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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 15816 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 27, *IT Security techniques*, in collaboration with ITU-T. The identical text is published as ITU-T Rec. X.841.

Annex A forms a normative part of of this International Standard. Annex B is for information only.

Introduction

This Recommendation | International Standard on Security Information Objects (SIOs) for Access Control provides object definitions that are commonly needed in more than one security standard such that multiple and different definitions of the same functionality may be avoided. Precision in these definitions is achieved by use of the Abstract Syntax Notation One (ASN.1) defined in ITU-T Rec. X.680 (1997) | ISO/IEC 8824-1:1998, and ITU-T Rec. X.681 (1997) | ISO/IEC 8824-2:1998.

The aim of security management is to ensure that assets, including information, are protected appropriately and cost effectively. In order to protect proprietary interests and Intellectual Property Rights, organizations need to control the handling of their information. Severe damage or embarrassment can be caused to either the originator or holder of sensitive information, for example, if it is released to those not authorized to receive it (a breach of confidentiality), or if it is modified in any way (a breach of integrity). Each organization needs to ensure that it protects its own information and assets adequately in all forms during its storage, processing and transmission between and within organizations over both private and public networks. Organizations must be satisfied that their assets will be protected properly when they are held or processed by others if business is to be conducted more widely.

The motivation for development of SIOs for Access Control is the achievement of the flexibility and interoperability in security management that accrues from the use of common structures for similar functions. Standardization of security labels and alternative methods for access control have been pursued in this Recommendation | International Standard.

INTERNATIONAL STANDARD

ITU-T RECOMMENDATION

INFORMATION TECHNOLOGY – SECURITY TECHNIQUES – SECURITY INFORMATION OBJECTS FOR ACCESS CONTROL

1 Scope

The scope of this Recommendation | International Standard is:

a) the definition of guidelines for specifying the abstract syntax of generic and specific Security Information Objects (SIOs) for Access Control;

b) the specification of generic SIOs for Access Control;

c) the specification of specific SIOs for Access Control.

The scope of this Recommendation | International Standard covers only the "statics" of SIOs through syntactic definitions in terms of ASN.1 descriptions and additional semantic explanations. It does not cover the "dynamics" of SIOs, for example rules relating to their creation and deletion. The dynamics of SIOs are a local implementation issue.

2 Normative references

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

2.1 Identical Recommendations | International Standards

- ITU-T Recommendation X.411 (1999) | ISO/IEC 10021-4, *Information technology – Message Handling Systems (MHS): Message transfer system: Abstract service definition and procedures.*
- ITU-T Recommendation X.500 (2001) | ISO/IEC 9594-1:2001, *Information technology – Open Systems Interconnection – The Directory: Overview of concepts, models and services.*
- ITU-T Recommendation X.501 (2001) | ISO/IEC 9594-2:2001, *Information technology – Open Systems Interconnection – The Directory: Models.*
- ITU-T Recommendation X.509 (2000) | ISO/IEC 9594-8:2001, *Information technology – Open Systems Interconnection – The Directory: Public-key and attribute certificate frameworks.*
- ITU-T Recommendation X.680 (1997) | ISO/IEC 8824-1:1998, *Information technology – Abstract syntax notation one (ASN.1): Specification of basic notation.*
- ITU-T Recommendation X.681 (1997) | ISO/IEC 8824-2:1998, *Information technology – Abstract syntax notation one (ASN.1): Information object specification.*
- ITU-T Recommendation X.682 (1997) | ISO/IEC 8824-3:1998, *Information technology – Abstract syntax notation one (ASN.1): Constraint specification.*
- ITU-T Recommendation X.683 (1997) | ISO/IEC 8824-4:1998, *Information technology – Abstract syntax notation one (ASN.1): Parameterization of ASN.1 specifications.*
- ITU-T Recommendation X.690 (1997) | ISO/IEC 8825-1:1998, *Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER).*

- CCITT Recommendation X.722 (1992) | ISO/IEC 10165-4:1992, *Information technology – Open Systems Interconnection – Structure of management information: Guidelines for the definition of managed objects.*
- ITU-T Recommendation X.741 (1995) | ISO/IEC 10164-9:1995, *Information technology – Open Systems Interconnection – Systems Management: Objects and attributes for access control.*
- ITU-T Recommendation X.803 (1994) | ISO/IEC 10745:1995, *Information technology – Open Systems Interconnection – Upper layers security model.*
- ITU-T Recommendation X.810 (1995) | ISO/IEC 10181-1:1996, *Information technology – Open Systems Interconnection – Security frameworks for open systems: Overview.*
- ITU-T Recommendation X.830 (1995) | ISO/IEC 11586-1:1996, *Information technology – Open Systems Interconnection – Generic upper layers security: Overview, models and notation.*

2.2 Paired Recommendations | International Standards equivalent in technical content

- CCITT Recommendation X.800 (1991), *Security architecture for Open Systems Interconnection for CCITT applications.*

  ISO 7498-2:1989, *Information processing systems – Open Systems Interconnection – Basic Reference Model – Part 2: Security Architecture.*

3 Definitions

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

3.1 **Compartmentalization**: As defined in ISO/IEC 2382-8.

