-7:1996, *Information technology – Open Systems Interconnection – Structure of management information: General relationship model.*
- CCITT Recommendation X.730 (1992) | ISO/IEC 10164-1:1993, *Information technology – Open Systems Interconnection – Systems Management: Object Management Function.*
- CCITT Recommendation X.735 (1992) | ISO/IEC 10164-6:1993, *Information technology – Open Systems Interconnection – Systems Management: Log control function.*
- ITU-T Recommendation X.741 (1995) | ISO/IEC 10164-9:1995, *Information technology – Open Systems Interconnection – Systems Management: Objects and attributes for access control.*

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.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.290 (1992), *OSI Conformance testing methodology and framework for protocol Recommendations for CCITT 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.291 (1992), *OSI Conformance testing methodology and framework for protocol Recommendations for CCITT applications – Abstract test suite specification.*

  ISO/IEC 9646-2:1994, *Information technology – Open Systems Interconnection – Conformance testing methodology and framework – Part 2: Abstract Test Suite specification.*

- ITU-T Recommendation X.296 (1995), *OSI conformance testing methodology and framework for protocol Recommendations for ITU-T applications – Implementation conformance statements.*

  ISO/IEC 9646-7:1995, *Information technology – Open Systems Interconnection – Conformance testing methodology and framework – Part 7: Implementation Conformance Statements.*

- 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.*

- 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 ISP 11183-1:1992, *Information technology – International Standardized Profiles AOM1n OSI Management – Management Communications – Part 1: Specification of ACSE, presentation and session protocols for the use by ROSE and CMISE.*

- ISO/IEC ISP 11183-2:1992, *Information technology – International Standardized Profiles AOM1n OSI Management – Management Communications – Part 2: CMISE/ROSE for AOM12 – Enhanced Management Communications.*

- ISO/IEC ISP 11183-3:1992, *Information technology – International Standardized Profiles AOM1n OSI Management – Management Communications – Part 3: CMISE/ROSE for AOM11 – Basic Management Communications.*

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) (N)-protocol data unit;

c) systems management;

d) systems management application entity.

3.2 Application layer structure definitions

This Recommendation | International Standard makes use of the following term defined in ITU-T Rec. X.207 | ISO/IEC 9545:

– application service element.

3.3 OSI conformance testing definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Rec. X.290 and ISO/IEC 9646-1 and ITU-T Rec. X.296 and ISO/IEC 9646-7:

a) ICS proforma;

b) implementation conformance statement;

c) PICS proforma;

d) protocol implementation conformance statement.

3.4 Directory definitions

This Recommendation | International Standard makes use of the following terms defined in ITU-T Rec. X.501 | ISO/IEC 9594-2:

a) alias entry;

b) attribute;

c) auxiliary object class;

d) Directory entry;

e) Directory information tree;

f) Directory name;

g) Directory object class;

h) Directory system agent;

i) Directory user agent;

j) distinguished name;

k) DIT content rule;

l) relative distinguished name;

m) structural object class;

n) subordinate;

o) superior;

p) the Directory.

NOTE – The terms "attribute", "distinguished name", "relative distinguished name", "subordinate" and "superior" are defined in both ITU-T Rec. X.501 | ISO/IEC 9594-2 and either CCITT Rec. X.710 and ISO/IEC 9595 or CCITT Rec. X.720 | ISO/IEC 10165-1 because of similarities between the Directory model and the Management information model. However, the uses of these terms in the two models are not identical in all details. The context of use, a Directory object or a managed object, identifies the appropriate definition.

3.5 Management framework definitions

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

– managed object.

3.6 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) generic definitions;
d) managed system;
e) managed object conformance statement;
f) management information;
g) management information conformance statement;
h) management operation;
i) manager;
j) manager role;
k) managing system;
l) MICS proforma;
m) MIS-user;
n) MOCS proforma;
o) notification;
p) notification type;
q) systems management application service element;
r) systems management functional unit.

3.7 CMIS definitions

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

a) attribute;
b) common management information service element;
c) common management information service(s);
d) set-valued (attribute).

3.8 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) action;
b) actual class;
c) allomorphic class;
d) attribute group;
e) attribute identifier;
f) attribute type;
g) behaviour;
h) characteristic;

i) conditional package;

j) containment;

k) distinguished name;

l) instantiation;

m) mandatory package;

n) name binding;

o) naming tree;

p) package;

q) parameter;

r) relative distinguished name;

s) specialization;

t) subclass;

u) superclass;

v) subordinate (object);

w) superior (object).

3.9 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:

a) managed object class definition;

b) template.

3.10 Requirements and guidelines for ICS proformas associated with OSI management definitions

This Recommendation | International Standard makes use of the following term defined in ITU-T Rec. X.724 | ISO/IEC 10165-6:

a) managed relationship conformance statement;

b) management conformance summary;

c) MCS proforma;

d) MRCS proforma.

3.11 General relationship model definitions

This Recommendation | International Standard makes use of the following term defined in ITU-T Rec. X.725 | ISO/IEC 10165-7:

– managed relationship.

3.12 Additional definitions

3.12.1 management knowledge object: A managed object or a Directory object that makes management knowledge available.

