INTERNATIONAL TELECOMMUNICATION UNION

CCITT

THE INTERNATIONAL
TELEGRAPH AND TELEPHONE
CONSULTATIVE COMMITTEE

X.732

(01/92)

DATA COMMUNICATION NETWORKS

INFORMATION TECHNOLOGY – OPEN SYSTEMS INTERCONNECTION – SYSTEMS MANAGEMENT: ATTRIBUTES FOR REPRESENTING RELATIONSHIPS

Recommendation X.732

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.732 was approved on 17th of January 1992. The identical text is also published as ISO/IEC International Standard 10164-3.

CCITT NOTE

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

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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: ATTRIBUTES FOR REPRESENTING RELATIONSHIPS

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 purpose of systems-management as defined by CCITT Rec. X.700 | ISO/IEC 7498-4. This Recommendation | International Standard defines the attributes for representing relationships and consists of services and generic definitions. It is positioned in the application layer of CCITT Rec. X.200 | ISO/IEC 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 attributes for representing relationships;
- establishes a model that relates the service and generic definitions provided by this function to user requirements;
- defines the services provided by the function;
- defines generic attribute types, 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 the service and management operations and notifications;
- specifies compliance requirements placed on other standards that makes 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 this function;
- specify the manner in which management is accomplished by the user of this function;
- define the nature of any interactions that result in the use of this 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 listed 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 management overview.*
- CCITT Recommendation X.720 (1992) | ISO/IEC 10165-1:1993, *Information technology – Open Systems Interconnection – Structure of management information: Management information model.*
- CCITT Recommendation X.721 (1992) | ISO/IEC 10165-2:1992, *Information technology – Open Systems Interconnection – Structure of management information: Definition of management information.*
- CCITT Recommendation X.722 (1992) | ISO/IEC 10165-4:1992, *Information technology – Open Systems Interconnection – Structure of management information: Guidelines for the definition of managed objects.*
- 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 terms defined in CCITT Rec. X.200 | ISO 7498:

a) open system;
b) systems management.

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).

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.

3.8 Additional definitions

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

3.8.1 service relationships: An asymmetric relationship denoting that the first of a pair of managed objects is a provider object (providing services) to the second, and that the second is a user object (using services) of the first.

3.8.2 peer relationships: A peer relationship is a symmetric relationship describing the rules under which pairs of similar managed objects communicate.

3.8.3 fallback relationships: A fallback relationship is an asymmetric relationship denoting that the second of a pair of managed objects (the secondary object) is capable of serving as a fallback or "next preferred choice" to the first managed object (the primary object).

3.8.4 back-up relationships: A back-up relationship is an asymmetric relationship denoting that the second of a pair of managed objects (the back-up object) is currently active and performing a back-up function in place of the first (the backed-up object).

3.8.5 group relationships: A group relationship is a relationship between two managed objects where one, the member object, belongs to a group represented by the other, the owner object.

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 Relationship Change Reporting 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 management user needs the ability to examine the relationships among various parts of the system or systems, to see how the operation of one part of the system depends upon or is depended upon by other parts. Knowing the existence of one part, the user needs to locate other parts that are related to it. The user also needs the ability to change such relationships and to be notified of such changes when they occur due to other causes.

This Recommendation | International Standard defines the general attributes, operations and notifications that can be part of any managed object definition.

7 Model

The definitions used in this Recommendation | International Standard are to assist the description of the model for attributes for representing relationships.

7.1 General

A relationship is defined by a set of rules that describe how the operation of one part of an open system affects the operation of other parts of the open system. A relationship is said to exist among managed objects when the operation of one managed object affects the operation of the other managed objects. For a relationship to be significant within the context of OSI management, sufficient management information must be available to allow the user of Management Information Services to identify the managed objects involved and the rules governing their interaction.

7.1.1 Direct and indirect relationships

A direct relationship exists between two managed objects when some portion of the management information associated with one managed object expressly identifies the other managed object with which it has a relationship.

An indirect relationship exists when such a relationship can be deduced from the concatenation of two or more direct relationships. Figure 1 illustrates the direct and indirect relationships.

