DEUTSCHE NORM

Juni 2014

DIN EN ISO 19117

DIN

ICS 35.240.70

Ersatz für
DIN EN ISO 19117:2006-09

Geoinformation – Darstellung (ISO 19117:2012); Englische Fassung EN ISO 19117:2014

Geographic information – Portrayal (ISO 19117:2012); English version EN ISO 19117:2014

Information géographique – Présentation (ISO 19117:2012); Version anglaise EN ISO 19117:2014

Gesamtumfang 107 Seiten

Normenausschuss Bauwesen (NABau) im DIN

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Nationales Vorwort

Der Text von ISO 19117:2012 wurde vom Technischen Komitee ISO/TC 211 „Geographic information/ Geomatics“ der Internationalen Organisation für Normung (ISO) erarbeitet und als EN ISO 19117:2014 durch das Technische Komitee CEN/TC 287 „Geoinformation“ übernommen, dessen Sekretariat vom BSI (Vereinigtes Königreich) gehalten wird.

Der für die deutsche Mitarbeit zuständige Arbeitsausschuss ist der als Spiegelausschuss zum CEN/TC 287 und ISO/TC 211 eingesetzte Arbeitsausschuss NA 005-03-03 AA „Kartographie und Geoinformation“ des DIN-Normenausschusses Bauwesen (NABau).

Das Präsidium des DIN hat mit seinem Beschluss 1/2004 festgelegt, dass von dem in den Regeln der europäischen Normungsarbeit von CEN/CENELEC verankerten Grundsatz, wonach Europäische Normen in den drei offiziellen Sprachen Deutsch, Englisch und Französisch veröffentlicht werden, in begründeten Ausnahmefällen abgewichen und auf die deutsche Sprachfassung verzichtet werden kann.

Die Genehmigung dafür hat die DIN-Geschäftsleitung entsprechend den festgelegten Kriterien für die vorliegende Norm auf Antrag des Normenausschusses Bauwesen (NABau), Fachbereich 03 „Vermessungswesen; Geoinformation“ erteilt.

Dieses Dokument enthält nur die englische Originalfassung von EN ISO 19117:2014 und ISO 19117:2012.

Änderungen

Gegenüber DIN EN ISO 19117:2006-09 wurden folgende Änderungen vorgenommen:

a) Erweiterung des Konzepts für Darstellungsregeln zu noch generischeren Darstellungsfunktionen, inklusive Definitionen für Symbole (einschließlich parametrisierte Symbole), Darstellungskataloge mit Darstellungsfunktionen und Symbolen und Definition eines Kern-Darstellungsschemas mit Erweiterungen für spezielle Anwendungsfälle;

b) Änderungen gab es bei dem Konzept zur Darstellungsspezifizierung (als Symbol statt als Operation), dem Darstellungskatalog (inklusive Symbole) und der regelbasierten Darstellung (mit der Möglichkeit zu mehrfachen Regeln).

Frühere Ausgaben

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Nationaler Anhang NA
(informativ)

Begriffe

4 Begriffe

Für die Anwendung dieses Dokuments gelten die folgenden Begriffe.

4.1
Anmerkung
(en: annotation)
jede Kennzeichnung für illustrierendes Material zur Klarstellung

Anmerkung 1 zum Eintrag: Zahlen, Buchstaben, **Symbole** (4.31) und Zeichen sind Beispiele für Anmerkungen

4.2
Klasse
(en: class)
Beschreibung einer Menge von Objekten mit gemeinsamen Attributen, Operationen, Methoden, Relationen und Semantiken

Anmerkung 1 zum Eintrag: Eine Klasse kann einen Satz von Schnittstellen benutzen, um die Operationen zu definieren, die bereitgestellt werden. Siehe Schnittstelle.

[QUELLE: ISO/TS 19103:2005, Definition 4.27]

4.3
komplexes Symbol
(en: complex symbol)
Symbol (4.31), das aus anderen Symbolen verschiedener Typen besteht

BEISPIEL Ein gestricheltes Liniensymbol mit einem **Punkt**symbol (4.19), welches in einem Intervall wiederholt wird.

4.4
zusammengesetztes Symbol
(en: compound symbol)
Symbol (4.31), das aus anderen Symbolen des gleichen Typs besteht

BEISPIEL Ein **Punkt**symbol (4.19), welches wiederum aus zwei Punktsymbolen besteht.

4.5
Präsentationsfunktion mit Bedingungen
(en: conditional feature portrayal function)
Funktion (4.11), die ein geographisches **Feature** (4.8) auf ein **Symbol** (4.31) abbildet, basierend auf Bedingungen, die durch Auswertung der Eigenschaften eines Features ermittelt werden

4.6
Kurve
(en: curve)
eindimensionales **geometrisches Primitiv** (4.13), das das kontinuierliche Abbild einer Linie darstellt

[QUELLE: ISO 19107:2003, Definition 4.23]

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4.7
Datensatz
(en: dataset)
identifizierbare Sammlung von Daten

Anmerkung 1 zum Eintrag: Ein Datensatz kann auch eine kleinere Gruppierung von Daten sein, die physikalisch Teil eines größeren Datensatzes ist, beschränkt z.B. durch räumliche Ausdehnung oder Objektart (**Feature**-Typ (4.8)). Theoretisch kann ein Datensatz aus einem einzelnen Feature oder **Feature-Attribut** (4.9) bestehen. Auch eine Karte auf Papier kann als Datensatz angesehen werden.

[QUELLE: ISO 19115:2003, Definition 4.2]

4.8
Feature
(en: feature)
Abstraktion eines Phänomens der realen Welt

Anmerkung 1 zum Eintrag: Ein Feature kann als Typ oder **Instanz** (4.14) vorkommen. Wenn nur eins von beiden gemeint ist, sollen die Begriffe „Feature-Typ“ oder „Feature-Instanz“ benutzt werden.

[QUELLE: ISO 19101:2002, Definition 4.11]

4.9
Feature-Attribut
(en: feature attribute)
Merkmal eines **Features** (4.8)

BEISPIEL 1 Ein Feature-Attribut namens „Farbe“ kann einen Attributwert „grün“ haben, der vom Datentyp „text“ ist.

BEISPIEL 2 Ein Feature-Attribut namens „Länge“ kann einen Attributwert „82,4“ haben, der vom Datentyp „real“ ist.

Anmerkung 1 zum Eintrag: Ein Feature-Attribut hat einen Namen, einen Datentyp und einen zugeordneten Wertebereich. Ein Feature-Attribut einer Feature-**Instanz** (4.14) hat darüber hinaus einen konkreten Attributwert aus dem Wertebereich.

Anmerkung 2 zum Eintrag: In einem Feature-Katalog kann ein Feature-Attribut einen Wertebereich beinhalten, aber keine Attributwerte für Feature Instanzen spezifizieren.

