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GML Encoding of Discrete Coverages

(interleaved pattern)

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i. Preface

This Document was produced as part of the OGC's Sensor Web Enablement (SWE) activity.

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

The changes made in this document version, relative to the previous version, are tracked by Microsoft Word, and can be viewed if desired. If you choose to submit suggested changes by editing this document, please first accept all the current changes, and then make your suggested changes with change tracking on.

ii. Submitting organizations

The following organizations submitted this document to the Open Geospatial Consortium Inc.

Commonwealth Scientific and Industrial Research Organisation (Australia) (CSIRO).

iii. Document contributor contact points

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iv. Revision history

Date	Release	Editor	Primary clauses modified	Description
2006-12-12	0.1.0	Simon Cox	Iniital version	Extract relevant sections from 05-087r4 O&M and re-organise
2007-04-04	0.2.0	Simon Cox	7, Annex A	Split schema into discreteCoverage.xsd and compactDeiscreteCoverage.xsd; Added domainExtent and rangeType properties to AbstractDiscreteCoverage class
2007-5-08	0.2.0	Carl Reed	Various	Edit for posting as OGC Best Practices

v. Changes to the OpenGIS® Specification

The OpenGIS® Specification requires changes to accommodate the technical contents of this document. The following is a list of the required changes:

a) CV_DiscreteTimeInstantCoverage and CV_TimeInstantValuePair to be added to CV package in the harmonized model.

b) CV_DiscreteElementCoverage and CV_ElementValuePair to be added to CV package in the harmonized model.

c) Conformance clauses in GML modified to allow the "interleaved" discrete coverage encoding to exist alongside the "sequential" domain-range form

vi. Future work

Improvements in this document are desirable to …

Foreword

This report replaces parts of clause 6 and Annex C in the the OGC Best Practices Paper 05-087r4 *Observations and Measurements*.

This specification was developed under the OWS 4 initiative as part of the Sensor Web Enablement thread. It provides an encoding for coverage data that may be used as the value of the result of an Observation, as well as for other purposes.

All parts of the document are normative except for ANNEX A – XML implementation examples, and ANNEX B – An XML implementation of simple items, records and arrays.

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 specification describes a GML encoding for discrete coverages. The encoding pattern is a variation from the standard GML Coverage, in that the values in the domain and range are effectively "interleaved" rather than represented as two blocks and encoded sequentially. The requirement for this variant emerged from the Sensor Web Enablement initiative, where some services were receiving data as a stream or from a large archive in interleaved mode. In order to gather the complete domain and range descriptions to write out a standard GML Coverage, the memoery requirements can become very large. Hence, this alternative is provided as a convenience for application development efficiency.

The schema was originally included as part of the Observations and Measurements specification (OGC 05-087r4) but is considered to be of more general interest, so has been refactored into a separate document.

OGC Application Schema — GML Encoding of Discrete Coverages (interleaved pattern)

1 Scope

ISO 19123 presents a conceptual model for spatial coverage including two complementary viewpoints:

    (i)   as a functional map, with values from the range mapped to elements of a spatio-temporal domain;

    (ii)   as a collection of elements, each composed of a geometry-value pair.

Compared with a simple tabular representation of a discrete coverage, the two viewpoints are related through transposition. Compared with common imagery terminology, they correspond approximately to sequential vs. interleaved encodings.

GML v3 introduced an XML representation for discrete coverages, which implements the "map" view, with values from the domain and range collected and serialized in separate blocks. While this is convenient for many analysis and portrayal applications, there are some situations concerning data-transfer where this ordering creates significant practical difficulties. This follows from the requirement for the entire coverage domain to be written-out prior to writing any of the range. If the data source is composed of interleaved (geometry, value) pairs, the description of the domain and range must be assembled first, and for large coverages this may impose a significant memory requirement, and is a particular challenge where the length of the array is not know at the outset (e.g. live streaming data).

In this document we describe a GML encoding corresponding to the alternative viewpoint, in which the coverage data is organised as interleaved (geometry, value) pairs. The encoding is patterned directly on the alternative version of the CV_DiscreteCoverage model presented in ISO 19123, and follows the UML-XML encoding rules set out in GML 3.2 (ISO DIS 19136).

A primary use of this schema is to provide an encoding of the result of an Observation, as described in OGC Best Practices Paper 05-087r4 Observations and Measurements.

2 Conformance

2.1 Overview

Clause 6 of this Specification use the Unified Modeling Language (UML) to present theconceptual schemas for describing discrete coverages. This schema defines conceptual classes that (i) may be considered to comprise a cross-domain application schema, or (ii) may be used in application schemas, profiles and implementation specifications. The document concerns ONLY externally visible interfaces and places no restriction on the underlying implementations other than what is needed to satisfy the interface specifications in the actual situation.

Clause 7 of this Specification specifies XML Schema components, in the form of GML Application Schemas that implement the conceptual model in accordance with ISO 19136.

This clause defines a set of conformance classes that will support applications whose requirements range from the minimum necessary to define data structures to full object implementation.

