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Identification cards — Integrated circuit cards — Privacy-enhancing protocols and services

Cartes d'identification — Cartes à circuit intégré — Protocoles et services renforçant la protection des données personnelles

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Contents

Page

Foreword

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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 document 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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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by ISO/IEC JTC 1, *Information technology*, SC 17, *Cards and security devices for personal identification*.

Introduction

National and pan-national (e.g. European) privacy regulations require the protection of personal data as well as implicitly linked parameters revealing the identity of the cardholder [see relevant documents in different countries (e.g. EU GDPR, US PIA, Canada PIA or Australian PIA)(see 5.1)].

Privacy-enhancing implementations allow a cardholder to be confident that their sensitive personally identifiable information (PII) is not exposed to an unauthorized environment. Thereby a cardholder may be exposed to an environment that might read sensitive PII from the Integrated Circuit Card (ICC) ahead of any external authentication. Such sensitive PII can be unique parameters of a card (e.g. the Card ID) or personalized parameters of the cardholder and could be linked to the cardholder.

For instance, if the nationality of a cardholder can be identified by the nature of the ICC description parameters (e.g. algorithm ID, if unique for particular country) then a cardholder of a certain nationality could be exposed to observation. An employee identification card, a health insurance card, a passport are typical examples which may require privacy protection.

ICC services ensuring privacy could, for instance, find further applications in the context of user privacy issues in eVoting systems with ICCs and in systems using the environment of Internet of Things as well as access services by means of an ICC.

This document reflects these requirements by harmonized operations and/or services in regard to a corresponding level of privacy. It envisions

— to strengthen common technical measures about privacy-enabling interchange at card edge and to facilitate its adoption,

— to harmonize privacy properties or privacy framework definitions when existing, and

— to address generic technical features related to privacy implementation at card edge (interchange) regardless of the cryptographic mechanisms by considering transactional aspects as asynchronous protocols involving several entities in privacy context.

Identification cards — Integrated circuit cards — Privacy-enhancing protocols and services

1 Scope

This document aims to normalize privacy-enhancing protocols and services by

— using the mechanisms from parts of ISO/IEC 7816 and parts of ISO/IEC 18328 that contribute to security and privacy,

— providing discoverability means of privacy-enabling attributes,

— defining requirements for attribute-based credential handling, and

— identifying data objects and commands for ICCs.

Existing privacy-enhancing protocols available in a generic context are adopted for distributed systems including ICCs. Additionally, existing authentication protocols between an ICC and an external device used for establishing a secure channel are enhanced with privacy protection. Secure communication between an ICC and an on-card device is also considered.

All the protocols and services described in this document contribute to privacy. Annex B describes an example of privacy impact assessments of respective systems.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 7816-4:2013, *Identification cards — Integrated circuit cards — Part 4: Organization, security and commands for interchange*

ISO/IEC 7816-8, *Identification cards — Integrated circuit cards — Part 8: Commands and mechanisms for security operations*

ISO/IEC 7816-9, *Identification cards — Integrated circuit cards with contacts — Part 9: Interindustry commands for card and file management*

ISO/IEC 7816-11, *Identification cards — Integrated circuit cards with contacts — Part 11: Personal verification through biometric methods*

ISO/IEC 18328-3, *Identification cards — ICC-managed devices — Part 3: Organization, security and commands for interchange*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
access phrase
alpha-numeric string to be captured by interface device to gain access to ICC

EXAMPLE MRZ printed on electronic passports and optically captured by inspection system.

3.2
anonymity
characteristic of information that does not permit a *personally identifiable information principal* (3.22) to be identified directly or indirectly

[SOURCE: ISO/IEC 29100:2011, 2.1]

3.3
attribute
user attribute
quality or characteristic ascribed to someone or something

[SOURCE: NIST SP 800-63-3]

EXAMPLE User name, address, date of birth or assertion about date of birth are user attributes.

Note 1 to entry: Examples of user attributes that can be used to identify natural persons are given in Reference [14].

3.4
attribute integrity
capability of an *attribute* (3.3) to resist to unintended or unauthorized modification

3.5
attribute provider
entity (3.13) that makes *user attributes* (3.3) available

Note 1 to entry: An attribute provider may be an *identity provider* (3.18) or an entity mandated by an identity provider.

