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Geographic information — Schema for coverage geometry and functions —

Part 2: Coverage implementation schema

Information géographique — Schéma de la géométrie et des fonctions de couverture —
Partie 2: Schéma de la mise en place de la couverture

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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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www. iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, 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.

This document was prepared by ISO/TC 211, *Geographic information/geomatics*.

A list of all the parts in the ISO 19123 series, can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Coverages represent digital geospatial information representing space/time-varying phenomena. Common examples include 1-D time series, 2-D imagery, 3-D x/y/t image time series and x/y/z geophysical voxel models, as well as 4-D x/y/z/t climate and ocean data.

This Coverage Implementation Schema (CIS) specifies a concrete, interoperable, conformance-testable coverage information schema. It is based on the abstract concepts of ISO 19123:2005 (which is equivalent to OGC Abstract Topic 6). ISO 19123:2005 specifies an abstract model which is not per se interoperable, i.e. many different and incompatible implementations of the abstract model are possible. CIS, on the other hand, is interoperable in the sense that coverages can be conformance tested, regardless of their data format encoding, down to the level of single “pixels” or “voxels”.

Coverages can be encoded in any suitable format (such as GML, JSON[4], GeoTIFF[7], NetCDF[9] or GMLJP2) and can be partitioned, e.g. for a time-interleaved representation. Coverages are independent from service definitions and, therefore, can be accessed through a variety of web based service types, such as the OGC Web Coverage Service (WCS) Standard. This document is a data model whereas WCS is a service model. Both are tentatively separate, thereby allowing different services to process and deliver coverages, such as WFS, WCS, WCPS, WPS, etc. WCS and WCPS are outstanding only in that they offer the most powerful coverage functionality.

Coverages are independent from service definitions and, therefore, can be accessed through a variety of standardized services types, such as the Web Coverage Service (WCS) Standard[6], which is used in the examples in this document. The coverage structure can serve a wide range of coverage application domains, thereby contributing to harmonization and interoperability between and across these domains.

This document implements part of the coverage types described in ISO 19123:2005. Any extension of the coverage types addressed will be left for a future version of this document. ISO 19123:2005 is under review and will be replaced with ISO 19123-1 once the revision is published. ISO 19123-1 will be an extension of ISO 19123:2005 containing additional coverage concepts, so any references to ISO 19123:2005 in this document can be taken as references to the revised standard. The references in this document are to ISO 19123:2005 because this document is a joint standard with OGC, and the equivalent OGC standard “09-146r2 Version 1.0.1 OGC Coverage Implementation Schema (CIS 1.0)” is an existing published standard that makes references to ISO 19123:2005.

This document is a derived work based on the OGC document "Coverage Implementation Schema" OGC 09-146r2. The two documents are NOT word for word identical because each follows the document template required by each organization. However, both documents are functionally equivalent. In particular Clauses 1 to 5 in both the ISO standard (this document) and the OGC standard (OGC 09-146r2) contain the Scope, Normative references, Terms and definitions (and Notation) and Conformance described in the manner required by each organization. Where there are minor differences, such as the definition of “coverage” and “grid”, this document makes use of the terms defined in ISO standards and identifies the differences in a note.

Any extension in OGC beyond CIS 1.0 (e.g. the development of CIS 1.1) is an extension beyond this document. ISO and OGC plan to work together to ensure future synchronization of these standards.

This document is a derived work based on OGC standard 09–146r2 Version 1.0.1 OGC Coverage Implementation Schema (CIS 1.0) also known as “OGC® GML Application Schema — Coverages” published 2012–05–11 and copyrighted by the OGC ©2012 and used with permission. OGC standard 09–146r2 Version 1.0.1 is a corrigendum to existing OGC standard 09–146r1 Version 1.0.0 published 2010–10–27.

Geographic information — Schema for coverage geometry and functions —

Part 2: Coverage implementation schema

1 Scope

This document specifies a concrete[1)] implementable, conformance-testable coverage structure based on the abstract schema for coverages defined in the ISO 19123 schema for coverage geometry. This document defines a structure that is suitable for encoding in many encoding formats.

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 19103:2015, *Geographic information — Conceptual schema language*

ISO 19123:2005, *Geographic information — Schema for coverage geometry and functions*

ISO 19136:2007, *Geographic information — Geography Markup Language (GML)*

OGC 07-011, *Abstract Specification Topic 6: The Coverage Type and its Subtypes*, version 7.0 (identical to ISO 19123:2005)

OGC 07-036, *Geography Markup Language (GML) Encoding Standard*, version 3.2.1

OGC 08-094, OGC® SWE *Common Data Model Encoding Standard*, version 2.0

3 Terms, definitions, and abbreviated terms

3.1 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 https://www.electropedia.org/

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

3.1.1
abstract test suite
abstract test module specifying all the requirements to be satisfied for conformance

[SOURCE: ISO 19105:2000, 3.4]

1) "concrete" is used here as a contrast to "abstract" in the sense described in the Introduction.

