INTERNATIONAL TELECOMMUNICATION UNION

CCITT

THE INTERNATIONAL
TELEGRAPH AND TELEPHONE
CONSULTATIVE COMMITTEE

X.730

(01/92)

DATA COMMUNICATION NETWORKS

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

Recommendation X.730

Foreword

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The CCITT (the International Telegraph and Telephone Consultative Committee) is a permanent organ of the ITU. Some 166 member countries, 68 telecom operating entities, 163 scientific and industrial organizations and 39 international organizations participate in CCITT which is the body which sets world telecommunications standards (Recommendations).

The approval of Recommendations by the members of CCITT is covered by the procedure laid down in CCITT Resolution No. 2 (Melbourne, 1988). In addition, the Plenary Assembly of CCITT, which meets every four years, approves Recommendations submitted to it and establishes the study programme for the following period.

In some areas of information technology, which fall within CCITT's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC. The text of CCITT Recommendation X.730 was approved on 17th of January 1992. The identical text is also published as ISO/IEC International Standard 10164-1.

CCITT NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized private operating agency.

© ITU 1993

All rights reserved. No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the ITU.

Contents

Page

1 Scope 1

2 Normative references 1

2.1 Identical CCITT Recommendations | International Standards 2

2.2 Paired CCITT Recommendations | International Standards equivalent in technical content 2

2.3 Additional references 2

3 Definitions 3

3.1 Basic reference model definitions 3

3.2 Management framework definitions 3

3.3 CMIS definitions 3

3.4 Systems management overview definitions 3

3.5 Management information model definitions 3

3.6 Service conventions definitions 4

3.7 OSI conformance testing definitions 4

4 Abbreviations 4

5 Conventions 4

6 Requirements 5

7 Model 5

7.1 Introduction 5

7.2 Pass-through services 5

8 Generic definitions 6

8.1 Event type 6

8.2 Event information 7

8.3 Event reply 9

8.4 Managed objects 9

8.5 Compliance 9

Page

9 Service definition 9

9.1 Introduction 9

9.2 Object creation reporting service 9

9.3 Object deletion reporting service 9

9.4 Attribute value change reporting service 10

9.5 PT-ACTION service 10

9.6 PT-CREATE service 10

9.7 PT-DELETE service 11

9.8 PT-EVENT-REPORT service 11

9.9 PT-GET service 15

9.10 PT-SET service 15

10 Functional units 15

11 Protocol 17

11.1 Elements of procedure 17

11.2 Abstract syntax 22

11.3 Negotiation of functional units 23

12 Relationships with other functions 23

13 Conformance 23

13.1 General conformance class requirements 23

13.2 Dependent conformance class requirements 24

INFORMATION NOTE

The following table gives a list of X.700 Series Recommendations which were developed in collaboration with the ISO/IEC and are identical to the corresponding International Standard. Cross-references to the corresponding ISO/IEC International Standard number and the short title of the Recommendation | International Standard are provided.

CCITT Recommendation ISO/IEC International Standard	Short Title
X.700 | 7498-4 (Note)	Management Framework
X.701 | 10040	System Management Overview
X.710 | 9595 (Note)	Common Management Information Service Definition
X.711 | 9596-1 (Note)	Common Management Information Protocol Specification
X.712 | 9596-2	CMIP PICS
X.720 | 10165-1	Management Information Model
X.721 | 10165-2	Definition of Management Information
X.722 | 10165-4	Guidelines for the Definition of Managed Objects
X.730 | 10164-1	Object Management Function
X.731 | 10164-2	State Management Function
X.732 | 10164-3	Attributes for Representing Relationships
X.733 | 10164-4	Alarm Reporting Function
X.734 | 10164-5	Event Management Function
X.735 | 10164-6	Log Control Function
X.736 | 10164-7	Security Alarm Reporting Function
X.740 | 10164-8	Security Audit Trail Function
NOTE – This Recommendation and International Standard are not identical, but are technically aligned.	

INTERNATIONAL STANDARD

CCITT RECOMMENDATION

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

1 Scope

This Recommendation | International Standard defines a systems management function which may be used by an application process in a centralized or decentralized management environment to interact for the purposes of systems management, as defined by CCITT Rec. X.700 | ISO/IEC 7498-4. This Recommendation | International Standard defines the object management function that consists of services, functional units, and generic definitions. It is positioned in the application layer of CCITT Rec. X.200 | ISO 7498 and is defined according to the model provided by ISO/IEC 9545. The role of systems management functions are described by CCITT Rec. X.701 | ISO/IEC 10040.

This Recommendation | International Standard

- establishes user requirements for the object management function;
- establishes a model that relates the services and generic definitions provided by this function to user requirements;
- defines the services provided by the function;
- defines generic notification types and parameters documented in accordance with CCITT Rec. X.722 | ISO/IEC 10165-4;
- specifies the protocol that is necessary in order to provide the services;
- defines the relationship between these services and management operations and notifications;
- specifies compliance requirements placed on other Standards that make use of these generic definitions;
- defines relationships with other systems management functions;
- specifies conformance requirements.

This Recommendation | International Standard does not

- define the nature of any implementation intended to provide the object management function;
- specify the manner in which management is accomplished by the user of the object management function;
- define the nature of any interactions which result in the use of the object management function;
- specify the services necessary for the establishment, normal and abnormal release of a management association;
- preclude the definition of further notification types;
- define managed objects.

2 Normative references

The following CCITT Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | International Standard. At the time of publication, the editions indicated were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this Recommendation | International Standard are encouraged to investigate the possibility of applying the most recent editions of the Recommendations and Standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards. The CCITT Secretariat maintains a list of the currently valid CCITT Recommendations.

