OGC® Coverage Implementation Schema

*(This document has been renamed from OGC® GML Application Schema – Coverages)*

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i. Preface

This document specifies a GML coverage structure extending the definition of GML 3.2.1 [07-036] in a compatible way.

Main change over GML is the addition of one mandatory component, rangeType, to the Coverage definition of GML 3.2.1 to provide a concise description of the coverage range value definition. Further, handling of format encodings different from GML are established.

This enhanced coverage type is used, for example, by the Web Coverage Service (WCS) Standard [1] version 2.0 and higher, but is independent from WCS service. This augmented coverage structure can serve a wide range of coverage application domains and service types, thereby contributing to harmonization and interoperability.

ii. Terms and definitions

This document uses the specification terms defined in Subclause 5.3 of [OGC 06-121r9], which is based on the ISO/IEC Directives, Part 2, Rules for the structure and drafting of International Standards. In particular, the word “shall” (not “must”) is the verb form used to indicate a requirement to be strictly followed to conform to this standard.

iii. Submitting organizations

The following organizations have submitted this Implementation Specification to the Open Geospatial Consortium, Inc.:

- Jacobs University Bremen
- National Center for Atmospheric Research (NCAR)
- Oracle USA
- PCI Geomatics Inc.
- ERDAS, Inc.
- EOX IT Services GmbH
- Spot Image
- BAE Systems - C3I Systems
- Natural Environment Research Council (NERC)
- George Mason University

iv. Document Contributor Contact Points

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<td>EOX IT Service GmbH</td>
</tr>
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</table>

v. Revision history

<table>
<thead>
<tr>
<th>Date</th>
<th>Release</th>
<th>Author</th>
<th>Paragraph modified</th>
<th>Description</th>
</tr>
</thead>
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<td></td>
<td></td>
<td></td>
<td>v</td>
<td>Copyright © 2012 Open Geospatial Consortium.</td>
</tr>
</tbody>
</table>
vi. Changes to the OGC® Abstract Specification

The OGC® Abstract Specification does not require any changes to accommodate the technical contents of this (part of this) document.

vii. Future Work

In collaboration with the GML Standard Working Group it is foreseen to merge this Application Schema into forthcoming version 4.0 of GML.
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Introduction

Coverages represent digital geospatial information representing space/time-varying phenomena. OGC Abstract Topic 6 [OGC 07-011] – which is identical to ISO 19123 – defines an abstract model of coverages. This is concretized by the Geography Markup Language (GML) 3.2 [07-036], an XML grammar written in XML Schema for the description of application schemas as well as the transport and storage of geographic information.

However, the definition contained in GML 3.2 has turned out to not contain sufficient information to describe coverage instances in a flexible, interoperable, and harmonized manner. To remedy this, the document on hand defines a GML Application Schema for coverages by applying the following enhancements to the GML 3.2 Coverage data type:

- A mandatory element `rangeType` has been added to carry information about the range value data structure of a `Coverage`.

- The property `coverageFunction`, which in GML 3.2 is associated with every subtype of `Coverage`, is moved up into `AbstractCoverage` in the coverage type hierarchy of the standard on hand. This semantic-preserving modification does not impact instance documents.

- A metadata hook has been added which allows definition of application specific supplementary information to be transported with a coverage.

- The grid coverage types are subtypes of `AbstractCoverage` rather than being subtypes of `DiscreteCoverage` as in GML 3.2.

Further, additional coverage format encodings beyond GML are established.

This is a strict extension: no existing part of the GML 3.2 Coverage is changed in its syntax, nor in its semantics.
OGC® Implementation Schema for Coverages

1 Scope

This document specifies the GML coverage structure to be used by OGC standards.

2 Conformance

Standardisation target of this document are concrete coverage instance documents, as generated by some service and/or consumed by some client.

This document establishes four requirements classes:

- **gml-coverage**, of URI http://www.opengis.net/spec/GMLCOV/1.0/req/gml-coverage, with a single pertaining conformance class, **gml-coverage**, of URI http://www.opengis.net/spec/GMLCOV/1.0/conf/gml-coverage. This conformance class is abstract.
- **gml**, of URI http://www.opengis.net/spec/GMLCOV/1.0/req/gml, with a single pertaining conformance class, **gml**, of URI http://www.opengis.net/spec/GMLCOV/1.0/conf/gml.
- **multipart**, of URI http://www.opengis.net/spec/GMLCOV/1.0/req/multipart, with a single pertaining conformance class, **multipart**, of URI http://www.opengis.net/spec/GMLCOV/1.0/conf/multipart.
- **special-format**, of URI http://www.opengis.net/spec/GMLCOV/1.0/req/special-format, with a single pertaining conformance class, **special-format**, of URI http://www.opengis.net/spec/GMLCOV/1.0/conf/special-format.

Any implementation claiming conformance with this GMLCOV standard must conform to the abstract conformance class **gml-coverage** and, in addition, at least one of the concrete conformance classes **gml**, **multipart**, and **special-format**.

Requirements and conformance test URIs defined in this document are relative to http://www.opengis.net/spec/GMLCOV/1.0/.

Annex A lists the conformance tests which shall be exercised on any software artefact claiming to implement a conformance class of this Application Schema.

3 Normative references

This OGC GML Application Schema for Coverages specification consists of the present document and an XML Schema including Schematron constraints. The complete specification is identified by OGC URI http://www.opengis.net/spec/GMLCOV/1.0, the document has OGC URI http://www.opengis.net/doc/AppSchema/GMLCOV/1.0.

The complete specification is available for download from http://www.opengeospatial.org/standards/wcs additionally, the XML Schema is posted
online at http://schemas.opengis.net/gmlcov/1.0 as part of the OGC schema repository. In the event of a discrepancy between bundled and schema repository versions of the XML Schema files, the schema repository shall be considered authoritative.

The following normative documents contain provisions (conformance classes) that, through reference in this text, constitute provisions of this specification. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the normative document referred to applies.

Conformance classes used:
  □ Simple coverage interface
  □ Discrete coverage interface
  □ Thiessen polygon coverage interface
  □ Quadrilateral grid coverage interface
  □ Hexagonal grid coverage interface
  □ TIN coverage interface
  □ Segmented curve coverage interface
  □ Discrete coverage interchange
  □ Thiessen polygon coverage interchange
  □ Quadrilateral grid coverage interchange
  □ Hexagonal grid coverage interchange
  □ TIN coverage interchange
    □ Segmented curve coverage interchange

OGC 07-036, Geography Markup Language (GML) Encoding Standard, version 3.2.1
Conformance classes used:
  □ GML application schemas defining coverages
    □ GML documents

OGC 08-094, OGC® SWE Common Data Model Encoding Standard, version 2.0
Conformance classes used:
  □ Core
  □ UML models
    □ XML Schema

4 Terms and definitions

For the purposes of this document, the terms and definitions given in the above references apply. In addition, the following terms and definitions apply.
4.1 coverage

feature that acts as a function to return values from its range for any direct position within its spatiotemporal domain [OGC 07-011]

4.2 GML coverage

feature which is a subclass (specialization) of a Coverage as defined in the GML Application Schema for Coverages [OGC 09-146r1]

5 Conventions

5.1 Use of term “coverage”

The definition of “coverage” in Subclause 4.1 is the generic one provided by Abstract Topic 6 [OGC 07-011]. The term “GML coverage” is coined to denote the concrete data structure defined in the document on hand, relying on GML 3.2.1 [OGC 07-036] and SWE Common 2.0 [OGC 08-094].

