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Nationales Vorwort

Dieses Dokument (EN ISO 19110:2016) wurde vom Technischen Komitee ISO/TC 211 „Geographic information/Geomatics" in Zusammenarbeit mit dem Technischen Komitee CEN/TC 287 „Geoinformation", dessen Sekretariat von BSI (Vereinigtes Königreich) gehalten wird, erarbeitet.

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Dieses Dokument (EN ISO 19110:2016) enthält unter Berücksichtigung des Präsidialbeschlusses 1/2004 den englischen Originaltext der Internationalen Norm ISO 19110:2016.

Änderungen

Gegenüber ISO 19110:2006-09 und DIN EN ISO 19110/A1:2011-09 wurden folgende Änderungen vorgenommen:

a) Behandlung von Mehrsprachigkeit von Objektartenkatalogen;

b) Berücksichtigung von Änderungen aus der DIN EN ISO 19110/A1:2011-09;

c) Korrektur geringfügiger Inkonsistenzen im konzeptuellen Modell;

d) Erweiterung zur Behandlung von globalen, Domain-übergreifenden Eigenschaften;

e) Einführung einer Schnittstelle für das konzeptuelle Modell (XML-Schema);

f) Management von Registern für Objektartenkataloge;

g) Regeln zur Überführung des bisherigen Modells in das verbesserte, neue Modell;

h) redaktionelle Überarbeitung.

Frühere Ausgaben

DIN EN ISO 19110: 2006-09
DIN EN ISO 19110/A1: 2011-09

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Nationaler Anhang NA
(informativ)

Begriffe

Für die Anwendung dieses Dokuments gelten die folgenden Begriffe.

3.1
Bezeichnung
Bezeichner
(en: designation, designator)
Darstellung eines Konzepts durch ein Zeichen, das dieses bezeichnet

Anmerkung 1 zum Begriff: In der Terminologiearbeit werden drei Arten von Bezeichnungen unterschieden: Symbole, Benennungen und Begriffe.

[Quelle: ISO 1087-1:2000, 3.4.1]

3.2
Feature
(en: feature)
Abstraktion eines Phänomens der realen Welt

BEISPIEL Das Phänomen „Eiffelturm“ kann mit anderen ähnlichen Phänomenen in einer Feature-Klasse „Turm“ klassifiziert werden.

Anmerkung 1 zum Begriff: Ein Feature kann als Klasse oder Instanz auftreten. Feature-Klasse oder Feature-Instanz sollte verwendet werden, wenn nur eine gemeint ist.

[Quelle: ISO 19101‑1:2014, 4.1.11]

3.3
Feature-Assoziation
(en: feature association)
Beziehung, die Instanzen einer Feature-Klasse mit Instanzen derselben oder einer anderen Feature-Klasse verbindet

3.4
Feature-Attribut
(en: feature attribute)
Merkmal eines Features

BEISPIEL 1 Ein Feature-Attribut mit dem Namen „Farbe“ kann einen Attributwert „grün“ haben, der zum Datentyp „Text“ gehört.

BEISPIEL 2 Ein Feature-Attribut mit dem Namen „Länge“ kann einen Attributwert „82,4“ haben, der zum Datentyp „reelle Zahl“ gehört.

Anmerkung 1 zum Begriff: Ein Feature-Attribut hat einen Namen, einen Datentyp und einen Wertebereich. Ein Feature-Attribut für eine Feature-Instanz besitzt außerdem einen Attributwert, der aus dem Wertebereich stammt.

[Quelle: ISO 19101‑1:2014, 4.1.12]

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3.5
Feature-Katalog
Objektartenkatalog
(en: feature catalogue)
Katalog mit Definitionen und Beschreibungen der Feature-Klassen, Feature-Attribute und Feature-Beziehungen, die in einem oder mehreren Geodatensätzen auftreten, zusammen mit Feature-Operationen, die angewendet werden dürfen

Anmerkung 1 zum Begriff: Feature-Beziehungen beinhalten Feature-Vererbung und Feature-Assoziationen.

[Quelle: ISO 19101‑1:2014, 4.1.13]

3.6
Feature-Vererbung
(en: feature inheritance)
Mechanismus, durch den spezifischere Features die Struktur und das Verhalten von allgemeineren Features übernehmen, mit denen sie durch ihr Verhalten in Beziehung stehen

3.7
Feature-Operation
(en: feature operation)
Operation, die jede Instanz einer Feature-Klasse ausführen darf

BEISPIEL Eine Feature-Operation auf einem „Staudamm“ ist, den Staudamm zu erhöhen. Die Ergebnisse dieser Operation sollen die Höhe des „Staudammes“ und die Wassermenge in einem „Stausee“ erhöhen.

Anmerkung 1 zum Begriff: Manchmal bilden Feature-Operationen eine Basis für die Definition der Feature-Klasse.