2.1 Identical Recommendations | International Standards

- CCITT Recommendation X.701 (1992) | ISO/IEC 10040:1992, *Information technology – Open Systems Interconnection – Systems managemet overview.*
- CCITT Recommendation X.720 (1992) | ISO/IEC 10165-1:1993, *Information technology – Open Systems Interconnection – Structure of management information: Management information model.*
- CCITT Recommendation X.721 (1992) | ISO/IEC 10165-2:1992, *Information technology – Open Systems Interconnection - Structure of management information: Definition of management information.*
- CCITT Recommendation X.722 (1992) | ISO/IEC 10165-4:1992, *Information technology – Open Systems Interconnection – Structure of management information: Guidelines for the definition of managed objects.*
- CCITT Recommendation X.733 (1992) | ISO/IEC 10164-4:1992, *Information technology – Open Systems Interconnection – Systems Management: Alarm reporting function.*
- CCITT Recommendation X.734 (1992) | ISO/IEC 10164-5:1993, *Information technology – Open Systems Interconnection – Systems Management: Event report management function.*
- CCITT Recommendation X.735 (1992) | ISO/IEC 10164-6:1993, *Information technology – Open Systems Interconnection – Systems Management: Log control function.*

2.2 Paired Recommendations | International Standards equivalent in technical content

- CCITT Recommendation X.200 (1988), *Reference Model of Open Systems Interconnection for CCITT Applications.*

  ISO 7498:1984, Information processing systems – Open Systems Interconnection – Basic Reference Model.

- CCITT Recommendation X.209 (1988), *Specification of basic encoding rules for Abstract Syntax Notation One (ASN.1).*

  ISO/IEC 8825:1990, Information technology – Open Systems Interconnection – Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1).

- CCITT Recommendation X.210 (1988), *Open Systems Interconnection. Layer Service Definition Conventions.*

  ISO/TR 8509:1987, Information processing systems – Open Systems Interconnection – Service conventions.

- CCITT Recommendation X.290 (1992), *OSI conformance testing methodology and framework for protocol Recommendations for CCITT applications – General concepts.*

  ISO/IEC 9646-1:1991, Information technology – Open Systems Interconnection – Conformance testing methodology and framework – Part 1: General concepts.

- CCITT Recommendation X.700 (1992), *Management Framework Definition for Open Systems Interconnection (OSI) for CCITT Applications.*

  ISO/IEC 7498-4:1989, Information processing systems – Open Systems Interconnection – Basic Reference Model – Part 4: Management framework.

- CCITT Recommendation X.710 (1991), *Common Management Information Service Definition for CCITT applications.*

  ISO/IEC 9595:1991, Information technology – Open Systems Interconnection – Common management information service definition.

2.3 Additional references

- ISO/IEC 9545:1989, *Information technology – Open Systems Interconnection – Application layer structure.*

3 Definitions

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

3.1 Basic reference model definitions

This Recommendation | International Standard makes use of the following term defined in CCITT Rec. X.200 | ISO 7498:

a) open system;

b) systems management;

c) layer management.

d) OSI environment;

3.2 Management framework definitions

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

managed object

3.3 CMIS definitions

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

attribute

3.4 Systems management overview definitions

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

a) agent;

b) agent role;

c) dependent conformance;

d) general conformance;

e) generic definitions;

f) managed object class;

g) manager;

h) manager role;

i) notification;

j) systems management functional unit;

k) systems management function;

l) systems management application protocol;

m) (systems management) operation.

3.5 Management information model definitions

This Recommendation | International Standard makes use of the following term defined in CCITT Rec. X.720 | ISO/IEC 10165-1:

managed object boundary

3.6 Service conventions definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Rec. X.210 | ISO/TR 8509:

a) confirm (primitive);

b) confirmed-service;

c) indication (primitive);

d) non-confirmed-service;

e) request (primitive);

f) response (primitive);

g) service-user;

h) service-provider.

3.7 OSI conformance testing definitions

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

system conformance statement

4 Abbreviations

ASN.1	Abstract Syntax Notation One
CMIS	Common Management Information service
Conf	Confirmation
Ind	Indication
MAPDU	Management application protocol data unit
OSI	Open systems interconnection
Req	Request
Rsp	Response
SMAPM	Systems management application protocol machine
SMI	Structure of management information

5 Conventions

This Recommendation | International Standard defines services for the object management function following the descriptive conventions defined in CCITT Rec. X.210 | ISO/TR 8509. In clause 9, the definition of each service includes a table that lists the service parameters. For a given service primitive, the presence of each parameter is described by one of the following values.

M the parameter is mandatory;

(=) the value of the parameter is equal to the value of the parameter in the column to the left;

U the use of the parameter is a Service-user option;

– the parameter is not present in the interaction described by the primitive concerned;

C the parameter is conditional;

P the parameter is subject to the constraints imposed by CCITT Rec. X.710 | ISO/IEC 9595.

NOTE – The parameters that are marked “P” in service tables of this Recommendation | International Standard are mapped directly onto the corresponding parameters of the CMIS service primitive, without changing the semantics or syntax of the parameters. The remaining parameters are used to construct an MAPDU.

6 Requirements

The MIS-User needs the ability to

- create and delete managed objects;
- examine and modify the value of attributes of managed objects;
- be made aware of changes in the configuration of managed objects.

7 Model

7.1 Introduction

Each resource that is subject to systems management is represented by a managed object. These are described in CCITT Rec. X.720 | ISO/IEC 10165-1.

Managed objects can be created and deleted, and values of attributes of managed objects can be changed, in one or more of three distinct ways

- through configuration processes in the local system environment that are outside the scope of OSI;
- through the (N)-layer operation and/or the layer management of an open system, as described in those (N)-layer standards;
- through the OSI systems management services.

Object management describes services for

- the reporting of creation and deletion of managed objects;
- the reporting of changes to attribute values of managed objects.

