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Observations and Measurements - XML Implementation

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i. Abstract

This standard specifies an XML implementation for the OGC and ISO Observations and Measurements (O&M) conceptual model (*OGC Observations and Measurements v2.0* also published as ISO/DIS 19156), including a schema for Sampling Features. This encoding is an essential dependency for the OGC Sensor Observation Service (SOS) Interface Standard.

More specifically, this standard defines XML schemas for observations, and for features involved in sampling when making observations. These provide document models for the exchange of information describing observation acts and their results, both within and between different scientific and technical communities.

ii. Keywords

ogcdoc, o&m, observations, measurements, swe, iso_19156, sos, gml

iii. Preface

The Observations and Measurements XML Implementation standard is part of the revision and refactoring of O&M for its publication in two parts

(i) The conceptual model (in UML) is being published as ISO 19156 through ISO/TC 211, and jointly by OGC as a Topic 20 of the Abstract Specification.

(ii) The XML implementation is being published by OGC as an independent document

- in recognition of the fact that XML is only one of all the possible implementations for O&M

- to decouple maintenance of the implementation from revision of the abstract model

- to better reflect the scope of activities and publications appropriate to ISO and OGC.

iv. Submitting organizations

The following organizations submitted this Implementation Specification to the Open Geospatial Consortium Inc. as an Implementation Specification.

- a) CSIRO Australia
- b) European Commission – Joint Research Centre
- c) International Geospatial Services Institute GmbH (iGSI)
- d) interactive instruments
- e) Science and Technology Facilities Council, NERC, UK
- f) IfGI - University of Muenster
- g) SpotImage
- h) Geoscience Australia

v. Submission contact points

All questions regarding this submission should be directed to the editor or the submitters:

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Chris Body	Geoscience Australia
Christoph Stasch	IfGI

vi. Changes to the OGC[®] Abstract Specification

The OGC[®] Abstract Specification does not require changes to accommodate this OGC[®] standard.

vii. Future work

Requirements and conformance classes for coverage observations will be defined when consensus has been reached and a standard published for a comprehensive OGC/GML encoding for coverages. This may be in a revision of this document, or in a separate specification.

Foreword

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. Open Geospatial Consortium Inc. shall not be held responsible for identifying any or all such patent rights. However, to date, no such rights have been claimed or identified.

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 specification set forth in this document, and to provide supporting documentation.

Introduction

This Standard arises from work originally undertaken through the Open Geospatial Consortium's Sensor Web Enablement (SWE) activity. SWE is concerned with establishing interfaces and protocols that will enable a "Sensor Web" through which applications and services will be able to access sensors of all types, and observations generated by them, over the Web. SWE has defined, prototyped and tested several components needed for a Sensor Web, namely:

- Sensor Model Language (SensorML).
- Observations & Measurements (O&M)
- Sensor Observation Service (SOS).
- Sensor Planning Service (SPS).

The SWE Architecture is described in the OGC [Sensor Web Enablement Architecture](#) [OGC 06-021r4] Best Practice document.

Observations and Measurements - XML Implementation

1 Scope

This Standard defines an XML implementation of schemas for observations, and for features involved in sampling when making observations. These provide document models for the exchange of information describing observation acts and their results, both within and between different scientific and technical communities.

The implementation is derived from a conceptual model defined in *OGC Observations and Measurements v2.0* (also published as ISO/DIS 19156), and follows the rules for GML Application Schemas described in *OGC Geography Markup Language v3.2* (also published as ISO 19136:2007).

2 Conformance

2.1 Overview

This Standard defines an XML implementation of the conceptual models for describing observations and sampling features. The implementation is described using the XML Schema language and Schematron.

Requirements for one standardization target type are considered:

- data instances, i.e. XML documents that encode observation data for exchange;

Since data *producing* applications should generate conformant data instances, the requirements and tests described in this standard also apply to this standardization target.

NOTE: It is recognized that requirements and tests for a second standardization target type (data consuming applications, i.e. data processing software that accepts observation data as input) are also highly desirable. However, a general solution to specifying this target this is more challenging and has been deferred.

2.2 Specification identifier

All requirements-classes and conformance-classes described in this document are owned by the specification identified as <http://www.opengis.net/spec/OMXML/2.0>.

2.3 Conformance classes related to Observations and Measurements instances

The conformance rules are based on XML validation using the XML Schema representation of OMXML, together with processing of constraints expressed using Schematron assertions and reports.

Annex A defines a set of tests and conformance classes that will support various applications with a range of different requirements. 18 conformance classes are distinguished.

Table 1 — Conformance classes related Observations and Measurements instances

Conformance class	Description	Clause
http://www.opengis.net/spec/OMXML/2.0/conf/observation	Observation data	A.1
http://www.opengis.net/spec/OMXML/2.0/conf/measurement	Measurement data	A.2
http://www.opengis.net/spec/OMXML/2.0/conf/categoryObservation	Category observation data	A.3
http://www.opengis.net/spec/OMXML/2.0/conf/countObservation	Count observation data	A.4
http://www.opengis.net/spec/OMXML/2.0/conf/truthObservation	Truth observation data	A.5
http://www.opengis.net/spec/OMXML/2.0/conf/geometryObservation	Geometry observation data	A.6
http://www.opengis.net/spec/OMXML/2.0/conf/temporalObservation	Temporal observation data	A.7
http://www.opengis.net/spec/OMXML/2.0/conf/complexObservation	Complex observation data	A.8
http://www.opengis.net/spec/OMXML/2.0/conf/SWEScalarObservation	Observation data with result encoded as a SWE Common simple data component	A.9
http://www.opengis.net/spec/OMXML/2.0/req/SWEArrayObservation	Observation data with result encoded as a SWE Common block data component	A.10
http://www.opengis.net/spec/OMXML/2.0/conf/spatialObservation	Spatially keyed observation data	A.11
http://www.opengis.net/spec/OMXML/2.0/conf/sampling	Sampling feature data	A.12
http://www.opengis.net/spec/OMXML/2.0/conf/spatialSampling	Spatial sampling feature data	A.13
http://www.opengis.net/spec/OMXML/2.0/conf/samplingPoint	Sampling point data	A.14
http://www.opengis.net/spec/OMXML/2.0/conf/samplingCurve	Sampling curve data	A.15
http://www.opengis.net/spec/OMXML/2.0/conf/samplingSurface	Sampling surface data	A.16
http://www.opengis.net/spec/OMXML/2.0/conf/samplingSolid	Sampling solid data	A.17
http://www.opengis.net/spec/OMXML/2.0/conf/specimen	Specimen data	A.18

3 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Geographic information – metadata – XML implementation ISO/TS 19139:2007.

<urn:iso:TS:iso:19139>

OGC Geography Markup Language v3.2 OGC Document 07-036

<http://www.opengis.net/doc/IS/GML/3.2> (also published as ISO 19136:2007, Geographic information — Geography Markup Language)

MIME Media Types for GML OGC Document 09-141r1

http://portal.opengeospatial.org/files/?artifact_id=37743

Namespaces in XML 1.0 (Third Edition) W3C Recommendation (8 December 2009)

<http://www.w3.org/TR/xml-names/>

OGC Observations and Measurements v2.0 OGC Document 10-004r1

<http://www.opengis.net/doc/AS/OM/2.0> (also published as ISO/DIS 19156:2010, Geographic information — Observations and Measurements)

OGC Naming Authority (OGC-NA) Policies & Procedures OGC Document 09-046r2

<http://www.opengis.net/doc/POL/OGC-NA/1.1>

Policy Directives for Writing and Publishing OGC Standards: TC Decisions. OGC

Document 06-135r9. <http://www.opengis.net/doc/POL/Standards/2.0.3>

Schematron: ISO/IEC 19757-3, Information technology — Document Schema Definition Languages (DSDL) — Part 3: Rule-based validation — Schematron

[http://standards.iso.org/ittf/PubliclyAvailableStandards/c040833_ISO_IEC_19757-3_2006\(E\).zip](http://standards.iso.org/ittf/PubliclyAvailableStandards/c040833_ISO_IEC_19757-3_2006(E).zip)

The Specification Model — A Standard for Modular specifications OGC Document 08-

131r3. <http://www.opengis.net/doc/POL/MOD-SPEC/1.0>

OGC SWE Common Data Model Encoding Standard v2.0 OGC Document 08-094r1

<http://www.opengis.net/doc/IS/SWE/2.0>

XML Schema Part 1: Structures Second Edition. W3C Recommendation (28 October

2004) <http://www.w3.org/TR/xmlschema-1/>

XML Schema Part 2: Datatypes Second Edition. W3C Recommendation (28 October

2004) <http://www.w3.org/TR/xmlschema-2/>

4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

4.1

all-components document

XML schema document that includes, either directly or indirectly, all of the components defined and declared in a namespace

[OGC Policy Directives. <http://www.opengis.net/doc/POL/Standards/2.0.3>]

4.2

application schema

conceptual schema for data required by one or more applications

[ISO 19101:2002, definition 4.2]

4.3

element <XML>

basic information item of an XML document containing **child elements**, **attributes** and character data

[ISO 19136:2007]

NOTE From the XML Information Set: —Each XML document contains one or more elements, the boundaries of which are either delimited by start-tags and end-tags, or, for empty elements, by an empty-element tag. Each element has a type, identified by name, sometimes called its ‘generic identifier’ (GI), and may have a set of attribute specifications. Each attribute specification has a name and a value.

4.4

GML application schema

application schema written in XML Schema in accordance with the rules specified in ISO 19136:2007

[ISO 19136:2007]

4.5

GML document

XML document with a root element that is one of the elements AbstractFeature, Dictionary or TopoComplex specified in the GML schema or any element of a substitution group of any of these elements

[ISO 19136:2007]

4.6

GML schema

schema components in the XML namespace —<http://www.opengis.net/gml/3.2> as specified in ISO 19136:2007

[ISO 19136:2007]

4.7

measurement

set of operations having the object of determining the **value** of a quantity

[ISO/TS 19101-2:2008, definition 4.20]

4.8

observation

act of observing a **property**

NOTE The goal of an observation may be to **measure** or otherwise determine the **value** of a property

[ISO/DIS 19156:2010]

4.9

observation result

estimate of the **value** of a **property** determined through a known procedure

[ISO/DIS 19156:2010]

4.10

sampling feature

feature, such as a station, transect, section or specimen, which is involved in making **observations** concerning a domain feature

NOTE A sampling feature is purely an artefact of the observational strategy, and has no significance independent of the observational campaign.

[ISO/DIS 19156:2010]

4.11

schema <XML Schema>

collection of schema components within the same target namespace

EXAMPLE Schema components of W3C XML Schema are types, elements, attributes, groups, etc.

[ISO 19136:2007]

4.12

schema document <XML Schema>

XML document containing schema component definitions and declarations

NOTE The W3C XML Schema provides an XML interchange format for schema information. A single schema document provides descriptions of components associated with a single XML namespace, but several documents may describe components in the same schema, i.e. the same target namespace.

[ISO 19136:2007]

5 Conventions

5.1 Abbreviated terms

GML	Geography Markup Language
O&M	Observations and Measurements
OMXML	Observations and Measurements XML Implementation
OGC	Open Geospatial Consortium
SOS	Sensor Observation Service
SWE	Sensor Web Enablement
UML	Unified Modeling Language
XML	Extensible Markup Language
XSD	W3C XML Schema Definition Language

5.2 Schema language

The XML implementation specified in this Standard is described using the XML Schema language (XSD) [*XML Schema Part 1: Structures* , *XML Schema Part 2: Datatypes*] and Schematron [*ISO/IEC 19757-3, Information technology — Document Schema Definition Languages (DSDL) — Part 3: Rule-based validation — Schematron*].

5.3 Document presentation of the specification

This document presents the OMXML specification using a representation that follows the structures defined in the OGC Policy [*The Specification Model — A Standard for Modular specifications*]. All normative material is organized as requirements, requirements classes, conformance tests and conformance classes. Each is identified with a URI, and the content and dependencies are described in tables whose structure matches the specification model.

6 XML Schema for Observations and Sampling Features

6.1 Introduction

6.2 XML Schema Packaging

OMXML is packaged in schema documents describing **four XML namespaces** together with **16 Schematron schemas** defining additional XML constraints. The OMXML schemas are available from the OGC schema repository at <http://schemas.opengis.net>. There are dependencies on components from **seven XML namespaces** described in other standards.

NOTE: Different XML Namespaces allow for independent maintenance (versioning) of groups of components without impacting on their dependencies.

The XML Namespaces for OMXML and their representations as XML Schema documents are listed in Table 2. The OMXML Schematron schemas are listed in Table 3. The external dependencies are listed in Table 4. The direct dependencies between XML Schemas (implemented as <import> elements) are shown in Figure 1.

NOTE: In the XML Schema context, direct dependencies are those namespaces that are the target of an <xs:import> element. In the Schematron context, dependencies are loaded using <sch:ns> and <xsl:import-schema> elements.

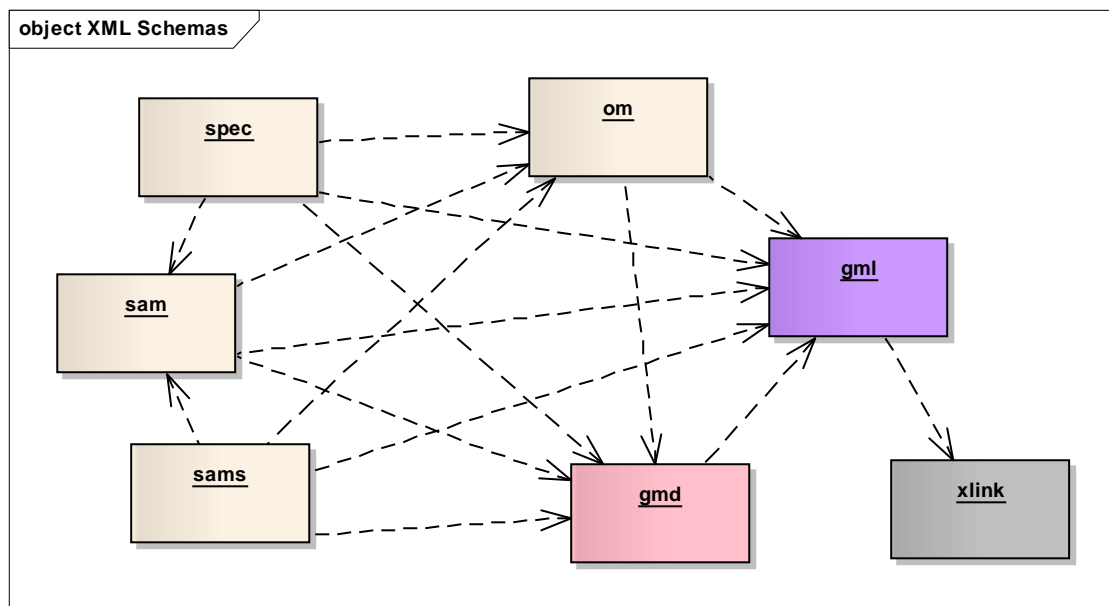


Figure 1. OMXML XML Schema dependencies. Dependency arrows indicate <import> elements in the schemas. Names correspond to the default namespace prefixes listed in Tables 2 and 4.

