

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Power systems management and associated information exchange – Data and communications security –
Part 11: Security for XML documents**

**Gestion des systèmes de puissance et échanges d'informations associés –
Sécurité des communications et des données –
Partie 11: Sécurité des documents XML**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2016 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 15 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

65 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Power systems management and associated information exchange – Data and communications security –
Part 11: Security for XML documents**

**Gestion des systèmes de puissance et échanges d'informations associés –
Sécurité des communications et des données –
Partie 11: Sécurité des documents XML**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 33.200

ISBN 978-2-8322-3636-9

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references	7
3 Terms and definitions	7
4 Security issues addressed by this document	8
4.1 General.....	8
4.2 Security threats countered.....	8
4.3 Attack methods countered	8
5 XML Documents	8
6 XML document encapsulation	10
6.1 General.....	10
6.2 HeaderType	11
6.3 Information	12
6.3.1 General	12
6.3.2 Nonce.....	13
6.3.3 AccessControl.....	13
6.3.4 Body.....	20
6.4 Encrypted element	21
6.4.1 General	21
6.4.2 EncryptionMethod	21
6.4.3 CipherData	22
6.4.4 KeyInfo	22
6.5 SignatureType.....	23
6.5.1 General	23
6.5.2 SignedInfoType.....	23
6.6 Supporting XSD Types	27
6.6.1 General	27
6.6.2 NameSeqType	27
6.7 Security algorithm selection.....	27
7 Example files (informative).....	28
7.1 Non-encrypted example.....	28
7.2 Encrypted example.....	30
8 IANA list of signature, digest, and encryption methods (informative)	32
Bibliography	37
Figure 1 – Overview of IEC 62351-11 structure.....	6
Figure 2 – Data in transition example	9
Figure 3 – Secure encapsulation for XML documents.....	10
Figure 4 – General IEC 62351-11 XSD layout.....	10
Figure 5 – XSD ComplexType definition of HeaderType.....	11
Figure 6 – XSD ComplexType definition of information.....	12
Figure 7 – XSD Complex Type Definition of AccessControl	13
Figure 8 – XSD Complex Type definition of AccessControlType	14
Figure 9 – XSD Complex Type Definition of ACLRestrictionType.....	15

Figure 10 – XSD Complex Type definition of EntityType	17
Figure 11 – Example of AccessControl and XPATH	19
Figure 12 – Example of an IEC 62351-11 Body with a CIM document.....	20
Figure 13 – Structure of the IEC 62351-11 Encrypted element	21
Figure 14 – Structure of EncryptionMethodType	21
Figure 15 – Structure of CipherDataType.....	22
Figure 16 – EncryptedData element definition.....	22
Figure 17 – W3C SignatureType definition.....	23
Figure 18 – SignedInfoType XML structure	24
Figure 19 – SignatureMethodType structure	24
Figure 20 – ReferenceType structure	25
Figure 21 – KeyInfoType Structure	26
Figure 22 – Definition of NameSeqType	27
Table 1 – Definitions of general structure for an IEC 62351-11 document.....	11
Table 2 – Definition of HeaderType Element.....	12
Table 3 – Definition of information element.....	13
Table 4 – Definition of Contractual and ACL Element.....	14
Table 5 – Definition of ACLRestrictionType Element	15
Table 6 – Definition of Enumerated Values for ACLType	16
Table 7 – Definition of Enumerated Values for Constraint	16
Table 8 – Definition of EntityType Element	17

INTERNATIONAL ELECTROTECHNICAL COMMISSION

POWER SYSTEMS MANAGEMENT AND ASSOCIATED INFORMATION EXCHANGE – DATA AND COMMUNICATIONS SECURITY –

Part 11: Security for XML documents

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62351-11 has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

The text of this standard is based on the following documents:

FDIS	Report on voting
57/1753/FDIS	57/1774/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 62351 series, published under the general title *Power systems management and associated information exchange – Data and communications security*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

POWER SYSTEMS MANAGEMENT AND ASSOCIATED INFORMATION EXCHANGE – DATA AND COMMUNICATIONS SECURITY –

Part 11: Security for XML documents

1 Scope

This part of IEC 62351 specifies schema, procedures, and algorithms for securing XML documents that are used within the scope of the IEC as well as documents in other domains (e.g. IEEE, proprietary, etc.). This part is intended to be referenced by standards if secure exchanges are required, unless there is an agreement between parties in order to use other recognized secure exchange mechanisms.

This part of IEC 62351 utilizes well-known W3C standards for XML document security and provides profiling of these standards and additional extensions. The IEC 62351-11 extensions provide the capability to provide:

- Header: the header contains information relevant to the creation of the secured document such as the Date and Time when IEC 62351-11 was created.
- A choice of encapsulating the original XML document in an encrypted (Encrypted) or non-encrypted (nonEncrypted) format. If encryption is chosen, there is a mechanism provided to express the information required to actually perform encryption in an interoperable manner (EncryptionInfo).
- AccessControl: a mechanism to express access control information regarding information contained in the original XML document.
- Body: is used to contain the original XML document that is being encapsulated.
- Signature: a signature that can be used for the purposes of authentication and tamper detection.

The general structure is shown in Figure 1.

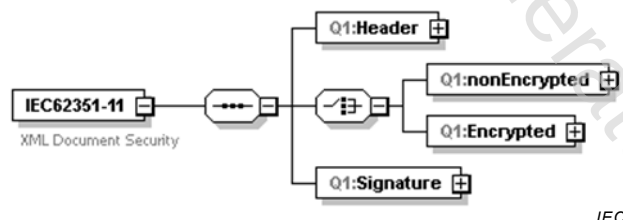


Figure 1 – Overview of IEC 62351-11 structure

For the measures described in this document to take effect, they must be accepted and referenced by the specifications themselves. This document is written to enable that process.

The subsequent audience for this part of IEC 62351 is intended to be the developers of products that implement these specifications.

Portions of this part of IEC 62351 may also be of use to managers and executives in order to understand the purpose and requirements of the work.

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.

IEC TS 62351-2, *Power systems management and associated information exchange – Data and communications security – Part 2: Glossary of terms*

IEC TS 62351-8, *Power systems management and associated information exchange – Data and communications security – Part 8: Role-based access control*

IEC TS 62351-9, *Power systems management and associated information exchange – Data and communications security – Part 9: Cyber security key management for power system equipment*

Recommended Canonical XML 1.0 with comments, W3C,
<http://www.w3.org/TR/2001/REC-xml-c14n-20010315#WithComments>

Required Canonical XML 1.0, Omits comments, W3C,
<http://www.w3.org/TR/2001/REC-xml-c14n-20010315>

RFC 6931, *Additional XML Security Uniform Resource Identifiers (URIs)*

XML Encryption Syntax and Processing Version 1.1 April 11, 2013,
<http://www.w3.org/TR/xmlenc-core1/>

XML Signature Syntax and Processing W3C Recommendation 10 June 2008,
<http://www.w3.org/TR/2008/REC-xmldsig-core-20080610/>

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC TS 62351-2 and the following 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

nonce

random or pseudo-random value used within an authentication system

[SOURCE: IEEE Std 1455-1999, IEEE Standard for Message Sets for Vehicle/Roadside Communications]

3.2

IANA

Internet Assigned Numbers Authority

Note 1 to entry: IANA is responsible for the global coordination of the DNS Root, IP addressing, and other Internet protocol resources.

[SOURCE: <http://www.iana.org>]