Object management describes pass-through services for

- the creation and deletion of managed objects;
- performing actions upon managed objects;
- attribute changing;
- attribute reading;
- event reporting.

7.2 Pass-through services

Where different parts of systems management functions define operations or notifications, then they do so independently of their mapping onto an underlying communications service. This enables this Recommendation | International Standard to be used across a range of underlying communications services by other systems management functions or managed objects. When a systems management function defines specific systems management services, then these services shall map directly onto the CMIS services.

In order to achieve this objective it is necessary for one of the systems management Recommendations | International Standards to detail the mapping between the operations and notifications that apply across a managed object boundary and the underlying communications services. This Recommendation | International Standard is used to document such mapping.

Currently, only the mapping onto CMIS are defined by this Recommendation | International Standard through the use of pass-through services.

Except where this Recommendation | International Standard describes specific services, the management operations and notifications that apply across a managed object boundary shall map onto the pass-through services of this Recommendation | International Standard as shown in Table 1.

The management operations are described in CCITT Rec. X.720 | ISO/IEC 10165-1.

Table 1 – Mapping of pass-through services

SMI	Pass-through
Create	PT-CREATE
Delete	PT-DELETE
Action	PT-ACTION
Replace	PT-SET
Add	PT-SET
Remove	PT-SET
Replace-with-Default	PT-SET
Get	PT-GET
Notification	PT-EVENT-REPORT

8 Generic definitions

The set of generic notifications, parameters and semantics defined by this Recommendation | International Standard provide the detail for the following general parameters of the M-EVENT-REPORT service as defined by CCITT Rec. X.710 | ISO/IEC 9595:

- event type;
- event information;
- event reply.

All notifications are potential entries in a systems management log and this Recommendation | International Standard defines three managed object classes for this purpose. CCITT Rec. X.721 | ISO/IEC 10165-2 defines a generic event log record object class from which all entries are derived, the additional information being specified by the event information and event reply parameters.

8.1 Event type

This parameter defines the type of the event. The following three event types are defined in this Recommendation | International Standard:

- object creation: An indication that a managed object instance has been created. Where a managed object class is required to report the creation of a managed object instance, then that managed object class shall import the object creation notification type. The creation of a managed object within an open system can be as a result of a PT-CREATE service, or a local operation within the open system;
- object deletion: An indication that a managed object instance has been deleted. Where a managed object class is required to report the deletion of a managed object instance, then that managed object class shall import the object deletion notification type. The deletion of a managed object within an open system can be as a result of a PT-DELETE service, or a local operation within the open system;
- attribute value change: An indication that the attribute value(s) of a managed object has changed. This notification type is used to report one or more of the following:
  a) the addition of one or more new members to one or more set-valued attributes;
  b) the removal of one or more members from one or more set-valued attributes;

c) the replacement of the value of one or more attributes;

d) the changing of the value of one or more attributes to their default value(s);

through either the internal operation of the resource or via management operation. This notification type shall not be used for conveying attribute value changes which have specific notification types already defined.

It is the role of the managed object class definer to fully detail the requirements that a managed object class has for generating one or more of the above notification types. For the attribute value change notification, this includes identifying which attributes, and which value changes to those attributes, are significant enough to warrant the notification being emitted.

8.2 Event information

The following parameters constitute the notification specific event information.

8.2.1 Object creation notification parameters

The following parameters are defined for the object creation notification.

8.2.1.1 Source Indicator

This parameter, when present, indicates the source of the operation that led to the generation of this notification type. It can have one of the following values:

- resource operation: The notification was generated in response to a creation effected through the internal operation of the resource;
- management operation: The notification was generated in response to a creation effected through an SMI management operation applied across the managed object boundary external to the managed object;
- unknown: It is not possible to determine the source of the operation.

8.2.1.2 Attribute list

This parameter, when present, contains a list of attributes and their values at the time the managed object was created. The managed object class definition may specify which attributes are to be included in the list. If the attribute list is not specified by the managed object class definition and the parameter is present in the notification, then all the attributes of the created managed object shall be included in the list.

8.2.1.3 Other information

The following parameters are also utilised. These parameters are defined by CCITT Rec. X.733 | ISO/IEC 10164-4:

- Additional information;
- Additional text;
- Correlated notifications;
- Notification identifier.

8.2.2 Object deletion notification parameters

The following parameters are defined for the object deletion notification.

8.2.2.1 Source Indicator

This parameter, when present, indicates the source of the operation that led to the generation of this notification type. It can have one of the following values:

- resource operation: The notification was generated in response to a deletion effected through the internal operation of the resource;
- management operation: The notification was generated in response to a deletion effected through an SMI management operation applied across the managed object boundary external to the managed object;
- unknown: It is not possible to determine the source of the operation.

8.2.2.2 Attribute list

This parameter, when present, contains a list of attributes and their values just before the managed object was deleted. The managed object class definition may specify which attributes are to be included in the list. If this is not specified by the managed object class definition and the parameter is present in the notification, then all the attributes of the managed object shall be included in the list.

8.2.2.3 Other information

The following parameters are also utilised. These parameters are defined by CCITT Rec. X.733 | ISO/IEC 10164-4:

- Additional information;
- Additional text;
- Correlated notifications;
- Notification identifier.

8.2.3 Attribute value change notification parameters

The following parameters are defined for attribute value change notification.

8.2.3.1 Source indicator

This parameter, when present, indicates the source of the operation that led to the generation of this notification type. It can have one of the following values:

- resource operation: The notification was generated in response to an attribute value change effected through the internal operation of the resource;
- management operation: The notification was generated in response to a an attribute value change effected through an SMI management operation applied across the managed object boundary external to the managed object;
- unknown: It is not possible to determine the source of the operation.

8.2.3.2 Attribute identifier list

This parameter, when present, identifies the set of attributes whose value changes are being reported.

