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Foreword

ETSI Technical Reports (ETRs) are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS), or Interim-European Telecommunication Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, relating to the use or application of ETSs, or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS, or I-ETS.

This ETR has been produced by the Network Aspects (NA) Technical Committee of the European Telecommunication Standard Institute (ETSI).

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1 Scope

This document provides guidance to the information modelling tasks contained in ETRs on the method for characterisation of Telecommunication Management Network (TMN) interfaces (DTR/NA-43302). The purpose of the modelling tasks is to define an ETSI TMN interface in terms of messages to and from managed objects in the "agent" system.

This ETR identifies which CCITT/ISO Recommendations/Standards, containing modelling guidelines, are of particular relevance and which sections are recommended for use in ETSI models (e.g. where options exist), provides additional guidelines for managed object modelling.

This ETR does not imply any specific system implementation.

2 References

[1] CCITT Recommendation X.700: "The Management Framework".

[2] CCITT Recommendation X.701: "The Systems Management Overview".

[3] CCITT Recommendation X.720: "The Management Information Model".

[4] CCITT Recommendation X.722: "The Guidelines for the Definition of Managed Objects".

3 Definitions, symbols and abbreviations

CCITT	International Telephone and Telegraph Consultative Committee
GDMO	Guidelines for the Definition of Managed Objects
ER	Entity Relationship
ETR	ETSI Technical Report
ISO	International Standards Organisation
OSI	Open Systems Interconnection
CMIS	Common Management Information Service
PICS	Protocol Implementation Conformance Statement
SMF	Specific Systems Management Function
TMN	Telecommunication Management Network

4 Introduction

The CCITT X.700 series of Recommendations provide overall guidelines for the development of a Management Information Model and the definition of Managed Objects. A description of the relevant CCITT Recommendations can be found in subclause 5.1.1.

The purpose of producing additional guidelines is to provide the basis for an approach for ETSI definers and reviewers of Managed Object Class Specifications and Management Applications by clarifying the options available in the CCITT X.700 series of Recommendations and providing additional guidelines where required.

Specific Systems Management Function (SMF) will be included in a separate ETR.

5 Systems management

5.1 Adoption of CCITT/ISO systems management work

In order to achieve consistency between specifications and to maximise the re-use of agreed recommendations/standards and the resultant tools and mechanisms, the CCITT X.700 series of Recommendations should be considered as the foundation for all management information exchange.

As a general rule, these guidelines assume that wherever possible, and whenever appropriate, the CCITT/ISO work on systems management shall be used as the basis for the work.

5.1.1 The following CCITT/ISO Recommendations are of specific relevance

The Management Framework (CCITT Recommendation X.700 [1]) defines the concepts and scope of Open Systems Interconnection (OSI) management. It also gives an overview of the OSI functional areas, management structure and areas of standardisation.

The Systems Management Overview (CCITT Recommendation X.701 [2]) defines the basic component and management structure for exchanging management information. The document may require specific extensions to cater for the wider Telecommunication Management Network (TMN) requirements.

The Management Information Model (CCITT Recommendation X.720 [3]) defines the information model for managed objects and their attributes that correspond to the information aspect of the systems management model as introduced in CCITT Recommendation X.701 [2]. CCITT Recommendation X.720 [3] provides descriptions of the basic management operations and the use of packages, allomorphism and inheritance, etc. These descriptions should be adopted as the basic framework for the application of Guidelines for the Definition of Managed Objects (GDMO) (CCITT Recommendation X.722 [4]); further guidelines may be needed.

The GDMO (CCITT Recommendation X.722 [4]) details the framework for defining managed objects. This Recommendation should be adopted as the basic framework for TMN managed objects. It may be necessary to supplement GDMO with further specific guidelines on its application to TMN and other CCITT telecommunication recommendations. (In this case the specific ETSI extensions appear in Clause 5 of this document).

5.2 Application of CCITT/ISO work to ETSI

5.2.1 Relationship between OSI systems management and the TMN

Systems management provides the management of the OSI communications environment and provides the tools and mechanisms for exchanging management information.

TMN provides the framework for managing telecommunications networks and identifies the interface points between network elements, management systems and other networks.

The exchange of management information across the TMN interface points should, as far as possible, be via an OSI based interface. Hence systems management capabilities can be utilised to transfer and negotiate TMN management information at the interfaces, however much of the scope of the TMN management information is outside the OSI environment and hence outside the scope of systems management information models and applications.

Where CCITT/ISO work is not available, or does not meet the needs of the TMN, every attempt should be made to convey the requirements of the TMN to the relevant CCITT/ISO study group. In the event that CCITT/ISO are unable, within the required timescales, to meet the requirement of the TMN, generic TMN standards will be developed.