3.6
attribute statement
statement or assertion about user attributes comprising predicates over *attributes* (3.3)

EXAMPLE The business case age verification usually does not require information about the user attribute "date of birth" but only the verification if the age is above a specific threshold, i.e. the attribute statement over the "date of birth" saying "is over 21".

3.7
authentication
provision of assurance in the *identity* (3.17) of an *entity* (3.13)

[SOURCE: ISO/IEC 29115:2013, 3.2]

3.8
authentication protocol
defined sequence of messages between an *entity* (3.13) and a verifier that enables the verifier to perform *authentication* (3.7) of an entity

[SOURCE: ISO/IEC 29115:2013, 3.4]

3.9
credential
set of data presented as evidence of a claimed or asserted *identity* (3.17) and/or entitlements

[SOURCE: ISO/IEC 29115:2013, 3.8]

3.10
domain-specific identifier
attribute (3.3) or *attribute statement* (3.6) over an *identifier* (3.16) of an entity, which carries semantics only in specific domains or contexts

Note 1 to entry: In the literature, such domain-specific identifiers may be also referred to as pseudonyms, domain pseudonyms, context-specific identifiers or sector-identifiers and in pseudonymization (see ISO/IEC 29100 for definition of pseudonymization).

Note 2 to entry: In contrast to *anonymity* (3.2), the *user* (3.32) creates and uses an ambiguous parameter, the pseudonym (e.g. a phantasy name), which is not sufficient for user *identification* (3.15) but is useful to partially recognize and address the user for dedicated communication purpose (e.g. chat room, forum).

3.11
eID-Application
on-card application that manages *user attributes* (3.3) for electronic *identification* (3.15) purposes and controls access to the user attributes

3.12
eID-Server
application running on a local or remote server that enables access to *user attributes* (3.3) managed by an *eID-Application* (3.11)

3.13
entity
something that has separate and distinct existence and that can be identified in a context

[SOURCE: ISO/IEC 29115:2013, 3.10]

3.14
generic attributes
user attributes (3.3) that are not linked to the *terminal domain-specific identifier* (3.29) of the requesting terminal stored in a file and identified by a file identifier

3.15
identification
process of distinguishing an *entity* (3.13) within a given context by the unique association of a set of descriptive parameters

EXAMPLE User attributes are descriptive parameters.

3.16
identifier
data which identifies an *entity* (3.13) in a given context towards another entity

3.17
identity
set of *attributes* (3.3) related to an *entity* (3.13)

[SOURCE: ISO/IEC 29115:2013, 3.13]

3.18
identity provider
trusted actor that issues and/or manages *credentials* (3.9)

Note 1 to entry: In literature, such identity provider is often referred to as identity information provider (see ISO/IEC 24760-1) or credential service provider (see ISO/IEC 29115).

3.19
issuer
entity that is an *identity provider* (3.18) or attribute provider

Note 1 to entry: An issuer may also issue the *token* (3.30).

3.20
mutual authentication
authentication of *identities* (3.17) of *entities* (3.13) which provides both entities with assurance of each other's identity

3.21
password
alpha-numeric string kept secret by the user and used for user verification

3.22
personally identifiable information
PII
any information that (a) can be used to identify the *PII principal* (3.23) to whom such information relates, or (b) is or might be directly or indirectly linked to a PII principal

[SOURCE: ISO/IEC 29100:2011, 2.9]

3.23
PII principal
natural person to whom the *personally identifiable information (PII)* (3.22) relates

[SOURCE: ISO/IEC 29100:2011, 2.11]

3.24
privacy impact assessment
PIA

overall process of identifying, analysing, evaluating, consulting, communicating and planning the treatment of potential privacy impacts with regard to the processing of *personally identifiable information* (3.22), framed within an organization's broader risk management framework

Note 1 to entry: This process is also known as a privacy risk assessment.