This flexibility is controlled by a set of UML types that can be implemented in a variety of manners. Common names for "metaphorically identical" but technically different entities are acceptable. The UML model in this Specification defines conceptual classes, various software systems define implementation classes or data structures, and the XML following the encoding standard (ISO 19136) defines entity tags. All of these reference the same information content. There is no difficulty in allowing the use of the same name to represent the same information content even though at a deeper level there are significant technical differences in the digital entities being implemented. This allows types defined in the UML model to be used directly in application schemas.

2.2 *Conformance classes related to Application Schema for CV_DiscreteCoverage*

*The conformance rules for Application Schemas in general are described in ISO 19109. Application Schemas also claiming conformance to this Specification shall also conform to the rules specified in Clauses 6 and **Error! Reference source not found.** and pass all relevant test cases of the Abstract Test Suite in **Error! Reference source not found.**. Depending on the characteristics of an Application Schema, NN conformance classes are distinguished. Table 1 lists these classes and the corresponding Subclause of the AbstractTest Suite.*

Table 1 — Conformance classes related to Application Schema for CV_DiscreteCoverage

Conformance class	Subclause of the Abstract Test Suite

TBC

3 Normative references

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

ISO 1000:1994, *SI units and recommendations for the use of their multiples and of certain other units.*

ISO 8601:2004, *Data elements and interchange formats — Information interchange Representation of dates and times*

ISO/IEC 11404:1996, *Information technology — Programming languages, their environments and system software interfaces – Language-independent datatypes*

ISO 19101:2002, *Geographic Information--ReferenceModel*

ISO/TS 19103:2005, *Geographic Information — Conceptual schema language*

ISO 19107:2003, *Geographic Information — Spatial schema*

ISO 19108:2002, *Geographic Information — Temporal schema*

ISO 19109:2005, *Geographic Information — Rules for application schemas*

ISO 19110:2006, *Geographic Information – Feature cataloguing methodology*

ISO 19115:2003, *Geographic Information — Metadata*

ISO 19118:2005, *Geographic Information — Encoding*

ISO 19123:2005, *Geographic Information — Coverages*

ISO DIS 19136:2006, *Geographic Information — Geography Markup Language*

ISO/FDTS 19139:2006, *Geographic Information — Metadata — XML schema implementation*

IETF RFC 2396, *Uniform Resource Identifiers (URI): Generic Syntax. (August 1998)*

OpenGIS® Implementation Specification *Geography Markup Language, version 3.2. OGC Document 05-108r1* http://www.opengeospatial.org/

OpenGIS® Best Practices Document *Observations and Measurements, OGC document 05-087r4.*

UCUM, *Unified Code for Units of Measure, Schadow, G. and McDonald, C. J. (eds.), <http://aurora.rg.iupui.edu/UCUM>*

W3C XLink, *XML Linking Language (XLink) Version 1.0. W3C Recommendation (27 June 2001)*

W3C XML, *Extensible Markup Language (XML) 1.0 (Second Edition), W3C Recommendation (6 October 2000)*

W3C XML Namespaces, *Namespaces in XML. W3C Recommendation (14 January 1999)*

W3C XML Schema Part 1, *XML Schema Part 1: Structures. W3C Recommendation (2 May 2001)*

W3C XML Schema Part 2, *XML Schema Part 2: Datatypes. W3C Recommendation (2 May 2001)*

4 Terms and definitions

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

4.1
application schema
conceptual schema for data required by one or more applications

[ISO 19101]

4.2
GML application schema
application schema written in XML Schema according to the rules specified in ISO 19136

[ISO 19136]

4.3
association
semantic relationship between two or more classifiers that specifies connections among their instances

[ISO 19501-1]

> NOTE: A binary association is an association among exactly two classifiers (including the possibility of an association from a classifier to itself).

4.4
attribute <UML>
feature within a classifier that describes a range of values that instances of the classifier may hold

NOTE: An attribute is semantically equivalent to a composition association; however, the intent and usage is normally different.

4.5
attribute <XML>
name-value pair contained in an **element**

4.6
child element <XML>
immediate descendant **element** of an **element**

4.7
coverage
feature that acts as a function to return values from its range for any direct position within its spatiotemporal domain

[ISO 19123]

4.8
data type
specification of a value domain with operations allowed on values in this domain

[ISO/TS 19103]

EXAMPLE   Integer, Real, Boolean, String, Date (conversion of a data into a series of codes).

NOTE: Data types include primitive predefined types and user-definable types. All instances of a data types lack identity.

4.9
domain
well-defined **set**

[ISO/TS 19103]

NOTE: 1   A mathematical function may be defined on this set, i.e. in a function f:A$\rightarrow$B A is the domain of the function f.

NOTE: 2   A domain as in domain of discourse refers to a subject or area of interest.

4.10
element <XML>
basic information item of an XML document containing **child elements**, **attributes** and character data

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."

4.11
feature
abstraction of real world phenomena

[ISO 19101]

> NOTE: A feature may occur as a type or an instance. Feature type or feature instance should be used when only one is meant.

4.12
feature association
relationship that links instances of one feature type with instances of the same or different feature type

[ISO 19110]

4.13
GML application schema
application schema implemented according to ISO 19136

4.14
grid
network composed of two or more sets of **curves** in which the members of each set intersect the members of the other sets in an algorithmic way

[ISO 19123]

> NOTE: The curves partition a space into grid cells.

