
**Information technology — Open Systems
Interconnection — Common management
information protocol —**

**Part 1:
Specification**

*Technologies de l'information — Interconnexion de systèmes ouverts
(OSI) — Protocole commun d'information de gestion —*

Partie 1: Spécification

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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.

International Standard ISO/IEC 9596-1 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 33, *Distributed application services*, in collaboration with ITU-T. The identical text is published as ITU-T Recommendation X.711.

This third edition cancels and replaces the second edition (ISO/IEC 9596-1:1991), which has been technically revised. It also incorporates Technical Corrigendum 1:1992, Technical Corrigendum 2:1992, Technical Corrigendum 3:1992, Technical Corrigendum 4:1993 and Technical Corrigendum 5:1994.

ISO/IEC 9596 consists of the following parts, under the general title *Information technology — Open Systems Interconnection — Common management information protocol*:

- *Part 1: Specification*
- *Part 2: Protocol Implementation Conformance Statement (PICS) proforma*

Annexes A to D of this part of ISO/IEC 9596 are for information only.

INTERNATIONAL STANDARD

ITU-T RECOMMENDATION

INFORMATION TECHNOLOGY – OPEN SYSTEMS INTERCONNECTION – COMMON MANAGEMENT INFORMATION PROTOCOL: SPECIFICATION

1 Scope

This Recommendation | International Standard specifies a protocol which is used by application layer entities to exchange management information.

This Recommendation | International Standard specifies:

- procedures for the transmission of management information between application entities;
- the abstract syntax of the Common Management Information Protocol (CMIP) and the associated encoding rules to be applied;
- procedures for the correct interpretation of protocol control information;
- the conformance requirements to be met by implementation of this Recommendation | International Standard.

This Recommendation | International Standard does not specify:

- the structure or meaning of the management information that is transmitted by means of CMIP;
- the manner in which management is accomplished as a result of CMIP exchanges;
- the interactions which result in the use of CMIP.

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 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.215 (1995) | ISO/IEC 8326:1996, *Information technology – Open Systems Interconnection – Session service definition*.
- ITU-T Recommendation X.216 (1994) | ISO/IEC 8822:1994, *Information technology – Open Systems Interconnection – Presentation service definition*.
- 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*.

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- ITU-T Recommendation X.710 (1997) | ISO/IEC 9595:1998, *Information technology – Open Systems Interconnection – Common management information service.*
- CCITT Recommendation X.712 (1992) | ISO/IEC 9596-2:1993, *Information technology – Open Systems Interconnection – Common management information protocol: Protocol Implementation Conformance Statement (PICS) proforma.*

2.2 Paired 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.219 (1988), *Remote operations: Model, notation and service definition.*
ISO/IEC 9072-1:1989, *Information processing systems – Text communication – Remote Operations – Part 1: Model, notation and service definition.*
- CCITT Recommendation X.229 (1988), *Remote operations: Protocol specification.*
ISO/IEC 9072-2:1989, *Information processing systems – Text communication – Remote Operations – Part 2: Protocol specification.*
- 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:

- application-service-element;
- application-process;
- real open system;
- 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:

- managed object;
- management information;
- management information base;
- systems management application-entity.

3.3 Remote Operations definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Rec. X.219 | ISO/IEC 9072-1:

- association-initiator;
- association-responder;

- c) linked-operations;
- d) Remote Operations;
- e) Remote Operation Service Element;
- f) invoker;
- g) performer;
- h) Association Class;
- i) Operation Class.

3.4 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 services;
- d) CMISE-service-provider;
- e) CMISE-service-user;
- f) invoking CMISE-service-user;
- g) performing CMISE-service-user.

3.5 ACSE definitions

This Recommendation | International Standard makes use of the following terms defined in ITU-T Rec. X.217 | ISO/IEC 8649:

- a) application context;
- b) application-association;
- c) association.

3.6 Presentation definitions

This Recommendation | International Standard makes use of the following terms defined in ITU-T Rec. X.216 | ISO/IEC 8822:

- a) abstract syntax;
- b) transfer syntax.

4 Symbols and abbreviations

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

ACSE	Association Control Service Element
APDU	Application Protocol Data Unit
ASE	Application Service Element
ASN.1	Abstract Syntax Notation One
CMIP	Common Management Information Protocol
CMIPM	Common Management Information Protocol Machine
CMIS	Common Management Information Services
CMISE	Common Management Information Service Element
DCS	Defined Context Set
PCI	Protocol Control Information
PDU	Protocol Data Unit

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PICS	Protocol Implementation Conformance Statement
RO	Remote Operations
ROSE	Remote Operations Service Element
SMAE	Systems Management Application-Entity

5 Overview

The Common Management Information Protocol (CMIP) specifies protocol elements that may be used to provide the operation and notification services described in ITU-T Rec. X.710 | ISO/IEC 9595, which defines the Common Management Information Services (CMIS).

5.1 Service provided

The protocol specified in this Recommendation | International Standard supports the services defined in ITU-T Rec. X.710 | ISO/IEC 9595. These services are summarized in Table 1.

Table 1 – Common management information services

Service	Type
M-CANCEL-GET	confirmed
M-EVENT-REPORT	confirmed/non-confirmed
M-GET	confirmed
M-SET	confirmed/non-confirmed
M-ACTION	confirmed/non-confirmed
M-CREATE	confirmed
M-DELETE	confirmed

5.2 Underlying services

This Recommendation | International Standard uses the RO-INVOKE, RO-RESULT, RO-ERROR and RO-REJECT-U services of the Remote Operations Service Element (ROSE) defined in CCITT Rec. X.219 | ISO/IEC 9072-1. ROSE assumes the use of the presentation service defined in ITU-T Rec. X.216 | ISO/IEC 8822. The confirmed operations of CMIP are operation class 2 (asynchronous) or operation class 1 (synchronous) as required by the application. The choice of operation class is a local matter. The unconfirmed operations of CMIP are operation class 5 (asynchronous, outcome not reported). CMIP uses association class 3.

If the extended service functional unit is successfully negotiated, ROSE APDUs may be mapped on to presentation services other than the P-DATA service.

NOTE – For example, it may be necessary to modify the presentation Defined Context Set (DCS) when the CMIP operation is sent to the peer CMISE-service-user. In this case, the ROSE APDU which carries the CMIP operation will be mapped onto the P-ALTER-CONTEXT service which is also used to perform the changes to the DCS.

Details of which other presentation services are required and how they are used, are described in the description of the application context in use on the association.

5.2.1 Service assumed from the ACSE

This Recommendation | International Standard assumes the use of the A-ASSOCIATE, A-RELEASE, A-ABORT, and A-P-ABORT services of the Association Control Service Element.

5.2.2 Service assumed from the presentation layer

CCITT Rec. X.229 | ISO/IEC 9072-2 assumes the use of the P-DATA service of the presentation layer for the transfer of the RO-INVOKE, RO-RESULT, RO-ERROR and RO-REJECT APDUs.

5.3 Management information definitions

This Recommendation | International Standard defines the abstract syntax of the Common Management Information Protocol. The definitions of management information to be carried by the protocol are not specified in this Recommendation | International Standard.

5.4 Protocol version

This Recommendation International Standard defines version 2 of CMIP. Version 2 replaces version 1. This Recommendation | International Standard does not define any interworking between version 2 and version 1.

6 Elements of procedure

This clause provides definition for the procedural elements of the CMIP. The procedures define the transfer of CMIP PDUs whose structure, coding and relationship with the CMIS service primitives is specified in clause 7.

The Common Management Information Protocol Machine (CMIPM) accepts CMIS request and response service primitives, and issues CMIP PDUs initiating specific elements of procedure as specified in this clause.

A CMIPM shall accept any well-formed CMIP PDU, and pass it to the performing CMISE-service-user for processing, by means of CMIS indication and confirmation service primitives. If the received PDU is not well formed or does not contain a supported notification or operation, a PDU is returned indicating that the received PDU has been rejected.

The procedures indicate only how to interpret the various fields in the CMIP PDU, not what an invoking CMISE-service-user should do with the information it requests nor how a performing CMISE-service-user should process the invocation.

6.1 Association establishment

The establishment of an association involves two CMISE-service-users, one that is the association-initiator and one that is the association-responder.

A CMISE-service-user may initiate an association establishment by using the A-ASSOCIATE service of ITU-T Rec. X.217 | ISO/IEC 8649.