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

5.2 UML notation

All the diagrams that appear in this specification are presented using the Unified Modeling Language (UML) static structure diagram, as described in Subclause 5.2 of OGC Web Service Common [OGC 06-121r9]. Further, the following conventions hold:

- UML elements having a package name of GML are those defined in the UML model of GML 3.2.1 [OGC 07-036].
- UML elements having a package name of “SWE Common” are those defined in the UML model of SWE Common 2.0 [OGC 08-094].
- UML elements not qualified with a package name are those defined in this Application Schema.

5.3 Namespace prefix conventions

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, however.
Table 1  Namespace mapping conventions

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Namespace URI</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>gml</td>
<td><a href="http://www.opengis.net/gml/3.2">http://www.opengis.net/gml/3.2</a></td>
<td>GML 3.2.1</td>
</tr>
<tr>
<td>swe</td>
<td><a href="http://www.opengis.net/swe/2.0">http://www.opengis.net/swe/2.0</a></td>
<td>SWE Common 2.0</td>
</tr>
<tr>
<td>gmlcov</td>
<td><a href="http://www.opengis.net/gmlcov/1.0">http://www.opengis.net/gmlcov/1.0</a></td>
<td>GML Application Schema for Coverages 1.0</td>
</tr>
</tbody>
</table>

6  Coverage Model

This Clause specifies the changes over the GML 3.2.1 coverage model and the components adopted from the SWE Common data model. As such, 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 standard.

NOTE Although this 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 conformance class gml.

6.1  Overview

In GML 3.2.1, 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 Application Schema extends GML 3.2.1 [OGC 07-036] 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 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 3.2.1 [OGC 07-036] specification:

- The property coverageFunction, which in GML 3.2.1 [OGC 07-036] is associated with every subtype of Coverage, is moved up into Coverage in the coverage type hierarchy of the standard on hand.

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

- The grid coverage types are subtypes of Coverage rather than being subtypes of DiscreteCoverage as in GML 3.2.1 [OGC 07-036].
NOTE  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 3.2.1 [OGC 07-036] are made in this document. In particular, no pre-existing component changes its semantics.

Figure 1: The Coverage structure

For the standard on hand, 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 standard.

**Table 2  The Coverage data structure**

<table>
<thead>
<tr>
<th>Name</th>
<th>Definition</th>
<th>Data type</th>
<th>Multiplicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>coverage-Function</td>
<td>GML 3.2.1 coverage function to describe how range values at cov-</td>
<td>GML::Coverage-</td>
<td>Zero or one</td>
</tr>
<tr>
<td></td>
<td>- GML 3.2.1 coverage function to describe how range values at cov-</td>
<td></td>
<td>(optional)</td>
</tr>
<tr>
<td></td>
<td>- GML 3.2.1 coverage function to describe how range values at cov-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>metadata</td>
<td>Application specific metadata</td>
<td>Any</td>
<td>Zero or more (optional)</td>
</tr>
<tr>
<td>----------</td>
<td>------------------------------</td>
<td>-----</td>
<td>------------------------</td>
</tr>
<tr>
<td>domainSet</td>
<td>GML 3.2.1 Definition of coverage domain</td>
<td>GML::DomainSet</td>
<td>One (mandatory)</td>
</tr>
<tr>
<td>rangeType</td>
<td>Structure definition of the coverage range values</td>
<td>SWE::DataRecord</td>
<td>One (mandatory)</td>
</tr>
<tr>
<td>rangeSet</td>
<td>GML 3.2.1 Coverage range values</td>
<td>GML::RangeSet</td>
<td>One (mandatory)</td>
</tr>
</tbody>
</table>

NOTE 1 The optional element `gml:Envelope` serves to establish a bounding box of the coverage on hand. For a purely spatial coverage, `gml:Envelope` is appropriate. In case the coverage also has a spatial axis, `gml:Envelope` can be substituted by a `gml:EnvelopeWithTimePeriod`; in case of a purely temporal coverage, spatial dimension in `gml:EnvelopeWithTimePeriod` will be zero.

NOTE 2 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 3 Following the GML pattern described in [OGC 07-036], on GML level `SWE::DataRecord` is linked to `rangeType` via an association `SWE::DataRecordPropertyType`.

6.2 CoverageFunction

The coverageFunction component is identical in its syntax and meaning to the `coverage-Function` element defined in GML [OGC 07-036] Subclause 19.3.11.

6.3 Metadata

The metaData component is a carrier for any kind of application dependent metadata. Hence, no requirements are imposed here.

6.4 RangeType

The rangeType component adds a structure description and technical metadata required for an appropriate (however, application independent) understanding of a coverage. For this structure description, the SWE Common `DataRecord` is used.

**Requirement 2** /req/gml-coverage/dataRecord:

The range type component of a coverage shall conform with the `DataRecord` of SWE Common [OGC 08-094].

**Dependency:** [OGC 08-094] Clause 7 (http://www.opengis.net/doc/SWE/2.0/clause/7), [OGC 08-094] Clause 8 (http://www.opengis.net/doc/SWE/2.0/clause/8).

NOTE Following GML patterns the `swe:DataRecord` is linked into `gmlwcs:AbstractCoverageType` via `swe:DataRecordPropertyType`. 

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Atomic data types available for range values are those given by the SWE Common data type AbstractSimpleComponent. As a range structure contains only structure definitions, but not the values themselves (these sit in the coverage range set component), the optional AbstractSimpleComponent component value is suppressed in coverages.

**Requirement 3 /req/gml-coverage/no-value-in-rangeType:**
For all SWE Common AbstractSimpleComponent subtypes in a range type structure, instance multiplicity of the value component shall be zero.

**NOTE** Following [OGC 08-094], omission of the value component implies that in a DataArray there is no encoding component either.

Range values can be structured as records or arrays. Both structuring principles can be nested (and mixed) to any depth for a concrete coverage range structure definition.

**Requirement 4 /req/gml-coverage/record-or-dataArray:**
Wherever the SWE Common XML schema allows an AbstractDataComponent in a coverage range structure the concrete instance shall be one of the AbstractDataComponent subtypes DataRecord and DataArray.

**NOTE** In particular, these AbstractDataComponent subtypes are not allowed in range structures: DataChoice, Vector, Matrix.

Within a DataRecord contained in a concrete range structure, each of its record components is locally uniquely identified by the record component’s field attribute, in accordance with the “soft-typing” property introduced by SWE Common.