6.3 XML elements

The schema is conformant to the rules for a GML Application Schema [*OGC Geography Markup Language v3.2*] and follows a UML to XML encoding rule explained in Annex C. This means that UML classes are implemented as XML elements, through global declarations in the XML schema. The correspondence of XML elements to the classes from *OGC Observations and Measurements v2.0* is given in Table 5.

The XML encoding also makes use of type identifiers, provided as OGC URIs. A mapping of the UML classes to OGC URIs, and the corresponding XML content model constraints are given in Tables 6 and 7. These are used in the requirements classes described in Clause 7.

6.4 Conformance with O&M model

OMXML satisfies the 'Conformance Classes related to Application Schemas including Observations and Measurements' listed in Clause 2.2 of *OGC Observations and Measurements v2.0*. The map from O&M v2.0 Conformance Classes to OMXML is given in Table 8.

NOTE: the conceptual model in *OGC Observations and Measurements v2.0* specifies specialized observation types with coverage results. However, the XML encoding for coverages is under active discussion at the time of preparation of this standard, so there is no specific implementation of these in OMXML pending resolution of this discussion. Note that the generic observation class may still have a coverage-valued result.

Table 2 — XML Namespaces defined for this implementation of the Observations and Measurements schema

XML Namespace	Default namespace prefix	Canonical location of all-components schema document
http://www.opengis.net/om/2.0	om	http://schemas.opengis.net/om/2.0/observation.xsd
http://www.opengis.net/sampling/2.0	sam	http://schemas.opengis.net/sampling/2.0/samplingFeature.xsd
http://www.opengis.net/samplingSpatial/2.0	sams	http://schemas.opengis.net/samplingSpatial/2.0/spatialSamplingFeature.xsd
http://www.opengis.net/samplingSpecimen/2.0	spec	http://schemas.opengis.net/samplingSpecimen/2.0/specimen.xsd

Table 3 — Schematron schemas used in this implementation of the Observations and Measurements schema

Schematron schemas for observations	Schematron schemas for observations and sampling features
http://schemas.opengis.net/om/2.0/categoryObservation.sch	http://schemas.opengis.net/om/2.0/complexObservation.sch
http://schemas.opengis.net/om/2.0/countObservation.sch	http://schemas.opengis.net/om/2.0/SWEArrayObservation.sch
http://schemas.opengis.net/om/2.0/geometryObservation.sch	http://schemas.opengis.net/om/2.0/SWEScalarObservation.sch
http://schemas.opengis.net/om/2.0/measurement.sch	http://schemas.opengis.net/samplingSpatial/2.0/samplingCurve.sch
http://schemas.opengis.net/om/2.0/spatialObservation.sch	http://schemas.opengis.net/samplingSpatial/2.0/samplingPoint.sch
http://schemas.opengis.net/om/2.0/temporalObservation.sch	http://schemas.opengis.net/samplingSpatial/2.0/samplingSolid.sch
http://schemas.opengis.net/om/2.0/truthObservation.sch	http://schemas.opengis.net/samplingSpatial/2.0/samplingSurface.sch
http://schemas.opengis.net/om/2.0/resultTypeConsistent.sch	http://schemas.opengis.net/samplingSpatial/2.0/shapeTypeConsistent.sch

Table 4 — External XML Namespaces used in this implementation of the Observations and Measurements schema

Standard	XML Namespace	Default namespace prefix	Canonical location of all-components schema document (if required)
XML Schema	http://www.w3.org/2001/XMLSchema	xs	
Schematron	http://purl.oclc.org/dsdl/schematron	sch	
XSLT v2	http://www.w3.org/1999/XSL/Transform	xsl	
XML Linking Language	http://www.w3.org/1999/xlink	xlink	http://schemas.opengis.net/xlink/1.0.0/xlinks.xsd
OGC GML 3.2.1	http://www.opengis.net/gml/3.2	gml	http://schemas.opengis.net/gml/3.2.1/gml.xsd
ISO TS 19139 metadata XML implementation	http://www.isotc211.org/2005/gmd	gmd	http://schemas.opengis.net/iso/19139/20070417/gmd/gmd.xsd
OGC SWE Common	http://www.opengis.net/swe/2.0	swe	http://schemas.opengis.net/sweCommon/2.0/swe.xsd

Table 5 — Map of UML classes in O&M v2.0 to XML elements in OMXML

O&M v2.0	OMXML	O&M v2.0	OMXML
OM_CategoryObservation	om:OM_Observation	ObservationContext	om:ObservationContext
OM_ComplexObservation	om:OM_Observation	PreparationStep	spec:PreparationStep
OM_CountObservation	om:OM_Observation	SamplingFeatureComplex	sam:SamplingFeatureComplex
OM_DiscreteCoverageObservation	om:OM_Observation ¹	SF_SamplingCurve	sams:SF_SpatialSamplingFeature
OM_GeometryObservation	om:OM_Observation	SF_SamplingFeature	sam:SF_SamplingFeature
OM_Measurement	om:OM_Observation	SF_SamplingFeatureCollection	sam:SF_SamplingFeatureCollection
OM_Observation	om:OM_Observation	SF_SamplingPoint	sams:SF_SpatialSamplingFeature
OM_PointCoverageObservation	om:OM_Observation ¹	SF_SamplingSolid	sams:SF_SpatialSamplingFeature
OM_TemporalObservation	om:OM_Observation	SF_SamplingSurface	sams:SF_SpatialSamplingFeature
OM_TimeSeriesObservation	om:OM_Observation ¹	SF_SpatialSamplingFeature	sams:SF_SpatialSamplingFeature
OM_TruthObservation	om:OM_Observation	SF_Specimen	spec:SF_Specimen
4.13 ¹ Coverage observations are implemented by the generic om:OM_Observation but there are no specific conformance tests.			

Table 6 — Map of UML classes in O&M v2.0 to OGC observation-type names and observation result-types

O&M v2.0	OGC Name	Content of result in OMXML ¹
OM_CategoryObservation	http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_CategoryObservation	type='gml:ReferenceType'
OM_ComplexObservation	http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_ComplexObservation	swe:DataRecord
OM_CountObservation	http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_CountObservation	type='xs:integer'
OM_DiscreteCoverageObservation	http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_DiscreteCoverageObservation	_2 or a reference using xlink attributes
OM_GeometryObservation	http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_GeometryObservation	gml:AbstractGeometry ³
OM_Measurement	http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_Measurement	type='gml:MeasureType'
OM_Observation	http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_Observation	type='xs:anyType' ⁴
OM_PointCoverageObservation	http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_PointCoverageObservation	_2 or a reference using xlink attributes
OM_TemporalObservation	http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_TemporalObservation	gml:AbstractTimeObject ³
OM_TimeSeriesObservation	http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_TimeSeriesObservation	_2 or a reference using xlink attributes
OM_TruthObservation	http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_TruthObservation	type='xs:boolean'
¹ An XML element name indicates that the result in this case has element content; type='...' indicates that the result has 'simple' (non-element) content. ² gml:AbstractDiscreteCoverage, cv:CV_AbstractDiscreteCoverage, gml:MultiPointCoverage, cv:CV_DiscretePointCoverage are available for encoding coverages in XML, but the preferred OGC encoding for coverages is under revision. ³ A concrete member of the substitution group shall substitute for an abstract element. ⁴ Any well-formed XML can substitute for xs:anyType.		

Table 7 — Map of UML classes in O&M v2.0 to OGC sampling-feature-type names and spatial-sampling-feature shape-types

O&M v2.0	OGC Name	Content of shape in OMXML
SF_SamplingFeature	http://www.opengis.net/def/samplingFeatureType/OGC-OM/2.0/SF_SamplingFeature	-
SF_SpatialSamplingFeature	http://www.opengis.net/def/samplingFeatureType/OGC-OM/2.0/SF_SpatialSamplingFeature	gml:AbstractGeometry ¹
SF_SamplingPoint	http://www.opengis.net/def/samplingFeatureType/OGC-OM/2.0/SF_SamplingPoint	gml:Point
SF_SamplingCurve	http://www.opengis.net/def/samplingFeatureType/OGC-OM/2.0/SF_SamplingCurve	gml:AbstractCurve ¹
SF_SamplingSurface	http://www.opengis.net/def/samplingFeatureType/OGC-OM/2.0/SF_SamplingSurface	gml:AbstractSurface ¹
SF_SamplingSolid	http://www.opengis.net/def/samplingFeatureType/OGC-OM/2.0/SF_SamplingSolid	gml:AbstractSolid ¹
SF_Specimen	http://www.opengis.net/def/samplingFeatureType/OGC-OM/2.0/SF_SamplingSpecimen	-
¹ A concrete member of the substitution group shall substitute for an abstract element.		

Table 8 —Map of O&M v2.0 Conformance Classes to OMXML.

O&M v2.0 Conformance Class		OMXML Conformance Class
Generic observation interchange		http://www.opengis.net/spec/OMXML/2.0/conf/observation
Measurement interchange		http://www.opengis.net/spec/OMXML/2.0/conf/measurement
Specialized observation interchange	<i>Category observation</i>	http://www.opengis.net/spec/OMXML/2.0/conf/categoryObservation
	<i>Count observation</i>	http://www.opengis.net/spec/OMXML/2.0/conf/countObservation
	<i>Truth observation</i>	http://www.opengis.net/spec/OMXML/2.0/conf/truthObservation
	<i>Geometry observation</i>	http://www.opengis.net/spec/OMXML/2.0/conf/geometryObservation
	<i>Temporal observation</i>	http://www.opengis.net/spec/OMXML/2.0/conf/temporalObservation
	<i>Complex observation</i>	http://www.opengis.net/spec/OMXML/2.0/conf/complexObservation
Coverage observation interchange	<i>Discrete coverage observation</i>	http://www.opengis.net/spec/OMXML/2.0/conf/observation
	<i>Point coverage observation</i>	http://www.opengis.net/spec/OMXML/2.0/conf/observation
Temporal coverage observation interchange		http://www.opengis.net/spec/OMXML/2.0/conf/observation
Sampling feature interchange		http://www.opengis.net/spec/OMXML/2.0/conf/sampling
Spatial sampling feature interchange		http://www.opengis.net/spec/OMXML/2.0/conf/spatialSampling
Sampling point interchange		http://www.opengis.net/spec/OMXML/2.0/conf/samplingPoint
Sampling curve interchange		http://www.opengis.net/spec/OMXML/2.0/conf/samplingCurve
Sampling surface interchange		http://www.opengis.net/spec/OMXML/2.0/conf/samplingSurface
Sampling solid interchange		http://www.opengis.net/spec/OMXML/2.0/conf/samplingSolid
Specimen interchange		http://www.opengis.net/spec/OMXML/2.0/conf/specimen

7 Requirements for XML instances of Observations and Measurements

7.1 Introduction

An Observations and Measurements data document will include one or more of the XML elements listed in Table 5, or elements declared to be in the substitution group of one or more of these. The basic requirements for data instances are, therefore, formalized in terms of these elements. The corresponding conformance tests use document validation using various combinations of schema documents.

18 requirements classes are described in this clause. Figure 2 provides a graphical (informative) summary of the dependencies of the requirements classes.

NOTE: ISO 19115, GML and W3C XML Schema are not formally structured with Requirements Classes in the sense described by *The Specification Model — A Standard for Modular specifications* (OGC 08-131r3), so the specific dependencies on these are indicated using clause numbers or internal document anchors instead.

7.2 Virtual typing strategy

Only a single XML element for observations is provided (om:OM_Observation) whose *result* is a wildcard (type='xs:anyType'). The specialized observations described in the conceptual model merely restrict the type of the result, so in the XML implementation this can be achieved efficiently through a lightweight XML Schema for the generic case, supplemented by Schematron to test the result type. An (optional) 'type' sub-element allows a data instance to be associated with a class in the conceptual model. Note that addition of a suitable xsi:type attribute on the result element would enable XML Schema-based validation strategies to be applied, but this tactic is optional. Schematron-based validation does not require it.

Similarly, only a single XML element for spatial sampling features is provided (sams:SF_SpatialSamplingFeature) whose *shape* property contains a wildcard (gml:AbstractGeometry). The specialized spatial sampling features described in the conceptual model merely restrict the type of the shape, so in the XML implementation this can be achieved efficiently through a lightweight XML Schema for the generic case, supplemented by Schematron to test the shape. An (optional) 'type' sub-element allows a data instance to be associated with a class in the conceptual model. Note that addition of a suitable xsi:type attribute on the shape element would enable XML Schema-based validation strategies to be applied, but this tactic is optional. Schematron-based validation does not require it.