The application context specifies, among other things, the rules required for the coordination of initialization information corresponding to different ASEs. The association rules for CMISE are specified in Annex A.

6.2 Remote operations

6.2.1 RO elements of procedure

The CMIP elements of procedure rely on the following underlying remote operations elements of procedure:

- a) invocation;
- b) return-result;
- c) return-error;
- d) user-reject;
- e) provider-reject.

These elements of procedure are described fully in CCITT Rec. X.229 | ISO/IEC 9072-2.

Table 2 specifies the correspondence between CMIS and ROSE parameters.

Table 2 – Correspondence between CMIS and ROSE parameters

CMIS parameter	ROSE parameter
Invoke identifier	InvokeID
Linked identifier	Linked-ID

The correspondence between other CMIS and ROSE parameters is specified in clause 7.

6.2.2 RO-Reject problem parameters

The RO-Reject problem parameters are mapped or processed as follows.

6.2.2.1 RO-Reject-User.Invoke-problem mapping to CMIS error codes is specified in Table 3.

Table 3 – Mapping RO-Reject-User.Invoke-problem to CMISE error codes

RO-REJECT parameter	CMISE error code
duplicate-invocation	duplicate invocation
mistyped-argument	mistyped argument
resource-limitation	resource limitation
unrecognized-operation	unrecognized operation

Other Invoke-problem parameters are a local matter.

6.2.2.2 Other RO-Reject parameters will be handled as a local matter.

6.3 Event reporting procedure

6.3.1 Invocation

The event reporting procedures are initiated by the M-EVENT-REPORT request primitive.

On receipt of the M-EVENT-REPORT request primitive, the CMIPM shall

- a) in the confirmed mode, construct an APDU requesting the m-EventReport-Confirmed operation, otherwise, construct an APDU requesting the m-EventReport operation;
- b) send the APDU using the RO-INVOKE procedure.

6.3.2 Receipt

On receipt of an APDU requesting either the m-EventReport or m-EventReport-Confirmed operation, the CMIPM shall, if the APDU is well formed, issue an M-EVENT-REPORT indication primitive to the CMISE-service-user with the mode parameter indicating whether or not confirmation is requested, otherwise, construct an APDU containing notification of the error and send it using the RO-REJECT-U procedure.

6.3.3 Response

In the confirmed mode, the CMIPM shall accept an M-EVENT-REPORT response primitive and shall:

- a) construct an APDU confirming the M-EVENT-REPORT notification;
- b) if the parameters in the M-EVENT-REPORT response primitive indicate that the notification was accepted send the APDU using the RO-RESULT procedure, otherwise, send the APDU using the RO-ERROR procedure.

6.3.4 Receipt of response

On receipt of an APDU responding to an M-EVENT-REPORT notification, the CMIPM shall, if the APDU is well formed, issue an M-EVENT-REPORT confirmation primitive to the CMISE-service-user, thus completing the notification procedure, otherwise, construct an APDU containing notification of the error and send it using the RO-REJECT-U procedure.

6.4 Get procedure

6.4.1 Invocation

The Get procedures are initiated by the M-GET request primitive.

On receipt of the M-GET request primitive, the CMIPM shall:

- a) construct an APDU requesting the m-Get operation;
- b) send the APDU using the RO-INVOKE procedure.

6.4.2 Receipt

On receipt of an APDU requesting the m-Get operation, the CMIPM shall, if the APDU is well formed, issue an M-GET indication primitive to the CMISE-service-user, otherwise, construct an APDU containing notification of the error and send it using the RO-REJECT-U procedure.

6.4.3 Response

The CMIPM shall:

- a) accept zero or more M-GET response primitives containing a linked-ID followed by a single M-GET response primitive without a linked-ID;
- b) for each M-GET response primitive containing a linked-ID:
 - construct an APDU requesting the m-Linked-Reply operation with LinkedReplyArgument set appropriately as either getListError, getResult or processingFailure;
 - send each APDU using the RO-INVOKE procedure;
- c) for the M-GET response primitive not containing a linked-ID:
 - construct an APDU confirming the m-Get operation;
 - if the parameters in the M-GET response primitive indicate that the operation was performed correctly, send the APDU using the RO-RESULT procedure. If the parameters in the M-GET response primitive indicate that the operation was performed with partial success or was not performed because of an error, the CMIPM shall send the APDU using the RO-ERROR procedure.

6.4.4 Receipt of response

On receipt of an APDU responding to an m-Get operation, the CMIPM shall:

- a) if the APDU included a linked-ID and is well formed, issue an M-GET confirmation primitive to the CMISE-service-user;
- b) if the APDU is the last response (i.e. not containing a linked-ID) and is well formed, issue an M-GET confirmation primitive to the CMISE-service-user, thus completing the M-GET procedure;
- c) if the APDU is not well formed, construct an APDU containing notification of the error and send it using the RO-REJECT-U procedure.

6.4.5 CancelGet procedure

6.4.5.1 Invocation

The CancelGet procedures are initiated by the M-CANCEL-GET request primitive.

On receipt of the M-CANCEL-GET request primitive, the CMIPM shall:

- a) construct an APDU requesting the m-CancelGet operation;
- b) send the APDU using the RO-INVOKE procedure.

6.4.5.2 Receipt

On receipt of an APDU requesting the m-CancelGet operation, the CMIPM shall, if the APDU is well formed, issue an M-CANCEL-GET indication primitive to the CMISE-service-user, otherwise, construct an APDU containing notification of the error and send it using the RO-REJECT-U procedure.

6.4.5.3 Response

The CMIPM shall:

- a) construct an APDU confirming the m-CancelGet operation;
- b) if the parameters in the M-CANCEL-GET response primitive indicate that the operation was performed correctly, send the APDU using the RO-RESULT procedure otherwise, send the APDU using the RO-ERROR procedure. If the m-CancelGet operation is successful, the performing CMISE-service-user shall cease from sending linked replies to the m-Get operation and shall issue an M-GET response primitive which shall contain the “operation cancelled” error.

6.4.5.4 Receipt of response

On receipt of an APDU responding to an m-CancelGet operation, the CMIPM shall, if the APDU is well formed, issue an M-CANCEL-GET confirmation primitive to the CMISE-service-user, otherwise, construct an APDU containing notification of the error and send it using the RO-REJECT-U procedure.

6.5 Set procedure

6.5.1 Invocation

The Set procedures are initiated by the M-SET request primitive.

On receipt of the M-SET request primitive, the CMIPM shall:

- a) in the confirmed mode, construct an APDU requesting the m-Set-Confirmed operation, otherwise, construct an APDU requesting the m-Set operation;
- b) send the APDU using the RO-INVOKE procedure.

6.5.2 Receipt

On receipt of an APDU requesting the m-Set or m-Set-Confirmed operation, the CMIPM shall, if the APDU is well formed, issue an M-SET indication primitive to the CMISE-service-user, with the mode parameter indicating whether or not confirmation is requested, otherwise, construct an APDU containing notification of the error and send it using the RO-REJECT-U procedure.

6.5.3 Response

In the confirmed mode, the CMIPM shall:

- a) accept zero or more M-SET response primitives containing a linked-ID followed by a single M-SET response primitive without a linked-ID;
- b) for each M-SET response primitive containing a linked-ID:
 - construct an APDU requesting the m-Linked-Reply operation with LinkedReplyArgument set appropriately as either setListError, setResult or processingFailure;
 - send each APDU using the RO-INVOKE procedure;
- c) for the M-SET response primitive not containing a linked-ID:
 - construct an APDU confirming the m-Set operation;
 - if the parameters in the M-SET response primitive indicate that the operation was performed correctly, send the APDU using the RO-RESULT procedure. If the parameters in the M-SET response primitive indicate that the operation was performed with partial success or was not performed because of an error, the CMIPM shall send the APDU using the RO-ERROR procedure.

6.5.4 Receipt of response

On receipt of an APDU responding to an m-Set-Confirmed operation, the CMIPM shall:

- a) if the APDU included a linked-ID and is well formed, issue an M-SET confirmation primitive to the CMISE-service-user;
- b) if the APDU is the last response (i.e. not containing a linked-ID) and is well formed, issue an M-SET confirmation primitive to the CMISE-service-user, thus completing the M-SET procedure;
- c) if the APDU is not well formed, construct an APDU containing notification of the error and send it using the RO-REJECT-U procedure.