[SOURCE: ISO/IEC 29134:2017, 3.7]

3.25
secure channel
communication link between the ICC and the external world that provides confidentiality and/or integrity

3.26
sensitive PII
category of *personally identifiable information (PII)* (3.22), either whose nature is sensitive, such as those that relate to the *PII principal's* (3.23) most intimate sphere, or that might have a significant impact on the PII principal

[SOURCE: ISO/IEC 29100:2011, 2.26]

3.27
service provider
entity (3.13) providing one or more services

3.28
specific attributes
user attributes (3.3) that are stored in data containers each linked to a *terminal domain-specific identifier* (3.29)

3.29
terminal domain-specific identifier
identifier of a terminal which carries semantics only in specific domains or contexts

Note 1 to entry: In contrast to domain-specific identifiers generated by the ICC to provide a pseudonym of the user, a terminal domain-specific identifier links a certain terminal identity to a certain domain (sector).

3.30
token
physical device or digital information, holding *credentials* (3.9), *user attributes* (3.3), *attribute statements* (3.6) and/or other information to be used in authentication procedures

3.31
unlinkability
property that *user's* (3.32) transactions are not linked with other transactions of the same user

3.32
user
natural person who receives and subsequently holds the *token* (3.30) and uses it to assert *user attribute* (3.3) information to relying entities

4 Abbreviated terms and notations

ABC	Attribute-Based Credentials
ADF	Application Dedicated File
APDU	Application Protocol Data Unit
AtP	Attribute Provider
CA-ABC	Chip Authentication based on ABC-based signatures
CA-PSA	Chip Authentication based on Pseudonymous Signature Authentication
CAR	Certificate Authority Reference
CAv2	Chip Authentication version 2 as part of EACv2
CHA	Certificate Holder Authorization
CIA	Cryptographic Information Application
CHAT	Certificate Holder Authorization Template
CHR	Certificate Holder Reference
C-RP	Command Response Pair, i.e. pair of command and response APDU
DF	Dedicated File
EACv2	Extended Access Control version 2
	NOTE Extended access control version 1 is defined for EU passports.
EF.ATR	Elementary File for Answer-To-Reset
eID	electronic Identification
eMRTD	electronic Machine Readable Travel Document

ERA	Enhance Role Authentication
GUI	Graphical User Interface
ICC	Integrated Circuit Card
IFD	Interface Device
MRZ	Machine Readable Zone
OID	Object Identifier
PACE	Password Authenticated Connection Establishment
PIA	Privacy Impact Assessment
PII	Personally Identifiable Information
PSC	Pseudonymous Signature for Credentials
SM	Secure Messaging
SP	Service Provider
SW1-SW2	Status Word one and Status Word two

5 General privacy principles

5.1 General

A number of basic principles have evolved [e.g. in ISO/IEC 29100 or Fair Information Practice Principles (FIPPs)[24]] of which this document considers the following general principles as being the most relevant from the ICC technical perspective:

— data minimization;

— user control over user attribute release;

— quality of user attributes.

Those principles have been expressed, among others, in data protection recommendations or legislation for the protection of personal data as well as implicitly linked parameters revealing the identity of the token holder (e.g. the OECD principles[1]) for transborder flows of personal data of 2013, the Data Protection Convention and Directive of the Council of Europe[2),3)] (also known as Convention 108) or the PIA Frameworks of ISO[17], the US[4)], Canada[5)] and Australia[6)].

1) The Recommendation of the OECD Council concerning Guidelines governing the Protection of Privacy and Transborder Flows of Personal Data (July 2013).

2) Council of Europe, Convention for the protection of individuals with regard to automatic processing of personal data, 1981.

3) Regulation 2016/679 of the European parliament and of the council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data.

4) US Department Of Commerce PIA requirement based on Homeland Security Presidential Directive 12 (HSPD-12), Policy for a Common Identification Standard for Federal Employees and Contractors (August 27th, 2004).

5) Directive on Privacy Impact Assessment, The Treasury Board of Canada Secretariat's (TBS), April 1 2010.

6) Office of the Australian Information Commissioner, "Guide to undertaking privacy impact assessments", http://www.oaic.gov.au/privacy/privacy-resources/privacy-guides/guide-to-undertaking-privacy-impact-assessments

This document focuses on security safeguards in the context of ICCs to protect PII against risks such as unauthorized access, use or modification or unintended or inappropriate disclosure.

NOTE ISO/IEC 29100 and FIPPS each list at all 11 and 8 privacy principles, respectively. The application of all these principles in a certain business case requires additional technical, organizational and procedural measures (e.g. at issuer, service provider and identity provider side) that are not addressed by this document.