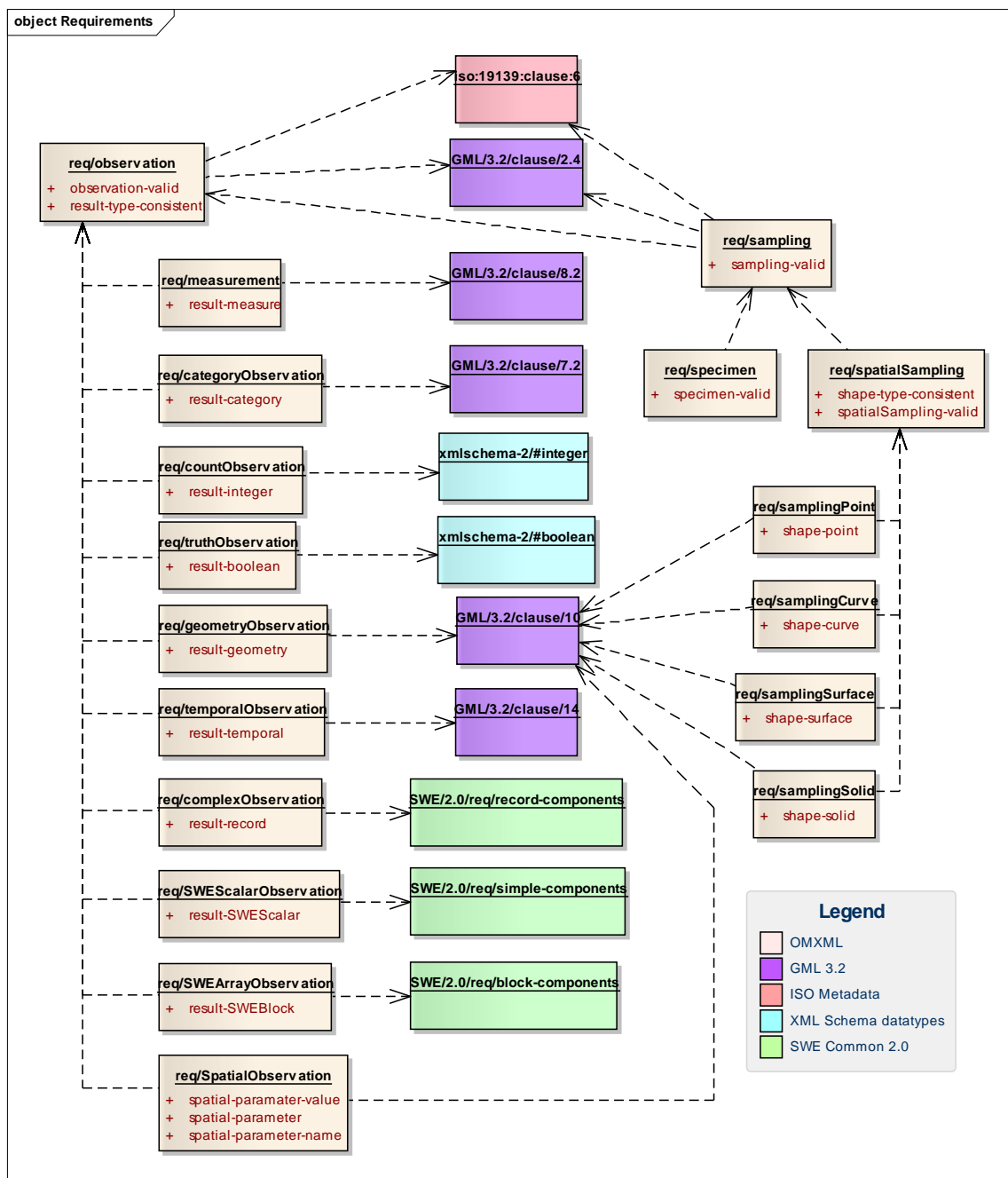


Figure 2. (informative) Dependencies of OMXML requirements classes. Note that req/observation has no external dependencies, so is the core requirements class in OMXML.

7.3 Requirements class: Generic observation data

XML representation of observation data requires use of the element `om:OM_Observation` or a member of its substitution group.

There is a dependency on the requirements classes for GML documents, defined in Clause 2.4 of *OGC Geography Markup Language v3.2*.

There is a dependency on the requirements class for Geographic Metadata XML encoding, described in Clause 6 of *Geographic information – metadata – XML implementation*.

Requirements Class	
http://www.opengis.net/spec/OMXML/2.0/req/observation	
Target type	Data instance
Dependency	http://www.opengis.net/doc/IS/GML/3.2#clause-2.4
Dependency	urn:iso:ts:iso:19139:clause:6
Requirement	<p>http://www.opengis.net/spec/OMXML/2.0/req/observation/observation-valid</p> <p>Any XML element in the substitution group of <code>om:OM_Observation</code> SHALL be well-formed and valid</p>
Requirement	<p>http://www.opengis.net/spec/OMXML/2.0/req/observation/result-type-consistent</p> <p>The content model of any <code>om:result</code> element SHALL be consistent with the value of the <code>xlink:href</code> attribute of the <code>om:type</code> element if one is present as a sub-element of the parent <code>om:OM_Observation</code>, according to the mapping given in Table 5.</p>

This is the core requirements class for all XML instances of Observations and Measurements.

7.4 Requirements class: Measurement data

XML representation of measurement data requires that it satisfies the core requirements class for observation data, and adds the requirement that the observation result is a scaled number.

There is a dependency on the requirements class for GML schema, Basic Types, described in Clause 8.2 of *OGC Geography Markup Language v3.2*.

Requirements Class	
http://www.opengis.net/spec/OMXML/2.0/req/measurement	
Target type	Data instance
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/observation
Dependency	http://www.opengis.net/doc/IS/GML/3.2#clause-8.2
Requirement	http://www.opengis.net/spec/OMXML/2.0/req/measurement/result-measure The XML element om:result SHALL have a value that matches the content model defined by gml:MeasureType.

7.5 Requirements class: Category observation data

XML representation of category observation data requires that it satisfies the core requirements class for observation data, and adds the requirement that the observation result selects an item from a controlled vocabulary or ontology.

There is a dependency on the requirements class for GML Base Schema Components, described in Clause 7.2 of *OGC Geography Markup Language v3.2*.

Requirements Class	
http://www.opengis.net/spec/OMXML/2.0/req/categoryObservation	
Target type	Data instance
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/observation
Dependency	http://www.opengis.net/doc/IS/GML/3.2#clause-7.2
Requirement	http://www.opengis.net/spec/OMXML/2.0/req/categoryObservation/result-category The XML element om:result SHALL have a value that matches the content model defined by gml:ReferenceType.

7.6 Requirements class: Count observation data

XML representation of count observation data requires that it satisfies the core requirements class for observation data, and adds the requirement that the observation result is an integer.

There is a dependency on elements from *XML Schema Part 2: Datatypes* (clause 3.3.13).

Requirements Class	
http://www.opengis.net/spec/OMXML/2.0/req/countObservation	
Target type	Data instance
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/observation
Dependency	http://www.w3.org/TR/xmlschema-2/#integer
Requirement	<p>http://www.opengis.net/spec/OMXML/2.0/req/countObservation/result-integer</p> <p>The XML element om:result SHALL have a value that matches the content model defined by xs:integer.</p>

7.7 Requirements class: Truth observation data

XML representation of truth observation data requires that it satisfies the core requirements class for observation data, and adds the requirement that the observation result is a truth value.

There is a dependency on elements from *XML Schema Part 2: Datatypes* (clause 3.2.2).

Requirements Class	
http://www.opengis.net/spec/OMXML/2.0/req/truthObservation	
Target type	Data instance
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/observation
Dependency	http://www.w3.org/TR/xmlschema-2/#boolean
Requirement	<p>http://www.opengis.net/spec/OMXML/2.0/req/truthObservation/result-boolean</p> <p>The XML element om:result SHALL have a value that matches the content model defined by xs:boolean.</p>

7.8 Requirements class: Geometry observation data

XML representation of geometry observation data requires that it satisfies the core requirements class for observation data, and adds the requirement that the observation result is a spatial object.

There is a dependency on the requirements class for GML schema - Geometric Primitives, described in Clause 10 of *OGC Geography Markup Language v3.2*.

Requirements Class	
http://www.opengis.net/spec/OMXML/2.0/req/geometryObservation	
Target type	Data instance
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/observation
Dependency	http://www.opengis.net/doc/IS/GML/3.2#clause-10
Requirement	<p>http://www.opengis.net/spec/OMXML/2.0/req/geometryObservation/result-geometry</p> <p>The XML element om:result SHALL contain a subelement in the substitution group of gml:AbstractGeometry.</p>

7.9 Requirements class: Temporal observation data

XML representation of temporal observation data requires that it satisfies the core requirements class for observation data, and adds the requirement that the observation result is a temporal object.

There is a dependency on the requirements class for Temporal schema, described in Clause 14 of *OGC Geography Markup Language v3.2*.

Requirements Class	
http://www.opengis.net/spec/OMXML/2.0/req/temporalObservation	
Target type	Data instance
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/observation
Dependency	http://www.opengis.net/doc/IS/GML/3.2#clause-14
Requirement	<p>http://www.opengis.net/spec/OMXML/2.0/req/temporalObservation/result-time-object</p> <p>The XML element om:result SHALL contain a subelement in the substitution group of gml:AbstractTimeObject.</p>

7.10 Requirements class: Complex observation data

XML representation of complex observation data requires that it satisfies the core requirements class for observation data, and adds the requirement that the observation result is a simple data record or vector from the SWE Common Data Model.

There is a dependency on the requirements class for SWE Common –Record Components, described in Clause 8.2 of *OGC SWE Common Data Model Encoding Standard v2.0*.

Requirements Class	
http://www.opengis.net/spec/OMXML/2.0/req/complexObservation	
Target type	Data instance
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/observation
Dependency	http://www.opengis.net/spec/SWE/2.0/req/xsd-record-components
Requirement	<p>http://www.opengis.net/spec/OMXML/2.0/req/complexObservation/result-SWErecord</p> <p>The XML element om:result SHALL contain a subelement swe:DataRecord or swe:Vector containing inline values.</p>

7.11 Requirements class: SWE scalar observation data

XML representation of SWE observation data requires that it satisfies the core requirements class for observation data, and adds the requirement that the observation result is a simple data component from the SWE Common Data Model.

There is a dependency on the requirements class for SWE Common – Basic Types and Simple Components, described in Clause 8.1 of *OGC SWE Common Data Model Encoding Standard v2.0*.

Requirements Class	
http://www.opengis.net/spec/OMXML/2.0/req/SWEScalarObservation	
Target type	Data instance
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/observation
Dependency	http://www.opengis.net/spec/SWE/2.0/req/xsd-simple-components
Requirement	<p>http://www.opengis.net/spec/OMXML/2.0/req/SWEArrayObservation/result-SWEBlock/result-SWEScalar</p> <p>The XML element om:result SHALL contain a concrete subelement in the substitution group swe:AbstractSimpleComponent containing an inline value.</p>

7.12 Requirements class: SWE array observation data

XML representation of SWE observation data requires that it satisfies the core requirements class for observation data, and adds the requirement that the observation result is a block data component from the SWE Common Data Model.

There is a dependency on the requirements class for SWE Common – Block Components, described in Clause 8.4 of *OGC SWE Common Data Model Encoding Standard v2.0*.

Requirements Class	
http://www.opengis.net/spec/OMXML/2.0/req/SWEArrayObservation	
Target type	Data instance
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/observation
Dependency	http://www.opengis.net/spec/SWE/2.0/req/xsd-block-components
Requirement	<p>http://www.opengis.net/spec/OMXML/2.0/req/SWEArrayObservation/result-SWEBlock</p> <p>The XML element om:result SHALL contain a subelement swe:DataArray, swe:Matrix or swe:DataStream containing inline values.</p>

7.13 Requirements class: Spatial observation data

XML representation of spatial observation data requires that it satisfies the core requirements class for observation data, and adds the requirement that the observation shall have exactly one parameter which contains the sampling geometry of the observation. The sampling geometry represents the spatial extent where the observation result applies to. This is usually the extent of the observation's feature of interest but may also be computed or determined by other means.

There is a dependency on the requirements class for GML schema - Geometric Primitives, described in Clause 10 of *OGC Geography Markup Language v3.2*.

Requirements Class	
http://www.opengis.net/spec/OMXML/2.0/req/SpatialObservation	
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/observation
Dependency	http://www.opengis.net/doc/IS/GML/3.2#clause-10
Requirement	http://www.opengis.net/spec/OMXML/2.0/req/SpatialObservation/spa

	tial-parameter A spatial observation SHALL have exactly one sampling geometry encoded as XML element om:parameter in an observation.
Requirement	http://www.opengis.net/spec/OMXML/2.0/req/SpatialObservation/spatial-parameter-name The xlink:href attribute in the XML element om:name of the om:parameter/om:NamedValue element that carries the sampling geometry SHALL have the value http://www.opengis.net/def/param-name/OGC-OM/2.0/samplingGeometry .
Requirement	http://www.opengis.net/spec/OMXML/2.0/req/SpatialObservation/spatial-parameter-value The XML element om:value in the om:parameter/om:NamedValue element SHALL contain a subelement in the substitution group of gml:AbstractGeometry.

7.14 Requirements class: Sampling feature data

XML representation of sampling feature data requires use of the element sam:SF_SamplingFeature or a member of its substitution group.

There is a dependency on the requirements classes for GML documents, defined in Clause 2.4 of *OGC Geography Markup Language v3.2*.

There is a dependency on the requirements class for Geographic Metadata XML encoding, described in Clause 6 of *Geographic information – metadata – XML implementation*.

Requirements Class	
http://www.opengis.net/spec/OMXML/2.0/req/sampling	
Target type	Data instance
Dependency	http://www.opengis.net/doc/IS/GML/3.2#clause-2.4
Dependency	urn:iso:ts:iso:19139:clause:6
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/observation
Requirement	http://www.opengis.net/spec/OMXML/2.0/req/sampling/sampling-valid Any XML element in the substitution group of sam:SF_SamplingFeature SHALL be well-formed and valid.

This is the core requirements class for all XML instances of Sampling Features.

7.15 Requirements class: Spatial sampling feature data

XML representation of spatial sampling feature data requires use of the element `sams:SF_SpatialSamplingFeature` or a member of its substitution group.

There is a dependency on the requirements class for GML schema – Abstract Geometry, described in Clause 10.1.3 of *OGC Geography Markup Language v3.2*.

Requirements Class	
http://www.opengis.net/spec/OMXML/2.0/req/spatialSampling	
Target type	Data instance
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/sampling
Dependency	http://www.opengis.net/doc/IS/GML/3.2#clause-10.1.3
Requirement	<p>http://www.opengis.net/spec/OMXML/2.0/req/spatialSampling/spatialSampling-valid</p> <p>Any XML element in the substitution group of <code>sams:SF_SpatialSamplingFeature</code> SHALL be well-formed and valid.</p>
Requirement	<p>http://www.opengis.net/spec/OMXML/2.0/req/spatialSampling/shape-type-consistent</p> <p>The content model of any <code>sams:shape</code> element SHALL be consistent with the value of the <code>xlink:href</code> attribute of the <code>sam:type</code> element if one is present as a sub-element of the parent <code>sams:SF_SpatialSamplingFeature</code>, according to the mapping given in Table 6.</p>

This is the core requirements class for all XML instances of Spatial Sampling Features.

7.16 Requirements class: Sampling point data

XML representation of sampling point data requires that it satisfies the core requirements class for spatial sampling feature data, and adds the requirement that the shape is a point.

There is a dependency on the requirements class for GML schema - Geometric Primitives, described in Clause 10 of *OGC Geography Markup Language v3.2*.

