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Information technology — Open Systems Interconnection — Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1)

*Technologies de l'information — Interconnexion de systèmes ouverts —
Spécification de règles de base pour coder la notation de syntaxe abstraite numéro
UNE (ASN.1)*



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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

International Standard ISO/IEC 8825 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.

This second edition cancels and replaces the first edition (ISO 8825 : 1987), which has been technically revised.

Annexes A, B and C are for information only.

Introduction

ISO/IEC 8824 (Specification of Abstract Syntax Notation One) specifies a notation for the definition of abstract syntaxes, enabling application layer standards to define the types of information they need to transfer using the presentation service. It also specifies a notation for the specification of values of a defined type.

This International Standard defines a set of encoding rules that may be applied to values of types defined using the notation specified in ISO/IEC 8824. 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 notation of ISO/IEC 8824. This International Standard defines one set of encoding rules, called **basic encoding rules**.

This International Standard is technically aligned with CCITT Recommendation X.209(1988).

Annex A gives examples of the application of the encoding rules. It is not part of this International Standard.

Annex B summarizes the assignment of object identifier values made in this International Standard and is not part of this International Standard.

Annex C gives examples of applying the rules for encoding reals. It is not part of this International Standard.

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Information technology — Open Systems Interconnection — Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1)

1 Scope

This 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 ISO/IEC 8824. These basic encoding rules are also to be applied for decoding such a transfer syntax in order to identify the data values being transferred.

These basic encoding rules are used at the time of communication (by the presentation service provider when required by a presentation context).

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards

ISO 2022: 1986, *Information processing - ISO 7-bit and 8-bit coded character sets - Code extension techniques*.

ISO 2375: 1985, *Data processing - Procedure for registration of escape sequences*.

ISO 6093: 1985, *Information processing - Representation of numerical values in character strings for information interchange*.

ISO 7498:1984, *Information processing systems - Open Systems Interconnection - Basic Reference Model*.

ISO 8823: 1988, *Information processing systems - Open Systems Interconnection - Connection-oriented presentation protocol specification*.

ISO/IEC 8824:1990, *Information technology — Open Systems Interconnection — Specification of Abstract Syntax Notation One (ASN.1)*.

CCITT X.209 (1988), *Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1)*.

3 Definitions

For the purposes of this International Standard the definitions of ISO 7498, of ISO/IEC 8824 and the following definitions apply.

3.1 dynamic conformance: A statement of the requirement for an implementation to adhere to the behaviour prescribed by this International Standard in an instance of communication.

3.2 static conformance: A statement of the requirement for support by an implementation of a valid set of features from among those defined by this International Standard.

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

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

NOTE — Some CCITT Recommendations use the term "data element" for this sequence of octets, but the term is not used in this International Standard, as other International Standards use it to mean "data value".

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

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

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

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

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

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

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

4 Abbreviations and notation

4.1 Abbreviations

ASN.1 Abstract Syntax Notation One

4.2 Notation

4.2.1 This International Standard references the notation defined by ISO/IEC 8824.

4.2.2 This International Standard specifies the value of each octet in an encoding by use of the terms "most significant bit" and "least significant bit".

NOTE — Lower layer specifications use the same notation to define the order of bit transmission on a serial line, or the assignment of bits to parallel channels.

4.2.3 For the purposes of this International Standard only, the bits of an octet are numbered from 8 to 1, where bit 8 is the "most significant bit", and bit 1 is the "least significant bit".

5 Conformance

5.1 Dynamic conformance is specified by clause 6 to clause 23 inclusive.

5.2 Static conformance is specified by those standards which specify the application of these basic encoding rules.

5.3 Alternative encodings are permitted by this International Standard as a sender's option. Conforming receivers shall support all alternatives.

NOTE — Examples of such alternative encodings appear in 6.3.2 b) and table 2.

6 General rules for encoding

6.1 Structure of an encoding

6.1.1 The encoding of a data value shall consist of four components which shall appear in the following order:

- a) identifier octets (see 6.2);
- b) length octets (see 6.3);
- c) contents octets (see 6.4);
- d) end-of-contents octets (see 6.5).

6.1.2 The end-of-contents octets shall not be present unless the value of the length octets requires them to be present (see 6.3).

6.1.3 Figure 1 illustrates the structure of an encoding (primitive or constructed). Figure 2 illustrates an alternative constructed encoding.

6.2 Identifier octets

6.2.1 The identifier octets shall encode the ASN.1 tag (class and number) of the type of the data value.

6.2.2 For tags with a number ranging from zero to 30 (inclusive), the identifier octets shall comprise a single octet encoded as follows:

- a) bits 8 and 7 shall be encoded to represent the class of the tag as specified in table 1.
- b) bit 6 shall be a zero or a one according to the rules of 6.2.5;
- c) bits 5 to 1 shall encode the number of the tag as a binary integer with bit 5 as the most significant bit.

6.2.3 Figure 3 illustrates the form of an identifier octet for a type with a tag whose number is in the range zero to 30 (inclusive).

6.2.4 For tags with a number greater than or equal to 31, the identifier shall comprise a leading octet followed by one or more subsequent octets.

6.2.4.1 The leading octet shall be encoded as follows:

- a) bits 8 and 7 shall be encoded to represent the class of the tag as listed in table 1;
- b) bit 6 shall be a zero or a one according to the rules of 6.2.5;
- c) bits 5 to 1 shall be encoded as 11111₂

6.2.4.2 The subsequent octets shall encode the number of the tag as follows:

- a) bit 8 of each octet shall be set to one unless it is the last octet of the identifier octets;
- b) bits 7 to 1 of the first subsequent octet, followed by bits 7 to 1 of the second subsequent octet, followed in turn by bits 7 to 1 of each further octet, up to and including the last subsequent octet in the identifier octets shall be the encoding of an unsigned binary integer equal to the tag number, with bit 7 of the first subsequent octet as the most significant bit;
- c) bits 7 to 1 of the first subsequent octet shall not all be zero.

6.2.4.3 Figure 4 illustrates the form of the identifier octets for a type with a tag whose number is greater than 30.

6.2.5 Bit 6 shall be set to zero if the encoding is primitive, and shall be set to one if the encoding is constructed.

NOTE — Subsequent clauses specify whether the encoding is primitive or constructed for each type.

6.2.6 ISO/IEC 8824 specifies that the tag of a type defined using the "CHOICE" keyword takes the value of the tag of the type from which the chosen data value is taken.

6.2.7 ISO/IEC 8824 specifies that the tag of a type defined using "ANY" is indeterminate. The "ANY" type is subsequently defined to be an ASN.1 type, and the complete encoding is then identical to that of a value of the assigned type (including the identifier octets).