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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

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

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The committee responsible for this document is ISO/TC 204, *Intelligent Transport Systems*.

This second edition cancels and replaces the first edition (ISO 24531:2006). Clause 7 onwards has been technically revised.

Introduction

As the exchange of information via the internet and other wired and wire-free networks develops and expands, the use of XML (Extended Mark-up 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.

However, within XML and its variants 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 definitions 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

This International Standard assists ITS standards developers and users of ITS standards who wish to use XML, by providing a consistent definition of the rules and rule references for the use of XML within ITS systems. This International Standard defines 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 ASN.1 data definitions required by ISO 14813-6 and ISO 14817.

NOTE A table of language comparisons (XML, ASN.1, UML) can be found in ISO 14813-6:2009.

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 schema 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 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 14812:1999, *Transport information and control systems — Glossary standard terminologies for the transport information and control sector*

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

ISO/IEC 19501:2005, *Information technology — Open Distributed Processing — Unified Modeling Language (UML) Version 1.4.2*

W3C Recommendation, *Extensible Mark-up Language (XML) 1.0* (Fifth Edition), 26 November 2008

W3C Recommendation, *Namespaces in XML 1.0* (Second Edition), 16 August 2006

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 1.0, 27 June 2001

W3C Recommendation, *XSL Transformations (XSLT)*, Version 2.0, 23 January 2007

OASIS, C*ode List Representation (Genericode)*, Version 1.0, December 2007

OASIS, *Context/value association using genericode 1.0*, April 2010

ISOC, RFC 5141, *A Uniform Resource Name (URN) Namespeace for the International Organization for Standardization (ISO)*, March 2008

4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14812 and the following apply.

4.1
application
<XML> program that reads XML documents and "does something useful" with them

Note 1 to entry: 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 XER)

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

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

4.5
attribute
<XML> property of an element

Note 1 to entry: 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 have to be quoted with single or double quotes.

4.6
attribute
<UML> feature within a classifier that describes a range of values those instances of the classifier may hold

4.7
child element
<XML> element contained within another element

Note 1 to entry: The element containing other elements is a parent element.

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

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

4.10
constraint
<UML> semantic condition or restriction

Note 1 to entry: Certain constraints are predefined in the UML, others may be user defined. Constraints are one of three extensibility mechanisms in UML.

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

Note 1 to entry: Content may be made up of mark-up characters and character data.

4.12
content model
<XML> 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 14817:2002, definition 4.4]

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 14817:2002, definition 4.6]

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 14817:2002, definition 4.7]

Note 1 to entry: 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 appears 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 14817:2002, definition 4.11]

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

Note 1 to entry: An author can specify an element's data type.

4.19
declaration
<XML> create new types (both simple and complex)

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

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

4.22
element
<XML> logical data structure within an XML document, a piece of data within a file

Note 1 to entry: 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.

4.23
element
<UML> atomic constituent of the UML model

4.24
end tag
<XML> element delimiter

Note 1 to entry: 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.

4.25
global
construct (e.g. element, group, attribute, attribute group, or data type) that is declared as a direct child of the schema root element

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

4.27
lexical space
<XML> set of valid literals for a data type

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

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

Note 1 to entry: The mark-up is not actually part of the content, but identifies the components and their roles.

4.31
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

[ISO 14817:2002, definition 4.19]

4.32
metadata
data that defines and describes other data

4.33
namespace
<XML> set of unique identifiers

Note 1 to entry: 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 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.

4.34
namespace
<UML> part of the model in which the names may be defined and used

Note 1 to entry: Within a namespace, each name has a unique meaning.

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

Note 1 to entry: 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 14817:2002, definition 4.25]

4.37
OID
<ASN.1> globally unique value associated with an object to identify it unambiguously

4.38
package
<UML> general purpose mechanism for organizing elements into groups

Note 1 to entry: Packages may be nested within other packages.

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

Note 1 to entry: If the parser goes beyond the XML rules for conformance and validates the document against an XML schema, 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
<XML> short name to uniquely identify the namespace

4.41
profile
<UML> 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 1 to entry: A profile may also specify model libraries on which it depends and the metamodel subset that it extends.

4.42
property
<UML> named value denoting a characteristic of an element

Note 1 to entry: Certain properties are predefined in the UML; others MAY be user defined. See: tagged value.

Note 2 to entry: A property has semantic impact.

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

4.44
schema
<XML, UML> system of representing an information model that defines the data's elements and attributes

4.45
schema processor
<UML> processor to validate schema

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

Note 1 to entry: Stereotypes have to be 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
tags
<XML> text structures that mark-up characters which mark the beginning and end of elements within the XML document

4.48
tagged value
<UML> explicit definition of a property as a name-value pair

Note 1 to entry: Certain tags are predefined in the UML; others MAY be user defined. Tagged values are one of three extensibility mechanisms in UML.

Note 2 to entry: In a tagged value, the name is referred as the tag.