[QUELLE: ISO 19101:2002, Definition 4.12]

4.10
Funktion zur Präsentation eines Features
(en: feature portrayal function)
Funktion (4.11), die ein geographisches **Feature** (4.8) als ein **Symbol** (4.31) darstellt

4.11
Funktion
(en: function)
Regel, die jedes Element eines Bereichs (Quelle oder Bereich der Funktion) mit einem einzelnen Element in einem anderen Bereich (Zielbereich, Wertebereich oder Wertemenge) verbindet

[QUELLE: ISO 19107:2003, Definition 4.41]

4.12
Geoinformation
(en: geograhic information)
Informationen über Objekte und Sachverhalte mit einem Bezug zur Erde

[QUELLE: ISO 19101:2002, Definition 4.16]

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4.13
geometrisches Primitiv
(en: geometric primitive)
Geometrieobjekt, das ein einzelnes, zusammenhängendes, homogenes Element des Raums darstellt

[QUELLE: ISO 19107:2003, Definition 4.48]

4.14
Instanz
(en: instance)
Objekt, das eine **Klasse** (4.2) realisiert

[QUELLE: ISO 19107:2003, Definition 4.53]

4.15
Lage
(en: layer)
grundlegende Einheit von **Geoinformation** (4.12), die als eigenständige Karte von einem Server abgefragt werden kann

[QUELLE: ISO 19128:2005, Definition 4.6]

4.16
Metadaten
(en: metadata)
Daten zur Beschreibung von Ressourcen

[QUELLE: ISO 19115:2003, Definition 4.5]

4.17
parametrisierte Funktion zur Präsentation eines Features
(en: parameterized feature portrayal function)
Funktion (4.11), die ein geographisches **Feature** (4.8) in Abhängigkeit von Attributwerten auf ein **parametrisiertes Symbol** (4.18) abbildet

Anmerkung 1 zum Eintrag: Eine parametrisierte **Funktion zur Darstellung eines Features** (4.10) übergibt die relevanten Attributwerte der **Feature-Instanz** (4.14) an das parametrisierte **Symbol** (4.31).

4.18
parametrisiertes Symbol
(en: parameterized symbol)
Symbol (4.31) mit variablen Parametern

Anmerkung 1 zum Eintrag: Die Attributwerte jeder **Feature-Instanz** (4.8) (4.14) werden auf variable Parameter des Symbols abgebildet.

4.19
Punkt
(en: point)
nulldimensionales **geometrisches Primitiv** (4.13), das einer Position entspricht

[QUELLE: ISO 19107:2003, Definition 4.61]

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4.20
Darstellung
(en: portrayal)
Präsentation von Geoinformationen in einer für Menschen verständlichen Form

Anmerkung 1 zum Eintrag: Im Rahmen dieses Internationalen Standards ist die Darstellung auf geographische Informationen beschränkt.

4.21
Signaturenkatalog
Darstellungskatalog
(en: portrayal catalogue)
Sammlung definierter **Darstellungen** (4.20) für einen **Feature-**Katalog (4.8)

Anmerkung 1 zum Eintrag: Ein Signaturenkatalog enthält **Darstellungsfunktionen** (4.23), **Symbole** (4.31) und (optional) **Darstellungskontexte** (4.22).

4.22
Darstellungskontext
(en: portrayal context)
Gegebenheiten, die die **Darstellung** (4.7) eines geographischen **Datensatzes** (4.20) beeinflussen

BEISPIEL Faktoren, die zum Darstellungskontext beitragen, können u.a. sein: der vorgeschlagene Darstellungs- oder Kartenmaßstab, die Betrachtungsbedingungen (Tag/Nacht/Dämmerung) und die Orientierung der Darstellung (Norden muss nicht notwendigerweise oben sein).

Anmerkung 1 zum Eintrag: Der Darstellungskontext kann die Auswahl der **Darstellungsfunktionen** (4.23) und die Art der **Symbole** (4.31) beeinflussen.

4.23
Darstellungsfunktion
(en: portrayal function)
Funktion (4.11), die geographische **Features** (4.8) als **Symbole** (4.31) darstellt

Anmerkung 1 zum Eintrag: **Darstellung**sfunktionen (4.20) können auch Parameter und andere Berechnungen enthalten, die nicht von Feature-Eigenschaften abhängen.

4.24
Satz von Darstellungsfunktionen
(en: portrayal function set)
Funktionen (4.11), die einen **Feature-**Katalog (4.8) als **Menge von Symbolen** (4.35) darstellen

4.25
Darstellungsregel
(en: portrayal rule)
spezifischer Typ einer **Darstellungsfunktion** (4.23), der in einer Auszeichnungssprache angegeben wird

Anmerkung 1 zum Eintrag: Eine Auszeichnungssprache ist regelbasiert und enthält Entscheidungs- und Verzweigungs-statements.

4.26
Präsentationsservice
Darstellungsdienst
(en: portrayal service)
allgemeine Schnittstelle zur **Feature**-Darstellung (4.8)

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4.27
Rendern
(en: render)
Umwandlung digitaler Graphikdaten in eine sichtbare Form

BEISPIEL Erstellung eines Bildes auf einem Bildschirm.

4.28
einfaches Symbol
(en: simple symbol)
Symbol (4.31), das weder zusammengesetzt noch parametrisiert ist

4.29
räumliches Attribut
(en: spatial attribute)
Feature-Attribut (4.9), das die räumliche Darstellung des **Features** (4.8) durch Koordinaten, durch mathematische **Funktionen** (4.11) und/oder durch topologische Grenzbeziehungen beschreibt

4.30
Fläche
(en: surface)
zweidimensionales **geometrisches Primitiv** (4.13), das das kontinuierliche Abbild eines Teils der Ebene darstellt

[QUELLE: ISO 19107:2003, Definition 4.75]

4.31
Symbol
(en: symbol)
Darstellungsgrundform (4.20), die graphisch, akustisch, taktil oder eine Kombination dieser ist

4.32
Symbolkomponente
(en: symbol component)
Symbol (4.31), welches als Teil eines **zusammengesetzten Symbols** (4.4) verwendet wird

4.33
Symboldefinition
(en: symbol definition)
technische Beschreibung eines **Symbols** (4.31)

4.34
Symbolreferenz
(en: symbol reference)
Verweis auf eine **Funktion zur Präsentation eines Features** (4.10), der den Feature-Typ mit einem spezifischen **Symbol** (4.31) verknüpft

4.35
Symbolsatz
(en: symbol set)
Sammlung von **Symbolen** (4.31)

Anmerkung 1 zum Eintrag: Symbolsätze werden gewöhnlich entworfen, um für eine spezifische Nutzergruppe die dort relevanten Informationen darzustellen.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 19117

March 2014

ICS 35.240.70

Supersedes EN ISO 19117:2006

English Version

Geographic information - Portrayal (ISO 19117:2012)

Information géographique - Présentation (ISO 19117:2012)

Geoinformation - Präsentation (ISO 19117:2012)

This European Standard was approved by CEN on 13 March 2014.

