
**Information technology — Security
techniques — Digital signature schemes
giving message recovery —**

**Part 3:
Discrete logarithm based mechanisms**

*Technologies de l'information — Techniques des sécurité — Schémas
de signature numérique rétablissant le message —*

Partie 3: Mécanismes basés sur les logarithmes discrets

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Contents

Foreword.....	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Symbols, notation and conventions	4
4.1 Symbols and notation	4
4.2 Conversion functions and mask generation functions	6
4.3 Legend for figures	6
5 Binding between signature mechanisms and hash-functions	7
6 Framework for digital signatures giving message recovery.....	7
6.1 Processes	7
6.2 Parameter generation process	8
6.3 Signature generation process	8
6.4 Signature verification process	9
7 General model for digital signatures giving message recovery.....	9
7.1 Requirements	9
7.2 Summary of functions and procedures.....	10
7.3 User key generation process.....	11
7.4 Signature generation process	11
7.5 Signature verification process	14
8 NR (Nyberg-Rueppel message recovery signature).....	17
8.1 Domain parameter and user keys	17
8.2 Signature generation process	17
8.3 Signature verification process	18
9 ECNR (Elliptic Curve Nyberg-Rueppel message recovery signature)	19
9.1 Domain parameter and user keys	19
9.2 Signature generation process	19
9.3 Signature verification process	20
10 ECMR (Elliptic Curve Miyaji message recovery signature).....	21
10.1 Domain parameter and user keys	21
10.2 Signature generation process	22
10.3 Signature verification process	23
11 ECAO (Elliptic Curve Abe-Okamoto message recovery signature)	23
11.1 Domain parameter	23
11.2 User keys	24
11.3 Signature generation process	24
11.4 Signature verification process	26
12 ECPV (Elliptic Curve Pintsov-Vanstone message recovery signature)	27
12.1 Domain and user parameters	27
12.2 Signature generation process	28
12.3 Signature verification process	29
13 ECKNR (Elliptic Curve KCDSA/Nyberg-Rueppel message recovery signature).....	31
13.1 Domain parameter and user keys	31
13.2 Signature generation process	31
13.3 Signature verification process	32

Annex A (informative) Mathematical conventions	34
A.1 Bit strings	34
A.2 Octet strings	34
A.3 Finite fields	34
A.4 Elliptic curves	35
Annex B (normative) Conversion functions	36
B.1 Octet string / bit string conversion: OS2BSP and BS2OSP	36
B.2 Bit string / integer conversion: BS2IP and I2BSP	36
B.3 Octet string / integer conversion: OS2IP and I2OSP	36
B.4 Finite field element / integer conversion: FE2IP_F	36
B.5 Octet string / finite field element conversion: OS2FEP_F and FE2OSP_F	37
B.6 Elliptic curve / octet string conversion: EC2OSP_E and OS2ECP_E	37
Annex C (normative) Mask generation functions (Key derivation functions)	39
C.1 Allowable mask generation functions	39
C.2 MGF1	39
C.3 MGF2	39
Annex D (informative) Example method for producing the data input	40
D.1 Splitting the message and producing the data input	40
D.2 Checking the redundancy	40
Annex E (normative) ASN.1 module	42
E.1 Formal definition	42
E.2 Use of subsequent object identifiers	43
Annex F (informative) Numerical examples	44
F.1 Numerical examples for NR	44
F.2 Numerical examples for ECNR	47
F.3 Numerical examples for ECMR	51
F.4 Numerical examples for ECAO	54
F.5 Numerical examples for ECPV	59
F.6 Numerical examples for ECKNR	62
Annex G (informative) Summary of properties of mechanisms	66
Annex H (informative) Correspondence of schemes	68
Bibliography	69

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 2.

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.

ISO/IEC 9796-3 was prepared by Joint Technical Committee ISO/IEC /JTC 1, *Information technology*, Subcommittee SC 27, *IT Security techniques*.

This second edition cancels and replaces the first edition (ISO/IEC 9796-3:2000), which has been technically revised. New mechanisms and object identifiers have been specified.

ISO/IEC 9796 consists of the following parts, under the general title *Information technology — Security techniques — Digital signature schemes giving message recovery*:

- *Part 2: Integer factorization based mechanisms*
- *Part 3: Discrete logarithm based mechanisms*

Introduction

Digital signature mechanisms can be used to provide services such as entity authentication, data origin authentication, non-repudiation, and integrity of data.

