

Health informatics — Mapping of hierarchical message descriptions to XML

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National foreword

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According to the replies received by the end of the review period, the responsible BSI Committee will decide whether to support the conversion into a European Standard, to extend the life of the Technical Specification or to withdraw it. Comments should be sent to the Secretary of the responsible BSI Technical Committee at British Standards House, 389 Chiswick High Road, London W4 4AL.

The UK participation in its preparation was entrusted to Technical Committee IST/35, Health informatics.

A list of organizations represented on IST/35 can be obtained on request to its secretary.

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hiérarchique en XML

Medizinische Informatik - Mapping von hierarchischen
Nachrichtenbeschreibungen nach XML

This Technical Specification (CEN/TS) was approved by CEN on 8 August 2005 for provisional application.

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Foreword

This document (CEN/TS 15211:2006) has been prepared by Technical Committee CEN/TC 251 “Health Informatics”, the secretariat of which is held by NEN.

This document includes material first defined in draft standards of HL7 (an ANSI accredited Standards Development Organisation) for which HL7 holds the copyright.

The descriptions in this document are partly different due to the fact that the CEN rules for drafting and presentation of standards are different.

CEN/TC 251 wishes to express its gratitude towards HL7 experts for generously sharing their work with the expert team and to thank the HL7 organisation for allowing the reproduction of their material in this document.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this CEN Technical Specification: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

Additional standards for representing CEN/TC 251 specifications may be developed for various technological approaches, e.g. for XML. These standards are called "Implementable Technology Specification" (ITS).

In developing this document for an XML ITS there has been the wish to harmonise with HL7 specifications, so that the health informatics industry in Europe and the USA can more easily be aligned. To this end a collaboration agreement was entered into in March 2000 between CEN/TC 251 and HL7. The goal was set for a maximum degree of alignment while maintaining their independence and need to serve the business requirements of the respective markets but also to make the results available to ISO for possible international standardisation.

This document differs from HL7 specifications in several areas:

- the CEN Data Types specification CEN/TS 14796 varies from the HL7 specifications in a number of respects. Some Data Types are not supported, while others are modified. The CEN/TS lists such changes where they have been identified;
- this document supports the CEN GPICs specification. Although comparable to HL7 CMETs in some ways, there are essential differences to be noted;
- this document supports CEN message specifications such as those used in the service messages specification;
- this document also supports an earlier version of CEN message specifications. This is an independent specification not linked to the three areas already identified.

In most other respects, this document is derived from the HL7 Version 3 XML ITS although partly described differently due to the fact that CEN is following the ISO rules for drafting and presentation of standards which HL7 is not.

NOTE Editor's note to the draft: The assistance of Charles McCay, Chair of the HL7 XML SIG in the preparation of this draft is gratefully acknowledged.

1 Scope

This document defines an XML ITS – Implementable Technology Specification for use in communicating healthcare information and for other health informatics purposes, using the CEN Data Types, CEN GPICs and CEN message specifications. The recommendations in each of the three areas are separately addressed, such that the ITS may have a scope wider than messaging, supporting other contexts of use of GPICs and CEN Data Types.

2 Normative references

Not applicable.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

Data Type

set of distinct values, characterised by properties of those values and by operations on those values

3.2

date

identification of a particular calendar day, expressed by some combination of the data elements calendar year, calendar month, calendar week, calendar day or day of the year

3.3

Implementable Technology Specification

description of how to implement CEN artefacts in a concrete syntax

3.4

null flavor

reason for the absence of a valid data value

3.5

period of time (= time-interval)

portion of time between two time points

NOTE A period of time is often also referred to as period.

3.6

recurring time-interval

series of consecutive time-intervals of the same duration

3.7

time-point

instant in the laps of time regarded as dimensionless

3.8

value domain

set of valid data values for a Data Type

3.9

vocabulary domain

value domain for coded values

4 Abbreviations

BIN	Binary Data
BL	Boolean Data Value
CD	Concept Descriptor
CE	Coded with Equivalents
CR	Concept Role
CS	Coded Simple Value
CV	Coded Value
DV	Data Value
ED	Encapsulated Data
EIVL	Event Related Periodic Interval of Time
HL7	Health Level Seven
II	Instance Identifier
ITS	Implementable Technology Specification
IVL	Interval
OID	ISO object identifier
ORD	Ordinal
PIVL	Periodic Interval of Time
PQ	Physical Quantity
RTO	Ratio
ST	Simple Text
TS	Time Point
URI	Universal Resource Identifier
UTC	Coordinated Universal Time
XML	Extensible Markup Language

5 Overall structure of this document

The document is divided into three parts, each addressing particular CEN requirements for XML ITS support.

