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Part 1: Specification of basic notation

Technologies de l'information — Notation de syntaxe abstraite numéro un (ASN.1) —

Partie 1: Spécification de la notation de base

Reference number
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A list of all parts in the ISO/IEC 8824 series can be found on the ISO and IEC websites.

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Introduction

This Recommendation | International Standard presents a standard notation for the definition of data types and values. A *data type* (or *type* for short) is a category of information (for example, numeric, textual, still image or video information). A *data value* (or *value* for short) is an instance of such a type. This Recommendation | International Standard defines several basic types and their corresponding values, and rules for combining them into more complex types and values.

In some protocol architectures, each message is specified as the binary value of a sequence of octets. However, standards-writers need to define quite complex data types to carry their messages, without concern for their binary representation. In order to specify these data types, they require a notation that does not necessarily determine the representation of each value. ASN.1 is such a notation. This notation is supplemented by the specification of one or more algorithms called *encoding rules* that determine the value of the octets that carry the application semantics (called the *transfer syntax*). Rec. ITU-T X.690 | ISO/IEC 8825-1, Rec. ITU-T X.691 | ISO/IEC 8825-2 and Rec. ITU-T X.693 | ISO/IEC 8825-4 specify three families of standardized encoding rules, called *Basic Encoding Rules (BER)*, *Packed Encoding Rules (PER)*, and *XML Encoding Rules (XER)*.

Some users wish to redefine their legacy protocols using ASN.1, but cannot use standardized encoding rules because they need to retain their existing binary representations. Other users wish to have more complete control over the exact layout of the bits on the wire (the transfer syntax). These requirements are addressed by Rec. ITU-T X.692 | ISO/IEC 8825-3 which specifies an *Encoding Control Notation (ECN)* for ASN.1. ECN enables designers to formally specify the abstract syntax of a protocol using ASN.1, but to then (if they so wish) take complete or partial control of the bits on the wire by writing an accompanying ECN specification (which may reference standardized Encoding Rules for some parts of the encoding).

A very general technique for defining a complicated type at the abstract level is to define a small number of *simple types* by defining all possible values of the simple types, then combining these simple types in various ways. Some of the ways of defining new types are as follows:

a) given an (ordered) list of existing types, a value can be formed as an (ordered) sequence of values, one from each of the existing types; the collection of all possible values obtained in this way is a new type (if the existing types in the list are all distinct, this mechanism can be extended to allow omission of some values from the list);

b) given an unordered set of (distinct) existing types, a value can be formed as an (unordered) set of values, one from each of the existing types; the collection of all possible unordered sets of values obtained in this way is a new type (the mechanism can again be extended to allow omission of some values);

c) given a single existing type, a value can be formed as an (ordered) list or (unordered) set of zero, one or more values of the existing type; the collection of all possible lists or sets of values obtained in this way is a new type;

d) given a list of (distinct) types, a value can be chosen from any one of them; the set of all possible values obtained in this way is a new type;

e) given a type, a new type can be formed as a subset of it by using some structure or order relationship among the values.

An important aspect of combining types in this way is that encoding rules should recognize the combining constructs, providing unambiguous encodings of the collection of values of the basic types. Thus, every basic type defined using the notation specified in this Recommendation | International Standard is assigned a *tag* to aid in the unambiguous encoding of values.

Tags are mainly intended for machine use, and are not essential for the human notation defined in this Recommendation | International Standard. Where, however, it is necessary to require that certain types be distinct, this is expressed by requiring that they have distinct tags. The allocation of tags is therefore an important part of the use of this notation, but (since 1994) it is possible to specify the automatic allocation of tags.

NOTE 1 – Within this Recommendation | International Standard, tag values are assigned to all simple types and construction mechanisms. The restrictions placed on the use of the notation ensure that tags can be used in transfer for unambiguous identification of values.

It is also possible to assign encoding instructions to a type in order to affect the encoding of that type. This can be done either by a type prefix placed before a type definition or use of a type reference, or by an encoding control section placed at the end of an ASN.1 module. The generic syntax of type prefixes and encoding control sections is specified in this Recommendation | International Standard, and includes an encoding reference to identify the encoding rules that are modified by the encoding instruction. The semantics and detailed syntax of encoding instructions are specified in the encoding rules Recommendation | International Standard identified by the encoding reference.

