
**Information technology — ASN.1
encoding rules: Specification of
Encoding Control Notation (ECN)**

*Technologies de l'information — Règles de codage ASN.1:
Spécification de la notation de contrôle de codage (ECN)*

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SERIES X: DATA NETWORKS, OPEN SYSTEM
COMMUNICATIONS AND SECURITY

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Notation One (ASN.1)

**Information technology – ASN.1 encoding rules:
Specification of Encoding Control Notation
(ECN)**

Recommendation ITU-T X.692

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For further details, please refer to the list of ITU-T Recommendations.

**Information technology – ASN.1 encoding rules:
Specification of Encoding Control Notation (ECN)**

Summary

Recommendation ITU-T X.692 | ISO/IEC 8825-3 defines the Encoding Control Notation (ECN) used to specify encodings (of ASN.1 types) that differ from those provided by standardized encoding rules such as the Basic Encoding Rules (BER) and the Packed Encoding Rules (PER).

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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.

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Introduction

The Encoding Control Notation (ECN) is a notation for specifying encodings of ASN.1 types that differ from those provided by standardized encoding rules. ECN can be used to encode all types of an ASN.1 specification, but can also be used with standardized encoding rules such as BER or PER (Rec. ITU-T X.690 | ISO/IEC 8825-1 and Rec. ITU-T X.691 | ISO/IEC 8825-2) to specify only the encoding of types that have special requirements.

An ASN.1 type specifies a set of abstract values. Encoding rules specify the representation of these abstract values as a series of bits. ECN is designed to meet the following encoding needs:

- a) The need to write ASN.1 types (and get the support of ASN.1 tools in implementations) for established ("legacy") protocols where the encoding is already determined and differs from all standardized encoding rules.
- b) The need to produce encodings that are minor variations on standardized rules.

The linkage provided in an ECN specification to an ASN.1 specification is well-defined and machine processable, so encoders and decoders can be automatically generated from the combined specifications. This is a significant factor in reducing both the amount of work and the possibility of errors in making interoperable systems. Another significant advantage is the ability to provide automatic tool support for testing.

These advantages are available with ASN.1 alone when standardized encoding rules suffice, but the ECN work provides these advantages in circumstances where the standardized encoding rules are not sufficient.

NOTE 1 – Currently ECN support only binary-based encodings, but could be extended in the future to cover character-based encodings.

Annex A forms an integral part of this Recommendation | International Standard, and details modifications to be made to Rec. ITU-T X.680 | ISO/IEC 8824-1 to support the notation used in this Recommendation | International Standard.

Annex B forms an integral part of this Recommendation | International Standard, and details modifications to be made to Rec. ITU-T X.681 | ISO/IEC 8824-2 to support the notation used in this Recommendation | International Standard.

Annex C forms an integral part of this Recommendation | International Standard, and details modifications to be made to Rec. ITU-T X.683 | ISO/IEC 8824-4 to support the notation used in this Recommendation | International Standard.

NOTE 2 – It is not intended that Annexes A, B and C be progressed as amendments to the referenced Recommendations | International Standards. The modifications are solely for the purpose of ECN definition (see clause 5 and 9.28).

Annex D does not form an integral part of this Recommendation | International Standard, and contains examples of the use of ECN.

Annex E does not form an integral part of this Recommendation | International Standard and provides more detail on the support for Huffman encodings in ECN.

Annex F does not form an integral part of this Recommendation | International Standard, and identifies a Web site providing access to further information and links relevant to ECN.

Annex G does not form an integral part of this Recommendation | International Standard, and provides a summary of ECN using the notation of clause 5.

**INTERNATIONAL STANDARD
ITU-T RECOMMENDATION**

**Information technology –
ASN.1 encoding rules:
Specification of Encoding Control Notation (ECN)**

1 Scope

This Recommendation | International Standard defines a notation for specifying encodings of ASN.1 types or of parts of types.

It provides several mechanisms for such specification, including:

- direct specification of the encoding using standardized notation;
- specification of the encoding by reference to standardized encoding rules;
- specification of the encoding of an ASN.1 type by reference to an encoding structure;
- specification of the encoding using non-ECN notation.

It also provides the means to link the specification of encodings to the type definitions to which they are to be applied.

ECN does not currently provide any support for specifications using the OID internationalized resource identifier type or the relative OID internationalized resource identifier type (see Rec. ITU-T X.680 | ISO/IEC 8824-1), and these are not referred to further in this Standard.

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 International 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.660 (2011) | ISO/IEC 9834-1:2012, *Information technology – Open Systems Interconnection – Procedures for the operation of OSI Registration Authorities: General procedures and top arcs of the international object identifier tree.*
- 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)*.

NOTE 1 – Notwithstanding the ISO publication date, the above specifications are normally referred to as "ASN.1:2015".

NOTE 2 – The above references 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/IEC 10646:2003, *Information technology – Universal Multiple-Octet Coded Character Set (UCS)*.

NOTE – The above reference shall be interpreted as a reference to ISO/IEC 10646 together with all its published amendments and technical corrigenda.

3 Definitions

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

3.1 ASN.1 definitions

This Recommendation | International Standard uses the terms defined in clause 3 of 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, Rec. ITU-T X.690 | ISO/IEC 8825-1 and Rec. ITU-T X.691 | ISO/IEC 8825-2.

3.2 ECN-specific definitions

3.2.1 alignment point: The point in an encoding (usually its start) which serves as a reference point when an encoding specification requires alignment to some boundary.

3.2.2 auxiliary field: A field of a replacement structure (that is added in the ECN specification) whose value is set directly by the encoder without the use of any abstract value provided by the application.

NOTE – An example of an auxiliary field is a length determinant for an integer encoding or for a repetition.

3.2.3 bit-field: Contiguous bits or octets in an encoding which are decoded as a whole, and which either represent an abstract value, or provide information (such as a length determinant for some other field – see 3.2.31) needed for successful decoding, or both.

NOTE – It is in legacy protocols that "or both" sometimes occurs.

3.2.4 bit-field class: An encoding class whose objects specify the encoding of abstract values (of some ASN.1 type) into bits.

NOTE – Other encoding classes are concerned with more general encoding procedures, such as those required to determine the end of repetitions of bit-field class encodings, or to determine which of a set of alternative bit-field encodings is present.

3.2.5 bounds condition: A condition on the existence of bounds of an integer field (and whether they allow negative values or not) which, if satisfied, means that specified encoding rules are to be applied.

3.2.6 choice determinant: A bit-field which determines which of several possible encodings (each representing different abstract values) is present in some other bit-field.

3.2.7 combined encoding object set: A temporary set of encoding objects produced by the combination of two sets of encoding objects for the purpose of applying encodings.

3.2.8 conditional encoding: An encoding which is to be applied only if some specified condition is satisfied.

NOTE – The condition may be a bounds condition or a size range condition, or other more complex conditions.

3.2.9 containing type: An ASN.1 type (or encoding structure field) where a contents constraint has been applied to the values of that type (or to the values associated with that encoding structure field).

NOTE – The ASN.1 types to which a contents constraint (using **CONTAINING/ENCODED BY**) can be applied are the bitstring and the octetstring types.

3.2.10 current application point: The point in an encoding structure at which a combined encoding object set is being applied.

3.2.11 differential encoding-decoding: The specification of rules for a decoder that require the acceptance of encodings that cannot be produced by an encoder conforming to the current specification.

NOTE – Differential encoding-decoding supports the specification of decoding by a decoder (conforming to an initial version of a standard) which is intended to enable it to successfully decode encodings produced by a later version of that standard. This is sometimes referred to as support for extensibility.