Clause 6 addresses support for messaging generally, together with support for GPICs. The GPIC ITS specifications are however not messaging-specific.

Clauses 7 to 13 specify how CEN Data Types should be supported. These specifications comprise XML schema fragments, together with, for many Data Types, definitions in a simple abstract notation, commonly used in W3C. These specifications are also not messaging-specific.

Clause 14 is an independent clause dealing with support of CEN messages defined prior to the definition of CEN Data Types, GPICs and use of the RIM.

6 Message and GPIC support

6.1 General

This clause is derived from the Ballot 7 HL7 XML ITS Structures document amended as necessary to support CEN requirements.

6.2 Mapping to the XML instance

This subclause describes how a CEN HMD can be represented in an XML instance document. The representation is determined algorithmically from the HMD definition.

For the purposes of this document, we will be referring to HMDs since they represent a fully specified, constrained, implementable definition of a CEN message in a serial tabular format. All information contained in CEN HMDs is ultimately derived from the RIM. Therefore, although the HMD is useful for defining how to create an XML instance for a message or document in an algorithmic way, the semantics may be better understood by also looking at higher level representations.

- The set of XML instances that are conformant for a message type have a structure with elements corresponding to class clones, and both element and attributes corresponding to class clone attributes. The association names determine the names of the elements that represent the class clones.
- Message Type hierarchic component descriptions comprise a sequence of references to GPICs.
- This document also describes how these embedded GPICs are encoded in a message instance. GPICs are numerically identified and comprise a set of attributes together with a set of relationships to other GPICs.

Each GPIC attribute has a Data Type associated with it. The XML implementation of these Data Types is described in Clauses 7 to 13.

6.3 XML structures derived from an HMD

The XML elements and attributes in a message instance correspond one-to-one with individual rows in the HCD. This is explained in more detail below. The names of the XML elements and attributes are taken from the element name of the HMD.

Structural attributes like classCode, are represented as XML attributes in the instance. Where these have fixed values defined in the HMD, they may be omitted from the instance. Where there is a default value, and the default is appropriate for the instance, the XML attribute may be omitted. Where an XML attribute has been omitted the receiving system should assume the fixed or default value as specified in the message type.

6.4 XML Namespaces

All XML elements and attributes (except for informal extensions and the contents of ED Data Types) are to be represented in the namespace defined by:

```
xmlns="urn:cen:messages"
```

In addition the xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" namespace will be used to indicate the datatype of elements where this could be ambiguous. This only applies when the DV Data Type is used, and the details are described in the description of DV in the Data Types ITS.

In this document all examples will be written with the assumption that CEN has been declared as a prefix for the CEN namespace as follows:

```
xmlns:hl7="urn: cen:messages "
```

NOTE any valid namespace prefix (or none) may be used in practice.

The content of an XML element that represents a CEN attribute of type ED may have content from any namespace, as determined by the mediaType attribute. This is described in the Data Types ITS document.

XML content from other namespaces (except within an ED datatype) will be ignored by receiving systems that do not recognize them.

6.5 Representation of choices

Choice is exercised in CEN message structures by multiple choices of GPICs. There are therefore no explicit choice requirements to be supported.

6.6 Determination of the XML representation

6.6.1 Cardinality

Each row in the HCD supports the inclusion of a specified GPIC with a specified cardinality, or indicated as a recursion.

For each row in the GPIC representing a class, attribute, or association, the cardinality in the HMD sets the upper and lower limits on the number of elements that may be included in the instance which correspond to that row. Note that it is never possible to repeat structural attributes, and these are optional in the XML instances if a default or fixed value has been set.

6.6.2 Message elements that are classes

The name for the element representing the Class is taken either from the association name.

Where the Class is flagged as Mandatory it shall be included in the message for the message to be valid.

6.6.3 GPIC

If a GPIC row references another GPIC then the XML representation of the element is determined by applying the rules in “Message Elements That Are RIM Classes” to the requisite GPIC. In the schemas that are generated to support this ITS, the GMET is used to create the name of a group reference, and there is a group defined in the schema for the GPIC.