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An ASN.1 specification will initially be produced with a set of fully defined ASN.1 types. At a later stage, however, it may be necessary to change those types (usually by the addition of extra components in a sequence or set type). If this is to be possible in such a way that implementations using the old type definitions can interwork with implementations using the new type definitions in a defined way, encoding rules need to provide appropriate support. The ASN.1 notation supports the inclusion of an *extension marker* on a number of types. This signals to encoding rules the intention of the designer that this type is one of a series of related types (i.e., versions of the same initial type) called an *extension series*, and that the encoding rules are required to enable information transfer between implementations using different types that are related by being part of the same extension series.

Clauses 11 to 33 (inclusive) define the simple types supported by ASN.1, and specify the notation to be used for referencing simple types and for defining new types using them. Clauses 11 to 33 also specify notations to be used for specifying values of types defined using ASN.1. Two value notations are provided. The first is called the basic ASN.1 value notation, and has been part of the ASN.1 notation since its first introduction. The second is called the XML ASN.1 Value Notation, and provides a value notation using Extensible Markup Language (XML).

NOTE 2 – The XML Value Notation provides a means of representing ASN.1 values using XML. Thus, an ASN.1 type definition also specifies the structure and content of an XML element. This makes ASN.1 a simple schema language for XML.

Clauses 36 to 37 (inclusive) define the types supported by ASN.1 for carrying within them the complete encoding of ASN.1 types.

Clause 38 and Annex B define the types that provide support for ISO 8601.

Clauses 39 to 44 (inclusive) define the character string types.

Clauses 45 to 48 (inclusive) define certain types which are considered to be of general utility, but which require no additional encoding rules.

Clauses 49 to 51 (inclusive) define a notation which enables subtypes to be defined from the values of a parent type.

Clause 52 defines a notation which allows ASN.1 types specified in a "version 1" specification to be identified as likely to be extended in "version 2", and for additions made in subsequent versions to be separately listed and identified with their version number.

Clause 53 defines a notation which allows ASN.1 type definitions to contain an indication of the intended error handling if encodings are received for values which lie outside those specified in the current standardized definition.

Annex A forms an integral part of this Recommendation | International Standard, and specifies ASN.1 regular expressions.

Annex B forms an integral part of this Recommendation | International Standard, and defines an ASN.1 module containing the definition of a set of time types providing the full functionality of ISO 8601. These types can be imported from this ASN.1 module by an application designer if the useful time types specified in clause 38 are not adequate for the application.

Annex C forms an integral part of this Recommendation | International Standard, and specifies rules for type and value compatibility.

Annex D forms an integral part of this Recommendation | International Standard, and records object identifier and object descriptor values assigned in the ASN.1 series of Recommendations | International Standards.

Annex E forms an integral part of this Recommendation | International Standard and specifies the currently defined encoding references and the Recommendation | International Standard that defines the semantics and detailed syntax of encoding instructions with those encoding references.

Annex F does not form an integral part of this Recommendation | International Standard, and references the specification of the top-level arcs of the International Object Identifier tree and the use of that tree to form an OID internationalized resource identifier which can be used as an IRI or URI registered as the "oid" scheme with IANA.

Annex G does not form an integral part of this Recommendation | International Standard, and provides examples and hints on the use of the ASN.1 notation.

Annex H does not form an integral part of this Recommendation | International Standard, and provides a tutorial on ASN.1 character strings.

Annex I does not form an integral part of this Recommendation | International Standard, and provides a tutorial on the ASN.1 model of type extension.

Annex J does not form an integral part of this Recommendation | International Standard and provides a tutorial introduction to ISO 8601 and to the **TIME** type. It is recommended that this be read before the normative text.

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Annex K does not form an integral part of this Recommendation | International Standard and provides information on how to identify the time properties of an abstract value from an instance of value notation.

Annex L does not form an integral part of this Recommendation | International Standard, and provides a summary of ASN.1 using the notation of clause 5.

