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Geografske informacije - Jezik za označevanje geografskih podatkov (GML) - 1. del: Osnove (ISO/DIS 19136-1:2018)

Geographic information - Geography Markup Language (GML) - Part 1: Fundamentals

Geoinformation - Geography Markup Language (GML) (ISO 19136:2007); Englische Fassung EN ISO 19136:2009

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35.060	Jeziki, ki se uporabljajo v informacijski tehniki in tehnologiji	Languages used in information technology
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Geographic information — Geography Markup Language (GML) —

Part 1: **Fundamentals**

Information géographique — Langage de balisage en géographie (GML) —

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Foreword

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

Recipients of this document are requested to submit, with their comments, notification of any relevant patent claims or other intellectual property rights of which they may be aware that might be infringed by any implementation of the standard set forth in this document, and to provide supporting documentation.

The Geography Markup Language (GML) was originally developed within the Open Geospatial Consortium, Inc. (OGC). ISO 19136 was prepared by ISO/TC 211 jointly with the OGC.

This version is a corrigendum to GML 3.2.1 (ISO 19136:2007). It addresses the OGC Change Request 12-092 (gml:id attribute on LinearRing) by applying the following changes:

- the XML attribute gml:id in gml:AbstractGMLType has been made optional;
- the elements gml:AbstractRing and gml:Shell have been added to the substitutionGroups gml:AbstractCurve and gml:AbstractSurface respectively;
- the types gml:AbstractRingType and gml:ShellType are now extended from base types gml:AbstractCurveType and gml:AbstractSurfaceType respectively;

These changes correct inconsistencies with ISO 19107 without breaking the validity of instance documents created using the GML 3.2.1 schema. I.e., all GML 3.2 instance documents that are valid against the GML 3.2.1 schema are also valid against the GML 3.2.2 schema.

The corrected GML 3.2 schema is available at http://schemas.opengis.net/gml/3.2.1/. Note that the use of "3.2.1" in the URL is unchanged since this version (3.2.2) is a corrigendum and the corrected schema replaces the GML 3.2.1 schema. Previous versions of the GML 3.2.1 schema are available at http://schemas.opengis.net/gml/gml-3_2_1.zip.

The change to the gml:id attribute reverts a change that has been made between GML 3.1.1 and GML 3.2.1. Reverting this change also addresses comments raised by several communities since the release of GML 3.2.1 / ISO 19136:2007.

As the correction relaxes a constraint in the XML schema, not all instance documents created based on the GML 3.2.2 schema will be valid against the GML 3.2.1 schema:

- all GML 3.2 instance documents that include a gml:id attribute on a ring or shell element are not valid against the GML 3.2.1 schema;
- all GML 3.2 instance documents that include a feature, a spatial object or a temporal object without a gml:id attribute are not valid against the GML 3.2.1 schema.

Local copies of the GML 3.2.1 schema documents have to be replaced by the GML 3.2.2 schema documents – or be replaced by links to http://schemas.opengis.net/gml/3.2.1/gml.xsd.

This corrigendum also updates URIs – mainly in examples – where OGC policies have changed since the release of GML 3.2.1 (location of the Xlink schema document, use of OGC HTTP URIs for coordinate reference systems).

As the corrigendum is currently not published by ISO, the reference to the normative schema documents in Annex C now refers to the OGC schema repository.

Introduction

Geography Markup Language is an XML grammar written in XML Schema for the description of application schemas as well as the transport and storage of geographic information.

The key concepts used by Geography Markup Language (GML) to model the world are drawn from the ISO 19100 series of International Standards and the OpenGIS Abstract Specification.

A feature is an "abstraction of real world phenomena" (ISO 19101); it is a geographic feature if it is associated with a location relative to the Earth. So a digital representation of the real world may be thought of as a set of features. The state of a feature is defined by a set of properties, where each property may be thought of as a {name, type, value} triple.

The number of properties a feature may have, together with their names and types, is determined by its type definition. Geographic features with geometry are those with properties that may be geometry-valued. A feature collection is a collection of features that may itself be regarded as a feature; as a consequence a feature collection has a feature type and thus may have distinct properties of its own, in addition to the features it contains.

Following ISO 19109, the feature types of an application or application domain is usually captured in an application schema. A GML application schema is specified in XML Schema and can be constructed in two different and alternative ways:

— by adhering to the rules specified in ISO 19109 for application schemas in UML, and conforming to both the constraints on such schemas and the rules for mapping them to GML application schemas specified in this International Standard;

— by adhering to the rules for GML application schemas specified in this International Standard for creating a GML application schema directly in XML Schema.