Message Elements that are supported as XML attributes

CEN structural attributes are conveyed as attributes. Where there is a default or fixed value defined in the HMD then the attribute may be omitted from the XML representation, and the receiving system will behave as though the fixed or default value was sent.

Non-structural attributes are represented as elements with the name taken from the “Element Name” in the Message Type.

For GPIC rows which are attributes, the XML representation will be the name of a CEN Data Type. This is full described in the CEN Data Types document.

6.6.4 Interactions

CEN/TS 14822-4, *Health informatics - General purpose information components - Part 4: Message headers* includes a description of how to reference the interaction associated with use of a particular Message Type. No additional XML ITS requirements arise.

6.7 Informal extensions

In order to support informal extensions, it is permitted to include additional XML elements and attributes that are not included in the CEN definition of a message type. These extensions should not change the meaning of any of the standard data items, and receiving applications shall be able to safely ignore these elements.

Extensions may be included in the instance in a namespace other than the CEN namespace. Such extensions shall not be included within an ED datatype, since it would not always be possible to distinguish between foreign namespace items that form part of the content of the standard ED datatype, and content that was intended to be an informal extension. Since all conformant content (outside of elements of type ED) is in the CEN namespace, the sender can put any extension content into a foreign namespace (any namespace other than the CEN namespace), and the receiver will be able to recognise that such content may be safely ignored. Receiving systems shall not report an error if such extensions are present.

6.8 Backwards and forwards compatibility

When there are different versions of either the abstract artifact definitions, or of the ITS, it is anticipated that these versions will be no more than a single XSLT (extend with link) transform apart.

While setting the rules for version compatibility between different versions of the same artifact is beyond the scope of this document, it is anticipated that it will be possible to generate XSLT transformations to convert between versions. There may be changes in valuesets for domains that need to be addressed in some other way, but again this is beyond the scope of an ITS specification.

It is a constraint on the definition of future versions of the XML ITS that it shall be possible to write an XSLT transformation to map between instances of the same artifact created under the different versions of the ITS.

6.9 Use of schema processors

Sending applications should not provide schema location hints for the CEN namespace and receiving applications that perform schema processing should ignore such hints if provided and instead, assuming they wish to perform schema processing, should use a trusted copy of appropriate schemas.

Receivers should not accept instances that contain violations of XML well-formedness constraints since, by definition, an XML instance that is not well-formed has no parse tree, and hence, the results of parsing the instance are undefined.

Senders are required to send conformant instances and receivers are not obliged to accept non-conformant ones.

7 Support of Data Types: general issues

7.1 General

The diagrams in the following clauses that define the XML ITS for Data Types are all taken from CEN/TS 14796. The schema fragments and abstract Data Type definitions are derived from the Ballot 7 HL7 XML ITS on Data Types, modified as necessary to reflect the requirements for CEN data Types. Data Types are described in the same order and using the same grouping as CEN/TS 14796.

The classes that form the abstract model of the Data Types are grouped for convenience into packages as shown in Figure 1 below.

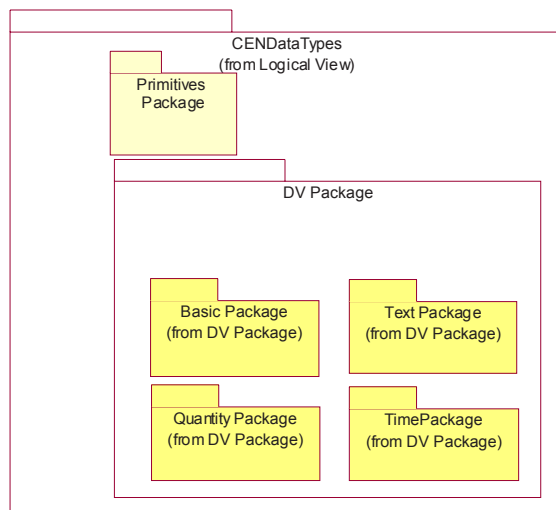


Figure 1 — Packages

NOTE The names of primitive classes (those that adopt industry standard definitions) are shown in lower case Capitalised, whereas constructed classes defined in this document are have their names shown in CAPITALS.

This document defines the semantics, the meaning of the Data Types, independent of representational and operational concerns or specific implementation technologies.

7.2 Characteristics of the Data Types

For each Data Type, the XML representation is described as follows:

- Data Type name and possibly a short name;
- Data Type informal description;
- specialisation;
- known differences (if any) from HL7;
- schema fragment extract;
- abstract Data Type definition.