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INTERNATIONAL STANDARD
ITU-T RECOMMENDATION

Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation

1 Scope

This Recommendation | International Standard provides a standard notation called Abstract Syntax Notation One (ASN.1) that is used for the definition of data types, values, and constraints on data types.

This Recommendation | International Standard:

- defines a number of simple types, with their tags, and specifies a notation for referencing these types and for specifying values of these types;
- defines mechanisms for constructing new types from more basic types, and specifies a notation for defining such types and assigning them tags, and for specifying values of these types;
- defines character sets (by reference to other Recommendations and/or International Standards) for use within ASN.1.

The ASN.1 notation can be applied whenever it is necessary to define the abstract syntax of information.

The ASN.1 notation is referenced by other standards which define encoding rules for the 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.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 ASN.1 International Object Identifier tree*.
- 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.693 (2021) | ISO/IEC 8825-4:2021, *Information technology – ASN.1 encoding rules: XML Encoding Rules (XER)*.

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– Recommendation ITU-T X.695 (2021) | ISO/IEC 8825-6:2021, *Information technology – ASN.1 encoding rules: Registration and application of PER encoding instructions*.

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

– Recommendation ITU-R TF.460-6 (2002), *Standard-frequency and time-signal emissions.*

– CCITT Recommendation T.100 (1988), *International information exchange for interactive Videotex.*

– Recommendation ITU-T T.101 (1994), *International interworking for Videotex services.*

– ISO *International Register of Coded Character Sets to be used with Escape Sequences*.

– ISO/IEC 646:1991, *Information technology – ISO 7-bit coded character set for information interchange*.

– ISO/IEC 2022:1994, *Information technology – Character code structure and extension techniques*.

– ISO/IEC 6523:1998, *Data interchange – Structures for the identification of organizations and organization parts*.

– ISO/IEC 7350:1991, *Information technology – Registration of repertoires of graphic characters from ISO/IEC 10367*.

– ISO 8601:2019, *Date and time – Representations for information interchange*.

– ISO/IEC 10646:2003, *Information technology – Universal Multiple-Octet Coded Character Set (UCS)*.

– The Unicode Standard, Version 3.2.0:2002. The Unicode Consortium. (Reading, MA, Addison-Wesley)

NOTE 1 – The above reference is included because it provides names for control characters and specifies categories of characters.

– W3C XML 1.0:2008, *Extensible Markup Language (XML) 1.0 (Fifth Edition), W3C Recommendation, Copyright ©2008 W3C, (MIT, ERCIM, Keio),* http://www.w3.org/TR/2008/REC-xml-20081126/.

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 following definitions apply.

3.1 International Object Identifier tree specification

This Recommendation | International Standard uses the following terms defined in Rec. ITU-T X.660 | ISO/IEC 9834-1:

a) integer-valued Unicode label;

b) international object identifier tree;

c) OID internationalized resource identifier;

d) long arc;

e) object identifier;

f) primary integer value;

g) secondary identifier;

h) Unicode label.

3.2 Information object specification

This Recommendation | International Standard uses the following terms defined in Rec. ITU-T X.681 | ISO/IEC 8824-2:

a) information object;

b) information object class;

c) information object set;

d) instance-of type;

e) object class field type.

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3.3 Constraint specification

This Recommendation | International Standard uses the following terms defined in Rec. ITU-T X.682 | ISO/IEC 8824-3:

a) component relation constraint;

b) table constraint.

3.4 Parameterization of ASN.1 specification

This Recommendation | International Standard uses the following terms defined in Rec. ITU-T X.683 | ISO/IEC 8824-4:

a) parameterized type;

b) parameterized value.

3.5 Structure for identification of organizations

This Recommendation | International Standard uses the following terms defined in ISO/IEC 6523:

a) issuing organization;
b) organization code;
c) International Code Designator.

3.6 Universal Multiple-Octet Coded Character Set (UCS)

This Recommendation | International Standard uses the following terms defined in ISO/IEC 10646:

a) Basic Multilingual Plane (BMP);
b) cell;
c) combining character;
d) graphic symbol;
e) group;
f) limited subset;
g) plane;
h) row;
i) selected subset.

