INTERNATIONAL STANDARD

ISO 19117

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Geographic information — Portrayal

Information géographique — Présentation

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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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 19117 was prepared by Technical Committee ISO/TC 211, *Geographic information/Geomatics*.

This second edition cancels and replaces the first edition (ISO 19117:2005), which has been technically revised.

Introduction

This International Standard specifies a conceptual schema for portrayal data, in particular symbols and portrayal functions. Portrayal functions associate features with symbols for the portrayal of the features on maps and other display media. This schema includes classes, attributes, associations and operations that provide a common conceptual framework that specifies the structure of and interrelationships between features, portrayal functions, and symbols. It separates the content of the data from the portrayal of that data, to allow the data to be portrayed in a manner independent of the dataset. This framework is derived from concepts found in existing portrayal implementations, and specifies a conceptual standard for use in future implementations (for example OGC Symbology Encoding and Styled Layer Descriptor Profile of WMS).

This International Standard provides an abstract model for developers of portrayal systems so that they can implement a system with the flexibility to portray geographic data to a user community in a manner that makes sense to that community.

The principal changes in this revision are to expand the concept of portrayal rules to more generic portrayal functions, include definitions for symbols (including parameterized symbols), include both portrayal functions and symbols in portrayal catalogues, and define a core portrayal schema, and extensions for specialized cases.

This revision for the most part expands on the concepts in ISO 19117:2005, but concepts for portrayal specifications (as a symbol instead of an operation), portrayal catalogue (also includes symbols), and rules-based portrayal (multiple rules allowed) have been changed.

Geographic information — Portrayal

1 Scope

This International Standard specifies a conceptual schema for describing symbols, portrayal functions that map geospatial features to symbols, and the collection of symbols and portrayal functions into portrayal catalogues. This conceptual schema can be used in the design of portrayal systems. It allows feature data to be separate from portrayal data, permitting data to be portrayed in a dataset independent manner.

This International Standard is not applicable to the following:

— standard symbol collection (e.g. International Chart 1 – IHO);

— a standard for symbol graphics (e.g. scalable vector graphics [SVG]);

— portrayal services (e.g. web map service);

— capability for non-visual portrayal (e.g. aural symbology);

— dynamic rendering (e.g. on the fly contouring of tides);

— portrayal finishing rules (e.g. generalization, resolve overprinting, displacement rules);

— 3D symbolization (e.g. simulation modeling).

2 Conformance

Any portrayal catalogue, portrayal function and symbol describing the portrayal of geographic information claiming conformance with this International Standard shall pass the relevant tests of the abstract test suite presented in Annex A, and those portrayal extension requirements that are applicable to the extension or extensions being used.

Conformance classes are defined for the portrayal core, and the core plus extensions. These extensions provide additional functionality, and are not mutually exclusive of each other.

Core portrayal conformance classes
Conformance class – portrayal core (general)
Conformance class – portrayal core – symbol
Conformance class – portrayal core – portrayal function
Conformance class – portrayal core – portrayal catalogue

Portrayal function extension conformance classes
Conformance class – portrayal core plus conditional function extension
Conformance class – portrayal core plus context extension

Conformance class – portrayal core plus function symbol parameter extension

Symbol extension conformance classes
Conformance class – portrayal core plus compound symbol extension
Conformance class – portrayal core plus complex symbol extension
Conformance class – portrayal core plus reusable symbol component extension
Conformance class – portrayal core plus symbol parameter extension

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/TS 19103:2005, *Geographic information — Conceptual schema language*

ISO 19107:2003, *Geographic information — Spatial schema*

ISO 19109:2005, *Geographic information — Rules for application schema*

ISO 19110:2005, *Geographic information — Methodology for feature cataloguing*

ISO 19111:2007, *Geographic information — Spatial referencing by coordinates*

ISO 19115:2003, *Geographic information — Metadata*

ISO/TS 19139:2007, *Geographic information — Metadata — XML schema implementation*

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

4 Terms and definitions

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

4.1
annotation
any marking on illustrative material for the purpose of clarification

Note 1 to entry: Numbers, letters, **symbols** (4.31), and signs are examples of annotation.

4.2
class
description of a set of objects that share the same attributes, operations, methods, relationships and semantics

Note 1 to entry: A class may use a set of interfaces to specify collections of operations it provides to its environment. See: interface.

[SOURCE: ISO/TS 19103:2005, definition 4.27]

4.3
complex symbol
symbol (4.31) composed of other symbols of different types

EXAMPLE A dashed line symbol with a **point** (4.19) symbol repeated at an interval.

