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

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

Reference number
ISO/IEC 8825-4:2002(E)

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Foreword

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The main task of the joint technical committee is to prepare International Standards. 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.

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ISO/IEC 8825 consists of the following parts, under the general title *Information technology — ASN.1 encoding rules*:

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

— *Part 2: Specification of Packed Encoding Rules (PER)*

— *Part 3: Specification of Encoding Control Notation (ECN)*

— *Part 4: XML Encoding Rules (XER)*

— *Part 5: Mapping W3C XML schema definitions into ASN.1*

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Introduction

The publications ITU-T Rec. X.680 | ISO/IEC 8824-1, ITU-T Rec. X.681 | ISO/IEC 8824-2, ITU-T Rec. X.682 | ISO/IEC 8824-3, ITU-T Rec. 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 ITU-T Rec. X.680 | ISO/IEC 8824-1 and ITU-T Rec. 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 two sets of encoding rules that use the Extensible Markup Language (XML). These are called the XML Encoding Rules (XER) for ASN.1, and both produce an XML document compliant to W3C XML 1.0. The first set is called the Basic XML Encoding Rules. The second set is called the Canonical XML Encoding Rules 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.)

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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 (XER) that may be used to derive a transfer syntax for values of types defined in ITU-T Rec. X.680 | ISO/IEC 8824-1 and ITU-T Rec. X.681 | ISO/IEC 8824-2. This Recommendation | International Standard also specifies a set of Canonical XML Encoding Rules which provide constraints on the Basic XML Encoding Rules and produce a unique encoding for any given ASN.1 value. 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 ITU-T Rec. X.680 | ISO/IEC 8824-1.

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.

2.1 Identical Recommendations | International Standards

- ITU-T Recommendation X.680 (2002) | ISO/IEC 8824-1:2002, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation*.
- ITU-T Recommendation X.681 (2002) | ISO/IEC 8824-2:2002, *Information technology – Abstract Syntax Notation One (ASN.1): Information object specification*.
- ITU-T Recommendation X.682 (2002) | ISO/IEC 8824-3:2002, *Information technology – Abstract Syntax Notation One (ASN.1): Constraint specification.*
- ITU-T Recommendation X.683 (2002) | ISO/IEC 8824-4:2002, *Information technology – Abstract Syntax Notation One (ASN.1): Parameterization of ASN.1 specifications*.
- ITU-T Recommendation X.690 (2002) | ISO/IEC 8825-1:2002, *Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)*.
- ITU-T Recommendation X.691 (2002) | ISO/IEC 8825-2:2002, *Information technology – ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)*.

2.2 Additional references

- ISO/IEC 10646-1:1993, *Information technology – Universal Multiple-Octet Coded Character Set (UCS) – Part 1: Architecture and Basic Multilingual Plane.*

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– ISO/IEC 10646-1:1993/Amd.2:1996, *Information technology – Universal Multiple-Octet Coded Character Set (UCS) – Part 1: Architecture and Basic Multilingual Plane – Amendment 2: UCS Transformation Format 8 (UTF-8)*.

– W3C XML 1.0:2000, *Extensible Markup Language (XML) 1.0 (Second Edition), W3C Recommendation, Copyright © [6 October 2000] World Wide Web Consortium, (Massachusetts Institute of Technology, Institut National de Recherche en Informatique et en Automatique, Keio University), http://www.w3.org/TR/2000/REC-xml-20001006*.

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 Basic Encoding Rules

This Recommendation | International Standard makes use of the following terms defined in ITU-T Rec. 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 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.

3.2.3 valid XML document (for an ASN.1 schema): An XML document which is well-formed (see W3C XML 1.0) and whose content conforms to the XER specification for the encoding of the ASN.1 type specified by an ASN.1 schema.

3.2.4 XML document: A sequence of characters which conforms to W3C XML 1.0 definition of document.

4 Abbreviations

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

ASN.1	Abstract Syntax Notation One
PDU	Protocol Data Unit
UCS	Universal Multiple-Octet Coded Character Set
UTC	Coordinated Universal Time
UTF-8	UCS Transformation Format, 8-bit form
XML	Extensible Markup Language
XER	XML Encoding Rules

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5 Notation

This Recommendation | International Standard references the notation defined by ITU-T Rec. X.680 | ISO/IEC 8824-1, clause 5.

Encodings specified by this Recommendation | International Standard

6.1 This Recommendation | International Standard specifies two sets of encoding rules:

- Basic XML Encoding Rules (BASIC-XER).
- Canonical XML Encoding Rules (CANONICAL-XER).