**Example** The following XML fragment represents a valid range structure; it models the red, green, and blue channel of a Landsat scene. Pixels are defined as unsigned 8-bit quantities where 0 and 255 denote null values:

```xml
<rangeType>
  <swe:DataRecord>
    <swe:field name="red">
      <swe:Quantity definition="http://opengis.net/def/property/OGC/0/Radiance">
        <gml:description>Red Channel</gml:description>
        <gml:name>Red</gml:name>
        <swe:nilValues>
          <swe:nilValue reason="http://www.opengis.net/def/nil/OGC/0/BelowDetectionRange">0</swe:nilValue>
          <swe:nilValue reason="http://www.opengis.net/def/nil/OGC/0/AboveDetectionRange">255</swe:nilValue>
        </swe:nilValues>
      </swe:nilValues>
    </swe:field>
  </swe:DataRecord>
  <swe:uom code="W/cm2"/>
  <swe:constraint>
    <swe:AllowedValues>
      <swe:interval>0 255</swe:interval>
      <swe:significantFigures>3</swe:significantFigures>
    </swe:AllowedValues>
  </swe:constraint>
</rangeType>
```
6.5 RangeSet coherence

Both domainSet and rangeType describe the coverage values given in the rangeSet. Hence, consistency must be enforced between them. The pertaining requirements are listed in this Subclause.

**Requirement 5** /req/gml-coverage/one-range-value-per-position:
For each coordinate position contained in the domain set description of a coverage there shall exist exactly one range value in the coverage’s range set.

**NOTE** Both duplicates and values omitted are not allowed. For range values not known for some reason nil values can be used.

**Requirement 6** /req/gml-coverage/range-structure-consistency:
All range values contained in the range set of a coverage shall be consistent with the structure description provided in its range type.

6.6 Specific coverage types

This standard supports all coverage types which GML 3.2.1 [OGC 07-036] supports, which implement the discrete coverage types defined in ISO 19123 (listed in parenthesis). The supported types are substitutable from Coverage and include:

- MultiPointCoverage (ISO 19123: CV_DiscretePointCoverage)
- MultiCurveCoverage (ISO 19123: CV_DiscreteCurveCoverage)
- MultiSurfaceCoverage (ISO 19123: CV_DiscreteSurfaceCoverage)
MultiSolidCoverage (ISO 19123: CV_DiscreteSolidCoverage)

GridCoverage (ISO 19123: CV_DiscreteGridPointCoverage)

RectifiedGridCoverage (ISO 19123: CV_DiscreteGridPointCoverage)

ReferenceableGridCoverage (added to GML via Change Request [OGC 07-112r3])

The above coverage types may be used as is, or new coverage types may be constructed by using or deriving from one of the subtypes of Coverage or one of its subtypes.

**Requirement 7 /req/gml-coverage/coverage-derivation:**
The type of the root element of a coverage document instance **shall** be a concrete direct or indirect subtype of Coverage.

Figure 2 shows the UML diagram of the coverage hierarchy.

**NOTE** As in GML, continuous coverages are not currently supported. Consequently, ContinuousCoverage does not have any concrete subtype.

### 6.6.1 DiscreteCoverage

The domain set of a discrete coverage consists of either spatial or temporal geometry objects, finite in number. The range set is comprised of a finite number of attribute values each of which is associated to every direct position within any single spatiotemporal object in the domain. In other words, the range values are constant on each spatiotemporal object in the domain. This coverage function maps each element from the coverage domain to an element in its range.

This class serves as the head of a specialization hierarchy which contains MultiPointCoverage, MultiCurveCoverage, MultiSurfaceCoverage, and MultiSolidCoverage.

**NOTE** In GML 3.2.1 [OGC 07-036] grid coverages are contained in this class hierarchy as well based on a distinction between discrete and continuous coverages which is not considered state of the art anymore. This Application Schema changes the hierarchy in that coverages are put separately, allowing to model continuous grid coverages.
6.6.2 ContinuousCoverage

A continuous coverage as defined in ISO 19123 is a coverage that can return different values for the same feature attribute at different direct positions within a single spatiotemporal object in its spatiotemporal domain. The base type for continuous coverages is ContinuousCoverage.

Abstract class ContinuousCoverage serves as the head of a substitution group which may contain any continuous coverage whose type is derived from ContinuousCoverage. It parallels GML::ContinuousCoverage, except that the coverageFunction element has been moved "up" into Coverage.

NOTE This GML handling of continuous coverages is under reconsideration, therefore use of ContinuousCoverage is not encouraged. The various grid coverage types (see Subclause 6.6.7ff) allow already modelling certain types of continuous coverages.

6.6.3 MultiPointCoverage

In a MultiPointCoverage the domain set is a GM_MultiPoint, that is a collection of arbitrarily distributed geometric points.

Requirement 8 /req/gml-coverage/multiPointCoverage:
A coverage of type MultiPointCoverage shall have a content model identical with DiscreteCoverage, except that the domainSet shall have GML::MultiPoint values.
In the GML representation of a MultiPointCoverage the mapping from the domain to the range is straightforward:

- For gml:DataBlock encodings the points of the gmlcov:MultiPoint are mapped in document order to the tuples of the data block.
- For gml:CompositeValue encodings the points of the gmlcov:MultiPoint are mapped to the members of the composite value in document order.
- For gml:File encodings the points of the gmlcov:MultiPoint are mapped to the records of the file in sequential order.

6.6.4 MultiCurveCoverage

In a MultiCurveCoverage the domain is partitioned into a collection of curves comprising a GM MultiCurve. The coverage function then maps each curve in the collection to a value in the range set.

**Requirement 9 /req/gml-coverage/multiCurveCoverage:**
A coverage of type MultiCurveCoverage **shall** have a content model identical with DiscreteCoverage, except that the domainSet **shall** have “GML 3.2”::MultiCurve values.

In the GML representation of a MultiCurveCoverage the mapping from the domain to the range is straightforward:

- For gml:DataBlock encodings the curves of the gmlcov:MultiCurve are mapped in document order to the tuples of the data block.
- For gml:CompositeValue encodings the curves of the gmlcov:MultiCurve are mapped to the members of the composite value in document order.
- For gml:File encodings the curves of the gmlcov:MultiCurve are mapped to the records of the file in sequential order.

6.6.5 MultiSurfaceCoverage

In a MultiSurfaceCoverage the domain is partitioned into a collection of surfaces comprising a GM MultiSurface. The coverage function maps each surface in the collection to a value in the range set.

**Requirement 10 /req/gml-coverage/multiSurfaceCoverage:**
A coverage of type MultiSurfaceCoverage **shall** have a content model identical with DiscreteCoverage, except that the domainSet **shall** have GML::MultiSurface values.

In the GML representation of a MultiSurfaceCoverage the mapping from the domain to the range is straightforward:
6.6.6 MultiSolidCoverage

In a MultiSolidCoverage the domain is partitioned into a collection of solids comprising a GM_MultiSolid. The coverage function then maps each solid in the collection to a value in the range set.

