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Health informatics — Privilege management and access control —

Part 2: Formal models

Informatique de santé — Gestion de privilèges et contrôle d'accès —

Partie 2: Modèles formels

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 215, *Health informatics*.

This first edition of ISO 22600-2 cancels and replaces ISO/TS 22600-2:2006, which has been technically revised.

ISO 22600 consists of the following parts, under the general title *Health informatics — Privilege management and access control*:

— *Part 1: Overview and policy management*

— *Part 2: Formal models*

— *Part 3: Implementations*

Introduction

The distributed architecture of shared care information systems supporting service-oriented architecture (SOA) is increasingly based on corporate networks and virtual private networks. For meeting the interoperability challenge, the use of standardized user interfaces, tools, and protocols, which ensures platform independence, but also the number of really open information systems, is rapidly growing during the last couple of years.

As a common situation today, hospitals are supported by several vendors providing different applications, which are not able to communicate authentication and authorization since each has its own way of handling these functions. For achieving an integrated scenario, it takes a remarkable amount of money, time, and efforts to get users and changing organizational environments dynamically mapped before starting communication and cooperation. Resources required for the development and maintenance of security functions grow exponentially with the number of applications, with the complexity of organizations towards a regional, national, or even international level, and with the flexibility of users playing multiple roles, sometimes even simultaneously.

The situation becomes even more challenging when inter-organizational communications happens, thereby crossing security policy domain boundaries. Moving from one healthcare centre to another or from country to country, different rules for privileges and their management can apply to similar types of users, both for execution of particular functions and for access to information. The policy differences between these domains have to be bridged automatically or through policy agreements, defining sets of rules followed by the parties involved, for achieving interoperability.

Another challenge to be met is how to improve the quality of care by using IT without infringing the privacy of the patient. To provide physicians with adequate information about the patient, a virtual electronic health care record is required which makes it possible to keep track of all the activities belonging to one patient regardless of where and by whom they have been performed and documented. In such an environment, a generic model or specific agreement between the parties for managing privileges and access control including the patient or its representative is needed.

Besides a diversity of roles and responsibilities, typical for any type of large organization, also ethical and legal aspects in the healthcare scenario due to the sensitivity of person-related health information managed and its personal and social impact have to be considered.

Advanced solutions for privilege management and access control are required today already, but this challenge will even grow over the next couple of years. The reason is the increase of information exchanged between systems in order to fulfil the demands of health service providers at different care levels for having access to more and more patient-related information to ensure the quality and efficiency of patient's diagnosis and treatment, however combined with increased security and privacy risks.

The implementation of this International Standard might be currently too advanced and therefore not feasible in certain organizational and technical settings. For meeting the basic principle of best possible action, it is therefore very important that at least a policy agreement is written between the parties stating to progress towards this International Standard when any update/upgrade of the systems is intended. The level of formalization and granularity of policies and the objects these policies are bound to defines the solution maturity on a pathway towards the presented specification.

The policy agreement also has to contain defined differences in the security systems and agreed solutions on how to overcome the differences. For example, the authentication service and privileges of a requesting party at the responding site have to be managed according to the policy declared in the agreement. For that reason, information and service requester, as well as information and service provider on the one hand, and information and services requested and provided on the other hand, have to be grouped and classified in a limited number of concepts for enabling the specification of a limited number of solution categories. Based on that classification, claimant mechanisms, target sensitivity mechanisms, and policy specification and management mechanisms can be implemented. Once all parties have signed the policy agreement, the communication and information exchange can start with the existing systems if the parties can accept the risks. If there are unacceptable risks which have to be eliminated before the information exchange starts, they shall also be recorded in the policy agreement

together with an action plan stating how these risks shall be removed. The policy agreement also has to contain a time plan for this work and an agreement on how it shall be financed.

The documentation of the negotiation process is very important and provides the platform for the policy agreement.

Privilege management and access control address security and privacy services required for communication and cooperation, i.e. distributed use of health information. It also implies safety aspects, professional standards, and legal and ethical issues. This International Standard introduces principles and specifies services needed for managing privileges and access control. Cryptographic protocols are out of the scope of this International Standard.

This three-part International Standard references existing architectural and security standards as well as specifications in the healthcare area such as ISO, CEN, ASTM, OMG, W3C, etc., and endorses existing appropriate standards or identifies enhancements or modifications or the need for new standards. It comprises of:

— ISO 22600-1: describes the scenarios and the critical parameters in information exchange across policy domains. It also gives examples of necessary documentation methods as the basis for the policy agreement.

— ISO 22600-2: describes and explains, in a more detailed manner, the architectures and underlying models for privilege management and access control which are necessary for secure information sharing including the formal representation of policies.

— ISO 22600-3: describes examples of implementable specifications of application security services and infrastructural services using different specification languages.