6.6 Action procedure

6.6.1 Invocation

The Action procedures are initiated by the M-ACTION request primitive.

On receipt of the M-ACTION request primitive, the CMIPM shall:

- a) in the confirmed mode, construct an APDU requesting the m-Action-Confirmed operation otherwise, construct an APDU requesting the m-Action operation;
- b) send the APDU using the RO-INVOKE procedure.

6.6.2 Receipt

On receipt of an APDU requesting the m-Action or m-Action-Confirmed operation, the CMIPM shall, if the APDU is well formed, issue an M-ACTION indication primitive to the CMISE-service-user, with the mode parameter indicating whether or not confirmation is requested, otherwise, construct an APDU containing notification of the error and send it using the RO-REJECT-U procedure.

6.6.3 Response

In the confirmed mode, the CMIPM shall:

- a) accept zero or more M-ACTION response primitives containing a linked-ID followed by a single M-ACTION response primitive without a linked-ID;
- b) for each M-ACTION response primitive containing a linked-ID:
 - construct an APDU requesting the m-Linked-Reply operation with LinkedReplyArgument set appropriately as either actionError, actionResult or processingFailure;
 - send each APDU using the RO-INVOKE procedure;
- c) for the M-ACTION response primitive not containing a linked-ID:
 - construct an APDU confirming the m-Action operation;
 - if the parameters in the M-ACTION response primitive indicate that the operation was performed correctly, send the APDU using the RO-RESULT procedure, otherwise, send the APDU using the RO-ERROR procedure.

6.6.4 Receipt of response

On receipt of an APDU responding to an m-Action-Confirmed operation, the CMIPM shall:

- a) if the APDU included a linked-ID and is well formed, issue an M-ACTION confirmation primitive to the CMISE-service-user;
- b) if the APDU is the last response (i.e. not containing a linked-ID) and is well formed, issue an M-ACTION confirmation primitive to the CMISE-service-user, thus completing the M-ACTION procedure;
- c) if the APDU is not well formed, construct an APDU containing notification of the error and send it using the RO-REJECT-U procedure.

6.7 Create procedure

6.7.1 Invocation

The Create procedures are initiated by the M-CREATE request primitive.

On receipt of the M-CREATE request primitive, the CMIPM shall:

- a) construct an APDU requesting the m-Create operation;
- b) send the APDU using the RO-INVOKE procedure.

6.7.2 Receipt

On receipt of an APDU requesting the m-Create operation, the CMIPM shall, if the APDU is well formed, issue an M-CREATE indication primitive to the CMISE-service-user, otherwise, construct an APDU containing notification of the error and send it using the RO-REJECT-U procedure.

6.7.3 Response

The CMIPM shall accept an M-CREATE response primitive and shall:

- a) construct an APDU confirming the m-Create operation;
- b) if the parameters in the M-CREATE response primitive indicate that the operation was performed correctly, send the APDU using the RO-RESULT procedure, otherwise, send the APDU using the RO-ERROR procedure.

6.7.4 Receipt of response

On receipt of an APDU responding to an m-Create operation, the CMIPM shall, if the APDU is well formed, issue an M-CREATE confirmation primitive to the CMISE-service-user, thus completing the M-CREATE procedure, otherwise, construct an APDU containing notification of the error and send it using the RO-REJECT-U procedure.

6.8 Delete procedure

6.8.1 Invocation

The Delete procedures are initiated by the M-DELETE request primitive.

On receipt of the M-DELETE request primitive, the CMIPM shall:

- a) construct an APDU requesting the m-Delete operation;
- b) send the APDU using the RO-INVOKE procedure.

6.8.2 Receipt

On receipt of an APDU requesting the m-Delete operation, the CMIPM shall, if the APDU is well formed, issue an M-DELETE indication primitive to the CMISE-service-user, otherwise, construct an APDU containing notification of the error and send it using the RO-REJECT-U procedure.

6.8.3 Response

The CMIPM shall:

- a) accept zero or more M-DELETE response primitives containing a linked-ID followed by a single M-DELETE response primitive without a linked-ID;
- b) for each M-DELETE response primitive containing a linked-ID:
 - construct an APDU requesting the m-Linked-Reply operation with LinkedReplyArgument set appropriately as either deleteError, deleteResult or processingFailure;
 - send each APDU using the RO-INVOKE procedure;
- c) for the M-DELETE response primitive not containing a linked-ID:
 - construct an APDU confirming the m-Delete operation;
 - if the parameters in the M-DELETE response primitive indicate that the operation was performed correctly, send the APDU using the RO-RESULT procedure, otherwise, send the APDU using the RO-ERROR procedure.

6.8.4 Receipt of response

On receipt of an APDU responding to an m-Delete operation, the CMIPM shall:

- a) if the APDU included a linked-ID and is well formed, issue an M-DELETE confirmation primitive to the CMISE-service-user;
- b) if the APDU is the last response (i.e. not containing a linked-ID) and is well formed, issue an M-DELETE confirmation primitive to the CMISE-service-user, thus completing the M-DELETE procedure;
- c) if the APDU is not well formed, construct an APDU containing notification of the error and send it using the RO-REJECT-U procedure.

6.9 Association orderly release

Either CMISE-service-user may initiate an orderly release of the association by using the A-RELEASE service of ITU-T Rec. X.217 | ISO/IEC 8649.

NOTE – This specification is different from the ROSE use of the BIND operation in which only the association-initiator may use the A-RELEASE procedure.

6.10 Association abrupt release

Either CMISE-service-user may initiate an abrupt release of the association using the A-ABORT service of ITU-T Rec. X.217 | ISO/IEC 8649.

The CMISE-service-user may receive an indication of the abrupt release of the association via the A-ABORT or A-P-ABORT services of ITU-T Rec. X.217 | ISO/IEC 8649.

7 Abstract syntax¹⁾

This clause specifies the abstract syntax for the CMIP PDUs.

7.1 Conventions

The abstract syntax is defined using the notation specified in CCITT Rec. X.208 | ISO/IEC 8824. The ASN.1 MACRO productions used or referenced by this Recommendation | International Standard do not exercise the ambiguous aspects of the grammar.

For each of the CMISE service parameters which is to be transferred by a CMIP PDU, there is a PDU field (an ASN.1 NamedType) with the same name as the corresponding service parameter (see ITU-T Rec. X.710 | ISO/IEC 9595), except for the differences required by the use of ASN.1, which are that blanks between words are removed and the first letter of the following word is capitalized, e.g. “managed object class” becomes “managedObjectClass”. To make some of the names shorter, some words are abbreviated as follows:

ack	acknowledgement
arg	argument
id	identifier
info	information
sync	synchronization

7.2 Correspondence between CMISE primitives and CMIP operations

Table 4 – Correspondence between CMISE primitives and CMIP operations

CMIS primitive	Mode	Linked-ID	CMIP operation
M-CANCEL-GET req/ind	Confirmed	Not applicable	m-Cancel-Get-Confirmed
M-CANCEL-GET rsp/conf	Not applicable	Not applicable	m-Cancel-Get-Confirmed
M-EVENT-REPORT req/ind	Non-confirmed	Not applicable	m-EventReport
M-EVENT-REPORT req/ind	Confirmed	Not applicable	m-EventReport-Confirmed
M-EVENT-REPORT rsp/conf	Not applicable	Not applicable	m-EventReport-Confirmed
M-GET req/ind	Confirmed	Not applicable	m-Get
M-GET rsp/conf	Not applicable	Absent	m-Get
M-GET rsp/conf	Not applicable	Present	m-Linked-Reply
M-SET req/ind	Non-confirmed	Not applicable	m-Set
M-SET req/ind	Confirmed	Not applicable	m-Set-Confirmed
M-SET rsp/conf	Not applicable	Absent	m-Set-Confirmed
M-SET rsp/conf	Not applicable	Present	m-Linked-Reply
M-ACTION req/ind	Non-confirmed	Not applicable	m-Action
M-ACTION req/ind	Confirmed	Not applicable	m-Action-confirmed
M-ACTION rsp/conf	Not applicable	Absent	m-Action-confirmed
M-ACTION rsp/conf	Not applicable	Present	m-Linked-Reply
M-CREATE req/ind	Confirmed	Not applicable	m-Create
M-CREATE rsp/conf	Not applicable	Not applicable	m-Create
M-DELETE req/ind	Confirmed	Not applicable	m-Delete
M-DELETE rsp/conf	Not applicable	Absent	m-Delete
M-DELETE rsp/conf	Not applicable	Present	m-Linked-Reply

NOTE – The mapping from the OPERATION and ERROR macros to ROSE is defined in CCITT Rec. X.219 | ISO/IEC 9072-1.