A digital signature mechanism satisfies the following requirements:

- given only the public verification key and not the private signature key, it is computationally infeasible to produce a valid signature for any given message;
- the signatures produced by a signer can neither be used for producing a valid signature for any new message nor for recovering the signature key;
- it is computationally infeasible, even for the signer, to find two different messages with the same signature.

Most digital signature mechanisms are based on asymmetric cryptographic techniques and involve three basic operations:

- a process for generating pairs of keys, where each pair consists of a private signature key and the corresponding public verification key;
- a process using the private signature key, called the **signature generation process**;
- a process using the public verification key, called the **signature verification process**.

There are two types of digital signature mechanisms:

- when, for each given private signature key, the signatures produced for the same message are the same, the mechanism is said to be **non-randomized** (or **deterministic**) [see ISO/IEC 14888-1];
- when, for a given message and a given private signature key, each application of the signature process produces a different signature, the mechanism is said to be **randomized**.

This part of ISO/IEC 9796 specifies randomized mechanisms.

Digital signature schemes can also be divided into the following two categories:

- when the whole message has to be stored and/or transmitted along with the signature, the mechanism is named a **signature mechanism with appendix** [see ISO/IEC 14888];
- when the whole message or a part of it is recovered from the signature, the mechanism is named a **signature mechanism giving message recovery**.

If the message is short enough, then the entire message can be included in the signature, and recovered from the signature in the signature verification process. Otherwise, a part of the message can be included in the signature and the rest of it is stored and/or transmitted along with the signature. The mechanisms specified in ISO/IEC 9796 give either total or partial recovery, aiming at reducing storage and transmission overhead.

This part of ISO/IEC 9796 includes six mechanisms, one of which was in ISO/IEC 9796-3:2000 and five of which are in ISO/IEC 15946-4:2004. The mechanisms specified in this part of ISO/IEC 9796 use a hash-function to hash the entire message. ISO/IEC 10118 specifies hash-functions. Some of the mechanisms specified in this part of ISO/IEC 9796 use a group on an elliptic curve over finite field. ISO/IEC 15946-1:2002 describes the mathematical background and general techniques necessary for implementing cryptosystems based on elliptic curves defined over finite fields.

The International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC) draw attention to the fact that it is claimed that compliance with this document may involve the use of patents concerning the mechanisms NR, ECMR and ECAO given in Clause 8, 10 and 11, respectively.

Area	Patent no.	Issue date	Inventors
NR [see Clause 8]	US 5 600 725, EP 0 639 907	1997-02-04	K. Nyberg and R. A. Rueppel
ECMR [see Clause 10]	JP H09-160492 (patent application)		A. Miyaji
ECAO [see Clause 11]	JP 3 434 251	2003-08-04	M. Abe and T. Okamoto

ISO and IEC take no position concerning the evidence, validity and scope of these patent rights.

The holders of these patent rights have assured the ISO and IEC that they are willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holders of these patent rights are registered with ISO and IEC. Information may be obtained from the following companies.

Patent no.	Name of holder of patent right	Contact address
US 5 600 725, EP 0 639 907	Certicom Corp.	5520 Explorer Drive, 4th Floor, Mississauga, Ontario, Canada L4W 5L1
JP H09-160492	Matsushita Electric Industrial Co., Ltd.	Matsushita IMP Building 19 th Floor, 1-3-7, Siromi, Chuo-ku, Osaka 540-6319, Japan
JP 3 434 251	NTT Intellectual Property Center	9-11 Midori-Cho 3-chome, Musashino-shi, Tokyo 180-8585, Japan

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those identified above. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

NOTE 1 Computational feasibility depends on the specific security requirements and environment.

NOTE 2 Any signature mechanism giving message recovery — for example, the mechanisms specified in this part of ISO/IEC 9796 — can be converted for provision of digital signatures with appendix. In this case, the signature is produced by application of the signature mechanism to a hash-token of the message.

Information technology — Security techniques — Digital signature schemes giving message recovery —

Part 3: Discrete logarithm based mechanisms

1 Scope

This part of ISO/IEC 9796 specifies six digital signature schemes giving message recovery. The security of these schemes is based on the difficulty of the discrete logarithm problem, which is defined on a finite field or an elliptic curve over a finite field.

This part of ISO/IEC 9796 also defines an optional control field in the hash-token, which can provide added security to the signature.

This part of ISO/IEC 9796 specifies randomized mechanisms.

The mechanisms specified in this part of ISO/IEC 9796 give either total or partial message recovery.

NOTE For discrete logarithm based digital signature schemes with appendix, see ISO/IEC 14888-3.