



International
Standard

ISO 19123-2

**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 mise en œuvre de la couverture

**Second edition
2026-10**

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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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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

For an explanation of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 211, *Geographic information/Geomatics*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 287, *Geographic Information*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement), in collaboration with the Open Geospatial Consortium (OGC).

This second edition cancels and replaces the first edition (ISO 19123-2:2018), which has been technically revised.

The main changes are as follows:

- The document is adjusted to the structure established in ISO 19123-1. Among others, a clear separation of logical level (UML structures) and physical level (encodings, such as XML) is established.
- Use of terminology is adjusted to align with ISO 19123-1.
- Coverage type `GeneralGridCoverage` is integrated from OGC CIS 1.1^[15] as an additional coverage structure which generalizes and simplifies grid coverage modelling. It adds comprehensive definitions for all possible types of irregular grids, including `RectifiedGridCoverage` and `ReferenceableGridCoverage` as special cases.
- `RectifiedGridCoverage` and `ReferenceableGridCoverage` have been moved into a (normative) annex as their specification follows a different logic which does not easily fit into the structuring given by the Coverage Fundamentals (ISO 19123-1). They form a legacy and will be deprecated in the next edition of this document as `GeneralGridCoverage` covers these cases while simpler in structure.
- Editorial changes have been made to the structure and nomenclature in order to conform to the most recent edition of the ISO/IEC Directives.
- The UML schema is updated to reflect the above updates.
- The XML coverage encoding is complemented with a structurally equivalent JSON encoding, based on modern JSON schema design patterns.

- The XML and JSON schemas of the coverage range type, which relies on the SWE Common DataRecord, have been copied verbatim from SWE Common into the coverage schema to make this document more self-contained and easier to read.

NOTE The RDF encoding of OGC CIS 1.1 has not been included at this time. It will possibly be added at a later time.

- More general grid identifiers (with punctuation, national character sets, etc.).
- Mixed regular and non-regular grids.
- Added support for non-regularly gridded sensor models.
- Clear regulation for interpolation methods associated with grid coverages, thereby also clarifying a long-standing confusion between discrete and continuous grid coverages.
- Distinction between grid dimension and CRS dimension.
- Introduction of `EnvelopeByAxis`, an envelope type which allows for a convenient handling of any type of coordinates.
- Partitioned (“tiled”) coverages, allowing – among others – “interleaved representations” of coverages and datacubes tiled for efficient subsetting.
- Removal of a namespace ambiguity in `ReferenceableGridCoverage` (resolved by introduction of `GeneralGridCoverage`).
- Some GML schema definitions whose generality complicates coverage understanding unnecessarily have been extracted and condensed into the pertaining XML schema. As a consequence, the XML encoding of this document is now a compact, freestanding definition, rather than a GML application schema. Nevertheless, by keeping with the coverage types inherited from the previous edition of this document, it is possible for implementers to remain in the realm of a GML application schema.

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

This document specifies an interoperable, conformance-testable information schema for coverages. As defined in ISO 19123-1 (which is equivalent to OGC Abstract Topic 6.1), coverages serve as digital representations of space-time varying phenomena, corresponding to the notion of a “field” in physics. Such coverages can be discrete or continuous. 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 atmospheric and ocean data. 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^[12], and through service instantiations realizing ISO 19123-3.

This document is a compliant standardization target of ISO 19123-1:2023 relying on its concepts, terms, definitions, and interfaces to establish a logical schema (via UML) implementing the interfaces defined there. Additionally, this document defines related physical coverage schemas (via format encodings) for the single logical schema. Thus, ISO 19123-1 and this document together establish an abstraction hierarchy:

- conceptual level: ISO 19123-1 defining abstract interfaces;
- logical level: [Clauses 5](#) to [10](#) of this document, defining data as object classes with attributes;
- physical level: [Clauses 11](#) and [12](#) of this document, plus further separate coverage encoding standards defined outside this document, defining the mapping of the logical-level data to byte streams (GeoTIFF, netCDF, JPEG2000, etc.).

The content of this document is based on OGC standards CIS 1.0 and CIS 1.1.