3.1.2
coverage
feature that acts as a function to return values from its range for any direct position within its spatial, temporal or spatiotemporal domain

Note 1 to entry: OGC CIS 1.0 has the definition for coverage: "feature that acts as a function to return values from its range for any direct position within its spatiotemporal domain."[13].

[SOURCE: ISO 19123:2005, 4.1.7, modified — Note 1 to entry has been replaced and the EXAMPLE has been deleted]

3.1.3
grid
network composed of two or more sets of curves in which the members of each set intersect the members of the other sets in an algorithmic way

Note 1 to entry: OGC Abstract Topic 6 has the definition for grid: "network composed of one or more sets of curves in which the members of each set intersect the members of the other sets in an algorithmic way". This accomplishes integration of the 1-D case, thereby enabling general n-D grids.

[SOURCE: ISO 19123:2005, 4.1.23, modified — Note 1 to entry has been replaced]

3.1.4
implementation coverage
feature which is a subclass (specialization) of a coverage as defined in this document

Note 1 to entry: An implementation coverage is a concrete document in some concrete encoding, such as a GeoTIFF file.

Note 2 to entry: The definition of implementation coverage in this standard is functionally identical to GML coverage as defined in the OGC Coverage Implementation Schema [OGC 09-146r2].

3.2 Abbreviated terms

CIS	Coverage Implementation Schema
GeoTIFF	Geo Tagged Image File Format
GML	Geography Markup Language
GMLCOV	GML Application Schema for Coverages
JSON	JavaScript Object Notation
netCDF	network Common Data Format
OGC	Open Geospatial Consortium
SWE	Sensor Web Enablement
TIN	Triangulated Irregular Network
UoM	Unit of Measure
UML	Unified Modeling Language
WCS	Web Coverage Service

4 Conformance

This document defines conformance classes that correspond to identified requirements. These conformance classes are described in Annex A. Any implementation claiming conformance with this document must conform to the abstract conformance class A.1: *gml-coverage* and, in addition, at least one of the concrete conformance classes A.2: *gml*, A.3: *multipart*, and A.4: *special-format*. Requirements and conformance test URIs defined in this document are relative to <http://www.opengis.net/spec/GMLCOV/1.0/>.

5 Notation

5.1 Use of the term “coverage”

The definition of “coverage” in 3.1.2 shall be the generic one provided by ISO 19123 (and equivalently shall be the one in OGC Abstract Topic 6 [OGC 07-011]). The term "implementation coverage" is coined to denote the concrete data structure defined in this document that shall rely on GML [ISO 19136:2007] and equivalently shall rely on GML 3.2.1 [OGC 07-036] and OGC SWE Common 2.0 [OGC 08-094].

For the remainder of this document, "coverage" shall be understood as a shorthand for "implementation coverage" unless explicitly stated otherwise.

5.2 UML notation

The conceptual schema specified in this document is described using the Unified Modeling Language (UML) static structure diagram, which shall follow the guidance in ISO 19103, and equivalently shall follow the guidance in OGC Web Service Common [OGC 06-121r9].

NOTE The UML and basic types used to express the diagrams in this document are equivalent to the UML and basic types used in the OGC standard even though the OGC standard is based on an earlier version of ISO 19103:2015.

Several model elements used in this schema are defined in other ISO geographic information standards and OGC standards. The uniqueness of objects is ensured by their namespace.

5.3 Namespace prefix conventions

UML diagrams and XML code fragments adhere to the namespace conventions shown in Table 1. The namespace prefixes used in this document are **not** normative and are merely chosen for convenience, they may appear in examples without being formally declared, and have no semantic significance. The namespaces to which the prefixes correspond are normative.

Table 1 — Namespace mapping conventions

UML prefix	GML prefix	Namespace URL	Description
GML	gml	http://www.opengis.net/gml/3.2	GML 3.2.1
SWE Common	swe	http://www.opengis.net/swe/2.0	SWE Common 2.0
CIS	cis	http://www.opengis.net/cis/1.0	Coverage Implementation Schema 1.0, formerly named GML 3.2.1 Application Schema — Coverages 1.0

6 Coverage model

6.1 Coverage general

This document specifies the coverage structure to be used by ISO geographic information standards and jointly in OGC standards.

This document is described in terms of the Geography Markup Language (GML). This document derives from the OGC standard previously called GMLCOV which has been renamed to be Coverage Implementation Specification (CIS) 1.0[5].

Clause 6 establishes an abstract conformance class whereby "abstract" denotes that a concrete program must implement one of the concrete conformance classes in addition to claim conformance with this document. Although Clause 6 heavily makes use of GML, it does not prescribe that a coverage instance document be encoded in GML. A GML encoding of such coverage structures is established in the conformance class *gml*.