4.4
compound symbol
symbol (4.31) composed of other symbols of the same type

EXAMPLE A **point** (4.19) symbol that is composed of two point graphics.

4.5
conditional feature portrayal function
function (4.11) that maps a geographic **feature** (4.8) to a **symbol** (4.31) based on some condition evaluated against a property or attribute of a feature

4.6
curve
1-dimensional **geometric primitive** (4.13), representing the continuous image of a line

[SOURCE: ISO 19107:2003, definition 4.23]

4.7
dataset
identifiable collection of data

Note 1 to entry: A dataset may be a smaller grouping of data which, though limited by some constraint such as spatial extent or **feature** (4.8) type, is located physically within a larger dataset. Theoretically, a dataset may be as small as a single feature or **feature attribute** (4.9) contained within a larger dataset. A hardcopy map or chart may be considered a dataset.

[SOURCE: ISO 19115:2003, definition 4.2]

4.8
feature
abstraction of real world phenomena

Note 1 to entry: A feature may occur as a type or an **instance** (4.14). Feature type or feature instance shall be used when only one is meant.

[SOURCE: ISO 19101:2002, definition 4.11]

4.9
feature attribute
characteristic of a **feature** (4.8)

EXAMPLE 1 A feature attribute named “colour” may have an attribute value “green” which belongs to the data type “text”.

EXAMPLE 2 A feature attribute named “length” may have an attribute value “82.4” which belongs to the data type “real”.

Note 1 to entry: A feature attribute has a name, a data type, and a value domain associated to it. A feature attribute for a feature **instance** (4.14) also has an attribute value taken from the value domain.

Note 2 to entry: In a feature catalogue, a feature attribute may include a value domain but does not specify attribute values for feature instances.

[SOURCE: ISO 19101:2002, definition 4.12]

4.10
feature portrayal function
function (4.11) that maps a geographic **feature** (4.8) to a **symbol** (4.31)

4.11
function
rule that associates each element from a domain (source, or domain of the function) to a unique element in another domain (target, co-domain, or range)

[SOURCE: ISO 19107:2003, definition 4.41]

4.12
geographic information
information concerning phenomena implicitly or explicitly associated with a location relative to the Earth

[SOURCE: ISO 19101:2002, definition 4.16]

4.13
geometric primitive
geometric object representing a single, connected, homogeneous element of space

[SOURCE: ISO 19107:2003, definition 4.48]

4.14
instance
object that realizes a **class** (4.2)

[SOURCE: ISO 19107:2003, definition 4.53]

4.15
layer
basic unit of **geographic information** (4.12) that may be requested as a map from a server

[SOURCE: ISO 19128:2005, definition 4.6]

4.16
metadata
data about data

[SOURCE: ISO 19115:2003, definition 4.5]

4.17
parameterized feature portrayal function
function (4.11) that maps a geographic **feature** (4.8) to a **parameterized symbol** (4.18)

Note 1 to entry: A parameterized **feature portrayal function** (4.10) passes the relevant attribute values from the feature **instance** (4.14) for use as input to the parameterized **symbol** (4.31).

4.18
parameterized symbol
symbol (4.31) that has dynamic parameters

Note 1 to entry: The dynamic parameters map to the attribute values of each **feature** (4.8) **instance** (4.14) being portrayed.

4.19
point
0-dimensional **geometric primitive** (4.13), representing a position

[SOURCE: ISO 19107:2003, definition 4.61]

4.20
portrayal
presentation of information to humans

Note 1 to entry: Within the scope of this International Standard, portrayal is restricted to the portrayal of geographic information.

4.21
portrayal catalogue
collection of defined **portrayals** (4.20) for a **feature** (4.8) catalogue

Note 1 to entry: Content of a portrayal catalogue includes **portrayal functions** (4.23), **symbols** (4.31), and **portrayal context** (4.22) (optional).

4.22
portrayal context
circumstances, imposed by factors extrinsic to a geographic **dataset** (4.7), that affect the **portrayal** (4.20) of that dataset

EXAMPLE Factors contributing to portrayal context can include the proposed display or map scale, the viewing conditions (day/night/dusk), and the display orientation requirements (north not necessarily at the top of the screen or page) among others.

Note 1 to entry: Portrayal context can influence the selection of **portrayal functions** (4.23) and construction of **symbols** (4.31).

4.23
portrayal function
function (4.11) that maps geographic **features** (4.8) to **symbols** (4.31)

Note 1 to entry: **Portrayal** (4.20) functions can also include parameters and other computations that are not dependent on geographic feature properties.