4.15
measure (noun)
value described using a numeric amount with a scale or using a scalar reference system

[ISO/TS 19103]

> NOTE: When used as a noun, measure is a synonym for physical quantity.

4.16
namespace <XML>
collection of names, identified by a URI reference, which are used in XML documents as element names and attribute names [W3C XML Namespaces]

4.17
observation (noun)
an act of observing a property or phenomenon, with the goal of producing an estimate of the value of the property. A specialized event whose result is a data value.

4.18
property <General Feature Model>
characteristic of a feature type, including attribute, association role, defined behaviour, feature association, specialization and generalization relationship, constraints

[ISO 19109]

4.19
property <GML>
a **child element** of a GML object

> NOTE: It corresponds to feature attribute and feature association role in ISO 19109. If a GML property of a feature has an xlink:href attribute that references a feature, the property represents a feature association role.

4.20
range
set of all values a function f can take as its arguments vary over its domain

4.21
result
an estimate of the value of some property generated by a known procedure

4.22
scale
a particular way of assigning numbers or symbols to measure something is called a scale of measurement [SAR1995].

4.23
schema
formal description of a model

[ISO 19101]

> NOTE: In general, a schema is an abstract representation of an object's characteristics and relationship to other objects. An XML schema represents the relationship between the attributes and elements of an XML object (for example, a document or a portion of a document)

4.24
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.

4.25
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.

4.26
sequence
finite, ordered collection of related items (objects or values) that may be repeated

[ISO 19107]

4.27
set
unordered collection of related items (**objects** or values) with no repetition

[ISO 19107]

4.28
tag <XML>
markup in an XML document delimiting the content of an **element**

EXAMPLE   <Road>

> NOTE: A tag with no forward slash (e.g. <Road>) is called a start-tag (also opening tag), and one with a forward slash (e.g. </Road> is called an end-tag (also closing tag).

4.29
tuple
ordered list of values

4.30
UML application schema
application schema written in UML according to ISO 19109

4.31
value
member of the value-space of a datatype. A value may use one of a variety of scales including nominal, ordinal, ratio and interval, spatial and temporal. Primitive datatypes may be combined to form aggregate datatypes with aggregate values, including vectors, tensors and images [ISO11404].

5 Conventions

5.1 Symbols (and abbreviated terms)

GFM   General Feature Model

GML   Geography Markup Language

ISO   International Organization for Standardization

O&M   Observations and Measurements

OGC   Open Geospatial Consortium

OWS   OGC Web Services

SWE   Sensor Web Enablement

UML   Unified Modeling Language

WXS   W3C XML Schema Definition Language

XML   Extensible Markup Language

1D   One Dimensional

2D   Two Dimensional

3D   Three Dimensional

5.2 UML notation

Most diagrams that appear in this specification are presented using the Unified Modeling Language (UML) static structure diagram, as described in Subclause 5.2 of the OGC Web Services Common Implementation Specification [OGC 04-016r2].

Many of the models refer to classes from various models in the ISO 19100 series of international standards. In this document these components have been imported from the ISO Harmonized Model as of 2004-05-11.

The UML is conformant with the profile described in ISO 19103 and ISO 19136 (GML) Annex E. Use of this restricted idiom supports direct transformation into a GML Application Schema.

The prose explanation of the model uses the term "property" to refer to both class attributes and association roles. This is consistent with the General Feature Model described in ISO 19109. In the context of properties, the term "value" refers to either a literal (for attributes whose type is simple), or to an instance of the class providing the type of the attribute or target of the association. Within the explanation, the property names are sometimes used as natural language words where this assists in constructing a readable text.

5.3 Document terms and definitions

This document uses the specification terms defined in Subclause 5.3 of [OGC 04-016r2].

6 The model for discrete coverages

6.1 General coverage model

ISO 19123 describes a schema for coverages. The schema has a root class CV_Coverage with specializations CV_ContinuousCoverage and CV_DiscreteCoverage.

In ISO 19123 Figure 2. CV_Coverage (and hence its specializations) is modelled as an aggregation of collections of CV_DomainObject and CV_AttributeValues, with the roles *rangeElement* and *domainElement* respectively. We will refer to this as the "domain-range" pattern.

In ISO 19123 Figure 3. this is rearranged so that the CV_DomainObject and the corresponding Record that holds the *values* of the CV_AttributeValues appear in a CV_GeometryValuePair, with the role *element* with respect to the CV_DiscreteCoverage. We will refer to this as the "geometry-value pair" pattern.

These views show the same information transposed.

6.2 Specialization of the coverage domain

Clause 6 in ISO 19123 describes some specializations of CV_DiscreteCoverage, in which the type of the elements of the coverage domain is constrained. For example, the specializations include CV_DiscretePointCoverage (ISO 19123 Figure 6) where the coverage domain is composed of explicit GM_Point elements, and CV_DiscreteGridPointCoverage (ISO 19123 Figure 7) where the coverage domain is described by a grid. In the geometry-value pair representation these are implemented with a specialized CV_GeometryValuePair in which the type of the *geometry* attribute is constrained to match.