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COMITÉ EUROPÉEN DE NORMALISATION
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Full document details: DIN EN ISO 19117:2014-06

Contents

Page

Foreword ... 3

Introduction ... 4

1 Scope ... 5

2 Conformance ... 5

3 Normative references ... 6

4 Terms and definitions ... 6

5 Abbreviated terms ... 10

6 Portrayal mechanism ... 10
6.1 Introduction ... 10
6.2 Portrayal functions ... 12
6.3 Portray nothing ... 14
6.4 Default portrayal ... 14
6.5 Annotation ... 14
6.6 Overview of portrayal ... 14

7 Package — ISO 19117 Portrayal ... 15
7.1 Introduction ... 15
7.2 Symbol structure ... 16

8 Package – Portrayal Core ... 21
8.1 Package semantics ... 21
8.2 Package – Portrayal Function ... 22
8.3 Package – Symbol ... 27
8.4 Package – Portrayal Catalogue ... 45

9 Package – Portrayal Extensions ... 47
9.1 Package semantics ... 47
9.2 Package – Conditional Function Extension ... 47
9.3 Package – Context Extension ... 50
9.4 Package – Compound Symbol Extension ... 54
9.5 Package – Complex Symbol Extension ... 63
9.6 Package – Reusable Symbol Component Extension ... 69
9.7 Package – Symbol Parameter Extension ... 73
9.8 Package – Function Symbol Parameter Extension ... 79

10 Basic implementation package ... 85
10.1 Package – Feature Data Model ... 85

Annex A (normative) **Abstract test suite** ... 87

Annex B (informative) **Rules-based portrayal functions** ... 91

Annex C (informative) **Enterprise view of portrayal** ... 93

Bibliography ... 99

Documents
Document Sharing Hub

Full document details: DIN EN ISO 19117:2014-06

Foreword

The text of ISO 19117:2012 has been prepared by Technical Committee ISO/TC 211 “Geographic information/Geomatics” of the International Organization for Standardization (ISO) and has been taken over as EN ISO 19117:2014 by Technical Committee CEN/TC 287 “Geographic Information” the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2014, and conflicting national standards shall be withdrawn at the latest by September 2014.

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

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According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 19117:2012 has been approved by CEN as EN ISO 19117:2014 without any modification.

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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.

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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

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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.

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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)

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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]

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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

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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

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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.

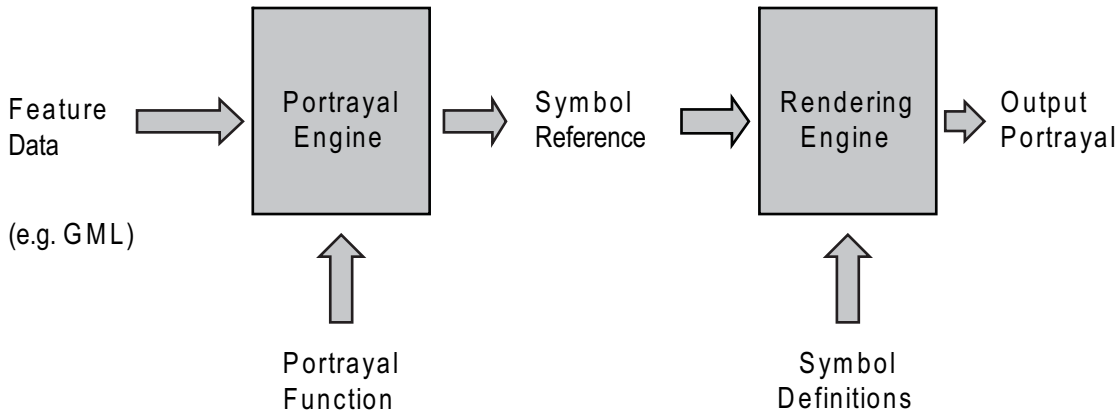

Figure 1 — Portrayal mechanism

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).

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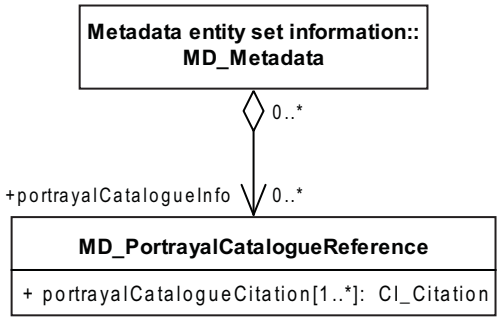

Figure 2 — UML model of the portrayal part of ISO 19115

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).

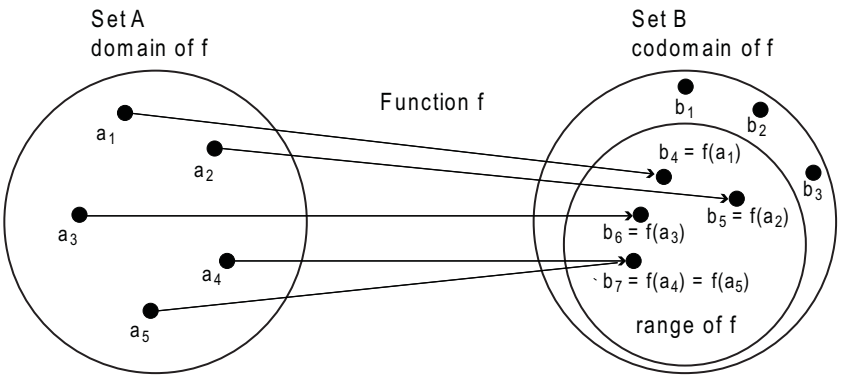

Figure 3 — Mapping from set A to set B

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

$$t : G \rightarrow G_k$$

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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.

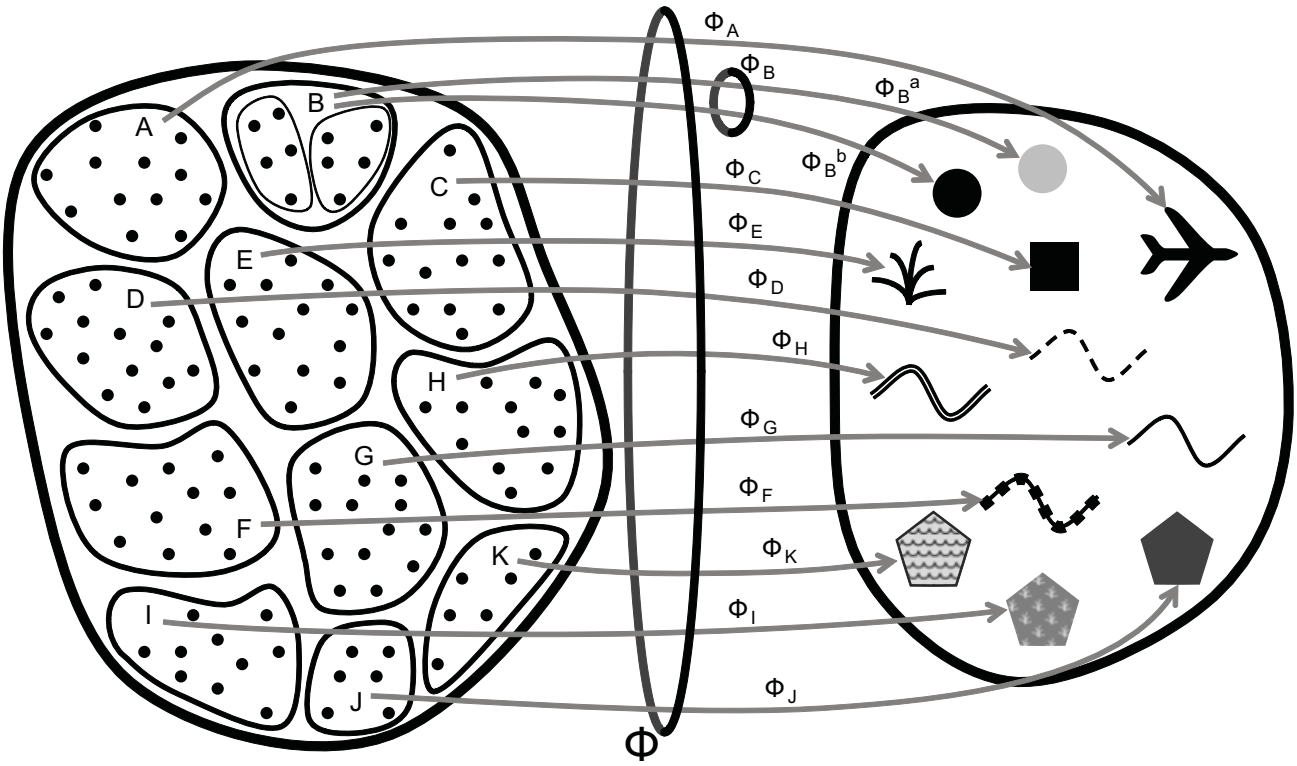

Figure 4 — Portrayal functions

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,

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multiple, conceptually separate functions are combined into one using the context to choose symbolization in the function. These two approaches may also be combined, using the context to select a portrayal function and then using the context in the function to choose symbolization.