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 14817:2002, definition 4.29]

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

EXAMPLE In the following example, the ASN.1 OID delimiter (white space) changed by a designated delimiter. ASN.1 OID : iso standard 24531 schema 1; XML OID (delimiter "_"): iso_standard_24531_schema_1; XML OID (delimiter "/"): iso/standard/24531/schema/1

5 Abbreviated terms

ASN.1

abstract syntax notation one

DD

data dictionary

DR

data registry

HTML

hyper text markup language

IRI

Internationalized Resource Identifiers

ISO

International Organization for Standardization

ITS

intelligent transport system(s)

NDR

naming and design rules

OID

object identifier

OMG

object management group

RFC

request for comments

TICS

transport information and control system(s)

UBL

unifversal business language

URL

uniform resource locator

UML

unified modelling language (as defined by ISO 19501)

W3C

world wide web consortium

WSDL

web services description language

XHTML

extensible hyper text mark-up language

XMI

XML metadata interchange

XML

eXtensible mark-up language

6 Document convention

In this International Standard the following documentation conventions are used.

a) The term ‘schema’ refers specifically to schemas authored in accordance with the World Wide Web Consortium (W3C) XML schema recommendation, unless otherwise indicated.

b) For reasons of brevity, not all examples are full schemas. In all prose and examples, the mappings shown in Table 1 apply, even if no namespace declaration appears in the example.

Table 1 — Namespace prefix and associated namespace

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

EXAMPLE

```
<xs:simpleType name = “car”/>
```

In this case, it is understood that

```
<xs:schema xmlns: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 and are therefore informative. All IRIs in the examples are virtual with the exception of the namespaces listed in Table 1.

e) Throughout this International Standard, in accordance with ISO 31-0:1992, Amd. 2:2005, decimal separators will be a point on the line.

7 Requirements

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

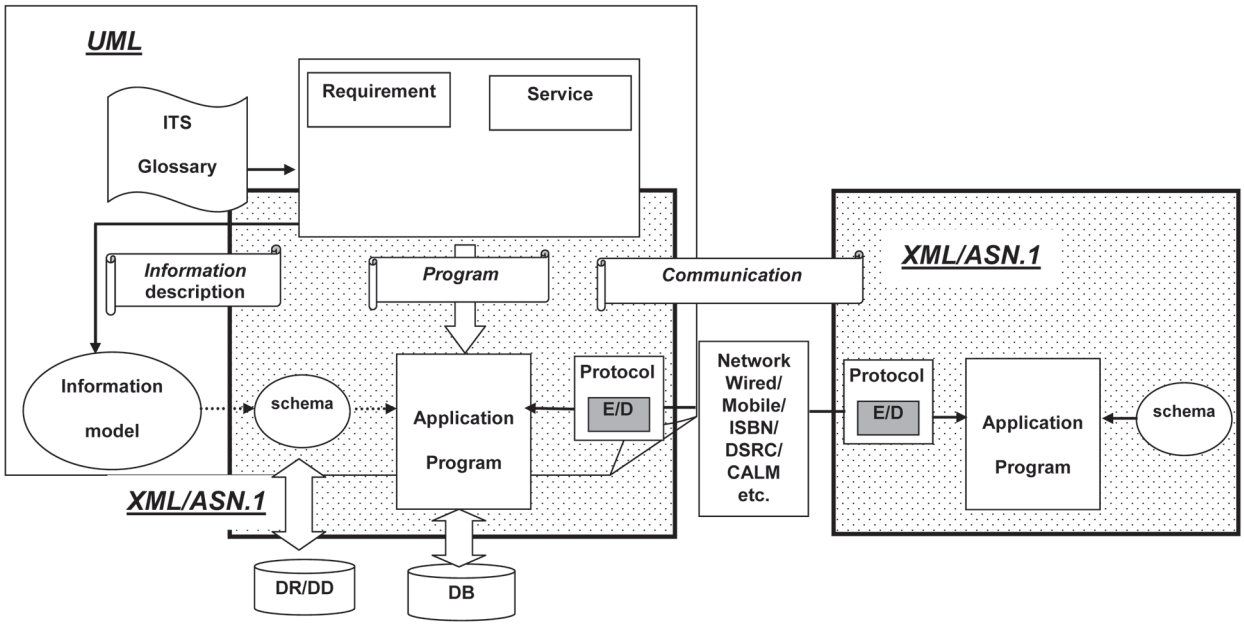

Figure 1 — XML functionality

7.1 Required conditions

Intelligent transport systems are evolving social infrastructure systems that offer various functions. To achieve their benefits, the following exchanges occur:

— information exchanges between various countries' organizations, including web services usages;

— information exchanges between different ITS functional areas;

— information exchanges between ITS-related industries' systems; and

— information exchanges through various networks.

7.2 Required items

From the viewpoint of ITS information technology, the following items are required:

— formal method to define precise and unambiguous ITS vocabularies;

— registration and management rules for XML components, management and maintenance rules (ITS data registries and ITS data dictionaries);

— formal method to define dialogues and messages;

— expandable and reusable vocabularies and programs;

— ways to support various networks (wired/mobile/DSRC/digital broadcast /CALM, etc.);

— efficient encoding method; and

— automatic generation of XML schemas from UML.

7.3 Rules for modelling data exchanges