Requirements Class	
http://www.opengis.net/spec/OMXML/2.0/req/samplingPoint	

Target type	Data instance
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/spatialSampling
Dependency	http://www.opengis.net/doc/IS/GML/3.2#clause-10
Requirement	<p>http://www.opengis.net/spec/OMXML/2.0/req/samplingPoint/shape-point</p> <p>The XML element sams:shape SHALL contain a subelement in the substitution group of gml:Point or a link to a representation of a point.</p>

7.17 Requirements class: Sampling curve data

XML representation of sampling curve data requires that it satisfies the core requirements class for spatial sampling feature data, and adds the requirement that the shape is a curve.

There is a dependency on the requirements class for GML schema - Geometric Primitives, described in Clause 10 of *OGC Geography Markup Language v3.2*.

Requirements Class	
http://www.opengis.net/spec/OMXML/2.0/req/samplingCurve	
Target type	Data instance
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/spatialSampling
Dependency	http://www.opengis.net/doc/IS/GML/3.2#clause-10
Requirement	<p>http://www.opengis.net/spec/OMXML/2.0/req/samplingCurve/shape-curve</p> <p>The XML element sams:shape SHALL contain a subelement in the substitution group of gml:AbstractCurve or a link to a representation of a curve.</p>

7.18 Requirements class: Sampling surface data

XML representation of sampling surface data requires that it satisfies the core requirements class for spatial sampling feature data, and adds the requirement that the shape is a surface.

There is a dependency on the requirements class for GML schema - Geometric Primitives, described in Clause 10 of *OGC Geography Markup Language v3.2*.

Requirements Class	
http://www.opengis.net/spec/OMXML/2.0/req/samplingSurface	
Target type	Data instance
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/spatialSampling
Dependency	http://www.opengis.net/doc/IS/GML/3.2#clause-10
Requirement	<p>http://www.opengis.net/spec/OMXML/2.0/req/samplingSurface/shape-surface</p> <p>The XML element sams:shape SHALL contain a subelement in the substitution group of gml:AbstractSurface or a link to a representation of a surface.</p>

7.19 Requirements class: Sampling solid data

XML representation of sampling solid data requires that it satisfies the core requirements class for spatial sampling feature data, and adds the requirement that the shape is a solid.

There is a dependency on the requirements class for GML schema - Geometric Primitives, described in Clause 10 of *OGC Geography Markup Language v3.2*.

Requirements Class	
http://www.opengis.net/spec/OMXML/2.0/req/samplingSolid	
Target type	Data instance
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/spatialSampling
Dependency	http://www.opengis.net/doc/IS/GML/3.2#clause-10
Requirement	<p>http://www.opengis.net/spec/OMXML/2.0/req/samplingSolid/shape-solid</p> <p>The XML element sams:shape SHALL contain a subelement in the substitution group of gml:AbstractSolid or a link to a representation of a solid.</p>

7.20 Requirements class: Specimen data

XML representation of specimen data requires use of the element spec:SF_Specimen or a member of its substitution group.

There is a dependency on the requirements class for GML schema – Referencing, described in Clause 7.2.3.7 of *OGC Geography Markup Language v3.2*.

There is a dependency on the requirements class for GML schema – Abstract Geometry, described in Clause 10.1.3 of <i>OGC Geography Markup Language v3.2</i> . Requirements Class	
http://www.opengis.net/spec/OMXML/2.0/req/specimen	
Target type	Data instance
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/sampling
Dependency	http://www.opengis.net/doc/IS/GML/3.2#clause-7.2.3.7
Dependency	http://www.opengis.net/doc/IS/GML/3.2#clause-10.1.3
Requirement	http://www.opengis.net/spec/OMXML/2.0/req/specimen/specimen-valid Any XML element in the substitution group of spec:SF_Specimen SHALL be well-formed and valid.

This is the core requirements class for all XML instances of Specimens.

8 Media types for Observations and Measurements data

Observations and measurements data conforming to this specification is encoded in GML-conformant XML documents. The standard MIME-type and sub-type for GML data should be used to indicate the encoding in internet exchange, as specified in *MIME Media Types for GML* , namely

application/gml+xml

Annex A Abstract test suite (normative)

A.1 Conformance class: Generic observation data

This is the core conformance class for XML implementation of Observations and Measurements data.

There is a dependency on the conformance class for GML documents, defined in clause 2.4 (with the test suite in A.3) of *OGC Geography Markup Language v3.2*.

There is a dependency on the conformance class for Geographic Metadata XML encoding, described in Clause 2 and Annex A of *Geographic information – metadata – XML implementation*.

Conformance Class		
http://www.opengis.net/spec/OMXML/2.0/conf/observation		
Requirements	http://www.opengis.net/spec/OMXML/2.0/req/observation	
Dependency	http://www.opengis.net/doc/IS/GML/3.2/clause/2.4 NOTE: The OMXML schema imports the XML Schema for GML 3.2. However GML 3.2 conformance includes additional tests that are not enforced by schema validation.	
Dependency	urn:iso:ts:iso:19139:clause:2 NOTE: The OMXML schema imports the XML Schema for Geographic Metadata. However ISO 19139 conformance includes additional tests that are not enforced by schema validation.	
Test	http://www.opengis.net/spec/OMXML/2.0/conf/observation/observation-valid	
	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/observation/observation-valid
	Test purpose	Verify that any XML element in the substitution group of om:OM_Observation is well-formed and valid
	Test method	Validate the XML document using the XML schema document http://schemas.opengis.net/om/2.0/observation.xsd . Pass if no errors reported. Fail otherwise.
	Test type	Basic

Test	http://www.opengis.net/spec/OMXML/2.0/conf/observation/result-type-consistent	
	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/observation/result-type-consistent
	Test purpose	Verify that the content model of any om:result element is consistent with the value of the xlink:href attribute of the om:type element if one is present as a sub-element of the parent om:OM_Observation, according to the mapping given in Table 5.
	Test method	Validate the XML document using the Schematron document http://schemas.opengis.net/om/2.0/resultTypeConsistent.sch . Pass if no errors reported. Fail otherwise.
	Test type	Capability

A.2 Conformance class: Measurement data

Conformance Class		
http://www.opengis.net/spec/OMXML/2.0/conf/measurement		
Requirements	http://www.opengis.net/spec/OMXML/2.0/req/measurement	
Dependency	http://www.opengis.net/spec/OMXML/2.0/conf/observation	
Test	http://www.opengis.net/spec/OMXML/2.0/conf/measurement/result-measure	
	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/measurement/result-measure
	Test purpose	Verify that the XML element om:result has a value that matches the content model defined by gml:MeasureType.
	Test method	Validate the XML document using the Schematron document http://schemas.opengis.net/om/2.0/measurement.sch . Pass if no errors reported. Fail otherwise.
	Test type	Capability

A.3 Conformance class: Category observation data

Conformance Class		
http://www.opengis.net/spec/OMXML/2.0/conf/categoryObservation		
Requirements	http://www.opengis.net/spec/OMXML/2.0/req/categoryObservation	
Dependency	http://www.opengis.net/spec/OMXML/2.0/conf/observation	
Test	http://www.opengis.net/spec/OMXML/2.0/conf/categoryObservation/result-category	
	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/categoryObservation/result-category
	Test purpose	Verify that the XML element om:result has a value that matches the content model defined by gml:ReferenceType
	Test method	Validate the XML document using the Schematron document http://schemas.opengis.net/om/2.0/categoryObservation.sch . Pass if no errors reported. Fail otherwise.
	Test type	Capability

A.4 Conformance class: Count observation data

Conformance Class		
http://www.opengis.net/spec/OMXML/2.0/conf/countObservation		
Requirements	http://www.opengis.net/spec/OMXML/2.0/req/countObservation	
Dependency	http://www.opengis.net/spec/OMXML/2.0/conf/observation	
Test	http://www.opengis.net/spec/OMXML/2.0/conf/countObservation/result-integer	
	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/countObservation/result-integer
	Test purpose	Verify that the XML element om:result has a value that matches the content model defined by xs:integer.
	Test method	Validate the XML document using the Schematron document http://schemas.opengis.net/om/2.0/countObservation.sch . Pass if no errors reported. Fail otherwise.
	Test type	Capability

A.5 Conformance class: Truth observation data

Conformance Class		
http://www.opengis.net/spec/OMXML/2.0/conf/truthObservation		
Requirements	http://www.opengis.net/spec/OMXML/2.0/req/truthObservation	
Dependency	http://www.opengis.net/spec/OMXML/2.0/conf/observation	
Test	http://www.opengis.net/spec/OMXML/2.0/conf/truthObservation/result-boolean	
	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/truthObservation/result-boolean
	Test purpose	Verify that the XML element om:result has a value that matches the content model defined by xs:boolean.
	Test method	Validate the XML document using the Schematron document http://schemas.opengis.net/om/2.0/truthObservation.sch . Pass if no errors reported. Fail otherwise.
	Test type	Capability

A.6 Conformance class: Geometry observation data

Conformance Class		
http://www.opengis.net/spec/OMXML/2.0/conf/geometryObservation		
Requirements	http://www.opengis.net/spec/OMXML/2.0/req/geometryObservation	
Dependency	http://www.opengis.net/spec/OMXML/2.0/conf/observation	
Test	http://www.opengis.net/spec/OMXML/2.0/conf/geometryObservation/result-geometry	
	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/geometryObservation/result-geometry
	Test purpose	Verify that XML element om:result contains a subelement in the substitution group of gml:AbstractGeometry.
	Test method	Validate the XML document using the Schematron document http://schemas.opengis.net/om/2.0/geometryObservation.sch . Pass if no errors reported. Fail otherwise.

	Test type	Capability
--	-----------	------------

A.7 Conformance class: Temporal observation data

Conformance Class		
http://www.opengis.net/spec/OMXML/2.0/conf/temporalObservation		
Requirements	http://www.opengis.net/spec/OMXML/2.0/req/temporalObservation	
Dependency	http://www.opengis.net/spec/OMXML/2.0/conf/observation	
Test	http://www.opengis.net/spec/OMXML/2.0/conf/temporalObservation/result-time-object	
	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/temporalObservation/result-time-object
	Test purpose	Verify that XML element om:result contains a subelement in the substitution group of gml:AbstractTimeObject.
	Test method	Validate the XML document using the Schematron document http://schemas.opengis.net/om/2.0/temporalObservation.sch . Pass if no errors reported. Fail otherwise.
	Test type	Capability

A.8 Conformance class: Complex observation data

There is a dependency on the conformance class for SWE Common – Record Components, described in Annex A.9 of *OGC SWE Common Data Model Encoding Standard v2.0*.

Conformance Class		
http://www.opengis.net/spec/OMXML/2.0/conf/complexObservation		
Requirements	http://www.opengis.net/spec/OMXML/2.0/req/complexObservation	
Dependency	http://www.opengis.net/spec/OMXML/2.0/conf/observation	
Dependency	http://www.opengis.net/spec/SWE/2.0/conf/xsd-record-components	
Test	http://www.opengis.net/spec/OMXML/2.0/conf/complexObservation/result-record	

	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/complexObservation/result-SWErecord
	Test purpose	Verify that the XML element om:result contains a subelement swe:DataRecord or swe:Vector with inline values.
	Test method	Validate the XML document using the Schematron document http://schemas.opengis.net/om/2.0/complexObservation.sch . Pass if no errors reported. Fail otherwise.
	Test type	Capability

A.9 Conformance class: SWE scalar observation data

There is a dependency on the conformance class for SWE Common – Basic Types and Simple Components, described in Annex A.8 of *OGC SWE Common Data Model Encoding Standard v2.0*.

Conformance Class		
http://www.opengis.net/spec/OMXML/2.0/conf/SWEScalarObservation		
Requirements	http://www.opengis.net/spec/OMXML/2.0/req/SWEArrayObservation/result-SWEBlock	
Dependency	http://www.opengis.net/spec/OMXML/2.0/conf/observation	
Dependency	http://www.opengis.net/spec/SWE/2.0/conf/xsd-simple-components	
Test	http://www.opengis.net/spec/OMXML/2.0/conf/SWEScalarObservation/result-SWEScalar	
	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/SWEArrayObservation/result-SWEBlock/result-SWEScalar
	Test purpose	Verify that the XML element om:result contains a concrete subelement in the substitution group swe:AbstractScalarComponent containing an inline value..
	Test method	Validate the XML document using the Schematron document http://schemas.opengis.net/om/2.0/SWEScalarObservation.sch . Pass if no errors reported. Fail otherwise.
	Test type	Capability

A.10 Conformance class: SWE array observation data

There is a dependency on the conformance class for SWE Common – Block Components, described in Annex A.11 of *OGC SWE Common Data Model Encoding Standard v2.0*.

Conformance Class		
http://www.opengis.net/spec/OMXML/2.0/conf/SWEArrayObservation		
Requirements	http://www.opengis.net/spec/OMXML/2.0/req/SWEArrayObservation	
Dependency	http://www.opengis.net/spec/OMXML/2.0/conf/observation	
Dependency	http://www.opengis.net/spec/SWE/2.0/conf/xsd-block-components	
Test	http://www.opengis.net/spec/OMXML/2.0/req/SWEArrayObservation/result-SWEBlock	
	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/SWEArrayObservation/result-SWEBlock
	Test purpose	Verify that the XML element om:result contains a subelement swe:DataArray, swe:Matrix or swe:DataStream containing inline values.
	Test method	Validate the XML document using the Schematron document http://schemas.opengis.net/om/2.0/SWEArrayObservation.sch . Pass if no errors reported. Fail otherwise.
	Test type	Capability

A.11 Conformance class: Spatial observation data

Conformance Class		
http://www.opengis.net/spec/OMXML/2.0/conf/spatialObservation		
Requirements	http://www.opengis.net/spec/OMXML/2.0/req/SpatialObservation	
Dependency	http://www.opengis.net/spec/OMXML/2.0/conf/observation	
Test	http://www.opengis.net/spec/OMXML/2.0/conf/spatialObservation/spatial-parameter	
	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/SpatialObservation/spatial-parameter

	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/SpatialObservation/spatial-parameter-name
	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/SpatialObservation/spatial-parameter-value
	Test purpose	Verify that the observation has exactly one sampling geometry encoded as XML element om:parameter/om:NamedValue in an observation, and that its sub-element om:name has an xlink:href attribute with the value http://www.opengis.net/def/parameter/OGC-OM/2.0/samplingGeometry , and its sub-element om:value contains a subelement in the substitution group of gml:AbstractGeometry.
	Test method	Validate the XML document using the Schematron document http://schemas.opengis.net/om/2.0/spatialObservation.sch . Pass if no errors reported. Fail otherwise.
	Test type	Capability

A.12 Conformance class: Sampling feature data

This is the core conformance class for XML implementation of Sampling Feature data.

There is a dependency on the conformance class for GML documents, defined in clause 2.4 (with the test suite in A.3) of *OGC Geography Markup Language v3.2*.