3.7 Representation of dates and times

This Recommendation | International Standard uses the following terms defined in ISO 8601:

a) basic format;

b) calendar date;

c) common year;

d) duration;

e) extended format;

f) Gregorian calendar;

g) instant;

h) leap second;

i) leap year;

j) local time of day;

k) ordinal date;

l) recurring time interval

m) time axis;

n) time interval;

o) time;

p) time-scale;

q) UTC;

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r) week date.

3.8 Additional definitions

3.8.1 abstract character: An abstract value which is used for the organization, control or representation of textual data.

NOTE – Annex H provides a more complete description of the term abstract character.

3.8.2 abstract value: A value whose definition is based only on the type used to carry some semantics, independently of how it is represented in any encoding.

NOTE – Examples of abstract values are the values of the integer type, the boolean type, a character string type, or of a type which is a sequence (or a choice) of an integer and a boolean.

3.8.3 additional time type: A type defined as a subtype of the time type (see 3.8.83) by applying the property setting subtype notation to the time type or to a useful or defined time type.

3.8.4 ASN.1 character set: The set of characters, specified in clause 11, used in the ASN.1 notation.

3.8.5 ASN.1 specification: A collection of one or more ASN.1 modules.

3.8.6 associated type: A type which is used only for defining the value and subtype notation for a type.

NOTE – Associated types are defined in this Recommendation | International Standard when it is necessary to make it clear that there may be a significant difference between how the type is defined in ASN.1 and how it is encoded. Associated types do not appear in user specifications.

3.8.7 bitstring type: A simple type whose distinguished values are an ordered sequence of zero, one or more bits.

NOTE – Where there is a need to carry embedded encodings of an abstract value, the use of a bitstring (or an octetstring) type without a contents constraint (see Rec. ITU-T X.682 | ISO/IEC 8824-3, clause 11) is deprecated. Otherwise, the use of the embedded-pdv type (see clause 36) provides a more flexible mechanism, allowing the announcement of the abstract syntax and of the encoding of the abstract value that is embedded.

3.8.8 boolean type: A simple type with two distinguished values.

3.8.9 character property: The set of information associated with a cell in a table defining a character repertoire.

NOTE – The information will normally include some or all of the following items:

a) a graphic symbol;
b) a character name;
c) the definition of functions associated with the character when used in particular environments;
d) whether it represents a digit;
e) an associated character differing only in (upper/lower) case.

3.8.10 character abstract syntax: Any abstract syntax whose values are specified as the set of character strings of zero, one or more characters from some specified collection of characters.

3.8.11 character repertoire: The characters in a character set without any implication on how such characters are encoded.

3.8.12 character string types: Simple types whose values are strings of characters from some defined character set.

3.8.13 character transfer syntax: Any transfer syntax for a character abstract syntax.

3.8.14 choice types: Types defined by referencing a list of distinct types; each value of the choice type is derived from the value of one of the component types.

3.8.15 component type: One of the types referenced when defining a **`CHOICE`**, **`SET`**, **`SEQUENCE`**, **`SET OF`**, or **`SEQUENCE OF`**.

3.8.16 constraint: A notation which can be used in association with a type, to define a subtype of that type.

3.8.17 contents constraint: A constraint on a bit string or octet string type that specifies either that the contents are to be an encoding of a specified ASN.1 type, or that specified procedures are to be used to produce and process the contents.

3.8.18 control characters: Characters appearing in some character repertoires that have been given a name (and perhaps a defined function in relation to certain environments) but which have not been assigned a graphic symbol, and which are not spacing characters.

NOTE – HORIZONTAL TABULATION (9) and LINE FEED (10) are examples of control characters that have been assigned a formatting function in a printing environment. DATA LINK ESCAPE (16) is an example of a control character that has been assigned a function in a communication environment.

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3.8.19 Coordinated Universal Time (UTC): The time scale maintained by the Bureau International de l'Heure (International Time Bureau) that forms the basis of a coordinated dissemination of standard frequencies and time signals.

NOTE 1 – The source of this definition is Rec. ITU-R TF.460-5. ITU-R has also defined the acronym for Coordinated Universal Time as UTC.

NOTE 2 – UTC and Greenwich Mean Time (GMT) are two alternative time standards which for most practical purposes determine the same time.