The portrayal function is analogous to a schema mapping from the application schema of the geospatial dataset to the application schema defined by the collection of symbol definitions that are available to portray the dataset. Application schema mapping is broader in applicability than just geospatial information portrayal, and therefore will not be addressed as a requirement in this International Standard.

A portrayal rule is a specific type of portrayal function that is expressed in some declarative language (rule language with an if/else, switch/case, etc.). Portrayal rules (a rules-based portrayal function) were described in a general sense in the previous version of this International Standard (ISO 19117:2005). An elementary portrayal rules-based portrayal function is defined in Annex B of this International Standard to provide users with a basic schema mapping method if they choose to use it, but since portrayal rules are not the only way to define a portrayal function, it is not a mandatory part of this International Standard.

6.3 Portray nothing

For a feature instance that is not to be portrayed, a feature portrayal function shall map to an empty symbol, i.e. a symbol with no symbol components.

6.4 Default portrayal

The default symbol shall be applied according to at least one of the spatial attributes of the feature instance, and shall only be applied when no feature portrayal function is applicable for a feature instance.

A default symbol reference shall be present to ensure that no feature instance is left unportrayed by mistake. The provider of the portrayal function set specifies the value of the default symbol reference but shall not portray nothing (6.3). Contextual information shall not be used in the default symbol definition. If the application fails to portray the data for some reason, the failure shall be handled by the application.

6.5 Annotation

The information that is to be portrayed shall be defined in an application schema. Typically there are two types of information included in a dataset: geographic information and annotation. Annotation includes text, grids, legends and special features such as a compass rose.

6.6 Overview of portrayal

Portrayal is illustrated by Figure 5. The diagram is not part of the portrayal schema and not for implementation. It is intended as an explanatory aid only.

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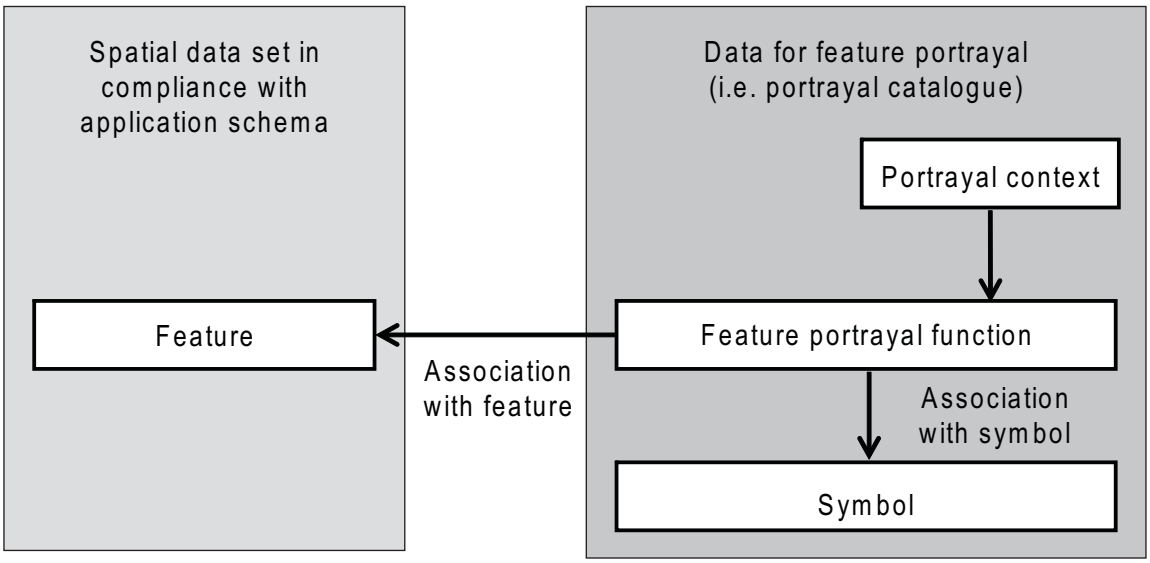

Figure 5 — Overview of portrayal

The portrayal catalogue consists of the feature portrayal functions, and symbols as shown in Figure 5. To produce different products, several portrayal catalogues may exist, portraying one or more datasets. Dataset is explained in ISO 19109. The portrayal catalogue relates to one or more symbols, and one symbol may be used in one or more portrayal catalogues.

7 Package — ISO 19117 Portrayal

7.1 Introduction

This International Standard presents a conceptual schema for describing portrayal functions, symbols, and symbol collections, all intended for use in the portrayal of geographic data. The conceptual schema is specified using the Unified Modeling Language (UML) (ISO 19501), following the guidance of ISO/TS 19103.

The schema is contained in a series of UML packages, defining the portrayal core, and extensions for conditional functions, context, compound symbols, complex symbols, reusable symbol components, parameterized symbols and the portrayal functions that use parameterized symbols. The Portrayal Catalogue package specializes the Feature Cataloguing package for portrayal. The Portrayal Function package defines a root for the mapping of features to symbols and several specializations. The Presentation package defines a root for presentation and several specializations. Classes in the packages of this schema are derived from classes included in this schema as well as classes included in the package Catalogues (ISO/TS 19139) carrying the prefix “CT_”. Classes in the packages of this schema reference and use as data types classes included in this schema as well as classes included in the packages Basic Types (ISO/TS 19103), Feature Cataloguing (ISO 19110) carrying the prefix “FC_”, Coordinate Reference Systems (ISO 19111) carrying the prefix “SC_”, Citation and responsible party information (ISO 19115) carrying the prefix “CI_”, Identification information (ISO 19115) carrying the prefix “MD_”, and Reference system information (ISO 19115) also carrying the prefix “MD_”.

Names of classes included in these packages carry the prefixes “PF_” for the portrayal function related classes and “SY_” for the symbol related classes.