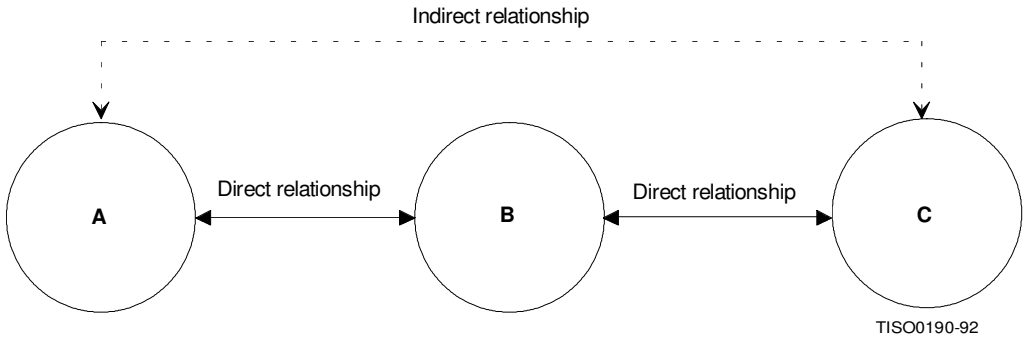

Figure 1 – Direct and indirect relationships

In this diagram, the circles represent managed objects, and the solid lines represent direct relationships (AB and BC), expressed as explicit management information. The dotted line represents an indirect relationship (AC) that can be inferred from the existence of the direct relationships.

7.1.2 Relationship role

In a relationship between two managed objects, the relationship role is a description of the part played by one managed object (i.e. the rules describing its behaviour) with respect to the other managed object.

7.1.3 Role attribute

A role attribute is a single valued or a set-valued attribute of a managed object whose values are the names of other managed objects that exist in a particular relationship role with respect to the managed object possessing the attribute. Role attributes are used to represent such relationships. The managed object class definer may impose a limit on the number of values in a set-valued role attribute.

Figure 2 illustrates a service relationship, comprising two managed objects, one in a service provider role and the other in a service user role.

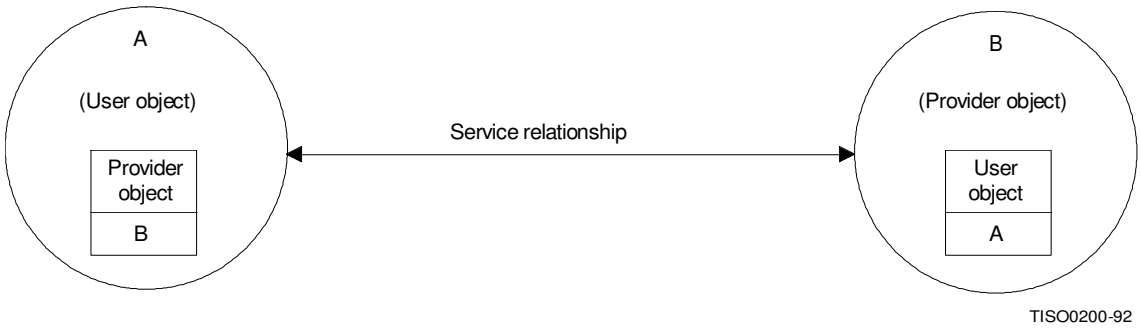

Figure 2 – Relationship roles

7.1.4 Symmetric and asymmetric relationships

A symmetric relationship exists between two managed objects when the set of generic rules governing their interactions with each other and the roles of the two managed objects are identical.

An asymmetric relationship exists between two managed objects when the set of generic rules governing their interactions with each other and the roles of the two managed objects differ.

7.1.5 Relationship type

Relationships among managed objects can be of many types. The relationship type is defined by the set of relationship roles applicable to the managed objects that constitute the relationship.

7.2 Categories of relationships

This Recommendation | International Standard defines reciprocal and one way relationships.

7.2.1 Reciprocal relationships

7.2.1.1 Definition of reciprocal relationship

A reciprocal relationship between two managed objects is represented by including, as one of the values of a role attribute of each of the managed objects, the name of the other managed object to which it is related. Figure 3 illustrates a reciprocal relationship.