3.8.20 default encoding reference (for a module): An encoding reference that is specified in the module header and is assumed in all type prefixes which do not contain an encoding reference.

NOTE – If a default encoding reference is not specified in the module header, then all type prefixes which do not contain an encoding reference are assigning tags.

3.8.21 defined time type: A type defined in Annex B as a subtype of the time type (see 3.8.83) that is intended for importation by application designers when needed for their application.

3.8.22 element: A value of a governing type or an information object of a governing information object class, distinguable from all other values of the same type or information objects of the same class, respectively.

3.8.23 element set: A set of elements, all of which are values of a governing type, or information objects of a governing class.

NOTE – Governing class is defined in Rec. ITU-T X.681 | ISO/IEC 8824-2, 3.4.7.

3.8.24 embedded-pdv type: A type whose set of values is formally the union of the sets of values in all possible abstract syntaxes. This type can be used in an ASN.1 specification that wishes to carry in its protocol an abstract value whose type may be defined externally to that ASN.1 specification. It carries an identification of the abstract syntax (the type) of the abstract value being carried, as well as an identification of the encoding rules used to encode that abstract value.

3.8.25 encoding: The bit-pattern resulting from the application of a set of encoding rules to an abstract value.

3.8.26 encoding control section: Part of an ASN.1 module that enables encoding instructions to be assigned to types defined or used within that ASN.1 module.

3.8.27 encoding instruction: Information which can be associated with a type using a type prefix or an encoding control section, and which affects the encoding of that type by one or more ASN.1 encoding rules.

NOTE – An encoding instruction does not affect the abstract values of a type, and is not expected to be visible to an application.

3.8.28 encoding reference: A name (see Annex E) that identifies which encoding rules are affected by an encoding instruction in a type prefix or an encoding control section.

NOTE – The encoding reference **TAG** can be used to specify that a type prefix is assigning a tag rather than an encoding instruction (see 31.2).

3.8.29 (ASN.1) encoding rules: Rules which specify the representation during transfer of the values of ASN.1 types. Encoding rules also enable the values to be recovered from the representation, given knowledge of the type.

NOTE – For the purpose of specifying encoding rules, the various referenced type (and value) notations, which can provide alternative notations for built-in types (and values), are not relevant.

3.8.30 enumerated types: Simple types whose values are given distinct identifiers as part of the type notation.

3.8.31 extension addition: One of the added notations in an extension series. For set, sequence and choice types, each extension addition is the addition of either a single extension addition group or a single component type. For enumerated types it is the addition of a single further enumeration. For a constraint it is the addition of (only) one subtype element.

NOTE – Extension additions are both textually ordered (following the extension marker) and logically ordered (having increasing enumeration values, and, in the case of **CHOICE** alternatives, increasing tags).

3.8.32 extension addition group: One or more components of a set, sequence or choice type grouped within version brackets. An extension addition group is used to clearly identify the components of a set, sequence or choice type that were added in a particular version of an ASN.1 module, and can identify that version with a simple integer.

3.8.33 extension addition type: A type contained within an extension addition group or a single component type that is itself an extension addition (in such a case it is not contained within an extension addition group).

3.8.34 extensible constraint: A subtype constraint with an extension marker at the outer level, or that is extensible through the use of set arithmetic with extensible sets of values.

3.8.35 extension insertion point (or insertion point): The location within a type definition where extension additions are inserted. This location is the end of the type notation of the immediately preceding type in the extension series if there is a single ellipsis in the type definition, or immediately before the second ellipsis if there is an extension marker pair in the definition of the type.

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NOTE – There can be at most one insertion point within the components of any choice, sequence, or set type.

3.8.36 extension marker: A syntactic flag (an ellipsis) that is included in all types that form part of an extension series.

3.8.37 extension marker pair: A pair of extension markers between which extension additions are inserted.

3.8.38 extension-related: Two types that have the same extension root, where one was created by adding zero or more extension additions to the other.

3.8.39 extension root: An extensible type that is the first type in an extension series. It carries either the extension marker with no additional notation other than comments and white-space between the extension marker and the matching "}" or ")", or an extension marker pair with no additional notation other than a single comma, comments and white-space between the extension markers.

NOTE – Only an extension root can be the first type in an extension series.