Both ways are supported by this International Standard. To ensure proper use of the conceptual modelling framework of the ISO 19100 series of International Standards, all application schemas are expected to be modelled in accordance with the General Feature Model as specified in ISO 19109. Within the ISO 19100 series, UML is the preferred language by which to model conceptual schemas.

GML specifies XML encodings, conformant with ISO 19118, of several of the conceptual classes defined in the ISO 19100 series of International Standards and the OpenGIS Abstract Specification. These conceptual models include those defined in:

— ISO/TS 19103 — Conceptual schema language (units of measure, basic types);

— ISO 19107 — Spatial schema (geometry and topology objects);

— ISO 19108 — Temporal schema (temporal geometry and topology objects, temporal reference systems);

— ISO 19109 — Rules for application schemas (features);

— ISO 19111 — Spatial referencing by coordinates (coordinate reference systems);

— ISO 19123 — Schema for coverage geometry and functions.

The aim is to provide a standardized encoding (i.e. a standardized implementation in XML) of types specified in the conceptual models specified by the International Standards listed above. If every application schema were encoded independently and the encoding process included the types from, for example, ISO 19108, then, without unambiguous and completely fixed encoding rules, the XML encodings would be different. Also, since every implementation platform has specific strengths and weaknesses, it is helpful to standardize XML encodings for core geographic information concepts modelled in the ISO 19100 series of International Standards and commonly used in application schemas.

In many cases, the mapping from the conceptual classes is straightforward, while in some cases the mapping is more complex (a detailed description of the mapping is part of this International Standard).

In addition, GML provides XML encodings for additional concepts not yet modelled in the ISO 19100 series of International Standards or the OpenGIS Abstract Specification, for example, dynamic features, simple observations or value objects.

Predefined types of geographic feature in GML include coverages and simple observations.

A coverage is a subtype of feature that has a coverage function with a spatiotemporal domain and a value set range of homogeneous 1- to *n*-dimensional tuples. A coverage may represent one feature or a collection of features "to model and make visible spatial relationships between, and the spatial distribution of, Earth phenomena" (OGC Abstract Specification Topic 6 [20]) and a coverage "acts as a function to return values from its range for any direct position within its spatiotemporal domain" (ISO 19123).

An observation models the act of observing, often with a camera or some other procedure, a person or some form of instrument (Merriam-Webster Dictionary: "an act of recognizing and noting a fact or occurrence often involving measurement with instruments"). An observation is considered to be a GML feature with a time at which the observation took place, and with a value for the observation.

A reference system provides a scale of measurement for assigning values to a position, time or other descriptive quantity or quality.

A coordinate reference system consists of a set of coordinate system axes that is related to the Earth through a datum that defines the size and shape of the Earth.

A temporal reference system provides standard units for measuring time and describing temporal length or duration.

A reference system dictionary provides definitions of reference systems used in spatial or temporal geometries.

Spatial geometries are the values of spatial feature properties. They indicate the coordinate reference system in which their measurements have been made. The "parent" geometry element of a geometric complex or geometric aggregate makes this indication for its constituent geometries.

Temporal geometries are the values of temporal feature properties. Like their spatial counterparts, temporal geometries indicate the temporal reference system in which their measurements have been made.

Spatial or temporal topologies are used to express the different topological relationships between features.

A units of measure dictionary provides definitions of numerical measures of physical quantities, such as length, temperature and pressure, and of conversions between units.

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Geographic information — Geography Markup Language (GML) — Part 1: Fundamentals

1 Scope

The Geography Markup Language (GML) is an XML encoding in compliance with ISO 19118 for the transport and storage of geographic information modelled in accordance with the conceptual modelling framework used in the ISO 19100 series of International Standards and including both the spatial and non-spatial properties of geographic features.

This International Standard defines the XML Schema syntax, mechanisms and conventions that:

- provide an open, vendor-neutral framework for the description of geospatial application schemas for the transport and storage of geographic information in XML;
- allow profiles that support proper subsets of GML framework descriptive capabilities;
- support the description of geospatial application schemas for specialized domains and information communities;
- enable the creation and maintenance of linked geographic application schemas and datasets;
- support the storage and transport of application schemas and datasets;
- increase the ability of organizations to share geographic application schemas and the information they describe.

Implementers may decide to store geographic application schemas and information in GML, or they may decide to convert from some other storage format on demand and use GML only for schema and data transport.

NOTE If an ISO 19109 conformant application schema described in UML is used as the basis for the storage and transportation of geographic information, this International Standard provides normative rules for the mapping of such an application schema to a GML application schema in XML Schema and, as such, to an XML encoding for data with a logical structure in accordance with the ISO 19109 conformant application schema.