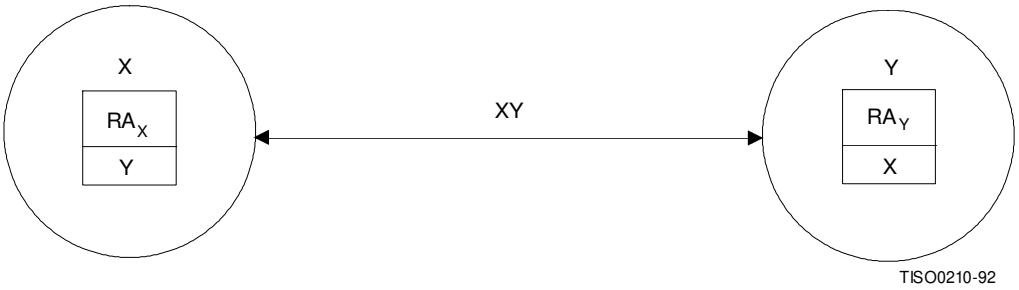

Figure 3 – Reciprocal relationship

In this diagram, the two managed objects X and Y have a direct relationship XY that is expressed both by the existence of the name of the object Y as a value of X's role attribute RA_X, and also by the existence of the name of the object X as a value of Y's role attribute RA_Y.

A reciprocal relationship is identified by the names of the two related managed objects and the name of either of the two role attributes that reflect the existence of the relationship. Thus in Figure 3, the relationship XY can be addressed in management information by addressing either the value Y in the role attribute RA_X, or the value X in the role attribute RA_Y.

A managed object may have multiple instances of similar reciprocal relationships. These relationships are expressed using a set valued role attribute.

7.2.1.2 Management of reciprocal relationships

Reciprocal relationships result from the creation of a managed object with specific role attribute(s). They may be changed through the create, delete, replace (add and remove in the case of set-valued attributes) operations. When a managed object is deleted, all reciprocal relationships pertaining to that managed object are deleted. The result of carrying out these operations on any one managed object causes a change to the relationships between managed objects. Depending on the behaviour of the managed object, these may result in further operations on related managed objects which assist in maintaining the consistency of the relationships.

Information about reciprocal relationships may be obtained through management operations or as a result of notifications. The relationships of a managed object can be read by applying get operations to the role attribute(s) of the managed object. Dependent upon the behaviour of managed objects, they may generate a notification whenever a relationship is created, deleted or changed.

7.2.2 One-way relationships

7.2.2.1 Definition of one-way relationships

A one-way relationship between two managed objects is represented by including, as one of the values of a role attribute of only one of the managed object, the name of the other managed object to which it is related.

7.2.2.2 Management of one-way relationships

One-way relationships are managed in the same manner as reciprocal relationships, by means of operations at the managed object boundary addressed to the role attribute.

7.2.3 Managed objects that also represent relationships

When two direct relationships are concatenated to form an indirect relationship, the managed object that is common to both the direct relationships (e.g., the managed object B in Figure 1) can be regarded as representing the (indirect) relationship between the other two managed objects (A and C in Figure 1).

Managed object B represents a relationship when it contains the information identifying the type of the relationship and other role attributes of the indirect relationships. By extension, such relationship objects may represent relationships between three or more managed objects which cannot be represented unambiguously through containment or reciprocal relationships alone.

7.3 Types of relationships

The relationship type describes the nature of the relationship between two or more managed objects. The type of the relationship is implied by the name of the role attribute. The following types of reciprocal relationships are defined by this Recommendation | International Standard.

7.3.1 Service relationships

A **service relationship** is an asymmetric relationship denoting that the first of a pair of managed objects is a **provider object** (providing services) to the second and that the second is a **user object** (using services) of the first.

The fact that a service relationship exists between managed objects does not necessarily imply that the service is available.

Provider object and user object are two roles in a service relationship. A one-way service relationship exists if a managed object designates a second managed object to be in the user object role, or if the second managed object designates the first managed object to be in the provider object role. A reciprocal service relationship exists if both managed objects designate each other to be in the complementary roles.

The order of preference in which the user objects are selected for the provision of service by the provider object is expressed as a priority value attached to each user object.

The order of preference in which the provider objects are selected to provide service to the user object is expressed as a priority value attached to each provider object.

7.3.2 Peer relationships

A **peer relationship** is a symmetric relationship under which pairs of similar managed objects communicate. The related managed objects are termed **peers**. The attribute is constrained to be read-only for management operations though the value of the attribute may be changed by the normal or abnormal operation of the layer.