8.2.3.3 Attribute value change definition

This parameter set consists of a set of sequences of the three parameters: Attribute identifier, Old attribute value and New attribute value described below. Each individual sequence describes a single attribute value change. At least one new attribute value shall be present in this list.

8.2.3.3.1 Attribute identifier

This parameter identifies the attribute whose value change is being reported.

8.2.3.3.2 Old attribute value

This parameter, when present, identifies the old value of the attribute.

8.2.3.3.3 New attribute value

This parameter identifies the current value of the attribute.

8.2.3.4 Other information

The following parameters are also utilised. These parameters are defined by CCITT Rec. X.733 | ISO/IEC 10164-4:

- Additional information;
- Additional text;
- Correlated notifications;
- Notification identifier.

8.3 Event reply

This Recommendation | International Standard does not specify information to be used in the event reply parameter.

8.4 Managed objects

8.4.1 Object creation record

An object creation record is a managed object class derived from the event log record object class defined in CCITT Rec. X.735 | ISO/IEC 10164-6. The object creation record object class represents information stored in logs resulting from object creation notification.

8.4.2 Object deletion record

An object deletion record is a managed object class derived from the event log record object class defined in CCITT Rec. X.735 | ISO/IEC 10164-6. The object deletion record object class represents information stored in logs resulting from object deletion notification.

8.4.3 Attribute value change record

An attribute value change record is a managed object class derived from the event log record object class defined in CCITT Rec. X.735 | ISO/IEC 10164-6. The attribute value change record object class represents information stored in logs resulting from attribute value change notification.

8.5 Compliance

Managed object class definitions support the function defined in this Recommendation | International Standard by incorporating the specification of the notification types defined in this Recommendation | International Standard through reference to the notification templates defined in CCITT Rec. X.721 | ISO/IEC 10165-2. The reference mechanism is defined in CCITT Rec. X.722 | ISO/IEC 10165-4.

The definition of the managed object class shall, for each imported notification, specify in the behaviour clause which of the optional and conditional parameters are to be utilized and any further restrictions on their use and their values. It is permissible to state that the use of a parameter remains optional.

9 Service definition

9.1 Introduction

This Recommendation | International Standard provides nine services, six of which are pass-through services. These are identified below together with the parameters that these services convey.

9.2 Object creation reporting service

This service allows an MIS-User, in the agent role, to report the creation of managed objects. It is defined both as a confirmed and as a non-confirmed service.

The object creation reporting service uses the parameters defined in clause 8 of this Recommendation | International Standard in addition to the general M-EVENT-REPORT service parameters defined in CCITT Rec. X.710 | ISO/IEC 9595.

Table 2 lists the parameters for the object creation reporting service.

The Event time, Correlated notifications and Notification identifier parameters may be assigned by the object emitting the notification or by the managed system.

Table 2 – Object creation reporting parameters

Parameter name	Req/Ind	Rsp/Conf
Invoke identifier	P	P
Mode	P	–
Managed object class	P	P
Managed object instance	P	P
Event type	M	C(=)
Event time	P	–
Event information		
Source indicator	U	–
Attribute list	U	–
Notification identifier	U	–
Correlated notifications	U	–
Additional text	U	–
Additional information	U	–
Current time	–	P
Event reply	–	–
Errors	–	P

9.3 Object deletion reporting service

This service allows an MIS-User, in the agent role, to report the deletion of managed objects. It is defined both as a confirmed and as a non-confirmed service.

The object deletion reporting service uses the parameters defined in clause 8 of this Recommendation | International Standard in addition to the general M-EVENT-REPORT service parameters defined in CCITT Rec. X.710 | ISO/IEC 9595.

Table 3 lists the parameters for the object deletion reporting service.

The Event time, Correlated notifications and Notification identifier parameters may be assigned by the object emitting the notification or by the managed system.

9.4 Attribute value change reporting service

This service allows an MIS-User, in the agent role, to report the changes in the values of managed object attributes. It is defined both as a confirmed and as a non-confirmed service.

The attribute value change reporting service uses the parameters defined in clause 8 of this Recommendation | International Standard in addition to the general M-EVENT-REPORT service parameters defined in CCITT Rec. X.710 | ISO/IEC 9595. Table 4 lists the parameters for the attribute value change reporting service.

The Event time, Correlated notifications and Notification identifier parameters may be assigned by the object emitting the notification or by the managed system.

Table 3 – Object deletion reporting parameters

Parameter name	Req/Ind	Rsp/Cnf
Invoke identifier	P	P
Mode	P	–
Managed object class	P	P
Managed object instance	P	P
Event type	M	C(=)
Event time	P	–
Event information		
Source indicator	U	–
Attribute list	U	–
Notification identifier	U	–
Correlated notifications	U	–
Additional text	U	–
Additional information	U	–
Current time	–	P
Event reply	–	–
Errors	–	P

9.5 PT-ACTION service

The PT-ACTION service is used by a pass-through service-user to request a peer pass-through service-user to perform an action on managed object(s). It is defined as a confirmed and a non-confirmed service.

This general service is used to perform actions unless a specific service has been defined by one of the systems management functions.

Table 5 lists the parameters for the PT-ACTION service.

The parameters of this service are identical to those described in the M-ACTION service of CCITT Rec. X.710 | ISO/IEC 9595.

9.6 PT-CREATE service

The PT-CREATE service is used by an invoking pass-through service-user to request a peer pass-through service-user to create a new managed object complete with its identification and the values of its associated management information, and simultaneously to register its identification. It is defined as a confirmed service. This general service is used to create new managed objects unless a specific service has been defined by one of the systems management functions.

Table 6 lists the parameters for the PT-CREATE service.

The parameters of this service are identical to those described in the M-CREATE service of CCITT Rec. X.710 | ISO/IEC 9595.