It accommodates policy bridging. It is based on a conceptual model where local authorization servers and cross border directory and policy repository services can assist access control in various applications (software components). The policy repository provides information on rules for access to various application functions based on roles and other attributes. The directory service enables identification of the individual user. The granted access will be based on four aspects:

— the authenticated identification of principals (i.e. human users and objects that need to operate under their own rights) involved;

— the rules for access to a specific information object including purpose of use;

— the rules regarding authorization attributes linked to the principal provided by the authorization manager;

— the functions of the specific application

This International Standard supports collaboration between several authorization managers that can operate over organizational and policy borders.

This International Standard is strongly related to other ISO/TC 215 work such as ISO 17090 (all parts), ISO 22857, ISO 21091, and ISO 21298.

This International Standard is meant to be read in conjunction with its complete set of associated standards.

Health informatics — Privilege management and access control —

Part 2: Formal models

1 Scope

This multi-part International Standard defines principles and specifies services needed for managing privileges and access control to data and/or functions.

It focuses on communication and use of health information distributed across policy domain boundaries. This includes healthcare information sharing across unaffiliated providers of healthcare, healthcare organizations, health insurance companies, their patients, staff members, and trading partners by both individuals and application systems ranging from a local situation to a regional or even national situation.

It specifies the necessary component-based concepts and is intended to support their technical implementation. It will not specify the use of these concepts in particular clinical process pathways.

This part of ISO 22600 introduces the underlying paradigm of formal high-level models for architectural components. It is based on ISO/IEC 10746 (all parts) and introduces the domain model, the document model, the policy model, the role model, the authorization model, the delegation model, the control model, and the access control model.

The specifications are provided using the meta-languages Unified Modelling Language (UML) and Extensible Markup Language (XML). Additional diagrams are used for explaining the principles. The attributes used have been referenced to the HL7 reference information model (see ISO 21731:2006) and the HL7 data type definitions.

The role model has been roughly introduced referring to ISO 21298.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 21298:—[1)], *Health informatics — Functional and structural roles*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
access control
means of ensuring that the resources of a data processing system can be accessed only by authorized entities in authorized ways

[SOURCE: ISO/IEC 2382-8:1998]

1) To be published.

3.2
accountability
property that ensures that the actions of an entity can be traced uniquely to the entity

[SOURCE: ISO 7498-2:1989]

3.3
attribute authority
AA
authority which assigns privileges by issuing attribute certificates

[SOURCE: ISO/IEC 9594-8:2008]

3.4
attribute certificate
data structure, digitally signed by an attribute authority, that binds some attribute values with identification about its holder

[SOURCE: ISO/IEC 9594-8:2008]

3.5
authentication
provision of assurance of the claimed identity of an entity by securely associating an identifier and its authenticator

Note 1 to entry: See also data origin authentication and peer entity authentication.

[SOURCE: ISO/IEC 15944-5:2008, 3.5]

3.6
authority
entity, which is responsible for the issuance of certificates

Note 1 to entry: Two types are distinguished in this part of ISO 22600: certification authority which issues public key certificates and attribute authority which issues attribute certificates.

3.7
authorization
granting of privileges, which includes the granting of privileges to access data and functions

[SOURCE: ISO 7498-2:1989, modified]

3.8
availability
property of being accessible and useable upon demand by an authorized entity

[SOURCE: ISO 7498-2:1989]

3.9
certificate validation
process of ensuring that a certificate was valid at a given time, including possibly the construction and processing of a certification path, and ensuring that all certificates in that path were valid (i.e. were not expired or revoked) at that given time

3.10
certification authority
CA
certificate issuer; an authority trusted by one or more relying parties to create, assign, and manage certificates

Note 1 to entry: Optionally, the certification authority can create the relying parties' keys. The CA issues certificates by signing certificate data with its private signing key.

Note 2 to entry: Authority in the CA term does not imply any government authorization, only that it is trusted. Certificate issuer can be a better term but CA is used very broadly.

[SOURCE: ISO/IEC 9594-8:2008]

3.11
certification path
ordered sequence of certificates of objects in the DIT which, together with the public key of the initial object in the path, can be processed to obtain that of the final object in the path

3.12
confidentiality
property that information is not made available or disclosed to unauthorized individuals, entities, or processes

[SOURCE: ISO 7498-2:1989]

3.13
credential
prerequisite issued evidence for the entitlement of, or the eligibility for, a role

3.14
delegation
conveyance of privilege from one entity that holds such privilege to another entity

3.15
delegation path
ordered sequence of certificates which, together with authentication of a privilege asserter's identity, can be processed to verify the authenticity of a privilege asserter's privilege

3.16
environmental variables
aspects of policy required for an authorization decision that are not contained within static structures, but are available through some local means to a privilege verifier (e.g. time of day or current account balance)

3.17
identification
performance of tests to enable a data processing system to recognize entities

[SOURCE: ISO/IEC 2382-8:1998]

