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OGC® WCS 2.0 Interface Standard - Core

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i. Preface

This document specifies the service core of an OGC Web Coverage Service (WCS). As such, it is based on the GML Application Schema for Coverages [OGC 09-146r1], OWS Common [OGC 06-121r9], and OGC Abstract Topic 6 [OGC 07-011].

Suggested additions, changes, and comments on this draft document are welcome and encouraged. Such suggestions may be submitted by email message or by making suggested changes in an edited copy of this document.

ii. Terms and definitions

This document uses the standard 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 Interface 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

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v. Revision history

Date	Release	Author	Paragraph modified	Description
2009-11-08	2.0.0	Peter Baumann, Andrei Aiordachioiae	All	Created

vi. Changes to the OpenGIS® Abstract Specification

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

vii. Future Work

Based on this WCS core interface standard, several extensions are foreseen; see [6] for a tentative list.

Foreword

This version 2.0 of the Web Coverage Service (WCS) Interface Standard improves (but does not supersede) previous version 1.1.2 [1]. Technical changes from WCS version 1.1.2 include building on the GML 3.2 encoding of coverages, and dividing the standard into this core plus multiple extensions.

This document includes one annex; this annex is normative.

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

Introduction

The OGC Web Coverage Service (WCS) supports electronic retrieval of geospatial data as "coverages" – that is, digital geospatial information representing space/time-varying phenomena.

This document specifies the WCS core; every implementation of a WCS shall adhere to this standard. This standard thus defines only basic requirements. Extensions to the core will define extensions to meet additional requirements, such as the response encoding. Indeed, additional extensions are required in order to completely specify a WCS for implementation.

A WCS provides access to coverage data in forms that are useful for client-side rendering, as input into scientific models, and for other clients. The WCS may be compared to the OGC Web Feature Service (WFS) [4] and the Web Map Service (WMS) [5]. As WMS and WFS service instances, a WCS allows clients to choose portions of a server's information holdings based on spatial constraints and other query criteria.

Unlike WMS, which portrays spatial data to return static maps (rendered as pictures by the server), the Web Coverage Service provides available data together with their detailed descriptions; defines a rich syntax for requests against these data; and returns data with its original semantics (instead of pictures) which may be interpreted, extrapolated, etc., and not just portrayed.

Unlike WFS, which returns discrete geospatial features, the Web Coverage Service returns coverages representing space/time-varying phenomena that relate a spatio-temporal domain to a (possibly multidimensional) range of properties. As such, WCS focuses on coverages as a specialized class of features and, correspondingly, defines streamlined functionality.

WCS 2.0 uses the coverage model of the GML Application Schema for Coverages [OGC 09-146r1] which has been developed with the goal that coverages handled by a WCS can be more easily interchanged with other OGC services. WCS 2.0 supports all coverage types supported by said Application Schema; it is not constrained to quadrilateral grid coverages like previous WCS versions.

Explanations and best practices for users and implementers of WCS 2.0 are provided in [6].

OGC® WCS 2.0 Interface Standard - Core

1 Scope

This document specifies how a Web Coverage Service (WCS) offers multi-dimensional coverage data for access over the Internet. This document specifies a core set of requirements that a WCS implementation must fulfil. WCS extension standards add further functionality to this core; some of these are required in addition to the core to obtain a complete implementation. This document indicates which extensions, at a minimum, need to be considered in addition to this core to allow for a complete WCS implementation.

This core does not prescribe support for any particular coverage encoding format. This also holds for GML as a coverage delivery format: while GML constitutes the canonical format for the *definition* of WCS, it is not required by this core that a WCS *implements* the GML coverage format. WCS extensions specifying use of data encoding formats in the context of WCS are designed in a way that the GML coverage information contents specified in this core is consistent with the contents of an encoded coverage.

2 Conformance

Standardization target are WCS 2.0 implementations (currently: servers).

This document establishes a single requirements class, *core*, of http://www.opengis.net/spec/WCS/2.0/req/core with a single pertaining conformance class, *core*, with URI http://www.opengis.net/spec/WCS/2.0/conf /core. Requirements and conformance test URIs defined in this document are relative to http://www.opengis.net/spec/WCS/2.0/.

Annex A lists the conformance tests which shall be exercised on any software artefact claiming to implement an OGC WCS.

3 Normative references

This *OGC WCS 2.0 Core* specification consists of the present document and an XML Schema. The complete specification is identified by OGC URI http://www.opengis.net/spec/WCS/2.0, the document has OGC URI http://www.opengis.net/doc/IS/WCS/2.0.

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/wcs/2.0/ 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 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.

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

Conformance classes used:

- GML writing

OGC 06-121r9, *OGC Web Service Common Specification*, version 2.0

Conformance classes used:

- GetCapabilities operation (Clause 7)

OGC 09-146r1, *OGC® GML Application Schema for Coverages*, version 1.0

Conformance classes used:

- gml-coverage

OGC 10-151, *OGC® Web Coverage Service 2.0 Interface Standard – Index Subsetting Extension*, version 1.0

Conformance classes used:

- index-subsetting

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 07-111]

4.2 GML coverage

feature which is a concrete subclass (specialization) of `gmlcov:AbstractCoverage`

NOTE The term "GML coverage" does not imply that such a coverage always needs to be represented by a GML document; a coverage can well be represented by some well-known encoding different from GML as long as the data model contents is semantically equivalent.

4.3 offered coverage

extended →*GML coverage* structure, stored on a WCS server and accessible by clients via WCS operations, which additionally carries WCS service relevant information

4.4 (coverage) subsetting

operation on →*GML coverages* which, for a coverage provided, extracts part or all of its cell/value pairs and returns a →*GML coverage* containing these cell/value pairs

4.5 (coverage) trimming

→ *GML coverage* subsetting operation which returns a →*coverage* with the same number of dimensions as the input → *GML coverage*

4.6 (coverage) slicing

→ *GML coverage* subsetting operation which returns a → *GML coverage* with a reduced number of dimensions as compared to the input → *GML coverage*

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 07-111]. The term "GML coverage" is coined to denote the concrete data structure definition provided in the document on hand, relying on the GML Application Schema for Coverages [OGC 09-146r1] and SWE Common [OGC 08-094].

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

5.2 UML notation

Unified Modeling Language (UML) static structure diagrams appearing in this specification are used 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 "`OWS Common`" are those defined in the UML model of OWS Common [OGC 06-121r9].
- UML elements having a package name of `GML` are those defined in the UML model of GML [OGC 07-036].
- UML elements having a package name of "`SWE Common`" are those defined in the UML model of SWE Common [OGC 08-094].
- UML elements having a package name of `GMLCOV` are those defined in the UML model of the GML Application Schema for Coverages [OGC 09-146r1].
- UML elements not qualified with a package name are those defined in this Standard.
- UML data type `Any` is used here as an equivalence to XML's `xsd:any`.

5.3 Data dictionary tables

The UML model data dictionary is specified herein in a series of tables. The contents of the columns in these tables are described in Subclause 5.5 of [OGC 06-121r9]. The contents of these data dictionary tables are normative, including any table footnotes.

For the reader's convenience, table rows describing inherited components are shaded.

5.4 Namespace prefix conventions

The following namespaces are used in this document. The prefix abbreviations used constitute conventions used here, but are **not** normative. The namespaces to which the prefixes refer are normative, however.

Table 1 — Namespace mappings

Prefix	Namespace URI	Description
xsd	http://www.w3.org/2001/XMLSchema	XML Schema
gml	http://www.opengis.net/gml/3.2	GML 3.2.1
gmlcov	http://www.opengis.net/gmlcov/1.0	GML Application Schema for Coverages 1.0
wcs	http://www.opengis.net/wcs/2.0	WCS 2.0

5.5 XPath / Schematron notation

Requirements on the contents of XML documents, derivation of complex entities, and the contents of WCS responses are specified herein using XPath 2.0 and Schematron.

5.6 Multiple representations

When multiple representations of the same information are given in a specification document, then reference to the XML schema takes precedence.

6 WCS data model

6.1 Overview

This clause specifies the underlying coverage data model used in the later clauses of this standard. For reasons of extensibility and flexibility, many components of the core GML structure `CoverageOfferings` introduced in this standard are left underspecified (e.g., in terms of multiplicity of the elements or proper semantics and use of a component), sometimes even in cases where other standards applying (like OWS Common and SWE Common) leave such details open. Any item thus underspecified can be handled arbitrarily by implementations – among others, a server is free to deliver optional elements or not, and a client is free to ignore optional elements when present. Note, however, that WCS extensions may regulate further syntax and semantics of such underspecified items.

A WCS server offers a – possibly empty – set of coverage objects. The offering of a WCS server is described by a single instance of type `CoverageOfferings`. The components of `CoverageOfferings` are as shown in Figure 1 and Table 2.

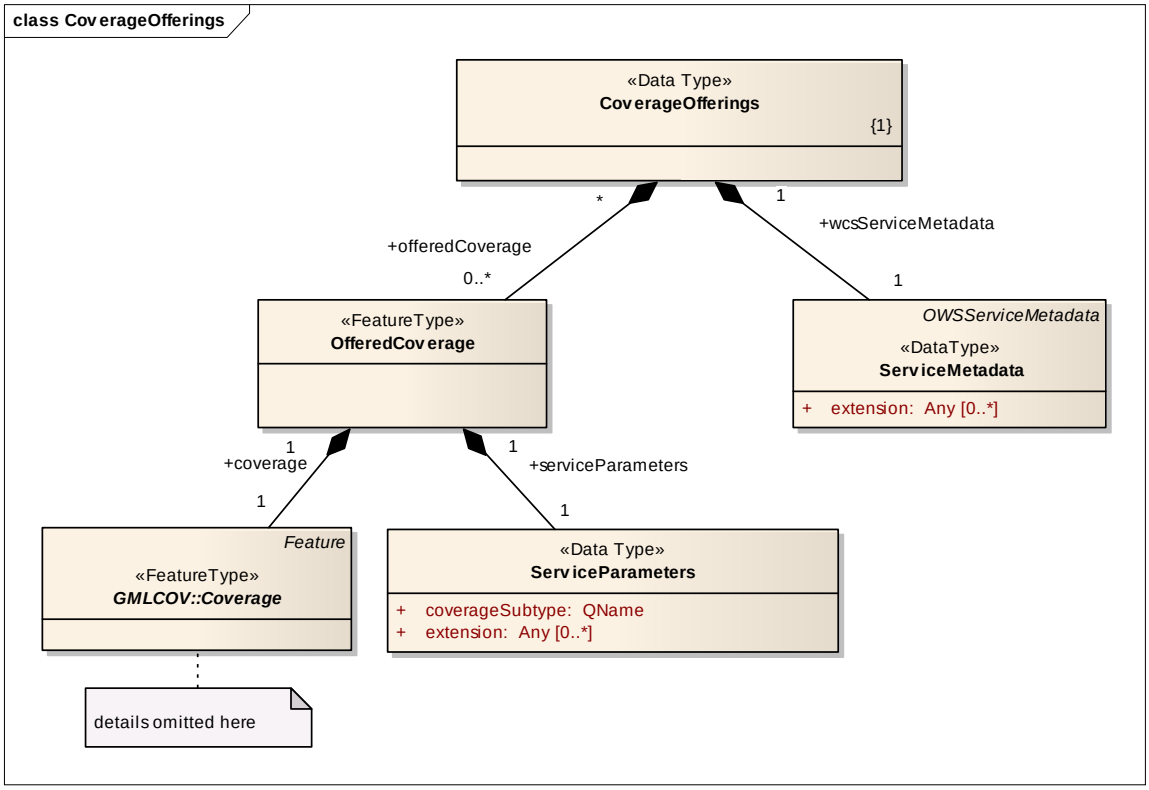

Figure 1 — `CoverageOfferings` UML class diagram

Table 2 — WCS `CoverageOfferings` components

Name	Definition	Data type	Multiplicity
`offered-Coverage`	Set of coverages offered by this service	`OfferedCoverage`	zero or more (optional)
`service-Metadata`	Information specific to this WCS service as a whole	`ServiceMetadata`	one (mandatory)

6.2 OfferedCoverage

An `OfferedCoverage` is a coverage as specified in the GML Application Schema for Coverages [OGC 09-146r1] and the further standards referenced therein. The components of an `OfferedCoverage` are detailed in Figure 1 and Table 3.