3.8
Fachsprache
(en: functional language)
Sprache, in der die Feature-Operationen formal beschrieben sind

Anmerkung 1 zum Begriff: In einer Fachsprache können Feature-Klassen als abstrakte Datentypen dargestellt werden.

3.9
Signatur
(en: signature)
Textzeichenfolge, die den Namen und die Parameter angibt, die erforderlich sind, um eine Operation aufzurufen

Anmerkung 1 zum Begriff: Sie kann optional zurückgegebene Parameter enthalten. Diese Signatur wird in der Regel aus der formalen Definition abgeleitet. Dies entspricht der UML-Signatur.

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European foreword

This document (EN ISO 19110:2016) has been prepared by Technical Committee ISO/TC 211 “Geographic information/Geomatics” in collaboration with 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 June 2017, and conflicting national standards shall be withdrawn at the latest by June 2017.

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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.

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

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 211, *Geographic information/Geomatics*.

This second edition cancels and replaces the first edition (ISO 19110:2005), which has been technically revised. It also replaces ISO 19110:2005/Amd1:2011. Annex G explains how to transform feature catalogues from the first edition to this revised version.

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Introduction

Geographic features are real-world phenomena associated with a location relative to the Earth, about which data are collected, maintained, and disseminated. Feature catalogues defining the types of features, their operations, attributes, and associations represented in geographic data are indispensable to turning the data into usable information. Such feature catalogues promote the dissemination, sharing, and use of geographic data through providing a better understanding of the content and meaning of the data. Unless suppliers and users of geographic data have a shared understanding of the kinds of real-world phenomena represented by the data, users will be unable to judge whether the data supplied are fit for their purpose.

The availability of standard feature catalogues that can be used multiple times will reduce costs of data acquisition and simplify the process of product specification for geographic datasets.

This document provides a standard framework for organizing and reporting the classification of real-world phenomena in a set of geographic data. Any set of geographic data is a greatly simplified and reduced abstraction of a complex and diverse world. A catalogue of feature types can never capture the richness of geographic reality. However, such a feature catalogue should present the particular abstraction represented in a given dataset clearly, precisely, and in a form readily understandable and accessible to users of the data.

Geographic features occur at two levels: instances and types. At the instance level, a geographic feature is represented as a discrete phenomenon that is associated with its geographic and temporal coordinates and may be portrayed by a particular graphic symbol. These individual feature instances are grouped into classes with common characteristics: feature types. It is recognized that geographic information is subjectively perceived and that its content depends on the needs of particular applications. The needs of particular applications determine the way instances are grouped into types within a particular classification scheme. ISO 19109 specifies how data shall be organized to reflect the particular needs of applications with similar data requirements.

NOTE The full description of the contents and structure of a geographic dataset is given by the application schema developed in compliance with ISO 19109. The feature catalogue defines the meaning of the feature types and their associated feature attributes, feature operations, and feature associations contained in the application schema.

This document enables the multilingual description of application schemas compliant with ISO 19109. It goes further to provide a mechanism enabling a single global description of some properties occurring many times in an application schema and a binding of those global properties to the corresponding feature types.

The collection criteria used to identify individual real-world phenomena and to represent them as feature instances in a dataset are not specified in this document. Because they are not included in the standards, collection criteria should be included separately in the product specification for each dataset.

A standard way of organizing feature catalogue information will not automatically result in harmonization or interoperability between applications. In situations where classifications of features differ, this document may at least serve to clarify the differences and thereby help to avoid the errors that would result from ignoring them. It may also be used as a standard framework within which to harmonize existing feature catalogues that have overlapping domains.

This revision of ISO 19110 addresses issues related to the multilingual management of feature catalogues and applies the changes documented in a previous amendment. In addition to removing minor inconsistencies in the conceptual schemas, the amendment enhanced the mechanism ensuring the management of global properties. The amendment also provided an XML schema implementation of the feature catalogue conceptual schema and a management of feature catalogue registers. If the initial conceptual schema is not a subset of the amended conceptual schema, it is possible to transform legacy instances.

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Geographic information — Methodology for feature cataloguing

1 Scope

This document defines the methodology for cataloguing feature types. This document specifies how feature types can be organized into a feature catalogue and presented to the users of a set of geographic data. This document is applicable to creating catalogues of feature types in previously uncatalogued domains and to revising existing feature catalogues to comply with standard practice. This document applies to the cataloguing of feature types that are represented in digital form. Its principles can be extended to the cataloguing of other forms of geographic data. Feature catalogues are independent of feature concept dictionaries defined in ISO 19126 and can be specified without having to use or create a Feature Concept Dictionary.

This document is applicable to the definition of geographic features at the type level. This document is not applicable to the representation of individual instances of each type. This document excludes portrayal schemas as specified in ISO 19117.