3.8.40 extension series: A series of ASN.1 types which can be ordered in such a way that each successive type in the series is formed by the addition of text at the extension insertion point.

3.8.41 extensible type: A type with an extension marker, or to which an extensible constraint has been applied.

NOTE – An extension marker can be textually present or can be inserted by an EXTENSIBILITY-IMPLIED (see 13.4).

3.8.42 external reference: A type reference, value reference, information object class reference, information object reference, or information object set reference (which may be parameterized), that is defined in some other module than the one in which it is being referenced, and which is being referred to by prefixing the module name to the referenced item.

EXAMPLE – **`ModuleName.TypeReference`**

3.8.43 external type: A type which is a part of an ASN.1 specification that carries a value whose type may be defined externally to that ASN.1 specification. It also carries an identification of the type of the value being carried.

3.8.44 false: One of the distinguished values of the boolean type (see also "true").

3.8.45 governing (type); governor: A type definition or reference which affects the interpretation of a part of the ASN.1 syntax, requiring that part of the ASN.1 syntax to reference values in the governing type.

3.8.46 identical type definitions: Two instances of the ASN.1 "Type" production (see clause 17) are defined as identical type definitions if, after performing the transformations specified in Annex C, they are identical ordered lists of identical lexical items (see clause 12).

3.8.47 OID internationalized resource identifier type: The set of all OID internationalized resource identifiers.

NOTE 1 – This is a simple type whose values are a sequence of Unicode labels that identify a series of arcs leading from the root to a node of the International Object Identifier tree, as specified by the Rec. ITU-T X.660 | ISO/IEC 9834-series.

NOTE 2 – The rules of Rec. ITU-T X.660 | ISO/IEC 9834-1 permit a wide range of authorities to independently associate Unicode labels with an arc of the tree.

3.8.48 integer type: A simple type with distinguished values which are the positive and negative whole numbers, including zero (as a single value).

NOTE – When particular encoding rules limit the range of an integer, such limitations are chosen so as not to affect any user of ASN.1.

3.8.49 lexical item: A named sequence of characters from the ASN.1 character set, specified in clause 12, which is used in forming the ASN.1 notation.

3.8.50 module: One or more instances of the use of the ASN.1 notation for type, value, value set, information object class, information object, and information object set (as well as the parameterized variant of those), encapsulated using the ASN.1 module notation (see clause 13).

NOTE – The terms information object class (etc.) are specified in Rec. ITU-T X.681 | ISO/IEC 8824-2, and parameterization is specified in Rec. ITU-T X.683 | ISO/IEC 8824-4.

3.8.51 null type: A simple type consisting of a single value, also called null.

3.8.52 object: A well-defined piece of information, definition, or specification which requires a name in order to identify its use in an instance of communication.

NOTE – Such an object may be an information object as defined in Rec. ITU-T X.681 | ISO/IEC 8824-2.

3.8.53 object descriptor type: A type whose distinguished values are human-readable text providing a brief description of an object (see 3.8.52).

NOTE – An object descriptor value is usually associated with a single object. Only an object identifier value unambiguously identifies an object.

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3.8.54 object identifier type: A simple type whose values are a sequence of primary integer values that identify a series of arcs leading from the root to a node of the International Object Identifier tree, as specified by the Rec. ITU-T X.660 | ISO/IEC 9834 series.

NOTE 1 – The rules of Rec. ITU-T X.660 | ISO/IEC 9834-1 permit a wide range of authorities to independently associate a primary integer value with an arc of the tree.

NOTE 2 – In the value notation for the object identifier type (and in XML encodings of that type) it is possible to include secondary identifiers for arcs.

3.8.55 octetstring type: A simple type whose distinguished values are an ordered sequence of zero, one or more octets, each octet being an ordered sequence of eight bits.

3.8.56 open systems interconnection: An architecture for computer communication which provides a number of terms which are used in this Recommendation | International Standard preceded by the abbreviation "OSI".

NOTE – The meaning of such terms can be obtained from the Rec. ITU-T X.200 series and equivalent ISO/IEC Standards if needed. The terms are only applicable if ASN.1 is used in an OSI environment.

3.8.57 open type notation: An ASN.1 notation used to denote a set of values from more than one ASN.1 type.