Table 3 — WCS `OfferedCoverage` components

Name	Definition	Data type	Multiplicity
`coverage`	The coverage	`GMLCOV::Coverage`	one (mandatory)
`service-Parameters`	Service parameters individual for the coverage on hand	`ServiceParameters`	zero or more (optional)

Coverages are uniquely identified within a service through the `GML::Id` attribute of the root of the `coverage` component. The corresponding requirement is stated in Subclause 8.5.

NOTE Class `GMLCOV::AbstractCoverage` inherits this attribute from class `GML::AbstractFeature` according to GML [OGC 07-036] and the GML Application Schema for Coverages [OGC 09-146r1].

6.3 Coverages

Coverages offered through a WCS need to fulfil particular requirements to allow for the WCS operations. Concretely, coordinate-based subsetting is based on the `gml:Envelope` structure of a coverage; to this end, this optional GML element is made mandatory in this Core. The `gml:Envelope` is part of the `gml:boundedBy` element which is defined in `gml:AbstractFeature`, cf. [OGC 09-146r1]. As both *DescribeCoverage* and *GetCoverage* responses inherit from `gml:AbstractFeature`, the `gml:boundedBy` element can be provided by both.

Requirement 1 /req/core/structure-boundedBy:
The `coverage` element of every `gmlcov:OfferedCoverage` **shall** contain a valid `gml:boundedBy` element.
Dependency: http://www.opengis.net/spec/GMLCOV/1.0/conf/gml-coverage

NOTE Requirements on the contents of this element are specified in [OGC 07-036].

Additionally, this `gml:boundedBy` element shall specify an `srsName` attribute.

Requirement 2 /req/core/structure-with-srsName:
The `srsName` attribute in the `gml:Envelope` element of a `gmlcov:OfferedCoverage` **shall** not be empty.
Dependency: http://www.opengis.net/spec/GMLCOV/1.0/conf/gml-coverage

NOTE Requirements on the contents of this attribute are specified in [OGC 07-036].

The `gml:boundedBy` element of a coverage shall specify an `axisLabels` attribute containing the coverage's dimension axis names. This is necessary as domain subsetting refers to them.

Requirement 3 /req/core/structure-with-axisLabels:
The `axisLabels` attribute in the `gml:Envelope` element of a `gmlcov:OfferedCoverage` **shall** not be empty.
Dependency: http://www.opengis.net/spec/GMLCOV/1.0/conf/gml-coverage

NOTE Requirements on the contents of this attribute are specified in [OGC 07-036].

It follows the construction rules given in OWS Common [OGC 06-121r9].

6.4 ServiceParameters

WCS `ServiceParameters` include coverage-specific information about functionality the server can offer on a particular coverage (as opposed to the overall service description pro-

vided by `ServiceMetadata`, see Subclause 6.5). The definition of `ServiceParameters` is shown in Figure 2 and Table 4.

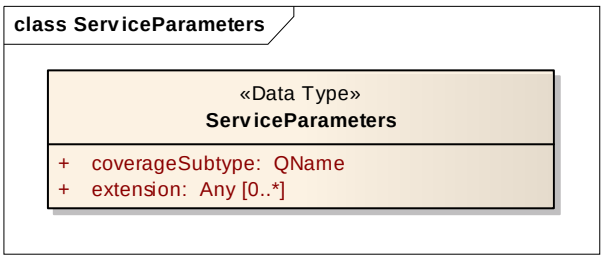

Figure 2 — `ServiceParameters` UML class diagram

Table 4 — `ServiceParameters` components

Name	Definition	Data type	Multiplicity
`coverage-Subtype`	Indicator of the type of coverage	`QName`	one (mandatory)
`extension`	Any kind of ancillary data	`Any`	zero or more (optional)

Component `CoverageSubtype` characterizes the type of the `OfferedCoverage`. This information is delivered in *GetCapabilities* and *DescribeCoverage* to allow clients an estimation of the amount of data to be expected in the domain and range set.

Requirement 4 /req/core/coverageSubtype-content:
The `coverageSubtype` in the `ServiceParameters` of an `OfferedCoverage` **shall** indicate the coverage's type.

NOTE Both domain set and range set of a coverage can become quite large; which of these can become unwieldy for complete transfer is determined by the type of the coverage. In gridded coverages, for example, the range set usually is the large part. In multi-solid coverages the domain set may become large while the range set usually will be small.

Normally, the coverage type will be given by one of the concrete (instantiateable) coverage types defined in the GML Application Schema for Coverages [OGC 09-146r1]. However, WCS extensions may derive further coverage types, and these are candidates for the `CoverageSubtype` as well.

Requirement 5 /req/core/coverageSubtype-reference:
The content model definition of the coverage type referenced in the `coverageSubtype` in the `ServiceParameters` of an `OfferedCoverage` **shall** either be normatively referenced by this WCS Core or by a WCS extension requirements class supported by the server.

Component `extension` is provided as a canonical place for extensions to define coverage-specific service quality information which is not part of `Coverage`. It follows the construction rules given in OWS Common [OGC 06-121r9].

The `ServiceParameters` section is delivered – in different shapes – in both *GetCapabilities* and *DescribeCoverage* response, but is not included in the coverage when delivered via *GetCoverage*.

6.5 ServiceMetadata

WCS `ServiceMetadata` provide service details plus information about the concrete service capabilities of the WCS service as a whole (as opposed to coverage-specific `ServiceParameters`, see Subclause 6.4). The definition of `ServiceMetadata` follows OWS Common [OGC 06-121r9]. The additional element `extension` within `ServiceMetadata` defines a canonical place for additional information eventually provided by WCS extension standards. This is shown in Figure 3, Table 5, and Table 9.

Requirement 6 /req/core/serviceMetadata-structure:
The `ServiceMetadata` structure shall adhere to Figure 3 and Table 5.

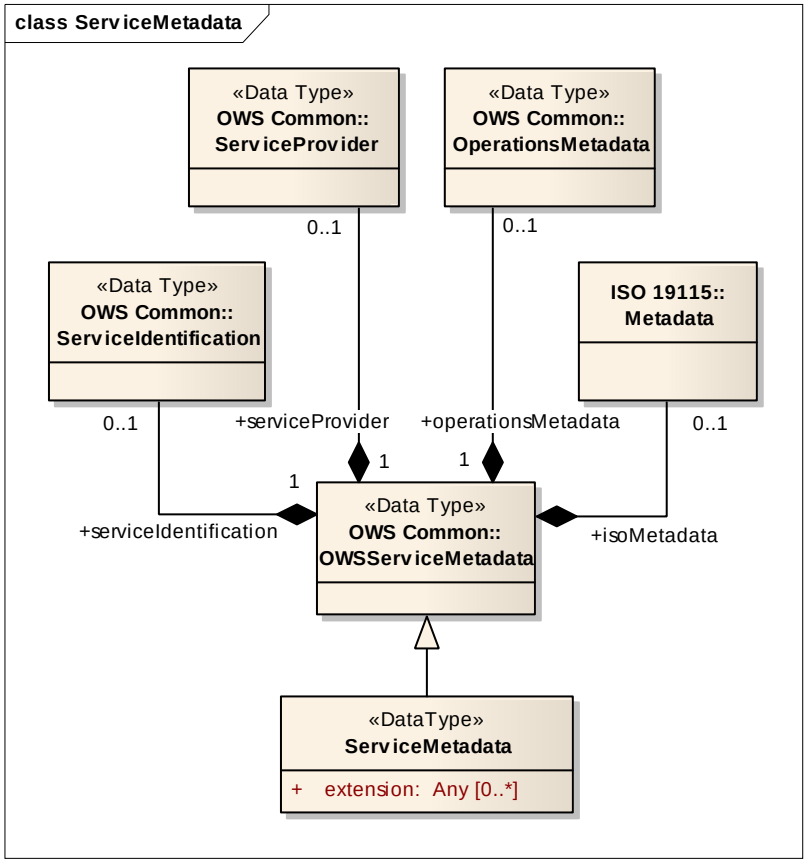

Figure 3 — `ServiceMetadata` UML class diagram

Table 5 — `ServiceMetadata` additional components

Name	Definition	Data type	Multiplicity
`extension`	Any kind of ancillary information about the service	`Any`	zero or more (optional)

Among other information, the URI identifiers of all conformance classes of OGC standards supported in addition to this WCS Core are published by the server.

Requirement 7 /req/core/conformance-class-in-profile:
Each element in the `Profile` list of the `ServiceMetadata` **shall** be the identifier of an OGC Interface Standard conformance class.

NOTE Typically, these will be WCS extensions and application profiles.

The operations metadata specified in OWS Common [OGC 06-121r9] describe the request types supported by the server. For the WCS Core, these are *GetCapabilities*, *DescribeCoverage*, and *GetCoverage*; extensions may add further request types to this list.

Requirement 8 /req/core/operationsMetadata:
The `OperationsMetadata` component **shall** contain three `Operation` instances with case-sensitive `name` values “GetCapabilities”, “DescribeCoverage”, and “GetCoverage”, respectively.

NOTE 1 Further operation instances can be present, this is only a minimum requirement of this WCS Core – extensions may add further request types.

NOTE 2 See [OGC 06-121r9] for proper use of the many optional elements in an OWS Common `ServiceMetadata` structure.

NOTE 3 OWS Common 2.0 [OGC 06-121r9], for historical reasons, uses different names for ServiceMetadata. In said standard, Figure 3 uses “`OWSServiceMetadata`“, Table 8 uses "service metadata document", and owsGetCapabilities.xsd uses "`CapabilitiesBaseType`". (The name `CapabilitiesBaseType` is used because the XML encoding of service metadata is commonly named `Capabilities`, and the suffix "`Base`" is used because it does not include any Contents, since not all services have Contents). Except for not including `Contents` in the XML Schema, all three names mean the same service metadata.

7 WCS service model

7.1 WCS operation types

The WCS interface herein specified supports retrieval of geospatial coverage data – that is, digital geospatial information representing space/time-varying phenomena [OGC 07-011]. To this end, the WCS interface specifies the following operations that may be invoked by a WCS client and performed by a WCS server:

a) *GetCapabilities* – This operation allows a client to request information about the server’s capabilities and coverages offered (see Subclause 8.2).

b) *DescribeCoverage* – This operation allows a client to request detailed metadata on selected coverages offered by a server (see Subclause 8.3).

c) *GetCoverage* – This operation allows a client to request a coverage comprised of selected range properties at a selected set of spatio-temporal locations, expedited in some coverage encoding format (see Subclause 8.4).

NOTE Extensions to this WCS Core may add further operation types.

A client should first, during a sequence of WCS requests, issue a *GetCapabilities* request to the server to obtain an up-to date listing of available data. Then, it may issue a *DescribeCov-*

erage request to find out more details about particular coverages offered. To retrieve a coverage or a part thereof, a client will issue a *GetCoverage* request.

NOTE A WCS server can change its offering at any time, in particular: between a *GetCapabilities*, a subsequent *DescribeCoverage*, and a subsequent *GetCoverage* request. Such a change in the service offering can be effected, e.g., through an intervening WCS-T [2] request.

7.2 WCS service handling package

The *DescribeCoverage* and *GetCoverage* request types make use of the `RequestBase` structure which mimics the OWS Common [OGC 06-121r9] `RequestBase` data structure,with the following adaptations, as shown in in Figure 4 and Table 6:

- Attributes `service` contains the WCS service name, which is fixed to the string "WCS".
- Attributes `version` contains the WCS version number, which is fixed to the string "2.0".
- `Extension` is a placeholder for further request parameters defined by WCS extension standards.

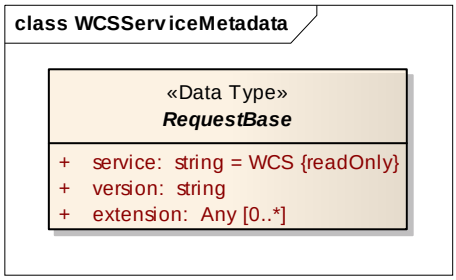

Figure 4 — `RequestBase` data structure UML class diagram

Table 6 — `RequestBase` components

Name	Definition	Data type	Multiplicity
`service`	Service name	`String`, fixed to "WCS"	one (mandatory)
`version`	Coverage identifiers	`String`	one or more (mandatory)
`extension`	Any ancillary information to be sent from client to server	`Any`	zero or more (optional)

Requirement 9 /req/core/requestbase:
All WCS request types shall be a subtype of `RequestBase`.