**Requirement 11 /req/gml-coverage/multiSolidCoverage:**
A coverage of type MultiSolidCoverage shall have a content model identical with DiscreteCoverage, except that the domainSet shall have GML::MultiSolid values.

In the GML representation of a MultiSolidCoverage the mapping from the domain to the range is straightforward:

- For gml:DataBlock encodings the solids of the gmlcov:MultiSolid are mapped in document order to the tuples of the data block.
- For gml:CompositeValue encodings the solids of the gmlcov:MultiSolid are mapped to the members of the composite value in document order.
- For gml:File encodings the solids of the gmlcov:MultiSolid are mapped to the records of the file in sequential order.

6.6.7 GridCoverage

A GridCoverage is a discrete point coverage in which the domain is a geometric grid of points encoded using gml:Grid (not its subtypes gml:RectifiedGrid or a subtype of AbstractReferenceableGrid). Note that this is similar to the MultiPointCoverage except that a gml:Grid shall be used to describe the domain.

**Requirement 12 /req/gml-coverage/gridCoverage:**
A coverage of type GridCoverage shall have a domain that is a GML::Grid.

**NOTE** Such geometric positioning is introduced in the RectifiedGridCoverage.

In order to address ambiguities in the gml:Grid definition, this GML Application Schema for Coverages imposes additional constraints on the use of a gml:Grid within a gmlcov:GridCoverage. (Specifically, there is no provision in the definition of gml:Grid definition to express the relationship between the grid positions and this geometry's coordinate reference system, which will always exist in some contexts, such as a Web Coverage Service. This coordinate reference system will be explicitly referenced in the srsName attribute of
the `gml: SRSReferenceGroup` of `gml:Grid`, or be inherited from an enclosing container element, such as the `gml:Envelope` of this `gmlcov:GridCoverage`.) Since provision for expressing a relationship does not exist, whenever used in `gmlcov:GridCoverage`, the relationship shall be simple. In this simple relationship, the dimension attribute of the `gml:Grid` shall be identical to the dimension of the geometry's coordinate system, the axes of the `gml:Grid` shall be identical to the axes of the geometry's coordinate system (which requires that the `axisLabels` be identical to those in the coordinate system definition), and the limits shall be treated as being expressed as coordinates in the geometry's coordinate reference system.

Clearly these additional constraints are quite limiting, in that gridded datasets whose Reference points happen to exist exactly at integral coordinates of a spatial coordinate system at a spacing of exactly one in all coordinate dimensions are exceedingly rare, unless that coordinate system is part of a `gml:ImageCRS`. Nevertheless, the `gmlcov:GridCoverage` is available for such purposes.

It is recommended that the more sensible provisions of the `gmlcov:RectifiedGridCoverage` or `gmlcov:ReferenceableGridCoverage` be utilized for all gridded datasets, since their domains can accommodate the simple provisions of the `gmlcov:GridCoverage` as well as more complex referencing situations.

Since this `GridCoverage` uses `Coverage`, it can be used for both discrete and continuous coverages.

### 6.6.8 RectifiedGridCoverage

A `RectifiedGridCoverage` is a discrete point coverage based on a rectified grid. It is similar to the grid coverage except that the points of the grid are geometrically referenced.

**Requirement 13** `/req/gml-coverage/rectifiedGridCoverage`:

A coverage of type `RectifiedGridCoverage` **shall** have a domain that is a `GML::RectifiedGrid` geometry.

Since this `RectifiedGridCoverage` uses `Coverage`, it can be used for both discrete and continuous coverages.

### 6.6.9 ReferenceableGridCoverage

A `ReferenceableGridCoverage` is an implementation of ISO 19123 `DiscreteGridPointCoverage` for a `ReferenceableGrid` domain.

**Requirement 14** `/req/gml-coverage/referenceableGridCoverage`:

A coverage of type `ReferenceableGridCoverage` **shall** have a domain geometry that is a subtype of `AbstractReferenceableGrid`.

Since this `ReferenceableGridCoverage` uses the `gmlcov:AbstractCoverage-Type`, it can be used for both discrete and continuous coverages.

**NOTE** The equivalent of this element has been added to GML 3.2.1 by approved Change Request 07-112r3 and, therefore, has been added to this standard as well.
6.7 Complete coverage example

Example  The following is a complete RectifiedGridCoverage instance:

```xml
<?xml version="1.0" encoding="UTF-8" ?>
<gmlcov:RectifiedGridCoverage
 xmlns="http://www.w3.org/2001/XMLSchema"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
 xmlns:xlink="http://www.w3.org/1999/xlink"
 xmlns:gmlcov="http://www.opengis.net/gmlcov/1.0"
 xmlns:gml="http://www.opengis.net/gml/3.2"
 xsi:schemaLocation="
 "http://www.opengis.net/gmlcov/1.0 http://schemas.opengis.net/gmlcov/1.0/gmlcovAll.xsd"
 gml:id="C001">
 <gml:boundedBy>
  <gml:Envelope srsName="http://www.opengis.net/def/crs/EPSG/0/4326" axisLabels="Lat Long"
    uomLabels="deg deg" srsDimension="2">
   <gml:lowerCorner>1 1</gml:lowerCorner>
   <gml:upperCorner>3 3</gml:upperCorner>
  </gml:Envelope>
 </gml:boundedBy>
 <gml:domainSet>
  <gml:RectifiedGrid gml:id="RG001_C001"
   srsName="http://www.opengis.net/def/crs/EPSG/0/4326" axisLabels="Lat Long"
   uomLabels="deg deg" dimension="2">
   <gml:limits>
    <gml:GridEnvelope>
     <gml:low>0 0</gml:low>
     <gml:high>9999 9999</gml:high>
    </gml:GridEnvelope>
   </gml:limits>
   <gml:axisLabels>Lat Long</gml:axisLabels>
   <gml:origin>
    <gml:Point gml:id="P001_C001" srsName="http://www.opengis.net/def/crs/EPSG/0/4326">
     <gml:pos>99.99.9</gml:pos>
    </gml:Point>
   </gml:origin>
   <gml:offsetVector>1 0</gml:offsetVector>
   <gml:offsetVector>0 1</gml:offsetVector>
  </gml:RectifiedGrid>
 </gml:domainSet>
 <rangeType>
  <swe:DataRecord>
   <swe:field name="white">
    <swe:Quantity definition="http://opengis.net/def/property/OGC/0/Radiance">
     <gml:description>Panchromatic</gml:description>
     <gml:name>White</gml:name>
     <swe:nilValues>
      <swe:nilValue reason="http://www.opengis.net/def/nil/OGC/0/BelowDetectionRange">0</swe:nilValue>
      <swe:nilValue reason="http://www.opengis.net/def/nil/OGC/0/AboveDetectionRange">255</swe:nilValue>
     </swe:nilValues>
     <swe:uom code="W/cm2"/>
     <swe:constraint/>
   </swe:Quantity>
  </swe:field>
 </swe:DataRecord>
</gmlcov:RectifiedGridCoverage>
```
7 GML representation requirements class

Requirements class gml-coverage establishes how coverages are represented in the GML encoding format. Its identifying URL is given by http://www.opengis.net/spec/GMLCOV/1.0/req/gml-coverage.