Table 4 – Attribute value change reporting parameters

Parameter name	Req/Ind	Rsp/Conf
Invoke identifier	P	P
Mode	P	–
Managed object class	P	P
Managed object instance	P	P
Event type	M	C(=)
Event time	P	–
Event information		
Source indicator	U	–
Attribute identifier list	U	–
Attribute value change definition		
Attribute identifier	M	–
Old attribute value	U	–
New attribute value	M	–
Notification identifier	U	–
Correlated notifications	U	–
Additional text	U	–
Additional information	U	–
Current time	–	P
Event reply	–	–
Errors	–	P

9.7 PT-DELETE service

The PT-DELETE service is used by an invoking pass-through service-user to request a peer pass-through service-user to delete a managed object and to deregister its identification. It is defined as a confirmed service. This general service is used to delete managed objects unless a specific service has been defined by one of the systems management functions.

Table 7 lists the parameters for the PT-DELETE service.

The parameters of this service are identical to those described in the M-DELETE service of CCITT Rec. X.710 | ISO/IEC 9595.

9.8 PT-EVENT-REPORT service

The PT-EVENT-REPORT service is used by a pass-through service-user to report an event to a peer pass-through service-user. It is defined as a confirmed and a non-confirmed service. This general service is used to report events unless a specific service has been defined by one of the systems management functions.

Table 8 lists the parameters for the PT-EVENT-REPORTING service.

The parameters of this service are identical to those described in the M-EVENT-REPORT service of CCITT Rec. X.710 | ISO/IEC 9595.

Table 5 – PT-ACTION parameters

Parameter name	Req/Ind	Rsp/Conf
Invoke identifier	P	P
Link identifier	–	P
Mode	P	–
Base object class	P	–
Base object instance	P	–
Scope	P	–
Filter	P	–
Managed object class	–	P
Managed object instance	–	P
Access control	P	–
Synchronization	P	–
Action type	P	P
Action information	P	–
Current time	–	P
Action reply	–	P
Errors	–	P

Table 6 – PT-CREATE parameters

Parameter name	Req/Ind	Rsp/Conf
Invoke identifier	P	P
Managed object class	P	P
Managed object instance	P	P
Superior object instance	P	–
Access control	P	–
Reference object instance	P	–
Attribute list	P	P
Current time	–	P
Errors	–	P

Table 7 – PT-DELETE parameters

Parameter name	Req/Ind	Rsp/Conf
Invoke identifier	P	P
Linked identifier	–	P
Base object class	P	–
Base object instance	P	–
Scope	P	–
Filter	P	–
Access control	P	–
Synchronization	P	–
Managed object class	–	P
Managed object instance	–	P
Current time	–	P
Errors	–	P

Table 8 – PT-EVENT-REPORT parameters

Parameter name	Req/Ind	Rsp/Conf
Invoke identifier	P	P
Mode	P	–
Managed object class	P	P
Managed object instance	P	P
Event type	P	P
Event time	P	–
Event information	P	–
Current time	–	P
Event reply	–	P
Errors	–	P

9.9 PT-GET service

The PT-GET service is used by a pass-through service-user to retrieve attribute values from a peer pass-through service-user. It is defined as a confirmed service. This general service is used to get attributes unless a specific service has been defined by one of the systems management functions.

Table 9 lists the parameters for the PT-GET service.

The parameters of this service are identical to those described in the M-GET service of CCITT Rec. X.710 | ISO/IEC 9595.

Table 9 – PT-GET parameters

Parameter name	Req/Ind	Rsp/Conf
Invoke identifier	P	P
Linked identifier	–	P
Base object class	P	–
Base object instance	P	–
Scope	P	–
Filter	P	–
Access control	P	–
Synchronization	P	–
Attribute identifier list	P	–
Managed object class	–	P
Managed object instance	–	P
Current time	–	P
Attribute list	–	P
Errors	–	P

9.10 PT-SET service

The PT-SET service is used by an invoking pass-through service-user to request the modification of attribute values by a peer pass-through service-user. It is defined as a confirmed and a non-confirmed service. This general service is used to set attributes unless a specific service has been defined by one of the systems management functions.

Table 10 lists the parameters for the PT-SET service.

The parameters of this service are identical to those described in the M-SET service of CCITT Rec. X.710 | ISO/IEC 9595.

10 Functional units

Table 11 lists the functional units that are defined within this Recommendation | International Standard.

Table 10 – PT-SET parameters

Parameter name	Req/Ind	Rsp/Conf
Invoke identifier	P	P
Linked identifier	–	P
Mode	P	–
Base object class	P	–
Base object instance	P	–
Scope	P	–
Filter	P	–
Access control	P	–
Synchronization	P	–
Managed object class	–	P
Managed object instance	–	P
Modification list	P	–
Attribute list	–	P
Current time	–	P
Errors	–	P

Table 11 – Functional units

Function name	Functional units	Systems management services
Object Management	allEvents	All notifications [1]
	control	All services except notifications [2]
	monitor	PT-GET only
	objectEvents	Object creation reporting,
		Object deletion reporting, and
		Attribute value change reporting.

[1] All systems management notification services which map onto the CMIS M-EVENT-REPORT service. This includes the PT-EVENT-REPORT service defined in this Recommendation | International Standard as well as systems management notification services defined by other systems management standards.

[2] All systems management services which map onto the CMIS M-GET, M-SET, M-ACTION, M-CREATE and M-DELETE services. This includes the PT-GET, PT-SET, PT-ACTION, PT-CREATE and PT-DELETEservices defined by this Recommendation | International Standard as well as systems management services (except notification services) defined by other systems management standards.