8 Primitive Data Types

CEN/TS 14796 defines the following list is set of primitive Data Types that are referenced and utilised within this document. In addition to the primitive Data Types, three 'primitive' abstract types are described. These are Numeric, Integer and Real. They have no attributes of their own but are used as generalisations of certain of the concrete types which are their specialisations.

- Boolean

- String
- Integer
- Byte
- Real
- Double
- Character
- List<T>
- Set<T>
- Bag<T>
- Array<T>

A Unified Modelling Language (UML) representation of these primitive types is shown below.

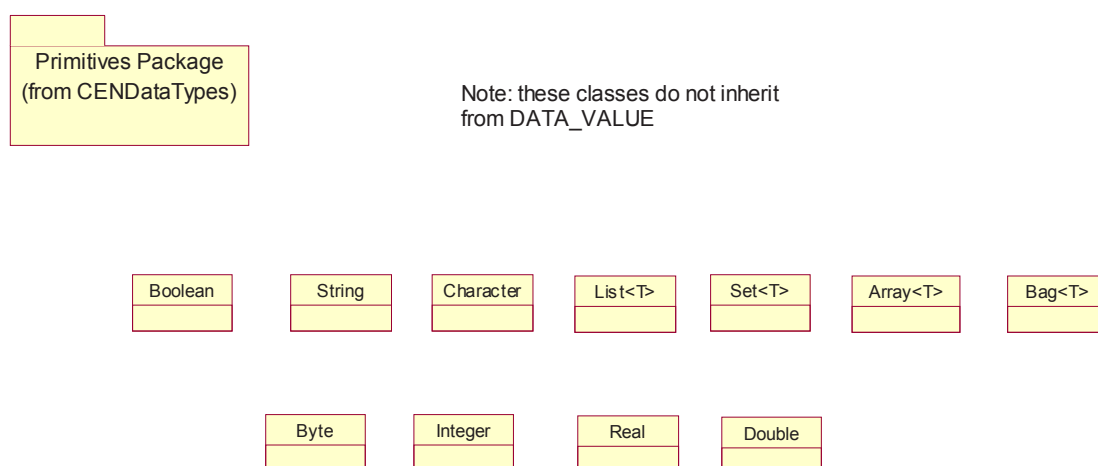


Figure 2 — UML Representation of Primitive Data Types

8.1 Numeric Types: Byte

8.1.1 Short name

8.1.2 Description

8.1.3 Specialisation of: N/A – Byte is a base CEN Data Type

8.1.4 Differences from HL7

N/A – Int would be used in HL7 in places where byte is used in CEN structures.

8.1.5 Schema fragment

```
<xsd:complexType name="BYTE">
  <xsd:attribute name="value" type="byte"/>
</xsd:complexType>

<xsd:simpleType name="byte">
  <xsd:restriction base="xsd:byte" />
</xsd:simpleType>
```

8.1.6 Abstract Data Type definition

```
<!-- type BYTE -->
<x
  value = {value}
/>
```

8.2 Numeric Types: Integer

8.2.1 Short name

8.2.2 Description

8.2.3 Specialisation of: N/A – Byte is a base CEN Data Type

8.2.4 Differences from HL7

CEN Data Type not an extension of quantity. NullFlavor not supported in CEN integer types

8.2.5 Schema fragment

NOTE The ITS specification here cites the W3C integer specification. There may be particular aspects of the ISO 11404 specification for integer which this ITS can therefore not support.

```
<xsd:simpleTypeName="int">
  <xsd:restriction base="xsd:integer" />
</xsd:simpleType>

<xsd:complexType name="INT">
  <xsd:attribute name="value" type="int"/>
</xsd:complexType>
```

8.2.6 Abstract Data Type definition

```
<!-- type INT -->
<x
  value = {value}
/>
```

8.3 Real

8.3.1 Short name

8.3.2 Description

8.3.3 Specialisation of: N/A – Real is a base CEN Data Type

8.3.4 Differences from HL7

CEN Real Data Type not an extension of quantity. NullFlavor not supported in CEN real Data Type.