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Geographic information — Schema for coverage geometry and functions —

Part 2: Coverage implementation schema

1 Scope

This document specifies an implementable, conformance-testable coverage structure based on the abstract schema for coverages defined in the ISO 19123-1 coverage fundamentals. This document defines a concrete data structure that is suitable for encoding in many 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 19123-1:2023, *Geographic information — Schema for coverage geometry and functions — Part 1: Fundamentals*

OGC 08-094r1, *OGC® SWE Common Data Model Encoding Standard, version 2.0*

OGC 24-014, *OGC® SWE Common Data Model Encoding Standard, version 3.0*

IETF RFC 2387, *The MIME Multipart/Related Content-type*, Internet Engineering Task Force, 1998

IETF RFC 2392, *Content-ID and Message-ID Uniform Resource Locators*, Internet Engineering Task Force, 1998

IETF RFC 7159, *The JavaScript Object Notation (JSON) Data Interchange Format*. Internet Engineering Task Force, 2014

3 Terms, definitions, and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 19123-1:2023 and the following apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1.1

coverage CRS

coverage coordinate reference system

<coverage> coordinate reference system (CRS) in which all coordinates in a coverage domain are expressed

Note 1 to entry: Sometimes a coverage's CRS is also referred to as the coverage's native CRS to express that this is the CRS to which all the coverage's location data refer.

3.1.2

displaced grid

<coverage> grid whose direct positions are topologically aligned to a grid, but whose geometric positions can vary arbitrarily

3.1.3

irregular grid

<coverage> grid whose direct positions have individual distances along each grid's axis

3.1.4

partition

<coverage> separately stored coverage acting, by being referenced in another coverage, as one of its components

3.1.5

regular grid

<coverage> grid whose direct positions have a constant distance along each grid's axis

3.1.6

transformation grid

<coverage> grid whose direct positions are given by a transformation

Note 1 to entry: This definition is adapted from OGC 08-094r1.

Note 2 to entry: The transformation algorithm described in this definition is not within the scope of this document.

3.2 Abbreviated terms

CIS coverage implementation schema

CRS coordinate reference system

EPSG European Petroleum Survey Group

GeoTIFF geo tagged image file format

GML geography markup language

JSON JavaScript Object Notation

netCDF network common data format

OGC Open Geospatial Consortium

RDF resource description framework

SWE sensor web enablement

TIN triangulated irregular network

UoM unit of measure

UML unified modeling language

WCS web coverage service

WCPS web coverage processing service

4 Conformance

4.1 Notation

Schemas are presented using the Unified Modeling Language (UML) as defined in ISO 19103.

4.2 Interoperability and conformance testing

The term “coverage”, together with related terms, is used as defined in ISO 19123-1:2023. This Coverage Implementation Schema standard implements ISO 19123-1:2023, Clauses 5 through 10 (ISO 19123-1:2023, Annex D is implemented by normative [Annex B](#) of this document). In other words, the data structures defined in the UML schema form an implementation of the interfaces established in ISO 19123-1:2023.

This document defines testable conformance classes which correspond to the requirements in [Clause 5](#) onwards. These conformance classes, together with the corresponding conformance tests, are described in [Annex A](#). Any implementation claiming conformance with this document shall conform to the abstract conformance class “coverage” and, in addition, at least one of the conformance classes “xml”, “json”, “multipart”.

4.3 Organization

The coverage schema is organized into the packages shown in [Figure 1](#). Each package establishes one requirements class. [Figure 1](#) show the requirements class dependencies depicted as a UML package diagram; each package represents one class, the “depends-on” relationship represents the requirements class dependency relationship. Packages have been grouped along practical implementation considerations, in particular to maximize modularity ([Figure 1](#) and [Table 1](#)):

- The core class “coverage” (in red). This is the only abstract class – it establishes the basic framework, while the concrete conformance classes listed below define how concrete coverage instances can be built.
- The grid coverage classes (in green):
 - Class “grid-regular” establishes multi-dimensional unreferenced and regular referenced grids; in particular, `GridCoverage` and `RectifiedGridCoverage` are provided here for backwards compatibility with version 1.0 of this document.
 - Class “grid-irregular” establishes multi-dimensional irregular referenced grids.
 - Class “grid-transformation” establishes multi-dimensional referenced grids defined by algorithmic transformations.
- The non-gridded coverage classes (in blue):
 - Class “pointcloud” establishes point clouds, a class kept separately as it frequently appears standalone in practice.
 - Class “mesh” establishes general multi-dimensional geometric meshes with curves, surfaces, and solids.
- The format encoding classes (in yellow):
 - Class “xml-coverage” establishes XML encoding of coverages.
 - Class “json-coverage” establishes JSON encoding of coverages.
 - Class “multipart” establishes a multipart encoding of coverages.
- Class “partitioning” (in grey) establishes coverages composed from several sub-coverages.