NOTE Clause 6 establishes a conceptual model of a coverage, independent form its encoding. While UML and GML are used for establishing this, Clause 6 does not anticipate a GML encoding. A GML representation is established by this Clause 7 instead.

Requirement 15 /req/gml/coverage:
In a coverage encoded in GML, the coverage structure represented shall conform with conformance class gml-coverage.

Requirement 16 /req/gml/content-type:
In a coverage encoded in GML, the IETF RFC 2387 Content-Type parameter of this coverage document shall have a value of “application/gml+xml”.

Requirement 17 /req/gml/special-format:
A coverage document shall be conformant with OCG GML [07-036] conformance class A.1.9.

8  Multipart representation requirements class

8.1  Coverages as multipart messages

A coverage can be represented as a multipart/related message document [4] consisting of a
GML-encoded part containing the coverage data minus its range set followed by a second
part containing an encoding of the coverage range set in some standard encoding format. This
establishes requirements class multipart. Its identifying URL is given by
http://www.opengis.net/spec/GMLCOV/1.0/req/multipart.

NOTE This encoding type describes a self-contained coverage document. The gml-coverage conformance class, as per GML specification, additionally allows a remote URL to be used for referencing coverage constituents. The difference between both encodings is that coverages conforming to gml-coverage are a single GML document containing references to any other place, resolvable by the reader in any context, whereas a multipart coverage contains all constituents as sub-documents in the file itself.

Requirement 18 /req/multipart/coverage:
In a coverage encoded in a multipart message, the coverage structure represented shall
conform with conformance class gml-coverage.
Dependency: http://www.opengis.net/spec/GMLCOV/1.0/req/gml-coverage.

Requirement 19 /req/multipart/multipart-mime:
A coverage encoded in a multipart message shall consist of a multipart MIME document as
specified by IETF RFC 2387 [4].

Requirement 20 /req/multipart/content-type:
In a coverage encoded in a multipart message, the IETF RFC 2387 Content-Type parameter of this coverage document shall have a value of “Multipart/Related”.

Requirement 21 /req/multipart/number-of-components:
A coverage encoded in a multipart message shall consist of two parts.

Requirement 22 /req/multipart/start:
In a coverage encoded in a multipart message, the IETF RFC 2387 [4] Type parameter of this coverage document shall have a value of “application/gml+xml”.

8.2  First part: GML coverage

Requirement 23 /req/multipart/gml-coverage:
In a coverage encoded in a multipart message, the first part shall consist of a GML document of type gmlcov:AbstractCoverageType.

Requirement 24 /req/multipart/use-file:
In a coverage encoded in a multipart message, in the first part the /gmlcov:Abstract-Coverage/gml:rangeSet element shall contain a gml:File element.

Requirement 25 /req/multipart/rangeParameters-role:
In a coverage encoded in a multipart message, in the first part the /gmlcov:Abstract-Coverage/gml:rangeSet/gml:File/gml:rangeParameters/@xlink:role attribute shall contain the URL identifier of a conformance class of an OGC data encoding standard.
Requirement 26 /req/multipart/rangeParameters-arcrole: In a coverage encoded in a multipart message, in the first part the /gmlcov:Abstract-Coverage/gml:rangeSet/gml:File/gml:rangeParameters/@xlink:arcrole attribute shall contain the value “fileReference”.


Example The following MIME message represents a valid multipart coverage structure (assuming all “...” substituted by proper XML and with a proper TIFF file instead of the second-to-last line):

```
Content-Type: Multipart/Related; boundary=wcs;
    start="GML-Part"
    type="text/xml"
--wcs
Content-type: text/xml
Content-ID: GML-Part
<?xml version="1.0" ...>
<gmlcov:RectifiedGridCoverage ...
<gml:domainSet>...
<gml:rangeSet>
    <gml:File>
        <gml:rangeParameters xlink:href="grey.tif"
            xlink:role="http://www.opengis.net/spec/WCS_coverage-encoding_geotiff/1.0/
            xlink:arcrole="fileReference"/>
        <gml:fileReference>grey.tif</gml:fileReference>
        <gml:fileStructure/>
        <gml:mimeType>image/tiff</gml:mimeType>
    </gml:File>
</gml:rangeSet>
    <gmlcov:rangeType>...
</gmlcov:RectifiedGridCoverage>
--wcs
Content-Type: image/tiff
Content-Description: coverage data
Content-Transfer-Encoding: binary
Content-ID: grey.tif
Content-Disposition: INLINE ...
    ...binary TIFF data...
--wcs--
```

Requirement 29 /req/multipart/mimeType: In a coverage encoded in a multipart message, in the first part the /gmlcov:Abstract-Coverage/gml:rangeSet/gml:File/gml:fileReference element shall contain a local "cid" (Content-ID) URL as specified by IETF RFC 2392 [5] to the second part of the multipart message.
Coverage/gml:rangeSet/gml:File/gml:mimeType **shall** contain that MIME type string which is defined in the standard referenced in the /gmlcov:AbstractCoverage/gml:rangeSet/gml:File/gml:rangeParameters/@xlink:role attribute.

**NOTE** The contents of the gml:File/gml:compression element is left undefined as this element is currently not used by this standard.

### 8.3 Second part: encoded coverage range set

**Requirement 30 /req/multipart/target-content-disposition:**
In a coverage encoded in a multipart message, the IETF RFC 2387 [4] Content-Disposition parameter of this coverage document **shall** be present and have a value of “inline” (not case sensitive).

**NOTE** This follows IETF RFC 2183 [6].

**Requirement 31 /req/multipart/target-mimetype:**
In a coverage encoded in a multipart message the MIME type identifier of the second part **shall** be identical to the value of /gmlcov:AbstractCoverage/gml:rangeSet/gml:File/gml:mimeType in the first part of the multipart coverage.

**Requirement 32 /req/multipart/target-encoding:**
In a coverage encoded in a multipart message the second part **shall** conform to the encoding specified in the /gmlcov:AbstractCoverage/gml:rangeSet/gml:rangeParameters/@xlink:role value in the first part of the multipart coverage.

**Requirement 33 /req/multipart/consistent:**
In a coverage encoded in a multipart message the coverage components encoded in the second message part, when decoded from the format on hand into GML, **shall** be consistent with the coverage components of the first part of the multipart coverage.