11 Protocol

11.1 Elements of procedure

11.1.1 Object creation reporting procedure

11.1.1.1 Agent role

11.1.1.1.1 Invocation

The object creation reporting procedures are initiated by the object creation reporting request primitive. On receipt of an object creation reporting request primitive, the SMAPM shall construct an MAPDU and issue a CMIS M-EVENT-REPORT request service primitive with parameters derived from the object creation reporting request primitive. In the non-confirmed mode, the procedure in 11.1.1.1.2 does not apply.

11.1.1.1.2 Receipt of response

On receipt of a CMIS M-EVENT-REPORT confirm primitive containing an MAPDU responding to an object creation reporting notification, the SMAPM shall issue an object creation reporting confirmation primitive to the object creation reporting service user with parameters derived from the CMIS M-EVENT-REPORT confirm service primitive, thus completing the object creation reporting procedure.

NOTE – The SMAPM ignores all errors in the received MAPDU. The object creation reporting service user may ignore such errors, or abort the association as a consequence of such errors.

11.1.1.2 Manager role

11.1.1.2.1 Receipt of request

On receipt of a CMIS M-EVENT-REPORT indication service primitive containing an MAPDU requesting the object creation reporting service, the SMAPM shall, if the MAPDU is well formed, issue an object creation reporting indication primitive to the object creation reporting service user with the parameters derived from the CMIS M-EVENT-REPORT response service primitive. Otherwise, the SMAPM shall in the confirmed mode construct an appropriate MAPDU containing notification of the error, and shall issue a CMIS M-EVENT-REPORT response service primitive with an error parameter present. In the non-confirmed mode, the procedure in 11.1.2.2 does not apply.

11.1.1.2.2 Response

In the confirmed mode, the SMAPM shall accept an object creation reporting response primitive and shall construct an MAPDU confirming the notification and issue a CMIS M-EVENT-REPORT response primitive with parameters derived from the object creation reporting response primitive.

11.1.2 Object deletion reporting procedure

11.1.2.1 Agent role

11.1.2.1.1 Invocation

The object deletion reporting procedures are initiated by the object deletion reporting request primitive. On receipt of an object deletion reporting request primitive, the SMAPM shall construct an MAPDU and issue a CMIS M-EVENT-REPORT request service primitive with parameters derived from the object deletion reporting request primitive. In the non-confirmed mode, the procedure in 11.1.2.1.2 does not apply.

11.1.2.1.2 Receipt of response

On receipt of a CMIS M-EVENT-REPORT confirm primitive containing an MAPDU responding to an object deletion reporting notification, the SMAPM shall issue an object deletion reporting confirmation primitive to the object deletion reporting service user with parameters derived from the CMIS M-EVENT-REPORT confirm service primitive, thus completing the object deletion reporting procedure.

NOTE – The SMAPM ignores all errors in the received MAPDU. The object deletion reporting service user may ignore such errors, or abort the association as a consequence of such errors.

11.1.2.2 Manager role

11.1.2.2.1 Receipt of request

On receipt of a CMIS M-EVENT-REPORT indication service primitive containing an MAPDU requesting the object deletion reporting service, the SMAPM shall, if the MAPDU is well formed, issue an object deletion reporting indication primitive to the object deletion reporting service user with the parameters derived from the CMIS M-EVENT-REPORT response service primitive. Otherwise, the SMAPM shall in the confirmed mode construct an appropriate MAPDU containing notification of the error, and shall issue a CMIS M-EVENT-REPORT response service primitive with an error parameter present. In the non-confirmed mode, the procedure in 11.1.2.2.2 does not apply.

11.1.2.2.2 Response

In the confirmed mode, the SMAPM shall accept an object deletion reporting response primitive and shall construct an MAPDU confirming the notification and issue a CMIS M-EVENT-REPORT response primitive with parameters derived from the object deletion reporting response primitive.

11.1.3 Attribute value change reporting procedure

11.1.3.1 Agent role

11.1.3.1.1 Invocation

The attribute value change reporting procedures are initiated by the attribute value change reporting request primitive. On receipt of an attribute value change reporting request primitive, the SMAPM shall construct an MAPDU and issue a CMIS M-EVENT-REPORT request service primitive with parameters derived from the attribute value change reporting request primitive. In the non-confirmed mode, the procedure in 11.1.3.1.2 does not apply.

11.1.3.1.2 Receipt of response

On receipt of a CMIS M-EVENT-REPORT confirm primitive containing an MAPDU responding to an attribute value change reporting notification, the SMAPM shall issue an attribute value change reporting confirmation primitive to the reporting service user with parameters derived from the CMIS M-EVENT-REPORT confirm service primitive, thus completing the attribute value change reporting procedure.

NOTE – The SMAPM ignores all errors in the received MAPDU. The attribute value change reporting service user may ignore such errors, or abort the association as a consequence of such errors.

11.1.3.2 Manager role

11.1.3.2.1 Receipt of request

On receipt of a CMIS M-EVENT-REPORT indication service primitive containing an MAPDU requesting the attribute value change reporting service, the SMAPM shall, if the MAPDU is well formed, issue an attribute value change reporting indication primitive to the reporting service user with the parameters derived from the CMIS M-EVENT-REPORT response service primitive. Otherwise, the SMAPM shall in the confirmed mode construct an appropriate MAPDU containing notification of the error, and shall issue a CMIS M-EVENT-REPORT response service primitive with an error parameter present. In the non-confirmed mode, the procedure in 11.1.3.2.2 does not apply.

11.1.3.2.2 Response

In the confirmed mode, the SMAPM shall accept an attribute value change reporting response primitive and shall construct an MAPDU confirming the notification and issue a CMIS M-EVENT-REPORT response primitive with parameters derived from the attribute value change reporting response primitive.

11.1.4 PT-CREATE procedure

11.1.4.1 Manager role

11.1.4.1.1 Invocation

The PT-CREATE procedures are initiated by the PT-CREATE request primitive. On receipt of a PT-CREATE request primitive, the SMAPM shall issue a CMIS M-CREATE request service primitive with parameters derived from the PT-CREATE request primitive.

