
**Information technology — ASN.1
encoding rules —**

**Part 4:
XML Encoding Rules (XER)**

*Technologies de l'information — Règles de codage ASN.1 —
Partie 4: Règles de codage XML (XER)*

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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 or www.iec.ch/members_experts/refdocs)

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This fourth edition cancels and replaces the third edition (ISO/IEC 8825-4:2015), which has been technically revised. It also incorporates ISO/IEC 8825-4:2015/Cor 1:2018.

A list of all parts in the ISO/IEC 8825 series can be found on the ISO and IEC websites.

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 and www.iec.ch/national-committees.

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Introduction

Rec. ITU-T X.680 | ISO/IEC 8824-1, Rec. ITU-T X.681 | ISO/IEC 8824-2, Rec. ITU-T X.682 | ISO/IEC 8824-3, Rec. ITU-T X.683 | ISO/IEC 8824-4 together describe Abstract Syntax Notation One (ASN.1), a notation for the definition of messages to be exchanged between peer applications.

This Recommendation | International Standard defines encoding rules that may be applied to values of ASN.1 types defined using the notation specified in Rec. ITU-T X.680 | ISO/IEC 8824-1 and Rec. ITU-T X.681 | ISO/IEC 8824-2. Application of these encoding rules produces a transfer syntax for such values. It is implicit in the specification of these encoding rules that they are also to be used for decoding.

There is more than one set of encoding rules that can be applied to values of ASN.1 types. This Recommendation | International Standard defines three sets of encoding rules that use the Extensible Markup Language (XML). These encoding rules all produce an XML document compliant to W3C XML 1.0. The first set is called the Basic XML Encoding Rules (BASIC-XER). The second set is called the Canonical XML Encoding Rules (CANONICAL-XER, or CXER) because there is only one way of encoding an ASN.1 value using these encoding rules. (Canonical encoding rules are generally used for applications using security-related features such as digital signatures.) The third set is called the extended XML Encoding Rules (EXTENDED-XER). The extended XML Encoding Rules allow additional encoders options, and take account of encoding instructions that specify variations of the BASIC-XER encodings in order to support specific styles of XML documents (see below). The extended XML Encoding Rules are not canonical, and there is no canonical form for these rules defined in this Recommendation | International Standard.

There are many aspects of an XML representation of data (such as the use of XML attributes instead of child elements, or the use of white-space delimited lists) whose use is a matter of style and XML designer choice. If a type defined in an ASN.1 specification is encoded by BASIC-XER or by CXER, then there is a single fixed style used for the XML representation, with no user control of stylistic features. This Recommendation | International Standard specifies the syntax and semantics of XER encoding instructions which specify the stylistic features of the XML in an EXTENDED-XER encoding. XER encoding instructions can also be used to determine the possible insertion of XML processing instructions in an EXTENDED-XER encoding. XER encoding instructions are ignored by BASIC-XER and by CXER, but are used by EXTENDED-XER.

NOTE – "Stylistic features", such as use of attributes or white-space delimited lists, can also affect the size of an encoding and the ease with which it can be processed, so use of such features is not just a matter of style. Where such issues are important, EXTENDED-XER with encoding instructions may be preferred over BASIC-XER or CXER.

Clause 8 specifies the BASIC-XER encoding of ASN.1 types.

Clause 9 specifies the CXER encoding of ASN.1 types.

Clause 10 specifies the EXTENDED-XER encoding of ASN.1 types, referencing later clauses which define the XER encoding instructions.

Clauses 11 to 14 list and categorize the XER encoding instructions and specify the syntax for their assignment to an ASN.1 type or component using either an XER type prefix (see Rec. ITU-T X.680 | ISO/IEC 8824-1, 31.3) or an XER encoding control section (see Rec. ITU-T X.680 | ISO/IEC 8824-1, clause 54).

Clause 15 defines the order of precedence if XER encoding instructions are present in both an XER type prefix and in an XER encoding control section.

Clause 16 specifies the XER encoding instruction support for XML namespaces when using EXTENDED-XER.

Clause 17 specifies EXTENDED-XER encodings.

Clauses 18 to 39 specify:

- a) the syntax of each XER encoding instruction used in a type prefix or an XER encoding control section;
- b) restrictions on the XER encoding instructions that can be associated with a particular ASN.1 type (resulting from inheritance and multiple assignments);
- c) modifications to the XER encoding rules that are required in an EXTENDED-XER encoding when an XER encoding instruction is applied.

Annex A is informative and contains examples of BASIC-XER and CXER encodings.

Annex B is informative and contains a description of the partial XML content that is produced when constructions such as sequence and sequence-of have their surrounding tags removed, together with restrictions on EXTENDED-XER specifications that enable easy determination of the ASN.1 component that an XML element is associated with.

Annex C is informative and contains examples of XER encoding instructions and of the corresponding EXTENDED-XER encodings.