NOTE – Where this Recommendation | International Standard uses "XER" without qualification, the text applies to both BASIC-XER and CANONICAL-XER.

6.2 The most general set of encoding rules specified in this Recommendation | International Standard is BASIC-XER, which does not in general produce a canonical encoding.

6.3 A second set of encoding rules specified in this Recommendation | International Standard is CANONICAL-XER, which produces encodings that are canonical. This is defined as a restriction of implementation-dependent choices in the BASIC-XER encoding.

NOTE 1 – Any implementation conforming to CANONICAL-XER for encoding is conformant to BASIC-XER for encoding. Any implementation conforming to BASIC-XER for decoding is conformant to CANONICAL-XER for decoding. Thus, encodings made according to CANONICAL-XER are encodings that are permitted by BASIC-XER.

NOTE 2 – CANONICAL-XER produces encodings that have applications when authenticators need to be applied to abstract values.

6.4 If a type encoded with CANONICAL-XER contains **`EMBEDDED PDV`**, **`EXTERNAL`** or **`CHARACTER STRING`** types, then the outer encoding ceases to be canonical unless the encoding used for all the **`EMBEDDED PDV`**, **`EXTERNAL`** and **`CHARACTER STRING`** types is canonical.

7 Conformance

7.1 Dynamic conformance for the Basic XML Encoding Rules is specified by clause 8, and dynamic conformance for the Canonical XML Encoding Rules is specified by clause 9 inclusive.

7.2 Static conformance is specified by those standards which specify the application of one or more of these encoding rules.

7.3 Alternative encodings are permitted by the Basic XML Encoding Rules as an encoder's option. Decoders that claim conformance to XER shall support all alternatives.

7.4 No alternative encodings are permitted by the Canonical XML Encoding Rules for the encoding of an ASN.1 value.

8 Basic XML encoding rules

8.1 Production of a complete XER encoding

8.1.1 A conforming XER encoding is a valid XML document which shall consist of:

a) an XML prolog (which may be empty) as specified in 8.2;

b) an XML document element which is the complete encoding of a value of a single ASN.1 type as specified in 8.3.

8.1.2 The specification in 8.2 to 8.4 completely defines the XER encoding.

NOTE – Other constructs of W3C XML 1.0, such as processing instructions and comments are not allowed by those subclauses, and can never appear in an XER encoding.

8.1.3 The XML document shall be encoded using UTF-8 to produce a string of octets which forms the encoding specified in this Recommendation | International Standard. The ASN.1 object identifier for these encoding rules is specified in clause 10.

8.1.4 Where this Recommendation | International Standard uses the term "white-space", this means one or more of the following characters: HORIZONTAL TABULATION (9), LINE FEED (10), CARRIAGE RETURN (13),

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SPACE (32). The numbers in parentheses are the decimal value of the ISO/IEC 10646-1 characters. The number and choice of characters that constitutes "white-space" is an encoder's option.

8.2 The XML prolog

8.2.1 The XML prolog shall either:

a) be empty; or

b) shall consist of the following character sequences in order, and as an encoder's option the last character sequence may be followed by "white-space" (see 8.1.4):

<?xml
version="1.0"
encoding="UTF-8"?>

8.2.2 The character sequences listed in 8.2.1 shall not contain "white-space", but shall be separated by a single SPACE (32) character.

8.3 The XML document element

8.3.1 The XML document element shall be an "XMLTypedValue" as specified in ITU-T Rec. X.680 | ISO/IEC 8824-1, 15.2, with the changes and restrictions specified in the following sub-clauses.

8.3.2 The ASN.1 "comment" lexical item (see ITU-T Rec. X.680 | ISO/IEC 8824-1, 11.6) shall not be present. If an XER encoding contains a pair of adjacent hyphens, or "/*", or "*/", these shall be treated as part of the data, and not as ASN.1 comment delimiters.

8.3.3 Where ITU-T Rec. X.680 | ISO/IEC 8824-1 permits the use of ASN.1 white-space between lexical items, the characters used shall be restricted to the "white-space" specified in 8.1.4.

8.3.4 The "XMLIntegerValue" specified in ITU-T Rec. X.680 | ISO/IEC 8824-1, 18.9, shall only be "SignedNumber".

8.3.5 The "XMLBitStringValue" specified in ITU-T Rec. X.680 | ISO/IEC 8824-1, 21.9, shall not be "XMLIdentifierList".

8.3.6 The "XMLExternalValue" specified in ITU-T Rec. X.680 | ISO/IEC 8824-1, clause 34, shall be replaced by the "XMLExternalValue" specified in 8.4.