NOTE This applies not only to the request types in the Core, but to any request type supported by the service on hand.

Requirement 10 /req/core/service-name:
For all WCS request types, the request `service` parameter **shall** have a fixed value of "WCS".

Requirement 11 /req/core/version-number:
For all WCS request types, the request `version` parameter **shall** have a fixed value of "2.0".

8 WCS operations

8.1 Overview

In this Clause, the WCS core operations *GetCapabilities*, *DescribeCoverage*, and *GetCoverage* are specified. Definition is based on the GML structure specified in Clause 6.

8.2 GetCapabilities operation

A *GetCapabilities* operation, as required by OWS Common [OGC 06-121r9], allows a WCS client to retrieve service metadata and coverages offered by a WCS server.

8.2.1 GetCapabilities request

Requirement 12 /req/core/getCapabilities:
A *GetCapabilities* request **shall** consist of a `GetCapabilities`s structure as defined in Figure 5 and Table 7.

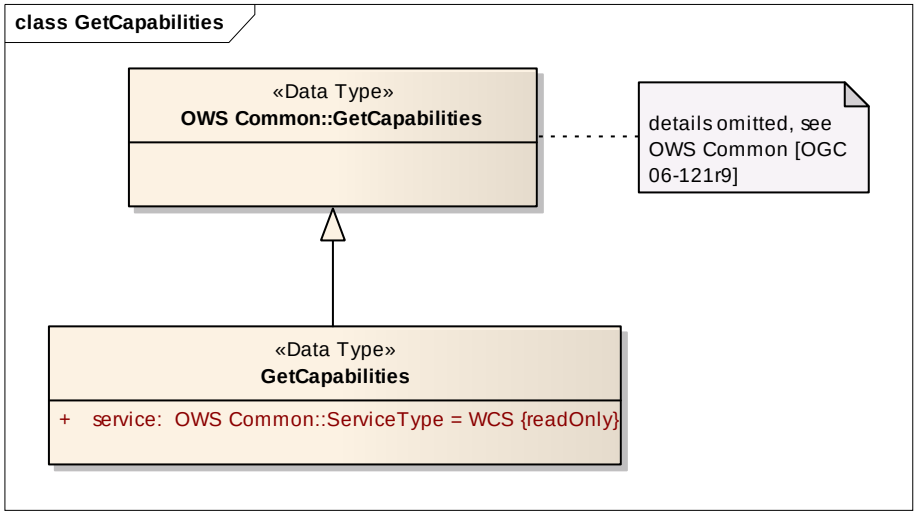

Figure 5 — `GetCapabilities` operation request UML class diagram

Table 7 — `GetCapabilities` components

Name	Definition	Data type	Multiplicity
`service`	Service name	`String`, fixed to "WCS"	one (mandatory)

8.2.2 GetCapabilities response

The *GetCapabilities* response document consists of a service metadata section and an optional contents section. Service metadata are those defined in the `serviceMetadata` component of the server's coverage offering. The contents section delivers information about the coverage offering of the server. Figure 6 and Table 8 show this structure.

Requirement 13 /req/core/wcsServiceMetadata-structure:
The response to a successful *GetCapabilities* request **shall** consist of a `Capabilities` structure as defined in Figure 6, Table 8, Figure 7, and Table 9.

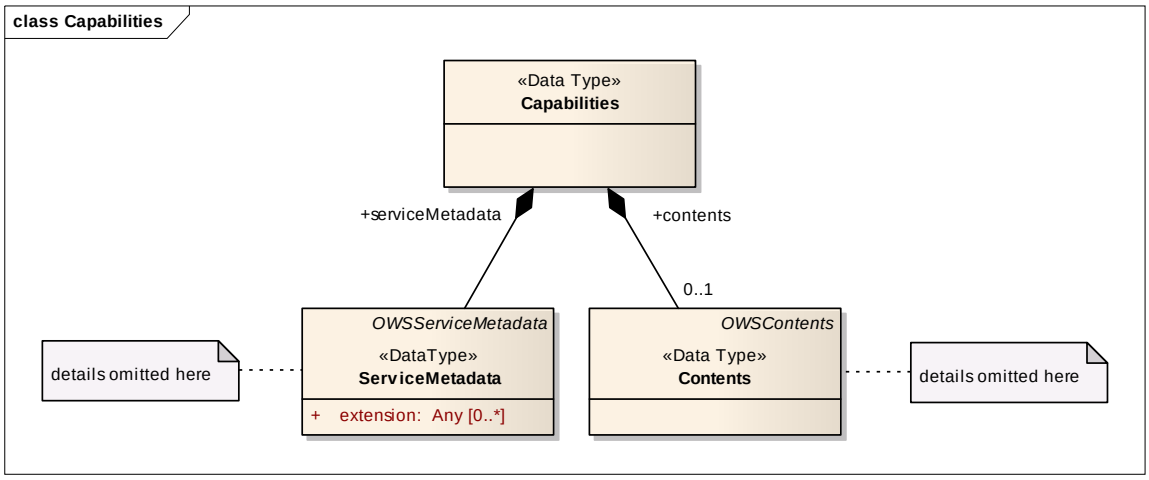

Figure 6 — `Capabilities` UML class diagram

Table 8 — `Capabilities` components

Name	Definition	Data type	Multiplicity
`service-Metadata`	Service metadata and functionality specific information	`ServiceMetadata`	one (mandatory)
`contents`	Information about coverages offered by this service	`Contents`	zero or one (optional)

The `Contents` section provides details about the coverages offered by the service. Its structure is derived from the `Contents` definition in OWS Common [OGC 06-121r9] along the mechanism prescribed there:

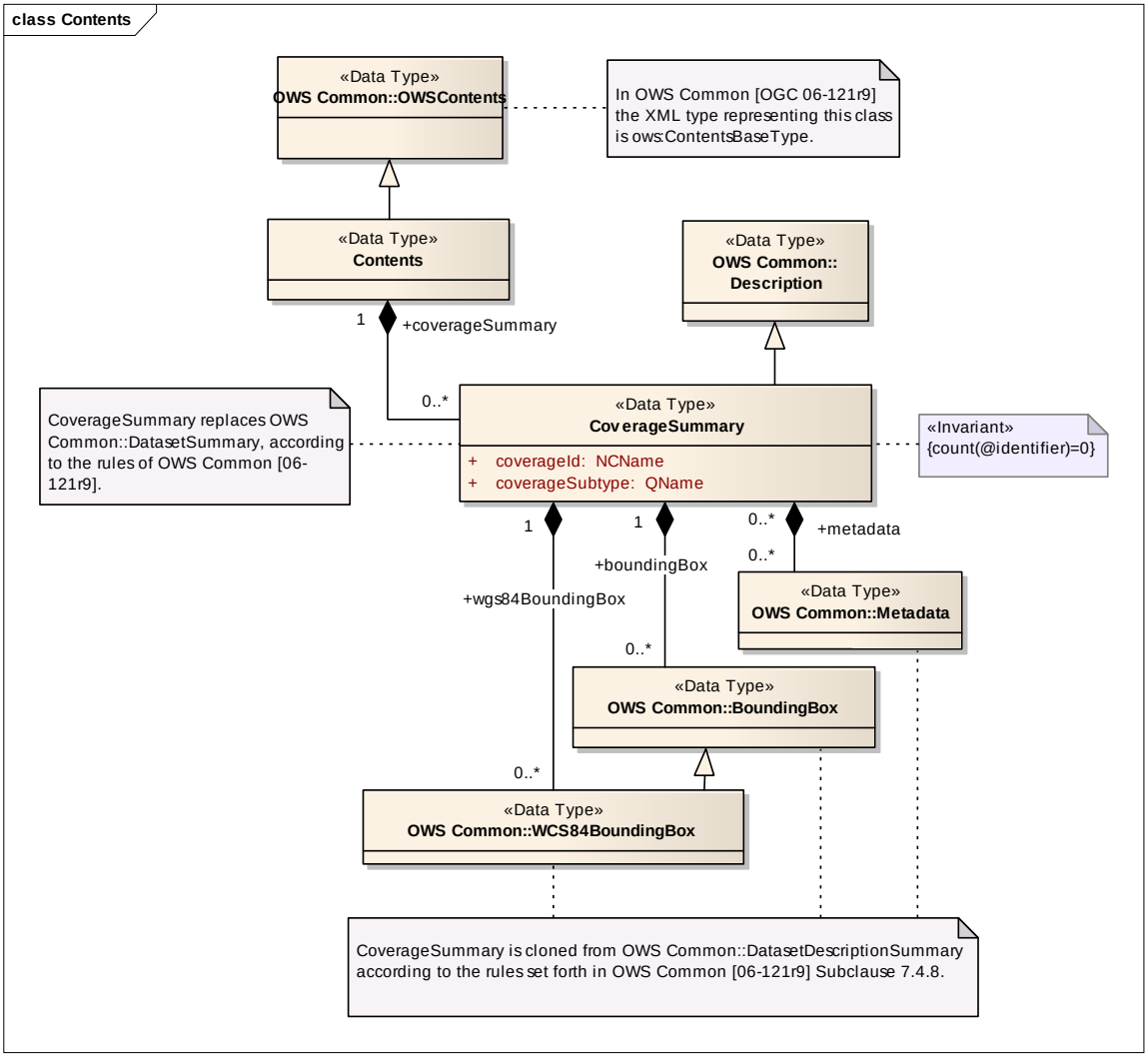

Figure 7 — `Contents` and `CoverageSummary` UML class diagram

a) `DatasetSummary` is renamed to `CoverageSummary`.

b) This `CoverageSummary` is extended (over `DatasetSummary`) with two additional components: `coverageId` and `coverageSubtype`.

c) The `DatasetSummary` attribute `identifier` is omitted (ie, set to cardinality zero in the XML Schema). Identification of items (i.e., coverages) offered is done through `coverageId` instead (see Figure 7 and Table 9).

Table 9 — `CoverageSummary` additional components

Name	Definition	Data type	Multiplicity
`coverageId`	Identifier of a coverage offered by the service on hand	`NCName`	one (mandatory)
`coverage-`	Type indicator for the cover-	`QName`	one

Subtype	age on hand		(mandatory)
wgs84-BoundingBox	Minimum bounding rectangle surrounding dataset, using WGS 84 CRS with decimal degrees and longitude before latitude	OWS Common::WGS84BoundingBox	zero or more (optional)
boundingBox	Minimum bounding rectangle surrounding dataset, in available CRS	OWS Common::BoundingBox	zero or more (optional)
metadata	Reference to more metadata about this dataset	OWS Common::Metadata	zero or one (optional)

NOTE OWS Common [OGC 06-121r9] Table 21 footnotes contain further normative rules for `wgs-84BoundingBox` and `boundingBox`. See OWS Common [OGC 06-121r9] Subclause D.9 for proper use of the many optional elements in an OWS Common `Contents` structure.

Requirement 14 /req/core/wcsServiceMetadata-contents:
If present in the response to a successful *GetCapabilities* request, the `Contents` section **shall** be populated as specified by OWS Common [OGC 06-121r9].
Dependency: [OGC 06-121r9] Clause 7 (http://www.opengis.net/doc/OWS/2.0/clause/7)

Whether a `Contents` section is provided in the response is up to the server. If it is provided then all coverage identifiers reported shall be valid:

Requirement 15 /req/core/coverageSummary:
In the response to a successful *GetCapabilities* request containing a `CoverageSummary` section, each coverage identifier listed **shall** refer to a coverage offered by the server.

NOTE There may be coverages which are not reported via *GetCapabilities*, but nevertheless accessible through *DescribeCoverage* and *GetCoverage*.