**INTERNATIONAL STANDARD
ITU-T RECOMMENDATION**

**Information technology – ASN.1 encoding rules:
XML Encoding Rules (XER)**

1 Scope

This Recommendation | International Standard specifies a set of basic XML Encoding Rules (BASIC-XER) that may be used to derive a transfer syntax for values of types defined in Rec. ITU-T X.680 | ISO/IEC 8824-1 and Rec. ITU-T X.681 | ISO/IEC 8824-2. This Recommendation | International Standard also specifies a set of Canonical XML Encoding Rules (CXER) which provide constraints on the basic XML Encoding Rules and produce a unique encoding for any given ASN.1 value. This Recommendation | International Standard further specifies a set of extended XML Encoding Rules (EXTENDED-XER) which adds further encoders options, and also allows the ASN.1 specifier to vary the encoding that would be produced by BASIC-XER. It is implicit in the specification of these encoding rules that they are also used for decoding.

The encoding rules specified in this Recommendation | International Standard:

- are used at the time of communication;
- are intended for use in circumstances where displaying of values and/or processing them using commonly available XML tools (such as browsers) is the major concern in the choice of encoding rules;
- allow the extension of an abstract syntax by addition of extra values for all forms of extensibility described in Rec. ITU-T X.680 | ISO/IEC 8824-1.

This Recommendation | International Standard also specifies the syntax and semantics of XER encoding instructions, and the rules for their assignment and combination. XER encoding instructions can be used to control the EXTENDED-XER encoding for specific ASN.1 types.

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.

NOTE – This Recommendation | International Standard is based on ISO/IEC 10646:2003 and the Unicode standard version 3.2.0:2002. It cannot be applied using later versions of these two standards.

2.1 Identical Recommendations | International Standards

- Recommendation ITU-T X.680 (2021) | ISO/IEC 8824-1:2021, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation*.
- Recommendation ITU-T X.681 (2021) | ISO/IEC 8824-2:2021, *Information technology – Abstract Syntax Notation One (ASN.1): Information object specification*.
- Recommendation ITU-T X.682 (2021) | ISO/IEC 8824-3:2021, *Information technology – Abstract Syntax Notation One (ASN.1): Constraint specification*.
- Recommendation ITU-T X.683 (2021) | ISO/IEC 8824-4:2021, *Information technology – Abstract Syntax Notation One (ASN.1): Parameterization of ASN.1 specifications*.
- Recommendation ITU-T X.690 (2021) | ISO/IEC 8825-1:2021, *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 (2021) | ISO/IEC 8825-2:2021, *Information technology – ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)*.
- Recommendation ITU-T X.692 (2021) | ISO/IEC 8825-3:2021, *Information technology – ASN.1 encoding rules: Specification of Encoding Control Notation (ECN)*.
- Recommendation ITU-T X.891 (2005) | ISO/IEC 24824-1:2007, *Information technology – Generic applications of ASN.1: Fast infoset*.

NOTE – The references above shall be interpreted as references to the identified Recommendations | International Standards together with all their published amendments and technical corrigenda.

2.2 Additional references

- IETF RFC 2045 (1996), *Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies*.
- IETF RFC 2141 (1997), *URN Syntax*.
- IETF RFC 2396 (1998), *Uniform Resource Identifiers (URI): Generic Syntax*.
- IETF RFC 3061 (2001), *A URN Namespace of Object Identifiers*.
- ISO/IEC 10646:2003, *Information technology – Universal Multiple-Octet Coded Character Set (UCS)*.
- The Unicode Standard, Version 3.2.0, The Unicode Consortium. (Reading, MA, Addison-Wesley)
 - NOTE 1 – The graphics characters (and their encodings) defined by the above reference are identical to those defined by ISO/IEC 10646, but the above reference is included because it also specifies the names of control characters.
- W3C XML 1.0:2008, *Extensible Markup Language (XML) 1.0 (Fifth Edition)*, W3C Recommendation, Copyright ©2008 W3C® (MIT, ERCIM, Keio), <https://www.w3.org/TR/2008/REC-xml-20081126/>.
- W3C XML Namespaces:1999, *Namespaces in XML*, W3C Recommendation, Copyright © 1999 W3C (MIT, INRIA, Keio), <http://www.w3.org/TR/1999/REC-xml-names-19990114>.

NOTE – The reference to a document within this Recommendation | International Standard does not give it, as a stand-alone document, the status of a Recommendation or International Standard.

3 Definitions

For the purposes of this Recommendation | International Standard, the definitions of Rec. ITU-T X.680 | ISO/IEC 8824-1 and the following definitions apply.

3.1 ASN.1 Basic Encoding Rules (BER)

This Recommendation | International Standard makes use of the following terms defined in Rec. ITU-T X.690 | ISO/IEC 8825-1:

- a) data value;
- b) dynamic conformance;
- c) encoding (of a data value);
- d) receiver;
- e) sender;
- f) static conformance.

3.2 Additional definitions

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

3.2.1 ASN.1 schema: The definition of the content and structure of data using an ASN.1 type definition.

NOTE – This enables encoding rules to produce binary encodings of the values of an ASN.1 type, or encodings using XML.

3.2.2 associated empty-element tag: The XML empty-element tag that can replace an associated preceding tag and an associated following tag, when present.

NOTE – Some encoding instructions remove the associated tags of an "XMLValue".

3.2.3 associated encoding instructions (for a type): A set of XER encoding instructions associated with a type.