There is a dependency on the conformance class for Geographic Metadata XML encoding, described in Clause 2 and Annex A of *Geographic information – metadata – XML implementation*.

Conformance Class	
http://www.opengis.net/spec/OMXML/2.0/conf/sampling	
Requirements	http://www.opengis.net/spec/OMXML/2.0/req/sampling
Dependency	http://www.opengis.net/doc/IS/GML/3.2/clause/2.4 NOTE: The OMXML schema imports the XML Schema for GML 3.2. However GML 3.2 conformance includes additional tests that are not enforced by schema validation.
Dependency	urn:iso:ts:iso:19139:clause:2 NOTE: The OMXML schema imports the XML Schema for Geographic Metadata. However ISO 19139 conformance includes additional tests that are not enforced by schema validation.

Test	http://www.opengis.net/spec/OMXML/2.0/conf/sampling/sampling-valid	
	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/sampling/sampling-valid
	Test purpose	Verify that any XML element in the substitution group of sam:SF_SamplingFeature is well-formed and valid
	Test method	Validate the XML document using the XML schema document http://schemas.opengis.net/sampling/2.0/samplingFeature.xsd . Pass if no errors reported. Fail otherwise.
	Test type	Basic

A.13 Conformance class: Spatial Sampling feature data

This is the core conformance class for XML implementation of Spatial Sampling Feature data.

Conformance Class		
http://www.opengis.net/spec/OMXML/2.0/conf/spatialSampling		
Requirements	http://www.opengis.net/spec/OMXML/2.0/req/spatialSampling	
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/sampling	
Test	http://www.opengis.net/spec/OMXML/2.0/conf/spatialSampling/spatialSampling-valid	
	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/sampling/sampling-valid
	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/spatialSampling/spatialSampling-valid
	Test purpose	Verify that any XML element in the substitution group of sams:SF_SpatialSamplingFeature is well-formed and valid
	Test method	Validate the XML document using the XML schema document http://schemas.opengis.net/samplingSpatial/2.0/spatialSamplingFeature.xsd . Pass if no errors reported. Fail otherwise.
	Test type	Basic
Test	http://www.opengis.net/spec/OMXML/2.0/conf/spatialSampling/shape-type-consistent	

	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/spatialSampling/shape-type-consistent
	Test purpose	Verify that the content model of any sams:shape element is consistent with the value of the xlink:href attribute of the sam:type element if one is present as a sub-element of the parent sams:SF_SpatialSamplingFeature, according to the mapping given in Table 6.
	Test method	Validate the XML document using the Schematron document http://schemas.opengis.net/samplingSpatial/2.0/shapeTypeConsistent.sch . Pass if no errors reported. Fail otherwise..
	Test type	Capability

A.14 Conformance class: Sampling point data

Conformance Class		
http://www.opengis.net/spec/OMXML/2.0/conf/samplingPoint		
Requirements	http://www.opengis.net/spec/OMXML/2.0/req/samplingPoint	
Dependency	http://www.opengis.net/spec/OMXML/2.0/conf/spatialSampling	
Test	http://www.opengis.net/spec/OMXML/2.0/conf/samplingPoint/shape-point	
	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/samplingPoint/shape-point
	Test purpose	Verify that XML element sams:shape contains a subelement in the substitution group of gml:Point or a link to a representation of a point.
	Test method	Validate the XML document using the Schematron document http://schemas.opengis.net/samplingSpatial/2.0/samplingPoint.sch . Pass if no errors reported. Fail otherwise.
	Test type	Capability

A.15 Conformance class: Sampling curve data

Conformance Class		
http://www.opengis.net/spec/OMXML/2.0/conf/samplingCurve		
Requirements	http://www.opengis.net/spec/OMXML/2.0/req/samplingCurve	
Dependency	http://www.opengis.net/spec/OMXML/2.0/conf/spatialSampling	
Test	http://www.opengis.net/spec/OMXML/2.0/conf/samplingCurve/shape-curve	
	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/samplingCurve/shape-curve
	Test purpose	Verify that the XML element sams:shape contains a subelement in the substitution group of gml:AbstractCurve or a link to a representation of a curve.
	Test method	Validate the XML document using the Schematron document http://schemas.opengis.net/samplingSpatial/2.0/samplingCurve.sch . Pass if no errors reported. Fail otherwise.
	Test type	Capability

A.16 Conformance class: Sampling surface data

Conformance Class		
http://www.opengis.net/spec/OMXML/2.0/conf/samplingSurface		
Requirements	http://www.opengis.net/spec/OMXML/2.0/req/samplingSurface	
Dependency	http://www.opengis.net/spec/OMXML/2.0/conf/spatialSampling	
Test	http://www.opengis.net/spec/OMXML/2.0/conf/samplingSurface/shape-surface	
	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/samplingSurface/shape-surface
	Test purpose	Verify that the XML element sams:shape contains a subelement in the substitution group of gml:AbstractSurface or a link to a representation of a surface.

	Test method	Validate the XML document using the Schematron document http://schemas.opengis.net/samplingSpatial/2.0/samplingSurface.sch . Pass if no errors reported. Fail otherwise.
	Test type	Capability

A.17 Conformance class: Sampling solid data

Conformance Class		
http://www.opengis.net/spec/OMXML/2.0/conf/samplingSolid		
Requirements	http://www.opengis.net/spec/OMXML/2.0/req/samplingSolid	
Dependency	http://www.opengis.net/spec/OMXML/2.0/conf/spatialSampling	
Test	http://www.opengis.net/spec/OMXML/2.0/conf/samplingSolid/shape-solid	
	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/samplingSolid/shape-solid
	Test purpose	Verify that the XML element sams:shape contains a subelement in the substitution group of gml:AbstractSolid or a link to a representation of a solid.
	Test method	Validate the XML document using the Schematron document http://schemas.opengis.net/samplingSpatial/2.0/samplingSolid.sch . Pass if no errors reported. Fail otherwise.
	Test type	Capability

A.18 Conformance class: Specimen data

Conformance Class		
http://www.opengis.net/spec/OMXML/2.0/conf/specimen		
Requirements	http://www.opengis.net/spec/OMXML/2.0/req/specimen	
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/sampling	
Test	http://www.opengis.net/spec/OMXML/2.0/conf/specimen/specimen-valid	

	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/sampling/sampling-valid
	Requirement	http://www.opengis.net/spec/OMXML/2.0/req/specimen/specimen-valid
	Test purpose	Verify that any XML element in the substitution group of spec:SF_Specimen is well-formed and valid
	Test method	Validate the XML document using the XML Schema document http://schemas.opengis.net/samplingSpecimen/2.0/specimen.xsd . Pass if no errors reported. Fail otherwise.
	Test type	Basic

Annex B XML Schema implementation (informative)

B.1 GML Application Schema

The implementation of OMXML is a GML Application Schema, satisfying the requirements of clause 21 and tests in clause 2.2 and annex A.1 from GML v3.2 [OGC Geography Markup Language v3.2].

B.2 Encoding rule

B.2.1 Variations from standard GML encoding rule

The encoding of the model from [OGC Observations and Measurements v2.0] generally follows the UML-XML encoding rule described in Annex E of [OGC Geography Markup Language v3.2]. The following elements of the encoding rule are variations from normal practice:

1. Class attributes of type 'GenericName' are implemented as gml:ReferenceType. This encourages the use of pre-registered values identified using URIs, and referred to using an unambiguous syntax.
2. Association classes are encoded following the rule described in GML Change Request 08-109.
3. The following XML elements whose cardinality in minOccurs=1, are classified nillable="true": om:procedure, om:observedProperty, om:featureOfInterest, sam:sampledFeature. This allows an element to appear in an instance marked xsi:nil="true" with missing content, and carry the attribute nilReason to provide an explanation for the missing data (see 8.2.3.2 in [OGC Geography Markup Language v3.2]). This supports applications where the information, though strictly required, is not available.
4. The abstract classes OM_Process and SF_Process are each implemented as a wildcard: `<any namespace="##any" processContents="lax" />`. This recognizes that specific encodings are in current use in some communities, and permits their use in OMXML provided only that a process description is encapsulated in a single XML element.
5. Some specializations are encoded using virtual sub-typing and constraints, instead of the usual XML schema derivation and new element declarations. This makes for a lighter-weight schema and easier software implementation.
6. Many observation and sampling feature properties are declared globally, and some included in globally-declared content-model groups, instead of as local

element declarations (as described in Clause E.2.4.11 in [OGC Geography Markup Language v3.2]). Globally declared properties can be more easily re-used in complex-type definitions.

Variations 5 and 6 are discussed in more detail in the following sub-clauses.

B.2.2 Virtual sub-typing of specialized classes

Where an implementation includes classes that specialize their parent only by restricting the value-space of one or more properties (attributes or association targets) of the parent, then:

- (a) the specializations shall be implemented by the same XML element as the parent class. The content of the properties whose value-space is restricted shall be tested using a constraint language to verify that they match the required model;
- (b) the XML element that implements the parent class shall carry an optional property 'type' whose value provides the name of the specialization.

The latter rule can only be triggered if the implementation includes the parent class as well as the specializations.

An example instance of a Measurement implemented using virtual sub-typing is shown Listing 1.

Listing 1 – Measurement implemented by virtual sub-typing

```
<om:OM_Observation gml:id="m1">
  <om:type xlink:href="http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_Measurement"/>
  <om:phenomenonTime>
    <gml:TimeInstant gml:id="ot1t">
      <gml:timePosition>2005-01-11T16:22:25.00</gml:timePosition>
    </gml:TimeInstant>
  </om:phenomenonTime>
  <om:resultTime xlink:href="#ot1t"/>
  <om:procedure xlink:href="http://www.example.org/register/process/scales34.xml"/>
  <om:observedProperty xlink:href="urn:ogc:def:phenomenon:OGC:mass"/>
  <om:featureOfInterest xlink:href="http://wfs.example.org?request=getFeature&featureid=f37f"/>
  <om:result uom="kg">0.28</om:result>
</om:OM_Observation>
```

The value of `om:type/@xlink:href` is `http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_Measurement`. This is used to provide the context for a result consistency test using a Schematron pattern [ISO/IEC 19757-3, Information technology — Document Schema Definition Languages (DSDL) — Part 3: Rule-based validation — Schematron], as shown in Listing 2.

Listing 2 – Schematron pattern for validating the Measurement implementation

```
<pattern id="observation-type-measurement">
  <rule context="//om:OM_Observation[
om:type/@xlink:href='http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_Measurement' ] ">
    <assert xmlns="http://purl.oclc.org/dsdl/schematron"
      test="( om:result/@uom castable as gml:UomSymbol
```

```

        or om:result/@uom castable as gml:UomURI )
        and om:result castable as xs:double"
    >result model must match gml:MeasureType</assert>
</rule>
</pattern>

```

In this Schematron the assert element explicitly tests that the content of the result element matches the model of gml:MeasureType. Similar consistency tests are provided for all the other standard observation-types.

B.2.3 Global property elements

In the schema document observation.xsd, the set of basic observation properties is declared as part of the group OM_CommonProperties and a global element declaration for 'result', as shown in Listing 3.

Listing 3 – Observation property declarations

```

<group name="OM_CommonProperties">
  <sequence>
    <element name="type" type="gml:ReferenceType" minOccurs="0"/>
    <element name="metadata" type="gmd:MD_Metadata_PropertyType" minOccurs="0"/>
    <element name="relatedObservation" type="om:ObservationContextPropertyType"
      minOccurs="0" maxOccurs="unbounded"/>
    <element name="phenomenonTime" type="om:TimeObjectPropertyType"/>
    <element name="resultTime" type="gml:TimeInstantPropertyType"/>
    <element name="validTime" type="gml:TimePeriodPropertyType" minOccurs="0"/>
    <element name="procedure" type="om:OM_ProcessPropertyType"/>
    <element name="parameter" type="om:NamedValuePropertyType"
      minOccurs="0" maxOccurs="unbounded"/>
    <element name="observedProperty" type="gml:ReferenceType"/>
    <element name="featureOfInterest" type="gml:FeaturePropertyType"/>
    <element name="resultQuality" type="gmd:DQ_Element_PropertyType" minOccurs="0"/>
  </sequence>
</group>

<element name="result" type="anyType"/>

```

Listing 2. shows an implementation for a possible observation class 'Some_Observation'. The declaration for 'result' type overrides the generic result, and the definition for Some_ObservationType uses this and the content-model group in a complex type definition that supports declaration of an element for Some_Observation that is schema valid and allows for the correct substitution group membership.

Listing 2 – Some_Observation type definition and element declaration

```

<element name="result" type="ex:SomeType" substitutionGroup="om:result"/>

<complexType name="Some_ObservationType">
  <complexContent>
    <restriction base="om:OM_ObservationType">
      <sequence>
        <group ref="gml:StandardObjectProperties"/>
        <group ref="om:OM_CommonProperties"/>
        <element ref="ex:result"/>
      </sequence>
    </restriction>
  </complexContent>
</complexType>

```

```
        </restriction>
      </complexContent>
    </complexType>

    <element name="Some_Observation" type="ex:Some_ObservationType"
      substitutionGroup="om:OM_Observation"/>
```

Without the global element and group declarations, redefinition of the 'result' property would not be possible because the base schema and specialization are in different namespaces.

Annex C Example OMXML documents (informative)

C.1 Introduction

The following documents illustrate the use of OMXML.

