

TECHNICAL SPECIFICATION

ISO/TS 19103

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2005-07-15

Geographic information — Conceptual schema language

Information géographique — Schéma de langage conceptuel

Preview

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Foreword

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ISO/TS 19103 was prepared by Technical Committee ISO/TC 211, *Geographic information/Geomatics*.

Introduction

This Technical Specification of the ISO geographic information standards is concerned with the adoption and use of a conceptual schema language (CSL) for developing computer-interpretable models, or schemas, of geographic information. Standardization of geographic information requires the use of a formal CSL to specify unambiguous schemas that can serve as a basis for data interchange and the definition of interoperable services. An important goal of the ISO geographic information standards is to create a framework in which data interchange and service interoperability can be realized across multiple implementation environments. The adoption and consistent use of a CSL to specify geographic information is of fundamental importance in achieving this goal.

There are two aspects to this Technical Specification. First, a CSL must be selected that meets the requirements for rigorous representation of geographic information. This Technical Specification identifies the combination of the Unified Modeling Language (UML) static structure diagram with its associated Object Constraint Language (OCL) and a set of basic type definitions as the conceptual schema language for specification of geographic information. Secondly, this Technical Specification provides guidelines on how UML should be used to create geographic information and service models that are a basis for achieving the goal of interoperability.

One goal of the ISO geographic information standards using UML models is that they will provide a basis for mapping to encoding schemas as defined in ISO 19118, as well as a basis for creating implementation specifications for implementation profiles for various environments.

Geographic information — Conceptual schema language

1 Scope

This Technical Specification provides rules and guidelines for the use of a conceptual schema language within the ISO geographic information standards. The chosen conceptual schema language is the Unified Modeling Language (UML).

This Technical Specification provides a profile of the Unified Modeling Language (UML) for use with geographic information. In addition, it provides guidelines on how UML should be used to create standardized geographic information and service models.

2 Conformance

Any conceptual schema written for a specification, including a profile or functional standard, that claims conformance with this Technical Specification shall pass all of the requirements described in the abstract test suite in Annex A. Non-UML schemas shall be considered conformant if there is a well-defined mapping from a model in the source language into an equivalent model in UML and that this model in UML is conformant.

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 19101:2002, *Geographic Information — Reference model*

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

4 Terms, definitions and abbreviations

4.1 ISO/TS 19103 terms

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

4.1.1

application

manipulation and processing of data in support of user requirements

[ISO 19101]

4.1.2

application schema

conceptual schema for data required by one or more **applications**

[ISO 19101]

**4.1.3
conceptual model**

model that defines concepts of a universe of discourse

[ISO 19101]

**4.1.4
conceptual schema**
formal description of a **conceptual model**

[ISO 19101]

**4.1.5
data type**
specification of a **value domain** with **operations** allowed on **values** in this **domain**

EXAMPLE Integer, Real, Boolean, String, Date and SG Point (conversion of data into a series of codes).

NOTE Data types include primitive predefined types and user-definable types.

**4.1.6
domain**
well-defined set

NOTE Domains are used to define the domain set and range set of attributes, operators and functions.

**4.1.7
feature**
abstraction of real world phenomena

[ISO 19101]

NOTE 1 A feature may occur as a type or an instance. Feature type or feature instance should be used when only one is meant.

NOTE 2 In UML ^[8] a feature is a property, such as operation or attribute, which is encapsulated as part of a list within a classifier, such as interface, class or data type.

**4.1.8
feature association**
relationship that links instances of one **feature** type with instances of the same or a different **feature** type

[ISO 19109]

NOTE 1 A feature association may occur as a type or an instance. Feature association type or feature association instance is used when only one is meant.

NOTE 2 Feature associations include aggregation of features.

**4.1.9
feature attribute**
characteristic of a **feature**

[ISO 19101]

NOTE 1 A feature attribute has a name, a data type, and a value domain associated to it. A feature attribute for a feature instance also has an attribute value taken from the value domain.

NOTE 2 A feature attribute may occur as a type or an instance. Feature attribute type or feature attribute instance should be used when only one is meant.

4.1.10**feature operation**

operation that every **instance** of a **feature** type may perform

[ISO 19110]

EXAMPLE 1 An operation upon a “dam” is to raise the dam. The result of this operation is to raise the level of water in a reservoir.

EXAMPLE 2 An operation by a “dam” might be to block vessels from navigating along a “watercourse”.

NOTE Feature operations provide a basis for feature type definition.

4.1.11**metadata**

data about data

[ISO 19115]

4.1.12**metadata element**

discrete unit of **metadata**

[ISO 19115]

NOTE 1 Metadata elements are unique within a metadata entity.

NOTE 2 Equivalent to an attribute in UML terminology.

4.1.13**schema**

formal description of a model

[ISO 19101]

4.1.14**service**

distinct part of the functionality that is provided by an entity through interfaces

[ISO/IEC TR 14252]

4.1.15**value domain**

set of accepted values

EXAMPLE The range 3-28, all integers, any ASCII character, enumeration of all accepted values (green, blue, white).