3.2 **Generic SIO Class**: An SIO Class in which the data types for one or more of the components are not fully specified.

3.3 **Information Object**: As defined in ITU-T Rec. X.681 | ISO/IEC 8824-2.

3.4 **Information Object Class**: As defined in ITU-T Rec. X.681 | ISO/IEC 8824-2.

3.5 **Object Identifier (OID)**: As defined in ITU-T Rec. X.680 | ISO/IEC 8824-1.

3.6 **Seal**: As defined in ITU-T Rec. X.810 | ISO/IEC 10181-1.

3.7 **Security Authority**: The entity accountable for the administration of a security policy within a security domain.

3.8 **Security Domain**: A collection of users and systems subject to a common security policy.

3.9 **Security Information Object**: An instance of an SIO Class.

3.10 **Security Information Object Class**: An Information Object Class that has been tailored for security use.

3.11 **Security Label**: As defined in CCITT Rec. X.800 and ISO/IEC 7498-2.

3.12 **Security Policy**: As defined in ISO/IEC 2382-8.

3.13 **Security Policy Information File**: A construct that conveys domain-specific security policy information.

3.14 **Specific SIO Class**: An SIO Class in which the data types for all components are fully specified.

4 Abbreviations

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

ASN.1	Abstract Syntax Notation One
EE	End Entity
IT	Information Technology

OID	Object Identifier
RBAC	Rule Based Access Control
SIO	Security Information Object
SPIF	Security Policy Information File

5 Conventions

5.1 Security Information Object Class Description

An SIO Class comprises:

- a value for a SIO Class identifier;
- a set of one or more data type specifications, one for each component the SIO Class contains; and
- a statement of the semantics associated with use of the SIO Class.

5.2 Generic Security Information Object Class Correspondence

A Generic SIO Class is an SIO Class in which the data types for one or more of the components are not fully specified. A Specific SIO Class is an SIO Class in which the data types for all components are fully specified. A generic SIO Class corresponds to a family of specific SIO Classes.

5.3 Security Information Object Composition

The specification of each SIO in this Recommendation | International Standard contains the following parts:

- a description of the SIO;
- an explanation of the usage of the SIO;
- a description of the components of the SIO.

The description of the components of the SIO includes the ASN.1 specification and the object identifier of the object class being defined.

6 Specification of Security Information Objects

When a new requirement is identified for an SIO, the following steps shall be followed to encourage reuse of existing specifications and to reduce the proliferation of different specifications meeting the same requirements:

- If this Recommendation | International Standard defines an SIO that meets the new requirement, the definition in this Recommendation | International Standard shall be used.
- Components of SIOs defined in this Recommendation | International Standard should be used in the definition of the new SIO if they satisfy part of the new requirement.

Specifications of the SIOs that have been developed to support access control are included in the following subclauses. A complete ASN.1 definition for the Security Information Objects discussed in these subclauses is included as a module in Annex A. This module is identified as follows:

```
id-SIOsAccessControl-MODULE OBJECT IDENTIFIER ::= {
        joint-iso-itu-t sios(24) specification(0) modules(0) accessControl(0)}
```

6.1 Confidentiality Label

6.1.1 Introduction

Organizations typically have one or more security policies that provide for the compartmentalization of data into groupings that are to be protected and handled in the same way. The security policy defines the protection to be applied to each compartment.

The aspects of security expressed by a security policy, indicated in a security label, include the following:

- the level of protection to be given to data stored on a system;
- who is authorized to access data, processes or resources;
- security markings required to be shown on any display or print of the material;
- routing and enciphering requirements for data transmitted between systems;
- requirements for protection against unauthorized copying;
- methods for storage of data;
- enciphering algorithms to be used;
- methods of authenticating entities;
- whether operations on the object are to be audited;
- whether preventing repudiation of receipt of an object by recipients is required;
- whether, and whose, digital signatures are required to authenticate the data.

When data is held on an Information Technology (IT) system, or when it is transmitted electronically between systems, the data are labelled to indicate the security compartment to which the data belongs and thus how the data is to be handled for security. The label may be separately identifiable from the protected information but is logically bound to it. The integrity of the labels, and the integrity of their binding to the information, must be assured. This allows IT systems and networks to make security-relevant decisions, such as access control and routing, without the need to access the information that is being protected. The security label may be associated with each data object in an IT system, such as documents, electronic mail messages, display windows, database entries, directory entries and electronic forms. The labels are intended for use when objects are stored, moved around (particularly between systems), and when they are being handled by applications that act on labels, including applications that create new objects from existing ones.

When labelled data is to be passed between different security domains, the domains should agree on a security policy to be applied to that data. If the labels specified by the policy applied within a domain differ from the labels specified by the policy for shared data, then the policy for the shared data shall specify how to translate between the two sets of labels.