¹⁾ Users of this Recommendation | International Standard may freely reproduce the abstract syntax definitions in the clause so that they may be used for their intended purpose.

7.3 ACSE user data

The ACSE protocol (see ITU-T Rec. X.227 | ISO/IEC 8650-1) is described using ASN.1. The “user information” is defined using the EXTERNAL data type.

7.3.1 A-ASSOCIATE user data

The encoding of the CMIP user information to be passed to A-ASSOCIATE in the “user information” parameter is defined as follows:

CMIP-A-ASSOCIATE-Information {joint-iso-itu-t ms(9) cmip(1) modules(0) aAssociateUserInfo(1)}

DEFINITIONS ::= BEGIN

FunctionalUnits ::= BIT STRING {
 multipleObjectSelection (0),
 filter (1),
 multipleReply (2),
 extendedService (3),
 cancelGet (4)
 }

-- Functional unit *i* is supported if and only if bit *i* is one

-- Information carried in user-information parameter of A-ASSOCIATE

CMIPUserInfo ::= SEQUENCE {
 protocolVersion [0] IMPLICIT ProtocolVersion DEFAULT { version1 },
 functionalUnits [1] IMPLICIT FunctionalUnits DEFAULT {},
 accessControl [2] EXTERNAL OPTIONAL,
 userInfo [3] EXTERNAL OPTIONAL
 }

ProtocolVersion ::= BIT STRING {
 version1 (0),
 version2 (1)
 }

END

The encoding of other “user information” supplied by the CMISE-service user is not defined by this Recommendation | International Standard.

7.3.2 A-ABORT user data

The encoding of the CMIP user information to be passed to A-ABORT in the “user information” parameter is defined as follows:

CMIP-A-ABORT-Information {joint-iso-itu-t ms(9) cmip(1) modules(0) aAbortUserInfo(2)}

DEFINITIONS ::= BEGIN

-- Information carried in user-information parameter of A-ABORT

CMIPAbortInfo ::= SEQUENCE {
 abortSource [0] IMPLICIT CMIPAbortSource,
 userInfo [1] EXTERNAL OPTIONAL
 }

CMIPAbortSource ::= ENUMERATED {
 cmiseServiceUser (0),
 cmiseServiceProvider (1)
 }

END

The encoding of other “user information” supplied by the CMISE-service user is not defined by this Recommendation | International Standard.

7.4 CMIP data units

The protocol is described in terms of Common Management Information Protocol Data Units exchanged between the peer CMISEs. The PDUs are specified using ASN.1 and the Remote Operations Protocol OPERATION and ERROR external macros defined in CCITT Rec. X.219 | ISO/IEC 9072-1.

-- *Common Management Information Protocol (CMIP)*

CMIP-1 {joint-iso-itu-t ms(9) cmip(1) modules(0) protocol(3)}

DEFINITIONS ::= BEGIN

-- *Remote Operations definitions*

IMPORTS OPERATION, ERROR FROM Remote-Operation-Notation {joint-iso-ccitt remote-operations(4) notation(0)}

-- *Remote Operations Service definitions*

InvokeIDType FROM Remote-Operations-APDUs {joint-iso-ccitt remote-operations(4) apdus(1)}

-- *Directory Service definitions*

-- *This Recommendation | International Standard imports abstract syntax from CCITT Rec. X.501 (1988) |*

-- *ISO/IEC 9594-2:1990, Annex D to this Recommendation | International Standard provides an extract*

-- *from CCITT Rec. X.501 (1988) | ISO/IEC 9594-2:1990, sufficient to meet the needs of CMIP.*

DistinguishedName, RDNSequence

FROM InformationFramework {joint-iso-ccitt ds(5) modules(1) informationFramework(1)};

-- *CMISE operations*

-- *in the following operations, the argument type is mandatory in the corresponding ROSE APDU*

-- *Action operations (M-ACTION)*

m-Action OPERATION

ARGUMENT ActionArgument

::= localValue : 6

m-Action-Confirmed OPERATION

ARGUMENT ActionArgument

RESULT ActionResult -- *this result is conditional; for conditions see 8.3.3.2.9 of ITU-T Rec. X.710 |*
-- *ISO/IEC 9595*

ERRORS { accessDenied, classInstanceConflict, complexityLimitation, invalidScope,
invalidArgumentValue, invalidFilter, noSuchAction, noSuchArgument, noSuchObjectClass,
noSuchObjectInstance, processingFailure, syncNotSupported }

LINKED { m-Linked-Reply }

::= localValue : 7

m-CancelGet OPERATION

ARGUMENT

getInvokeId InvokeIDType

RESULT

ERRORS { mistypedOperation, noSuchInvokeId, processingFailure }

::= localValue : 10

-- *Create operation (M-CREATE)*

m-Create OPERATION

ARGUMENT CreateArgument

RESULT CreateResult -- *this result is conditional; for conditions see 8.3.4.1.3 of ITU-T Rec. X.710 |*
-- *ISO/IEC 9595*

ERRORS { accessDenied, classInstanceConflict, duplicateManagedObjectInstance,
invalidAttributeValue, invalidObjectInstance, missingAttributeValue, noSuchAttribute,
noSuchObjectClass, noSuchObjectInstance, noSuchReferenceObject, processingFailure }

::= localValue : 8

-- *Delete operation (M-DELETE)*

m-Delete OPERATION

Argument DeleteArgument

RESULT DeleteResult -- *this result is conditional; for conditions see 8.3.5.2.8 of ITU-T Rec. X.710 |*
-- *ISO/IEC 9595*

ERRORS { accessDenied, classInstanceConflict, complexityLimitation, invalidFilter,
InvalidScope, noSuchObjectClass, noSuchObjectInstance, processingFailure, syncNotSupported }

ISO/IEC 9596-1 : 1998 (E)

LINKED { m-Linked-Reply }
 ::= localValue : 9

-- *Event Reporting operations (M-EVENT-REPORT)*

m-EventReport OPERATION

ARGUMENT EventReportArgument
 ::= localValue : 0

m-EventReport-Confirmed OPERATION

ARGUMENT EventReportArgument
RESULT EventReportResult -- *optional*
ERRORS { invalidArgumentValue, noSuchArgument, noSuchEventType, noSuchObjectClass,
 noSuchObjectInstance, processingFailure }
 ::= localValue : 1

-- *Get operation (M-GET)*

m-Get OPERATION

ARGUMENT GetArgument
RESULT GetResult -- *this result is conditional; for conditions see 8.3.1.2.8 of ITU-T Rec. X.710 /*
 -- *ISO/IEC 9595*
ERRORS { accessDenied, classInstanceConflict, complexityLimitation, getListError, invalidFilter, invalidScope,
 noSuchObjectClass, noSuchObjectInstance, operationCancelled, processingFailure, syncNotSupported
 }
LINKED { m-Linked-Reply }
 ::= localValue : 3

-- *Linked operation to M-GET, M-SET (Confirmed), M-ACTION (Confirmed), and M-DELETE*

m-Linked-Reply OPERATION

ARGUMENT LinkedReplyArgument
 ::= localValue : 2

-- *Set operations (M-SET)*

m-Set OPERATION

ARGUMENT SetArgument
 ::= localValue : 4

m-Set-Confirmed OPERATION

ARGUMENT SetArgument
RESULT SetResult -- *this result is conditional; for conditions see 8.3.2.2.9 of ITU-T Rec. X.710 /*
 -- *ISO/IEC 9595*
ERRORS { accessDenied, classInstanceConflict, complexityLimitation, invalidFilter, invalidScope,
 noSuchObjectClass, noSuchObjectInstance, processingFailure, setListError, syncNotSupported }
LINKED { m-Linked-Reply }
 ::= localValue : 5

-- *CMIS error definitions*

-- *in the following errors, unless otherwise indicated, the parameter type is mandatory in the corresponding ROSE*