4.24
portrayal function set
function (4.11) that maps a **feature** (4.8) catalogue to a **symbol set** (4.35)

4.25
portrayal rule
specific type of **portrayal function** (4.23) expressed in a declarative language

Note 1 to entry: A declarative language is rule-based and includes decision and branching statements.

4.26
portrayal service
generic interface used to portray **features** (4.8)

4.27
render
conversion of digital graphics data into visual form

EXAMPLE Generation of an image on a video display.

4.28
simple symbol
symbol (4.31) that is neither compound nor parameterized

4.29
spatial attribute
feature attribute (4.9) describing the spatial representation of the **feature** (4.8) by coordinates, mathematical **functions** (4.11) and/or boundary topology relationships

4.30
surface
2-dimensional **geometric primitive** (4.13), locally representing a continuous image of a region of a plane

[SOURCE: ISO 19107:2003, definition 4.75]

4.31
symbol
portrayal (4.20) primitive that can be graphic, audible, or tactile in nature, or a combination of these

4.32
symbol component
symbol (4.31) that is used as a piece of a **compound symbol** (4.4)

4.33
symbol definition
technical description of a **symbol** (4.31)

4.34
symbol reference
pointer in a **feature portrayal function** (4.10) that associates the feature type with a specific **symbol** (4.31)

4.35
symbol set
collection of **symbols** (4.31)

Note 1 to entry: Symbol sets are usually designed for a community of interest to portray information of interest to the community.

5 Abbreviated terms

CRS Coordinate Reference System

URL Uniform Resource Locator

UML Unified Modeling Language (ISO 19501)

6 Portrayal mechanism

6.1 Introduction

This International Standard is organized as a core portrayal model and a series of extensions.

The core portrayal model uses portrayal functions to map geospatial features to symbols. A portrayal function set maps a feature catalogue to a symbol set. A Feature Portrayal Function maps a geospatial feature to a symbol. A Portrayal Catalogue that can be used to transmit symbols and portrayal functions is also a part of the portrayal core.

There are two extensions to the portrayal function. The Conditional Function Extension extends the basic portrayal function to enable conditions to be applied in the function. Conditions can test for feature attributes, geometry, and other properties of the feature. The Context Extension extends the basic portrayal function to

enable contextual information such as display scale, viewing conditions, and other factors external to the application schema of the geospatial dataset to be utilized in portrayal functions.

The core symbol model provides for the definition of a basic symbol, which includes building up a symbol made from multiple components. There are three extensions of the symbol model, the Compound Symbol Extension (9.4), the Complex Symbol Extension (9.5), and the Reusable Symbol Component Extension (9.6) that allow a symbol to be stored at an external URL.

Finally, symbols can be parameterized by use of a Symbol Parameter Extension, and a Function Symbol Parameter Extension. Whereas conditional extensions allow a portrayal function to point to a specific symbol based on an attribute condition, the parameterized symbol uses feature attribute information as input to a symbol definition. The Function Symbol Parameter Extension allows that feature attribute information to be passed to the symbol by the Feature Portrayal Function.

This International Standard defines a feature-centred function-based portrayal mechanism. Instances of features are portrayed based on portrayal functions, which make use of geometry and attribute information. The relationship between the feature instances, attributes and the underlying spatial geometry is specified in an application schema according to ISO 19109. Spatial geometry and associated topological relationships are defined in ISO 19107.

Portrayal information is needed to portray a dataset containing geographic data. The portrayal information is handled as symbol references selected according to specific portrayal functions. The portrayal mechanism makes it possible to portray the same dataset in different ways without altering the dataset itself.

The portrayal mechanism is illustrated by Figure 1.