A one-way relationship exists if one managed object designates another managed object to be in the peer role. A reciprocal peer relationship exists if both managed objects designate each other to be in the peer role.

7.3.3 Fallback relationships

A **fallback relationship** is an asymmetric relationship denoting that the second of a pair of managed objects (the **secondary object**) has been designated as a fallback or “next preferred choice” to the first managed object (the **primary object**). The existence of a fall back relationship implies that the secondary resource is capable of providing Back-up service to the primary resource if the latter is unable to fulfil its function. It does not necessarily imply that the secondary resource is currently active and performing its Back-up function in place of the primary resource.

Primary and secondary are two roles in a fallback relationship. A one-way fallback relationship exists if a managed object designates a second managed object to be in the secondary role, or if the second managed object designates the first managed object to be in the primary role. A reciprocal fallback relationship exists if both managed objects designate each other to be in the complementary roles.

The order of preference in which the secondary objects are selected to provide Back-up service to the primary object is expressed as a priority value attached to each secondary object.

The order of preference in which the primary objects are selected for the provision of Back-up service by the secondary object is expressed as a priority value attached to each primary object.

7.3.4 Back-up relationships

A **back-up relationship** is an asymmetric relationship denoting that the second of a pair of managed objects (the **back-up object**) is currently active and performing a back-up function in place of the first managed object (the **backed-up object**).

Back-up object and backed-up object are two roles in a back-up relationship. A one-way back-up relationship exists if a managed object designates a second managed object to be in the back-up role, or if the second managed object designates the first managed object to be in the backed-up role. A reciprocal back-up relationship exists if both managed objects designate each other to be in the complementary roles.

A back-up relationship is created as a result of a pre-existing fallback relationship between two managed objects. The back-up relationship comes into existence when the backed-up resource is not fulfilling its function, and the back-up resource is activated to provide the same service. The back-up relationship ceases to exist when the backed-up resource resumes fulfilling its function, and the back-up resource ceases to provide that service. Creation and deletion of the back-up relationship has no effect on the existence of the fallback relationship between the two managed objects.

A backed-up object may be in the **disabled** or **enabled** operational state. The administrative state of the back-up object must be **unlocked** to allow the back-up relationship to exist. When a managed object is being backed-up for any reason (i.e., a back-up relationship exists), the back-up object is in use as long as it is not **disabled**. The operational and administrative states are defined in CCITT Rec. X.731 | ISO/IEC 10164-2.

7.3.5 Group relationships

A **group relationship** is a relationship between two managed objects where one, the **member object**, belongs to a group represented by the other, the **owner object**. Group relationships are used to express the grouping of the same or different classes of member objects for some identified functional or administrative purpose, and can be changed during the lifetime of the member objects. Membership in groups can overlap, i.e., a given member object can have multiple owners.

Owner and **member** are the two roles in a group relationship. A one-way group relationship exists if a managed object designates a second managed object to be in the member role, or if the second managed object designates the first managed object to be in the owner role. A reciprocal group relationship exists if both managed objects designate each other to be in the complementary roles.

7.4 Relationship roles

The following types of relationship roles have been defined by this Recommendation | International Standard.

For service relationships:

- provider object;
- user object.

For peer relationships:

- peer.

For fallback relationships:

- primary;
- secondary.

For back-up relationships:

- back-up object;
- backed-up object.

For group relationships:

- owner;
- member.

8 Generic definitions

This clause specifies a set of generic attributes and notification and their applicable parameters and semantics.

8.1 Generic attributes

This Recommendation | International Standard defines the following specific management attributes and attribute group, the abstract syntax of which are specified in CCITT Rec. X.721 | ISO/IEC 10165-2:

a) providerObject;
b) userObject;
c) peer;
d) primary;
e) secondary;
f) backUpObject;
g) backedUpObject;
h) member;
i) owner;
j) relationships.

These standardized attribute definitions can be used to derive new attribute definitions to identify more specific roles for the related managed object classes.

8.1.1 Provider object

A managed object definition shall use the provider object attribute to identify one or more managed objects acting in a service provider role with respect to that managed object, and the order of priority in which they do so. If the same priority is applied to more than one managed object, then the order of priority among these managed objects is a local matter. The provider object attribute is set-valued and read-write.