-- *APDU*

accessDenied ERROR
 ::= localValue : 2

classInstanceConflict ERROR
PARAMETER BaseManagedObjectId
 ::= localValue : 19

complexityLimitation ERROR
PARAMETER ComplexityLimitation-- *optional*
 ::= localValue : 20

duplicateManagedObjectInstance ERROR
PARAMETER ObjectInstance
 ::= localValue : 11

getListError ERROR
PARAMETER GetListError
 ::= localValue : 7

invalidArgumentValue ERROR
 PARAMETER InvalidArgumentValue
 ::= localValue : 15

invalidAttributeValue ERROR
 PARAMETER Attribute
 ::= localValue : 6

invalidFilter ERROR
 PARAMETER CMISFilter
 ::= localValue : 4

invalidObjectInstance ERROR
 PARAMETER ObjectInstance
 ::= localValue : 17

invalidScope ERROR
 PARAMETER Scope
 ::= localValue : 16

missingAttributeValue ERROR
 PARAMETER SET OF AttributeId
 ::= localValue : 18

mistypedOperation ERROR
 ::= localValue : 21

noSuchAction ERROR
 PARAMETER NoSuchAction
 ::= localValue : 9

noSuchArgument ERROR
 PARAMETER NoSuchArgument
 ::= localValue : 14

noSuchAttribute ERROR
 PARAMETER AttributeId
 ::= localValue : 5

noSuchEventType ERROR
 PARAMETER NoSuchEventType
 ::= localValue : 13

noSuchInvokeId ERROR
 PARAMETER InvokeIDType
 ::= localValue : 22

noSuchObjectClass ERROR
 PARAMETER ObjectClass
 ::= localValue : 0

noSuchObjectInstance ERROR
 PARAMETER ObjectInstance
 ::= localValue : 1

noSuchReferenceObject ERROR
 PARAMETER ObjectInstance
 ::= localValue : 12

operationCancelled ERROR
 ::= localValue : 23

processingFailure ERROR
 PARAMETER ProcessingFailure -- optional
 ::= localValue : 10

setListError ERROR
 PARAMETER SetListError
 ::= localValue : 8

syncNotSupported ERROR
 PARAMETER CMISSync
 ::= localValue : 3

-- Supporting type definitions

AccessControl ::= EXTERNAL

ActionArgument ::= SEQUENCE {
 COMPONENTS OF BaseManagedObjectId,
 accessControl [5] AccessControl OPTIONAL,
 synchronization [6] IMPLICIT CMISSync DEFAULT bestEffort,
 scope [7] Scope DEFAULT namedNumbers : baseObject,
 filter CMISFilter DEFAULT and : {},
 actionInfo [12] IMPLICIT ActionInfo
 }

ActionError ::= SEQUENCE {
 managedObjectClass ObjectClass OPTIONAL,
 managedObjectInstance ObjectInstance OPTIONAL,
 currentTime [5] IMPLICIT GeneralizedTime OPTIONAL,
 actionErrorInfo [6] ActionErrorInfo
 }

ActionErrorInfo ::= SEQUENCE {
 errorStatus ENUMERATED { accessDenied (2),
 noSuchAction (9),
 noSuchArgument (14),
 invalidArgumentValue (15) },
 errorInfo CHOICE {
 actionType ActionTypeId,
 actionArgument [0] NoSuchArgument,
 argumentValue [1] InvalidArgumentValue
 }
 }

ActionInfo ::= SEQUENCE {
 actionType ActionTypeId,
 actionInfoArg [4] ANY DEFINED BY actionType OPTIONAL
 }

ActionReply ::= SEQUENCE {
 actionType ActionTypeId,
 actionReplyInfo [4] ANY DEFINED BY actionType
 }

ActionResult ::= SEQUENCE {
 managedObjectClass ObjectClass OPTIONAL,
 managedObjectInstance ObjectInstance OPTIONAL,
 currentTime [5] IMPLICIT GeneralizedTime OPTIONAL,
 actionReply [6] IMPLICIT ActionReply OPTIONAL
 }

ActionTypeId ::= CHOICE {
 globalForm [2] IMPLICIT OBJECT IDENTIFIER,
 localForm [3] IMPLICIT INTEGER
 }

-- This Recommendation / International Standard does not allocate any values for localForm. Where this alternative is
 -- used, the permissible values for the integers and their meanings shall be defined as part of the application context in
 -- which they are used

Attribute ::= SEQUENCE {
 attributeId AttributeId,
 attributeValue ANY DEFINED BY attributeId
 }

AttributeError ::= SEQUENCE {
 errorStatus ENUMERATED { accessDenied (2),
 noSuchAttribute (5),
 invalidAttributeValue(6),
 invalidOperation (24),
 invalidOperator (25) },
 modifyOperator [2] IMPLICIT ModifyOperator OPTIONAL, -- present for invalidOperator & invalidOperation
 attributeId AttributeId,
 attributeValue ANY DEFINED BY attributeId OPTIONAL -- absent for setToDefault
 }

```

AttributeId ::= CHOICE {
    globalForm      [0] IMPLICIT OBJECT IDENTIFIER,
    localForm      [1] IMPLICIT INTEGER
}
-- This Recommendation / International Standard does not allocate any values for localForm. Where this alternative is
-- used, the permissible values for the integers and their meanings shall be defined as part of the application context in
-- which they are used

AttributeIdError ::= SEQUENCE {
    errorStatus     ENUMERATED {      accessDenied      (2),
                                     noSuchAttribute  (5) },
    attributeId     AttributeId
}

BaseManagedObjectId ::= SEQUENCE {
    baseManagedObjectClass  ObjectClass,
    baseManagedObjectInstance  ObjectInstance
}

CMISFilter ::= CHOICE {
    item      [8] FilterItem,
    and      [9] IMPLICIT SET OF CMISFilter,
    or      [10] IMPLICIT SET OF CMISFilter,
    not     [11] CMISFilter
}

CMISSync ::= ENUMERATED {      bestEffort      (0),
                              atomic          (1) }

ComplexityLimitation ::= SET {
    scope      [0] Scope OPTIONAL,
    filter     [1] CMISFilter OPTIONAL,
    sync      [2] CMISSync OPTIONAL
}

CreateArgument ::= SEQUENCE {
    managedObjectClass      ObjectClass,
    managedOrSuperiorObjectInstance  CHOICE {
        managedObjectInstance      ObjectInstance,
        superiorObjectInstance     [8] ObjectInstance } OPTIONAL,
    accessControl            [5] AccessControl OPTIONAL,
    referenceObjectInstance  [6] ObjectInstance OPTIONAL,
    attributeList            [7] IMPLICIT SET OF Attribute OPTIONAL
}

CreateResult ::= SEQUENCE {
    managedObjectClass      ObjectClass OPTIONAL,
    managedObjectInstance  ObjectInstance OPTIONAL, -- shall be returned if omitted from CreateArgument
    currentTime            [5] IMPLICIT GeneralizedTime OPTIONAL,
    attributeList          [6] IMPLICIT SET OF Attribute OPTIONAL
}

DeleteArgument ::= SEQUENCE {
    COMPONENTS OF      BaseManagedObjectId,
    accessControl      [5] AccessControl OPTIONAL,
    synchronization    [6] IMPLICIT CMISSync DEFAULT bestEffort,
    scope              [7] Scope DEFAULT namedNumbers : baseObject,
    filter              CMISFilter DEFAULT and : {}
}

DeleteError ::= SEQUENCE {
    managedObjectClass      ObjectClass OPTIONAL,
    managedObjectInstance  ObjectInstance OPTIONAL,
    currentTime            [5] IMPLICIT GeneralizedTime OPTIONAL,
    deleteErrorInfo       [6] ENUMERATED { accessDenied (2)
}

DeleteResult ::= SEQUENCE {
    managedObjectClass      ObjectClass OPTIONAL,
    managedObjectInstance  ObjectInstance OPTIONAL,
    currentTime            [5] IMPLICIT GeneralizedTime OPTIONAL
}

```

```

EventReply ::= SEQUENCE {
    eventType      EventTypeId,
    eventReplyInfo [8] ANY DEFINED BY eventType OPTIONAL
}
    
```

```

EventReportArgument ::= SEQUENCE {
    managedObjectClass      ObjectClass,
    managedObjectInstance   ObjectInstance,
    eventTime                [5] IMPLICIT GeneralizedTime OPTIONAL,
    eventType                EventTypeId,
    eventInfo                [8] ANY DEFINED BY eventType OPTIONAL
}
    
```

```

EventReportResult ::= SEQUENCE {
    managedObjectClass      ObjectClass OPTIONAL,
    managedObjectInstance   ObjectInstance OPTIONAL,
    currentTime            [5] IMPLICIT GeneralizedTime OPTIONAL,
    eventReply              EventReply OPTIONAL
}
    
```

```

EventTypeId ::= CHOICE {
    globalForm      [6] IMPLICIT OBJECT IDENTIFIER,
    localForm       [7] IMPLICIT INTEGER
}
    
```