8.4 Encoding of the EXTERNAL type

8.4.1 The "XMLExternalValue" production used for an XER encoding of an "EXTERNAL" type shall be the "XMLValue" for the encoding of the sequence type specified in ITU-T Rec. X.691 | ISO/IEC 8825-2, 26.1, with a value as specified in 26.2 to 26.4 of that Recommendation | International Standard.

NOTE – For historical reasons, the XER encoding of an "EXTERNAL" type is not the same as the XML value notation specified in ITU-T Rec. X.680 | ISO/IEC 8824-1.

8.4.2 ITU-T Rec. X.691 | ISO/IEC 8825-2, 26.5 to 26.8 shall apply, except that the provisions of 26.6 shall be replaced by 8.4.3 of this Recommendation | International Standard.

8.4.3 If the data value is the value of a single ASN.1 type, and if the encoding rules for this data value are those specified in this (XER) Recommendation | International Standard, then the sending implementation shall use the "single-ASN1-type" alternative.

8.4.4 ITU-T Rec. X.691 | ISO/IEC 8825-2, 26.9 to 26.11 shall apply, except that the provisions of 26.9 shall be replaced by 8.4.5 of this Recommendation | International Standard. The Note in ITU-T Rec. X.691 | ISO/IEC 8825-2, 26.9 applies.

8.4.5 If the "encoding" choice is "single-ASN1-type", then the ASN.1 type shall be the "XMLTypedValue" of the type encoded in the "EXTERNAL", with a value equal to the data value to be encoded.

9 Canonical XML encoding rules

Where "XMLTypedValue" contains options, this clause specifies precisely one of those options in order to produce a unique encoding. The provisions of this clause determine the canonical XML encoding rules.

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9.1 General rules for canonical XML encodings

9.1.1 The XML prolog shall be empty (see 8.2.1).

9.1.2 All lexical items forming the "XMLTypedValue" shall have no "white-space" between them (see ITU-T Rec. X.680 | ISO/IEC 8824-1, 11.1.4).

NOTE – This ensures that the digital signature of a document can be easily generated without considering any possible insertion of "white-space" between the lexical items of the "XMLTypedValue".

9.1.3 The escape sequences specified in ITU-T Rec. X.680 | ISO/IEC 8824-1, 11.15.8, shall not be used.

9.1.4 If the XML value notation permits the use of an XML empty-element tag (see ITU-T Rec. X.680 | ISO/IEC 8824-1, 15.5 and 16.8), then this empty-element tag shall be used.

9.2 Real values

9.2.1 The real value zero shall be encoded as "0".

9.2.2 For all other values, the following subclauses specify restrictions that apply to "realnumber" (see ITU-T Rec. X.680 | ISO/IEC 8824-1, 11.9).

9.2.3 The "realnumber" shall be normalized so that the integer part consists of a single, non-zero digit. The decimal point shall be present and shall be followed by a fractional part containing at least one digit (which may be zero). The fractional part shall not contain any trailing zeros after the first digit.

9.2.4 The fractional part shall be followed by an "E" (not an "e") and by an exponent (which may be zero).

NOTE – Leading zeros in the exponent are already forbidden by ITU-T Rec. X.680 | ISO/IEC 8824-1, 11.9.

9.2.5 No "+" sign shall be present either before the integer part or before the exponent.

9.3 Bitstring value

9.3.1 If the "XMLTypedValue" alternative of "XMLBitStringValue" (see ITU-T Rec. X.680 | ISO/IEC 8824-1, 21.9) can be used (as specified in ITU-T Rec. X.680 | ISO/IEC 8824-1, 21.10), then it shall be used. Otherwise, the "xmlbstring" alternative shall be used with all white-space removed.

9.3.2 If the bitstring type has a "NamedBitList", there shall be no trailing zero bits (see ITU-T Rec. X.680 | ISO/IEC 8824-1, 21.7).

9.4 Octetstring value

If the "XMLTypedValue" alternative of "XMLOctetStringValue" (see ITU-T Rec. X.680 | ISO/IEC 8824-1, 22.3) can be used (as specified in ITU-T Rec. X.680 | ISO/IEC 8824-1, 22.4), then it shall be used. Otherwise, the "xmlhstring" alternative shall be used with all white-space removed, and all letters in upper-case.

9.5 Sequence value

All components of a sequence which have default values, and which have an abstract value set to those default values, shall have the encoding of the default value textually present. There shall always be an encoding for those components.