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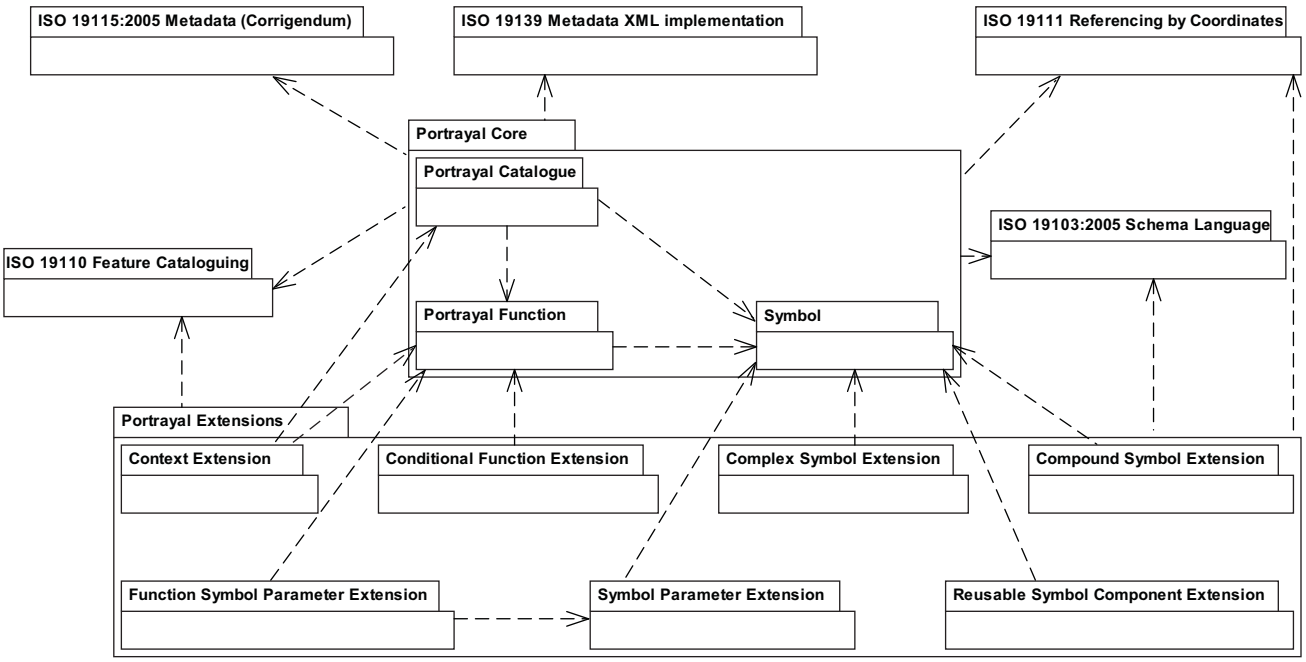

Figure 6 — Package structure with dependencies

7.2 Symbol structure

7.2.1 Introduction

Symbols can be almost infinite in variety and are defined in several different ways. Symbols can be composed of several graphic elements or geometries.

7.2.2 Simple symbols

Simple symbols are included in the portrayal core. Point symbols typically have a single graphic icon, located at one geographic point, with a symbol origin that defines the relationship between the icon and the geographic position of the feature that the icon represents. An example of a simple point symbol might be a black square that represents a building.

Figure 7 — Example symbol: black square representing a building

The point symbol can also be composed of text. The point text is based on a single geographic coordinate. An example might be a label indicating numerous lakes.

Numerous
lakes

Figure 8 — Example symbol: text label indicating numerous lakes

Line symbols are typically represented by a line that follows a geometric curve. An example is using a line to symbolize a river.

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Figure 9 — Example symbol: solid line symbolizing a river

Line symbols can sometimes have point components associated with it, on one or both ends. An example of this kind of symbol might be a line symbol for a footbridge with wing ticks on both ends.

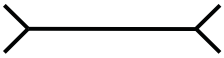

Figure 10 — Example symbol: solid line with wing ticks on both ends symbolizing a footbridge

Line symbols may also be composed of text. An example might be a name label for a region on a map that is spread out along a line.

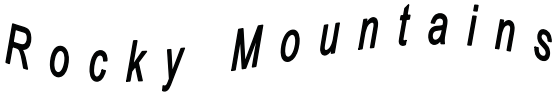

Figure 11 — Example symbol: text flowing along curve labelling a region

Area symbols are typically symbolized by an area fill or colour that fills up the extent of an areal feature. An example might be a forest on a topographic map.

Figure 12 — Example symbol: area fill colour symbolizing a forest

Sometimes the area symbol has a boundary and a fill. An example might be a symbol for a lake, in which both the water body and shoreline are symbolized.

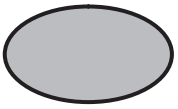

Figure 13 — Example symbol: area with boundary and fill symbolizing a water body and shoreline

Sometimes a point icon graphic is placed inside the area symbol to further illustrate the symbol. An area symbol may have area, line and point components, for example a symbol for a dangerous wreck.

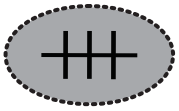

Figure 14 — Example symbol: area symbol with area, line and point components symbolizing a dangerous wreck

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7.2.3 Compound symbols

To enable the reuse of graphic components and to build more complex symbols, some symbols may be composed of more than one graphic component of the same type. An example of a compound point symbol might be a school symbol, shown by a black square with a flag on top.

Figure 15 — Example symbol: point symbol composed of black square and flag symbolizing a school

A common example of a compound line symbol is a cased road, in which a narrow line is superimposed over a wider line of a different colour.

Figure 16 — Example symbol: cased line symbolizing a road

A compound area symbol uses complex symbols and is described later.

Each of these compound symbols may also show text components.

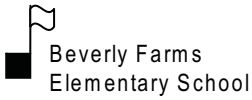

Figure 17 — Example symbol: compound point symbol with text component symbolizing a school

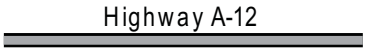

Figure 18 — Example symbol: compound line symbol with text component symbolizing a road

7.2.4 Complex symbols

Complex symbols are made up from various types of component symbols. These include line symbols with repeated point symbols, pattern filled area symbols, and cross-hatched area symbols.

An example of a line symbol with repeated points might be a boundary to an anchorage area, where the anchor point icons are repeated at intervals along a boundary line.

Figure 19 — Example symbol: complex line symbol with anchor point icons repeated along a line symbolizing a boundary to an anchorage area

An example of a pattern fill might be a swamp symbol, in which the grass pattern is tiled and repeated over the area of the swamp.

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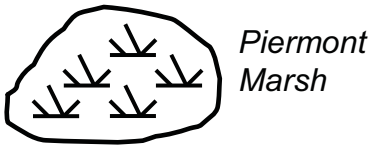

Figure 20 — Example symbol: complex area symbol with grass pattern is tile symbolizing a swamp

An example of a cross-hatch area fill might be a symbol for a filtration bed.

Figure 21 — Example symbol: complex area symbol with line symbol cross-hatching symbolizing a filtration bed

As with compound symbols, complex symbols may also have a text component.

7.2.5 Symbol composition

Symbols are initially without meaning and without location. When they become part of a portrayal they gain both meaning and location both with respect to the portrayal and with respect to the universe they represent. The definition of a symbol has its own engineering coordinate reference system. A coordinate reference system transformation places a point symbol into a portrayal (Figure 22). Similarly, a coordinate reference system transformation places a subsymbol into a parent point symbol.