8.3.5 Schema fragment

NOTE The ITS specification here cites the W3C decimal/double specifications. There may be particular aspects of the ISO 11404 specification for real which this ITS can therefore not support.

```
<xsd:simpleTypeName="real">
  <xsd:union>
    <xsd:simpleType>
      <xsd:restriction base="xsd:decimal" />
    </xsd:simpleType>
    <xsd:simpleType>
      <xsd:restriction base="xsd:double" />
    </xsd:simpleType>
  </xsd:union>
</xsd:simpleType>

<xsd:complexType="REAL">
  <xsd:attribute name="value" type="real"/>
</xsd:complexType>
```

8.3.6 Abstract Data Type definition

```
<!-- type REAL -->
<x
  value = {value}
/>
```

8.4 Numeric Types: Double

8.4.1 Short name: DOUBLE, double

8.4.2 Description

8.4.3 Specialisation of: N/A – Double is a base CEN Data Type

8.4.4 Differences from HL7

CEN Real Data Type not an extension of quantity. NullFlavor not supported in CEN double Data Type.

8.4.5 Schema fragment

NOTE The ITS specification here cites the W3C double specifications. There may be particular aspects of the ISO 11404 specification for double which this ITS can therefore not support.

```
<xsd:simpleTypeName="double">
  <xsd:restriction base="xsd:double" />
</xsd:simpleType>

<xsd:complexType name="DOUBLE">

  <xsd:attribute name="value" type="double"/>

</xsd:complexType>
```

8.4.6 Abstract Data Type definition

```
<!-- type DOUBLE -->
<x
  value = {value}
/>
```

8.5 Boolean

8.5.1 Short name: BL,bl

8.5.2 Description

8.5.3 Specialisation of: N/A – Boolean is a base CEN Data Type

8.5.4 Differences from HL7

CEN Boolean Data Type not an extension of DV. NullFlavor not supported in CEN real types.

8.5.5 Schema fragment

```
<xsd:simpleTypeName="bl">
  <xsd:restriction base="xsd:boolean">

    <xsd:pattern value="true|false">

  </xsd:restriction>
</xsd:simpleType>

<xsd:complexType name="BL">

  <xsd:attribute name="value" type="bl"/>

</xsd:complexType>
```

8.6 String

8.6.1 Short name: st

8.6.2 Description

This is a string Data Type that is only used within CEN Data Type components, and therefore does not have a public representation. TEXT is the appropriate public representation.

8.6.3 Specialisation of: “st” is a base Data Type**8.6.4 Differences from HL7**

None.

8.6.5 Schema fragment

```
<xsd:simpleTypeName="st">
  <xsd:restriction base="xsd:string">

    <xsd:minLength value="1"/>

  </xsd:restriction>
</xsd:simpleType>
```

8.7 Character**8.7.1 Short name: char****8.7.2 Description**

Single character representation.

8.7.3 Specialisation of

Char is a base type and therefore is not a specialisation of anything.

8.7.4 Differences from HL7

There is no equivalent HL7 type.

8.7.5 Schema fragment

NOTE The ITS specification here supports a simple character representation. There may be particular aspects of the ISO 11404 specification for character which this ITS can therefore not support.

```
<xsd:simpleTypeName="char">
  <xsd:restriction base="xsd:string">

    <xsd:minLength value="1"/>

    <xsd:maxLength value="1"/>

  </xsd:restriction>
</xsd:simpleType>
```

8.8 Set <T>

8.8.1 Short name

8.8.2 Description

A set is a value that contains other values of a certain Data Type as its elements. The elements are contained in no particular ordering.

8.8.3 Specialisation of: DV

8.8.4 Differences from HL7

None.

8.8.5 Schema fragment

In this ITS, a SET<T> is represented in two ways. Some sets that are components of other Data Types and whose item type T has a literal form are represented as an XML attribute whose XML attribute type is "xsd:token".

```
<gsd:template name="set">
  <gsd:param name="T" type="DV" />

  <xsd:simpleType>
    <xsd:list>
      <gsd:attribute name="itemType" type="T" />

    </xsd:list>
  </xsd:simpleType>
</gsd:template>
```

If, however, the base Data Type T is not represented as an XML simple type that does not contain whitespace characters, SET<T> is represented as a sequence of XML elements by the tag name of that attribute or component.

The XML ITS in its XML schema definition does not formally constrain elements of a set to be unique and non-NULL. Applications may raise an error if they encounter an instance with non-unique or NULL elements.

8.9 Sequence<T>

8.9.1 Short name: LIST

8.9.2 Description

8.9.3 Specialisation of: DV

8.9.4 Differences from HL7

None.

8.9.5 Description

A sequence is an ordered collection of discrete values.