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BSI Standards Publication

Information security — Anonymous digital signatures

Part 3: Mechanisms using multiple public keys

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The UK participation in its preparation was entrusted to Technical Committee IST/33/2, Cryptography and Security Mechanisms.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Foreword

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 27, *Information security, cybersecurity and privacy protection*.

A list of all parts in the ISO/IEC 20008 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

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Introduction

Anonymous digital signature mechanisms are a special type of digital signature mechanism in which, where a digital signature is present, an unauthorized entity cannot discover the signer's identifier yet can verify that a legitimate signer has generated a valid signature.

The ISO/IEC 20008 series specifies anonymous digital signature mechanisms. ISO/IEC 20008-1 specifies principles and requirements for two categories of anonymous digital signatures mechanisms:

1) signature mechanisms using a group public key;

2) signature mechanisms using multiple public keys.

This document specifies a number of anonymous signature mechanisms in the second category.

Anonymous signature mechanisms in the second category allow a signer to form a group spontaneously by combining the public keys of the relevant users with the signer’s own public key. The verifier can confirm that a signature is generated by one of the users within this group but cannot find out who the actual signer is. Unlike the first category described in ISO/IEC 20008 series, mechanisms in the second category do not require a group manager, and the private key and public key are generated individually by each user.

Some mechanisms described in this document are unlinkable, where no one can determine whether two signatures are generated by the same signer or not. Some mechanisms have a linking capability, making it possible to be determined whether two signatures were generated by the same signer under certain conditions. Some mechanisms have a tracing capability, where, given two (message, signature) pairs generated by the same signer within the same ring setting, the true signer can be identified. Some mechanisms have a threshold setting, where the verifier can confirm a signature is generated by subsets (of specified size) of group users, but cannot determine which users were involved.

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Information security — Anonymous digital signatures —

Part 3: Mechanisms using multiple public keys

1 Scope

This document specifies anonymous digital signature mechanisms in which a verifier uses multiple public keys to verify a digital signature.

This document provides:

— a general description of an anonymous digital signature mechanism using multiple public keys;

— a variety of mechanisms that provide such anonymous digital signatures.

For each mechanism, this document specifies the process for:

— generating the private key and public key of each user;

— producing signatures;

— verifying signatures;

— linking signatures (if the mechanism supports linking);

— tracing signatures (if the mechanism supports tracing);

— producing signatures with threshold capability (if the mechanism supports a threshold capability);

— verifying signatures with threshold capability (if the mechanism supports a threshold capability).

This document does not define the implementation of a public key infrastructure (PKI) and the means for distinct entities to exchange, extract and verify their respective public key certificates.

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 10116, *Information technology — Security techniques — Modes of operation for an n-bit block cipher*

ISO/IEC 10118-1, *Information technology — Security techniques — Hash-functions — Part 1: General*

ISO/IEC 10118-2, *Information technology — Security techniques — Hash-functions — Part 2: Hash-functions using an n-bit block cipher*

ISO/IEC 10118-3, *IT Security techniques — Hash-functions — Part 3: Dedicated hash-functions*

ISO/IEC 10118-4, *Information technology — Security techniques — Hash-functions — Part 4: Hash-functions using modular arithmetic*

ISO/IEC 18033-2:2006, *Information technology — Security techniques — Encryption algorithms — Part 2: Asymmetric ciphers*

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ISO/IEC 18033-3, *Information technology — Security techniques — Encryption algorithms — Part 3: Block ciphers*

ISO/IEC 18033-4, *Information technology — Security techniques — Encryption algorithms — Part 4: Stream ciphers*

ISO/IEC 18033-5:2015, *Information technology — Security techniques — Encryption algorithms — Part 5: Identity-based ciphers*

ISO/IEC 29192-2, *Information security — Lightweight cryptography — Part 2: Block ciphers*

ISO/IEC 29192-3, *Information technology — Security techniques — Lightweight cryptography — Part 3: Stream ciphers*

ISO/IEC 18031, *Information technology — Security techniques — Random bit generation*

ISO/IEC 18032, *Information security — Prime number generation*

ISO/IEC 20008-1, *Information technology — Security techniques — Anonymous digital signatures — Part 1: General*

ISO/IEC 20008-2:2013, *Information technology — Security techniques — Anonymous digital signatures — Part 2: Mechanisms using a group public key*

RFC 9380, *Hashing to Elliptic Curves, Internet Research Task Force (IRTF)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 20008-1, ISO/IEC 18033-4 and the following apply.

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

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

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

3.1
symmetric encryption system
encryption system based on symmetric cryptographic techniques

[SOURCE: ISO/IEC 18033-1:2021, 3.29, modified — the admitted terms “symmetric encipherment system” and “symmetric cipher” were removed.]

4 Symbols and abbreviated terms

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

Bsn	Linking base, either a special symbol ⊥ or an arbitrary string.
$\oplus$	Bitwise exclusive OR (XOR) operation.
$\backslash$	Set subtraction operation.
$\mathrm{Enc}_k(m)$	A symmetric-key encryption function taking a secret key k and a variable-length message m as input and giving a ciphertext c as output, e.g. the encryption function for one of the symmetric encryption systems specified in ISO/IEC 18033-3, ISO/IEC 18033-4, ISO/IEC 10116, ISO/IEC 29192-2 or ISO/IEC 29192-3.
$\mathrm{Dec}_k(C)$	A symmetric-key decryption function taking a secret key k and a ciphertext C as input and giving a message m or a decryption failure symbol ⊥ as output.
C	A ciphertext generated from a symmetric-key encryption function.

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