C.2 Observation data

C.2.1 A scalar observation whose result is a Measure

Conforms to <http://www.opengis.net/spec/OMXML/2.0/conf/measurement>

```
<om:OM_Observation
  gml:id="obsTest1"
  xmlns:om="http://www.opengis.net/om/2.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xsi:schemaLocation="http://www.opengis.net/om/2.0 http://schemas.opengis.net/om/2.0/observation.xsd">

  <gml:description>Observation test instance: fruit mass</gml:description>
  <gml:name>Observation test 1</gml:name>
  <om:type xlink:href="http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_Measurement"/>
  <om:phenomenonTime>
    <gml:TimeInstant
      gml:id="ot1t">
        <gml:timePosition>2005-01-11T16:22:25.00</gml:timePosition>
      </gml:TimeInstant>
    </om:phenomenonTime>
    <om:resultTime xlink:href="#ot1t"/>
    <!-- a notional URL identifying a procedure ... -->
    <om:procedure
      xlink:href="http://www.example.org/register/process/scales34.xml"/>
    <!-- environmental conditions during measurement -->
    <om:parameter>
      <om:NamedValue>
        <om:name xlink:href="http://sweet.jpl.nasa.gov/ontology/property.owl#Temperature"/>
        <om:value xsi:type="gml:MeasureType" uom="Cel">22.3</om:value>
      </om:NamedValue>
    </om:parameter>
    <!-- a notional URN identifying the observed property -->
    <om:observedProperty
      xlink:href="http://sweet.jpl.nasa.gov/2.0/phys.owl#Mass"/>
    <!-- a notional WFS call identifying the object regarding which the observation was made -->
    <om:featureOfInterest
      xlink:href="http://wfs.example.org?request=getFeature&featureid=fruit37f"/>

    <om:result
      xsi:type="gml:MeasureType"
      uom="kg">0.28</om:result>
    <!-- The XML Schema type of the result is indicated using the value of the xsi:type attribute -->
```



```
</om:OM_Observation>
```

C.2.2 A scalar observation whose result is a classification or category

Conforms to <http://www.opengis.net/spec/OMXML/2.0/conf/categoryObservation>

```
<om:OM_Observation
  gml:id="obsTest2"
  xmlns:om="http://www.opengis.net/om/2.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xsi:schemaLocation="http://www.opengis.net/om/2.0 http://schemas.opengis.net/om/2.0/observation.xsd">

  <gml:description>Observation test instance: fruit identification</gml:description>
  <gml:name>Observation test 1</gml:name>
  <om:type
    xlink:href="http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_CategoryObservation"/>
  <om:phenomenonTime>
    <gml:TimeInstant
      gml:id="ot2t">
        <gml:timePosition>2005-01-11T17:22:25.00</gml:timePosition>
      </gml:TimeInstant>
    </om:phenomenonTime>
  <om:resultTime
    xlink:href="#ot2t"/>
  <om:procedure
    xlink:title="Abby Bachrach-Cox"
    xlink:role="http://sweet.jpl.nasa.gov/2.0/biolAnimal.owl#Human"
    xlink:arcrole="http://www.example.org/party/role/field_worker"
    xlink:href="http://www.example.org/party/individual/abc123"/>
  <om:observedProperty
    xlink:href="http://sweet.jpl.nasa.gov/2.0/biol.owl#Species"/>
  <om:featureOfInterest
    xlink:href="http://wfs.example.org?request=getFeature&featureid=fruit37f"/>

  <om:result
    xsi:type="gml:ReferenceType"
    xlink:title="Banana"
    xlink:href="http://en.wikipedia.org/wiki/List_of_fruits#Banana"/>

</om:OM_Observation>
```

C.2.3 An observation whose result is provided out-of-band

Conforms to <http://www.opengis.net/spec/OMXML/2.0/conf/observation>

```
<om:OM_Observation
  gml:id="OPTest1"
  xmlns:om="http://www.opengis.net/om/2.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xsi:schemaLocation="http://www.opengis.net/om/2.0 http://schemas.opengis.net/om/2.0/observation.xsd">
```

```

<gml:description>Observation instance with remote result</gml:description>
<gml:name>Observation Pointer 1</gml:name>
<om:type
  xlink:href="http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_TimeSeriesObservation"/>
<om:phenomenonTime>
  <gml:TimePeriod
    <gml:id="op1t">
      <gml:beginPosition>2005-01-11T17:22:25.00</gml:beginPosition>
      <gml:endPosition>2005-01-11T18:22:25.00</gml:endPosition>
    </gml:TimePeriod>
  </om:phenomenonTime>
  <om:resultTime>
    <gml:TimeInstant
      <gml:id="eoplt">
        <gml:timePosition>2005-01-11T18:22:25.00</gml:timePosition>
      </gml:TimeInstant>
    </om:resultTime>
    <om:procedure
      xsi:nil="true"
      nilReason="unknown"/>
    <om:observedProperty
      xlink:href="urn:example:RelativeHumidity"/>
    <om:featureOfInterest
      xlink:href="http://my.example.org/wfs%26request=getFeature%26;featureid=789002"
      xlink:role="urn:ogc:def:featureType:NWS:station"/>

    <om:result
      xlink:href="http://my.example.org/results%3f798002%26property=RH"
      xlink:role="application/xmpp"
      xsi:type="gml:ReferenceType"/>

  </om:OM_Observation>

```

C.2.4 Observation with complex result

Conforms to <http://www.opengis.net/spec/OMXML/2.0/conf/complexObservation>

```

<om:OM_Observation
  gml:id="COTest3"
  xmlns:om="http://www.opengis.net/om/2.0"
  xmlns:swe="http://www.opengis.net/swe/2.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xsi:schemaLocation="http://www.opengis.net/om/2.0 http://schemas.opengis.net/om/2.0/observation.xsd
    http://www.opengis.net/swe/2.0 http://schemas.opengis.net/sweCommon/2.0/swe.xsd">

  <gml:description>Complex Observation test instance</gml:description>
  <om:type
    xlink:href="http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_ComplexObservation"/>
  <om:phenomenonTime>
    <gml:TimeInstant
      <gml:id="ot1t">
        <gml:timePosition>2005-01-11T17:22:25.00</gml:timePosition>
      </gml:TimeInstant>
    </om:phenomenonTime>

```

```

<om:resultTime
  xlink:href="#ot1t"/>
<om:procedure
  xlink:href="http://www.example.org/register/process/weatherStation3"/>
<om:observedProperty
  xlink:href="http://sweet.jpl.nasa.gov/2.0/atmo.owl#Weather"/>
<om:featureOfInterest
  xlink:href="http://www.ga.gov.au/bin/gazd01?rec=293604"
  xlink:role="urn:cgi:featureType:SEEGRID:framework:locality"/>

<om:result
  xsi:type="swe:DataRecordPropertyType">
  <swe:DataRecord
    definition="record_weather.xml">
    <swe:field
      name="AirTemperature">
      <swe:Quantity>
      <swe:uom
        xlink:href="Cel"/>
      <swe:value>35.1</swe:value>
      </swe:Quantity>
    </swe:field>
    <swe:field
      name="WindSpeed">
      <swe:Quantity>
      <swe:uom
        xlink:href="km.h-1"/>
      <swe:value>6.5</swe:value>
      </swe:Quantity>
    </swe:field>
    <swe:field
      name="WindDirection">
      <swe:Quantity>
      <swe:uom
        xlink:href="deg"/>
      <swe:value>085.0</swe:value>
      </swe:Quantity>
    </swe:field>
    <swe:field
      name="AtmosphericPressure">
      <swe:Quantity>
      <swe:uom
        xlink:href="hPa"/>
      <swe:value>950.</swe:value>
      </swe:Quantity>
    </swe:field>
    <swe:field
      name="RelativeHumidity">
      <swe:Quantity>
      <swe:uom
        xlink:href="percent"/>
      <swe:value>32.</swe:value>
      </swe:Quantity>
    </swe:field>
    <swe:field
      name="visibility">
      <swe:Category>
      <swe:value>clear</swe:value>
      </swe:Category>
    </swe:field>
  </swe:DataRecord>
</om:result>

```

```

    </swe:DataRecord>
  </om:result>

</om:OM_Observation>

```

C.2.5 Observation with complex result –SWE TextBlock encoding

Conforms to <http://www.opengis.net/spec/OMXML/2.0/req/SWEArrayObservation>

```

<om:OM_Observation
  gml:id="O35235"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xmlns:om="http://www.opengis.net/om/2.0"
  xmlns:swe="http://www.opengis.net/swe/1.0/gml32"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.opengis.net/om/2.0 http://schemas.opengis.net/om/2.0/observation.xsd">

  <gml:name>Weather Data</gml:name>
  <om:type
    xlink:href="http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_SWEObservation"/>
  <om:phenomenonTime>
    <gml:TimePeriod
      gml:id="TP2523">
        <gml:beginPosition>2007-04-01T00:00:00.000-06:00</gml:beginPosition>
        <gml:endPosition>2007-04-01T03:40:00.000-06:00</gml:endPosition>
      </gml:TimePeriod>
    </om:phenomenonTime>
    <om:resultTime>
      <gml:TimeInstant
        gml:id="eTP2523">
          <gml:timePosition>2007-04-01T03:40:00.000-06:00</gml:timePosition>
        </gml:TimeInstant>
      </om:resultTime>
      <om:procedure
        xlink:href="urn:vast:sensor:weatherStation"/>
      <om:observedProperty
        xlink:href="weather1.xml"/>
      <om:featureOfInterest
        xlink:href="http://www.ga.gov.au/bin/gazd01?rec=293604"
        xlink:role="urn:ogc:def:featureType:SEEGRID:locality"/>
    </om:result>
    <swe:DataArray
      gml:id="DA3464">
        <swe:elementCount>
          <swe:Count
            gml:id="C457">
              <swe:value>23</swe:value>
            </swe:Count>
          </swe:elementCount>
          <swe:elementType
            name="WeatherRecordType"
            xlink:href="weatherRecord1_t.xml"/>
          <swe:encoding>
            <swe:TextBlock
              decimalSeparator="."

```

```

        tokenSeparator=","
        blockSeparator=" " />
    </swe:encoding>
    <swe:values> 2007-04-01T00:00:00.000-06:00,30.4,28.8,155.8,1055.32,55,haze
        2007-04-01T00:00:10.000-06:00,30.4,28.8,155.8,1055.4,59,haze
        2007-04-01T00:00:20.000-06:00,30.4,28.8,155.7,1055.47,65,haze
        2007-04-01T00:00:30.000-06:00,30.3,28.9,155.7,1055.55,66,haze
        2007-04-01T00:00:40.000-06:00,30.3,28.9,155.6,1055.62,61,haze
        2007-04-01T00:00:50.000-06:00,30.3,28.9,155.6,1055.69,55,haze
        2007-04-01T00:01:00.000-06:00,30.3,28.9,155.5,1055.77,51,haze
        2007-04-01T00:01:10.000-06:00,30.2,28.9,155.5,1055.84,48,haze
        2007-04-01T00:01:20.000-06:00,30.2,28.9,155.4,1055.91,43,haze
        2007-04-01T00:01:30.000-06:00,30.2,28.9,155.4,1055.99,44,haze
        2007-04-01T00:01:40.000-06:00,30.2,29,155.3,1056.06,46,haze
        2007-04-01T00:01:50.000-06:00,30.1,29,155.3,1056.13,48,haze
        2007-04-01T00:02:00.000-06:00,30.1,29,155.2,1056.2,44,haze
        2007-04-01T00:02:10.000-06:00,30.1,29,155.2,1056.27,41,haze
        2007-04-01T00:02:20.000-06:00,30.1,29,155.1,1056.34,40,haze
        2007-04-01T00:02:30.000-06:00,30,29,155.1,1056.41,36,clear
        2007-04-01T00:02:40.000-06:00,30,29,155,1056.48,39,clear
        2007-04-01T00:02:50.000-06:00,30,29.1,155,1056.55,50,haze
        2007-04-01T00:03:00.000-06:00,30,29.1,155,1056.62,65,haze
        2007-04-01T00:03:10.000-06:00,30,29.1,154.9,1056.69,70,haze
        2007-04-01T00:03:20.000-06:00,29.9,29.1,154.9,1056.76,71,haze
        2007-04-01T00:03:30.000-06:00,29.9,29.1,154.8,1056.83,75,haze
        2007-04-01T00:03:40.000-06:00,29.9,29.1,154.8,1056.89,75,haze </swe:values>
    </swe:DataArray>
</om:result>

</om:OM_Observation>

```

C.2.6 Observation with complex result – alternative schema for result

Conforms to <http://www.opengis.net/spec/OMXML/2.0/conf/observation>

```

<om:OM_Observation
  gml:id="obsTest4"
  xmlns:cv="http://www.opengis.net/cv/0.2/gml32"
  xmlns:swe="http://www.opengis.net/swe/1.0/gml32"
  xmlns:om="http://www.opengis.net/om/2.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xsi:schemaLocation="http://www.opengis.net/om/2.0 http://schemas.opengis.net/om/2.0/observation.xsd
    http://www.opengis.net/cv/0.2/gml32 http://bp.schemas.opengis.net/06-188r2/cv/0.2.2_gml32/cv.xsd">

  <gml:description>Observation test instance - multi-element featureOfInterest </gml:description>
  <gml:name>Multi-element 1</gml:name>

  <om:phenomenonTime>
    <gml:TimeInstant
      gml:id="ots1t">
        <gml:timePosition>2005-06-17</gml:timePosition>
      </gml:TimeInstant>
    </om:phenomenonTime>

    <om:resultTime
      xlink:href="#ots1t"/>

```

```

<om:procedure
  xlink:href="urn:ogc:object:feature:Sensor:NASA:xyz345"/>
<om:observedProperty
  xlink:href="http://sweet.jpl.nasa.gov/2.0/physRadiation.owl#Radiance"/>
<om:featureOfInterest
  xlink:href="http://wfs.example.org?request=getFeature&#38;featureid=stc1"/>

<om:result>
  <cv:CV_DiscreteCoverage
    gml:id="DC756254">
    <cv:domainExtent

xlink:href="http://wfs.example.org?request=getFeature&#38;featureid=stc1#xpointer(./boundedBy)"/>
    <cv:rangeType
      xlink:href="http://sweet.jpl.nasa.gov/2.0/physRadiation.owl#Radiance"/>
    <cv:element>
      <cv:CV_GeometryValuePair>
        <cv:geometry
          xlink:href="pixel1"/>
        <cv:value
          xsi:type="gml:MeasureType"
          uom="uV">10.1</cv:value>
        </cv:CV_GeometryValuePair>
      </cv:element>
      <cv:element>
        <cv:CV_GeometryValuePair>
          <cv:geometry
            xlink:href="pixel2"/>
          <cv:value
            xsi:type="gml:MeasureType"
            uom="uV">15.7</cv:value>
          </cv:CV_GeometryValuePair>
        </cv:element>
        <cv:element>
          <cv:CV_GeometryValuePair>
            <cv:geometry
              xlink:href="pixel3"/>
            <cv:value
              xsi:type="gml:MeasureType"
              uom="uV">20.2</cv:value>
            </cv:CV_GeometryValuePair>
          </cv:element>
          <cv:element>
            <cv:CV_GeometryValuePair>
              <cv:geometry
                xlink:href="pixel4"/>
              <cv:value
                xsi:type="gml:MeasureType"
                uom="uV">27.5</cv:value>
              </cv:CV_GeometryValuePair>
            </cv:element>
          </cv:CV_DiscreteCoverage>
        </om:result>

</om:OM_Observation>

```

C.2.7 Observation with spatial location indicated in a parameter

This observation type is provided to support spatial filtering in SOS applications.

