

Nederlandse norm

# NEN-ISO/IEC 11770-4

(en)

Information technology - Security techniques -  
Key management - Part 4: Mechanisms based on  
weak secrets (ISO/IEC 11770-4:2017, IDT)

Vervangt NEN-ISO/IEC 11770-4:2006;  
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**Information technology — Security techniques — Key management —**

**Part 4:  
Mechanisms based on weak secrets**

*Technologies de l'information — Techniques de sécurité — Gestion de clés —*

*Partie 4: Mécanismes basés sur des secrets faibles*



Reference number  
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**ISO/IEC 11770-4:2017(E)****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.

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](http://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](http://www.iso.org/iso/foreword.html).

This document was prepared by ISO/IEC JTC 1, *Information technology, SC 27, IT Security techniques*.

This second edition cancels and replaces the first edition (ISO/IEC 11770-4:2006), which has been technically revised. It also incorporates the Technical Corrigendum ISO/IEC 11770-4:2006/Cor1:2009.

This edition includes the following significant changes with respect to the previous edition:

- revision of the Balanced Key Agreement Mechanism 1 (BKAM1) to address the attacks reported in Reference [6];
- addition of a new Balanced Key Agreement Mechanism 2 (BKAM2) based on the J-PAKE scheme of Reference [5];
- addition of a new Augmented Key Agreement Mechanism 3 (AKAM3) based on the AugPAKE scheme of Reference [23].

A list of all parts in the ISO/IEC 11770 series can be found on the ISO website.

## Introduction

The mechanisms specified in this document are designed to achieve one of the following three goals.

- a) **Balanced password-authenticated key agreement:** Establish one or more shared secret keys between two entities that share a common weak secret. In a balanced password-authenticated key agreement mechanism, the shared secret keys are the result of a data exchange between the two entities; the shared secret keys are established if, and only if, the two entities have used the same weak secret; and neither of the two entities can predetermine the values of the shared secret keys.
- b) **Augmented password-authenticated key agreement:** Establish one or more shared secret keys between two entities *A* and *B*, where *A* has a weak secret and *B* has verification data derived from a one-way function of *A*'s weak secret. In an augmented password-authenticated key agreement mechanism, the shared secret keys are the result of a data exchange between the two entities; the shared secret keys are established if, and only if, the two entities have used the weak secret and the corresponding verification data; and neither of the two entities can predetermine the values of the shared secret keys.

NOTE 1 This type of key agreement mechanism is unable to protect *A*'s weak secret being discovered by *B*, but only increases the cost for an adversary to get *A*'s weak secret from *B*. A typical application scenario would involve use between a client (*A*) and a server (*B*).

- c) **Password-authenticated key retrieval:** Establish one or more secret keys for an entity, *A*, associated with another entity, *B*, where *A* has a weak secret and *B* has a strong secret associated with *A*'s weak secret. In an authenticated key retrieval mechanism, the secret keys, retrievable by *A* (not necessarily derivable by *B*), are the result of a data exchange between the two entities, and the secret keys are established if, and only if, the two entities have used the weak secret and the associated strong secret. However, although *B*'s strong secret is associated with *A*'s weak secret, the strong secret does not (in itself) contain sufficient information to permit either the weak secret or the secret keys established in the mechanism to be determined.

NOTE 2 This type of key retrieval mechanism is used in those applications where *A* does not have secure storage for a strong secret, and requires *B*'s assistance to retrieve the strong secret. Such a mechanism is appropriate for use between a client (*A*) and a server (*B*).

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Probleem  
Preview



# Information technology — Security techniques — Key management —

## Part 4: Mechanisms based on weak secrets

### 1 Scope

This document defines key establishment mechanisms based on weak secrets, i.e. secrets that can be readily memorized by a human, and hence, secrets that will be chosen from a relatively small set of possibilities. It specifies cryptographic techniques specifically designed to establish one or more secret keys based on a weak secret derived from a memorized password, while preventing offline brute-force attacks associated with the weak secret. This document is not applicable to the following aspects of key management:

- life-cycle management of weak secrets, strong secrets, and established secret keys;
- mechanisms to store, archive, delete, destroy, etc. weak secrets, strong secrets, and established secret keys.

### 2 Normative reference

There are no normative references in this document.

### 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

##### **augmented password-authenticated key agreement**

password-authenticated key agreement where entity *A* uses a password-based weak secret and entity *B* uses verification data derived from a one-way function of *A*'s weak secret to negotiate and authenticate one or more shared secret keys

#### 3.2

##### **balanced password-authenticated key agreement**

password-authenticated key agreement where two entities *A* and *B* use a shared common password-based weak secret to negotiate and authenticate one or more shared secret keys

#### 3.3

##### **brute-force attack**

attack on a cryptosystem that employs an exhaustive search of a set of keys, passwords or other data

**ISO/IEC 11770-4:2017(E)****3.4****collision-resistant hash-function**

hash-function satisfying the following property: it is computationally infeasible to find any two distinct inputs which map to the same output

Note 1 to entry: Computational feasibility depends on the specific security requirements and environment. Refer to ISO/IEC 10118-1:2016, Annex C.

[SOURCE: ISO/IEC 10118-1:2016, 3.1]

**3.5****dictionary attack**

(on a password-based system) attack on a cryptosystem that employs a search of a given list of passwords

Note 1 to entry: A dictionary attack on a password-based system can use a stored list of specific password values or a stored list of words from a natural language dictionary.