This document may be used as a basis for defining the universe of discourse being modelled in a particular application, or to standardize general aspects of real world features being modelled in more than one application.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 19103, *Geographic information — Conceptual schema language*

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

ISO 19115-1:2014, *Geographic information — Metadata — Part 1: Fundamentals*

ISO/TS 19115-3:2016, *Geographic information — Metadata — Part 3: XML schema implementation for fundamental concepts*

ISO 19135-1:2015, *Geographic information — Procedures for item registration — Part 1: Fundamentals*

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

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

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3.1
designation
designator
representation of a concept by a sign which denotes it

Note 1 to entry: In terminology work, three types of designations are distinguished: symbols, appellations and terms.

[SOURCE: ISO 1087-1:2000, 3.4.1]

3.2
feature
abstraction of real-world phenomena

EXAMPLE The phenomenon named "Eiffel Tower" may be classified with other similar phenomena into a feature type "tower."

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

[SOURCE: ISO 19101-1:2014, 4.1.11]

3.3
feature association
relationship that links instances of one *feature* (3.2) type with instances of the same or a different feature type

3.4
feature attribute
characteristic of a *feature* (3.2)

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 also has an attribute value taken from the value domain.

[SOURCE: ISO 19101-1:2014, 4.1.12]

3.5
feature catalogue
catalogue containing definitions and descriptions of the *feature* (3.2) types, *feature attributes* (3.4) and feature relationships occurring in one or more sets of geographic data, together with any *feature operations* (3.7) that can be applied

Note 1 to entry: Feature relationships include *feature inheritances* (3.6) and *feature associations* (3.3).

[SOURCE: ISO 19101-1:2014, 4.1.13]

3.6
feature inheritance
mechanism by which more specific *features* (3.2) incorporate structure and behaviour of more general features related by behaviour

3.7
feature operation
operation that every instance of a *feature* (3.2) type may perform

EXAMPLE A feature operation upon a "dam" is to raise the dam. The results of this operation are to raise the height of the "dam" and the level of water in a "reservoir".

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Note 1 to entry: Sometimes, feature operations provide a basis for feature type definition.

3.8
functional language
language in which *feature operations* (3.7) are formally specified

Note 1 to entry: In a functional language, feature types may be represented as abstract data types.

3.9
signature
text string that specifies the name and parameters required to invoke an operation

Note 1 to entry: It may contain optional returned parameters. This signature is usually derived from the formal definition. This is the equivalent of the UML signature.

4 Conformance

4.1 Conformance classes

The methodology for cataloguing feature types is defined through a set of requirements for the description of feature types. A single conformance class is defined for models meeting all the conceptual requirements. This document presents a conceptual model for a representation of feature type descriptions as a set of UML diagrams that satisfy this conformance class. Annex A presents the abstract test suits for conformance classes.

A second set of requirements for XML implementation of the conceptual model are the basis for a conformance class for XML implementation of the UML model for representation of feature types in a feature catalogue. This implementation is based on rules defined in ISO/TS 19139 and ISO/TS 19115-3.

Annex D defines a conceptual model for a registered feature catalogue, but no corresponding XML implementation is specified by this document.

Table 1 — Conformance classes defined by this specification

Conformance class URI[a]	Standardization target	Conformance class name (implemented clause)
/conf/conceptual-model	Conceptual model	Conceptual model for a feature catalogue
/conf/feature-catalogue-xml	XML implementation	XML implementation of feature catalogue conceptual model
/conf/feature-catalogue-xml-instance	XML instance document	Valid XML instance document for interchange of feature catalogue content

[a] All Conformance Class URIs are HTTP URIs, prefix 'http://standards.iso.org/iso/19110' to the paths in the table cell to get the complete URI.

5 Abbreviated terms

GFC Geographic Feature Cataloguing

GFM General Feature Model

HTTP Hyper Text Transfer Protocol

IHO International Hydrographic Organization

TS Technical Specification

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UML	Unified Modeling Language
URI	Uniform Resource Identifier
XML	eXtensible Markup Language

6 Requirements

6.1 General

Clause 6 specifies general and specific requirements for feature catalogue information elements.

6.2 Conceptual requirements

Tables 2 to 10, 12, and 13 summarize requirements for the conceptual model for describing feature types and their attributes, operations, and associations in a feature catalogue. Requirements are grouped into requirements classes; each requirements class has a URI, and each requirement has a URI that is based on the URI for the requirements class to which it is included. The dependencies column provides the URI for any requirements class that must be met as a precondition for the requirements class.

In Tables 2 to 10 and 12 to 13, the following conventions are followed.

— The term “entity” is used to refer to model elements representing instantiable information objects in the conceptual model. Depending on the modelling paradigm used, these may have other labels, e.g. “object,” “class,” “element,” or “feature”.

— Inclusion of a model entity name in a requirements statement implies that entity or any subtype is derived from that entity in a model instance.

— Property names are provided in single quotes (‘ ‘), and are all in lower case.