9.6 Set value

9.6.1 The set type shall have the elements in its "RootComponentTypeList" sorted into the canonical order specified in ITU-T Rec. X.680 | ISO/IEC 8824-1, 8.6, and additionally for the purposes of determining the order in which components are encoded when one or more component is an untagged choice type, each untagged choice type is ordered as though it has a tag equal to that of the smallest tag in the "RootAlternativeTypeList" of that choice type or any untagged choice types nested within.

9.6.2 The set elements that occur in the "RootComponentTypeList" shall then be encoded in the resulting sorted order. After the elements in the "RootComponentTypeList", if any, have been encoded, the set elements that occur in the "ExtensionAdditionList" shall be encoded in the order in which they are defined. (An example of this ordering of elements is provided in ITU-T Rec. X.691 | ISO/IEC 8825-2, clause 20.)

9.6.3 All components of a set which have default values, and which have an abstract value set to those default values, shall have the encoding of the default value textually present. There shall always be an encoding for those components.

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9.7 Set-of value

9.7.1 The order of the elements of an "XMLSetOfValue" (see ITU-T Rec. X.680 | ISO/IEC 8824-1, 27.3) shall be determined by sorting the character strings which represent the CANONICAL-XER encoding for each element as specifed in 9.7.2 and 9.7.3.

9.7.2 The sort order for the character strings is determined using the 32-bit value of characters specified in ISO/IEC 10646-1, with lower numbered characters preceding higher numbered characters.

9.7.3 A conceptual "pad" character is used in specifying the sort order. This character precedes all other characters. When determining whether a string "A" sorts before a string "B", the shorter string has conceptual "pad" characters added at its end if necessary. String "A" sorts before string "B" if and only if the character in string "A" precedes the corresponding character in string "B" in the first character position in which they have different characters.

9.8 Object identifier value

The "XMLObjIdComponent" (see ITU-T Rec. X.680 | ISO/IEC 8824-1, 31.3) shall be "XMLNumberForm".

9.9 Relative object identifier value

The "XMLRelativeOIDComponent" (see ITU-T Rec. X.680 | ISO/IEC 8824-1, 32.3) shall be "XMLNumberForm".

9.10 GeneralizedTime

9.10.1 The encoding of a value of type "GeneralizedTime" shall terminate with the character "Z" (see ITU-T Rec. X.680 | ISO/IEC 8824-1, 42.3).

9.10.2 The string representing the seconds shall always be present.

9.10.3 The string representing fractions of seconds, if present, shall omit all trailing zeros. If the fractional part corresponds to 0, this string shall be wholly omitted together with the decimal point.

EXAMPLE

Seconds represented with the string "26.000" shall be encoded as "26". Seconds represented with the string "26.5200" shall be encoded as "26.52".

9.10.4 The decimal point, if present, shall be ".".

9.10.5 Midnight (GMT) shall be encoded as a string of the form:

"YYYYMMDD000000Z"

where "YYYYMMDD" represents the day following the midnight in question.

EXAMPLE

The followings encodings are valid:

"19920521000000Z"

"19920622123421Z"

"19920722132100.3Z"

The following encodings are invalid:

"19920520240000Z" (midnight represented incorrectly)

"19920622123421.0Z" (spurious trailing zeros)

"19920722132100.30Z" (spurious trailing zeros)

9.11 UTCTime

9.11.1 The encoding of a value of type "UTCTime" shall terminate with the character "Z" (see ITU-T Rec. X.680 | ISO/IEC 8824-1, 43.3).

9.11.2 The string representing the seconds shall always be present.

9.11.3 Midnight (GMT) shall be encoded as a string of the form:

"YYMMDD000000Z"

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where "YYMMDD" represents the day following the midnight in question.

EXAMPLE

The following encodings are valid:

"920521000000Z"

"920622123421Z"

"920722132100Z"

The following encodings are invalid:

"920520240000Z" (midnight represented incorrectly)

"9207221321Z" (seconds of "00" omitted)

10 Object identifier values referencing the encoding rules

10.1 The encoding rules specified in this Recommendation | International Standard can be referenced and applied whenever there is a need to specify an unambiguous character string representation for the values of a single identified ASN.1 type.

10.2 The following object identifier and object descriptor values are assigned to identify the encoding rules specified in this Recommendation | International Standard:

For BASIC-XER:

```
{joint-iso-itu-t asn1 (1) xml-encoding (5) basic (0) }
"Basic XML encoding of a single ASN.1 type"
```

For CANONICAL-XER:

```
{joint-iso-itu-t asn1 (1) xml-encoding (5) canonical (1) }
"Canonical XML encoding of a single ASN.1 type"
```

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Annex A

Example of encodings

(This annex does not form an integral part of this Recommendation | International Standard)

This annex illustrates the use of the XML Encoding Rules specified in this Recommendation | International Standard by showing XML Markup representations of a (hypothetical) personnel record which is defined using ASN.1.

