INTERNATIONAL STANDARD

**ISO/IEC 29192-7**

First edition
2019-07

# Information security — Lightweight cryptography —

## Part 7: Broadcast authentication protocols

*Sécurité de l'information — Cryptographie pour environnements contraints —*

*Partie 7: Protocole d'authentification diffusée*

Reference number
ISO/IEC 29192-7:2019(E)

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Published in Switzerland

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# 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 of 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 www.iso.org/iso/foreword.html.

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 29192 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.


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# Introduction

Many IT environments involve broadcast communication, in which one sender communicates with multiple receivers. Securing such communication is a non-trivial task. Broadcast authentication protocols aim to enable the recipient to verify the authenticity of transmitted data and ensure entity authentication of the sender.

A straightforward way of achieving broadcast authentication is to use digital signatures, as for example described in the ISO/IEC 9796 series or ISO/IEC 14888 series. However, there are situations in which the additional communication and computational overhead of digital signatures are prohibitively expensive, as can be the case with satellites broadcasting to earth.

This document specifies lightweight broadcast authentication protocols, which offer a significantly lower implementation cost than deploying digitial signatures as a solution to the authentication of broadcast communication.

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# Information security — Lightweight cryptography —

# Part 7:
# Broadcast authentication protocols

## 1 Scope

This document specifies broadcast authentication protocols, which are protocols that provide data integrity and entity authentication in a broadcast setting, i.e. a setting with one sender transmitting messages to many receivers. To provide entity authentication, there needs to be a pre-existing infrastructure which links the sender to a cryptographic secret. The establishment of such an infrastructure is beyond the scope of this document.

## 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 9797 (all parts), *Information technology — Security techniques — Message authentication codes (MACs)*

ISO/IEC 10118 (all parts), *IT Security techniques — Hash-functions*

ISO/IEC 29192-1, *Information technology — Security techniques — Lightweight cryptography — Part 1: General*

ISO/IEC 29192-5, *Information technology — Security techniques — Lightweight cryptography — Part 5: Hash-functions*

ISO/IEC 29192-6[1)], *IT Security techniques — Lightweight cryptography — Part 6: Message authentication codes (MACs)*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 29192-1 and the following apply.

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

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

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

**3.1**
**broadcast**
method of communication by which information originating from a *sender* (3.11) is distributed to a group of *receivers* (3.9)

1) Under preparation. (Stage at the time of publication: ISO/IEC DIS 29192-6:2019.)

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**3.2**
**data integrity**
property that data has not been altered or destroyed in an unauthorized manner

[SOURCE: ISO/IEC 9797-1:2011, 3.4]

**3.3**
**collision-resistant hash-function**
*hash-function* (3.4) 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.

[SOURCE: ISO/IEC 10118-1:2016, 3.1, modified — Reference to Annex C has been removed from Note 1 to entry.]

**3.4**
**hash-function**
function which maps strings of bits 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.

[SOURCE: ISO/IEC 10118-1:2016, 3.4, modified — Reference to Annex C has been removed from Note 1 to entry.]

**3.5**
**key**
sequence of symbols that controls the operation of a cryptographic transformation (e.g., encipherment, decipherment, cryptographic check function computation, signature generation, or signature verification)

[SOURCE: ISO/IEC 18033-3:2010, 2.4, modified — Between the brackets, the words after "decipherment" have been added.]

**3.6**
**MAC algorithm key**
key that controls the operation of a MAC algorithm

[SOURCE: ISO/IEC 9797-1:2011, 3.8]

**3.7**
**Message Authentication Code**
**MAC**
string of bits which is the output of a MAC algorithm

Note 1 to entry: A MAC is sometimes called a cryptographic check value (see for example ISO 7498-2).

[SOURCE: ISO/IEC 9797-1:2011, 3.9]

**3.8**
**Message Authentication Code algorithm**
**MAC 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;


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— 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 the 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 $i > 1$)

Note 1 to entry: A MAC algorithm is sometimes called a cryptographic check function (see for example ISO 7498-2).

Note 2 to entry: Computational feasibility depends on the user's specific security requirements and environment.

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

**3.9**
**receiver**
entity receiving communication from the *sender* (3.11) requiring data integrity and *entity authentication* (3.10)

**3.10**
**entity authentication**
corroboration that an entity is the one claimed

[SOURCE: ISO/IEC 9798-1:2010, 3.14]

**3.11**
**sender**
entity generating messages to be *broadcast* (3.1)

**3.12**
**chain of keys**
sequence of keys generated by applying a *collision-resistant hash-function* (3.3) to a *key* (3.5) and then repeatedly applying a collision-resistant hash-function to the output of the previous execution

## 4 Symbols and abbreviated terms

| | |
|---|---|
| $F(X)$ | output of a hash-function $F$ when applied to data $X$, truncated to the length required for keys used by the MAC algorithm |
| MAC($K$,$M$) | output of a MAC algorithm given MAC algorithm key $K$ and message $M$ as input |
| $X \|\| Y$ | concatenation of data items $X$ and $Y$ in the order specified |
| | NOTE 1 For $X$, $K$, $M$, $Y$ strings of arbitrary length. |
| $D$ | length of each time interval |
| $d$ | delay between the transmission of the MAC and the disclosure of the key, measured in units of $D$ |
| $N$ | length of a chain of keys |
| $\alpha$ | a value used in the generation of the chain of keys to frustrate time-memory tradeoff attacks |
| $L$ | length of $\alpha$ |
| $i, j$ | time intervals |

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