11.1.4.1.2 Receipt of response

On receipt of a CMIS M-CREATE confirm service primitive responding to a PT-CREATE operation, the SMAPM shall issue a PT-CREATE confirmation primitive to the PT-CREATE service user with parameters derived from the CMIS M-CREATE confirm service primitive thus completing the PT-CREATE procedure.

11.1.4.2 Agent role

11.1.4.2.1 Receipt of request

On receipt of a CMIS M-CREATE indication service primitive requesting the PT-CREATE service, the SMAPM shall issue a PT-CREATE indication primitive to the PT-CREATE service user with parameters derived from the CMIS M-CREATE indication service primitive.

11.1.4.2.2 Response

The SMAPM shall accept a PT-CREATE response primitive and shall issue a CMIS M-CREATE response service primitive with parameters derived from the PT-CREATE response primitive.

11.1.5 PT-DELETE procedure

11.1.5.1 Manager role

11.1.5.1.1 Invocation

The PT-DELETE procedures are initiated by the PT-DELETE request primitive. On receipt of a PT-DELETE request primitive, the SMAPM shall issue a CMIS M-DELETE request service primitive with parameters derived from the PT-DELETE request primitive.

11.1.5.1.2 Receipt of response

On receipt of a CMIS M-DELETE confirm service primitive responding to a PT-DELETE operation, the SMAPM shall issue a PT-DELETE confirmation primitive to the PT-DELETE service user with parameters derived from the CMIS M-DELETE confirm service primitive thus completing the PT-DELETE procedure.

11.1.5.2 Agent role

11.1.5.2.1 Receipt of request

On receipt of a CMIS M-DELETE indication service primitive requesting the PT-DELETE service, the SMAPM shall issue a PT-DELETE indication primitive to the PT-DELETE service user with parameters derived from the CMIS M-DELETE indication service primitive.

11.1.5.2.2 Response

The SMAPM shall accept a PT-DELETE response primitive and shall issue a CMIS M-DELETE response service primitive with parameters derived from the PT-DELETE response primitive.

11.1.6 PT-SET procedure

11.1.6.1 Manager role

11.1.6.1.1 Invocation

The PT-SET procedures are initiated by the PT-SET request primitive. On receipt of a PT-SET request primitive, the SMAPM shall issue a CMIS M-SET request service primitive with parameters derived from the PT-SET request primitive. In the non-confirmed mode, the procedure in 11.1.6.1.2 does not apply.

11.1.6.1.2 Receipt of response

On receipt of a CMIS M-SET confirm service primitive responding to a PT-SET operation, the SMAPM shall issue a PT-SET confirmation primitive to the PT-SET service user with parameters derived from the CMIS M-SET confirm service primitive thus completing the PT-SET procedure.

11.1.6.2 Agent role

11.1.6.2.1 Receipt of request

On receipt of a CMIS M-SET indication service primitive requesting the PT-SET service, the SMAPM shall issue a PT-SET indication primitive to the PT-SET service user with parameters derived from the CMIS M-SET indication service primitive. In the non-confirmed mode, the procedure in 11.1.6.2.2 does not apply.

11.1.6.2.2 Response

In the confirmed mode, the SMAPM shall accept a PT-SET response primitive and shall issue a CMIS M-SET response service primitive with parameters derived from the PT-SET response primitive.

11.1.7 PT-GET procedure

11.1.7.1 Manager role

11.1.7.1.1 Invocation

The PT-GET procedures are initiated by the PT-GET request primitive. On receipt of a PT-GET request primitive, the SMAPM shall issue a CMIS M-GET request service primitive with parameters derived from the PT-GET request primitive.

11.1.7.1.2 Receipt of response

On receipt of a CMIS M-GET confirm service primitive responding to a PT-GET operation, the SMAPM shall issue a PT-GET confirmation primitive to the PT-GET service user with parameters derived from the CMIS M-GET confirm service primitive thus completing the PT-GET procedure.

11.1.7.2 Agent role

11.1.7.2.1 Receipt of request

On receipt of a CMIS M-GET indication service primitive requesting the PT-GET service, the SMAPM shall issue a PT-GET indication primitive to the PT-GET service user with parameters derived from the CMIS M-GET indication service primitive.

11.1.7.2.2 Response

The SMAPM shall accept a PT-GET response primitive and shall issue a CMIS M-GET response service primitive with parameters derived from the PT-GET response primitive.

11.1.8 PT-ACTION procedure

11.1.8.1 Manager role

11.1.8.1.1 Invocation

The PT-ACTION procedures are initiated by the PT-ACTION request primitive. On receipt of a PT-ACTION request primitive, the SMAPM shall issue a CMIS M-ACTION request service primitive with parameters derived from the PT-ACTION request primitive. In the non-confirmed mode, the procedure in 11.1.8.1.2 does not apply.

11.1.8.1.2 Receipt of response

On receipt of a CMIS M-ACTION confirm service primitive responding to a PT-ACTION operation, the SMAPM shall issue a PT-ACTION confirmation primitive to the PT-ACTION service user with parameters derived from the CMIS M-ACTION confirm service primitive thus completing the PT-ACTION procedure.

11.1.8.2 Agent role

11.1.8.2.1 Receipt of request

On receipt of a CMIS M-ACTION indication service primitive requesting the PT-ACTION service, the SMAPM shall issue a PT-ACTION indication primitive to the PT-ACTION service user with parameters derived from the CMIS M-ACTION indication service primitive. In the non-confirmed mode, the procedure in 11.1.6.2.2 does not apply.

11.1.8.2.2 Response

In the confirmed mode, the SMAPM shall accept a PT-ACTION response primitive and shall issue a CMIS M-ACTION response service primitive with parameters derived from the PT-ACTION response primitive.