8.2.3 Sample GetCapabilities response

Example The response to a valid *GetCapabilities* may look like this:

```
<?xml version="1.0" encoding="UTF-8"?>
<wcs:Capabilities  xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance'
  xmlns:ows='http://www.opengis.net/ows/1.2'
  xmlns:wcs='http://www.opengis.net/wcs/2.0'
  xmlns:gml='http://www.opengis.net/gml/3.2'
  xmlns='http://www.opengis.net/ows/1.2'
  xmlns:xlink='http://www.w3.org/1999/xlink'
  xsi:schemaLocation='http://schemas.opengis.net/wcs/2.0 ../wcsAll.xsd' version="2.0.0">
   <ServiceIdentification>
      <Title>rasdaman</Title>
      <Abstract>WCS Server developed at Jacobs University</Abstract>
      <ServiceType>OGC WCS</ServiceType>
      <ServiceTypeVersion>2.0.0</ServiceTypeVersion>
      <Profile>
         http://www.opengis.net/spec/WCS_service-model_index-subsetting/1.0/conf/index-subsetting
```



```
    </Profile>
    <Profile>
      http://www.opengis.net/spec/WCS_service-model_processing/1.1/conf/processing
    </Profile>
    <Profile>
      http://www.opengis.net/spec/WCS_protocol-binding_soap/1.0/conf/soap
    </Profile>
    <Profile>
      http://www.opengis.net/spec/WCS_coverage-encoding_netcdf/1.0/conf/netcdf
    </Profile>
  </ServiceIdentification>
  <ServiceProvider>
    <ProviderName>Jacobs University Bremen</ProviderName>
    <ProviderSite xlink:href="http://www.jacobs-university.de/"/>
    <ServiceContact>
      <IndividualName>Andrei Aiordachioaie</IndividualName>
      <PositionName>Developer</PositionName>
      <ContactInfo>
        <Phone>
          <Voice></Voice>
        </Phone>
      </ContactInfo>
    </ServiceContact>
  </ServiceProvider>
  <OperationsMetadata>
    <Operation name="GetCapabilities">
      <DCP>
        <HTTP>
          <Get xlink:href="http://server:port/GetCapabilitiesURL"/>
        </HTTP>
      </DCP>
    </Operation>
    <Operation name="DescribeCoverage">
      <DCP>
        <HTTP>
          <Get xlink:href="http://server:port/DescribeCoverageURL"/>
        </HTTP>
      </DCP>
    </Operation>
    <Operation name="GetCoverage">
      <DCP>
        <HTTP>
          <Get xlink:href="http://server:port/GetCoverageURL"/>
        </HTTP>
      </DCP>
    </Operation>
  </OperationsMetadata>
  <wcs:Contents>
    <wcs:CoverageSummary>
      <wcs:CoverageId>C0001</wcs:CoverageId />
      <wcs:CoverageSubtype>GridCoverage</wcs:CoverageSubtype>
    </wcs:CoverageSummary>
    <wcs:CoverageSummary>
      <wcs:CoverageId>C0002</wcs:CoverageId />
      <wcs:CoverageSubtype>MultiPointCoverage</wcs:CoverageSubtype>
    </wcs:CoverageSummary>
    <wcs:CoverageSummary>
      <wcs:CoverageId>C0003</wcs:CoverageId />
```



```
        <wcs:CoverageSubtype>MultiCurveCoverage</wcs:CoverageSubtype>
      </wcs:CoverageSummary>
      <wcs:CoverageSummary>
        <wcs:CoverageId>C0004</wcs:CoverageId />
        <wcs:CoverageSubtype>MultiSurfaceCoverage</wcs:CoverageSubtype>
      </wcs:CoverageSummary>
      <wcs:CoverageSummary>
        <wcs:CoverageId>C0005</wcs:CoverageId />
        <wcs:CoverageSubtype>MultiSolidCoverage</wcs:CoverageSubtype>
      </wcs:CoverageSummary>
    </wcs:Contents>
</wcs:Capabilities>
```

8.2.4 GetCapabilities exceptions

When a WCS server encounters an error while performing a *GetCapabilities* operation, it shall return an exception report message as set forth in Subclause 7.4 of [OGC 06-121r9].

8.3 DescribeCoverage operation

A *DescribeCoverage* request submits a list of coverage identifiers and returns, for each identifier, a description of the coverage.

NOTE A *GetCapabilities* request allows retrieval of the identifiers of all coverage objects currently offered by the WCS service. However, a client is not required to retrieve identifiers via a *GetCapabilities* request. Alternative means of retrieving these identifiers, not defined in this standard, are allowed.

Requirement 16 /req/core/describeCoverage:
Every WCS server **shall** offer the *DescribeCoverage* operation.

8.3.1 DescribeCoverage request

The *DescribeCoverage* request structure is derived from `RequestBase`, extended with a non-empty list of coverage identifiers. This structure is shown in Figure 8 and Table 10.

Requirement 17 /req/core/describeCoverage-request-structure:
A *DescribeCoverage* request **shall** consist of a structure as defined in Figure 8 and Table 10.

The concrete representation of this structure depends on the protocol binding chosen.

Requirement 18 /req/core/describeCoverage-valid-identifier:
Each coverage identifier in the list submitted in a *DescribeCoverage* request **shall** identify a `wcs:OfferedCoverage` object available on the server addressed.

8.3.2 DescribeCoverage response

The response to a successful *DescribeCoverage* request contains a list of coverage metadata, one for each coverage identifier passed in the request.

Requirement 19 /req/core/describeCoverage-response-structure:
The response to a successful *DescribeCoverage* request **shall** consist of a `CoverageDescriptions` as described in Figure 9, Table 11, and Table 12.

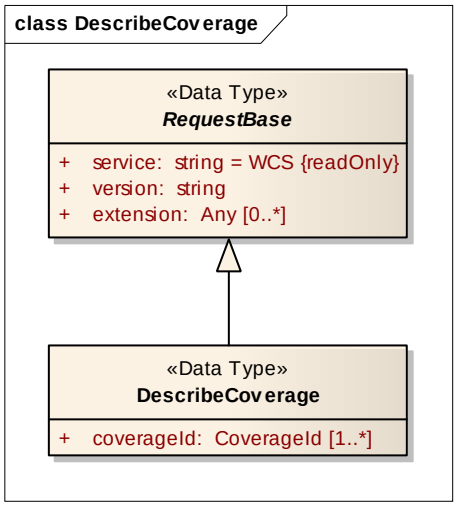

Figure 8 — `DescribeCoverage` operation request UML class diagram

Table 10 — `DescribeCoverage` components

Name	Definition	Data type	Multiplicity
`service`	Service identifier	`String`, fixed to "WCS"	one (mandatory)
`version`	WCS service version indicator	`String`, fixed to a pattern of three dot-separated decimal digits	one (mandatory)
`extension`	Any ancillary information to be sent from client to server	`Any`	zero or more (optional)
`coverageId`	Coverage identifiers	List of `NCName`	one or more (mandatory)

Requirement 20 /req/core/describeCoverage-response-list-size:
The response to a successful *DescribeCoverage* request with *n*>0 coverage identifiers **shall** be a list containing *n* items.

NOTE For brevity, the substructures of `domainSet`, `rangeType`, and `rangeSet` have been omitted in Figure 4. OGC document [OGC 09-146r1] contains their complete definitions.

Table 11 lists the components of a `CoverageDescriptions` list, Table 12 those of a single `CoverageDescription`.

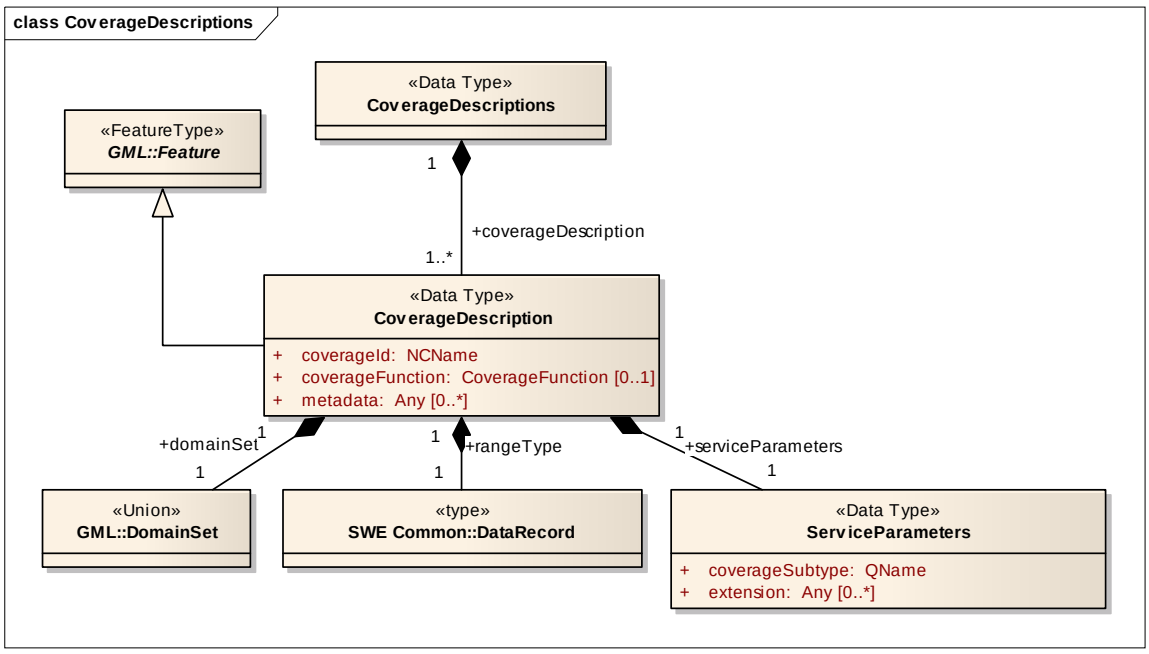

Figure 9 — `CoverageDescriptions` UML class diagram

Table 11 — WCS `CoverageDescriptions` components

Name	Definition	Data type	Multiplicity
`coverage-Description`	List of descriptions of coverages	`Coverage-Description`	one or more (mandatory)

Table 12 — WCS `CoverageDescription` components

Name	Definition	Data type	Multiplicity
`coverageId`	Identifier of the coverage described	`NCName`	one (mandatory)
`coverage-Function`	GML 3.2.1 coverage function to describe how range values at coverage locations can be obtained	`GML:: CoverageFunction`	zero or one (optional)
`metadata`	Application specific metadata	`Any`	zero or more (optional)
`domainSet`	Domain description of this coverage	`GML::DomainSet`	one (mandatory)
`rangeType`	Range structure description of this coverage	`SWE Common:: DataRecord`	one (mandatory)
`service-Parameters`	Service-specific parameters of this coverage	`ServiceParameters`	one (mandatory)

Requirement 21 /req/core/describeCoverage-response-contents:
The response to a successful *DescribeCoverage* request containing n>0 identifiers id_1, …, id_n **shall** contain, at position i in the response list, a `wcs:coverageDescription` consisting of a copy of the identified coverage's metadata, that is: the complete `wcs:CoverageOffering` information minus the coverage `rangeSet`.
Dependency: http://www.opengis.net/spec/GMLCOV/1.0/conf/gml-coverage

NOTE GML [OGC 07-036] allows the domain set of a coverage to be referenced externally, using `xlink:href`. This feature may be useful when the coverage domain set becomes unwieldy in size, which can occur particularly with multi-point/curve/surface/ solid-coverages.

Requirement 22 /req/core/describeCoverage-response-srsName:
If a geometric or temporal object in the `domainSet` of a `coverageDescription` specifies an `srsName` attribute, the value of this attribute **shall** be identical to the `srsName` attribute of the `boundedBy` element of the containing `coverageDescription`.

Example The response to a valid *DescribeCoverage* request for coverage with id *C0001* might be:

```
<?xml version="1.0" encoding="UTF-8"?>
<wcs:CoverageDescriptions  xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance'
   xmlns='http://www.opengis.net/gml/3.2'
   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://schemas.opengis.net/swe/2.0 ../sweCommon/2.0/swe.xsd
      http://www.opengis.net/wcs/2.0 ../wcsAll.xsd'
   xmlns:wcs='http://www.opengis.net/wcs/2.0'>
   <wcs:CoverageDescription gml:id=”cd0001”>
      <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>5 3</gml:upperCorner>
         </gml:Envelope>
      </gml:boundedBy>
      <wcs:CoverageId>C0002</wcs:CoverageId />
      <domainSet>
         <Grid gml:id="gr0001_C0001"  dimension="2">
            <limits>
               <GridEnvelope><!-- This is a 5-by-3 matrix -->
                  <low>1 1</low>
                  <high>5 3</high>
               </GridEnvelope>
            </limits>
            <axisLabels>Lat Long</axisLabels>
         </Grid>
      </domainSet>
      <gmlcov:rangeType>
         <swe:field name="singleBand">
            <swe:Quantity definition="http://opengis.net/def/property/OGC/0/Radiance">
                  <gml:description>Panchromatic Channel</gml:description>
                  <gml:name>single band</gml:name>
                  <swe:uom code="W/cm2"/>
                  <swe:constraint>
                     <swe:AllowedValues>
                        <swe:interval>0 255</swe:interval>
```



```
                    <swe:significantFigures>3</swe:significantFigures>
                  </swe:AllowedValues>
                </swe:constraint>
              </swe:Quantity>
            </swe:field>
          </gmlcov:rangeType>
          <wcs:ServiceParameters>
            <wcs:CoverageSubtype>GridCoverage</wcs:CoverageSubtype>
          </wcs:ServiceParameters>
        </wcs:CoverageDescription>
</wcs:CoverageDescriptions>
```

8.3.3 DescribeCoverage exceptions

Requirement 23 /req/core/describeCoverage-exceptions:
When a WCS server encounters an error while performing a *DescribeCoverage* operation it **shall** return an exception report message chosen as follows:
- if the error occurs while performing some extension functionality:
  an exception as specified by the respective extension;
- otherwise, if an error occurs which is described in column "meaning of exception code" in Table 13:
  the corresponding exception as listed in Table 13;
- otherwise:
  an exception as specified in Clause 8 of [OGC 06-121r9].