-- This Recommendation / International Standard does not allocate any values for localForm. Where this alternative is used, the permissible values for the integers and their meanings shall be defined as part of the application context in which they are used

```

FilterItem ::= CHOICE {
    equality          [0] IMPLICIT Attribute,
    substrings       [1] IMPLICIT SEQUENCE OF CHOICE {
        initialString [0] IMPLICIT SEQUENCE {
            attributeIdAttributeId,
            string      ANY DEFINED BY attributeId },
        anyString      [1] IMPLICIT SEQUENCE {
            attributeIdAttributeId,
            string      ANY DEFINED BY attributeId },
        finalString    [2] IMPLICIT SEQUENCE {
            attributeIdAttributeId,
            string      ANY DEFINED BY attributeId } },
    greaterOrEqual   [2] IMPLICIT Attribute, -- asserted value ≥ attribute value
    lessOrEqual      [3] IMPLICIT Attribute, -- asserted value ≥ attribute value
    present          [4] AttributeId,
    subsetOf         [5] IMPLICIT Attribute, -- asserted value is a subset of attribute value
    supersetOf       [6] IMPLICIT Attribute, -- asserted value is a superset of attribute value
    nonNullSetIntersection [7] IMPLICIT Attribute
}
    
```

```

GetArgument ::= SEQUENCE {
    COMPONENTS OF      BaseManagedObjectId,
    accessControl      [5] AccessControl OPTIONAL,
    synchronization    [6] IMPLICIT CMISync DEFAULT bestEffort,
    scope              [7] Scope DEFAULT namedNumbers : baseObject,
    filter              CMISFilter DEFAULT and : {},
    attributeIdList     [12] IMPLICIT SET OF AttributeId OPTIONAL
}
    
```

```

GetInfoStatus ::= CHOICE {
    attributeIdError [0] IMPLICIT AttributeIdError,
    attribute        [1] IMPLICIT Attribute
}
    
```

```

GetListError ::= SEQUENCE {
    managedObjectClass      ObjectClass OPTIONAL,
    managedObjectInstance   ObjectInstance OPTIONAL,
    currentTime            [5] IMPLICIT GeneralizedTime OPTIONAL,
    getInfoList             [6] IMPLICIT SET OF GetInfoStatus
}
    
```

```

GetResult ::= SEQUENCE {
    managedObjectClass ObjectClass OPTIONAL,
    managedObjectInstance ObjectInstance OPTIONAL,
    currentTime [5] IMPLICIT GeneralizedTime OPTIONAL,
    attributeList [6] IMPLICIT SET OF Attribute OPTIONAL
}

```

```

InvalidArgumentValue ::= CHOICE {
    actionValue [0] IMPLICIT ActionInfo,
    eventValue [1] IMPLICIT SEQUENCE {
        eventType EventTypeId,
        eventInfo [8] ANY DEFINED BY eventType OPTIONAL
    }
}

```

```

LinkedReplyArgument ::= CHOICE {
    getResult [0] IMPLICIT GetResult,
    getListError [1] IMPLICIT GetListError,
    setResult [2] IMPLICIT SetResult,
    setListError [3] IMPLICIT SetListError,
    actionResult [4] IMPLICIT ActionResult,
    processingFailure [5] IMPLICIT ProcessingFailure,
    deleteResult [6] IMPLICIT DeleteResult,
    actionError [7] IMPLICIT ActionError,
    deleteError [8] IMPLICIT DeleteError
}

```

```

ModifyOperator ::= INTEGER {
    replace (0),
    addValues (1),
    removeValues (2),
    setToDefault (3)
}

```

```

NoSuchAction ::= SEQUENCE {
    managedObjectClass ObjectClass,
    actionType ActionTypeId
}

```

```

NoSuchArgument ::= CHOICE {
    actionId [0] IMPLICIT SEQUENCE {
        managedObjectClass ObjectClass OPTIONAL,
        actionType ActionTypeId
    },
    eventId [1] IMPLICIT SEQUENCE {
        managedObjectClass ObjectClass OPTIONAL,
        eventType EventTypeId
    }
}

```

```

NoSuchEventType ::= SEQUENCE {
    managedObjectClass ObjectClass,
    eventType EventTypeId
}

```

```

ObjectClass ::= CHOICE {
    globalForm [0] IMPLICIT OBJECT IDENTIFIER,
    localForm [1] IMPLICIT INTEGER
}

```

-- This Recommendation / International Standard does not allocate any values for localForm. Where this alternative is used, the permissible values or the integers and their meanings shall be defined as part of the application context in which they are used

```

ObjectInstance ::= CHOICE {
    distinguishedName [2] IMPLICIT DistinguishedName,
    nonSpecificForm [3] IMPLICIT OCTET STRING,
    localDistinguishedName [4] IMPLICIT RDNSSequence
}

```

-- localDistinguishedName is that portion of the distinguished name that is necessary to unambiguously identify the managed object within the context of communication between the open systems

```

ProcessingFailure ::= SEQUENCE {
    managedObjectClass ObjectClass,
    managedObjectInstance ObjectInstance OPTIONAL,
    specificErrorInfo [5] SpecificErrorInfo
}

```

```

Scope ::= CHOICE {
    namedNumbers    INTEGER {
        baseObject      (0),
        firstLevelOnly (1),
        wholeSubtree    (2) },
    individualLevels [1] IMPLICIT INTEGER, -- POSITIVE integer indicates the level to be selected
    baseToNthLevel  [2] IMPLICIT INTEGER } -- POSITIVE integer N indicates that the range of levels
                                           -- (0 – N) is to be selected
-- with individualLevels and baseToNthLevel, a value of 0 has the same semantics as baseObject
-- with individualLevels, a value of 1 has the same semantics as firstLevelOnly

SetArgument ::= SEQUENCE {
    COMPONENTS OF
    accessControl      [5] AccessControl OPTIONAL,
    synchronization    [6] IMPLICIT CMISSync DEFAULT bestEffort,
    scope              [7] Scope DEFAULT namedNumbers : baseObject,
    filter              CMISFilter DEFAULT and : {},
    modificationList  [12] IMPLICIT SET OF SEQUENCE {
        modifyOperator [2] IMPLICIT ModifyOperator DEFAULT replace,
        attributeId     AttributeId,
        attributeValue  ANY DEFINED BY attributeId OPTIONAL -- absent for setToDefault
    } }

SetInfoStatus ::= CHOICE {
    attributeError [0] IMPLICIT AttributeError,
    attribute      [1] IMPLICIT Attribute
}

SetListError ::= SEQUENCE {
    managedObjectClass  ObjectClass OPTIONAL,
    managedObjectInstance ObjectInstance OPTIONAL,
    currentTime         [5] IMPLICIT GeneralizedTime OPTIONAL,
    setInfoList         [6] IMPLICIT SET OF SetInfoStatus
}

SetResult ::= SEQUENCE {
    managedObjectClass  ObjectClass OPTIONAL,
    managedObjectInstance ObjectInstance OPTIONAL,
    currentTime         [5] IMPLICIT GeneralizedTime OPTIONAL,
    attributeList       [6] IMPLICIT SET OF Attribute OPTIONAL
}

SpecificErrorInfo ::= SEQUENCE {
    errorId             OBJECT IDENTIFIER,
    errorInfo           ANY DEFINED BY errorId
}

END -- End of CMIP syntax definitions

```

7.5 Definition of abstract syntax for CMIP

This Recommendation | International Standard assigns the ASN.1 object identifier value

{joint-iso-itu-t ms(9) cmip(1) cmip-pci(1) abstractSyntax(4)}

as an abstract syntax name for the set of presentation data values, each of which is either a value of the ASN.1 type

Remote-Operations-APDUs.ROSEapdus

as defined in CCITT Rec. X.229 | ISO/IEC 9072-2 with the argument component filled according to the definitions in CMIP-1, or a value of one of the ASN.1 types:

- CMIP-A-ASSOCIATE-Information.CMIPUserInfo;
- CMIP-A-ABORT-Information.CMIPAbortInfo.

