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Information technology — ASN.1 encoding rules —

Part 1: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)

Technologies de l'information — Règles de codage ASN.1 —

Partie 1: Spécification des règles de codage de base (BER), des règles de codage canoniques (CER) et des règles de codage distinctives (DER)

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This sixth edition cancels and replaces the fifth edition (ISO/IEC 8825-1:2015), which has been technically revised.

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

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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 (Abstract Syntax Notation One or ASN.1) together specify a notation for the definition of abstract syntaxes, enabling application standards to define the types of information they need to transfer. It also specifies a notation for the specification of values of a defined type.

This Recommendation | International Standard defines encoding rules that may be applied to values of types defined using the ASN.1 notation. 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 may be more than one set of encoding rules that can be applied to values of types that are defined using the ASN.1 notation. This Recommendation | International Standard defines three sets of encoding rules, called *basic encoding rules*, *canonical encoding rules* and *distinguished encoding rules*. Whereas the basic encoding rules give the sender of an encoding various choices as to how data values may be encoded, the canonical and distinguished encoding rules select just one encoding from those allowed by the basic encoding rules, eliminating all of the sender's options. The canonical and distinguished encoding rules differ from each other in the set of restrictions that they place on the basic encoding rules.

The distinguished encoding rules is more suitable than the canonical encoding rules if the encoded value is small enough to fit into the available memory and there is a need to rapidly skip over some nested values. The canonical encoding rules is more suitable than the distinguished encoding rules if there is a need to encode values that are so large that they cannot readily fit into the available memory or it is necessary to encode and transmit a part of a value before the entire value is available. The basic encoding rules is more suitable than the canonical or distinguished encoding rules if the encoding contains a set value or set-of value and there is no need for the restrictions that the canonical and distinguished encoding rules impose. This is due to the memory and CPU overhead that the latter encoding rules exact in order to guarantee that set values and set-of values have just one possible encoding.

Annex A gives an example of the application of the basic encoding rules. It does not form an integral part of this Recommendation | International Standard.

Annex B summarizes the assignment of object identifier and OID internationalized resource identifier values made in this Recommendation | International Standard. It does not form an integral part of this Recommendation | International Standard.

Annex C gives examples of applying the basic encoding rules for encoding reals. It does not form an integral part of this Recommendation | International Standard.

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INTERNATIONAL STANDARD
ITU-T RECOMMENDATION

Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)

1 Scope

This Recommendation | International Standard specifies a set of basic encoding rules that may be used to derive the specification of a transfer syntax for values of types defined using the notation specified in 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, and Rec. ITU-T X.683 | ISO/IEC 8824-4, collectively referred to as Abstract Syntax Notation One or ASN.1. These basic encoding rules are also to be applied for decoding such a transfer syntax in order to identify the data values being transferred. It also specifies a set of canonical and distinguished encoding rules that restrict the encoding of values to just one of the alternatives provided by the basic encoding rules.

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. It cannot be applied using later versions of this standard.

2.1 Identical Recommendations | International Standards

- Recommendation ITU-T X.200 (1994) | ISO/IEC 7498-1: 1994, *Information technology – Open Systems Interconnection – Basic Reference Model: The basic model*.
- 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.*

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

- ISO *International Register of Coded Character Sets to be used with Escape Sequences.*
- ISO/IEC 2022:1994, *Information technology – Character code structure and extension techniques.*
- ISO/IEC 2375:2003, *Information technology – Procedure for registration of escape sequences and coded character sets*.

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- ISO 6093:1985, *Information processing – Representation of numerical values in character strings for information interchange.*
- ISO/IEC 6429:1992, *Information technology – Control functions for coded character sets.*
- ISO/IEC 10646:2003, *Information technology – Universal Multiple-Octet Coded Character Set (UCS).*

3 Definitions

For the purposes of this Recommendation | International Standard, the definitions of Rec. ITU-T X.200 | ISO/IEC 7498-1 and Rec. ITU-T X.680 | ISO/IEC 8824-1 and the following definitions apply.

3.1 canonical encoding: A complete encoding of an abstract value obtained by the application of encoding rules that have no implementation-dependent options. Such rules result in the definition of a 1-1 mapping between unambiguous and unique encodings and values in the abstract syntax.

3.2 constructed encoding: A data value encoding in which the contents octets are the complete encoding of one or more data values.

3.3 contents octets: That part of a data value encoding which represents a particular value, to distinguish it from other values of the same type.

3.4 data value: Information specified as the value of a type; the type and the value are defined using ASN.1.

3.5 dynamic conformance: A statement of the requirement for an implementation to adhere to the prescribed behaviour in an instance of communication.

3.6 encoding (of a data value): The complete sequence of octets used to represent the data value.

3.7 end-of-contents octets: Part of a data value encoding, occurring at its end, which is used to determine the end of the encoding.

NOTE – Not all encodings require end-of-contents octets.

3.8 identifier octets: Part of a data value encoding which is used to identify the type of the value.

NOTE – Some ITU-T Recommendations use the term "data element" for this sequence of octets, but the term is not used in this Recommendation | International Standard, as other Recommendations | International Standards use it to mean "data value".

3.9 length octets: Part of a data value encoding following the identifier octets which is used to determine the end of the encoding.

3.10 primitive encoding: A data value encoding in which the contents octets directly represent the value.

3.11 receiver: An implementation decoding the octets produced by a sender, in order to identify the data value which was encoded.

3.12 sender: An implementation encoding a data value for transfer.

3.13 static conformance: A statement of the requirement for support by an implementation of a valid set of features from among the defined features.

3.14 trailing 0 bit: A 0 in the last position of a bitstring value.

NOTE – The 0 in a bitstring value consisting of a single 0 bit is a trailing 0 bit. Its removal produces an empty bitstring.

4 Abbreviations

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

ASN.1 Abstract Syntax Notation One

BER Basic Encoding Rules of ASN.1

CER Canonical Encoding Rules of ASN.1

DER Distinguished Encoding Rules of ASN.1

ULA Upper Layer Architecture

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