For each listed `exceptionCode`, the contents of the `locator` parameter value **shall** be as specified in the right column of Table 13.
Dependency: [OGC 06-121r9] Clause 8 (http://www.opengis.net/doc/OWS/2.0/clause/8)

Table 13 — Exception codes for `DescribeCoverage` operation

`exceptionCode` value	HTTP code	Meaning of exception code	`locator` value
`NoSuchCoverage`	404	One of the identifiers passed does not match with any of the coverages offered by this server	list of violating coverage identifiers

8.4 GetCoverage operation

A *GetCoverage* request prompts a WCS service to process a particular coverage selected from the service's offering and return a derived coverage. The WCS Core standard defines the *domain subsetting* operation which delivers all data from a coverage inside a specified request envelope ("bounding box"), relative to the coverage's envelope – more precisely, the intersection of the request envelope with the coverage envelope.

Requirement 24 /req/core/getCoverage:
Every WCS implementation **shall** support the *GetCoverage* operation.

Domain subsetting is subdivided into *trimming* and *slicing*. A trim operation identifies a dimension and a lower and upper bound (which both must lie inside the coverage's domain) and delivers a coverage whose domain, in the dimension specified, is reduced to these new, narrower limits. The result coverage's dimension is identical to that of the input coverage.

A domain slice operation receives a dimension and a position (which must lie inside the coverage's domain) and delivers a coverage which is a slice of the offered coverage obtained at the cutting position provided. The dimension of the result coverage is reduced by one as compared to the operand coverage.

Both trimming and slicing can be combined arbitrarily in a request and on as many dimensions as desired. However, per request at most one operation can be applied per dimension.

8.4.1 GetCoverage request

Requirement 25 /req/core/getCoverage-request-structure:
A *GetCoverage* request **shall** consist of a structure as defined in Figure 10, Table 14, Table 15, Table 16, and Table 17.
Dependency: [OGC 06-121r9] Clause 7 (http://www.opengis.net/doc/OWS/2.0/clause/7)

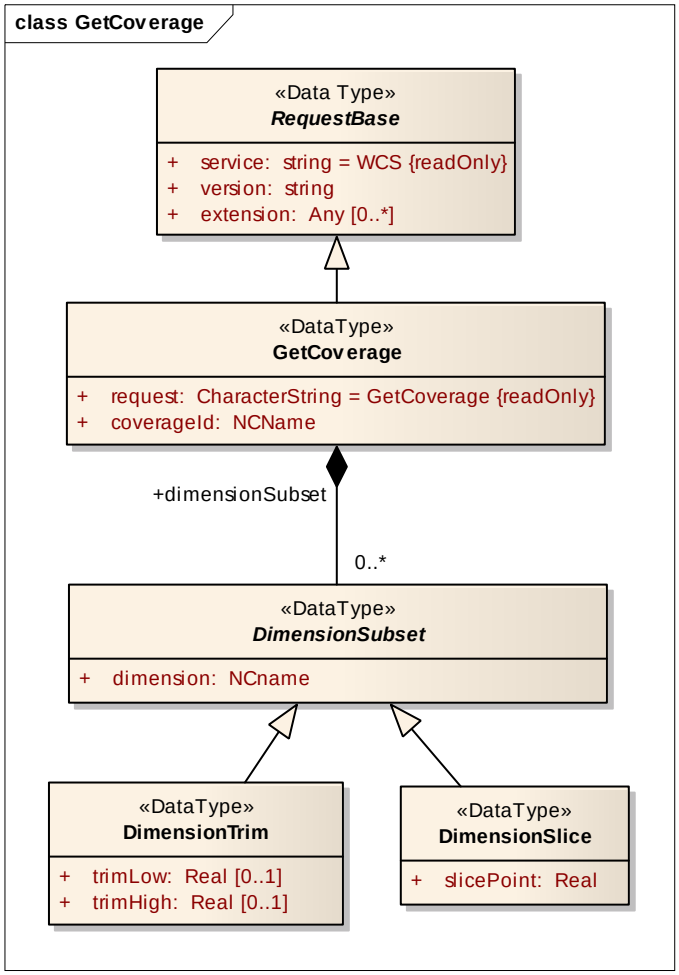

Figure 10 — `GetCoverage` operation request UML class diagram

Table 14 — WCS `GetCoverage` operation request

Name	Definition	Data type	Multiplicity
`service`	Service identifier	`String`,	one

		fixed to “WCS”	(mandatory)
version	WCS service version indicator	String, fixed to a pattern of three dot-separated decimal digits	one (mandatory)
extension	Any ancillary information to be sent from client to server	Any	zero or more (optional)
coverageId	Identifier of coverage evaluated	NCName	One (mandatory)
dimension-Subset	Subsetting specifications, one per subsetting dimension	DimensionSubset	Zero or more (optional)

Requirement 26 /req/core/getCoverage-request-valid-identifier:
The id parameter value in a *GetCoverage* request **shall** be equal to the identifier of one of the coverages offered by the server addressed.

Subsetting in the core is defined only on point coverages, that is: coverages of type GML-COV::GridCoverage , GMLCOV::RectifiedGridCoverage, GMLCOV::ReferenceableGridCoverage and GMLCOV::MultiPointCoverage.

NOTE Extensions may specify subsetting on additional coverage types.

Requirement 27 /req/core/getCoverage-request-subsetting-type:
If a *GetCoverage* request contains a dimensionSubset component then the id parameter in the request **shall** refer to a coverage on the server which is of one of the following subtypes of GMLCOV::Coverage: GMLCOV:GridCoverage , GMLCOV:RectifiedGridCoverage, GMLCOV:ReferenceableGridCoverage, GMLCOV:MultiPointCoverage.
Dependency: http://www.opengis.net/spec/GMLCOV/1.0/conf/gml-coverage

The DomainSubset structure consists of a set of subsetting specifications for the coverage’s dimensions. The corresponding class, DimensionSubset, is described in Table 15.

Table 15 — WCS DimensionSubset structure

Name	Definition	Data type	Multiplicity
Dimension	Name of dimension along which to subset	NCName	One (mandatory)

Subsetting in this Core is evaluated against the gml:Envelope element contained in the boundedBy element of a coverage. No CRS parameter is foreseen in the Core *GetCoverage* request; subsetting coordinates are always interpreted as being relative to the CRS in which the gml:Envelope coordinates are expressed; this CRS is listed in the srsName attribute of the gml:Envelope.

NOTE This CRS is always present as per Requirement 2.

Subsetting dimension names refer to the coverage's dimension names as listed in the `gml:SRSInformationGroup` of the coverage's `gml:Envelope`.

Requirement 28 /req/core/getCoverage-request-valid-dimension:
Every `dimension` value in a *GetCoverage* request **shall** be equal to one of the `axisLabels` dimension names specified in the `gml:SRSInformationGroup` of the coverage's `gml:Envelope`, unless the server offers a WCS CRS extension which overrides this requirement.
Dependency: [OGC 07-036] Clause 10 http://www.opengis.net/doc/GML/3.2/clause/10

NOTE GML [OGC 07-036] states in schema file geometryBasic0d1d.xsd: "The attribute axisLabels is an ordered list of labels for all the axes of this CRS. The gml:axisAbbrev value should be used for these axis labels, after spaces and forbidden characters are removed."

In one single GetCoverage request, subsetting can be done at most once for every axis.

Requirement 29 /req/core/getCoverage-request-no-duplicate-dimension:
A *GetCoverage* request **shall** contain at most one subsetting operation for each of the dimensions of the coverage addressed.

Depending on whether the `DimensionSubset` is a trim or slice operation, its corresponding subclasses are `DimensionTrim` and `DimensionSlice`, as shown in Table 16 and Table 17.

Table 16 — WCS `DimensionTrim` structure

Name	Definition	Data type	Multiplicity
`trimLow`	Lower bound of cutout along dimension	`Real`	Zero or one (optional)
`trimHigh`	Upper bound of cutout along dimension	`Real`	Zero or one (optional)

Requirement 30 /req/core/getCoverage-request-trim-within-extent:
Let the extent of the coverage's `gml:Envelope` along the dimension specified in the trim request range from `L` to `H`. Then, for the trim bounds `trimLow` and `trimHigh` the following **shall** hold: $L \le trimLow \le trimHigh \le H$.

Table 17 — WCS `DimensionSlice` structure

Name	Definition	Data type	Multiplicity
`slicePoint`	Slicing point along dimension	`Real`	One (mandatory)

Requirement 31 /req/core/getCoverage-request-slice-within-extent:
For an extent `L` to `H` of the input coverage along the given dimension, the slicing position, `slicePoint`, **shall** be $L \le slicePoint \le H$.

NOTE Extensions to this core may add further functionality, including further parameters required to invoke such functionality.

8.4.2 GetCoverage response

8.4.2.1. General coverage response structure

The response to a successful *GetCoverage* request is a coverage as per [OGC 09-146r1].

Requirement 32 /req/core/getCoverage-response-structure:
The contents of the response to a successful *GetCoverage* request **shall** be a concrete subtype of `AbstractCoverage`.
Dependency: http://www.opengis.net/spec/GMLCOV/1.0/conf/gml-coverage

Further, the response is expected to be a data structure whose type is the same subtype of `gmlcov:AbstractCoverage` as the requested coverage has, unless the server offers a WCS extension which overrides this requirement.

NOTE As the latter cannot be tested it is not phrased as a formal requirement.

Requirement 33 /req/core/getCoverage-response-encoding:
The contents of the response to a successful *GetCoverage* request **shall** be encoded as specified in one of the coverage format extensions supported, with the coverage information contents being consistent with the requirements stated in this WCS Core.

NOTE This WCS Core and [OGC 09-146r1] refer to the `DataBlock` choice in the `gmlcov:rangeSet` component in the response to a successful *GetCoverage* request. This GML encoding is solely used for the purpose of defining the response semantics. It does not exclude that a server delivers a result coverage in some other format (defined by a WCS format extension, see Clause 9), and it does not even mandate that a server supports this concrete GML encoding. However, it is required that result coverages, regardless of what the encoding chosen is, have a contents which is consistent with the above specification.

8.4.2.2. Complete coverage retrieval

In this Subclause, retrieval of a complete coverage is described. This is the case whenever neither trimming nor slicing is specified in the corresponding *GetCoverage* request.

Requirement 34 /req/core/getCoverage-response-contents:
The response to a successful *GetCoverage* request with coverage identifier *`id`* **shall** consist of the `coverage` component of the `OfferedCoverage` identified by *`id`*, unless the server supports a WCS extension which overrides this requirement.

NOTE This states that a complete coverage retrieval returns the coverage identified. One deviation from this is specified by the WCS extension handling range subsetting; it changes this Requirement in a way that, for each coverage cell, also part of its range values can be retrieved.