6.2 Overview

In GML (ISO 19136 and OGC GML 3.2.1[14]), all coverage types are derived from the abstract `Coverage` data type. This structure contains a `domainSet` describing the coverage's domain and a `rangeSet` component containing the range values ("pixels", "voxels") of the coverage. This coverage implementation schema extends (ISO 19136 and OGC GML 3.2.1[14]), class `Coverage` with two components, `rangeType` and `metadata`.

— The `rangeType` element describes the coverage's range set data structure. A range value often consists of one or more fields (in remote sensing also referred to as *bands* or *channels*), however, much more general definitions are possible. Range value structure description is based on the OGC SWE Common [OGC 08-094] `DataRecord`.

— The abstract coverage definition is augmented with an extensible slot for metadata. The intended use is to define concrete metadata structures and their semantics in extensions or application profiles.

The following changes apply over the GML (ISO 19136 and OGC GML 3.2.1[14]) specification:

— The property `coverageFunction`, which in GML is associated with every subtype of `Coverage`, is moved up into `Coverage` in the coverage type hierarchy of this document.

NOTE 1 This way, the coverage function is available in any subtype of `Coverage`. This serves to prepare for continuous coverages, like in the case described by the next bullet below.

— The grid coverage types are subtypes of `Coverage` rather than being subtypes of `DiscreteCoverage` as in GML

NOTE 2 This allows representing not only discrete grid coverages, but also continuous coverages by using grids for the reference points in conjunction with a coverage function defining interpolation.

No further changes over GML (ISO 19136 and OGC GML 3.2.1[14]) are made in this document. In particular, no pre-existing component changes its semantics.

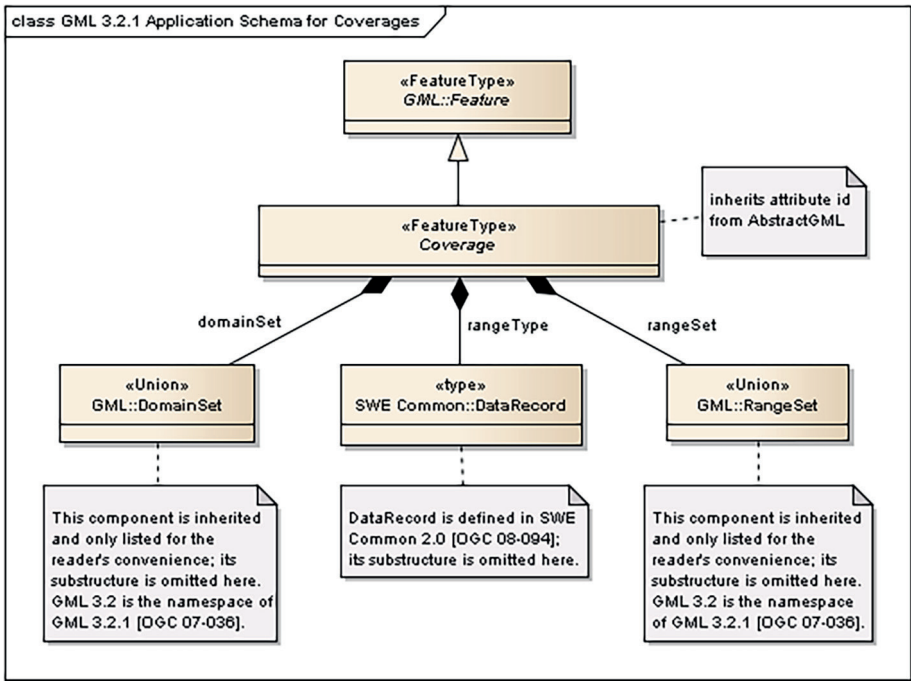

Figure 1 — The Coverage structure

In this document, `Coverage` shall always refer to the definition of this Application Schema and *not* to the GML definition of the same name, unless explicitly stated otherwise.

Figure 1 shows the UML diagram pertaining to this Application Schema.

Requirement 1 /req/gml-coverage/structural-adherence:
Any XML document instantiating a concrete subtype of Coverage **shall** conform with the UML diagram in Figure 1, with Table 2, and with the XML schema defined as part of this document.

Table 2 — The Coverage data structure

Name	Definition	Data type	Multiplicity
`coverage-Function`	GML 3.2.1 coverage function to describe how range values at coverage locations can be obtained	`GML::Coverage-Function`	Zero or one (optional)
`metadata`	Application specific metadata	Any	Zero or more (optional)
`domainSet`	GML 3.2.1 Definition of coverage domain	`GML::DomainSet`	One (mandatory)
`rangeType`	Structure definition of the coverage range values	`SWE::DataRecord`	One (mandatory)
`rangeSet`	GML 3.2.1 Coverage range values	`GML::RangeSet`	One (mandatory)

NOTE 3 UML data type Any is used here with the same meaning as XML's `xsd:any`, which does not have a direct equivalent in UML.

NOTE 4 Following the GML pattern described in [14] on GML level, `SWE::DataRecord` is linked to `rangeType` via an association `SWE::DataRecordPropertyType`.