Conforms to <http://www.opengis.net/spec/OMXML/2.0/conf/spatialObservation>

```
<om:OM_Observation
  gml:id="obsTest1"
  xmlns:om="http://www.opengis.net/om/2.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xsi:schemaLocation="http://www.opengis.net/om/2.0 http://schemas.opengis.net/om/2.0/observation.xsd">

  <!-- optional description of observation -->
  <gml:description>Spatial observation test instance: water level</gml:description>

  <!-- optional name of observation -->
  <gml:name>Spatial observation test 1</gml:name>

  <!-- phenomenon time of observation -->
  <om:phenomenonTime>
    <gml:TimeInstant
      gml:id="pt1">
        <gml:timePosition>2010-03-08T16:22:25.00</gml:timePosition>
      </gml:TimeInstant>
    </om:phenomenonTime>

  <!-- result time is same as phenomenon time of observation -->
  <om:resultTime
    xlink:href="#pt1"/>

  <!-- link to DescribeSensor operation of SOS which is providing the sensor description -->
  <om:procedure
    xlink:href="http://mySOSURL?service=SOS&request=DescribeSensor&version=2.0.0&procedureIdentifier=&quot;procedure1&quot;">

  <!-- parameter containing samplingPoint as defined in SOS 2.0 Extension - Data Encoding Restriction-->
  <om:parameter>
    <om:NamedValue>
      <om:name
        xlink:href="http://www.opengis.net/def/param-name/OGC-OM/2.0/samplingGeometry"/>
      <om:value>
        <gml:Point
          gml:id="SamplingPoint">
            <gml:pos
              srsName="urn:ogc:def:crs:EPSG:4326">52.9 7.52</gml:pos>
            </gml:Point>
          </om:value>
        </om:NamedValue>
      </om:parameter>

  <!-- a notional URN identifying the observed property -->
  <om:observedProperty
    xlink:href="http://sweet.jpl.nasa.gov/2.0/hydroSurface.owl#WaterHeight"/>

  <!-- a notional WFS call identifying the object regarding which the observation was made -->
  <om:featureOfInterest
    xlink:href="http://wfs.example.org?request=getFeature&featureid=river1"/>
```

```

<!-- The XML Schema type of the result is indicated using the value of the xsi:type attribute -->
<om:result
  xsi:type="gml:MeasureType"
  uom="cm">28</om:result>

```

```
</om:OM_Observation>
```

C.3 Spatial sampling features

C.3.1 Sampling Point

Conforms to <http://www.opengis.net/spec/OMXML/2.0/conf/samplingPoint>

```

<sams:SF_SpatialSamplingFeature
  gml:id="st2"
  xmlns:sf="http://www.opengis.net/sampling/2.0"
  xmlns:sams="http://www.opengis.net/samplingSpatial/2.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xsi:schemaLocation="http://www.opengis.net/samplingSpatial/2.0
http://schemas.opengis.net/samplingSpatial/2.0/spatialSamplingFeature.xsd">

  <gml:description>Hydrology sampling station</gml:description>
  <gml:name
    codeSpace="http://my.hydrology.example.org/catchments/Potamos">st2</gml:name>
  <sf:type
    xlink:href="http://www.opengis.net/def/samplingFeatureType/OGC-OM/2.0/SF_SamplingPoint"/>
  <sf:sampledFeature
    xlink:href="http://my.hydrology.example.org/catchments/Potamos"/> <sf:relatedObservation
    xlink:href="http://my.hydrology.example.org/chemistry/2007/rtg78n"/>
  <sf:relatedObservation
    xlink:href="http://my.hydrology.example.org/chemistry/2007/rtg108q"/>
  <sf:relatedSamplingFeature>
    <sf:SamplingFeatureComplex>
      <sf:role
        xlink:href="http://www.example.org/complex/member"/>
      <sf:relatedSamplingFeature
        xlink:href="http://my.example.org/wfs?request=getFeature;featureid=coll32"/>
    </sf:SamplingFeatureComplex>
  </sf:relatedSamplingFeature>
  <sams:shape>
    <gml:Point
      gml:id="st2p">
      <gml:pos
        srsName="urn:ogc:def:crs:EPSG:6.8:4283">-30.711 134.205</gml:pos>
    </gml:Point>
  </sams:shape>
</sams:SF_SpatialSamplingFeature>

```


C.3.2 Sampling Curve with metadata

Conforms to <http://www.opengis.net/spec/OMXML/2.0/conf/samplingCurve>

```
<sams:SF_SpatialSamplingFeature
  gml:id="pr1"
  xmlns:sams="http://www.opengis.net/samplingSpatial/2.0"
  xmlns:sam="http://www.opengis.net/sampling/2.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:gmd="http://www.isotc211.org/2005/gmd"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xsi:schemaLocation="http://www.opengis.net/samplingSpatial/2.0
http://schemas.opengis.net/samplingSpatial/2.0/spatialSamplingFeature.xsd">

  <gml:description>Geology traverse</gml:description>
  <gml:name
    codeSpace="http://my.geology.example.org/projects/2007">pr1</gml:name>
  <gml:boundedBy>
    <gml:Envelope
      srsName="urn:ogc:def:crs:EPSG:6.8:4283">
        <gml:lowerCorner>-30.711 134.196</gml:lowerCorner>
        <gml:upperCorner>-30.702 134.205</gml:upperCorner>
      </gml:Envelope>
    </gml:boundedBy>
  <sam:type
    xlink:href="http://www.opengis.net/def/samplingFeatureType/OGC-OM/2.0/SF_SamplingCurve"/>
  <sam:sampledFeature
    xlink:href="http://my.geology.example.org/unit/g345"/>
  <sam:lineage>
    <gmd:LI_Lineage>
      <gmd:statement>
        <CharacterString
          xmlns="http://www.isotc211.org/2005/gco">elevation and position obtained using
          http://my.geology.example.org/procedures/survey/position/GPS4 </CharacterString>
        </gmd:statement>
      </gmd:LI_Lineage>
    </sam:lineage>
  <sams:positionalAccuracy>
    <gmd:DQ_AbsoluteExternalPositionalAccuracy>
      <gmd:nameOfMeasure>
        <CharacterString
          xmlns="http://www.isotc211.org/2005/gco">horizontal accuracy</CharacterString>
        </gmd:nameOfMeasure>
      <gmd:result>
        <gmd:DQ_QuantitativeResult>
          <gmd:valueUnit
            xlink:href="urn:ogc:def:UCUM::m"/>
          <gmd:value>
            <Record
              xmlns="http://www.isotc211.org/2005/gco">3.</Record>
            </gmd:value>
          </gmd:DQ_QuantitativeResult>
        </gmd:result>
      </gmd:DQ_AbsoluteExternalPositionalAccuracy>
    </sams:positionalAccuracy>
  <sams:positionalAccuracy>
    <gmd:DQ_AbsoluteExternalPositionalAccuracy>
      <gmd:nameOfMeasure>
```

```

        <CharacterString
          xmlns="http://www.isotc211.org/2005/gco">elevation accuracy</CharacterString>
        </gmd:nameOfMeasure>
        <gmd:result>
          <gmd:DQ_QuantitativeResult>
            <gmd:valueUnit
              xlink:href="urn:ogc:def:UCUM::m"/>
            <gmd:value>
              <Record
                xmlns="http://www.isotc211.org/2005/gco">10.</Record>
              </gmd:value>
            </gmd:DQ_QuantitativeResult>
          </gmd:result>
        </gmd:DQ_AbsoluteExternalPositionalAccuracy>
      </sams:positionalAccuracy>
    </sams:shape>
    <gml:LineString
      gml:id="pr1_ls1"
      srsName="urn:ogc:def:crs:EPSG:6.8:4347">
      <gml:pos>-30.711 134.205 321.</gml:pos>
      <gml:pos>-30.710 134.204 315.</gml:pos>
      <gml:pos>-30.709 134.203 303.</gml:pos>
      <gml:pos>-30.708 134.201 296.</gml:pos>
      <gml:pos>-30.706 134.196 272.</gml:pos>
      <gml:pos>-30.703 134.197 271.</gml:pos>
      <gml:pos>-30.702 134.199 280.</gml:pos>
    </gml:LineString>
  </sams:shape>
</sams:SpatialSamplingFeature>

```

C.3.3 Sampling feature collection – sampling curve with association stations

Conforms to <http://www.opengis.net/spec/OMXML/2.0/conf/sampling>

```

<sf:SpatialSamplingFeatureCollection
  gml:id="foi"
  xmlns:sf="http://www.opengis.net/sampling/2.0"
  xmlns:sams="http://www.opengis.net/samplingSpatial/2.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xsi:schemaLocation="http://www.opengis.net/samplingSpatial/2.0
http://schemas.opengis.net/samplingSpatial/2.0/spatialSamplingFeature.xsd">

  <gml:description>This collection contains a sampling curve plus some associated stations</gml:description>
  <gml:boundedBy>
    <gml:Envelope
      srsName="urn:ogc:def:crs:EPSG:6.3:62836405">
      <gml:lowerCorner>-90 -180</gml:lowerCorner>
      <gml:upperCorner>90 180</gml:upperCorner>
    </gml:Envelope>
  </gml:boundedBy>

  <sf:member>

```

```

<sams:SF_SpatialSamplingFeature
  gml:id="ot2s">
    <gml:name>8903</gml:name>
    <sf:type
      xlink:href="http://www.opengis.net/def/samplingFeatureType/OGC-
OM/2.0/SF_SamplingCurve"/>
    <sf:sampledFeature
      xlink:href="http://wfs.flakey.org?request=getFeature&featureid=tract470"/>
    <sf:relatedSamplingFeature>
      <sf:SamplingFeatureComplex>
        <sf:role
          xlink:href="urn:example:station"/>
        <sf:relatedSamplingFeature
          xlink:href="#st1p"/>
        </sf:SamplingFeatureComplex>
      </sf:relatedSamplingFeature>
    <sf:relatedSamplingFeature>
      <sf:SamplingFeatureComplex>
        <sf:role
          xlink:href="urn:example:station"/>
        <sf:relatedSamplingFeature
          xlink:href="#st2p"/>
        </sf:SamplingFeatureComplex>
      </sf:relatedSamplingFeature>
    <sf:relatedSamplingFeature>
      <sf:SamplingFeatureComplex>
        <sf:role
          xlink:href="urn:example:station"/>
        <sf:relatedSamplingFeature
          xlink:href="#st3p"/>
        </sf:SamplingFeatureComplex>
      </sf:relatedSamplingFeature>
    <sf:relatedSamplingFeature>
      <sf:SamplingFeatureComplex>
        <sf:role
          xlink:href="urn:example:station"/>
        <sf:relatedSamplingFeature
          xlink:href="#st4p"/>
        </sf:SamplingFeatureComplex>
      </sf:relatedSamplingFeature>
    <sams:shape>
      <gml:LineString
        gml:id="pr1_ls1"
        srsName="urn:ogc:def:crs:EPSG:6.8:4347">
        <gml:pos>-30.711 134.205 321.</gml:pos>
        <gml:pos>-30.710 134.204 315.</gml:pos>
        <gml:pos>-30.709 134.203 303.</gml:pos>
        <gml:pos>-30.708 134.201 296.</gml:pos>
        <gml:pos>-30.706 134.196 272.</gml:pos>
        <gml:pos>-30.703 134.197 271.</gml:pos>
        <gml:pos>-30.702 134.199 280.</gml:pos>
        </gml:LineString>
      </sams:shape>
    </sams:SF_SpatialSamplingFeature>

</sf:member>
<sf:member>

```

```

<sams:SF_SpatialSamplingFeature
  gml:id="st1">

```

```

        <sf:type
          xlink:href="http://www.opengis.net/def/samplingFeatureType/OGC-
OM/2.0/SF_SamplingPoint"/>
        <sf:sampledFeature
          xlink:href="http://wfs.flakey.org?request=getFeature&featureid=tract470"/>
        <sams:shape>
          <gml:Point
            gml:id="st1p">
              <gml:pos>-30.702 134.199</gml:pos>
            </gml:Point>
          </sams:shape>
        </sams:SF_SpatialSamplingFeature>

      </sf:member>
      <sf:member>

        <sams:SF_SpatialSamplingFeature
          gml:id="st2">
            <sf:type
              xlink:href="http://www.opengis.net/def/samplingFeatureType/OGC-
OM/2.0/SF_SamplingPoint"/>
            <sf:sampledFeature
              xlink:href="http://wfs.flakey.org?request=getFeature&featureid=tract470"/>
            <sams:shape>
              <gml:Point
                gml:id="st2p">
                  <gml:pos>-30.710 134.204 315.</gml:pos>
                </gml:Point>
              </sams:shape>
            </sams:SF_SpatialSamplingFeature>

          </sf:member>
          <sf:member>

            <sams:SF_SpatialSamplingFeature
              gml:id="st3">
                <sf:type
                  xlink:href="http://www.opengis.net/def/samplingFeatureType/OGC-
OM/2.0/SF_SamplingPoint"/>
                <sf:sampledFeature
                  xlink:href="http://wfs.flakey.org?request=getFeature&featureid=tract470"/>
                <sams:shape>
                  <gml:Point
                    gml:id="st3p">
                      <gml:pos>-30.709 134.203 303.</gml:pos>
                    </gml:Point>
                  </sams:shape>
                </sams:SF_SpatialSamplingFeature>

              </sf:member>
              <sf:member>

                <sams:SF_SpatialSamplingFeature
                  gml:id="st4">
                    <sf:type
                      xlink:href="http://www.opengis.net/def/samplingFeatureType/OGC-
OM/2.0/SF_SamplingPoint"/>
                    <sf:sampledFeature

```

```

        xlink:href="http://wfs.flakey.org?request=getFeature&featureid=tract470"/>
      <sams:shape>
        <gml:Point>
          <gml:id="st4p">
            <gml:pos>-30.708 134.201 296.</gml:pos>
          </gml:Point>
        </sams:shape>
      </sams:SF_SpatialSamplingFeature>

    </sf:member>

  </sf:SF_SamplingFeatureCollection>