5.2 Data minimization

Data minimization refers to the property of reducing the amount of PII being transmitted in a given transaction to exactly what is required from the point of view of the underlying business process the data is required for. The data minimization principle can be derived from the purpose specification and the proportionality principles.

The excessive release of user attributes as well as the establishment of non-required linkabilities between transactions is a main problem countering the data minimization principle. For instance, conventional signature schemes, such as RSA, DSA or elliptic curve use certificates, which may allow traceability of transactions if not deployed appropriately.

Realizing data minimization in practice does not only require the use of appropriate technology, but it also requires design of business processes to be data minimizing. Current business processes are defined with only the traditional technologies in mind and thus, have substantial shortcomings in terms of data minimization. Thus, implementing the data minimization principle requires the whole identity system to evolve. This document describes the technology that enables system designers to develop data minimizing solutions.

5.3 User control

User control of the release of user attributes refers to a user's authority over which user attribute is released to which entities. This control over disclosure of attribute information is at the core of European data protection legislation and also of various large R&D projects in the security and privacy domain in Europe[7]. User control is also a key principle in the US-based NSTIC program[8]. Different strengths of user control related to the release of data can be achieved depending on the trust in the reader devices and online versus offline interaction.

The way a solution is realized from a technical perspective determines the degree of user control. A first class of use cases is characterized by the ICC being handed over and used in the device of the attribute recipient, while a second class is characterized by the user using their own device (e.g. computer or phone). As the user should be able to select the user attributes to be released in the transaction, a user's own device may be considered more trusted.

Cryptographic technologies defined in this document can be used to enforce user control for the initial release of user attributes to a service provider. Though, in today's complex value chains of online services, data need to be provided by service providers to third party service providers. Interactions between the service providers and third-party providers are out of scope of this document.

5.4 Data quality

Data quality relates to user attributes being accurate and kept up to date and inaccurate or incomplete attributes are rectified or deleted. The correctness aspect of attributes has relevance in the reduction of cost, increasing efficiencies, and avoiding problems for both processing parties and citizens. Hence, data quality is the combination of organizational and technical measures. The approach adopted is to consider technical mechanisms for updating and improving the quality of data retained. Organizational elements are out of scope of this document.

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7) ABC4Trust Consortium, ABC4Trust Web site, available at: https://abc4trust.eu/ PRIME Consortium, PRIME project web site, 2008, www.prime-project.eu PrimeLife Consortium, Primelife project web site, 2010, www.primelife.eu

8) NSTIC: National Strategy for Trusted Identities in Cyberspace, available at http://www.nist.gov/nstic/.

Any technology that can convey attributes in integrity-protected form can help improve data correctness and thus data quality. Thus, the widespread use of such technology can reduce data management costs of both public and private sector service providers.

6 Privacy architecture

6.1 General

This clause provides an introductory material for the ICC privacy-enhancing protocols and services. Command and data flow between the ICC and "the external world" is defined for each protocol in the following clauses along with its privacy assessment. The "external world" could be one or more of these entities:

a) an IFD;

b) a GUI controlled by either:

   1) the ICC;

   2) the IFD;

   3) the eID-Server;

c) Service providers;

d) eID-Servers;

e) Attribute providers.

The description of multi-party protocols involving an ICC includes information about what participating entity has rights to access particular ICC data and how the user can control this access. Clause 6 lists the participating entities, categorizes the various data and links data with the respective entities. Moreover, several generic privacy requirements are listed in this clause in order to determine to what extent a particular protocol or sequence of protocols contributes to privacy. Figure 1 gives an overview of the document structure focusing on the protocols, mechanisms, data types and participating entities used.