**Dependency:** [http://www.opengis.net/spec/GMLCOV/1.0/req/gml-coverage](http://www.opengis.net/spec/GMLCOV/1.0/req/gml-coverage)

**Example** The following sketches a valid multipart coverage (contents of second part omitted):

```
Content-Type: Multipart/Related; boundary=wcs; start="GML-Part"
type="application/gml+xml"

--wcs
Content-type: application/gml+xml
Content-ID: GML-Part

<?xml version="1.0" encoding="UTF-8"?>
<gmlcov:RectifiedGridCoverage xmlns:wcs="http://www.opengis.net/wcs/2.0"
xmlns:ows="http://www.opengis.net/ows/2.0"
xmlns:ogc="http://www.opengis.net/ogc"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:gml="http://www.opengis.net/gml/3.2"
xmlns:gmlcov="http://www.opengis.net/gmlcov/1.0"
xmlns:swe="http://www.opengis.net/swe/2.0"
xsi:schemaLocation="http://www.opengis.net/wcs/2.0 http://schemas.opengis.net/wcs/2.0/wcsAll.xsd" gml:id="grey">
```

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9 Special format requirements class

Requirements class special-format establishes how coverages are represented in encoding formats other than GML. Its identifying URL is given by http://www.opengis.net/spec/GMLCOV/1.0/req/special-format.

NOTE Such formats may be able to encode only parts of a coverage, and they may be able to encode only specific categories of coverages.

**Requirement 34 /req/special/coverage:**
In a coverage encoded in a multipart message, the coverage structure represented shall conform with conformance class gml-coverage.
**Dependency:** [http://www.opengis.net/spec/GMLCOV/1.0/req/gml-coverage](http://www.opengis.net/spec/GMLCOV/1.0/req/gml-coverage).

**Requirement 35 /req/special/special-format:**
A coverage document not encoded in GML shall be conformant with some OGC data format encoding standard.
**Dependency:** OGC format encoding standards.

Example  A 2-D rectified grid coverage can be represented by a GeoTIFF file.
Bibliography


Annex A
(normative)

Abstract test suite

This Annex specifies an Abstract Test Suite which shall be passed in completeness by any implementation claiming conformance with this Application Schema.

Tests identifiers below are relative to http://www.opengis.net/spec/GMLCOV/1.0/.

A.1 Conformance Test Class: gml-coverage

The OGC URI identifier of this conformance class is: http://www.opengis.net/spec/GMLCOV/1.0/conf/gml-coverage.

A.1.1 Document validates

Test id: /conf/gml-coverage/structural-adherence

Test Purpose: Requirement /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 standard.

Test method: If the coverage instance document is encoded in XML, load the document into an XML validator. Test passes if the document is a valid concrete subtype of gmlcov:AbstractCoverageType.

A.1.2 DataRecord range structure

Test id: /conf/gml-coverage/dataRecord

Test Purpose: Requirement /req/gml-coverage/dataRecord:
The range type component of a coverage shall conform with the Data-Record of SWE Common [OGC 08-094].

Test method: Validate the coverage instance under test against SWE Common by evaluating its conformance test suite.

Test passes if all SWE Common tests applicable pass.
A.1.3 No value component in rangeType

Test id: /conf/gml-coverage/no-value-in-rangeType

Test Purpose: Requirement /req/gml-coverage/no-value-in-rangeType:
For all SWE Common AbstractSimpleComponent subtypes in a range type structure, instance multiplicity of the value component shall be zero.

Test method: In the instance document under test, inspect all SWE Common AbstractSimpleComponent subtypes in a range type structure and check that no value component is present.

One way of doing so is to evaluate this Schematron rule:

```xml
  <sch:assert test="count(//swe:value)=0"/>
</sch:rule>
```

Test passes if constraint holds.

A.1.4 Admissible DataRecord subtypes

Test id: /conf/gml-coverage/record-or-dataArray

Test Purpose: Requirement /req/gml-coverage/record-or-dataArray:
Wherever the SWE Common XML schema allows an AbstractDataComponent in a coverage range structure the concrete instance shall be one of the AbstractDataComponent subtypes DataRecord and DataArray.

Test method: Inspect the instance document under test and check the above constraint. One way of doing so is to evaluate this Schematron rule:

```xml
<sch:rule>
  <sch:assert test="descendant-or-self::*:*

  [name()]='swe:DataRecord' or
  name()='swe:DataArray'"/>
</sch:rule>
```

Test passes if constraint holds.
A.1.5 Exactly one range value

Test id: /conf/gml-coverage/one-range-value-per-position

Test Purpose: Requirement /req/gml-coverage/one-range-value-per-position:
For each coordinate position contained in the domain set description of a coverage there shall exist exactly one range value in the coverage’s range set.

Test method: Inspect the instance document under test and check, for each possible location as defined in the coverage’s domain set, that there is exactly one corresponding value in the range set.

Test passes if all constraints evaluate to true.

A.1.6 Range values adhere to range structure definition

Test id: /conf/gml-coverage/range-structure-consistency

Test Purpose: Requirement /req/gml-coverage/range-structure-consistency:
All range values contained in the range set of a coverage shall be consistent with the structure description provided in its range type.

Test method: Inspect the instance document under test and check, for each range value tuple:

- Number of tuple components adheres to range structure definition.
- Data type of each atomic value conforms to the corresponding data type specification in the range structure definition.

Test passes if all constraints evaluate to true.

A.1.7 Coverage type correctly derived

Test id: /conf/gml-coverage/coverage-derivation

Test Purpose: Requirement /req/gml-coverage/coverage-derivation:
The type of the root element of a coverage document instance shall be a concrete direct or indirect subtype of Coverage.

Test method: Check whether the XML type of the root element of the instance document
under test

- Is not abstract
- Is a direct or indirect subtype of gmlcov:AbstractCoverage.

Test passes if constraints evaluate to true.

### A.1.8 Correct structure of multi-point coverage

**Test id:** /conf/gml-coverage/multiPointCoverage

**Test Purpose:** Requirement /req/gml-coverage/multiPointCoverage:
A coverage of type MultiPointCoverage shall have a content model identical with DiscreteCoverage, except that the domainSet shall have GML::MultiPoint.

**Test method:** Check the XML type of the root element of the instance document under test.

- If type is MultiPointCoverage: check whether the document’s domainSet element contains values of type gml:MultiPoint.
- otherwise: pass test.

Test passes if constraints evaluate to true.

### A.1.9 Correct structure of multi-curve coverage

**Test id:** /conf/gml-coverage/multiCurveCoverage

**Test Purpose:** Requirement /req/gml-coverage/multiCurveCoverage:
A coverage of type MultiCurveCoverage shall have a content model identical with DiscreteCoverage, except that the domainSet shall have “GML 3.2”:::MultiCurve values.

**Test method:** Check the XML type of the root element of the instance document under test.

- If type is MultiCurveCoverage: check whether the document’s domainSet element contains values of type gml:MultiCurve.
- otherwise: pass test.

Test passes if constraints evaluate to true.
A.1.10 Correct structure of multi-surface coverage

Test id: /conf/gml-coverage/multiSurfaceCoverage

Test Purpose: Requirement /req/gml-coverage/multiSurfaceCoverage:
A coverage of type MultiSurfaceCoverage shall have a content model identical with DiscreteCoverage, except that the domainSet shall have GML::MultiSurface values.

Test method: Check the XML type of the root element of the instance document under test.