```

C.3.4 Sampling curve with embedded observations

Conforms to <http://www.opengis.net/spec/OMXML/2.0/conf/samplingCurve>

```

<sams:SF_SpatialSamplingFeature
  gml:id="b1"
  xmlns:swe="http://www.opengis.net/swe/2.0"
  xmlns:om="http://www.opengis.net/om/2.0"
  xmlns:sams="http://www.opengis.net/samplingSpatial/2.0"
  xmlns:sam="http://www.opengis.net/sampling/2.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xmlns:cv="http://www.opengis.net/cv/0.2/gml32"
  xsi:schemaLocation="http://www.opengis.net/swe/2.0 http://schemas.opengis.net/sweCommon/2.0/swe.xsd
    http://www.opengis.net/cv/0.2/gml32 http://bp.schemas.opengis.net/06-188r2/cv/0.2.2_gml32/cv.xsd
    http://www.opengis.net/om/2.0 http://schemas.opengis.net/om/2.0/observation.xsd
    http://www.opengis.net/samplingSpatial/2.0
    http://schemas.opengis.net/samplingSpatial/2.0/spatialSamplingFeature.xsd">
  <gml:description>Geology borehole Encoded as a SamplingCurve With three logs encoded as the
    results of relatedObservations</gml:description>
  <gml:name
    codeSpace="http://my.geology.custodian.org/projects/2007">b1</gml:name>
  <gml:boundedBy>
    <gml:Envelope
      srsName="urn:ogc:def:crs:EPSG:6.8:4283">
        <!-- 2D CRS -->
        <gml:lowerCorner>-30.7117 134.2053</gml:lowerCorner>
        <gml:upperCorner>-30.7111 134.2059</gml:upperCorner>
      </gml:Envelope>
    </gml:boundedBy>
  <sam:type
    xlink:href="http://www.opengis.net/def/samplingFeatureType/OGC-OM/2.0/SF_SamplingCurve"/>
  <sam:sampledFeature
    xlink:href="http://my.geology.custodian.org/unit/g345"/>
  <sam:relatedObservation>
    <om:OM_Observation
      gml:id="b1_lith1">
        <gml:description>Lithology log Result is encoded using OGC Discrete Coverage/interleaved
          pattern</gml:description>
        <om:type
          xlink:href="http://www.opengis.net/def/observationType/OGC-
OM/2.0/OM_DiscreteCoverageObservation"/>
        <om:phenomenonTime>
          <gml:TimeInstant
            gml:id="T3247149">

```

```

        <gml:timePosition>2007-06-06T17:20:30.00+08:00</gml:timePosition>
      </gml:TimeInstant>
    </om:phenomenonTime>
    <om:resultTime
      xlink:href="#T3247149"/>
    <om:procedure
      xlink:href="http://www.csiro.au/people/ps205.html"/>
    <om:observedProperty
      xlink:href="urn:ogc:def:phenomenon:CGI:2007:lithology"/>
    <om:featureOfInterest
      xlink:href="..../..../.."/>
    <om:result>
      <cv:CV_DiscreteCoverage
        gml:id="CV12415">
        <cv:domainExtent
          xlink:href="#b1_ls1"/>
        <cv:rangeType
          xlink:href="urn:ogc:def:phenomenon:CGI:2007:lithology"/>
        <cv:element>
          <cv:CV_GeometryValuePair>
            <cv:geometry>
              <cv:CV_DomainObject>
                <cv:spatialElement>
                  <gml:LineString
                    gml:id="ls91826"
                    srsName="#b1_ls1"
                    srsDimension="1">
                      <!-- positions given in 1D CRS defined by borehole shape
-->
                      <gml:pos>0.0</gml:pos>
                      <gml:pos>5.6</gml:pos>
                    </gml:LineString>
                  </cv:spatialElement>
                </cv:CV_DomainObject>
              </cv:geometry>
            <cv:value
              xsi:type="gml:CodeType"
              codeSpace="http://www.cgi-
iugs.org/geoSciML/vocabulary/lithology/2007">Laterite</cv:value>
            </cv:CV_GeometryValuePair>
          </cv:element>
        </cv:element>
        <cv:CV_GeometryValuePair>
          <cv:geometry>
            <cv:CV_DomainObject>
              <cv:spatialElement>
                <gml:LineString
                  gml:id="ls91827"
                  srsName="#b1_ls1"
                  srsDimension="1">
                    <gml:pos>5.6</gml:pos>
                    <gml:pos>35.0</gml:pos>
                  </gml:LineString>
                </cv:spatialElement>
              </cv:CV_DomainObject>
            </cv:geometry>
          <cv:value
            xsi:type="gml:CodeType"
            codeSpace="http://www.cgi-

```

```

iugs.org/geoSciML/vocabulary/lithology/2007">Granite</cv:value>
  </cv:CV_GeometryValuePair>
</cv:element>
<cv:element>
  <cv:CV_GeometryValuePair>
    <cv:geometry>
      <cv:CV_DomainObject>
        <cv:spatialElement>
          <gml:LineString
            gml:id="ls91828"
            srsName="#b1_ls1"
            srsDimension="1">
              <gml:pos>35.6</gml:pos>
              <gml:pos>55.0</gml:pos>
            </gml:LineString>
          </cv:spatialElement>
        </cv:CV_DomainObject>
      </cv:geometry>
    <cv:value
      xsi:type="gml:CodeType"
      codeSpace="http://www.cgi-
iugs.org/geoSciML/vocabulary/lithology/2007">Dacite</cv:value>
    </cv:CV_GeometryValuePair>
  </cv:element>
</cv:CV_DiscreteCoverage>
</om:result>
</om:OM_Observation>
</sam:relatedObservation>
<sam:relatedObservation>
  <om:OM_Observation
    gml:id="b1_ms1">
      <gml:description>Magnetic susceptibility log Result is encoded using SWE Common
        "DataArray" element, which embeds values in a text string</gml:description>
      <om:type
        xlink:href="http://www.opengis.net/def/observationType/OGC-OM/2.0/SWEObservation"/>
      <om:phenomenonTime>
        <gml:TimeInstant
          gml:id="T13411414">
            <gml:timePosition>2007-06-06T14:20:30.00+08:00</gml:timePosition>
          </gml:TimeInstant>
        </om:phenomenonTime>
      <om:resultTime
        xlink:href="#T13411414"/>
      <om:procedure
        xlink:href="http://www.geophysics.org/MS34"/>
      <om:observedProperty
        xlink:href="urn:ogc:def:phenomenon:CGI:2007:MagneticSusceptibility"/>
      <om:featureOfInterest
        xlink:href="../../.."/>
      <om:result>
        <swe:DataArray
          gml:id="DA1412412">
            <swe:elementCount>
              <swe:Count
                gml:id="C346373">
                  <swe:value>5</swe:value>
                </swe:Count>
              </swe:elementCount>
            <swe:elementType
              name="MagSusElement">

```

```

        <swe:DataRecord
          gml:id="DR12412414">
          <swe:field
            name="offset">
            <swe:Quantity
              definition="urn:ogc:def:phenomenon:CGI:2007:offset"
              gml:id="Q23525">
              <swe:uom
                xlink:href="urn:ogc:def:uom:UCUM:m"/>
              </swe:Quantity>
            </swe:field>
            <swe:field
              name="MagSus">
              <swe:Quantity
                definition="urn:ogc:def:phenomenon:CGI:2007:MagneticSusceptibility"
                gml:id="Q1231421">
                <swe:uom
                  xlink:href="urn:ogc:def:uom:UCUM:1"/>
                </swe:Quantity>
              </swe:field>
            </swe:DataRecord>
          </swe:elementType>
          <swe:encoding>
            <swe:TextEncoding
              decimalSeparator="."
              tokenSeparator=","
              blockSeparator=" "/>
            </swe:encoding>
            <swe:values> 1.0,0.0568 2.0,0.2568 3.0,0.3568 4.0,0.3578 5.0,0.3597
            </swe:values>
          </swe:DataArray>
        </om:result>
      </om:OM_Observation>
    </sam:relatedObservation>
    <sam:relatedObservation>
      <om:OM_Observation
        gml:id="b1_p1">
        <gml:description>Porosity log Result is encoded using OGC Discrete Point
          Coverage/interleaved pattern</gml:description>
        <om:type
          xlink:href="http://www.opengis.net/def/observationType/OGC-
OM/2.0/OM_DiscretePointCoverageObservation"/>
        <om:phenomenonTime>
          <gml:TimeInstant
            gml:id="T9897">
            <gml:timePosition>2007-06-06T14:20:30.00+08:00</gml:timePosition>
          </gml:TimeInstant>
        </om:phenomenonTime>
        <om:resultTime
          xlink:href="#T9897"/>
        <om:procedure
          xlink:href="http://www.geophysics.org/MS34"/>
        <om:observedProperty
          xlink:href="http://sweet.jpl.nasa.gov/ontology/property.owl#Porosity"/>
        <om:featureOfInterest
          xlink:href="../../.." />
        <om:result>

```



```

<cv:CV_DiscretePointCoverage
  gml:id="CV123476">
  <cv:domainExtent
    xlink:href="#b1_ls1"/>
  <cv:rangeType
    xlink:href="http://sweet.jpl.nasa.gov/ontology/property.owl#Porosity"/>
  <cv:element>
    <cv:CV_PointValuePair>
      <cv:geometry>
        <gml:Point
          srsName="#b1_ls1"
          srsDimension="1"
          gml:id="P342343">
            <gml:pos>1.0</gml:pos>
          </gml:Point>
        </cv:geometry>
        <cv:value
          xsi:type="gml:MeasureType"
          uom="1">0.0568</cv:value>
        </cv:CV_PointValuePair>
      </cv:element>
      <cv:element>
        <cv:CV_PointValuePair>
          <cv:geometry>
            <gml:Point
              srsName="#b1_ls1"
              srsDimension="1"
              gml:id="P23144">
                <gml:pos>2.0</gml:pos>
              </gml:Point>
            </cv:geometry>
            <cv:value
              xsi:type="gml:MeasureType"
              uom="1">0.0068</cv:value>
            </cv:CV_PointValuePair>
          </cv:element>
          <cv:element>
            <cv:CV_PointValuePair>
              <cv:geometry>
                <gml:Point
                  srsName="#b1_ls1"
                  srsDimension="1"
                  gml:id="P737643">
                    <gml:pos>3.0</gml:pos>
                  </gml:Point>
                </cv:geometry>
                <cv:value
                  xsi:type="gml:MeasureType"
                  uom="1">0.08</cv:value>
                </cv:CV_PointValuePair>
              </cv:element>
            </cv:CV_DiscretePointCoverage>
          </om:result>
        </om:OM_Observation>
      </sam:relatedObservation>
    <sams:shape>
      <gml:LineString
        gml:id="b1_ls1"
        srsName="urn:ogc:def:crs:EPSG:6.8:4347">
        <!-- 3D CRS -->

```

```

        <gml:pos>-30.7111 134.2059 321.</gml:pos>
        <gml:pos>-30.7112 134.2058 315.</gml:pos>
        <gml:pos>-30.7113 134.2057 303.</gml:pos>
        <gml:pos>-30.7114 134.2056 296.</gml:pos>
        <gml:pos>-30.7115 134.2055 272.</gml:pos>
        <gml:pos>-30.7116 134.2054 271.</gml:pos>
        <gml:pos>-30.7117 134.2053 270.</gml:pos>
    </gml:LineString>
</sams:shape>
</sams:SF_SpatialSamplingFeature>

```

C.4 Specimens

Conforms to <http://www.opengis.net/spec/OMXML/2.0/conf/specimen>

```

<sp:SF_Specimen
  gml:id="pr1_s2"
  xmlns:sf="http://www.opengis.net/sampling/2.0"
  xmlns:sp="http://www.opengis.net/samplingSpecimen/2.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xsi:schemaLocation="http://www.opengis.net/samplingSpecimen/2.0
http://schemas.opengis.net/samplingSpecimen/2.0/specimen.xsd">

  <gml:description>Rock sample collected on traverse</gml:description>
  <gml:name
    codeSpace="http://my.geology.example.org/samples/2007">pr1_s2</gml:name>
  <sf:type
    xlink:href="http://www.opengis.net/def/samplingFeatureType/OGC-OM/2.0/SF_Specimen"/>
  <sf:sampledFeature
    xlink:href="http://my.geology.example.org/unit/g345"/>
  <sf:relatedSamplingFeature>
    <sf:SamplingFeatureComplex>
      <sf:role
        xlink:href="http://www.example.org/sampling/parentSpecimen"/>
      <sf:relatedSamplingFeature
        xlink:href="http://my.geology.example.org/projects/2007/pr1_s1"/>
    </sf:SamplingFeatureComplex>
  </sf:relatedSamplingFeature>
  <sp:materialClass
    xlink:href="http://www.opengis.net/def/material/OGC-OM/2.0/rock"/>
  <sp:samplingTime>
    <gml:TimeInstant
      gml:id="pr1_s2_t">
        <gml:timePosition>2007-01-29T12:19:55.00+09:00</gml:timePosition>
      </gml:TimeInstant>
    </sp:samplingTime>
  <sp:samplingMethod
    xlink:href="http://geochemistry.example.org/splits/biased/density/greaterThan/2.9"/>
  <sp:samplingLocation>
    <gml:Point
      gml:id="pr1_s2_p">
        <gml:pos
          srsName="http://www.opengis.net/def/crs/EPSSG/0/4347">-30.706 134.196 272.</gml:pos>
        </gml:Point>
      </sp:samplingLocation>

```

```
<sp:currentLocation  
  xlink:href="http://www.opengis.net/def/nil/OGC-OM/2.0/destroyed"/>  
</sp:SF_Specimen>
```

Document revision history

Date	Release	Author	Paragraph modified	Description
2010-02-17	0.1	Simon Cox	All	Document created
2010-02-24	0.2	Simon Cox		Refactored requirements to reflect different standardization targets
2010-04-21	0.3	Simon Cox	Most	Reformatted requirements and conformance tests in tabular form to match Modular Spec principles
2010-04-27	0.4	Simon Cox, Christof Stasch	Table 1, Clause 7, Annex A	Added SpatialObservation; modified URIs to match proposed hierarchical scheme; rebuilt internal document links between tests, reqs, classes, etc., added test purposes
2010-05-26	0.5	Simon Cox	6, 7, 8, Annex A	1. Remove coverage-observation clauses (pending new GML Application Schema for Coverages coming out of WCS 2.0 group) 2. Remove specific MIME-type declarations, replace with instruction to use application/gml+xml 3. Add external direct dependencies (on GML, SWE Common, ISO 19139)
2010-06-11	0.6	Simon Cox	Annex C	Inserted examples
2010-06-16	0.7	Simon Cox, Alex Robin	6, 7, Annex A	Added dependency diagrams. Separated SWE observations into scalar and array classes.
2010-10-13	0.8	Simon Cox	6, 7, Annex A	Improved Figure 2. Inserted Table 3. Added shading to Req and Conf tables. Corrected URIs & nits.
2010-10-28	0.9	Simon Cox, Alex Robin, Peter Taylor	7.11, 7.12	Corrected requirements classes
2011-01-31	1.0	Simon Cox, Carl Reed	Various	Clean-up for publication; correct URIs, fix broken links, insert missing dependencies.