Table 2 — Requirements class for catalogue

Identifier	http://standards.iso.org/iso/19110/1.1/req/catalogue
Target type	Conceptual model
Name	Core conceptual catalogue requirements for ISO 19110 feature catalogue
Dependency	ISO 19115-1:2014, 6.6.2 ISO/TS 19139:2007, 7.4.4
Requirement	**/req/catalogue/representation** A feature catalogue shall document an abstraction of reality representing one or more geographic features. NOTE A feature catalogue may comply with the specifications of this document independent of any existing set of geographic data.
Requirement	**/req/catalogue/abstraction** The feature type shall be the basic level of abstraction in a feature catalogue.
Requirement	**/req/catalogue/electronic-form** A feature catalogue shall be available in electronic form.
Requirement	**/req/catalogue/inheritance** A feature catalogue shall inherit all the properties and relationships defined on the abstract CT_Catalogue class in ISO/TS 19139:2007, 7.4.4.
Requirement	**/req/catalogue/identification** The feature catalogue shall include identification information that includes a ‘name’, a ‘versionNumber’, a ‘versionDate’.

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Table 2 *(continued)*

Requirement	**/req/catalogue/producer** The feature catalogue entity shall include a mandatory 'producer' property with exactly one value that is an entity conforming to the content of the CI_Responsibility entity defined by ISO 19115-1:2014, 6.6.2.
Requirement	**/req/catalogue/functional-language** If a functional language is used to formally define feature operations, the feature catalogue entity shall have a 'functional language' property with a text value that specifies the language used.
Requirement	**/req/catalogue/identifier** If a globally unique identifier is included as a property of a feature catalogue, it shall be named 'identifier' and shall have a value that is an entity conforming to the content of the MD_Identifier entity defined by ISO 19115-1:2014, 6.6.2.
Recommendation	**/rec/catalogue/schema-language** To maximize the usefulness of a feature catalogue across different applications, the use of a conceptual schema language to model feature catalogue information is recommended. NOTE Natural-language definitions, feature-type aliases, criteria for the creation and withdrawal of feature instances, and other semantic elements of the feature catalogue may be included in a conceptual schema as structured comments or as attributes.

Table 3 — Requirements class for base content

Identifier	http://standards.iso.org/iso/19110/1.1/req/base-content
Target type	Conceptual model
Name	Core conceptual base content requirements for ISO 19110 feature catalogue
Dependency	http://standards.iso.org/iso/19110/req/catalogue
Requirement	**/req/base-content/minimum** A feature catalogue shall describe at least one feature type.
Requirement	**/req/base-content/feature-type-names** A feature type shall be identified by exactly one 'type name' that is unique in the scope of the containing feature catalogue. The 'type name' value shall consist of an optional 'codespace' property that specifies a namespace, and a string value that provides the name.
Requirement	**/req/base-content/feature-type-is-abstract** A feature type shall have a mandatory 'is abstract' property with a Boolean value.
Requirement	**/req/base-content/feature-properties** Properties of a feature type shall be linked to the feature type with the role 'carrierOf-Characteristics'. Properties of a feature type shall be categorized as one of feature attribute, feature operation, or association role.
Requirement	**/req/base-content/property-type-names** All property types (attribute, operation, or association role) shall be identified by a single 'type name' that is unique within the scope of the feature type (local properties) or feature catalogue (global properties) that contains the property definition. The 'type name' value shall consist of an optional 'codespace' property that specifies a namespace, and a string value that provides the name.
Requirement	**/req/base-content/all-type-definitions** The feature catalogue shall include definitions of all feature types and property types (attribute, operation, or association role) included in the model.

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Table 3 *(continued)*

Requirement	**/req/base-content/constraints** If the model includes constraints on feature type or property type entities, they shall be represented by a constraints entity that has a description property with a string value. The feature type or property type entity shall be linked to the constraints entity via a 'constrainedBy' role.
Recommendation	**/rec/base-content/multiple-definition** If the same term is defined in both a referenced definition source and in a feature catalogue element (feature type, property, association, or listed value), the definition in the feature catalogue element should take precedence.
Recommendation	**/rec/base-content/only-elements** To ensure predictability and comparability of feature catalogue content, it is recommended that the model includes only the elements specified in the UML conceptual model included in this document (see Annex B).
Recommendation	**/rec/base-content/functional-language** The use of functional language specifications to help define feature types is recommended.
Identifier	http://standards.iso.org/iso/19110/1.1/req/base-content
Target type	Conceptual model
Name	Core conceptual base content requirements for ISO 19110 feature catalogue
Dependency	http://standards.iso.org/iso/19110/req/catalogue
Recommendation	**/rec/base-content/abstract-property-type** Specification of feature properties should be implemented through an abstract property type class from which attribute, operation, and association role types are derived.
Recommendation	**/rec/base-content/property-closure** A feature catalogue should include, for each feature type, specifications of any properties bound to the feature type, and specifications of any operations that affect feature properties defined in the catalogue.
Informative	Each feature attribute, listed value, feature association, and feature type may have a 'code' property that has an alphanumeric value intended as an identifier.