☐ If type is MultiSurfaceCoverage: check whether the document’s domainSet element contains values of type gml:MultiSurface.

☐ otherwise: pass test.

Test passes if all constraints evaluate to true.

A.1.11 Correct structure of multi-solid coverage

Test id: /conf/gml-coverage/multiSolidCoverage

Test Purpose: Requirement /req/gml-coverage/multiSolidCoverage:
A coverage of type MultiSolidCoverage shall have a content model identical with DiscreteCoverage, except that the domainSet shall have GML::MultiSolid values.

Test method: Check the XML type of the root element of the instance document under test.

☐ If type is MultiSolidCoverage: check whether the document’s domainSet element contains values of type gml:MultiSolid.

☐ otherwise: pass test.

Test passes if all constraints evaluate to true.

A.1.12 Correct structure of grid coverage

Test id: /conf/gml-coverage/gridCoverage

Test Purpose: Requirement A GridCoverage is a discrete point coverage in which the domain is a geometric grid of points encoded using gml:Grid (not its sub-
types gml:RectifiedGrid or a subtype of
AbstractReferenceableGrid). Note that this is similar to the Multi-
PointCoverage except that a gml:Grid shall be used to describe the
domain.

/req/gml-coverage/gridCoverage:
A coverage of type GridCoverage shall have a domain that is a
GML::Grid.

Test method: Check the XML type of the root element of the instance document under
test.

  □ If type is GridCoverage: check whether the document’s
domainSet element is a gml:Grid.

  □ otherwise: pass test.

Test passes all if constraints evaluate to true.

A.1.13 Correct structure of rectified grid coverage

Test id: /conf/gml-coverage/rectifiedGridCoverage

Test Purpose: Requirement /req/gml-coverage/rectifiedGridCoverage:
A coverage of type RectifiedGridCoverage shall have a domain that
is a GML::RectifiedGrid geometry.

Test method: Check the XML type of the root element of the instance document under
test.

  □ If type is RectifiedGridCoverage: check whether the docu-
ment’s domainSet element is a gml:RectifiedGrid.

  □ otherwise: pass test.

Test passes if all constraints evaluate to true.

A.1.14 Correct structure of referenceable grid coverage

Test id: /conf/gml-coverage/referenceableGridCoverage

Test Purpose: Requirement /req/gml-coverage/referenceableGridCoverage:
A coverage of type ReferenceableGridCoverage shall have a domain
gometry that is a subtype of AbstractReferenceableGrid.
Test method: Check the XML type of the root element of the instance document under test.

- If type is ReferenceableGridCoverage: check whether the document’s domainSet element is in the substitution group of AbstractReferenceableGrid.

- otherwise: pass test.

Test passes if all constraints evaluate to true.

A.2 Conformance Test Class: gml

The OGC URI identifier of this conformance class is:
http://www.opengis.net/spec/GMLCOV/1.0/conf/gml.

A.1.15 GML coverage

Test id: /conf/gml/coverage

Test Purpose: Requirement /req/gml/coverage:
In a coverage encoded in GML, the coverage structure represented shall conform with conformance class gml-coverage.

Dependency: http://www.opengis.net/spec/GMLCOV/1.0/req/gml-coverage.

Test method: If the coverage instance document under test is encoded in XML, check that the coverage is a valid concrete subtype of gmlcov:AbstractCoverageType.

Test passes if constraint holds.

A.1.16 GML content type

Test id: /conf/gml/content-type

Test Purpose: Requirement /req/gml/content-type:
In a coverage encoded in GML, the IETF RFC 2387 Content-Type parameter of this coverage document shall have a value of “application/gml+xml”.

Test method: If the coverage instance document under test is encoded in GML, check that the IETF RFC 2387 Content-Type parameter of this coverage document has a value of “application/gml+xml”.

Test passes if constraint holds.
A.1.17 GML special format

Test id: /conf/gml/special-format

Test Purpose: Requirement /req/gml/special-format:
A coverage document shall be conformant with OCG GML [07-036] conformance class A.1.9.


Test method: Validate the coverage document under test against OCG GML [07-036] conformance class A.1.9 test suite.

Test passes if all test applicable pass.

A.3 Conformance Test Class: multipart

The OGC URI identifier of this conformance class is:
http://www.opengis.net/spec/GMLCOV/1.0/conf/multipart.

A.1.18 Multipart coverage

Test id: /conf/multipart/coverage

Test Purpose: Requirement /req/multipart/coverage:
In a coverage encoded in a multipart message, the coverage structure represented shall conform with conformance class gml-coverage.

Dependency: http://www.opengis.net/spec/GMLCOV/1.0/req/gml-coverage.

Test method: If the coverage under test is encoded in a multipart message, check that the instance document is a valid concrete subtype of gmlcov:AbstractCoverageType.

Test passes if constraint evaluates to true.

A.1.19 Multipart mime

Test id: /conf/multipart/multipart-mime

Test Purpose: Requirement /req/multipart/multipart-mime:
A coverage encoded in a multipart message shall consist of a multipart MIME document as specified by IETF RFC 2387 [4].

Test method: If the coverage is encoded in a multipart message, check that the instance document consists of a multipart MIME documents.
Test passes if constraint evaluates to true.

A.1.20 Multipart content type

Test id: /conf/multipart/content-type

Test Purpose: Requirement /req/multipart/content-type:
In a coverage encoded in a multipart message, the IETF RFC 2387 Content-Type parameter of this coverage document shall have a value of “Multipart/Related”.

Test method:
If the coverage under test is encoded in a multipart message, check that its IETF RFC 2387 Content-Type parameter has a value of “Multipart/Related”.

Test passes if constraint evaluates to true.

A.1.21 Correct component number

Test id: /conf/multipart/number-of-components

Test Purpose: Requirement /req/multipart/number-of-components:
A coverage encoded in a multipart message shall consist of two parts.

Test method:
If the coverage under test is encoded in a multipart message, check that the given coverage consists of two parts.

Test passes if constraint evaluates to true.

A.1.22 Correct multipart start

Test id: /conf/multipart/multipart/start

Test Purpose: Requirement /req/multipart/start:
In a coverage encoded in a multipart message, the IETF RFC 2387 Type parameter of this coverage document shall have a value of “application/gml+xml”.

Test method:
If the coverage under test is encoded in a multipart message, check that its IETF RFC 2387 Type parameter has a value of “application/gml+xml”.

Test passes if constraint evaluates to true.
A.1.23 First part of multipart coverage

Test id: /conf/multipart/gml-coverage

Test Purpose: Requirement /req/multipart/gml-coverage:
In a coverage encoded in a multipart message, the first part shall consist of a GML document of type gmlcov:AbstractCoverageType.

Test method: If the coverage under test is encoded in a multipart message, check that its first part consists of a GML document of type gmlcov:AbstractCoverageType.

Test passes if constraint evaluates to true.

