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Intelligent transport systems — System architecture, taxonomy and terminology — Using XML in ITS standards, data registries and data dictionaries

Systèmes intelligents de transport — Architecture, taxinomie et terminologie des systèmes — Usage de XML dans les normes, registres de données et dictionnaires de données, en ITS

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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ISO 24531 was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

Introduction

As the exchange of information via the Internet and other wired and wire-free networks develops and expands, the use of XML (extensible markup language) and its variants continues to grow and develop.

XML will be an important tool in the development and operation of intelligent transport systems (ITS) services.

Within XML and its variants, however, there are options. In order to obtain maximum benefit, interoperability and re-use of data within the ITS sector, it is important to implement XML and its variants in a consistent manner.

This International Standard provides the definition of how to use XML and its variants in a consistent and interoperable manner within the ITS sector.

Intelligent transport systems — System architecture, taxonomy and terminology — Using XML in ITS standards, data registries and data dictionaries

1 Scope

The International Standard has been developed to assist developers and users of intelligent transport systems (ITS) standards who wish to use extensible markup language (XML), by providing a consistent definition of the rules and rule references for the use of XML within ITS systems. The scope of the International Standard is to define consistent rules and rule references to provide a framework to be used when implementing XML-based applications in ITS, and particularly, in specifying XML in ITS standards, ITS data registries and ITS data dictionaries. This International Standard also provides guidance and examples in respect of the use of XML in ITS, and the elaboration of XML within the abstract syntax notation one (ASN.1) data definitions required by ISO 14813-6 and ISO 14817.

This International Standard defines:

— Rules concerning the creation of XML Schemas for ensuring interoperability in various types of ITS applications that use XML (Clause 7, normative);

— Rules for using XML for the purpose of reusing XML Schemas (Clause 7, normative);

— Rules concerning registration and management of XML components in data dictionaries and data registries (Clause 8, normative);

— Examples of the use of XML in ITS applications (Annex A, informative);

— Representation of IRI (international resource identifiers) and/or ID-related constructs of this standard (Annex B, informative);

— Schema header template (Annex C, informative);

— Example of registering XML constructs (Annex D, informative);

— Example of automatic generation of an XML Schema from unified modelling language (UML) (Annex E, informative);

— Applying ASN.1 encoding for XML document (Annex F, informative);

— ASN.1 transformation to XML Schema example (Annex G, informative).

NOTE A table of language comparisons (XML, ASN.1, UML) may be found in ISO 14813-6.

2 Conformance

This International Standard prescribes a conceptual model; it does not define any single physical implementation. It provides a consistent and interoperable means of achieving interoperability for the

international exchange of information in XML application programs. Regional and national XML Schema have the option of providing additional schemas and variants for use in local situations.

In order to claim conformance with this International Standard, it is only required to design systems and exchange data internationally consistently in accordance with the provisions of this International Standard. No external conformance procedures are proposed or defined in this International Standard, although regional, national and local implementations are free to, and may choose to define and require local conformance procedures.

3 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 31-0, *Quantities and units — Part 0: General principles*

ISO/IEC 8824-1:2002, *Information technology — Abstract Syntax Notation One (ASN.1): Specification of basic notation*

ISO/IEC 8825-4:2002, *Information technology — ASN.1 encoding rules: XML Encoding Rules (XER)*

ISO/IEC 8825-5:2004, *Information technology — ASN.1 encoding rules: Mapping W3C XML schema definitions into ASN.1*

ISO 14813-6, *Transport information and control systems — Reference model architecture(s) for TICS sector — Part 6: Data presentation in ASN.1*

ISO 14817:2002, *Transport information and control systems — Requirements for an ITS/TICS central Data Registry and ITS/TICS Data Dictionaries*

W3C Recommendation, *Extensible Mark-up Language (XML) 1.0, Second Edition*, 6 October 2000

W3C Recommendation, *Namespaces in XML*, 4 January 1999

W3C Recommendation, *XML Schema, Part 1: Structures, Second Edition*, 28 October 2004

W3C Recommendation, *XML Schema, Part 2: Datatypes, Second Edition*, 28 October, 2004

W3C Recommendation, *XML Linking Language (XLink), Version 1*, 27 June 2001

OMG, *XML Metadata Interchange (XMI) Specification, Version 2.0,* 3 May 2003

OMG, *Meta Object Facility (MOF) Specification, Version 2.0*, April 2004

ISOC, RFC 3987: *Internationalized Resource Identifiers (IRIs)*, January 2005

ISOC, RFC 2616: *Hypertext Transfer Protocol — HTTP/1.1*, June 1999

4 Terms and definitions

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

4.1
application
program that reads XML documents and “does something useful” with them

NOTE Applications will normally be interfaced to an XML parser, for example via DOM or SAX.

4.2
ASN.1 application
application that uses ASN.1 encodings for communication (except XML encoding rules)

4.3
ASN.1 schema
definition of the content and structure of data using an ASN.1 type definition

NOTE ASN.1 is specified in ISO/IEC 8824.