Example Assume an unrectified, unreferenced grid coverage with two dimensions *Lat* and *Long*, extent [1:3,1:5], and a single integer-valued field, *singleBand*. The response to a *GetCoverage* request selecting this whole coverage could be like this:

```
<?xml version="1.0" encoding="UTF-8"?>
<gmlcov:GridCoverage xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance'
   xmlns:gml='http://www.opengis.net/gml/3.2'
   xmlns='http://www.opengis.net/gml/3.2'
   xmlns:swe='http://www.opengis.net/swe/2.0'
   xmlns:gmlcov='http://www.opengis.net/gmlcov/1.0'
   xsi:schemaLocation='http://www.opengis.net/swe/2.0 ../sweCommon/2.0/swe.xsd
      http://schemas.opengis.net/gmlcov/1.0 ../gmlcov/1.0/gmlcovAll.xsd'
```



```
  gml:id="C0001">
  <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 >5 3</gml:upperCorner>
    </gml:GridEnvelope>
  </gml:boundedBy>
  <domainSet>
    <Grid gml:id="gr0001_C0001" dimension="2">
      <limits>
        <GridEnvelope>
          <low>1 1</low>
          <high>5 3</high>
        </GridEnvelope>
      </limits>
      <axisLabels>Lat Long</axisLabels>
    </Grid>
  </domainSet>
  <gmlcov:rangeType>
    <swe:field name="singleBand">
      <swe:Quantity definition="http://opengis.net/def/property/OGC/0/Radiance">
          <gml:description>Panchromatic Channel</gml:description>
          <gml:name>single band</gml:name>
          <swe:uom code="W/cm2"/>
          <swe:constraint>
            <swe:AllowedValues>
              <swe:interval>0 255</swe:interval>
              <swe:significantFigures>3</swe:significantFigures>
            </swe:AllowedValues>
          </swe:constraint>
        </swe:Quantity>
    </swe:field>
  </gmlcov:rangeType>
  <gml:rangeSet>
    <DataBlock>
      <rangeParameters/>
      <tupleList>
        1  2  3  4  5
        6  7  8  9  10
        11 12 13 14 15
      </tupleList>
    </DataBlock>
  </gml:rangeSet>
</gmlcov:GridCoverage>
```

8.4.2.3. Single Dimension Trimming

In this Subclause, the *GetCoverage* response is defined for the case that one trimming is included in the request and no slicing.

For trimming a coverage in a particular dimension, the corresponding dimension name is indicated as well as the lower and upper bound of the resulting coverage. Both lower and upper bound are optional. A lower bound omitted shall be substituted in the server by the coverage's lower bound in the dimension on hand, an upper bound omitted shall be substituted in the server by the coverage's upper bound. The result coverage shall contain only

those range values of the original coverage which lie within the effective lower and upper bound, obtained as described.

Let

id be the coverage identifier specified in the *GetCoverage* request;
dname be the dimension name specified in the trim request parameter;
tLow and *tHigh* be the `trimLow` and `trimHigh` parameter, resp., in the request, if provided

where

the coverage addressed is of type `gmlcov:GridCoverage`, `gmlcov:Rectified-GridCoverage`, `gmlcov:ReferenceableGridCoverage`, or `gmlcov:Multi-PointCoverage`.

Let further

c be the `OfferedCoverage` of the server addressed;

low = *tLow* if specified in the request, otherwise *low* is set to the coverage's lower bound in dimension *dname*;

high = *tHigh* if specified in the request, otherwise *high* is set to the coverage's upper bound in dimension *dname*;

B be an envelope equal to the domain of *c*, except that in dimension *dname* the extent is given by the closed interval [*low,high*];

Then, the following requirement holds:

Requirement 35 /req/core/getCoverage-response-trimming:
The response to a successful *GetCoverage* request on coverage identifier *id* of admissible type containing no slicing and exactly one trimming operation with dimension name *dname*, lower bound parameter evaluating to *low*, and upper bound parameter evaluating to *high* **shall** be a coverage identical to *c*, but with extent *B* and containing all points of *c* with location inside *B*, and no other points.

8.4.2.4. Single Dimension Slicing

In this Subclause, the *GetCoverage* response is defined for the case that slicing in one dimension is included in the request and no trimming.

Let

id be the coverage identifier specified in the *GetCoverage* request;
dname be the dimension name specified in the slice request parameter;
s be the `slicePoint` request parameter

where

the coverage addressed is of type `gmlcov:GridCoverage`, `gmlcov:RectifiedGridCoverage`, `gmlcov:ReferenceableGridCoverage`, or `gmlcov:MultiPointCoverage`.

Let further

c be the `OfferedCoverage` of the server addressed;

B be an envelope equal to the domain of *c*, except that in dimension *dname* the extent is given by the closed interval `[s,s]`.

Then, the following requirement holds:

Requirement 36 /req/core/getCoverage-response-slicing:
The response to a successful *GetCoverage* request on coverage identifier *id* of admissible type containing no trimming and exactly one slicing operation with dimension name *dname*, and slice point *s* **shall** be a coverage identical to *c*, but containing exactly those cells from *c* which lie within *B*, with dimension *dname* removed from both the coverage's domain set and all of the coverage's cell coordinate positions, with the number of dimensions of the result coverage set to the number of dimensions *c* minus 1.

NOTE In this WCS Core, no further details are required on the CRS of the result coverage; that is left to a CRS extension. The only (implicit) requirement is that the result be a complete, consistent coverage in the sense of GML and [OGC 09-146r1], which induces a CRS definition consistent with the domain of the result coverage.

8.4.2.5. Multiple and Mixed Subsetting

A *GetCoverage* request may contain several subsetting operations; trimming and slicing operations may be combined in a single request in any sequence.

Requirement 37 /req/core/getCoverage-response-multiple-subsetting:
The response to a *GetCoverage* request containing multiple `dimensionSubset` elements **shall** be identical to applying the evaluation steps in Subclauses 8.4.2.3 and 8.4.2.4 to the coverage addressed in any sequence.

8.4.3 GetCoverage exceptions

Requirement 38 /req/core/getCoverage-exception-noSuchCoverage:
When a WCS server encounters an error while performing a *GetCoverage* operation it **shall** return an exception report message chosen as follows:
- if the error occurs while performing some extension functionality:
  an exception as specified by the respective extension;
- otherwise, if an error occurs which is described in column "meaning of exception code" in Table 18:
  the corresponding exception as listed in Table 18;
- otherwise:
  an exception as specified in Clause 8 of [OGC 06-121r9].

For each listed `exceptionCode`, the contents of the `locator` parameter value **shall** be as specified in the right column of Table 18.
Dependency: [OGC 06-121r9] Clause 8 (http://www.opengis.net/doc/OWS/2.0/clause/8)

Table 18 — Exception codes for `GetCoverage` operation

`exceptionCode` value	HTTP code	Meaning of exception code	`locator` value
`NoSuchCoverage`	404	The identifier passed does not match with any of the coverages offered by this server	list of violating coverage identifiers
`InvalidAxisLabel`	404	The dimension subsetting operation specified an axis label that does not exist in the Envelope or has been used more than once in the *GetCoverage* request	List of violating dimension names
`InvalidSubsetting`	404	Operation request contains an invalid subsetting value; either a trim or slice parameter value is outside the extent of the coverage or, in a trim operation, a lower bound is above the upper bound	Name of parameter with invalid value

8.5 Information Coherence

Coverages are uniquely identified within a service through their `coverageId` identifier – in other words, the information which a service delivers with respect to a given coverage identifier through any of the request types specified in this document shall depend only on the value of this identifier. The identifier's property of being the link between the request types has been established in requirements Requirement 18 and Requirement 26.

Additionally, addressing a coverage by its identifier through different WCS Core request types shall deliver the same information with respect to the common parts.

Requirement 39 /req/core/information-coherence:
For every coverage identifier returned in a *GetCapabilities* response, *DescribeCoverage* and *GetCoverage* requests on such an identifier **shall** always deliver information about the same `OfferedCoverage` object.

NOTE The above holds as long as the service offering is unchanged. The service offering can be updated at any time, though, through successful WCS-T requests, updates by the service operator, for example.

Identifiers of coverages offered by a WCS server **shall** be immutable over the lifetime of the coverage identified, and not be reused for any other coverage offered by this service in future.

NOTE As this requirement cannot be stated formally for conformance testing based on the WCS request types only, it is not expressed as a requirement.

9 Extensions

The specification contained in this WCS Core is not sufficient for a WCS implementation. In this Clause, the additional specifications are listed which, together with the core, constitute a specification of a minimal WCS-conformant implementation. These specifications are contained in WCS extension standards.

A client can verify implementation of such an extension in a server by evaluating the URIs delivered in the `Profile` elements of a *GetCapabilities* response (see Clause 8.2.2).

In the sequel, extensions are listed which WCS implementations are required to support.

9.1 Index-based subsetting

On grid coverages, access by array index coordinates is required.

Requirement 40 /req/core/index-subsetting:
If a WCS implementation offers coverages of type `GMLCOV::GridCoverage` , `GMLCOV::RectifiedGridCoverage`, or `GMLCOV::ReferenceableGridCoverage` then it **shall** support the extension for indexed subsetting, which has URI identifier `http://www.opengis.net/spec/WCS_service-model_index-subsetting/1.0` .

NOTE This way, clients can subset coverages in two independent ways, either by indicating coordinates in the CRS named in the `srsName` attribute of the coverage's `gml:Envelope` or by using grid coordinates (sometimes referred to as "ImageCRS" coordinates) as specified in the coverage's `gml:Grid`.

9.2 Protocol binding

For communication between client and server, at least one protocol extension is required to be implemented by both.

Requirement 41 /req/core/protocol-extension:
For the transmission of all operation requests and responses, WCS implementations **shall** support at least one WCS protocol extension, that is: an extension whose URI starts with `http://www.opengis.net/spec/WCS_protocol-binding_`

Example The GET/KVP protocol encoding version 1.0 for WCS Core 2.0 is defined by URI `http://www.opengis.net/spec/WCS_protocol-binding_get-kvp/1.0`

NOTE As there is no canonical practice among and within communities dealing with coverages to use one particular protocol none of the protocols specified in WCS extensions is mandatory. In practice, this may lead to a lack of interoperability between client and server implementations. In future user communities might agree eventually to make on particular protocol binding mandatory.

9.3 Coverage encoding formats

For the transfer of coverage-valued results from server to client, at least one coverage format encoding extension is required to be implemented by both.

Requirement 42 /req/core/format-extension:
For transmission of *GetCoverage* responses, WCS implementations **shall** support the `coverage-encoding` conformance class of the Coverage Format Extension, that is: the conformance class with URI `http://www.opengis.net/spec/WCS_coverage-encoding/1.0/conf/coverage-encoding`.

NOTE The conformance class mentioned specifies alternatives to return a coverage either as pure GML, in some well-known data format (such as GeoTIFF), or as a GML envelope plus a separate file encoded in some well-known coverage data format.

Bibliography

[1] OGC 07-067r5, *Web Coverage Service Implementation Standard*, version 1.1.2

[2] OGC 07-068r4, *Web Coverage Service (WCS) – Transaction operation extension*, version 1.1.4

[3] OGC 08-059r3, *Web Coverage Service (WCS) – Processing extension*, version 1.0.0

[4] OGC 04-094, *Web Feature Service (WFS) Implementation Specification*, version 1.1.0

[5] OGC 06-042, *Web Map Service (WMS) Implementation Specification*, version 1.3.0

[6] OGC 09-153, *WCS 2.0 Overview: Core and Extensions*, version 1.0.0

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

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

Annex A
(normative)

Abstract test suite

A WCS implementation must satisfy the following system characteristics to be conformant with this specification.

A.1 Conformance Test Class: core

The OGC URI identifier of this conformance class is:
http://www.opengis.net/spec/WCS/2.0/conf/core.

Tests identifiers below are relative to http://www.opengis.net/spec/WCS/2.0/.

A.1.1 Coverage structure contains Envelope

Test id: **/conf/core/structure-with-boundedBy**

Test Purpose: **Requirement /req/core/structure-boundedBy**:
The `coverage` element of every `gmlcov:OfferedCoverage` **shall** contain a valid `gml:boundedBy` element.

Test method: For all coverages offered by the server under test, retrieve coverage information via both *DescribeCoverage* and *GetCoverage* operations. Verify that both responses contain a `gml:Envelope`, and that both responses contain the same information. Test passes if all individual tests pass.

A.1.2 Coverage structure contains srsName

Test id: **/conf/core/structure-with-srsName**

Test Purpose: **Requirement /req/core/structure-with-srsName**:
The `srsName` attribute in the `gml:Envelope` element of a `gmlcov:OfferedCoverage` **shall** not be empty.

Test method: For all coverages offered by the server under test, retrieve `gml:domainSet` information through either *DescribeCoverage* or *GetCoverage* requests. Verify that the `srsName` attribute refers to a valid CRS definition, and is the same in both responses. Test passes if all individual tests pass.