Table 4 — Requirements class for attribute

Identifier	http://standards.iso.org/iso/19110/1.1/req/attribute
Target type	Conceptual model
Name	Core conceptual attribute requirements for ISO 19110 feature catalogue
Dependency	http://standards.iso.org/iso/19110/req/base-content
Requirement	**/req/attribute/inheritance** The feature attribute entity shall inherit all the properties and associations of the property type entity.
Requirement	A feature attribute shall have a property named 'valueType' with a value that is a string referencing a data or object type. The 'valueType' shall be specified either directly as part of the attribute definition, or indirectly in a binding (see /req/global, below).

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Table 4 *(continued)*

Requirement	**/req/attribute/attribute-cardinality** A feature attribute shall have a cardinality property that specifies the lower and upper limit on the number of instances of the target value type that may occur in a valid data instance. Default value is 1.
Requirement	**/req/attribute/measurement-unit** If a feature attribute entity has a property specifying the measurement units associated with an attribute value, it shall be named 'valueMeasurementUnit' and have a value that is a string that identifies a unit of measure.
Requirement	**/req/attribute/code** If a feature attribute entity has a property providing an additional identifier for the attribute, it shall be named 'code'.

Table 5 — Requirements class for association

Identifier	http://standards.iso.org/iso/19110/1.1/req/association
Target type	Conceptual model
Name	Core conceptual association requirements for ISO 19110 feature catalogue
Dependency	http://standards.iso.org/iso/19110/req/base-content
Requirement	**/req/association/inheritance** The feature association entity shall inherit all the properties and associations of the feature type entity.
Requirement	**/req/association/association-participation** A feature association shall have at least two association role instances linked through the 'roleName' role.
Requirement	**/req/association/role-cardinality** The association role entity shall have a 'cardinality' property that specifies the lower and upper limit on the number of instances of the target feature type that may occur in a valid data instance. Default value is "0..*".
Requirement	**/req/association/association-role-inheritance** The association role entity shall inherit all the properties and associations of the property type entity.
Requirement	**/req/association/role-relation** An association role entity shall be bound to exactly one feature association entity through a 'relation' role.
Requirement	**/req/association/role-player** An association role entity shall be bound to at least one feature type through the 'rolePlayer' role. NOTE This binding may be directly from the association role, in which case the cardinality is 1, or indirectly via a binding and bound association role, in which case multiple feature types may be bound to the association role.

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Table 5 *(continued)*

Requirement	**/req/association/role-type** An association role entity shall have a 'type' property with a value specified by an enumeration consisting of the following terms {ordinary, aggregation, composition}.
Requirement	**/req/association/role-is-ordered** An association role entity shall have an 'isOrdered' property with a Boolean value that indicates if the instances of this association role within the containing feature instance are ordered or not, with FALSE= "not ordered" and TRUE = "ordered".
Requirement	**/req/association/role-is-navigable** An association role entity shall have an 'is navigable property with a Boolean value that indicates whether this role is navigable from the source feature to the target feature of the association. TRUE = 'navigable'.

Table 6 — Requirements class for inheritance

Identifier	http://standards.iso.org/iso/19110/1.1/req/inheritance
Target type	Conceptual model
Name	Core conceptual inheritance requirements for ISO 19110 feature catalogue
Dependency	http://standards.iso.org/iso/19110/req/base-content
Requirement	**/req/inheritance/class** Inheritance relationships in a feature catalogue shall be represented using an inheritance relation class that associates one feature type in the 'subtype' role with a different feature type in the 'supertype' role.
Requirement	**/req/inheritance/description** An inheritance relation shall have a 'description' property.
Requirement	**/req/inheritance/unique-instance** An inheritance relation shall have a 'uniqueInstance' property that is a Boolean value, true if an instance of the 'supertype' can be an instance of at most one of its 'subtype' feature types.

Table 7 — Requirements class for global

Identifier	http://standards.iso.org/iso/19110/1.1/req/global
Target type	Conceptual model
Name	Core conceptual global properties requirements for ISO 19110 feature catalogue
Dependency	http://standards.iso.org/iso/19110/req/base-content
Requirement	**/req/global/global-property** A globalProperty type shall be associated to one feature catalogue through the 'featureCatalogue' role and shall not be associated to any feature type via a 'featureType' role.
Requirement	**/req/global/binding** A binding shall associate exactly one property type in a 'globalProperty' role to exactly one feature type in either a 'featureType' role, or a 'rolePlayer' role, but not in both roles.
Requirement	**/req/global/binding-description** If a binding has a property used to describe the binding instance, it shall be named 'description' and have a string value.
Requirement	**/req/global/global-xor-local** A property type that fills a 'globalProperty' role on a binding shall not also fill a 'carrierOfCharacteristics' role on a feature type and shall be associated to one feature catalogue through the 'featureCatalogue' role.