3.18
identifier
piece of information used to claim an identity, before a potential corroboration by a corresponding authenticator

[SOURCE: ENV 13608-1:2000]

3.19
integrity
property that information is not altered in any way, deliberately or accidentally

3.20
key
sequence of symbols that controls the operations of encipherment and decipherment

[SOURCE: ISO 7498-2:1989]

3.21
non-repudiation
service providing proof of the integrity and origin of data (both in an unforgeable relationship) which can be verified by any party

[SOURCE: ISO 17090-1:2013]

3.22
policy
set of legal, political, organizational, functional, and technical obligations for communication and cooperation

3.23
policy agreement
written agreement where all involved parties commit themselves to a specified set of policies

3.24
principal
human users and objects that need to operate under their own rights

[SOURCE: OMG Security Services Specification: 2001]

3.25
private key
key that is used with an asymmetric cryptographic algorithm and whose possession is restricted (usually to only one entity)

[SOURCE: ISO/IEC 10181-1:1996]

3.26
privilege
capacity assigned to an entity by an authority according to the entity's attribute

3.27
privilege asserter
privilege holder using their attribute certificate or public key certificate to assert privilege

3.28
privilege management infrastructure
PMI
infrastructure able to support the management of privileges in support of a comprehensive authorization service and in relationship with a public key infrastructure

3.29
privilege policy
policy that outlines conditions for privilege verifiers to provide/perform sensitive services to/for qualified privilege asserters

Note 1 to entry: Privilege policy relates attributes associated with the service as well as attributes associated with privilege asserters.

3.30
privilege verifier
entity verifying certificates against a privilege policy

3.31
public key
key that is used with an asymmetric cryptographic algorithm and that can be made publicly available

[SOURCE: ISO/IEC 10181-1:1996]

3.32
public key certificate
PKC
certificate that binds an identity and a public key

[SOURCE: ISO/IEC 9594-8:2008]

Note 1 to entry: The identity can be used to support identity-based access control decisions after the client proves that it has access to the private key that corresponds to the public key contained in the PKC (see RFC 2459).

3.33
role
set of competences and/or performances that are associated with a task

3.34
role assignment certificate
certificate that contains the role attribute, assigning one or more roles to the certificate holder

3.35
role certificate
certificate that assigns privileges to a role rather than directly to individuals

Note 1 to entry: Individuals assigned to that role, through an attribute certificate or public key certificate with a subject directory attributes extension containing that assignment, are indirectly assigned the privileges contained in the role certificate.

3.36
role specification certificate
certificate that contains the assignment of privileges to a role

3.37
sensitivity
characteristic of a resource that implies its value or importance

3.38
security
combination of availability, confidentiality, integrity, and accountability

[SOURCE: ENV 13608-1:2000]

3.39
security policy
plan or course of action adopted for providing computer security

[SOURCE: ISO/IEC 2382-8:1998]

Note 1 to entry: The set of rules laid down by the security authority governing the use and provision of security services and facilities constitutes its security policy.

3.40
security service
service, provided by a layer of communicating open systems, which ensures adequate security of the systems or of data transfers

[SOURCE: ISO 7498-2:1989]

3.41
source of authority
SOA
attribute authority that a privilege verifier for a particular resource trusts as the ultimate authority to assign a set of privileges

3.42
target
resource being accessed by a claimant

Note 1 to entry: Its sensitivity is modelled in this part of ISO 22600 as a collection of attributes, represented as either ASN.1 attributes or XML elements.

3.43
trust
circumstance existing between two entities whereby one entity makes the assumption that the other entity will behave exactly as the first entity expects

Note 1 to entry: This trust applies only for some specific function. The key role of trust in this framework is to describe the relationship between an authenticating entity and an authority; an entity must be certain that it can trust the authority to create only valid and reliable certificates.

4 Abbreviated terms

AA	Attribute Authority
PKC	Public Key Certificate
UML	Unified Modelling Language
XML	Extensible Markup Language

5 Component paradigm

The framework for a future-proof health information system architecture is based on the generic component model developed in the mid-nineties (e.g. References [1], [2], and [3]). Bases of that architecture are a reference information model (RIM) and agreed vocabularies enabling interoperability. Referenced to them, domain-specific constraint models will be specified which represent domain-specific knowledge concepts, considering both structural and functional knowledge. The corresponding components have to be established according to all views of the ISO/IEC 10746-1 reference model of open distributed processing (RM-ODP), i.e. enterprise view, information view, computational view, engineering view, and technology view. A view focuses consideration on one aspect abstracting from all others. The different domain concepts and their view representation is not the task of programmers but of domain experts. For that reason, they will use appropriate expression means such as specific graphical representation (e.g. UML diagrams) or structured text expressed in XML.

The components can be aggregated to a higher level of composition. Contrary to the ISO definition of primitives and composition, in the generic component model at least four levels of composition/decomposition have been defined (Figure 1).