4 Abbreviations

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

ACSE	Association Control Service Element
ASE	Application Service Element
ASN.1	Abstract Syntax Notation One

CMIP	Common Management Information Protocol
CMIS	Common Management Information Service
CMISE	Common Management Information Service Element
Cnf	Confirm
DIT	Directory Information Tree
DKDT	Definition Knowledge Directory Tree
DSA	Directory System Agent
DUA	Directory User Agent
GDMO	Guidelines for the Definition of Managed Objects
ICS	Implementation Conformance Statement
Id	Identifier
Ind	Indication
ISP	International Standardized Profile
MAPDU	Management Application Protocol Data Unit
MCS	Management Conformance Summary
MICS	Management Information Conformance Statement
MIS	Management Information Service
MKM	Management Knowledge Management Function
MOCS	Managed Object Conformance Statement
MRCS	Managed Relationship Conformance Statement
PDU	Protocol Data Unit
PICS	Protocol Implementation Conformance Statement
RDN	Relative Distinguished Name
Req	Request
Rsp	Response
SMAE	Systems Management Application Entity
SMAPM	Systems Management Application Protocol Machine
SMASE	Systems Management Application Service Element

5 Conventions

This Recommendation | International Standard defines services for the Management knowledge management function following the descriptive conventions defined in ITU-T Rec. X.210 | ISO/IEC 10731.

The following notation is used in the service parameter tables:

M	The parameter is mandatory
C	The parameter is conditional
(=)	The value of the parameter is identical to the corresponding parameter in the interaction described by the preceding related service primitive
U	The use of the parameter is a service-user option
–	The parameter is not present in the interaction described by the primitive concerned
P	The parameter is subject to the constraints imposed by ITU-T Rec. X.710 and ISO/IEC 9595.

NOTE – The parameters which 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

Open systems which are participating, or may participate, in OSI Systems Management associations require specific knowledge in order to determine the peer open systems with which to associate, to enable association and to fulfil the functions of OSI Systems Management. Particular requirements, categorized by field of knowledge, are listed herein.

Three types of management knowledge are identified:

- *Repertoire knowledge*: Information on what the managed system is capable of performing. There are three categories of capabilities:
  - managed object class capabilities;
  - managed relationship class capabilities;
  - function capabilities.

  There is a need for a manager to be able to discover capabilities of managed systems without accessing each managed system.
- *Definition knowledge*: Information on the formal specification of managed object classes, name bindings, etc., e.g. templates for classes, name bindings.
- *Instance knowledge*: Information regarding what managed objects and managed relationships are made visible by a managed system and what systems management application entities can be used to establish an association to a managed system that makes a given managed object visible.

Knowledge sharing mechanisms shall preserve all access control requirements upon the open systems about which information is provided. In particular, knowledge sharing mechanisms for the purpose of OSI Systems Management shall not expose information to a given user if that user is otherwise prohibited from obtaining that information when using OSI Systems Management services.

The requirements necessary to acquire repertoire, definition and instance knowledge are subdivided into the following five major categories (see Table 1).

Table 1 – Requirements

		Types of management knowledge		
Subclause	Major categories	Repertoire knowledge	Definition knowledge	Instance knowledge
6.1	Managed object class knowledge	X		
6.2	Managed object class instance knowledge			X
6.3	Relationship knowledge	X		X
6.4	MIS-user knowledge	X		X
6.5	Management information definition knowledge		X	

6.1 Managed object class knowledge

There is a need to determine the following repertoire knowledge:

- the managed object classes that can be made available by a given managed system;
- the constraints imposed upon managed objects of a given class (e.g. the implemented value set for a given attribute);
- for a given managed object class, the conditional packages that are always included and those that are never included in an instance of the class;
- the initial values of an instance of a particular class that can be created in a given managed system;
- the supported allomorphs for each supported managed object class.

6.2 Managed object class instance knowledge

Without obligatory recourse to the CMIS multiple object selection functional unit, there is a need to determine the following instance knowledge:

- the instances of a given managed object class made visible by a given managed system;
- the managed systems making a given managed object visible;
- how many instances of a given managed object class are made visible by a given managed system.

6.3 Relationship knowledge

There is a need to determine the following repertoire knowledge:

- the relationship classes supported by a given managed system;
- the relationship role bindings, including name bindings, that may exist between managed object classes made visible by a given managed system;

as well as the following instance knowledge:

- the relationship instances that exist between managed objects made visible by a given managed system or by different managed systems.

6.4 MIS-user knowledge

There is a need to determine the following repertoire knowledge:

- the SMAE titles of the managed systems or managing systems with which management associations can be established;
- the presentation addresses of those SMAEs;
- the application contexts supported by those SMAEs, including the syntaxes and identifiers of information associated with those application contexts;
- which functional units for SMASE, CMISE, ACSE and any additional ASEs used for management purposes are supported by those SMAEs for systems management associations;
- which standard profiles are supported,

as well as the following instance knowledge:

- given a global name of a managed object, the systems management application entities that can be used to establish an association to a managed system that makes the managed object visible.

6.5 Management information definition knowledge

There is a need to determine the following definition knowledge:

- the formal definitions of management information, including managed object classes, name bindings, test categories, relationship classes and all attendant information;

  NOTE – Where a Directory service is available, some or all of this information may be held in and made available through such a Directory service. Definitions for such a solution are provided in Annex B;
- which management information definitions are understood by a given managing system?

7 Model

This model discusses how information on various types of management knowledge can be made available. This information is specified as:

1) managed objects according to the Guidelines for the definition of managed objects, CCITT Rec. X.722 | ISO/IEC 10165-4; or
2) Directory objects according to The Directory: Models, ITU-T Rec. X.501 | ISO/IEC 9594-2.

These management knowledge objects are described in 7.1 and 7.2 respectively.

This model is consistent with the way standardized management knowledge is specified in CCITT Rec. X.701 | ISO/IEC 10040.