Discrete coverages may be used in the description of sampling of a varying phenomenon, which is a common application of sensor observations. A special case of the latter concerns monitoring a time-varying property sampled at discrete points in time. In this application the domain objects may be represented using GM_Point with a temporal CRS. However, the definition of CV_DomainObject also allows for a *temporalElement* of type TM_GeometricPrimitive (ISO 19123 Figure 2) so we propose an additional specialization CV_DiscreteTimeInstantCoverage, being an aggregate of CV_TimeInstantValuePair elements, which leverages the ISO 19108 temporal schema for the *geometry* property (see Figure 1).

6.3 Range value

The value of a coverage on any element of its domain is encapsulated in a Record. The mapping from a member of the record to its type (i.e. the record structure) is described in an associated RecordType (ISO 19103 Figure 15), which is also provided through the attribute *rangeType* on the CV_Coverage class..
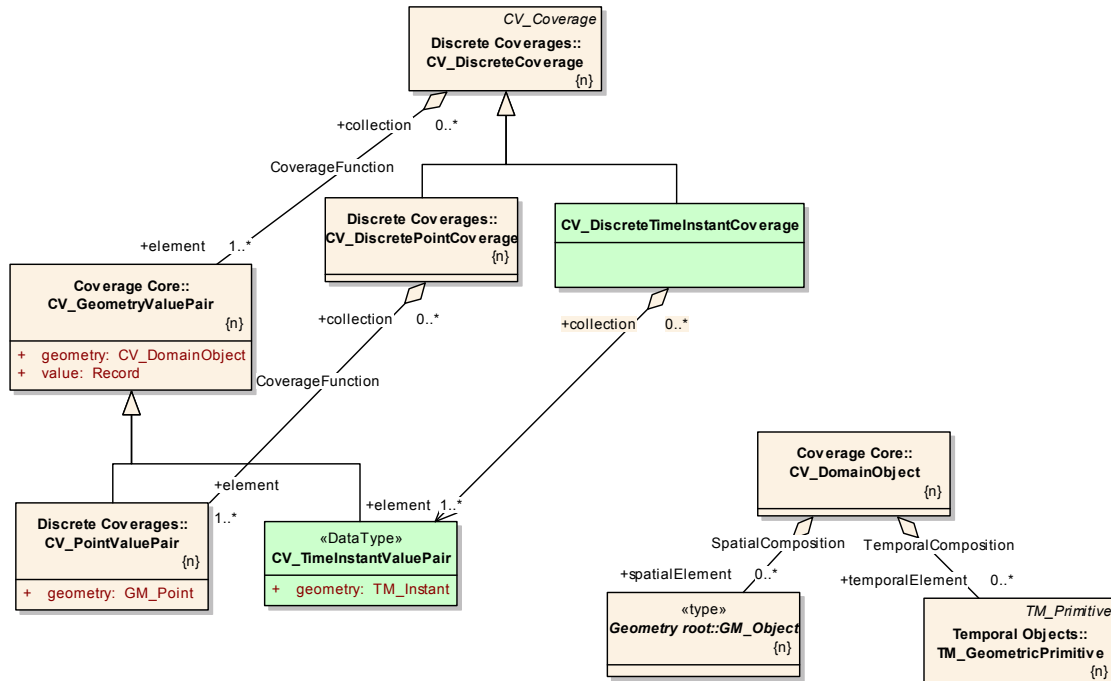
Figure 1.   Extract from ISO 19123 discrete coverage model showing relationship with new components for a TimeInstantCoverage variant

7 GML encoding of discrete coverages (interleaved pattern)

7.1 Encoding rules

We follow the encoding rules described in ISO DIS 19136 Annex E, which is a profile of ISO 19118. This formalizes the GML "Object-property" pattern, providing for an explicit XML representation which encodes class, attribute and association-role names as XML elements.

7.2 XML Schemas

The documents in Listing 1 and Listing 2 implement the classes shown in Figure 1, with fully explicit and compact domain elements respectively . To assist in understanding this document, some simple example instances are shown in ANNEX A.

The schema is assigned to the namespace http://www.opengis.net/cv/0.0

7.3 Domain specialization

Two versions of the discrete coverages are provided:

− CV_DiscreteCoverage, CV_DiscretePointCoverage, CV_DiscreteTimeInstantCoverage and CV_ElementCoverage implement the classes

shown in Figure 1 in an explicit form, with the value of the domain objects taking gml:AbstractGeometry, gml:Point and gml:TimeInstant which are the GML implementations of GM_Object, GM_Point (ISO 19107) and TM_Instant (ISO 19108), respectively

−   in CompactDiscreteCoverage, CompactDiscretePointCoverage and CompactDiscreteTimeCoverage the values of the domain objects are encoded as a gml:DirectPositionType, and gml:TimePositionType which are the GML implementations of DirectPosition (ISO 19107) and TM_TemporalPosition (ISO 19108), respectively.

In addition, in CV_DiscreteElementCoverage, the domain geometry is expressed using references, following the standard gml:ReferenceType pattern. The target of the reference is either a proxy for the spatio-temporal domain object, or is a geometry provider.

7.4 Range value representation

The *value* element of the CV_GeometryValuePair implementation is an (implicit) xs:anyType.