8.1.2 User object

A managed object definition shall use the user object attribute to identify one or more managed objects acting in a service user role with respect to that managed object, and the order of priority in which they do so. If the same priority is applied to more than one managed object, then the order of priority among these managed objects is a local matter. The user object attribute is set-valued and read-write.

8.1.3 Peer

A managed object definition shall use the peer attribute to identify one other managed object that acts in the peer role with respect to it. The peer attribute is single-valued and read-only. The attribute value may either be null or a managed object name.

8.1.4 Primary

A managed object shall use the primary attribute to identify one or more managed objects acting in a primary role with respect to that managed object, and the order of priority in which they do so. If the same priority is applied to more than one managed object, then the order of priority among these managed objects is a local matter. The primary attribute is set-valued and read-write.

8.1.5 Secondary

A managed object shall use the secondary attribute to identify one or more managed objects acting in a secondary role with respect to that managed object, and the order of priority in which they do so. If the same priority is applied to more than one managed object, then the order of priority among these managed objects is a local matter. The secondary attribute is set-valued and read-write.

8.1.6 Back-up object

A managed object shall use the back-up object attribute to identify a managed object acting in a back-up role with respect to it. The back-up object attribute is single-valued and read-only. The attribute value may either be null if the managed object that has the attribute is currently active and not in need of back-up service, or a managed object name. The back-up object attribute forms the back-up object parameter defined in CCITT Rec. X.733 | ISO/IEC 10164-4.

8.1.7 Backed-up object

A managed object shall use the backed-up object attribute to identify a second managed object acting in a backed-up role with respect to it. The backed-up object attribute is single-valued and read-only. The attribute value may either be null if the managed object that has the attribute is not currently active as a back-up on behalf of any other object, or a managed object name.

8.1.8 Member

A managed object shall use the member attribute to identify one or more managed objects acting in the member role with respect to that managed object. The member attribute is set-valued and read-write.

8.1.9 Owner

A managed object shall use the owner attribute to identify one or more managed objects acting in the owner role with respect to that managed object. The owner attribute is set-valued and read-write.

8.1.10 Relationships attribute group

The relationships attribute group is defined as an empty attribute group. It provides a means of referring to the collection of all relationship attributes of a managed object. The intent of the relationships attribute group is to contain the generic and specific relationship attributes of a managed object when included in the managed object class definition. When the relationships attribute group is read, the set of attribute identifiers and values which are members of the relationships attribute group will be returned.

8.1.11 Rules applicable to relationship attributes

When a managed object is required to represent any of the relationships described above as management information it shall include the appropriate attribute type(s) as part of the object class definition. If an instance of that object class does not currently have a relationship established, then the relevant attributes shall be assigned a null value.

When there is a set of multiple objects related in a certain role to a given object, the objects in the set can be assigned a priority value showing the order of preference. Such a priority feature is provided for objects in the following roles.

- (service) provider object: The priority shows which service provider objects are preferred;
- (service) user object: The priority shows which service user objects are preferred;
- primary: The priority shows which primary objects are given preference for back-up service if more than one primary object is disabled;
- secondary: The priority shows which back-up objects are preferred.

In the relationship attributes for each of these *four* roles, each value is a bound pair of values comprising the related object name and the priority value assigned to that related object. A lower numerical priority value indicates that the related object has a higher preference.

8.2 Generic notifications

The generic notification, 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 one managed object class 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.

8.2.1 Event type

This parameter defines the type of the event. The following event type is defined in this Recommendation | International Standard.

- relationship change: This notification type is used to report the change in the value of one or more relationship attributes of a managed object, that result through either the internal operation of the resource or via management operation. It is also used to report changes in object class specific relationship attributes.

8.2.2 Event information

The following parameters constitute the notification specific event information.

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 relationship attribute value change effected through the internal operation of the resource;
- management operation: The notification was generated in response to a relationship 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.

8.2.2.2 Attribute identifier list

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

8.2.2.3 Relationship 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 relationship attribute value change. At least one new relationship attribute value shall be present in this list.