A.1.24 RangeSet in file

Test id: /conf/multipart/use-file

Test Purpose: Requirement /req/multipart/use-file:
In a coverage encoded in a multipart message, in the first part the gmlcov:AbstractCoverage/gml:rangeSet element shall contain a gml:File element.

Test method: If the coverage under test is encoded in a multipart message, check that the given coverage is a multipart coverage and the gmlcov:AbstractCoverage/gml:rangeSet element of its first part contains a gml:File element.

Test passes if all constraints evaluates to true.

A.1.25 Correct rangeParameter role

Test id: /conf/multipart/rangeParameters-role

Test Purpose: Requirement /req/multipart/rangeParameters-role:
In a coverage encoded in a multipart message, in the first part the gmlcov:AbstractCoverage/gml:rangeSet/gml:File/gml:rangeParameters/@xlink:role attribute shall contain the URL identifier of a conformance class of an OGC data encoding standard.

Test method: If the coverage under test is encoded in a multipart message, check that its gmlcov:AbstractCoverage/gml:rangeSet/gml:File/gml:rangeParameters/@xlink:role attribute of the first part contains the URL identifier of a conformance class of an OGC data encoding standard.
Test passes if constraint evaluates to true.

A.1.26 Correct rangeParameters arcrole

Test id: /conf/multipart/rangeParameters-arcrole

Test Purpose: Requirement /req/multipart/rangeParameters-arcrole:
In a coverage encoded in a multipart message, in the first part the
/gmlcov:AbstractCoverage/gml:rangeSet/gml:File/gml:rangeParameters/@xlink:arcrole attribute shall contain the value “fileReference”.

Test method: If the coverage under test is encoded in a multipart message, check that its

Test passes if constraint evaluates to true.

A.1.27 Correct rangeParameters href

Test id: /conf/multipart/rangeParameters-href

Test Purpose: Requirement /req/multipart/rangeParameters-href:
In a coverage encoded in a multipart message, in the first part the

Test method: If the coverage under test is encoded in a multipart message, check that its

Test passes if constraint evaluates to true.

A.1.28 Correct fileReference

Test id: /conf/multipart/fileReference

Test Purpose: Requirement /req/multipart/fileReference:
In a coverage encoded in a multipart message, in the first part the
/gmlcov:AbstractCoverage/gml:rangeSet/gml:File/gml:fileReference element shall
contain a local "cid" (Content-ID) URL as specified by IETF RFC 2392 [5] to the second part of the multipart message.

**Test method:** If the coverage under test is encoded in a multipart message, check that its /gmlcov:AbstractCoverage/gml:rangeSet/gml:File/gml:fileReference element of the first part contains a local "cid" (Content-ID) URL as specified by IETF RFC 2392 to access the second part of the multipart message.

Test passes if constraint evaluates to true.

### A.1.29 Consistent mimeType

**Test id:** /conf/multipart/mimeType

**Test Purpose:** Requirement /req/multipart/mimeType:
In a coverage encoded in a multipart message, in the first part the /gmlcov:AbstractCoverage/gml:rangeSet/gml:File/gml:mimeType shall contain that MIME type string which is defined in the standard referenced in the /gmlcov:AbstractCoverage/gml:rangeSet/gml:File/gml:rangeParameters/@xlink:role attribute.

**Test method:** If the coverage under test is encoded in a multipart message, check that its /gmlcov:AbstractCoverage/gml:rangeSet/gml:File/gml:mimeType of the first part contains the MIME type string which is defined in the standard referenced in the /gmlcov:AbstractCoverage/gml:rangeSet/gml:File/gml:rangeParameters/@xlink:role attribute.

Test passes if constraint evaluates to true.

### A.1.30 Correct Content-Disposition

**Test id:** /conf/multipart/target-content-disposition

**Test Purpose:** Requirement /req/multipart/target-content-disposition:
In a coverage encoded in a multipart message, the IETF RFC 2387 [4] Content-Disposition parameter of this coverage document shall be present and have a value of “inline” (not case sensitive).

**Test method:** If the coverage under test is encoded in a multipart message, check that its IETF RFC 2387 Content-Disposition parameter of the first part presents and has a value of “inline” (not case sensitive).

Test passes if constraint evaluates to true.
A.1.31 Consistent target mimeType

Test id: /conf/multipart/target-mimeType

Test Purpose: **Requirement /req/multipart/target-mimetype:**
In a coverage encoded in a multipart message the MIME type identifier of the second part **shall** be identical to the value of /gmlcov:AbstractCoverage/gml:rangeSet/gml:File/gml:mimeType in the first part of the multipart coverage.

Test method: If the coverage is encoded in a multipart message, check that the Content-Type of the second part is identical to the value of /gmlcov:AbstractCoverage/gml:rangeSet/gml:File/gml:mimeType.

Test passes if constraint evaluates to true.

A.1.32 Consistent target encoding

Test id: /conf/multipart/target-encoding

Test Purpose: **Requirement /req/multipart/target-encoding:**
In a coverage encoded in a multipart message the second part **shall** conform to the encoding specified in the /gmlcov:AbstractCoverage/gml:rangeParameters/@xlink:role value in the first part of the multipart coverage.

Test method: If the coverage under test is encoded in a multipart message, check that the Content-Transfer-Encoding of the second part conforms to the encoding specified in the /gmlcov:AbstractCoverage/gml:rangeParameters/@xlink:role value in the first part of the multipart coverage.

Test passes if constraint evaluates to true.

A.1.33 Consistent multipart coverage

Test id: /conf/multipart/consistent

Test Purpose: **Requirement /req/multipart/consistent:**
In a coverage encoded in a multipart message the coverage components encoded in the second message part, when decoded from the format on hand into GML, **shall** be consistent with the coverage components of the first part of the multipart coverage.

Test method: If the coverage under test is encoded in a multipart message, decode the second message part of the multipart coverage into GML. Check that the
decoded message is consistent with the coverage components of the first part of the multipart coverage for all components present in the first part.

Test passes if constraint evaluates to true.

A.4 Conformance Test Class: special-format

The OGC URI identifier of this conformance class is: http://www.opengis.net/spec/GMLCOV/1.0/conf/special-format.

A.1.34 Special coverage

Test id: /conf/special/coverage

Test Purpose: Requirement /req/special/coverage:
In a coverage encoded in a multipart message, the coverage structure represented shall conform with conformance class gml-coverage.
Dependency: http://www.opengis.net/spec/GMLCOV/1.0/req/gml-coverage.

Test method: If the coverage under test is encoded in GML, check that the coverage instance document is a valid concrete subtype of gmlcov:Abstract-CoverageType by performing all tests of conformance class gml-coverage on it.

Test passes if constraint evaluates to true.

A.1.35 Special format

Test id: /conf/multipart/special-format

Test Purpose: Requirement /req/special/special-format:
A coverage document not encoded in GML shall be conformant with some OGC data format encoding standard.
Dependency: OCG format encoding standards.

Test method: If the coverage under test is not encoded in GML, invoke corresponding test according to its encoding format declaration.

Test passes if the resp. format encoding conformance test passes.

-- end of ATS --