The corresponding ASN.1 object descriptor value shall be

“CMIP-PCI”.

This abstract syntax is defined to include all data types resolved by the ANY DEFINED BY X productions, in which X is of type OBJECT IDENTIFIER.

The ASN.1 object identifier and object descriptor values

{joint-iso-ccitt asn1(1) basic-encoding(1)} and “Basic Encoding of single ASN.1 type”

(assigned to an object in CCITT Rec. X.209 | ISO/IEC 8825) can be used as a transfer syntax name with this abstract syntax.

7.5.1 Extensibility rules

7.5.1.1 When processing incoming CMIP-A-ASSOCIATE-Information, the accepting CMIPM shall:

- ignore all tagged values that are not defined in the abstract syntax of this Recommendation | International Standard; and
- ignore all unknown bit name assignments within a BIT STRING.

7.5.1.2 The abstract syntax name may be used when the presentation data values are modified to include:

- new system management operations;
- new tagged elements within a SET or SEQUENCE;
- new bit name assignments within a BIT STRING;
- new named numbers for an INTEGER; and
- new named enumerations within an ENUMERATED.

8 Conformance

A system claiming to implement the procedures specified in this Recommendation | International Standard shall comply with the requirements in 8.1 and 8.2.

8.1 Static requirements

An implementation that is claimed to conform to this Recommendation | International Standard shall be accompanied by a PICS in conformance with the PICS proforma as specified by ITU-T Rec. X.712 | ISO/IEC 9596-2. In particular, it shall be stated that the implementation either:

- 1) supports the protocol, required to provide all of the CMIS services defined in the kernel functional unit, in both the invoker and performer roles; or
- 2) supports the protocol, required to provide some of the CMIS services defined in the kernel functional unit, in the invoker and/or performer roles; but not all of the protocol in both roles for all of the CMIS services.

The implementation shall:

- a) support the elements of procedure specified in clause 6 of this Recommendation | International Standard for those services in the role for which conformance is claimed;
- b) support the abstract syntax associated with the protocol data units that are necessary to convey the requests and/or responses for those services in the role for which conformance is claimed;
- c) support the transfer syntax derived from the encoding rules specified in CCITT Rec. X.209 | ISO/IEC 8825 and named

{joint-iso-ccitt asn1(1) basic-encoding(1)},

for the purpose of generating and interpreting CMIP PDUs as defined by the abstract syntax

“CMIP-PCI”,

for the elements of protocol to which conformance is claimed:

- d) support the ACSE protocol defined in ITU-T Rec. X.227 | ISO/IEC 8650-1, to establish and to release an association;
- e) support the rules specified in Annex A in any application context that includes CMISE as one of the ASEs;
- f) support association class 3 of the ROSE protocol defined in CCITT Rec. X.229 | ISO/IEC 9072-2;

- g) support the elements of protocol that are required to provide the multiple reply functional unit if the multiple object selection functional unit is selected;
- h) support the elements of protocol that are required to provide the M-GET service if the cancel get functional unit is supported;

8.2 Dynamic requirements

The system shall:

- a) support the elements of procedure for each of the CMIS services in the role for which conformance is claimed;
- b) when used, verify the optional security parameters defined in the CMIP PDUs;
- c) when the extended service functional unit is supported, support the presentation protocol defined in ITU-T Rec. X.226 | ISO/IEC 8823-1, as required by the application context;
- d) when scoping is provided, support the elements of procedure for the multiple reply functional unit.

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Annex A

Association rules for CMISE

(This annex does not form an integral part of this Recommendation | International Standard)

A.1 ACSE, session and presentation requirements

A.1.1 CMISE requires the kernel presentation functional unit as defined in ITU-T Rec. X.216 | ISO/IEC 8822.

A.1.2 CMISE requires the kernel and full duplex session functional units as defined in ITU-T Rec. X.215 | ISO/IEC 8326.

A.1.3 CMISE requires the normal mode of ACSE and presentation services as defined in ITU-T Rec. X.227 | ISO/IEC 8650-1 and ITU-T Rec. X.216 | ISO/IEC 8822.

A.2 Association initialization rules

A.2.1 Request

The CMISE-service-user that initiates the association establishment shall provide the A-ASSOCIATE user information defined by ITU-T Rec. X.710 | ISO/IEC 9595. The CMIP user information shall be made available to the CMIPM which shall:

- a) construct CMIPUserInfo from the information supplied;
- b) set the protocol version parameter within CMIPUserInfo by setting the bit corresponding to each version supported;
- c) include CMIPUserInfo as a separate EXTERNAL in the user information parameter of the A-ASSOCIATE request primitive;
- d) wait for the user information specific to CMIS to be returned in the A-ASSOCIATE confirmation primitive.

A.2.2 Indication

On receipt of an A-ASSOCIATE indication primitive, the CMIPUserInfo parameter shall be made available to the CMIPM which shall:

- a) check that at least one of the proposed protocol version can be supported;
- b) verify that the optional access control parameter is valid;
- c) if any of the checks fail, the association shall be rejected by setting the reason for failure parameter in the A-ASSOCIATE response primitive to "rejected by responder (permanent)". The association is not established and that instance of the CMIPM shall cease to exist;
- d) if the above checks succeed, the following information, if present in CMIPUserInfo, shall be made available to the CMISE-service-user: functional units supported by the CMISE-service-provider, access control and user information. The CMIPM shall wait for the response from the CMISE-service-user.

A.2.3 Response

The A-ASSOCIATE response primitive indicating "accepted" or "rejected", and which if accepted, includes the functional units, access control and user information parameters, shall be made available to the CMIPM which shall:

- a) construct CMIPUserInfo required for the response. The CMIPUserInfo shall include the version parameter indicating all versions of CMIP that are supported;
- b) include CMIPUserInfo as a separate EXTERNAL in the user information parameter of the A-ASSOCIATE response primitive;
- c) if the association response indicates "accepted", the protocol version agreed to is the version corresponding to the highest number supported by both CMIPMs. The CMIPM shall then be ready to accept CMISE indication primitives;
- d) if the association response indicates "rejected", that instance of the CMIPM shall cease to exist.

A.2.4 Confirmation

On receipt of the A-ASSOCIATE confirmation primitive, the CMIPUserInfo parameter shall be made available to the CMIPM which shall:

- a) if the association confirmation indicates success, the association is established and the functional units, access control and user information parameters, if present in the confirmation, are made available to the association-initiator. The functional units agreed to correspond to those for which both CMISE-service-users indicated support and the protocol version is the highest version number supported by both CMIPMs;
- b) if the association confirmation indicates failure, the association is not established and that instance of the CMIPM shall cease to exist.

A.3 Association release rules

Either CMISE-service-user may initiate an association release.

A.3.1 Request

On receipt of a request for association release, the necessary A-RELEASE parameters shall be made available to the CMIPM which shall cease to accept service requests and wait for the confirmation of the release of the association.

A.3.2 Indication

On receipt of an A-RELEASE indication primitive, the necessary A-RELEASE indication parameters shall be made available to the responding CMIPM which shall wait for the association release response.

A.3.3 Response

On receipt of an association release response from the responding CMISE-service-user, the necessary A-RELEASE response parameters shall be made available to the responding CMIPM. Thereafter, that instance of the CMIPM shall cease to exist.

A.3.4 Confirmation

On receipt of an A-RELEASE confirmation primitive, the necessary A-RELEASE confirmation parameters shall be made available to the initiating CMIPM. Thereafter, that instance of the CMIPM shall cease to exist.

A.4 Association abort rules

Either CMISE-service-user may initiate an abrupt termination of the association.

On the basis of local information, if the ability of the underlying services to convey unlimited user information by A-ABORT does not exist, the CMIPAbortInfo parameter may not be included in the A-ABORT service primitives.

A.4.1 A-ABORT request

On receipt of a request to abort the association, the necessary A-ABORT request parameters including the A-ABORT user information defined by ITU-T Rec. X.710 | ISO/IEC 9595 shall be made available to the CMIPM which shall:

- a) construct CMIPAbortInfo from the information supplied;
- b) set the abort source parameter within CMIPUserInfo to CMISE-service-user;
- c) include CMIPAbortInfo as a separate field in the user information parameter of the A-ABORT request primitive;
- d) thereafter, that instance of the CMIPM shall cease to exist.