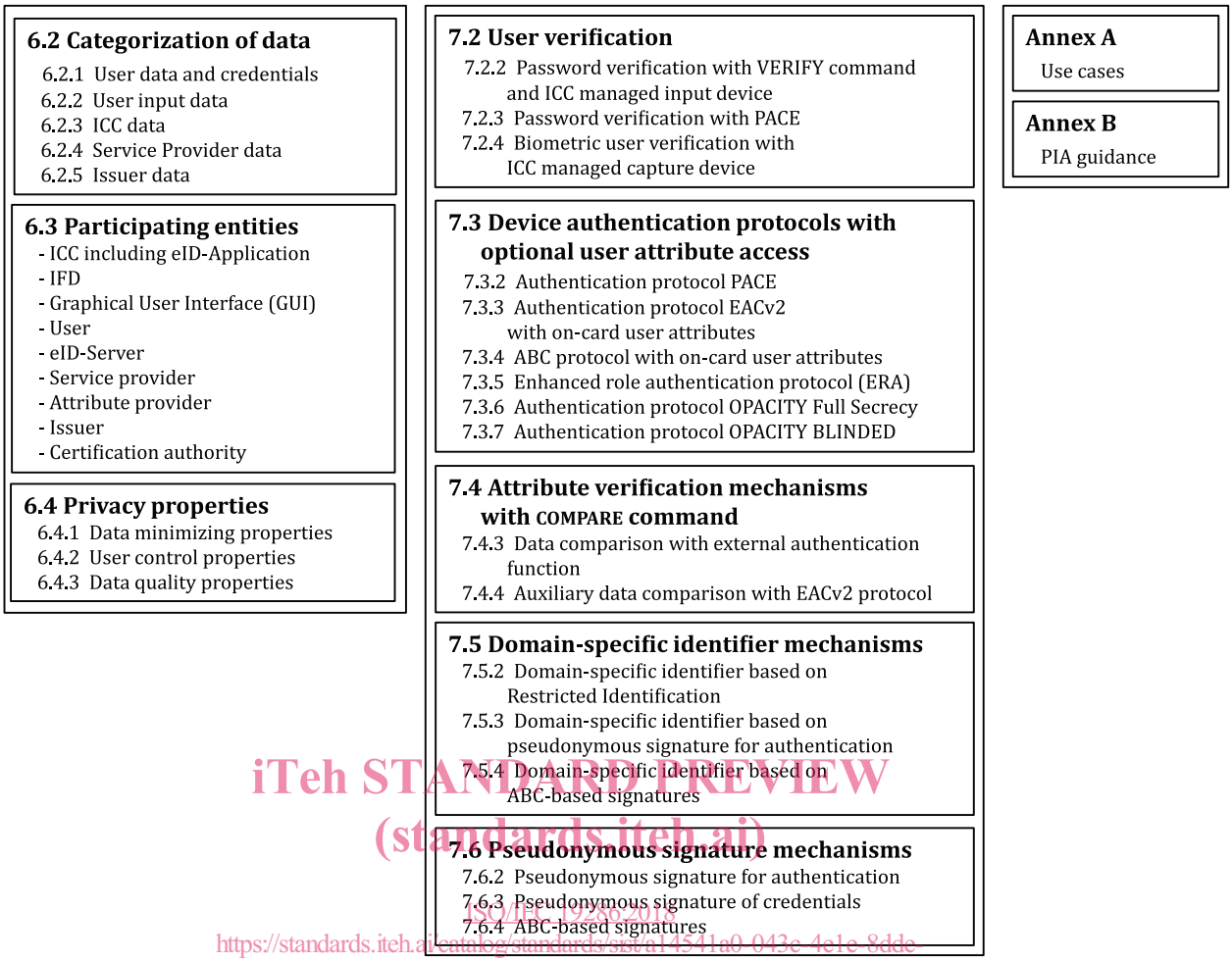

Figure 1 — Overview on the structure of this document without introductory and general clauses

6.2 Categorization of data

6.2.1 User data and credentials

User data (e.g. user attributes or attribute statements or credentials) are PII and refer to any item of personal information identifying the user and delivered under control of an issuing authority. Such data may be stored within an ICC and protected by access rules depending on the issuer's policy. These data may be requested either by an authority eligible to identify the user or by a system granting access to some electronic service (e.g. service provider, identity provider or certification authority).

User attributes

— may be in all or parts of information disclosed to a system upon user consent and upon access condition defined by issuer's policy,

— may be stored in any structure defined in ISO/IEC 7816-4 or in any proprietary structure depending on the application,

— may be replicated on-card of an ICC and stored in a database from where they may be updated onto the ICC,

— may encompass as well the biometric reference data of the user,

— may be permanent or updated over time,