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Table 7 *(continued)*

Requirement	**/req/global/bound-association-role** If the model allows a 'rolePlayer' association between an association role in a 'globalProperty' role and a feature type, then that binding shall be through a bound association role entity that inherits all the properties and associations of the binding entity.
Identifier	http://standards.iso.org/iso/19110/1.1/req/global
Target type	Conceptual model
Name	Core conceptual global properties requirements for ISO 19110 feature catalogue
Dependency	http://standards.iso.org/iso/19110/req/base-content
Requirement	**/req/global/bound-feature-attribute** A feature attribute that fills a 'globalProperty' role shall specify a 'valueType' for the attribute if and only if there is no valid 'valueType' specified in the feature attribute definition. A binding between a feature attribute and a feature type that specifies a 'valueType' shall be through a bound feature attribute entity that inherits all the properties and associations of the binding entity.
Requirement	**/req/global/binding-constraints** If the model includes constraints on binding entities, they shall be represented by a Constraints entity that has a description property with a string value. The binding entity shall be linked to the Constraints entity via a 'constrainedBy' role.

Table 8 — Requirements class for operation

Identifier	http://standards.iso.org/iso/19110/1.1/req/operation
Target type	Conceptual model
Name	Core conceptual operation requirements for ISO 19110 feature catalogue
Dependency	http://standards.iso.org/iso/19110/req/base-content
Requirement	**/req/operation/inheritance** The feature operation class shall inherit all the properties and associations of the property type class.
Requirement	**/req/operation/affected-features** If the feature operation is contained inside a feature type, this containment shall be specified through the 'featureType' role. NOTE A feature operations may be defined as a standalone class for operations that affect property values of other features but are not considered a part of any feature type.
Requirement	**/req/operation/operation-attributes** Only feature attributes shall be associated with feature operations via 'observesValueOf', 'affectsValuesOf', or 'triggeredByValuesOf' association roles.
Requirement	**/req/operation/signature** Each feature operation entity shall have exactly one 'signature' property that is unique in the scope of the feature catalogue. NOTE The signature specifies the operation name and required parameter names used to invoke the operation.
Requirement	**/req/operation/operation-cardinality** A feature operation entity shall have a cardinality property that specifies the number of return values possible. Default value is 1.
Identifier	http://standards.iso.org/iso/19110/1.1/req/operation
Target type	Conceptual model
Name	Core conceptual operation requirements for ISO 19110 feature catalogue

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Table 8 *(continued)*

Dependency	http://standards.iso.org/iso/19110/req/base-content
Requirement	**/req/operation/formal-definition** If an operation is formally specified using a functional language; the text of this specification shall be provided in a feature operation entity property named 'formal definition.'
Requirement	**/req/operation/functional-language** If a feature operation entity includes a 'formalDefinition' property, then the containing feature catalogue entity shall have a 'functional language' property. NOTE The intention is that formal definitions utilize the functional language specified for the catalogue, but this can only be verified with feature catalogue instances.

Table 9 — Requirements class for value list

Identifier	http://standards.iso.org/iso/19110/1.1/req/value-list
Target type	Conceptual model
Name	Core conceptual value list requirements for ISO 19110 feature catalogue
Dependency	http://standards.iso.org/iso/19110/req/base-content
Requirement	**/req/value-list/class** If the domain of a feature attribute is an enumeration or controlled vocabulary, as indicated by the 'valueType' property, that list shall be specified using a listed value entity that fills the 'listed value' role on the feature attribute.
Requirement	**/req/value-list/label** Each listed value instance shall have exactly one text 'label' property value.
Requirement	**/req/value-list/definition** If a listed value entity has a property providing a definition of the value, it shall be named 'definition'.
Requirement	**/req/value-list/code** If a listed value entity has a property providing an additional identifier for a value, it shall be named 'code'.

Table 10 — Requirements class for conceptual model

Identifier	http://standards.iso.org/iso/19110/1.1/req/conceptual-model
Target type	Conceptual model
Name	Conceptual model for ISO 19110 feature catalogue
Dependency	http://standards.iso.org/iso/19110/req/catalogue http://standards.iso.org/iso/19110/req/base-content http://standards.iso.org/iso/19110/req/attributes http://standards.iso.org/iso/19110/req/association http://standards.iso.org/iso/19110/req/inheritance http://standards.iso.org/iso/19110/req/global http://standards.iso.org/iso/19110/req/operation http://standards.iso.org/iso/19110/req/value-list
Requirement	**/req/conceptual-model/all** A conceptual model that conforms to the ISO 19110 methodology for representing a feature catalogue shall meet all the requirements enumerated in the catalogue, base-content, attributes, association, inheritance, global, operation and value-list requirements classes.

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In order to enable XML implementation of a model conforming to the above requirements, this document includes as Annex B a UML model conforming to the requirements enumerated above. The UML model adds some additional, optional properties, associations, and classes that are not mandated by the requirements classes in Table 1, but were determined to be useful by the editing committee. The UML model in Annex B is considered normative for the definitions, properties, and cardinalities of these elements and associations.