A.1.3 Coverage structure contains axisLabels

Test id: **/conf/core/structure-with-axisLabels**

Test Purpose: **Requirement /req/core/structure-with-axisLabels:**
The `axisLabels` attribute in the `gml:Envelope` element of a `gmlcov:OfferedCoverage` **shall** not be empty.

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

Test method: For all coverages offered by the server under test, retrieve `gml:domainSet` information through both *DescribeCoverage* and *GetCoverage* requests. Verify that the `srsName` attribute refers to a valid CRS definition, and is the same in both responses. Test passes if all individual tests pass.

A.1.4 Coverage element name dictionary

Test id: **/conf/core/coverageSubtype-content**

Test Purpose: **Requirement /req/core/coverageSubtype-content:**
The `coverageSubtype` in the `ServiceParameters` of an `OfferedCoverage` **shall** indicate the coverage's type.

Test method: Send a *GetCapabilities* request to the server under test.

For each coverage identifier delivered:

- If GML is supported by the server as a coverage encoding format:
  - Send a *GetCoverage* request (with or without subsetting) indicating output format GML.
  - Verify that the root element of the coverage returned is equal to the coverage's `coverageSubtype` value as delivered through *GetCapabilities*.
- Otherwise, if a coverage encoding format is supported by the server which allows to extract the coverage type:
  - Send a *GetCoverage* request (with or without subsetting) indicating said output format.
  - Verify that the coverage type returned is equal to the coverage's `coverageSubtype` value as delivered through *GetCapabilities*.
- Otherwise:
  - Do nothing (property cannot be tested).

Overall test passes if all individual tests pass.

A.1.5 Coverage element name lookup

Test id: **/conf/core/coverageSubtype-reference**

Test Purpose: **Requirement /req/core/coverageSubtype-reference:**
The content model definition of the coverage type referenced in the `coverageSubtype` in the `ServiceParameters` of an `OfferedCoverage` **shall** either be normatively referenced by this WCS Core or by a WCS extension requirements class supported by the server.

Test method: Send a *GetCapabilities* request to the server under test.

For each `coverageSubtype` reported check that one of the following holds:

- Its value is equal to one of the (non-abstract) coverage types defined in the GML Application Schema for Coverages [OGC 09-146r1].
- Its value is equal to a coverage type defined in a WCS extension, the associated conformance class for which has been included in the `ows:Profiles` of the server's *GetCapabilities* response.

Overall test passes if all individual tests pass.

A.1.6 `ServiceMetadata` structure

Test id: **/conf/core/serviceMetadata-structure**

Test Purpose: **Requirement /req/core/serviceMetadata-structure:**
The `ServiceMetadata` structure shall adhere to Figure 3 and Table 5.

Test method: Send a valid *GetCapabilities* request to the service under test. Verify that the result contains an XML subtree of type `ServiceMetadata`.

A.1.7 *GetCapabilities*: `Profile` lists valid external conformance classes

Test id: **/conf/core/conformance-class-in-profile**

Test Purpose: **Requirement /req/core/conformance-class-in-profile:**
Each element in the `Profile` list of the `ServiceMetadata` **shall** be the identifier of an OGC Interface Standard conformance class.

Test method: Send a valid *GetCapabilities* request to the service under test; for each `ows:Profile` element listed in the response, check that the corresponding conformance class exists and, if so, perform its conformance tests in completeness. Test passes if all conformance classes listed exist and each check succeeds completely.

A.1.8 *GetCapabilities* response contents: OperationsMetadata

Test id: **/conf/core/operationsMetadata**

Test Purpose: **Requirement /req/core/operationsMetadata:**
The `OperationsMetadata` component **shall** contain three `Operation` instances with case-sensitive `name` values "GetCapabilities", "DescribeCoverage", and "GetCoverage", respectively.

Test method: Send a *GetCapabilities* request to the service under test; for each operation listed in the `OperationsMetadata` part of the response (if this part is present), send a valid request. Check that these requests do not result in exceptions. Test passes if all checks are successful.

A.1.9 Request base

Test id: **/conf/core/requestbase**

Test Purpose: **Requirement /req/core/requestbase:**
All WCS request types shall be a subtype of `RequestBase`.

Test method: For each request type, send valid requests to server under test. Verify that all parameters defined in `RequestBase` are mandatory.

Overall test passes if all individual tests pass.

A.1.10 Service name

Test id: **/conf/core/service-name**

Test Purpose: **Requirement** NOTE This applies not only to the request types in the Core, but to any request type supported by the service on hand.

/req/core/service-name:
For all WCS request types, the request `service` parameter **shall** have a fixed value of "WCS".

Test method: For each request type, send valid requests to server under test. Modulate `request` parameter:

- Parameter value equal to what is required. Verify that request succeeds.
- Parameter value not equal to what is required. Verify that request fails.

Overall test passes if all individual tests deliver the result expected.

A.1.11 Version value

Test id: **/conf/core/version-number**

Test Purpose: **Requirement** /req/core/version-number:
For all WCS request types, the request version parameter shall have a fixed value of "2.0".

Test method: For each request type, send valid requests to server under test. Modulate `version` parameter:

- Parameter value equal to what is required. Verify that request succeeds.
- Parameter value not equal to what is required. Verify that request fails.

Overall test passes if all individual tests deliver the result expected.

A.1.12 Correct *GetCapabilities* request structure

Test id: **/conf/core/getCapabilities**

Test Purpose: **Requirement /req/core/getCapabilities:**
A *GetCapabilities* request **shall** consist of a `GetCapabilities` structure as defined in Figure 5 and Table 7.

Test method: Send *GetCapabilities* requests with valid and invalid request structure. Pass test if appropriate valid results or exceptions, resp., are delivered.

A.1.13 Correct *GetCapabilities* response structure

Test id: **/conf/core/wcsServiceMetadata-structure**

Test Purpose: **Requirement /req/core/wcsServiceMetadata-structure:**
The response to a successful *GetCapabilities* request **shall** consist of a `Capabilities` structure as defined in Figure 6, Table 8, Figure 7, and Table 9.

Test method: Send a valid *GetCapabilities* request to the server under test, check the result consists of an XML document of type `Capabilities` and the appropriate components, as defined in the places referenced.

A.1.14 *GetCapabilities* response contents: service metadata

Test id: **/conf/core/wcsServiceMetadata-contents**

Test Purpose: **Requirement /req/core/wcsServiceMetadata-contents:**
If present in the response to a successful *GetCapabilities* request, the `Contents` section **shall** be populated as specified by OWS Common [OGC 06-121r9].
Dependency: [OGC 06-121r9] Clause 7 (http://www.opengis.net/doc/OWS/2.0/clause/7)

Test method: Test the referenced conformance class of OWS Common [OGC 06-121r9]. Test passes if the conformance test passes in completeness.

A.1.15 *GetCapabilities* response contents: CoverageSummary

Test id: **/conf/core/operationsMetadata**

Test Purpose: **Requirement /req/core/coverageSummary:**
In the response to a successful *GetCapabilities* request containing a `CoverageSummary` section, each coverage identifier listed **shall** refer to a coverage offered by the server.

Test method: Send a *GetCapabilities* request to the service under test. If a `wcs:CoverageSummary` section is contained in the response then send, for each coverage identifier listed, a valid *DescribeCoverage* request. Check that none of these requests results in an exception. Test passes if all checks are successful.

A.1.16 DescribeCoverage supported

Test id: **/conf/core/describeCoverage**

Test Purpose: **Requirement /req/core/describeCoverage:**
Every WCS server **shall** offer the *DescribeCoverage* operation.

Test method: Send a valid *DescribeCoverage* request and check that the result is not an exception.

A.1.17 Correct *DescribeCoverage* request structure

Test id: **describeCoverage-request-structure**

Test Purpose: **Requirement /req/core/describeCoverage-request-structure:**
A *DescribeCoverage* request **shall** consist of a structure as defined in Figure 8 and Table 10.

Test method: Send *DescribeCoverage* requests with valid and invalid request structure. Pass test if appropriate valid results or exceptions, resp., are delivered.

A.1.18 Valid coverage identifiers in *DescribeCoverage* request

Test id: **/conf/core/describeCoverage-valid-identifier**

Test Purpose: **Requirement /req/core/describeCoverage-valid-identifier:**
Each coverage identifier in the list submitted in a *DescribeCoverage* request **shall** identify a `wcs:OfferedCoverage` object available on the server addressed.

Test method: Send *DescribeCoverage* requests with more than one id to server under test where

- All coverages exist
- At least one exists, and at least one does not exist
- None of the coverages exist.

Pass test if appropriate valid results or exceptions, resp., are delivered.

A.1.19 Correct *DescribeCoverage* response structure

Test id: **/conf/core/describeCoverage-response-structure**

Test Purpose: **Requirement /req/core/describeCoverage-response-structure:**
The response to a successful *DescribeCoverage* request **shall** consist of a `CoverageDescriptions` as described in Figure 9, Table 11, and Table 12.

Test method: For all coverages offered by the server under test, send a *DescribeCoverage* request to server under test, check the result consists of an XML document of type `CoverageDescriptions` as described in the references stated by the requirement. Test passes if all individual tests pass.

A.1.20 *DescribeCoverage* returns information on all coverages requested

Test id: **/conf/core/describeCoverage-response-list-size**

Test Purpose: **Requirement /req/core/describeCoverage-response-list-size:**
The response to a successful *DescribeCoverage* request with $n>0$ coverage identifiers **shall** be a list containing n items.

Test method: Obtain the list of coverage identifiers by sending a valid *GetCapabilities* request to the server under test. Send *DescribeCoverage* requests with a (non-empty) subset of the list and with the complete identifier list. Check that the response list matches the request list in size.

A.1.21 Correct *DescribeCoverage* response contents

Test id: **/conf/core/describeCoverage-response-contents**

Test Purpose: **Requirement /req/core/describeCoverage-response-contents:**
The response to a successful *DescribeCoverage* request containing $n>0$ identifiers id_1, …, id_n **shall** contain, at position *i* in the response list, a `wcs:coverageDescription` consisting of a copy of the identified coverage's metadata, that is: the complete `wcs:CoverageOffering` information minus the coverage `rangeSet`.
Dependency: http://www.opengis.net/spec/GMLCOV/1.0/conf/gml-coverage

Test method: Obtain the list of coverage identifiers by sending a valid *GetCapabilities* request to the server under test. Send *DescribeCoverage* requests with a (non-empty) subset of the list and with the complete identifier list. Check responses whether they fulfill the requirement for each coverage description returned.

A.1.22 DescribeCoverage srsName value

Test id: **/conf/core/describeCoverage-response-srsName**

Test Purpose: **Requirement /req/core/describeCoverage-response-srsName:**
If a geometric or temporal object in the `domainSet` of a `coverageDescription` specifies an `srsName` attribute, the value of this attribute **shall** be identical to the `srsName` attribute of the `boundedBy` element of the containing `coverageDescription`.

Test method: Send *DescribeCoverage* requests containing an identifier of a coverage on the server under test which contains an `srsName` attribute value in its `coverageDescription`. Check that, in the response, both `srsName` values addressed in the requirement are equal. Pass test if check succeeds.

A.1.23 DescribeCoverage exceptions

Test id: **/conf/core/describeCoverage-exceptions**

Test Purpose: **Requirement /req/core/describeCoverage-exceptions:**
When a WCS server encounters an error while performing a *DescribeCoverage* operation it **shall** return an exception report message chosen as follows:
- if the error occurs while performing some extension functionality: an exception as specified by the respective extension;
- otherwise, if an error occurs which is described in column "meaning of exception code" in Table 13: the corresponding exception as listed in Table 13;
- otherwise:

an exception as specified in Clause 8 of [OGC 06-121r9].
For each listed `exceptionCode`, the contents of the `locator` parameter value **shall** be as specified in the right column of Table 13.
Dependency: [OGC 06-121r9] Clause 8
(http://www.opengis.net/doc/OWS/2.0/clause/8)

Test method: For each exception referenced in the requirement: Send an erroneous *DescribeCoverage* request to the server under test provoking this exception, as per its definition. Check for proper exception reporting. Pass test if all checks succeed.

A.1.24 GetCoverage supported

Test id: **/conf/core/getCoverage**

Test Purpose: **Requirement /req/core/getCoverage:**
Every WCS implementation **shall** support the *GetCoverage* operation.