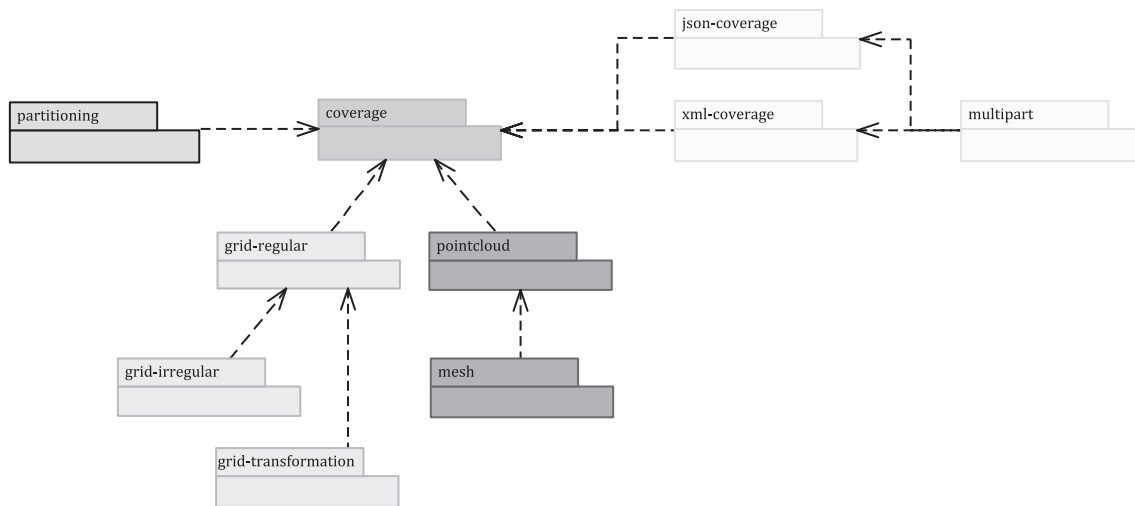


Figure 1 — The Coverage class hierarchy as UML package diagram

Requirement 1: <https://standards.isotc211.org/19123/-/2/2/req/coverage/conformance>

An implementation of this CIS standard, in order to be compliant, shall conform to:

- be an implementation of ISO 19123-1;
- the core conformance class coverage plus;
- at least one of the grid-regular, grid-irregular, grid-transformation, pointcloud, and mesh conformance classes plus;
- at least one of the encoding conformance classes xml-coverage and json-coverage plus;
- the conformance tests specified in [Annex A](#).

All requirements-classes and conformance-classes described in this document are owned by the standard(s) identified.

The URIs in this document have a stem of <https://standards.isotc211.org/19123/-2/2/> which corresponds to the OGC URI stem <https://www.opengis.net/spec/CIS/1.2/>, except that the numbering (such as of requirements) has changed sometimes.

Table 1 — Package (conformance class) URIs established in this document

Class	Description and URI
coverage	General, abstract coverage class, implementing ISO 19123-1:2023 https://standards.isotc211.org/19123/-2/2/conf/coverage
pointcloud	Coverage specialization for Multi-Point Coverages (point clouds) https://standards.isotc211.org/19123/-2/2/conf/pointcloud
grid-regular	Coverage specialization for regular Grid Coverages https://standards.isotc211.org/19123/-2/2/conf/grid-regular
grid-irregular	Coverage specialization for irregular Grid Coverages https://standards.isotc211.org/19123/-2/2/conf/grid-irregular
grid-transformation	Coverage specialization for transformation Grid Coverages https://standards.isotc211.org/19123/-2/2/conf/grid-transformation
mesh	Coverage specialization for curve, surface, and solid coverages https://standards.isotc211.org/19123/-2/2/conf/mesh
partitioning	Partitioned representation of coverages https://standards.isotc211.org/19123/-2/2/conf/partitioning

Table 1 (continued)

Class	Description and URI
xml-coverage	Coverage encoding in XML https://standards.iso211.org/19123/-2/2/conf/xml-coverage
json-coverage	Coverage encoding in JSON https://standards.iso211.org/19123/-2/2/conf/json-coverage
multipart	Multi-part representation of coverages https://standards.iso211.org/19123/-2/2/conf/multipart

This document consists of the UML diagrams and textual requirements classes established in this document as well as an external file bundle consisting of the corresponding schema files, plus example coverage files.