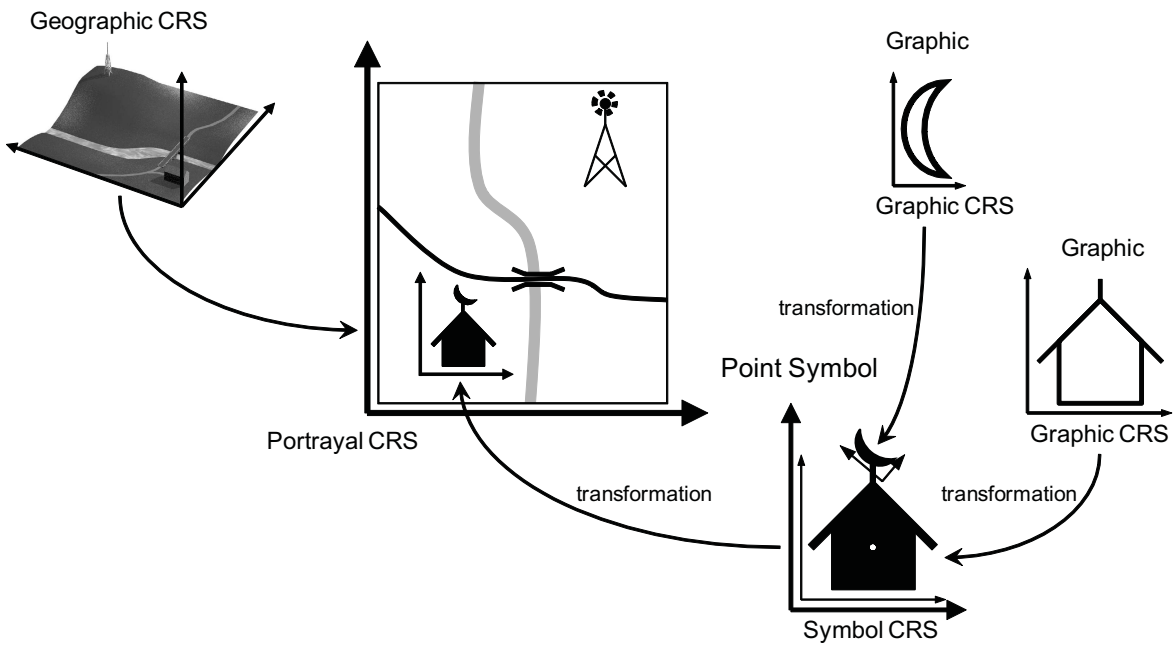

Figure 22 — Portrayal and Symbol CRSs

Line symbols and patterns have two kinds of coordinate reference systems. A line coordinate reference system is used to define the pen or line style. This coordinate reference system is perpendicular to the geometry of the curve and allows for the specification of line widths and offsets. The second kind of coordinate reference system is a local coordinate reference system which is defined for every location along a curve. This coordinate reference system has an x-axis that is tangential to the curve and a y-axis perpendicular to the x-axis (Figure 23).

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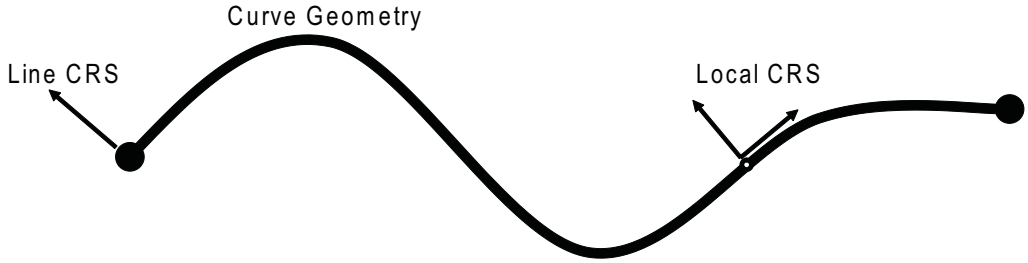

Figure 23 — Line and Local CRSs

An area symbol defines coordinate reference systems for its boundary and for its interior. The boundary coordinate reference systems are those defined for line symbols. The interior of the area symbol has its own coordinate reference systems (Figure 24).

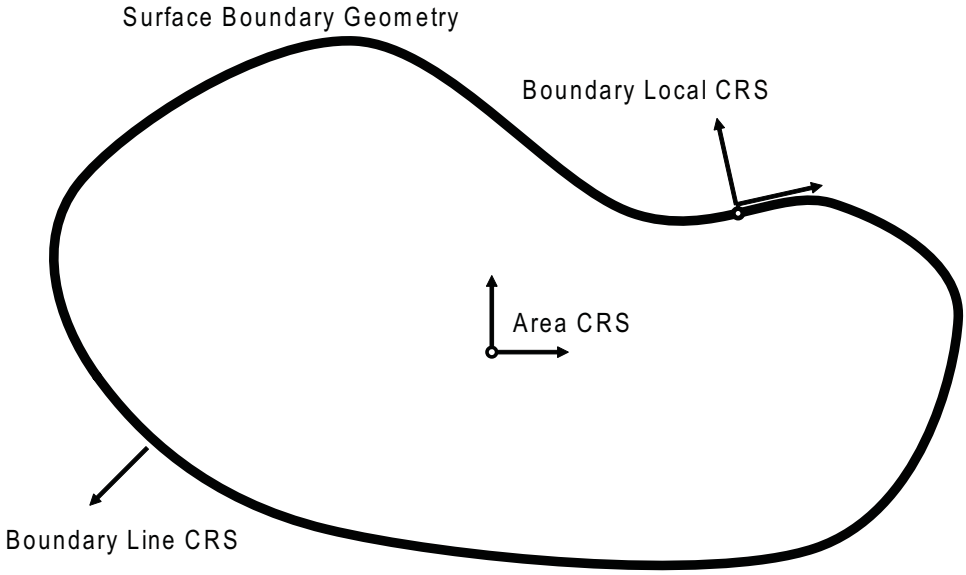

Figure 24 — Area and Boundary CRSs

Should the area symbol include a tiled pattern area fill then there is a tile coordinate reference system as well (Figure 25).

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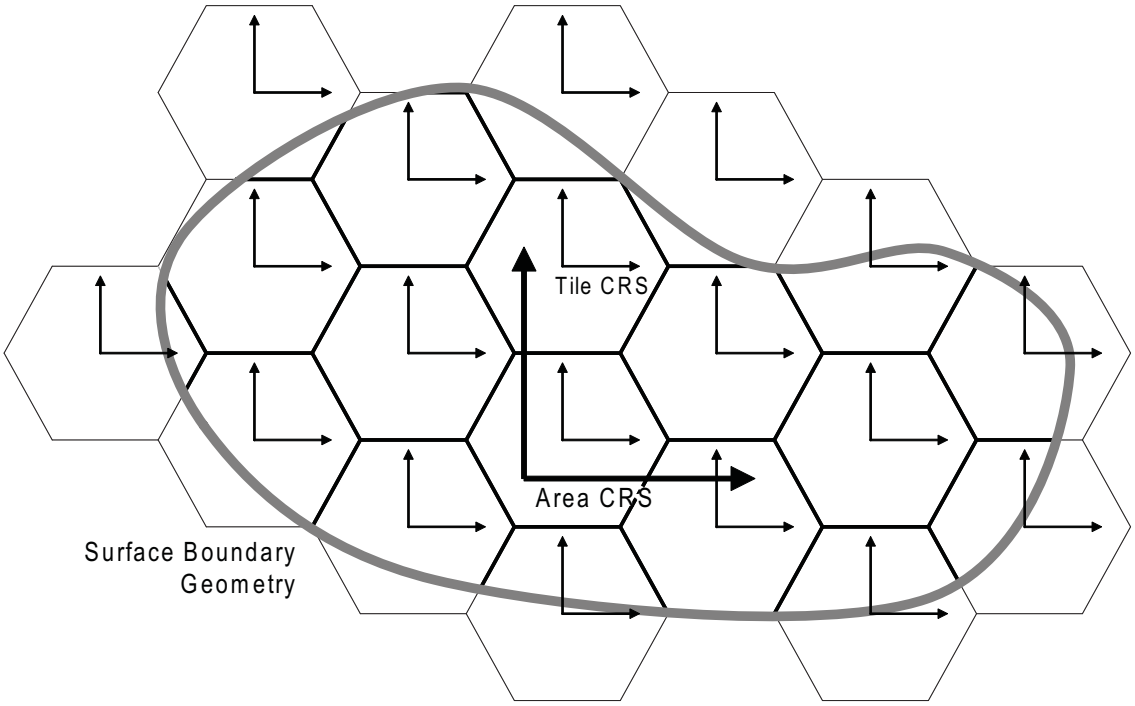