Test method: Send a valid *GetCoverage* request to the server under test and check that the response is not an exception.

A.1.25 *GetCoverage* request structure

Test id: **/conf/core/getCoverage-request-structure**

Test Purpose: **Requirement /req/core/getCoverage-request-structure:**
A *GetCoverage* request **shall** consist of a structure as defined in Figure 10, Table 14, Table 15, Table 16, and Table 17.
Dependency: [OGC 06-121r9] Clause 7
(http://www.opengis.net/doc/OWS/2.0/clause/7)

Test method: Send a valid *GetCoverage* request to server under test which conforms to the references in the requirement. Check that the response is not an exception.

A.1.26 *GetCoverage* request addresses existing coverage

Test id: **/conf/core/getCoverage-request-valid-identifier**

Test Purpose: **Requirement /req/core/getCoverage-request-valid-identifier:**
The `id` parameter value in a *GetCoverage* request **shall** be equal to the identifier of one of the coverages offered by the server addressed.

Test method: Send valid *GetCoverage* requests to server under test addressing existing and non-existing coverages, resp. Check if appropriate results or exceptions, resp., are delivered.

A.1.27 *GetCoverage* subsetting: allowed coverage types

Test id: **/conf/core/getCoverage-request-subsetting-type**

Test Purpose: **Requirement /req/core/getCoverage-request-subsetting-type:**
If a *GetCoverage* request contains a `dimensionSubset` component then the `id` parameter in the request **shall** refer to a coverage on the server which is of one of the following subtypes of `GMLCOV::Coverage`: `GMLCOV:GridCoverage` , `GMLCOV:RectifiedGridCoverage`, `GMLCOV:ReferenceableGridCoverage`, `GMLCOV:MultiPoint-Coverage`.

Test method: Send valid *GetCoverage* subsetting requests on all coverages on the server on hand. Check that for the disallowed subtypes an exception is returned and for the allowed subtypes a non-exception response.

A.1.28 *GetCoverage* request parameter `dimension`

Test id: **/conf/core/getCoverage-request-valid-dimension**

Test Purpose: **Requirement /req/core/getCoverage-request-valid-dimension:**
Every `dimension` value in a *GetCoverage* request **shall** be equal to one of the `axisLabels` dimension names specified in the `gml:SRSInformationGroup` of the coverage's `gml:Envelope`, unless the server offers a WCS CRS extension which overrides this requirement.

Test method:

- If a CRS extension is implemented by the server under test which overrides this requirement:

  Do nothing.

- Otherwise:

  Send otherwise valid *GetCoverage* requests with all `dimension` values appearing in the `axisLabel` of the coverage addressed, with some of the `dimension` values appearing there, and with none of the dimension names provided appearing there. Verify that coverage response is returned if an only if `dimension` occurring in the `axisLabel` attribute are used, and an exception is reported otherwise.

A.1.29 No duplicate dimension subsetting in *GetCoverage*

Test id: **/conf/core/getCoverage-request-no-duplicate-dimension**

Test Purpose: **Requirement /req/core/getCoverage-request-no-duplicate-dimension:**
A *GetCoverage* request **shall** contain at most one subsetting operation for each of the dimensions of the coverage addressed.

Test method: Send otherwise valid *GetCoverage* requests to server under test which contain duplicate, and send requests which contain no duplicate `dimension` names. Do so for requests with single, multiple, and mixed subsetting. Verify that, whenever at least one duplicate `dimension` occurs, an exception is returned and a normal response otherwise.

A.1.30 *GetCoverage* trimming within coverage limits

Test id: **/conf/core/getCoverage-request-trim-within-extent**

Test Purpose: **Requirement /req/core/getCoverage-request-trim-within-extent:**
Let the extent of the coverage's `gml:Envelope` along the dimension specified in the trim request range from `L` to `H`. Then, for the trim bounds `trimLow` and `trimHigh` the following **shall** hold: `L` ≤ `trimLow` ≤ `trimHigh` ≤ `H`.

Test method: Send otherwise valid *GetCoverage* requests with matching and with violating trimming positions to server under test. Check if appropriate results are returned if and only if the requirement is fulfilled, and an exception otherwise. Pass test if all checks succeed.

A.1.31 *GetCoverage* slicing within coverage limits

Test id: **/conf/core/getCoverage-request-slice-within-extent**

Test Purpose: **Requirement /req/core/getCoverage-request-slice-within-extent:**
For an extent `L` to `H` of the input coverage along the given dimension, the slicing position, `slicePoint`, **shall** be `L` ≤ `slicePoint` ≤ `H`.

Test method: Send otherwise valid *GetCoverage* requests with matching and with violating slicing positions to server under test. Check if appropriate results are returned if and only if the requirement is fulfilled, and an exception otherwise. Pass test if all checks succeed.

A.1.32 *GetCoverage* response structure

Test id: **/conf/core/getCoverage-response-structure**

Test Purpose: **Requirement /req/core/getCoverage-response-structure:**
The contents of the response to a successful *GetCoverage* request **shall** be a concrete subtype of `AbstractCoverage`.

Test method: For each coverage offered by the server on hand, send a valid *GetCoverage* request to server under test. Check that the result validates against `gmlcov:AbstractCoverage`. Test passes if all individual tests pass.

A.1.33 Correct coverage representation in *GetCoverage* result

Test id: **/conf/core/getCoverage-response-encoding**

Test Purpose: **Requirement /req/core/getCoverage-response-encoding:**
The contents of the response to a successful *GetCoverage* request **shall** be encoded as specified in one of the coverage format extensions supported, with the coverage information contents being consistent with the requirements stated in this WCS Core.

Test method: For each coverage encoding format (i.e., format encoding extension) supported by the server under test: Send a valid *GetCoverage* request to retrieve a coverage in this format. Check that the result is a valid instance of the format indicated. Do so for both complete and subsetted coverages. Pass test if all checks succeed.

A.1.34 Correct coverage contents in *GetCoverage* result

Test id: **/conf/core/getCoverage-response-contents**

Test Purpose: **Requirement /req/core/getCoverage-response-contents:**
The response to a successful *GetCoverage* request with coverage identifier *`id`* **shall** consist of the `coverage` component of the `OfferedCoverage` identified by *`id`*, unless the server supports a WCS extension which overrides this requirement.

Test method: For all coverage types supported for all coverage types supported and for all coverage encoding formats (i.e., format encoding extension) supported by the server under test:

- Perform two *GetCoverage* requests on the same coverage where the request envelopes contain a non-empty overlap. If the coverage type supports subsetting then include trim and slice operations in the coverage requests, otherwise retrieve the complete coverage twice.
- For all locations present in both coverage responses (i.e., for all locations in the overlap region) check that corresponding locations in both response coverages have identical values.

Test passes if all comparison reveal equality.

A.1.35 *GetCoverage* trimming operation

Test id: **/conf/core/getCoverage-response-trimming**

Test Purpose: **Requirement /req/core/getCoverage-response-trimming:**
The response to a successful *GetCoverage* request on coverage identifier *`id`* of admissible type containing no slicing and exactly one trimming operation with dimension name *`dname`*, lower bound parameter evaluating to

low, and upper bound parameter evaluating to *high* **shall** be a coverage identical to *c*, but with extent *B* and containing all points of *c* with location inside *B*, and no other points.

Test method: Send valid *GetCoverage* requests to the server under test with a single trimming as the only subsetting operation. Check correctness of the coverage response returned. Do so up to the maximum number of dimensions supported by the server and for subsetting dimensions at any position in the list of dimensions. Pass test if all checks succeed.

A.1.36 *GetCoverage* slicing operation

Test id: **/conf/core/getCoverage-response-slicing**

Test Purpose: **Requirement /req/core/getCoverage-response-slicing:**
The response to a successful *GetCoverage* request on coverage identifier *id* of admissible type containing no trimming and exactly one slicing operation with dimension name *dname*, and slice point *s* **shall** be a coverage identical to *c*, but containing exactly those cells from *c* which lie within *B*, with dimension *dname* removed from both the coverage's domain set and all of the coverage's cell coordinate positions, with the number of dimensions of the result coverage set to the number of dimensions *c*

Test method: Send valid *GetCoverage* requests to the server under test with a single slicing as the only subsetting operation. Check correctness of the coverage response returned. Do so up to the maximum number of dimensions supported by the server and for subsetting dimensions at any position in the list of dimensions. Pass test if all checks succeed.

A.1.37 Dimension subsetting sequence invariance in *GetCoverage*

Test id: **/conf/core/getCoverage-response-multiple-subsetting**

Test Purpose: **Requirement /req/core/getCoverage-response-multiple-subsetting:**
The response to a *GetCoverage* request containing multiple `dimensionSubset` elements **shall** be identical to applying the evaluation steps in Subclauses 8.4.2.3 and 8.4.2.4 to the coverage addressed in any sequence.

Test method: Pick some combination of trimming and slicing operations on a given coverage. Construct a set of *GetCoverage* requests by building all permutations of these subsetting operations. Compare the results of all requests whether the result returned is identical. Pass test if all checks succeed.

A.1.38 *GetCoverage* exceptions

Test id: **/conf/core/getCoverage-exceptions**

Test Purpose: **Requirement /req/core/getCoverage-exception-noSuchCoverage:**
When a WCS server encounters an error while performing a *GetCoverage* operation it **shall** return an exception report message chosen as follows:
- if the error occurs while performing some extension functionality:
  an exception as specified by the respective extension;
- otherwise, if an error occurs which is described in column "meaning of exception
  code" in Table 18:
  the corresponding exception as listed in Table 18;
- otherwise:
  an exception as specified in Clause 8 of [OGC 06-121r9].

For each listed `exceptionCode`, the contents of the `locator` parameter value **shall** be as specified in the right column of Table 18.

Test method: For each exception referenced in the requirement: Send an erroneous *GetCoverage* request to the server under test provoking this exception, as per its definition. Check for proper exception reporting. Pass test if all checks succeed.

A.1.39 Information coherence across request types

Test id: **/conf/core/information-coherence**

Test Purpose: **Requirement /req/core/information-coherence:**
For every coverage identifier returned in a *GetCapabilities* response, *DescribeCoverage* and *GetCoverage* requests on such an identifier **shall** always deliver information about the same `OfferedCoverage` object.

Test method: Send a valid *GetCapabilities* request to the server under test to obtain an identifier list, *`idList`*, of the coverages offered.

For each identifier *`id`* within *`idList`*:

- Issue a valid *DescribeCoverage*, resulting in response d_{id}
- Issue a valid *GetCoverage* request retrieving the complete, unchanged coverage as specified in Subclause 8.4.2.2 (i.e., without any subsetting operation), resulting in response g_{id}
- Check if common components of d_{id} and g_{id} (as per schema) are equal

Pass test if all checks succeed.

A.1.40 Grid subsetting

Test id: **/conf/core/index-subsetting**

Test Purpose: **Requirement /req/core/index-subsetting:**
If a WCS implementation offers coverages of type `GMLCOV::GridCoverage` , `GMLCOV::RectifiedGridCoverage`, or `GMLCOV::ReferenceableGridCoverage` then it **shall** support the extension for indexed subsetting, which has URI identifier
`http://www.opengis.net/spec/WCS_service-model_index-subsetting/1.0`

Test method: Determine the list of supported extensions via a valid *GetCapabilities* request; check that the extension required is listed.

A.1.41 Protocol binding extensions

Test id: **/conf/core/protocol-extension**

Test Purpose: **Requirement /req/core/protocol-extension:**
For the transmission of all operation requests and responses, WCS implementations **shall** support at least one WCS protocol extension, that is: an extension whose URI starts with
`http://www.opengis.net/spec/WCS_protocol-binding_`

Test method: Determine the list of supported extensions via a valid *GetCapabilities* request; check that there is at least one protocol extension listed.

A.1.42 Coverage encoding format extensions

Test id: **/conf/core/format-extension**

Test Purpose: **Requirement /req/core/format-extension:**
For transmission of *GetCoverage* responses, WCS implementations **shall** support the `coverage-encoding` conformance class of the Coverage Format Extension, that is: the conformance class with URI
`http://www.opengis.net/spec/WCS_coverage-encoding/1.0/conf/coverage-encoding`

Test method: Determine the list of supported extensions via a valid *GetCapabilities* request; check that the `coverage-encoding` conformance class is listed in the response.

-- end of ATS --