8.2.2.3.1 Attribute identifier

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

8.2.2.3.2 Old attribute value

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

8.2.2.3.3 New attribute value

This parameter identifies the current value of the relationship attribute.

8.2.2.4 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.

8.2.3 Event reply

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

8.3 Managed objects

A relationship 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 relationship change record object class represents information stored in logs resulting from relationship change notification.

8.4 Compliance

Managed object class definitions support the function defined in this Recommendation | International Standard by incorporating the specification of the notification and/or relationship attribute types defined in this Recommendation | International Standard through reference to the notification and/or attribute 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 the 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.

The managed object class definitions may import one or more of the relationship attribute types defined in this Recommendation | International Standard. For each imported relationship attribute, the managed object class shall state any further restrictions on the use and the values of the attribute.

9 Service definition

9.1 Introduction

This Recommendation | International Standard defines one service which is identified below together with the appropriate parameters.

9.1.1 Relationship change reporting service

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

The relationship change reporting service uses the parameters defined in clause 8 in addition to the general M-EVENT-REPORT service parameters defined in CCITT Rec. X.710 | ISO/IEC 9595. Table 1 lists the parameters for the relationship change reporting service.

Table 1 – Relationship 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	–
Relationship 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

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

9.2 Management of relationship attributes

This Recommendation | International Standard uses the pass-through services of the CCITT Rec. X.730 | ISO/IEC 10164-1 for managing the relationship attributes of managed objects.

10 Functional units

The relationship change reporting service constitutes a single systems management functional unit.

11 Protocol

11.1 Elements of procedure

11.1.1 Agent role

11.1.1.1 Invocation

The relationship change reporting procedures are initiated by the relationship change reporting request primitive. On receipt of a relationship 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 relationship change reporting request primitive. In the non-confirmed mode, the procedure in 11.1.1.1.2 does not apply.

11.1.1.2 Receipt of response

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

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

11.1.2 Manager role

11.1.2.1 Receipt of request

On receipt of a CMIS M-EVENT-REPORT indication service primitive containing an MAPDU requesting the relationship Change Reporting service, the SMAPM shall, if the MAPDU is well formed, issue a relationship 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 11.1.1.2.2 does not apply.

11.1.2.2 Response

In the confirmed mode, the SMAPM shall accept a relationship 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 relationship change reporting response primitive.

11.2 Abstract syntax

11.2.1 Managed objects

This Recommendation | International Standard references the following management support object whose ASN.1 value notation is specified in CCITT Rec. X.721 | ISO/IEC 10165-2:

relationshipChangeRecord

11.2.2 Attributes

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

a) backedUpObject;
b) backUpObject;
c) member;
d) owner
e) peer;
f) primary;
g) providerObject;
h) secondary;
i) userObject.

11.2.3 Parameter to attribute mapping

Table 2 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 2 – Parameter to attribute mapping

Parameter	Attribute Name
Source Indicator	sourceIndicator
Attribute Identifier List	attributeIdentifierList
Relationship Change Definition	relationshipChangeDefinition

11.2.4 Attribute group

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

relationships

11.2.5 Actions

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

11.2.6 Notifications

Table 3 identifies the relationship between the notification defined in 8.1 and the notification type specification in CCITT Rec. X.721 | ISO/IEC 10165-2.

Table 3 – Notifications

Event type	Notification type
Relationship change	relationshipChange

11.3 Negotiation of functional units

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

{joint-iso-ccitt ms(9) function(2) part3(3) 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 unit:

0 relationship change reporting

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

When performing an operation on a relationship attributes, this Recommendation | International Standard utilises the PT-GET and PT-SET services provided by the CCITT Rec. X.730 | ISO/IEC 10164-1.

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 relationship change reporting service 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 relationship change reporting 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 11.2.2, 11.2.4 and 11.2.6 of this Recommendation | International Standard.

13.1.2 Dynamic conformance

The system shall, in the role(s) for which conformance is claimed

a) support the elements of procedure defined in CCITT Rec. X.730 | ISO/IEC 10164-1 for PT-GET and the PT-SET services; and,

b) support the elements of procedure defined in this Recommendation | International Standard for the relationship change reporting service.

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 11.2.2, 11.2.4 and 11.2.6, 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, or referenced by, this Recommendation | International Standard, as required by a standardized use of this systems management function.