A.4.2 A-ABORT indication

On receipt of an A-ABORT indication primitive, the necessary A-ABORT indication parameters including CMIPAbortInfo shall be made available to the CMIPM. Thereafter, that instance of the CMIPM shall cease to exist.

A.4.3 A-P-ABORT indication

On receipt of an A-P-ABORT indication primitive, the necessary A-P-ABORT indication parameters shall be made available to the CMIPM. Thereafter, that instance of the CMIPM shall cease to exist.

A.4.4 CMIP protocol error

On detecting a protocol error, the CMIPM shall:

- a) construct CMIPAbortInfo with the abort source parameter set to CMISE-service-provider;
- b) indicate to the CMISE-service-user that a protocol error has occurred;
- c) include CMIPAbortInfo as a separate field in the user information parameter of the A-ABORT request primitive;
- d) thereafter, that instance of the CMIPM shall cease to exist.

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Annex B

Expanded ASN.1 syntax

(This annex does not form an integral part of this Recommendation | International Standard)

This annex describes how the OPERATION and ERROR macros of CCITT Rec. X.219 | ISO/IEC 9072-1 are expanded into ASN.1 data types and subtypes.

If any inconsistencies exist between these definitions and the definitions in clause 7, then the definitions in clause 7 take precedence.

-- *Common Management Information Protocol (CMIP)*

CMIP-1 {joint-iso-itu-t ms(9) cmip(1) modules(0) protocol(3)}

DEFINITIONS ::= BEGIN

-- *Remote Operations definitions*

IMPORTS OPERATION, ERROR FROM Remote-Operation-Notation {joint-iso-ccitt remote-operations(4) notation(0)}

-- *Directory Service definitions*

DistinguishedName, RDNSequence

FROM InformationFramework {joint-iso-ccitt ds(5) modules(1) informationFramework(1)};

-- *CMISE operations*

ROSEapdu ::= CHOICE {

roiv-apdu [1] IMPLICIT ROIVapdu,
rors-apdu [2] IMPLICIT RORSapdu,
roer-apdu [3] IMPLICIT ROERapdu,
rorj-apdu [4] IMPLICIT RORJapdu
}

ROIVapdu ::= SEQUENCE {

invokeID InvokeIDType,
linked-ID [0] IMPLICIT InvokeIDType OPTIONAL,
operation-value OPERATION,
argument ANY DEFINED BY operation-value OPTIONAL
}

RORSapdu ::= SEQUENCE {

invokeID InvokeIDType,
SEQUENCE { operation-value OPERATION,
result ANY DEFINED BY operation-value } OPTIONAL
}

ROERapdu ::= SEQUENCE {

invokeID InvokeIDType,
error-value ERROR,
parameter ANY DEFINED BY error-value OPTIONAL
}

RORJapdu ::= SEQUENCE {

invokeID CHOICE {InvokeIDType,
NULL },
problem CHOICE { [0] IMPLICIT GeneralProblem,
[1] IMPLICIT InvokeProblem,
[2] IMPLICIT ReturnResultProblem,
[3] IMPLICIT ReturnErrorProblem }
}

InvokeIDType ::= INTEGER

-- *The use of the GeneralProblem, ReturnResultProblem, and ReturnErrorProblem codes are a local issue.*

GeneralProblem ::= INTEGER {

unrecognisedAPDU (0), -- ROSE-provider detected
mistypedAPDU (1),
badlyStructuredAPDU (2)
}

```

InvokeProblem ::= INTEGER {
    duplicateInvocation      (0), -- ROSE-user detected
    unrecognisedOperation   (1),
    mistypedArgument        (2),
    resourceLimitation       (3),
    initiatorReleasing      (4),
    unrecognisedLinkedID    (5),
    linkedResponseUnexpected (6),
    unexpectedChildOperation (7)
}

```

```

ReturnResultProblem ::= INTEGER {
    unrecognisedInvocation   (0), -- ROSE-user detected
    resultResponseUnexpected (1),
    mistypedResult           (2)
}

```

```

ReturnErrorProblem ::= INTEGER {
    unrecognisedInvocation   (0), -- ROSE-user detected
    errorResponseUnexpected  (1),
    unrecognisedError        (2),
    unexpectedError          (3),
    mistypedParameter        (4)
}

```

-- This part of the ASN.1 specification provides a definition of the InvokeProblem subtype used by CMIP.

```

InvokeProblem-CMIPUser ::= InvokeProblem (
    duplicateInvocation   |
    unrecognisedOperation |
    mistypedArgument      |
    resourceLimitation     )

```

-- This part of the ASN.1 specification provides a definition of ROIVapdu and RORSapdu subtypes used by CMIP.

-- The subtypes of the ROIVapdu define the allowed values of the operation-value and argument defined by that operation-value for all CMIP notifications and operations. The subtypes of the RORSapdu define the allowed values of the operation-value and result defined by that operation-value for all CMIP notifications and operations.

m-Action OPERATION ::= localValue : 6

```

ROIV-m-Action ::= ROIVapdu (WITH COMPONENTS {
    invokeID      PRESENT,
    linked-ID     ABSENT,
    operation-value (m-Action),
    argument      (INCLUDES ActionArgument) })

```

m-Action-Confirmed OPERATION ::= localValue : 7

```

ROIV-m-Action-Confirmed ::= ROIVapdu (WITH COMPONENTS {
    invokeID      PRESENT,
    linked-ID     ABSENT,
    operation-value (m-Action-Confirmed),
    argument      (INCLUDES ActionArgument) })

```

RORS-m-Action-Confirmed ::= RORSapdu (WITH COMPONENTS {

```

    ... ,
    invokeID      PRESENT,
    -- result sequence -- (WITH COMPONENTS
    { operation-value (m-Action-Confirmed),
    result          (INCLUDES ActionResult) })

```

-- required only if there is a single reply to the ROIV-m-Action-Confirmed ROIVapdu and data is to be returned in the RORSapdu

m-Cancel-Get OPERATION ::= localValue : 10

ROIV-m-Cancel-Get ::= ROIVapdu (WITH COMPONENTS {
invokeID PRESENT,
linked-ID ABSENT,
operation-value (m-Cancel-Get),
argument (INCLUDES InvokeIDType)
})

RORS-m-Cancel-Get ::= RORSapdu (WITH COMPONENTS {
invokeID PRESENT,
-- There is no result sequence for RORS-m-Cancel-Get
})

m-Create OPERATION ::= localValue : 8

ROIV-m-Create ::= ROIVapdu (WITH COMPONENTS {
invokeID PRESENT,
linked-ID ABSENT,
operation-value (m-Create),
argument (INCLUDES CreateArgument) }
})

RORS-m-Create ::= RORSapdu (WITH COMPONENTS {
... ,
invokeID PRESENT,
-- result sequence -- (WITH COMPONENTS
{ operation-value (m-Create),
result (INCLUDES CreateResult) }
})

m-Delete OPERATION ::= localValue : 9

ROIV-m-Delete ::= ROIVapdu (WITH COMPONENTS {
invokeID PRESENT,
linked-ID ABSENT,
operation-value (m-Delete),
argument (INCLUDES DeleteArgument) }
})

RORS-m-Delete ::= RORSapdu (WITH COMPONENTS {
... ,
invokeID PRESENT,
-- result sequence -- (WITH COMPONENTS
{ operation-value (m-Delete),
result (INCLUDES DeleteResult) }
})
-- required only if there is a single reply to the ROIV-m-DeleteROIVapdu and data is to be returned in the RORSapdu
})

m-EventReport OPERATION ::= localValue : 0

ROIV-m-EventReport ::= ROIVapdu (WITH COMPONENTS {
invokeID PRESENT,
linked-ID ABSENT,
operation-value (m-EventReport),
argument (INCLUDES EventReportArgument) }
})

m-EventReport-Confirmed OPERATION ::= localValue : 1

ROIV-m-EventReport-Confirmed ::= ROIVapdu (WITH COMPONENTS {
invokeID PRESENT,
linked-ID ABSENT,
operation-value (m-EventReport-Confirmed),
argument (INCLUDES EventReportArgument) }
})

RORS-m-EventReport-Confirmed ::= RORSapdu (WITH COMPONENTS {
... ,
invokeID PRESENT,
-- result sequence -- (WITH COMPONENTS
{ operation-value (m-EventReport-Confirmed),
result (INCLUDES EventReportResult) }
})
-- required only if data is to be returned in the RORSapdu
})