NOTE 1 – The term "open type" is used synonymously with "open type notation" in the body of this Recommendation | International Standard.

NOTE 2 – All ASN.1 encoding rules provide unambiguous encodings for the values of a single ASN.1 type. They do not necessarily provide unambiguous encodings for "open type notation", which carries values from ASN.1 types that are not normally determined at specification time. Knowledge of the type of the value being encoded in the "open type notation" is needed before the abstract value for that field can be unambiguously determined.

NOTE 3 – The only notation in this Recommendation | International Standard which is an open type notation is the "ObjectClassFieldType" specified in Rec. ITU-T X.681 | ISO/IEC 8824-2, clause 14, where the "FieldName" denotes either a type field or a variable-type value field.

3.8.58 parent type (of a subtype): The type that is being constrained when defining a subtype, and which governs the subtype notation.

NOTE – The parent type may itself be a subtype of some other type.

3.8.59 production: A part of the formal notation (also called grammar or Backus-Naur Form, BNF) used to specify ASN.1.

3.8.60 real type: A simple type whose distinguished values (specified in clause 21) include the set of real numbers (numerical real numbers) together with special values such as **`NOT-A-NUMBER`**.

3.8.61 recursive definition (of a type): A set of ASN.1 definitions which cannot be reordered so that all types used in a construction are defined before the definition of the construction.

NOTE – Recursive definitions are allowed in ASN.1: the user of the notation has the responsibility for ensuring that those values (of the resulting types) which are used have a finite representation and that the value set associated with the type contains at least one value.

3.8.62 relative OID internationalized resource identifier type: A value which identifies an object by its position relative to some known OID internationalized resource identifier.

3.8.63 relative object identifier: A value which identifies an object by its position relative to some known object identifier.

3.8.64 relative object identifier type: A simple type whose values are the set of all possible relative object identifiers.

3.8.65 restricted character string type: A character string type whose characters are taken from a fixed character repertoire identified in the type specification.

3.8.66 selection types: Types defined by reference to a component type of a choice type, and whose values are precisely the values of that component type.

3.8.67 sequence types: Types defined by referencing a fixed, ordered list of types (some of which may be declared to be optional); each value of the sequence type is an ordered list of values, one from each component type.

NOTE – Where a component type is declared to be optional, a value of the sequence type need not contain a value of that component type.

3.8.68 sequence-of types: Types defined by referencing a single component type; each value in the sequence-of type is an ordered list of zero, one or more values of the component type.

3.8.69 serial application (of constraints): The application of a constraint to a parent type which is already constrained.

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3.8.70 set arithmetic: The formation of new sets of values or information objects using the operations of union, intersection and set difference (use of **EXCEPT**) as specified in 50.2.

NOTE – The result of serial application of constraints is not covered by the term "set arithmetic".

3.8.71 setting (of a time property): One of a number of values that can be associated with a given time property (see 3.8.82 and the note in J.4.2).

NOTE – Any time property that applies to a particular time abstract value has only a single setting (see Table 6).

3.8.72 set types: Types defined by referencing a fixed, unordered, list of types (some of which may be declared to be optional); each value in the set type is an unordered list of values, one from each component type.

NOTE – Where a component type is declared to be optional, a value of the set type need not contain a value of that component type.

3.8.73 set-of types: Types defined by referencing a single component type; each value in the set-of type is an unordered list of zero, one or more values of the component type.

3.8.74 simple types: Types defined by directly specifying the set of their values.

3.8.75 spacing character: A character in a character repertoire which is intended for inclusion with graphic characters in the printing of a character string but which is represented in the physical rendition by empty space; it is not normally considered to be a control character (see 3.8.18).

NOTE – There may be a single spacing character in the character repertoire, or there may be multiple spacing characters with varying widths.

3.8.76 subtype (of a parent type): A type whose values are a subset (or the complete set) of the values of some other type (the parent type).

3.8.77 tag: Additional information, separate from the abstract values of the type, which is associated with every ASN.1 type and which can be changed or augmented by a type prefix.

NOTE – Tag information is used in some encoding rules to ensure that encodings are not ambiguous. Tag information differs from encoding instructions because tag information is associated with all ASN.1 types, even if they do not have a type prefix.