4.4
association end
endpoint of an association, which connects the association to a classifier

4.5
attribute
⟨classifier⟩ feature that describes a range of values those instances of the classifier may hold

4.6
attribute
⟨element⟩ property

NOTE It is additional information about a piece of data (element). Often attributes are used to pass information about the element and hence can be said to provide metadata for the element. An attribute is a value indicator (=) and the attribute value is specified within the tag (i.e. <H3 align="centre">). Attribute in XML is a name="value" pair that can be placed in the start tag of an element. For XML, all values are quoted with single or double quotes.

4.7
child element
element contained within another element

NOTE The element containing other elements is a parent element.

4.8
class
description of a set of objects that share the same attributes, operations, methods, relationships and semantics

4.9
class diagram
diagram that shows a collection of declarative (static) model elements, such as classes, types, and their contents and relationships

4.10
constraint
semantic condition or restriction

NOTE Certain constraints are predefined in the UML, others may be user defined. Constraints are one of three extensibility mechanisms in UML.

4.11
content
all data between the start tag and end tag of an element

NOTE Content may be made up of mark-up characters and character data.

4.12
content model
expression specifying what elements and data are allowed within an element

4.13
data concept
any of a group of data dictionary structures defined in ISO 14817 (i.e. object class, property, value domain, data element concept, data element, data frame, message, interface dialogue, association) referring to abstractions or things in the natural world that can be identified with explicit boundaries and meaning and whose properties and behaviour all follow the same rules

[ISO 14817]

4.14
data dictionary
organized and constructed (electronic data base) compilation of descriptions of data concepts that provides a consistent means for documenting, storing and retrieving the syntactical form (i.e. representational form) and the meaning and connotation of each data concept

[ISO 14817]

4.15
data element
⟨data concept⟩ some single unit of information of interest (such as a fact, proposition, observation, etc.) about some (entity) class of interest (e.g. a person, place, process, property, concept, association, state, event)

[ISO 14817]

NOTE A data element is considered to be indivisible in a particular context.

4.16
data frame
⟨data concept⟩ grouping of data elements primarily for the purpose of referring to the group with a single name, and thereby efficiently reusing groups of data elements that commonly appear together (as an ASN.1 SEQUENCE, SEQUENCE OF, SET, SET OF or CHOICE) in a message specification

4.17
data registry
store of data, characterized in a consistent manner, as determined according to the provisions of this International Standard, used for a specific purpose (in this case ITS)

[ISO 14817]

4.18
data type
type of content that an element contains in XML and UML

NOTE An author can specify an element's data type.

4.19
declaration
create new types (both simple and complex)

4.20
definition
enable elements and attributes with specific names and types (both simple and complex) to appear in document instances

4.21
document type definition
rules that define the tags that can be used in an XML file and their valid values

4.22
EBNF
formal set of production rules that comprise a grammar defining language, such as XML

4.23
element
⟨XML⟩ logical data structure within an XML document, a piece of data within a file

NOTE An XML element consists of a start tag and end tag, and the information between the tags, which is often referred to as the contents. Start tags and end tags show the beginning and end of an element. A schema that can provide a description of the structure of the data describes elements used in an XML file.

4.24
element
atomic constituent of the UML model

4.25
end tag
element delimiter

NOTE In: <foo>this is a bar</foo> the construct </foo> is the end tag. End tags cannot include anything other than the element name and trailing space.

4.26
Internet (uniform) resource identifier
IRI
compact string of characters for identifying an abstract or physical resource

4.27
lexical space
the set of valid literals for a datatype

4.28
local
element, group, attribute, attribute group or data types that are not global

4.29
mark-up
identification of element types and structure within a document

NOTE The mark-up is not actually part of the content, but identifies the components and their roles.

4.30
message
⟨data concept⟩ grouping of data elements and/or data frames as well as associated message metadata, that is used to convey a complete unit of information

[ISO14817]

4.31
metadata
data that defines and describes other data

4.32
namespace
set of unique identifiers

NOTE Namespace is a mechanism to resolve naming conflicts between elements in an XML document when each comes from a different vocabulary. It allows the commingling of like tag names from different namespaces. A namespace identifies an XML vocabulary defined within a uniform resource name (URN). An attribute on an element, attribute or entity

reference associates a short name with the URN that defines the namespace; that short name is then used as a prefix to the element, attribute or entity reference name to uniquely identify the namespace. Namespace references have scope. All child nodes beneath the node that specifies the namespace inherit that namespace. This allows nonqualified names to use the default namespace.

4.33
namespace
part of the model in which the names may be defined and used

NOTE Within a namespace, each name has a unique meaning.

4.34
namespace prefix
see prefix

4.35
node
elements, comments, processing instructions and text in an XML document

NOTE An XML document has a hierarchical structure, described as a tree. The tree has branches connecting at the nodes.