The name and contact information of the maintenance agency for this document can be found at www.iso.org/maintenance_agencies.

5 Coverages

5.1 Overview

Conformance class “coverage” lays the foundation for the Coverage Implementation Schema. It is the abstract core class, meaning it does not allow creating coverage instances itself, but rather provides the fundament for the further classes which define various specializations of coverage instances.

The following ISO 19123-1:2023 coverages are sorted along the topological dimension of the elements they contain (Figure 2), visible in their respective domain set structure:

- 0-D point sets, known as Multi-Point Coverages for irregular point agglomerations (see Clause 6) and General Grid Coverages for points sitting on some regular or irregular grid (see Clause 7);
- 1-D curve bundles, known as Multi-Curve Coverages (see Clause 8);
- 2-D surface bundles, known as Multi-Surface Coverages (see Clause 9);
- 3-D solid bundles, known as Multi-Solid Coverages (see Clause 10).

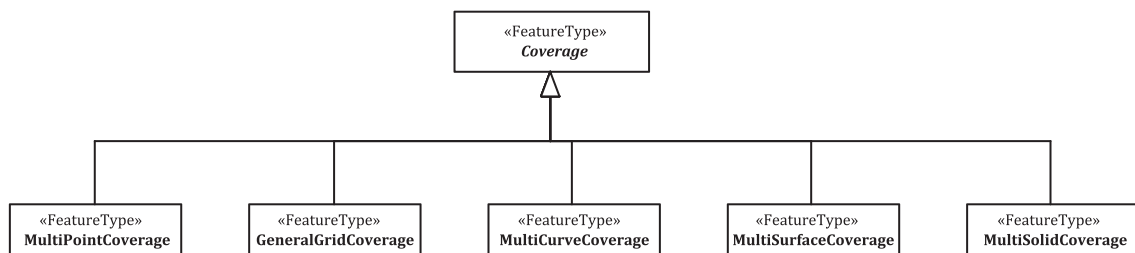


Figure 2 — Coverage subtypes defined in CIS (overview)

Requirement 2: <https://standards.iso211.org/19123/-2/2/req/coverage/subtypes>

A coverage shall be one of: MultiPointCoverage, GeneralGridCoverage, MultiCurveCoverage, MultiSurfaceCoverage, MultiSolidCoverage.

NOTE This structuring, adopted from ISO 19123-1:2023, is different from the previous edition of this document, ISO 19123-2:2018.

5.2 General coverage structure

A coverage consists of the following main components ([Figure 3](#)):

- Domain set: “where are values available?” Coordinate positions for which values are stored in the coverage are called direct positions.
- Range set: “what is the value at a particular position?” (often referred to as “pixels” or “voxels”). Such values can be atomic (such as in grayscale images) or record structures (such as in colour or hyperspectral images). Record components are known as bands, channels, and variables in different disciplines.
- Range type: “what do these values mean?” Such a type often consists of one or more fields (also referred to as bands or channels or variables – not to be confused with the physics field a coverage represents). For this description of the semantics, coverages in this document make use of OGC SWE Common (OGC 08-094r1).
- Metadata: “what else do we know about this coverage?” This item is added in this document, it is not present in the abstract definition of ISO 19123-1:2023.

Technically, all coverage types are derived from abstract class `Coverage`. This structure contains a `DomainSet` describing the coverage’s domain and a `RangeSet` component containing the range value consisting of one or more record fields. The `RangeType` element describes the coverage’s range data structure. Its structure description is based on the OGC SWE Common [OGC 08-094r1] `DataRecord`, so that the semantics description from upstream sensor acquisitions into downstream services is carried over seamlessly.

In conformance class “coverage”, this domain/range representation is used; requirements class “coverage-partitioning” ([Clause 11](#)) adds partitioning and position/value pair list as alternatives. This is why coverage subtype `CoverageByDomainAndRange` is introduced in [Figure 3](#); while it can seem artificial in this requirements class, it will allow modelling the alternative representations later in this document.