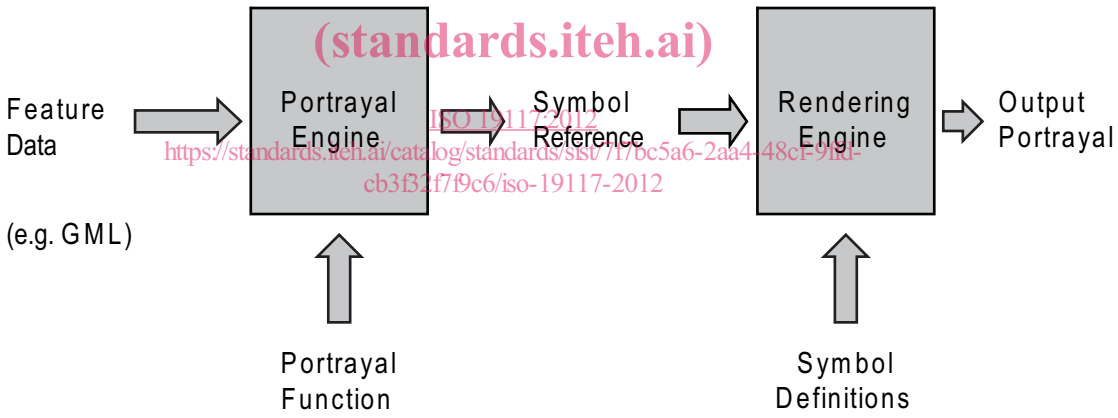

Figure 1 — Portrayal mechanism

The symbol definitions and portrayal function shall not be part of the dataset. The portrayal functions and symbol shall be able to be transferred in a portrayal catalogue. The symbols shall be referenced from portrayal functions. The feature portrayal functions shall be specified for the feature class or feature instances they will be applied on. The symbol definitions may be stored externally and referenced using a universal reference standard such as a network based URL. Portrayal information may be specified either by sending a portrayal catalogue with the dataset, or by referencing an existing portrayal catalogue from metadata.

In addition, the user may want to apply a user defined portrayal function and symbol definition. The model in Figure 2 shows how the portrayal catalogue is referenced by the dataset metadata. Only the metadata reference is shown and not the contents of the portrayal catalogue (see ISO 19115).

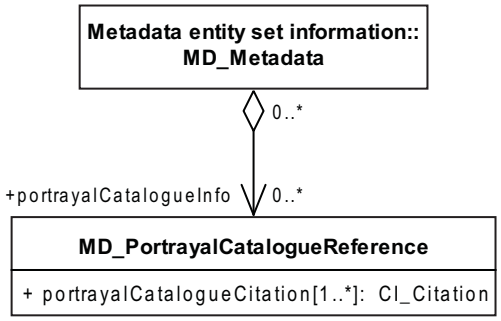

Figure 2 — UML model of the portrayal part of ISO 19115

6.2 Portrayal functions

A function is a rule that associates each element from a domain (source, or domain of the function) to a unique element in another domain (target, co-domain, or range) (ISO 19107]. In the portrayal of geographic information, a portrayal function can be considered as the assignment of a symbol instance to each geographic feature instance in a geographic dataset.

A function from a set *A* into a set *B* is defined as a rule that assigns to each element $a \in A$ a unique element $b \in B$ [4]. The set *A* is called the domain of the function while the set *B* is called the codomain. The subset of the codomain *B* that is assigned to from the domain *A* by the function *f* is called the range of *f* (see Figure 3).

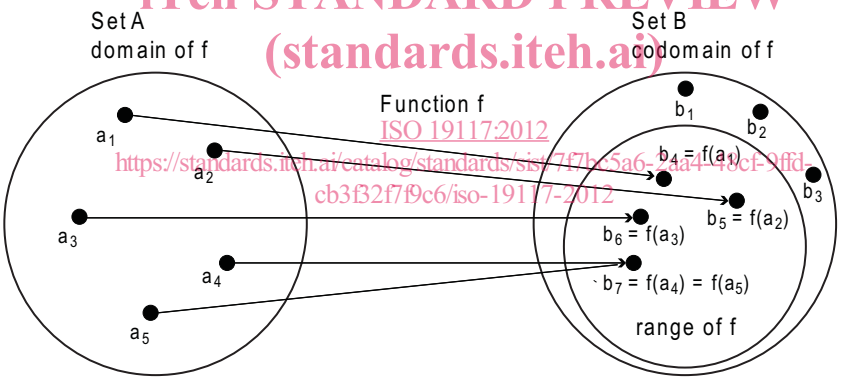

Figure 3 — Mapping from set A to set B

A geographic feature in a dataset is a member in the set of the domain. The geographic dataset is the domain. A symbol is a member in the set of the codomain. Those symbols that are actually assigned to a feature by the portrayal function are the range of the domain. Similar to features, symbols can be templates (corresponding to feature types) or instances. A symbol is a template defining, for example, the symbol used to represent a bridge, and a symbol is an instance defining, for example, the symbol that represents the Chesapeake Bay Bridge on a map.

The portrayal function is illustrated in the following equations. If domain G = a set of geographic features and codomain S = a set of symbols, then the function

$$\Phi : G \rightarrow S$$

is the **portrayal function** that maps geographic features to symbols.

If k is a feature type, and there is a function

$$t : G \rightarrow G_k$$

that maps geographic feature instances to geographic feature types, then the function

$$\Phi_k : G_k \rightarrow S$$

is a feature type dependent portrayal function or a **feature portrayal function**.