6.3 XML implementation requirements

The XML implementation of the methodology for feature cataloguing is based on the UML model presented in Annex B. The implementation requires two namespaces. The namespace http://standards.iso.org/iso/19110/gfc/1.1 (standard abbreviation is gfc) implements the classes, properties and associations included in the UML model. The namespace http://standards.iso.org/iso/19110/fcc/1.0 (standard abbreviation is fcc) includes elements that implement abstract classes necessary to enable other ISO XML implementations to link to elements of this document without committing to a particular version of the XML implementation. This pattern is based on the implementation rule in ISO/TS 19115-3:2016, Clause 8. Table 11 summarizes the abstract classes implemented in the fcc namespace.

Table 11 — Abstract classes defined in the fcc namespace to allow loose coupling to other ISO/TC 211 XML implementations

Abstract class	Namespace defining concrete implementation
_FeatureCatalogue	feature catalogue (gfc)
_FeatureType	feature catalogue (gfc)

ISO/TS 19139:2007, Clauses 7, 8 and 9, and ISO/TS 19115-3:2016, 8.3 describe the details of encoding the UML conceptual schema into a set of XML schemas. The XML schema implementation of the ISO 19110 conceptual model provided in Annex B follows the rules and patterns described in those clauses, applying them to the UML model for XML implementation.

Because XML schema validation is insufficient to test all of the enumerated requirements, some conformance tests require other validation procedures. For instance, as stated in ISO/TS 19139:2007, 8.4, a property element following the default XML Class property type (XCPT) pattern may have exactly one of

1) inline content (by-value) that is an XML Class,

2) an xlink:href attribute (by-reference value), or

3) a gco:nilReason attribute (nil value).

Because XML schema cannot constrain the co-occurrence of content or attributes, some mechanism in addition to XML schema validation shall be used to restrict a property to be exclusively by-value or by-reference or a nil value.

Rules implementing these constraints are included in the appropriate requirements class for the XML document instances. The ISO 19110 XML implementation package includes a Schematron rule set for testing conformance with these requirements. If a tool for Schematron validation is not available, conformance to these requirements may need to be tested by inspection.

Table 12 — Requirements class for XML implementation

Identifier	http://standards.iso.org/iso/19110/req/1.1/xml-implementation
Target type	XML schema and Schematron rule documents
Name	Core requirements for implementation of feature catalogue conceptual model using XML.

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Table 12 *(continued)*

Dependency	http://standards.iso.org/iso/19139/spec#7 http://standards.iso.org/iso/19139/spec#8 http://standards.iso.org/iso/19139/spec#9 http://standards.iso.org/iso/19115-3/1.0/spec#8.4 http://standards.iso.org/iso/19110/1.1/spec/annex-b
Requirement	**/req/xml-implementation/rule-based** XML schema and Schematron rules implementing the UML model for feature catalogue defined in this specification shall follow the rules and patterns defined in ISO/TS 19139 and ISO/TS 19115-3.
Requirement	**/req/xml-implementation/base-data-types** Base data types shall be implemented according to rules set forth in ISO/TS 19139.

6.4 XML instance document requirements

Various conformance tests for this document require that metadata instance (XML) documents can be validated without error against the XML schemas defined in this document. While many tools are available to test the validation of XML instance documents against provided XML schemas, it is important to understand that not all validation tools implement the full W3C XML Schema Recommendation and not all validation tools interpret the W3C XML Schema Recommendation in the same manner. It is recommended that a tool that implements a strict interpretation of and full support for the W3C XML Schema Recommendation be used when validating XML instance documents to test conformance.

Conformance classes for requirements related to XML instance documents (the conformance target) are tested by XML schema validation, the use of Schematron rule sets, and by inspection of instance documents. Conformance class requirements and tests are presented in Tables A.1 through A.2.

Table 13 — Requirements class for XML instance

Identifier	http://standards.iso.org/iso/19110/req/xml-instance
Target type	XML instance document
Name	Core requirements for feature catalogue instance documents
Dependency	http://standards.iso.org/iso/19139/spec#8.4.1 http://standards.iso.org/iso/19110/1.1/req/xml-implementation
Requirement	**/req/xml-instance/instance-validation** XML instance documents shall be well formed and valid according to XML schema and Schematron rules associated with feature catalogue namespace (gfc.xsd, gfc.sch).
Requirement	**/req/xml-instance/property-type-content** A property element instance shall have exactly one of 1) inline content (by-value) that is a schema-valid XML Class instance, or 2) an xlink:href attribute (by-reference value), or 3) a gco:nilReason attribute (nil value).
Requirement	**/req/xml-instance/unique-type-name** The values of the 'typeName' property for each FC_FeatureType shall be unique within a FC_FeatureCatalogue instance.
Requirement	**/req/xml-instance/unique-code-value** Values assigned to 'code' properties on FC_FeatureAttribute, FC_ListedValue, FC_Feature-Association, and FC_FeatureType instances shall be unique within the scope of a FC_Fea-tureCatalogue instance.