3.8.78 tagged types: A type defined by referencing a single existing type and a tag; the new type is isomorphic to the existing type, but is distinct from it.

3.8.79 tagging: Assigning a new tag to a type, replacing or adding to the existing (possibly the default) tag.

3.8.80 time abstract value: An abstract value of the time type.

3.8.81 time component: Part of the definition of a time abstract value that specifies a part of that abstract value.

NOTE – Examples of time components are a date component (that would have a year component), a time-of-day component, or a time difference component.

3.8.82 time property (of a time abstract value): One of a number of terms used to describe a time abstract value (see 3.8.80).

NOTE – The time properties that can be used to describe a time abstract value often depend on the setting of some other time property of that abstract value. The time properties are listed in Table 6, column 1.

3.8.83 time type: The **TIME** type that supports all the abstract values implicitly defined by ISO 8601.

3.8.84 transfer syntax: The set of bit strings used to exchange the abstract values in an abstract syntax, usually obtained by application of encoding rules to an abstract syntax.

NOTE – The term "transfer syntax" is synonymous with "encoding".

3.8.85 true: One of the distinguished values of the boolean type (see also "false").

3.8.86 type: A named set of values.

3.8.87 type prefix: Part of the ASN.1 notation that can be used to assign an encoding instruction or a tag to a type.

3.8.88 type reference name: A name associated uniquely with a type within some context.

NOTE – Reference names are assigned to the types defined in this Recommendation | International Standard; these are universally available within ASN.1. Other reference names are defined in other Recommendations | International Standards, and are applicable only in the context of that Recommendation | International Standard.

3.8.89 unrestricted character string type: A type whose abstract values are values from a character abstract syntax, together with an identification of the character abstract syntax and of the character transfer syntax to be used in its encoding.

3.8.90 useful time type: A built-in type defined as a subtype of the time type (see 3.8.83) that is intended for direct use by application designers.

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3.8.91 user (of ASN.1): The individual or organization that defines the abstract syntax of a particular piece of information using ASN.1.

3.8.92 value mapping: A 1-1 relationship between values in two types that enables a reference to one of those values to be used as a reference to the other value. This can, for example, be used in specifying subtypes and default values (see Annex C).

3.8.93 value reference name: A name associated uniquely with a value within some context.

3.8.94 value set: A collection of values of a type. Semantically equivalent to a subtype.

3.8.95 version brackets: A pair of adjacent left and right brackets ("`[[`" or "`]]`") used to delineate the start and end of an extension addition group. The pair of left brackets can optionally be followed by a number giving a version number for the extension addition group.

3.8.96 version number: A number which can be associated with a version bracket (see I.1.8).

NOTE – A version number cannot be added to an extension addition which is not part of an extension addition group, nor to extension additions to any type other than choice, sequence, or set.

3.8.97 white-space: Any formatting action that yields a space on a printed page, such as spaces or tabs.

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
BMP	Basic Multilingual Plane
DCC	Data Country Code
DNIC	Data Network Identification Code
ECN	Encoding Control Notation of ASN.1
ICD	International Code Designator
IRI	Internationalized Resource Identifier
OID	Object Identifier
OSI	Open Systems Interconnection
PER	Packed Encoding Rules of ASN.1
ROA	Recognized Operating Agency
UCS	Universal Multiple-Octet Coded Character Set
URI	Universal Resource Identifier
UTC	Coordinated Universal Time
XML	Extensible Markup Language

5 Notation

5.1 General

5.1.1 The ASN.1 notation consists of a sequence of characters from the ASN.1 character set specified in clause 11.

5.1.2 Each use of the ASN.1 notation contains characters from the ASN.1 character set grouped into lexical items. Clause 12 specifies all the sequences of characters forming lexical items, and names each item.

5.1.3 The ASN.1 notation is specified in clause 13 (and following clauses) by specifying and naming those sequences of lexical items which form valid instances of the ASN.1 notation, and by specifying the ASN.1 semantics of each sequence.

5.1.4 In order to specify the permitted sequences of lexical items, this Recommendation | International Standard uses a formal notation defined in the following subclauses.

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