[Figure 3](#) contains the complete coverage structure with all variants allowed; in the subsequent subclauses, all parts are successively described in detail.

NOTE ISO 19123-3:2023, which is based on the OGC Web Coverage Processing Service (WCPS),^[24] defines a coverage-specific query language based on this document allowing extraction, recoding, fusion, derivation of coverages and general analytics, currently on multi-dimensional grid coverages, i.e. geo datacubes.

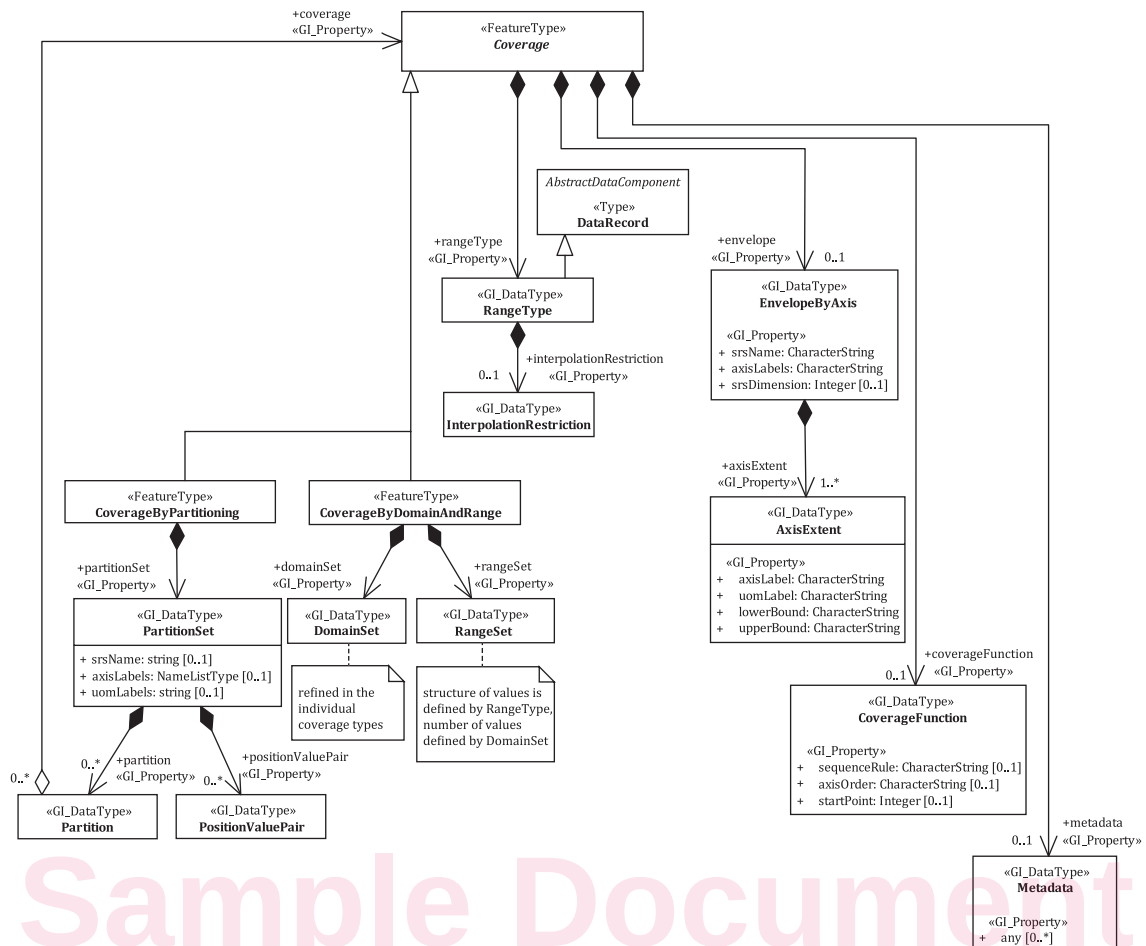


Figure 3 — The Coverage structure (overview)

5.3 Domain/range based coverage structure

The coverage structure defined normatively in this class coverage is `CoverageByDomainAndRange`.

Requirement 3: <https://standards.iso/19123-2/2/req/coverage/domain+range>

A coverage instantiating class coverage shall conform with [Figure 4](#) and [Table 2](#).