

INTERNATIONAL
STANDARD

ISO/IEC
11770-4

Second edition
2017-11

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

© ISO/IEC 2017



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2017, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative reference	1
3 Terms and definitions	1
4 Symbols and abbreviated terms	6
5 Requirements	8
6 Password-authenticated key agreement	10
6.1 General	10
6.2 Balanced Key Agreement Mechanism 1 (BKAM1)	10
6.2.1 General	10
6.2.2 Prior shared parameters	11
6.2.3 Functions	11
6.2.4 Key agreement operation	14
6.3 Balanced Key Agreement Mechanism 2 (BKAM2)	15
6.3.1 General	15
6.3.2 Prior shared parameters	15
6.3.3 Functions	16
6.3.4 Key agreement operation	19
6.4 Augmented Key Agreement Mechanism 1 (AKAM1)	22
6.4.1 General	22
6.4.2 Prior shared parameters	22
6.4.3 Functions	23
6.4.4 Key agreement operation	24
6.5 Augmented Key Agreement Mechanism 2 (AKAM2)	25
6.5.1 General	25
6.5.2 Prior shared parameters	26
6.5.3 Functions	26
6.5.4 Key agreement operation	29
6.6 Augmented Key Agreement Mechanism 3 (AKAM3)	30
6.6.1 General	30
6.6.2 Prior shared parameters	30
6.6.3 Functions	31
6.6.4 Key agreement operation	33
7 Password-authenticated key retrieval	35
7.1 General	35
7.2 Key Retrieval Mechanism 1 (KRM1)	35
7.2.1 General	35
7.2.2 Prior shared parameters	36
7.2.3 Functions	36
7.2.4 Key retrieval operation	37
Annex A (normative) Functions for data type conversion	38
Annex B (normative) Object identifiers	42
Annex C (informative) Guidance on choice of parameters	45
Bibliography	47

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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 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 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*).

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.

ISO and IEC take no position concerning the evidence, validity and scope of these patent rights. The holders of these patent rights have assured 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 statements of the holders of these patent rights are registered with ISO and IEC. Information may be obtained from:

National Institute of Advanced Industrial Science and Technology

1-1-1 Umezono

Tsukuba, Ibaraki

305-8560 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.

ISO (www.iso.org/patents) and IEC (<http://patents.iec.ch>) maintain online databases of patents relevant to their documents. Users are encouraged to consult the databases for the most up to date information concerning patents.

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.