11.1.9 PT-EVENT-REPORT procedure

11.1.9.1 Agent role

11.1.9.1.1 Invocation

The PT-EVENT-REPORT procedures are initiated by the PT-EVENT-REPORT request primitive. On receipt of a PT-EVENT-REPORT request primitive, the SMAPM shall issue a CMIS M-EVENT-REPORT request service primitive with parameters derived from the PT-EVENT-REPORT request primitive. In the non-confirmed mode, the procedure in 11.1.9.1.2 does not apply.

11.1.9.1.2 Receipt of response

On receipt of a CMIS M-EVENT-REPORT confirm service primitive responding to a PT-EVENT-REPORT operation, the SMAPM shall issue a PT-EVENT-REPORT confirmation primitive to the PT-EVENT-REPORT service user with parameters derived from the CMIS M-EVENT-REPORT confirm service primitive thus completing the PT-EVENT-REPORT procedure.

11.1.9.2 Manager role

11.1.9.2.1 Receipt of request

On receipt of a CMIS M-EVENT-REPORT indication service primitive requesting the PT-EVENT-REPORT service, the SMAPM shall issue a PT-EVENT-REPORT indication primitive to the PT-EVENT-REPORT service user with parameters derived from the CMIS M-EVENT-REPORT indication service primitive. In the non-confirmed mode, the procedure in 11.1.9.2.2 does not apply.

11.1.9.2.2 Response

In the confirmed mode, the SMAPM shall accept a PT-EVENT-REPORT response primitive and shall issue a CMIS M-EVENT-REPORT response service primitive with parameters derived from the PT-EVENT-REPORT response primitive.

11.2 Abstract syntax

11.2.1 Managed objects

This Recommendation | International Standard references the following management support objects, the abstract syntax of which are specified in CCITT Rec. X.721 | ISO/IEC 10165-2:

a) objectCreationRecord;

b) objectDeletionRecord;

c) attributeValueChangeRecord.

11.2.2 Attributes

Table 12 identifies the relationship between the parameters defined in 8.2 and the attributes type specifications in CCITT Rec. X.721 | ISO/IEC 10165-2.

Table 12 – Parameter to attribute mapping

Parameter	Attribute Name
Source indicator	sourceIndicator
Attribute list	attributeList
Attribute identifier list	attributeIdentifierList
Attribute value change definition	attributeValueChangeDefinition

11.2.3 Attribute groups

There are no attribute groups defined by this Recommendation | International Standard.

11.2.4 Actions

There are no specific actions defined by this Recommendation | International Standard.

11.2.5 Notifications

Table 13 identifies the relationship between the notifications defined in 8.1 and the notification type specification in CCITT Rec. X.721 | ISO/IEC 10165-2.

Table 13 – Notifications

Event type	Notification type
Object creation	objectCreation
Object deletion	objectDeletion
Attribute value change	attributeValueChange

11.3 Negotiation of functional units

This Recommendation | International Standard assigns the following object identifier value:

{joint-iso-ccitt ms(9) function(2) part1(1) functionalUnitPackage(1)}

as a value of ASN.1 type FunctionalUnitPackageId defined in CCITT Rec. X.701 | ISO/IEC 10040 to use for negotiating the availability of the following functional units:

- 0 allEvents;
- 1 control;
- 2 monitor;
- 3 objectEvents;

where the number identifies the bit position assigned to the functional unit as defined in clause 10.

Within the Systems management application context, the mechanism for negotiating functional units is described by CCITT Rec. X.701 | ISO/IEC 10040.

NOTE – The requirement to negotiate functional units is specified by the application context.

12 Relationships with other functions

Control of the reporting services defined in this Recommendation | International Standard is provided by mechanisms specified in CCITT Rec. X.734 | ISO/IEC 10164-5. The reporting services defined in this Recommendation | International Standard may exist independently of the control mechanisms of CCITT Rec. X.734 | ISO/IEC 10164-5.

Other systems management functions make use of the pass-through services specified in this Recommendation | International Standard for all operations and notifications that apply across a managed object boundary, except where specific services are defined by other systems management functions.

13 Conformance

There are two conformance classes: general conformance class and dependent conformance class. A system claiming to implement the elements of procedure for the object creation reporting, object deletion reporting and attribute value change reporting services defined in this Recommendation | International Standard shall comply with the requirements for either the general or the dependent conformance class as defined in the following sub-clauses. The supplier of the implementation shall state the class to which conformance is claimed.

13.1 General conformance class requirements

A system claiming general conformance to this Recommendation | International Standard shall support this systems management function for all managed object classes that import the management information defined by this Recommendation | International Standard.

13.1.1 Static conformance

The system shall

a) support the role of manager, agent or both, with respect to the objectEvent functional unit;

b) support the transfer syntax derived from the encoding rules specified in CCITT Rec. X.209 | ISO/IEC 8825 named {joint-iso-ccitt ans1(1) basic encoding(1)}, for the purpose of generating and interpreting the MAPDUs, defined by the abstract data types referenced in 11.2.5 of this Recommendation | International Standard.

13.1.2 Dynamic conformance

The system shall, in the role(s) for which conformance is claimed support the elements of procedure defined in this Recommendation | International Standard for the object creation reporting, object deletion reporting and the attribute value change reporting services .

13.2 Dependent conformance class requirements

13.2.1 Static conformance

The system shall

a) supply a System Conformance Statement which identifies the standardized use of this systems management function;

b) 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 the MAPDUs, defined by the abstract data types referenced in 11.2.5 of this Recommendation | International Standard, as required by a standard use of this systems management function.

13.2.2 Dynamic conformance

The system shall support the element of procedure, defined in this Recommendation | International Standard, as required by a standardized use of this systems management function.