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Table 13 *(continued)*

Requirement	**/req/xml-instance/unique-property-name** If an FC_PropertyType (attribute, operation, or association role) is the value for a 'globalProperty' XML property, then the 'memberName' of the property shall be unique within the containing FC_FeatureCatalogue instance; otherwise, the 'memberName' of the property shall be unique within the containing FC_FeatureType. If the identifiers are not globally unique URIs, then their scope of uniqueness should be specified in the catalogue scope statement.
Requirement	**/req/xml-instance/definition-language** All 'definition' XML properties shall have values provided in a natural language. NOTE The concrete XML classes that have definition properties are FC_FeatureType, FC_FeatureAssociation, FC_FeatureAttribute, FC_FeatureOperation, FC_AssociationRole, and FC_ListedValue.
Requirement	**/req/xml-instance/unique-subtype-instance** If the 'uniqueInstance' property of FC_InheritanceRelation is true, then an instance of the 'supertype' shall be an instance of at most one of its 'subtype' featureTypes.
Requirement	**/req/xml-instance/functional-language-specified** If any 'formalDefinition' property of FC_FeatureOperation has a non-null value, then the 'functionalLanguage' property of FC_FeatureCatalogue shall have a valid value.
Requirement	**/req/xml-instance/definition-source** Definitions for featureTypes, feature properties (attributes, operations, or association role), or listed values shall either be included as text values for 'definition' property instances, or referenced to a separate definition source via 'definitionReference' properties populated by FC_DefinitionReference elements.
Identifier	http://standards.iso.org/iso/19110/req/xml-instance
Target type	XML instance document
Name	Core requirements for feature catalogue instance documents
Dependency	http://standards.iso.org/iso/19139/spec#8.4.1 http://standards.iso.org/iso/19110/1.1/req/xml-implementation
Requirement	**/req/xml-instance/value-list-label-unique** Each 'label' value in an FC_ListedValue element shall be unique within scope of the FC_FeatureAttribute to which it is bound.
Requirement	**/req/xml-instance/role-is-ordered** If the 'isOrdered' property of an FC_AssociationRole is TRUE, then the 'definition' property shall be present and shall contain an explanation of the meaning of the order (Table B.10).
Recommendation	**/rec/xml-instance/functional-language-consistency** The 'functionalLanguage' property value in the FC_FeatureCatalogue element should actually be the language used in the 'formalDefinition' values of FC_FeatureOperation elements, and all formal operations definitions provided in a feature catalogue should use the same functional language. NOTE This is a recommendation because testing of this condition is considered to be outside the scope of expected test facilities.
Recommendation	**/rec/xml-instance/all-feature-types** It is recommended that FC_FeatureCatalogue instances that are bound to specific datasets document all the featureTypes found in those datasets.

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Annex A
(normative)

Abstract test suite

A.1 Introduction

This annex presents the abstract test suite for evaluating conformance to this document. This abstract test suite defines test procedures for the requirements enumerated in Clause 6. Three conformance classes are defined that aggregate these tests to specify validation criteria for conceptual models conforming to this document, XML schema and Schematron rules implementing the conceptual model, and XML instance documents that encode feature catalogue content.

A.2 Conceptual model conformance class

Most of the specified requirements constrain the conceptual model for a feature catalogue. The single requirements class specified for a conformant conceptual model aggregates all the requirements classes defined in Table 2. Tests for these requirements are enumerated in Table A.1, grouped for each requirements class aggregated in the conformance class.

In these tables, the following conventions are followed.

— The term “entity” is used to refer to model elements representing instantiable information objects in the conceptual model. Depending on the modelling paradigm used, these may have other labels, e.g. “object,” “entity,” “class,” “element,” or “feature”.

— Inclusion of a model entity name in a condition or test implies that entity or any subtype is derived from that entity in a model instance.

— Property names are provided in single quotes (‘ ‘), and are all in lower case.

Table A.1 — Conformance class: Conceptual model

Identifier	http://standards.iso.org/iso/19110/1.1/conf/conceptual-model	
Standardization target	Conceptual model	
Name	Conceptual model for a feature catalogue	
Requirements	http://standards.iso.org/iso/19110/1.1/req/conceptual-model	
Dependent requirements class	http://standards.iso.org/iso/19110/1.1/req/catalogue	
Test	Identifier	**/conf/conceptual-model/catalogue/representation**
	Requirement	/req/catalogue/representation
	Test method	Inspect the model to verify that the model documents representation of geographic features.
Identifier	http://standards.iso.org/iso/19110/1.1/conf/conceptual-model	
Standardization target	Conceptual model	
Name	Conceptual model for a feature catalogue	
Requirements	http://standards.iso.org/iso/19110/1.1/req/conceptual-model	

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