A.1 ASN.1 description of the record structure

The structure of the hypothetical personnel record is formally described below using ASN.1 specified in ITU-T Rec. X.680 | ISO/IEC 8824-1. This is identical to the example defined in Annex A of ITU-T Rec. X.690 | ISO/IEC 8825-1.

```
PersonnelRecord ::= [APPLICATION 0] IMPLICIT SET {
           name             Name,
           title            [0] VisibleString,
           number           EmployeeNumber,
           dateOfHire       [1] Date,
           nameOfSpouse     [2] Name,
           children         [3] IMPLICIT
                SEQUENCE OF ChildInformation DEFAULT {} }

ChildInformation ::= SET
           { name               Name,
             dateOfBirth        [0] Date}

Name ::= [APPLICATION 1] IMPLICIT SEQUENCE
           { givenName          VisibleString,
             initial            VisibleString,
             familyName         VisibleString}

EmployeeNumber ::= [APPLICATION 2] IMPLICIT INTEGER

Date ::= [APPLICATION 3] IMPLICIT VisibleString  -- YYYYMMDD
```

NOTE – Tags are used in this example only because it was felt appropriate to use the identical example to that which appeared in the earliest version of ITU-T Rec. X.680 | ISO/IEC 8824-1. They have no effect on the XML encodings.

A.2 ASN.1 description of a record value

The value of John Smith's personnel record is formally described below using the basic ASN.1 value notation:

```
{    name                {givenName "John", initial "P", familyName "Smith"},
     title               "Director",
     number              51,
     dateOfHire          "19710917",
     nameOfSpouse        {givenName "Mary", initial "T", familyName "Smith"},
     children
          {{name {givenName "Ralph", initial "T", familyName "Smith"},
                 dateOfBirth "19571111"},
           {name {givenName "Susan", initial "B", familyName "Jones"},
                 dateOfBirth "19590717"}}}
```

A.3 Basic XML representation of this record value

The representation of the record value given above (after applying the Basic XML Encoding Rules defined in this Recommendation | International Standard) is shown below assuming an empty prolog.

The length of this encoding in BASIC-XER is 653 octets ignoring all "white-space". For comparison, the same PersonnelRecord value encoded with the UNALIGNED variant of PER (see ITU-T Rec. X.690 | ISO/IEC 8825-1) is 84 octets, with the ALIGNED variant of PER it is 94 octets, with BER (see ITU-T Rec. X.691 | ISO/IEC 8825-2) using the definite length form it is a mininum of 136 octets, and with BER using the indefinite length form it is a minimum of 161 octets.

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```
<PersonnelRecord>
      <name>
            <givenName>John</givenName>
            <initial>P</initial>
            <familyName>Smith</familyName>
      </name>
      <title>Director</title>
      <number>51</number>
      <dateOfHire>19710917</dateOfHire>
      <nameOfSpouse>
            <givenName>Mary</givenName>
            <initial>T</initial>
            <familyName>Smith</familyName>
      </nameOfSpouse>
      <children>
            <ChildInformation>
                  <name>
                        <givenName>Ralph</givenName>
                        <initial>T</initial>
                        <familyName>Smith</familyName>
                  </name>
                  <dateOfBirth>19571111</dateOfBirth>
            </ChildInformation>
            <ChildInformation>
                  <name>
                        <givenName>Susan</givenName>
                        <initial>B</initial>
                        <fam8ilyName>Jones</familyName>
                  </name>
                  <dateOfBirth>19590717</dateOfBirth>
            </ChildInformation>
      </children>
</PersonnelRecord>
```

A.4 Canonical XML representation of this record value

The representation of the record value given above (after applying the Canonical XML Encoding Rules defined in this Recommendation | International Standard) is shown below:

```
<PersonnelRecord><name><givenName>John</givenName><initial>P</initial><familyName>Smith</fam
ilyName></name><number>51</number><title>Director</title><dateOfHire>19710917</dateOfHire><n
ameOfSpouse><givenName>Mary</givenName><initial>T</initial><familyName>Smith</familyName></n
ameOfSpouse><children><ChildInformation><name><givenName>Ralph</givenName><initial>T</initia
l><familyName>Smith</familyName></name><dateOfBirth>19571111</dateOfBirth></ChildInformation
><ChildInformation><name><givenName>Susan</givenName><initial>B</initial><familyName>Jones</
familyName></name><dateOfBirth>19590717</dateOfBirth></ChildInformation></children></Personn
elRecord>
```

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