The standard XML Schema mechanisms for run-time indication of the datatype are (i) explicitly using the xsi:type attribute, or (ii) implicitly through namespace binding. The XML schema referred to this way is implicitly an implementation of the RecordType for the value. Note that an XML Schema is essentially a description of datatype *structure*, and a suitably designed datatype may add a mechanism allowing the indication of additional semantic information concerning the members of the record.

In ANNEX B we provide a schema for explicit XML representation of simple items, records and arrays. This is a convenience schema primarily intended for use for simple data aggregations corresponding to lists and tables, and should not be expected to replace the rich capabilities of W3C XML Schema for all applications. Its use is illustrated in some example instances provided in ANNEX A.

Listing 1.   discreteCoverage.xsd

```xml
<?xml version="1.0"?>
<schema xmlns="http://www.w3.org/2001/XMLSchema" targetNamespace="http://www.opengis.net/cv/0.0"
xmlns:cv="http://www.opengis.net/cv/0.0" xmlns:gml="http://www.opengis.net/gml" elementFormDefault="qualified"
attributeFormDefault="unqualified"
    version="0.0.0">
  <annotation>
    <documentation>An explicit representation of the CV_DiscreteCoverage, interleaved model, from ISO 19123
    All items are XML encoded

Copyright (c) 2007 Open Geospatial Consortium - see http://www.opengeospatial.org/about/?page=ipr</documentation>
  </annotation>
  <!-- =============== -->
  <import namespace="http://www.opengis.net/gml"
schemaLocation="http://schemas.opengis.net/gml/3.1.1/base/gml.xsd"/>
  <!-- =============== -->
  <!-- =============== -->
  <complexType name="CV_DomainObjectType">
    <annotation>
      <documentation>Explicit implementation of ISO 19123 CV_DomainObject</documentation>
```

```
        </annotation>
        <sequence>
          <element name="spatialElement" minOccurs="0" maxOccurs="unbounded" type="gml:GeometryPropertyType"/>
          <element name="temporalElement" minOccurs="0" maxOccurs="unbounded"
type="cv:TimeGeometricPrimitivePropertyType"/>
        </sequence>
      </complexType>
      <!-- .............. -->
      <element name="CV_DomainObject" type="cv:CV_DomainObjectType">
        <annotation>
          <documentation>Explicit implementation of ISO 19123 CV_DomainObject</documentation>
        </annotation>
      </element>
      <!-- .............. -->
      <complexType name="CV_DomainObjectPropertyType">
        <sequence minOccurs="0">
          <element ref="cv:CV_DomainObject"/>
        </sequence>
        <attributeGroup ref="gml:AssociationAttributeGroup"/>
      </complexType>
      <!-- =============== -->
      <!-- =============== -->
      <!-- === Implementations of CV_GeometryValuePair and specializations === -->
      <!-- =============== -->
      <complexType name="CV_AbstractGeometryValuePairType">
        <annotation>
          <documentation>Head of substitution group of ISO 19123 CV_GeometryValuePair and specializations
 - concrete types derived from this must add geometry and value properties of a suitable type</documentation>
        </annotation>
        <!--
        <sequence>
          <element name="geometry"/>
          <element name="value"/>
        </sequence>
        -->
      </complexType>
      <!-- ........... -->
      <element name="CV_AbstractGeometryValuePair" type="cv:CV_AbstractGeometryValuePairType" abstract="true">
        <annotation>
          <documentation>Head of substitution group of ISO 19123 CV_GeometryValuePair and specializations
 - concrete types derived from this must add geometry and value properties of a suitable type</documentation>
        </annotation>
      </element>
      <!-- ........... -->
      <complexType name="CV_AbstractGeometryValuePairPropertyType">
        <sequence>
          <element ref="cv:CV_AbstractGeometryValuePair"/>
        </sequence>
      </complexType>
      <!-- =============== -->
      <complexType name="CV_GeometryValuePairType">
        <annotation>
          <documentation>Explicit implementation of ISO 19123 CV_GeometryValuePair - this is the most general case,
and is a literal encoding of the model.
          It is implemented as a sibling of specialized versions because of XML Schema derivation by restriction
gotchas.</documentation>
        </annotation>
        <complexContent>
          <extension base="cv:CV_AbstractGeometryValuePairType">
            <sequence>
              <element name="geometry" type="cv:CV_DomainObjectPropertyType"/>
              <element name="value">
                <annotation>
                  <documentation>Implicitly xs:anyType. Use xsi:type attribute to indicate the datatype at run-
time.</documentation>
                </annotation>
              </element>
            </sequence>
          </extension>
        </complexContent>
      </complexType>
```

```xml
<!-- .......... -->
<element name="CV_GeometryValuePair" type="cv:CV_GeometryValuePairType"
substitutionGroup="cv:CV_AbstractGeometryValuePair">
    <annotation>
        <documentation>Explicit implementation of ISO 19123 CV_GeometryValuePair - this is the most general case,
and is a literal encoding of the model.
        It is implemented as a sibling of specialized versions because of XML Schema derivation by restriction
gotchas.</documentation>
    </annotation>
</element>
<!-- .......... -->
<complexType name="CV_GeometryValuePairPropertyType">
    <sequence>
        <element ref="cv:CV_GeometryValuePair"/>