6 Identification of managed objects in ETSI

6.1 Requirements capture

Managed object classes and their components should fulfil clearly justified requirements related to particular management activities. Items of interest to management should be recorded via the managed objects that represent the resources where it happened.

In order to ensure consistency between the managed objects identified by different ETSI groups, the following procedure is proposed:

- split up network resources into manageable parts based on the requirements of Management Services, system knowledge and good judgement;

- develop models and managed objects for each manageable part. The models should be used to test the generic standards and to indicate insufficiencies in the generic standards;

- unify the partial models in a single generic model. In the unification process, the partial models must be cross-checked for object classes and attributes that are used in more than one partial model. Differences in object and attribute definitions must be eliminated, and relations between objects in the set of partial models must be added;

- check that the model is capable of meeting the requirements of all relevant Management Services.

6.2 General modelling requirements

An object class shall not repeat a previously registered object class definition. If a definition has an element of commonality with, but is not identical to a previously registered definition, it shall maximise the re-use of specifications through inheritance, or by use of package definition.

6.2.1 Logical and intuitive representation of resources

The requirements captured and their representation in terms of managed objects must present a view of the resources, behaviour and relationships that would be logical and intuitive to those who will manage the resources themselves. This will include both those who understand the resources and require close control and detailed information and those who require only an overview. The managed object definition is therefore likely to balance the use of resource specific and generic attributes. This is essentially to be able to capture, review, interpret and use the management information.

6.2.2 Accommodation of a wide variety of management functions

It is important that all aspects of a resource, from all functional, operational, hierarchical and life cycle aspects are considered during the requirements capture. The information may then be presented in several ways (e.g. one object with many packages, or several objects) depending on the network model, and the context of the management activity.

6.2.3 Presentation of different views to different managers

The structuring of managed object models should allow management from various perspectives/functional areas without undue difficulty.

A logical, or intuitive representation may differ on the point of view (e.g. network user versus network operator).

6.2.4 Managing optionality/conditionality of resources

The requirements capture and the subsequent managed object model must consistently reflect the fact that managed resources have optional characteristics for various reasons.

A resource represented by a managed object class may consist of different products. Thus one instance of the class may contain characteristics which are not present in another instance of the same class.

During the lifetime of a managed object instance, the optional characteristics may be present for a period of time and then absent. Various mechanisms can be used to reflect this, such as subclassing, null values of attributes and the use of conditional packages. However, the use of conditional packages is discouraged as it increases the complexity of implemented systems. Optionality should, wherever possible be achieved by subclassing objects.

If null, or other special value attributes are used, the meaning of the value should be made clear in the behaviour. The use of special value attributes having special meanings is discouraged.

6.2.5 Describing relationships in the real world

Definitions should ensure that objects adequately reflect the characteristics and behaviour of the resources which are represented, and the management infrastructure. The intention is to avoid mismatches between the modelled resources and the definitions which provide abstractions of these resources and the services they support.

6.2.6 Documentation of specific object models

The purpose of the modelling tasks is to define an interface in terms of the message exchanges between two applications. For the TMN, a list of 22 Management Services exists and most of them will correspond to a specific model. In order to facilitate implementation and testing of these applications, the following structure of the model description is proposed:

- a brief prose description of the Management Service;

- a prose description of the object classes, attributes, notifications and behaviour which are required by the Management Service;

- a formal description of Managed Object Classes, attributes, name bindings, actions and notifications following the templates contained in CCITT Recommendation X.722 [4];

- the list of SMFs (or parts of) which should be used;

- application contexts, definitions and registration;

- when they are not part of SMFs, mapping of operations onto underlying services (Common Management Information Service (CMIS)) and corresponding conformance requirements (Protocol Implementation Conformance Statement (PICS)).

7 Specific ETSI modelling requirements

7.1 Application of inheritance (CCITT Recommendation X.720, § 5.1.2)

When defining the classes and subclasses for an information model, common characteristics of a group of managed objects should be abstracted out of the group and placed in a superclass. If the common characteristics sort themselves into two or more integral abstractions, then superclasses should be defined separately for each integrated set of characteristics.

a) Strict inheritance.

   A class shall be specialised only by the addition of new attributes, notification, or behaviour. Specialisation by deleting any of the parent class characteristics is not allowed.

b) Multiple inheritance.

   Multiple inheritance may be used in ETSI models.

   Multiple inheritance refers to the ability of a subclass to be specialised from more than one superclass. The subclass inherits the attributes, operations, notifications and behaviour from more than one superclass.

It is important to ensure that specialisation through multiple inheritance does not introduce contradictions (i.e. care should be taken that superclasses do not contain contradictory attributes, operations, notifications, or behaviour).