Labels alone are not sufficient to ensure the security of information. The security policy that applies to the information needs to be enforced by each organization while the labelled information is within the scope of their control. All the organizations, individuals and IT systems that process an item of information are presumed to know the security policy for that information. Organizations that exchange information need to establish trust in one another to be satisfied that information will be handled according to agreed security policies. This trust is usually established through a formal agreement.

6.1.2 ASN.1 Specification of the Label

The confidentiality label is identified as follows:

```
id-ConfidentialityLabel OBJECT IDENTIFIER  ::= {
        joint-iso-itu-t sios(24) specification(0) securityLabels(1) confidentiality(0)}

ConfidentialityLabel  ::=  SET {
          security-policy-identifier        SecurityPolicyIdentifier OPTIONAL,
          security-classification           INTEGER(0..MAX) OPTIONAL,
          privacy-mark                      PrivacyMark OPTIONAL,
          security-categories               SecurityCategories OPTIONAL }
(ALL EXCEPT({-- none; at least one component shall be present --}))

SecurityPolicyIdentifier  ::=  OBJECT IDENTIFIER

PrivacyMark  ::=  CHOICE {
  pString                   PrintableString (SIZE(1..ub-privacy-mark-length)),
  utf8String                UTF8String (SIZE(1..ub-privacy-mark-length))
}

ub-privacy-mark-length INTEGER  ::=  128  -- as defined in ITU-T Rec. X.411 | ISO/IEC 10021-4

SecurityCategories  ::=  SET SIZE (1..MAX) OF SecurityCategory

SecurityCategory  ::=  SEQUENCE {
     type [0]   SECURITY-CATEGORY.&id ({SecurityCategoriesTable}),
     value      [1]   SECURITY-CATEGORY.&Type ({SecurityCategoriesTable} {@type})
}
```

SECURITY-CATEGORY ::= TYPE-IDENTIFIER

SecurityCategoriesTable SECURITY-CATEGORY ::= {...}

An example of the expansion of the TYPE-IDENTIFIER information object class is provided in Annex B.

6.1.3 Binding Methods for Confidentiality Labels

6.1.3.1 Binding Method 1

A copy of the data (D) and a copy of the security label (L) are stored together, as a data record, inside the secure boundary of the system. It is assumed that the system is capable of protecting the integrity of the security label and the integrity, as well as possibly the secrecy, of the data. The protection provided by the system must be such that an unauthorized user or application is not capable of altering the data or its associated security label. With this binding method, no cryptographic function is needed to bind the data and the security label.

6.1.3.2 Binding Method 2

A non-secret digital signature (S) is calculated on D and L using a digital signature algorithm (SigAlg) and the private key (X) of a public key algorithm. That is,

S = SigAlg(X,f(D),L)

The digital signature is stored together with D and L in a data record. The generated digital signature binds L to D. In this definition, f is a public function such that f(D) does not reveal information about D.

With this binding method, L and S need not be stored inside the secure boundary of the system. If a cryptographic service is invoked with an incorrect value of L, D or S, the inconsistency is detected. This is accomplished using the public key of the public key algorithm as a verification key to verify the signature.

6.1.3.3 Binding Method 3

A non-secret message authentication code (MAC) is calculated on D and L using a MAC-generation mode of an encipherment algorithm (MacAlg) and a secret MAC algorithm key (K-MAC). That is,

MAC = MacAlg(K-MAC,f(D),L)

The MAC is stored together with D and L in a data record. The generated MAC binds L to D. In this definition, f is a public function such that f(D) does not reveal information about D.

With this binding method, L and MAC need not be stored inside the secure boundary of the system. If a cryptographic service is invoked with an incorrect value of L, D or MAC, the inconsistency is detected. This is accomplished by calculating a MAC-of-reference using the provided values of L and D and a copy of K-MAC, and comparing the result against the provided MAC.

6.2 Security Policy Information File

6.2.1 Introduction

A security policy in its simplest form is a set of criteria for the provision of security services. With regard to access control, security policy is a subset of a higher system-level security policy that defines the means for enforcing access control policies between initiators and targets. The access control mechanisms must:

- allow communication where a specific policy permits; and
- deny communication where a specific policy does not explicitly permit.

A security policy is the basis for the decisions made by the access control mechanisms. Domain-specific security policy information is conveyed via the Security Policy Information File.

The Security Policy Information File contains a sequence of the following:

- **versionInformation** – indicates the version of the ASN.1 syntax and associated semantics of the Security Policy Information File specification.
- **updateInformation** – indicates the currency of the security policy information file data.
- **securityPolicyIdData** – identifies the security policy to which the Security Policy Information File applies.
- **privilegeId** – indicates the OID that identifies the syntax included in the clearance attribute security category of relying certificates used in conjunction with the Security Policy Information File. The syntax indicated by **privilegeId** must be consistent with that indicated by **rbacId**.