**3.6****domain parameter**

data item which is common to and known by or accessible to all entities within the domain

Note 1 to entry: The set of domain parameters may contain data items such as hash-function identifier, length of the hash-token, length of the recoverable part of the message, finite field parameters, elliptic curve parameters, or other parameters specifying the security policy in the domain.

[SOURCE: ISO/IEC 9796-3:2006, 3.2]

**3.7****elliptic curve**

cubic curve  $E$  without a singular point

Note 1 to entry: The set of points  $E$  together with an appropriately defined operation for a field that includes all coefficients of the equation describing  $E$  is called the definition field of  $E$ . In ISO/IEC 15946-1, only finite fields  $F$  are dealt with as the definition field. When it is necessary to describe the definition field  $F$  of  $E$  explicitly, the curve is denoted as  $E/F$ .

Note 2 to entry: The form of a cubic curve equation used to define an elliptic curve varies depending on the field. The general form of an appropriate cubic equation for all possible finite fields is defined in ISO/IEC 15946-1:2016, 6.1.

[SOURCE: ISO/IEC 15946-1:2016, 3.3, modified]

**3.8****explicit key authentication**

<from entity  $A$  to entity  $B$ > assurance for entity  $B$  that entity  $A$  is the only other entity that is in possession of the correct key

Note 1 to entry: Implicit key authentication from entity  $A$  to entity  $B$  and key confirmation from entity  $A$  to entity  $B$  together imply explicit key authentication from entity  $A$  to entity  $B$ .

[SOURCE: ISO/IEC 11770-3:2015, 3.12, modified]

**3.9****hash-function**

function which maps strings of bits of variable (but usually upper bounded) length to fixed-length strings of bits, satisfying the following two properties:

- for a given output, it is computationally infeasible to find an input which maps to this output;
- for a given input, it is computationally infeasible to find a second input which maps to the same output.

Note 1 to entry: Computational feasibility depends on the specific security requirements and environment. Refer to ISO/IEC 10118-1:2016, Annex C.

[SOURCE: ISO/IEC 10118-1:2016, 3.4]

### 3.10

#### **hashed password**

result of applying a hash-function to a password

### 3.11

#### **implicit key authentication**

<from entity *A* to entity *B*> assurance for entity *B* that entity *A* is the only other entity that can possibly be in possession of the correct key

[SOURCE: ISO/IEC 11770-3:2015, 3.16, modified]

### 3.12

#### **key**

sequence of symbols that controls the operation of a cryptographic transformation (e.g. encryption, decryption, cryptographic check function computation, signature calculation, or signature verification)

[SOURCE: ISO/IEC 11770-3:2015, 3.17]

### 3.13

#### **key agreement**

process of establishing a shared secret key between entities in such a way that neither of them can predetermine the value of that key

Note 1 to entry: By predetermine, it is meant that neither entity *A* nor entity *B* can, in a computationally efficient way, choose a smaller key space and force the computed key in the protocol to fall into that key space.

[SOURCE: ISO/IEC 11770-3:2015, 3.18]

### 3.14

#### **key confirmation**

<from entity *A* to entity *B*> assurance for entity *B* that entity *A* is in possession of the correct key

[SOURCE: ISO/IEC 11770-3:2015, 3.20, modified]

### 3.15

#### **key control**

ability to choose the key or the parameters used in the key computation

[SOURCE: ISO/IEC 11770-3:2015, 3.21]

### 3.16

#### **key derivation function**

function which takes as input a number of parameters, at least one of which shall be secret, and which gives as output keys appropriate for the intended algorithm(s) and applications

### 3.17

#### **key establishment**

process of making available a shared secret key to one or more entities

Note 1 to entry: Key establishment includes key agreement, key transport and key retrieval.

### 3.18

#### **key management**

administration and use of generation, registration, certification, deregistration, distribution, installation, storage, archiving, revocation, derivation and destruction of keying material in accordance with a security policy

[SOURCE: ISO/IEC 11770-1:2010, 2.28]

**ISO/IEC 11770-4:2017(E)****3.19****key retrieval**

process of establishing a key for one or more entities known as the retrieving entities with the involvement of one or more other entities who are not necessarily able to access the key after the process, and which normally requires authentication of the retrieving entity/entities by the other entity/entities

**3.20****key token**

key establishment message sent from one entity to another entity during the execution of a key establishment mechanism

**3.21****key token check function**

function that utilizes a key token and other publicly known parameters as input and outputs a Boolean value during the execution of a key establishment mechanism

**3.22****key token factor**

value that is kept secret and that is used, possibly in conjunction with a weak secret, to create a key token

**3.23****key token generation function**

function that utilizes a key token factor and other parameters as input and outputs a key token during the execution of a key establishment mechanism

**3.24****message authentication code algorithm**

algorithm for computing a function which maps strings of bits and a secret key to fixed-length strings of bits, satisfying the following two properties:

- for any key and any input string, the function can be computed efficiently;
- for any fixed key, and given no prior knowledge of the key, it is computationally infeasible to compute the function value on any new input string even given knowledge of a set of input strings and corresponding function values, where the value of the  $i$ th input string may have been chosen after observing the value of the first  $i-1$  function values (for integers  $i > 1$ )

[SOURCE: ISO/IEC 9797-1:2011, 3.10, modified]

**3.25****mutual key authentication**

assurance for two entities that only the other entity is in possession of the correct key

**3.26****one-way function**

function with the property that it is easy to compute the output for a given input but it is computationally infeasible to find an input which maps to a given output

[SOURCE: ISO/IEC 11770-3:2015, 3.30]

**3.27****password**

secret word, phrase, number, or character sequence used for entity authentication, which is a memorized weak secret

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