Figure 25 — Tile CRS

8 Package – Portrayal Core

8.1 Package semantics

The Portrayal Core package supplies the core facilities for defining functions for mapping geographic features to symbols, for defining symbols for portrayal, and for packaging functions and symbols in catalogues for interchange by transfer. The package is divided into three subpackages: the Portrayal Function package is used to define mapping functions, the Symbol package is used to define symbol, and the Portrayal Catalogue package is used to define portrayal catalogues.

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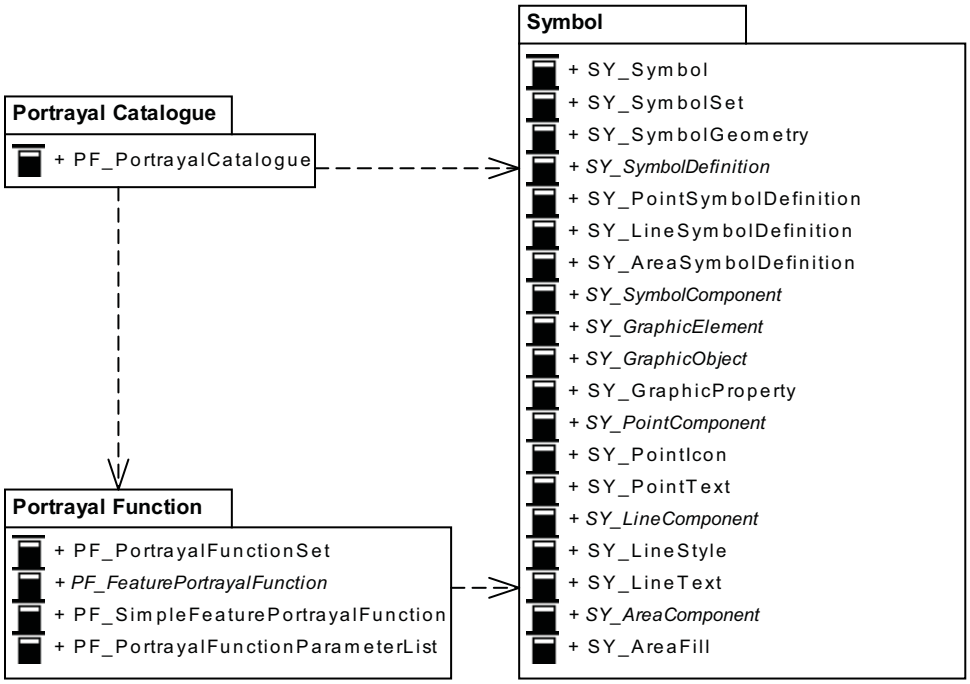

Figure 26 — Core package structure with dependencies

8.2 Package – Portrayal Function

8.2.1 Package semantics

The Portrayal Function package defines functions that map feature types to symbols.

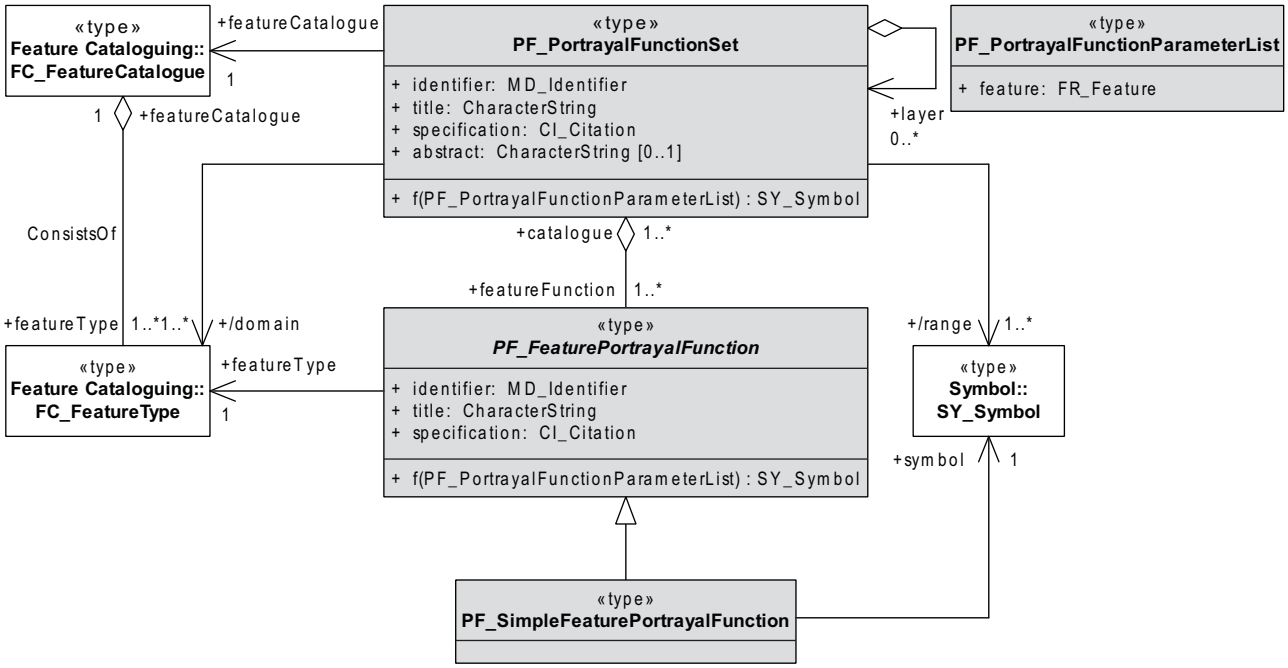

Figure 27 — Portrayal Function

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8.2.2 Type – PF_PortrayalFunctionSet

8.2.2.1 Class semantics

PF_PortrayalFunctionSet describes a function, which maps the feature types of a feature catalogue to symbols. A *PF_PortrayalFunctionSet* collects feature portrayal functions, which in turn map an individual feature type to a symbol. *PF_PortrayalFunctionSet* represents the concept of the portrayal function set Φ as illustrated in Figure 4.