If i is a specific symbol definition, then the function

$$\Phi_k{}^i : G_k \rightarrow S_i$$

is the feature portrayal function for a symbol definition. A **portrayal function** set is a set of feature portrayal functions, over all feature types in a dataset.

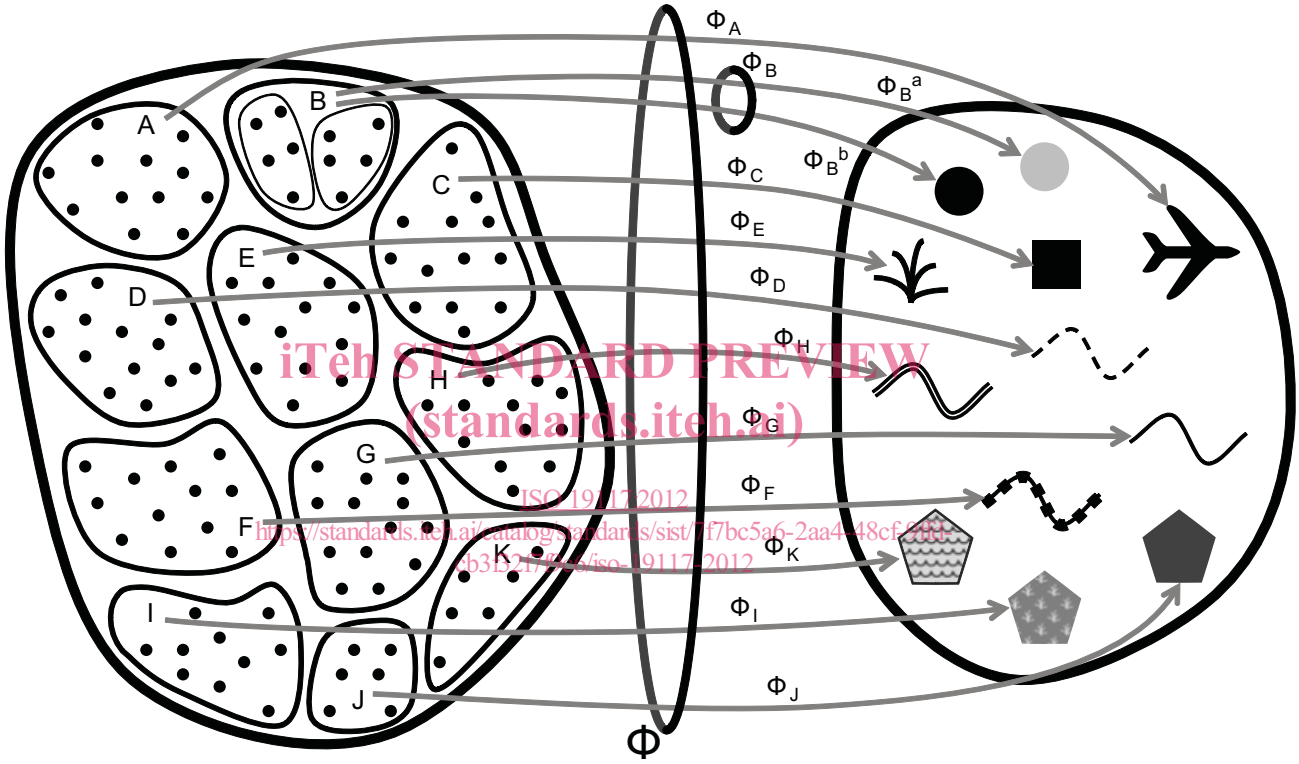

Figure 4 — Portrayal functions

Figure 4 illustrates the mapping of the portrayal function set Φ and its component feature portrayal functions Φ_A – Φ_K. The set on the left represents the domain of the function, collecting feature instances (black dots) of a dataset. This set is divided into subsets by feature type, labelled A – K. The set on the right is the range of the function and is the collection of symbols to which the features on the left are mapped. Each feature portrayal function maps the instances of a feature type to a single symbol except for ΦB which maps the instances of type B conditionally to one of two symbols.

Geographic features have properties, and so do symbols. Portrayal functions can also map feature properties to symbol properties.

Portrayal functions may also consider the context or parameters and other computations that are not dependent on the feature properties, or are external to the geospatial dataset's application schema in association of symbols to geographic features. This is particularly important where the portrayal context may determine symbolization. Information such as viewing conditions, medium, and rendering scale may influence symbolization and are thus part of the context. The context may determine which portrayal function to apply but may also be used as input to the portrayal function to achieve the same result. In the former case, a condition attached to the function is used to test the function's applicability to a context. In the latter case,