7.2 Use of allomorphism (CCITT Recommendation X.720, § 5.1.6)

Allomorphism is the object modelling tool which enables an object to imitate another class containing a subset of the attributes, notifications and operations present in the allomorphic class. For example a signalling link termination point object could be managed as a termination point object. Thus a management system, without knowledge of the new object class can manage that object as if it were its superclass (with multiple inheritance an object may have more than one superclass which it is able to imitate).

NOTE: As the 1991 version of CMIS does not support allomorphism, it is not considered advisable to use this tool until it is fully supported by CMIS (1994 at the earliest). However, care should be taken designing object classes if it is expected that allomorphism will be required at a future date.

7.3 Managed object relationship descriptions (CCITT Recommendation X.720, § 6)

7.3.1 Naming - General aspects (CCITT Recommendation X.720, § 6.2)

Managed object instances are named (unambiguously identified) through the use of a chosen set of containment relationships. These containment relationships form a hierarchy but must also satisfy two other properties:

- each managed object is contained in only one other managed object, however a managed object may contain many other objects;

- a managed object can only exist if its containing (superior) managed object exists.

Any set of containment relationships satisfying these properties may be used for naming.

NOTE 1: The containment relationships used for naming do not reflect physical containment.

NOTE 2: The inheritance hierarchy is completely independent of the naming tree.

The name of a managed object instance is based on the naming tree and is a combination of the name of the superior plus information uniquely identifying the managed object within the scope of its superior managed object.

7.3.2 Naming - ETSI specific aspects

Objects reflecting the Network Element Viewpoint (that information required to manage a network element) shall be named through the ETSI Managed Element Object class, or a subclass of the Managed Element Object class.

Objects reflecting the Network Level Viewpoint (that information required to manage the physical and logical network) shall be named through the Network Object class, or subclass of the Network Object class.

NOTE: Specific naming constraints and the relationships these represent should be described as part of behaviour. The use of subclasses with different naming constraints is an inefficient mechanism to replace that which can easily be achieved as part of behaviour.

7.3.3 Modelling managed properties of a resource

It is preferable to define each managed property of a resource (represented by an object) as an attribute, and operate on this attribute with the defined operations (i.e. GET, REPLACE, ADD, REMOVE, SET TO DEFAULT). Hence, correlation of management operations on these properties could be represented in a similar way (e.g. by a state table) and the behaviour description simplified.

The use of actions (operations acting on a resource) without representing each property as an attribute is not recommended as there is no formal way of describing the effect of the action on the object to provide a conformance statement.

7.4 Capturing behavioural requirements and describing behaviour (CCITT Recommendation X.720, § 5.1.4)

In a package, the behaviour part contains information on how its attributes attain particular values, what they mean, how changes in attribute values are related to changes in other attribute values in the same object class, how changes in attribute values are related to changes in other attribute values in other classes, and what circumstances cause notifications to be generated.

In name binding, the behaviour contains constraints on naming between superior to sub-ordinate object classes.

In notifications, the behaviour indicates when the notifications should be emitted and the list of parameters it may contain.

In an action the behaviour part identifies the effect of the action on the object.

NOTE: Behaviour is currently expressed in English prose. The behaviour part can be the only difference between two managed object classes. There is a need for a more formal method of recording behaviour.

7.5 Use of packages

Packages consisting of a combination of behaviour definitions, attributes, attribute groups, operations, notifications and parameters may be defined for subsequent insertion into a managed object under the characterised by, or conditional package constructs.

a) Mandatory Packages.

Each object shall contain at least one, and normally only one, mandatory (characterised by) package. The use of multiple packages as an alternative to multiple inheritance is not recommended.

b) Conditional Packages (CCITT Recommendation X.720 [3], § 5.1.5).

Use conditional packages only for object classes which will be created locally (not by the manager), or when it is possible for the manager to determine in advance (before creation) whether the managed system supports the conditional packages.

The use of conditional packages is discouraged as it increases the complexity of implemented systems. Optionality should, wherever possible, be achieved by subclassing objects.

7.6 Representation of object models, diagrams (entity relationship, etc.)

Entity Relationship (ER) diagrams shall be used to illustrate the relationships between object classes and instances. Separate ER diagrams are required for naming hierarchy, inheritance hierarchy and for relationships (containment, associated with, points to, etc.). These ER diagrams may be fragmented to aid understanding (e.g. Network Fragment). If practicable, and considered useful by the working group, an overall diagram (or series of fragments) showing all relationships, may be provided.

7.7 Areas for further study

- strategy for naming within and between TMNs;
- mechanisms for exchanging shared management knowledge;
- relationship management;
- registration of managed objects.

History

Document history	
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