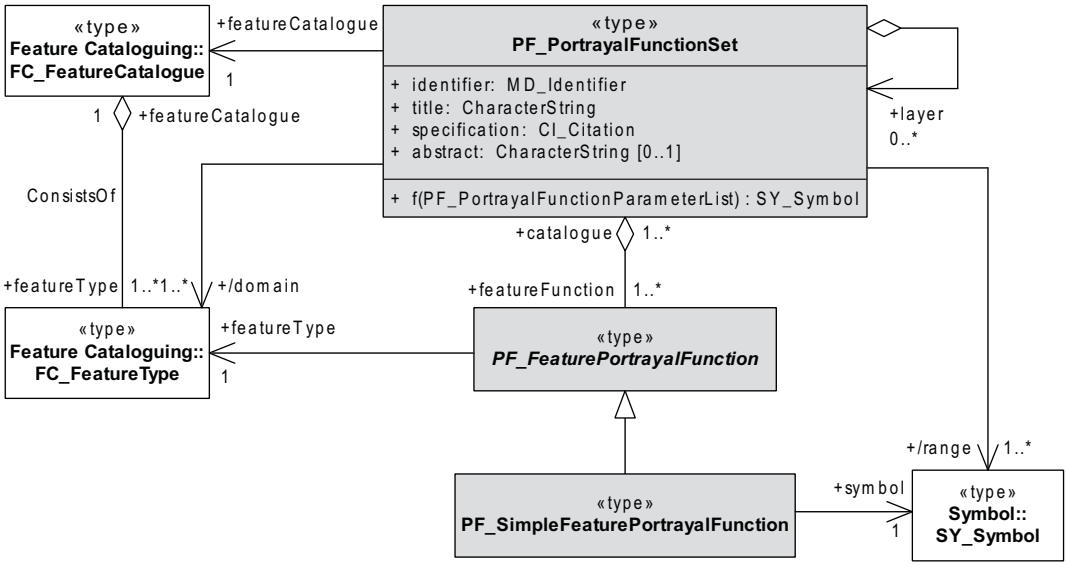

Figure 28 — PF_PortrayalFunctionSet context diagram

8.2.2.2 Association role – featureCatalogue

The association role *featureCatalogue* defines the feature catalogue containing the feature type domain of the feature to symbol mapping.

```
PF_PortrayalFunctionSet::featureCatalogue[1] : FC_FeatureCatalogue
```

8.2.2.3 Association role – domain

The association role *domain* defines the set of feature types that are mapped to symbols.

```
PF_PortrayalFunctionSet::domain[1..*] : FC_FeatureType
```

8.2.2.4 Association role – range

The association role *range* defines the set of symbols to which feature types are mapped.

```
PF_PortrayalFunctionSet::range[1..*] : SY_Symbol
```

8.2.2.5 Aggregation role – featureFunction

The aggregation role *featureFunction* collects the feature portrayal functions that make up the individual feature mappings of the portrayal function set.

```
PF_PortrayalFunctionSet::featureFunction[1..*] : PF_FeaturePortrayalFunction
```

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8.2.2.6 Aggregation role – layer

The aggregation role *layer* associates a portrayal function set with a subordinate portrayal function set. The subordinate catalogue defines a layer in the overall portrayal.

```
PF_PortrayalFunctionSet::layer[0..*] : PF_PortrayalFunctionSet
```

8.2.2.7 Attribute – identifier

The attribute *identifier* is a machine readable name for the portrayal function set. The identifier shall be unique.

```
PF_PortrayalFunctionSet::identifier : MD_Identifier
```

8.2.2.8 Attribute – title

The attribute *title* is a multi-lingual human readable name for the portrayal function set.

```
PF_PortrayalFunctionSet::title : CharacterString
```

8.2.2.9 Attribute – specification

The attribute *specification* is a reference to the full details of the portrayal function set.

```
PF_PortrayalFunctionSet::specification : CI_Citation
```

8.2.2.10 Attribute – abstract

The optional attribute *abstract* contains a brief summary of the portrayal function set.

```
PF_PortrayalFunctionSet::abstract : CharacterString[0..1]
```

8.2.2.11 Operation – f

The operation *f* maps the feature in the parameter list to a symbol using the associated feature portrayal functions.

```
PF_PortrayalFunctionSet::f(
     parameterList : PF_PortrayalFunctionParameterList
  ) : SY_Symbol
```

8.2.3 Type – PF_FeaturePortrayalFunction

8.2.3.1 Class semantics

PF_FeaturePortrayalFunction is the abstract root type for types that define feature portrayal functions, which map features to symbols. *PF_FeaturePortrayalFunctions* are collected in a *PF_PortrayalFunctionSet*, mapping sets of features in a feature catalogue (domain) to sets of symbols (range). *PF_FeaturePortrayalFunction* represents the concept of the feature portrayal function Φ_l as illustrated in Figure 4.

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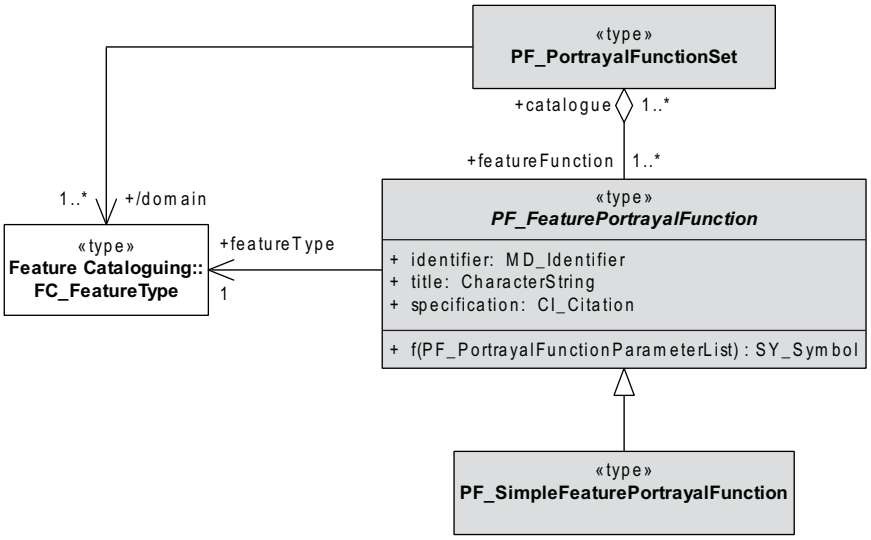

Figure 29 — PF_FeaturePortrayalFunction context diagram

8.2.3.2 Association role – catalogue

The association role *catalogue* associates a feature portrayal function with its containing portrayal function sets.

```
PF_FeaturePortrayalFunction::catalogue[1..*] : PF_PortrayalFunctionSet
```

8.2.3.3 Association role – featureType

The association role *featureType* defines the feature type that is mapped to a symbol.

```
PF_FeaturePortrayalFunction::featureType[1] : FC_FeatureType
```

8.2.3.4 Attribute – identifier

The attribute *identifier* is a machine readable name for the feature portrayal function. The identifier shall be unique.

```
PF_FeaturePortrayalFunction::identifier : MD_Identifier
```

8.2.3.5 Attribute – title

The attribute *title* is a multi-lingual human readable name for the feature portrayal function.

```
PF_FeaturePortrayalFunction::title : CharacterString
```

8.2.3.6 Attribute – specification

The attribute *specification* is a reference to the full details of the feature portrayal function.

```
PF_FeaturePortrayalFunction::specification : CI_Citation
```

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