
**Information technology — Open
systems interconnection directory —
Part 11:
Protocol specifications for secure
operations**



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Published in Switzerland

INTERNATIONAL STANDARD ISO/IEC 9594-11
RECOMMENDATION ITU-T X.510

Information technology – Open Systems Interconnection –
The Directory: Protocol specifications for secure operations

Summary

Recommendation ITU-T X.510 | ISO/IEC 9594-11 specifies a general protocol, called the wrapper protocol, that provides cybersecurity for protocols designed for its protection. The wrapper protocol provides authentication, integrity and optionally confidentiality (encryption). The wrapper protocol allows cybersecurity to be provided independently of the protected protocols, which means that security may be enhanced without affecting protected protocol specifications.

The wrapper protocol is specified without specifying specific cryptographic algorithms, but is designed for plucking-in cryptographic algorithms as required.

The wrapper protocol is designed for easy migration of cryptographic algorithms, as stronger cryptographic algorithms become necessary.

Recommendation ITU-T X.510 | ISO/IEC 9594-11 contains recommendations for how other Recommendations and International Standards may include features for migration of cryptographic algorithms, and it includes ASN.1 specifications to be applied for that purpose.

Recommendation ITU-T X.510 | ISO/IEC 9594-11 also specifies three protocols that make use of the wrapper protocol protection. This includes a protocol for maintenance of authorization and validation lists (AVLs), a protocol for subscribing of public-key certificate status and a protocol for accessing a trust broker.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T X.510	2020-08-22	17	11.1002/1000/14320

Keywords

Certification authority, cryptography, cryptographic algorithm, digital signature, public-key certificate, PKI, quantum-safe, trust anchor, validation.

* To access the Recommendation, type the URL <http://handle.itu.int/> in the address field of your web browser, followed by the Recommendation's unique ID. For example, <http://handle.itu.int/11.1002/1000/11830-en>.

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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Introduction

The Internet Engineering Task Force (IETF) maintains a substantial set of protocols for supporting public-key infrastructure (PKI). Recommendation ITU-T X.510 | ISO/IEC 9594-11 provides protocols to supplement those protocols developed by IETF, especially for:

- a) supporting new functions specified by Rec. ITU-T X.509 | ISO/IEC 9594-8, for which IETF has not provided support, e.g., support for authorization and validation list (AVL) maintenance;
- b) constraint environments, where lean protocols are required.

In addition, it specifies:

- c) a wrapper protocol that provides security services for other protocols.

This Recommendation | International Standard consist of three sections as follows.

Section 1 gives general specifications for this Recommendation | International Standard.

Section 2 is the wrapper protocol specification.

Section 3 specifies some protocols to be protected by the wrapper protocol:

- a) a protocol for maintaining authorization and validation lists (AVLs);
- b) a protocol for subscribing public-key certificate status information from certification authorities (CAs); and
- c) a protocol for accessing a trust broker.

The following annexes are included.

Annex A, which is an integral part of this Recommendation | International Standard, provides the ASN.1 module for specifications to be imported by protocols providing a migration path for cryptographic algorithms.

Annex B, which is an integral part of this Recommendation | International Standard, provides the ASN.1 module for the wrapper protocol.

Annex C, which is an integral part of this Recommendation | International Standard, provides specifications for how a protected protocol is wrapped by the wrapper protocol.

Annex D, which is an integral part of this Recommendation | International Standard, provides cryptographic algorithm specification.

Annex E, which is an integral part of this Recommendation | International Standard, provides the ASN.1 module for maintenance of the authorization and validation lists (AVLs) protocol.

Annex F, which is an integral part of this Recommendation | International Standard, provides the ASN.1 module for certification authority subscription protocol.

Annex G, which is an integral part of this Recommendation | International Standard, provides the ASN.1 module for the trust broker protocol.

Annex H, which is not an integral part of this Recommendation | International Standard, provides guidance for cryptographic algorithm migration.

The content of this Rec. ITU-T X.510 | ISO/IEC 9594-11 was moved to here from Rec. ITU-T X.509 (2016) | ISO/IEC 9594-8:2017 and subsequently updated.

**INTERNATIONAL STANDARD ISO/IEC 9594-11
RECOMMENDATION ITU-T X.510**

**Information technology – Open Systems Interconnection –
The Directory: Protocol specifications for secure operations**

SECTION 1 – GENERAL

1 Scope

The scope of this Recommendation | International Standard is threefold.

This Recommendation | International Standard provides guidance on how to prepare new and old protocols for cryptographic algorithm migration, and defines auxiliary cryptographic algorithms to be used for migration purposes.

This Recommendation | International Standard specifies a general wrapper protocol that provides authentication, integrity and confidentiality (encryption) protection for other protocols. This wrapper protocol includes a migration path for cryptographic algorithms allowing for smooth migration to stronger cryptographic algorithms as such requirements evolve. This will allow migration to quantum-safe cryptographic algorithms. Protected protocols can then be developed without taking security and cryptographic algorithms into consideration.