4.2 UML terms

The following are UML terms that are adapted from ISO/IEC 19501.

4.2.1**actor**

coherent set of roles that users of use cases play when interacting with these use cases

NOTE An actor may be considered to play a separate role with regard to each use case with which it communicates.

4.2.2

aggregation

special form of **association** that specifies a whole-part **relationship** between the aggregate (whole) and a **component** part

NOTE See composition.

4.2.3

association

semantic **relationship** between two or more **classifiers** that specifies connections among their **instances**

NOTE A binary association is an association among exactly two classifiers (including the possibility of an association from a classifier to itself).

4.2.4

attribute

feature within a **classifier** that describes a range of **values** that **instances** of the **classifier** may hold

NOTE 1 An attribute is semantically equivalent to a composition association; however, the intent and usage is normally different.

NOTE 2 "Feature" used in this definition is the UML meaning of the term and is not meant as defined in 4.1 of this Technical Specification.

4.2.5

behaviour

observable effects of an **operation** or event, including its results

4.2.6

cardinality

number of elements in a set

NOTE Contrast: multiplicity.

4.2.7

class

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

NOTE A class may use a set of interfaces to specify collections of operations it provides to its environment. See: interface.

4.2.8

classifier

mechanism that describes behavioural and structural **features**

NOTE Classifiers include interfaces, classes, datatypes, and components.

4.2.9

component

modular, deployable, and replaceable part of a system that encapsulates implementation and exposes a set of **interfaces**

NOTE A component represents a physical piece of implementation of a system, including software code (source, binary or executable) or equivalents such as scripts or command files.

4.2.10

composition

form of **aggregation** which requires that a part **instance** be included in at most one composite at a time, and that the composite **object** is responsible for the creation and destruction of the parts

NOTE Parts with non-fixed multiplicity may be created after the composite itself, but once created they live and die with it (i.e. they share lifetimes). Such parts can also be explicitly removed before the death of the composite. Composition may be recursive. Synonym: composite aggregation.

4.2.11

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. See: tagged value, stereotype.

4.2.12

dependency

relationship between two modeling elements, in which a change to one modeling element (the independent element) will affect the other modeling element (the dependent element)

4.2.13

generalization

taxonomic **relationship** between a more general element and a more specific element that is fully consistent with the more general element and contains additional information

NOTE An instance of the more specific element may be used where the more general element is allowed. See: inheritance.

4.2.14

inheritance

mechanism by which more specific elements incorporate structure and **behaviour** of more general elements related by **behaviour**

NOTE See generalization.

4.2.15

instance

entity that has unique identity, a set of **operations** can be applied to it, and state that stores the effects of the **operations**

NOTE See: object.

4.2.16

interface

named set of **operations** that characterize the **behaviour** of an element

4.2.17

metamodel

model that defines the language for expressing a model

4.2.18

method

implementation of an **operation**

NOTE It specifies the algorithm or procedure associated with an operation.

4.2.19

multiplicity

specification of the range of allowable cardinalities that a set may assume

NOTE Multiplicity specifications may be given for roles within associations, parts within composites, repetitions and other purposes. Essentially a multiplicity is a (possibly infinite) subset of the non-negative integers. Contrast: cardinality.

4.2.20

object

entity with a well-defined boundary and identity that encapsulates state and **behaviour**

NOTE State is represented by attributes and relationships, behaviour is represented by operations, methods and state machines. An object is an instance of a class. See: class, instance.

4.2.21

operation

service that can be requested from an **object** to affect **behaviour**

NOTE 1 An operation has a signature, which may restrict the actual parameters that are possible.

NOTE 2 Definition from UML Reference Manual: A specification of a transformation or query that an object may be called to execute.

NOTE 3 An operation has a name and a list of parameters. A method is a procedure that implements an operation. It has an algorithm or procedure description.

4.2.22

package

general purpose mechanism for organizing elements into groups

NOTE Packages may be nested within other packages. Both model elements and diagrams may appear in a package.

4.2.23

refinement

relationship that represents a fuller **specification** of something that has already been specified at a certain level of detail

NOTE For example, a design class is a refinement of an analysis class

4.2.24

relationship

semantic connection among model elements

NOTE Kinds of relationships include association, generalization, metarelationship, flow and several kinds grouped under dependency.

4.2.25

specification

declarative description of what something is or does

NOTE Contrast: implementation.

4.2.26

stereotype

new type of modeling element that extends the semantics of the **metamodel**

NOTE Stereotypes must 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. The others are constraint and tagged value.

4.2.27

tagged value

explicit definition of a property as a name-**value** pair

NOTE In a tagged value, the name is referred as the tag. Certain tags are predefined in the UML; others may be user defined. Tagged values are one of three extensibility mechanisms in UML. The others are constraint and stereotype.

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