    </sequence>
</complexType>
<!-- =============== -->
<complexType name="CV_PointValuePairType">
    <annotation>
        <documentation>Specialization of ISO 19123 CV_GeometryValuePair.
        Explicit implementation of ISO 19123 CV_PointValuePair - this is a literal encoding of the model.</documentation>
    </annotation>
    <complexContent>
        <extension base="cv:CV_AbstractGeometryValuePairType">
            <sequence>
                <element name="geometry" type="gml:PointPropertyType"/>
                <element name="value">
                    <annotation>
                        <documentation>Implicitly xs:anyType. Use xsi:type attribute to indicate the datatype at run-
time.</documentation>
                    </annotation>
                </element>
            </sequence>
        </extension>
    </complexContent>
</complexType>
<!-- .......... -->
<element name="CV_PointValuePair" type="cv:CV_PointValuePairType"
substitutionGroup="cv:CV_AbstractGeometryValuePair">
    <annotation>
        <documentation>Specialization of ISO 19123 CV_GeometryValuePair.
        Explicit implementation of ISO 19123 CV_PointValuePair - this is a literal encoding of the model.</documentation>
    </annotation>
</element>
<!-- .......... -->
<complexType name="CV_PointValuePairPropertyType">
    <sequence>
        <element ref="cv:CV_PointValuePair"/>
    </sequence>
</complexType>
<!-- =============== -->
<complexType name="CV_TimeInstantValuePairType">
    <annotation>
        <documentation>Specialization of ISO 19123 CV_GeometryValuePair.
        Explicit implementation of CV_TimeInstantValuePair - this is the temporal equivalent to
CV_PointValuePair.</documentation>
    </annotation>
    <complexContent>
        <extension base="cv:CV_AbstractGeometryValuePairType">
            <sequence>
                <element name="geometry" type="gml:TimeInstantPropertyType"/>
                <element name="value">
                    <annotation>
                        <documentation>Implicitly xs:anyType. Use xsi:type attribute to indicate the datatype at run-
time.</documentation>
                    </annotation>
                </element>
            </sequence>
        </extension>
    </complexContent>
</complexType>
```

```xml
<!-- ........... -->
<element name="CV_TimeInstantValuePair" type="cv:CV_TimeInstantValuePairType"
substitutionGroup="cv:CV_AbstractGeometryValuePair">
    <annotation>
        <documentation>Specialization of ISO 19123 CV_GeometryValuePair.
        Explicit implementation of CV_TimeInstantValuePair - this is the temporal equivalent to
CV_PointValuePair.</documentation>
    </annotation>
</element>
<!-- ........... -->
<complexType name="CV_TimeInstantValuePairPropertyType">
    <sequence>
        <element ref="cv:CV_TimeInstantValuePair"/>
    </sequence>
</complexType>
<!-- =============== -->
<complexType name="CV_ElementValuePairType">
    <annotation>
        <documentation>Specialization of ISO 19123 CV_GeometryValuePair.
        Explicit implementation of CV_ElementValuePair - the "geometry" property carries a pointer to an object which
acts as the geometry-provider.</documentation>
    </annotation>
    <complexContent>
        <extension base="cv:CV_AbstractGeometryValuePairType">
            <sequence>
                <element name="geometry" type="gml:ReferenceType">
                    <annotation>
                        <documentation>In a CV_ElementValuePair the "geometry" property carries a pointer to an object which
acts as the geometry-provider.</documentation>
                    </annotation>
                </element>
                <element name="value">
                    <annotation>
                        <documentation>Implicitly xs:anyType. Use xsi:type attribute to indicate the datatype at run-
time.</documentation>
                    </annotation>
                </element>
            </sequence>
        </extension>
    </complexContent>
</complexType>
<!-- ........... -->
<element name="CV_ElementValuePair" type="cv:CV_ElementValuePairType"
substitutionGroup="cv:CV_AbstractGeometryValuePair">
    <annotation>
        <documentation>Specialization of ISO 19123 CV_GeometryValuePair.
        Explicit implementation of CV_ElementValuePair - the "geometry" property carries a pointer to an object which
acts as the geometry-provider.</documentation>
    </annotation>
</element>
<!-- ........... -->
<complexType name="CV_ElementValuePairPropertyType">
    <sequence>
        <element ref="cv:CV_ElementValuePair"/>
    </sequence>
</complexType>
<!-- =============== -->
<!-- === Implementations of CV_DiscreteCoverage and specializations === -->
<!-- =============== -->
<complexType name="CV_AbstractDiscreteCoverageType">
    <annotation>
        <documentation>Head of substitution group implementing ISO 19123 CV_DiscreteCoverage and specializations.
        Includes the standard elements defined for CV_Coverage.
        Concrete descendants must add an "element" property of a suitable type.</documentation>
    </annotation>
    <complexContent>
        <extension base="gml:AbstractFeatureType">
            <sequence>
                <element name="domainExtent" type="gml:BoundingShapeType" maxOccurs="unbounded"/>
                <element name="rangeType" type="anyType"/>
                <!--
```

```xml
      <element name="element" type="cv:CV_AbstractGeometryValuePairPropertyType" maxOccurs="unbounded"/>
-->
        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <!-- .......... -->