This Recommendation | International Standard also includes some protocols to be protected by the wrapper protocol primarily for support of public-key infrastructure (PKI). Other specifications, e.g., Recommendations or International Standards, may also develop protocols designed to be protected by the wrapper protocol.

2 Normative references

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | International Standard. At the time of publication, the editions indicated were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this Recommendation | International Standard are encouraged to investigate the possibility of applying the most recent edition of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The Telecommunication Standardization Bureau of the ITU maintains a list of currently valid ITU-T Recommendations.

2.1 Identical Recommendations | International Standards

- Recommendation ITU-T X.500 (2019) | ISO/IEC 9594-1:2020, *Information technology - Open Systems Interconnection - The Directory: Overview of concepts, models and services.*
- Recommendation ITU-T X.501 (2019) | ISO/IEC 9594-2:2020, *Information technology – Open Systems Interconnection – The Directory: Models.*
- Recommendation ITU-T X.509 (2019) | ISO/IEC 9594-8:2020, *Information technology – Open Systems Interconnection – The Directory: Public-key and attribute certificate frameworks.*
- Recommendation ITU-T X.511 (2019) | ISO/IEC 9594-3:2020, *Information technology - Open Systems Interconnection - The Directory: Abstract service definition.*
- Recommendation ITU-T X.518 (2019) | ISO/IEC 9594-4:2020, *Information technology - Open Systems Interconnection - The Directory: Procedures for distributed operation.*
- Recommendation ITU-T X.519 (2019) | ISO/IEC 9594-5:2020, *Information technology - Open Systems Interconnection - The Directory: Protocol specifications.*
- Recommendation ITU-T X.520 (2019) | ISO/IEC 9594-6:2020, *Information technology – Open Systems Interconnection – The Directory: Selected attribute types.*
- Recommendation ITU-T X.521 (2019) | ISO/IEC 9594-7:2020, *Information technology - Open Systems Interconnection - The Directory: Selected object classes.*
- Recommendation ITU-T X.525 (2019) | ISO/IEC 9594-9:2020, *Information technology - Open Systems Interconnection - The Directory: Replication.*
- Recommendation ITU-T X.680 (2015) | ISO/IEC 8824-1:2015, *Information technology - Abstract Syntax Notation One (ASN.1): Specification of basic notation.*

- Recommendation ITU-T X.681 (2015) | ISO/IEC 8824-2:2015, *Information technology – Abstract Syntax Notation One (ASN.1): Information object specification*.
- Recommendation ITU-T X.682 (2015) | ISO/IEC 8824-3:2015, *Information technology – Abstract Syntax Notation One (ASN.1): Constraint specification*.
- Recommendation ITU-T X.683 (2015) | ISO/IEC 8824-4:2015, *Information technology – Abstract Syntax Notation One (ASN.1): Parameterization of ASN.1 specifications*.
- Recommendation ITU-T X.690 (2015) | ISO/IEC 8825-1:2015, *Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)*.
- Recommendation ITU-T X.691 (2015) | ISO/IEC 8825-2:2015, *Information technology – ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)*.

2.2 Paired Recommendations | International Standards equivalent in technical content

- Recommendation ITU-T X.800 (1991), *Security architecture for Open Systems Interconnection for CCITT applications*.
ISO 7498-2:1989, *Information processing systems – Open Systems Interconnection – Basic Reference Model – Part 2: Security Architecture*.

2.3 Other references

- IETF RFC 793 (1981), *Transmission Control Protocol*.
- IETF RFC 2104 (1997), *HMAC: Keyed-Hashing for Message Authentication*.
- IETF RFC 3526 (2003), *More Modular Exponential (MODP) Diffie-Hellman groups for Internet Key Exchange (IKE)*.
- IETF RFC 5084 (2007), *Using AES-CCM and AES-GCM Authenticated Encryption in the Cryptographic Message Syntax (CMS)*.
- IETF RFC 5114 (2008), *Additional Diffie-Hellman Groups for Use with IETF Standards*.
- IETF RFC 5869 (2010), *HMAC-based Extract-and-Expand Key Derivation Function (HKDF)*.
- IETF RFC 6932 (2013), *Brainpool Elliptic Curves for the Internet Key Exchange (IKE) Group Description Registry*.

3 Definitions

For the purposes of this Recommendation | International Standard, the following definitions apply:

3.1 OSI Reference Model definitions

The following terms are defined in Rec. ITU-T X.800 | ISO 7498-2:

- a) confidentiality;
- b) cryptography;
- c) digital signature.

3.2 Directory model definitions

The following terms are defined in Rec. ITU-T X.501 | ISO/IEC 9594-2:

- a) attribute;
- b) distinguished name (of an entry).

3.3 Public-key and attribute certificate definitions

The following terms are defined in Rec. ITU-T X.509 | ISO/IEC 9594-8:

- a) authorization and validation list (AVL);
- b) authorization and validation list entity (AVL entity);
- c) authorizer;