4.36
object class
⟨data concept⟩ construct used to represent any kind of object (also referred to as an entity) within an ITS/TICS information environment

[ISO 14817]

4.37
OID
globally unique value associated with an object to identify it unambiguously

4.38
package
general purpose mechanism for organizing elements into groups

NOTE Packages may be nested within other packages.

4.39
parser (for XML)
processor that reads an XML document and determines the structure and properties of the data

NOTE If the parser goes beyond the XML rules for conformance and validates the document against an XML Schema (or DTD), the parser is said to be a “validating” parser. A generalized XML parser reads XML files and generates a hierarchically structured tree, then hands off data to viewers and other applications for processing. A validating XML parser also checks the XML syntax and reports errors.

4.40
prefix
namespace prefix
short name to identify uniquely the namespace

4.41
profile
stereotyped package that contains model elements, which have been customized for a specific domain or purpose using extension mechanisms, such as stereotypes, tagged definitions and constraints

NOTE A profile may also specify model libraries on which it depends and the metamodel subset that it extends.

4.42
property
named value, with semantic impact, denoting a characteristic of an element

NOTE Certain properties are predefined in the UML; others may be user defined (see tagged value).

4.43
role
named specific behaviour of an entity participating in a particular context

4.44
schema
system of representing an information model that defines the data's elements and attributes

4.45
schema processor
processor to validate schema

4.46
stereotype
new type of modelling element that extends the semantics of the metamodel

NOTE Stereotypes are based on certain existing types or classes in the metamodel. Stereotypes may extend the semantics, but not the structure of pre-existing types and classes. Certain stereotypes are predefined in the UML, others may be user defined. Stereotypes are one of three extensibility mechanisms in UML.

4.47
tagged value
explicit definition of a property as a name-value pair; in a tagged value, the name is referred as the tag

NOTE Certain tags are predefined in the UML, others may be user defined. Tagged values are one of three extensibility mechanisms in UML.

4.48
tags
text structures that mark up characters which mark the beginning and end of elements within the XML document

4.49
value domain
⟨data concept⟩ expression of a specific and explicit representation of some information about something of interest within the ITS/TICS domain

[ISO 14817]

4.50
XMI
XML-based model interchange format for UML models

4.51
XML application
application that uses XML encoding

4.52
XML OID
XML representation of an ASN.1 OID

NOTE In the following example, the ASN.1 OID delimiter (white space) changed by a designated delimiter.

EXAMPLE

```
ASN.1 OID : iso standard 24531 schema 1

XML OID (delimiter "_"): iso_standard_24531_schema_1_v_1_._0

XML OID (delimiter "/"): iso/standard/24531/schema/1/v1.0
```

5 Symbols and abbreviated terms

ASN.1
abstract syntax notation one

BER
basic encoding rule

CER
canonical encoding rule

DD
data dictionary

DER
distinguished encoding rule

DR
data registry

DTD
document type definition

HTML
hypertext markup language

IRI
internationalized resource identifiers

ISO
International Organization for Standardization

ITS
intelligent transport system(s)

OID
object identifier

OMG
object management group

PER
packed encoding rule

RFC
request for comments

TICS
transport information and control system(s)

UML
unified modelling language

URL
uniform resource locator

W3C
World Wide Web consortium

WSDL
web services description language

XHTML
extensible hypertext markup language

XMI
XML metadata interchange

XML
extensible markup language

6 Document convention

In this International Standard the following documentation conventions are used:

a) The term “schema” with a small “s” is used generically (to include DTDs, XML Schema and in some case ASN.1 schemas), while the term XML Schema or just Schema (capital “S”) refers specifically to schemas authored in accordance with the World Wide Web Consortium (W3C) XML Schema recommendation.

b) For reasons of brevity, not all examples are full schemas. In all prose and examples, the *xs* name space prefix is mapped to the namespace of the XML Schema language http://www.w3.org/2001/XMLSchema, even if no namespace declaration appears in the example. Similarly, the *xsi* and *xmi* namespace prefixes are mapped to the namespace name of Table 1.

Table 1 — Namespace prefix and associated namespace

Namespace prefix	Associated Namespace
xs	http://www.w3.org/2001/XMLSchema
xmi, *xsi*	http://www.omg.org/2001/XMLSchema-instance

EXAMPLE <xs:simpleType name = “car”/>

In this case, it is understood that

```
<xs:schema xlmns:xs = “http://www.w3.org/2001/XMLSchema”>
```

has already been declared.

c) Even if no end tag appears in the example, assume the end tag is declared at the appropriate place.

d) All examples are only for the purpose of explanation therefore informative. All IRIs in example are virtual with the exception of http://www.w3.org/2001/XMLSchema.

e) Throughout this International Standard, in accordance with ISO 31-0, decimal separators will be a point on the line.

7 Requirements

Figure 1 shows the scope of XML functionality in the ITS sector.