  <element name="CV_AbstractDiscreteCoverage" type="cv:CV_AbstractDiscreteCoverageType" abstract="true"
substitutionGroup="gml:_Feature">
    <annotation>
      <documentation>Head of substitution group implementing ISO 19123 CV_DiscreteCoverage and specializations.
      Concrete descendants must add an "element" property of a suitable type.</documentation>
    </annotation>
  </element>
  <!-- .......... -->
  <complexType name="CV_AbstractDiscreteCoveragePropertyType">
    <sequence>
      <element ref="cv:CV_AbstractDiscreteCoverage"/>
    </sequence>
  </complexType>
  <!-- =============== -->
  <complexType name="CV_DiscreteCoverageType">
    <annotation>
      <documentation>Explicit implementation of ISO 19123 CV_DiscreteCoverage.</documentation>
    </annotation>
    <complexContent>
      <extension base="cv:CV_AbstractDiscreteCoverageType">
        <sequence>
          <element name="element" type="cv:CV_GeometryValuePairPropertyType" maxOccurs="unbounded"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <!-- .......... -->
  <element name="CV_DiscreteCoverage" type="cv:CV_DiscreteCoverageType"
substitutionGroup="cv:CV_AbstractDiscreteCoverage">
    <annotation>
      <documentation>Explicit implementation of ISO 19123 CV_DiscreteCoverage.</documentation>
    </annotation>
  </element>
  <!-- .......... -->
  <complexType name="CV_DiscreteCoveragePropertyType">
    <sequence>
      <element ref="cv:CV_DiscreteCoverage"/>
    </sequence>
  </complexType>
  <!-- =============== -->
  <complexType name="CV_DiscretePointCoverageType">
    <annotation>
      <documentation>Explicit implementation of ISO 19123 CV_DiscretePointCoverage.</documentation>
    </annotation>
    <complexContent>
      <extension base="cv:CV_AbstractDiscreteCoverageType">
        <sequence>
          <element name="element" type="cv:CV_PointValuePairPropertyType" maxOccurs="unbounded"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <!-- .......... -->
  <element name="CV_DiscretePointCoverage" type="cv:CV_DiscretePointCoverageType"
substitutionGroup="cv:CV_AbstractDiscreteCoverage">
    <annotation>
      <documentation>Explicit implementation of ISO 19123 CV_DiscretePointCoverage.</documentation>
    </annotation>
  </element>
  <!-- .......... -->
  <complexType name="CV_DiscretePointCoveragePropertyType">
    <sequence>
      <element ref="cv:CV_DiscretePointCoverage"/>
    </sequence>
```

```xml
      </complexType>
      <!-- =============== -->
      <complexType name="CV_DiscreteTimeInstantCoverageType">
        <annotation>
          <documentation>Explicit implementation of specialized CV_DiscreteCoverage in which the coverage domain is
composed of time-instants.</documentation>
        </annotation>
        <complexContent>
          <extension base="cv:CV_AbstractDiscreteCoverageType">
            <sequence>
              <element name="element" type="cv:CV_TimeInstantValuePairPropertyType" maxOccurs="unbounded"/>
            </sequence>
          </extension>
        </complexContent>
      </complexType>
      <!-- ........... -->
      <element name="CV_DiscreteTimeInstantCoverage" type="cv:CV_DiscreteTimeInstantCoverageType"
substitutionGroup="cv:CV_AbstractDiscreteCoverage">
        <annotation>
          <documentation>Explicit implementation of specialized CV_DiscreteCoverage in which the coverage domain is
composed of time-instants.</documentation>
        </annotation>
      </element>
      <!-- ........... -->
      <complexType name="CV_DiscreteTimeInstantCoveragePropertyType">
        <sequence>
          <element ref="cv:CV_DiscreteTimeInstantCoverage"/>
        </sequence>
      </complexType>
      <!-- =============== -->
      <complexType name="CV_DiscreteElementCoverageType">
        <annotation>
          <documentation>Explicit implementation of specialized CV_DiscreteCoverage in which the coverage domain is
composed of pointers to objects that act as geometry-providers.</documentation>
        </annotation>
        <complexContent>
          <extension base="cv:CV_AbstractDiscreteCoverageType">
            <sequence>
              <element name="element" type="cv:CV_ElementValuePairPropertyType" maxOccurs="unbounded"/>
            </sequence>
          </extension>
        </complexContent>
      </complexType>
      <!-- ........... -->
      <element name="CV_DiscreteElementCoverage" type="cv:CV_DiscreteElementCoverageType"
substitutionGroup="cv:CV_AbstractDiscreteCoverage">
        <annotation>
          <documentation>Explicit implementation of specialized CV_DiscreteCoverage in which the coverage domain is
composed of pointers to objects that act as geometry-providers.</documentation>
        </annotation>
      </element>
      <!-- ........... -->
      <complexType name="CV_DiscreteElementCoveragePropertyType">
        <sequence>
          <element ref="cv:CV_DiscreteElementCoverage"/>
        </sequence>
      </complexType>
      <!-- ================================================================ -->
      <!-- ===== Missing property types ====== -->
      <!-- ================================================================= -->
      <complexType name="TimeGeometricPrimitivePropertyType">
        <annotation>
          <documentation>Property type not provided by GML</documentation>
        </annotation>
        <sequence minOccurs="0">
          <element ref="gml:_TimeGeometricPrimitive"/>
        </sequence>
        <attributeGroup ref="gml:AssociationAttributeGroup"/>
      </complexType>
```

```
    <!-- =============== -->
</schema>
```