2 Conformance

2.1 Conformance requirements

Clauses 7 to 19 of this International Standard specify XML Schema components, i.e. the GML schema, which shall be used in GML application schemas in accordance with Clause 21. Clause 20 specifies rules for the specification of a GML profile that may be defined for use in a GML application schema.

Few applications will require the full range of capabilities described by the GML schema. This clause, therefore, defines a set of conformance classes that will support applications whose requirements range from the minimum necessary to define simple feature types to full use of the GML schema.

Most of the schema components specified in this International Standard implement concepts defined in the ISO 19100 series of International Standards. In these cases, the conformance classes defined in this International Standard are based on the conformance classes defined in the corresponding standard.

Any GML application schema, GML profile or software implementation claiming conformance with one of the conformance classes shall pass all test cases of the corresponding abstract test suite.

Any software implementation claiming conformance to this International Standard shall document the GML profile supported by the implementation. The GML profile shall pass all mandatory test cases of the abstract test suite corresponding to GML profiles.

2.2 Conformance classes related to GML application schemas

GML application schemas claiming conformance to this International Standard shall conform to the rules specified in Clauses 7 to 21 and pass all relevant test cases of the abstract test suite in A.1.

Depending on the characteristics of a GML application schema, 12 conformance classes are distinguished. Table 1 lists these classes and the corresponding subclause of the abstract test suite.

Table 1 — Conformance classes related to GML application schemas

Conformance class	Subclause of the abstract test suite
All GML application schemas	A.1.1
GML application schemas converted from an ISO 19109 application schema in UML	A.1.2
GML application schemas to be converted to an ISO 19109 application schema in UML	A.1.3
GML application schemas defining features and feature collections	A.1.4
GML application schemas defining spatial geometries	A.1.5
GML application schemas defining spatial topologies	A.1.6
GML application schemas defining time	A.1.7
GML application schemas defining coordinate reference systems	A.1.8
GML application schemas defining coverages	A.1.9
GML application schemas defining observations	A.1.10
GML application schemas defining dictionaries and definitions	A.1.11
GML application schemas defining values	A.1.12

2.3 Conformance classes related to GML profiles

The requirements of an application schema determine the XML Schema components from the GML schema that shall be included in a GML profile. GML profiles claiming conformance to this International Standard shall satisfy the requirements of the abstract test suite in A.2.

Depending on the contents and requirements concerning a specific GML profile, 31 conformance classes are distinguished. Table 2 lists these classes and the corresponding subclause of the abstract test suite.

Table 2 — Conformance classes related to GML profiles

Conformance class	Subclause of the abstract test suite
All GML profiles	A.2.1
Geometric primitives (spatial) — 0-dimensional	A.2.2.1.1
Geometric primitives (spatial) — 0/1-dimensional	A.2.2.1.2
Geometric primitives (spatial) — 0/1/2-dimensional	A.2.2.1.3
Geometric primitives (spatial) — 0/1/2/3-dimensional	A.2.2.1.4
Geometric complexes (spatial) — 0/1-dimensional	A.2.3.1.1
Geometric complexes (spatial) — 0/1/2-dimensional	A.2.3.1.2
Geometric complexes (spatial) — 0/1/2/3-dimensional	A.2.3.1.3
Topologic complexes (spatial) — 0/1-dimensional	A.2.4.1.1
Topologic complexes (spatial) — 0/1/2-dimensional	A.2.4.1.2
Topologic complexes (spatial) — 0/1/2/3-dimensional	A.2.4.1.3
Topologic complexes with geometric realization (spatial) — 1-dimensional	A.2.5.1.1
Topologic complexes with geometric realization (spatial) — 2-dimensional	A.2.5.1.2
Topologic complexes with geometric realization (spatial) — 3-dimensional	A.2.5.1.3
Coordinate reference systems	A.2.6
Coordinate operations between two coordinate reference systems	A.2.7
Temporal geometry — 0-dimensional	A.2.8.1
Temporal geometry — 0/1-dimensional	A.2.8.2
Temporal topology	A.2.9
Temporal reference systems	A.2.10
Dynamic features	A.2.11
Dictionaries	A.2.12
Units dictionaries	A.2.13
Observations	A.2.14
Abstract coverage	A.2.15.1
Discrete point coverage	A.2.15.2
Discrete curve coverage	A.2.15.3
Discrete surface coverage	A.2.15.4
Discrete solid coverage	A.2.15.5
Grid coverage	A.2.15.6
Continuous coverage	A.2.15.7

Curve implementations, for those GML profiles including 1-dimensional spatial geometry objects, shall always include a “linear” interpolation technique. Surface implementations, for those GML profiles including 2-dimensional spatial geometry objects, shall always include a “planar” interpolation technique. Additional curve and surface interpolation mechanisms are optional but, if implemented, they shall follow the definition included in this International Standard.