Listing 2. compactDiscreteCoverage.xsd

```
<?xml version="1.0"?>
<schema xmlns="http://www.w3.org/2001/XMLSchema" targetNamespace="http://www.opengis.net/cv/0.0"
xmlns:cv="http://www.opengis.net/cv/0.0" xmlns:gml="http://www.opengis.net/gml" elementFormDefault="qualified"
attributeFormDefault="unqualified"
    version="0.0.0">
  <annotation>
    <documentation>An explicit representation of the CV_DiscreteCoverage, interleaved model, from ISO 19123
Compact format
    All items are XML encoded

Copyright (c) 2007 Open Geospatial Consortium - see http://www.opengeospatial.org/about/?page=ipr</documentation>
  </annotation>
  <!-- =============== -->
  <import namespace="http://www.opengis.net/gml"
schemaLocation="http://schemas.opengis.net/gml/3.1.1/base/gml.xsd"/>
  <include schemaLocation="./discreteCoverage.xsd"/>
  <!-- =============== -->
  <!-- =============== -->
  <complexType name="CompactDomainObjectType">
    <annotation>
      <documentation>Compact equivalent to ISO 19123 CV_DomainObject, in which the spatial and temporal
elements are encoded directly.</documentation>
    </annotation>
    <sequence>
      <element name="spatialElement" minOccurs="0" maxOccurs="unbounded" type="gml:DirectPositionType"/>
      <element name="temporalElement" minOccurs="0" maxOccurs="unbounded" type="gml:TimePositionType"/>
    </sequence>
  </complexType>
  <!-- ............... -->
  <element name="CompactDomainObject" type="cv:CompactDomainObjectType">
    <annotation>
      <documentation>Compact equivalent to ISO 19123 CV_DomainObject, in which the spatial and temporal
elements are encoded directly.</documentation>
    </annotation>
  </element>
  <!-- ............... -->
  <complexType name="CompactDomainObjectPropertyType">
    <sequence minOccurs="0">
      <element ref="cv:CompactDomainObject"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
  <!-- =============== -->
  <!-- =============== -->
  <complexType name="CompactGeometryValuePairType">
    <annotation>
      <documentation>Compact equivalent to ISO 19123 CV_GeometryValuePair, in which the spatial and temporal
elements of the geometry are encoded directly.</documentation>
    </annotation>
    <complexContent>
      <extension base="cv:CV_AbstractGeometryValuePairType">
        <sequence>
          <element name="geometry" type="cv:CompactDomainObjectPropertyType"/>
          <element name="value">
            <annotation>
              <documentation>Implicitly xs:anyType. Use xsi:type attribute to indicate the datatype at run-
time.</documentation>
            </annotation>
          </element>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
```

```xml
<!-- ........... -->
<element name="CompactGeometryValuePair" type="cv:CompactGeometryValuePairType"
substitutionGroup="cv:CV_AbstractGeometryValuePair">
    <annotation>
        <documentation>Compact equivalent to ISO 19123 CV_GeometryValuePair, in which the spatial and temporal
elements of the geometry are encoded directly.</documentation>
    </annotation>
</element>
<!-- ........... -->
<complexType name="CompactGeometryValuePairPropertyType">
    <sequence>
        <element ref="cv:CompactGeometryValuePair"/>
    </sequence>
</complexType>
<!-- =============== -->
<complexType name="CompactPointValuePairType">
    <annotation>
        <documentation>Compact equivalent to ISO 19123 CV_PointValuePair, in which the geometry is encoded
directly.</documentation>
    </annotation>
    <complexContent>
        <extension base="cv:CV_AbstractGeometryValuePairType">
            <sequence>
                <element name="geometry" type="gml:DirectPositionType"/>
                <element name="value">
                    <annotation>
                        <documentation>Implicitly xs:anyType. Use xsi:type attribute to indicate the datatype at run-
time.</documentation>
                    </annotation>
                </element>
            </sequence>
        </extension>
    </complexContent>
</complexType>
<!-- ........... -->
<element name="CompactPointValuePair" type="cv:CompactPointValuePairType"
substitutionGroup="cv:CV_AbstractGeometryValuePair">
    <annotation>
        <documentation>Compact equivalent to ISO 19123 CV_PointValuePair, in which the geometry is encoded
directly.</documentation>
    </annotation>
</element>
<!-- ........... -->
<complexType name="CompactPointValuePairPropertyType">
    <sequence>
        <element ref="cv:CompactPointValuePair"/>
    </sequence>
</complexType>
<!-- =============== -->
<complexType name="CompactTimeValuePairType">
    <annotation>
        <documentation>Compact equivalent to CV_TimeInstantValuePair, in which the geometry is encoded
directly.</documentation>
    </annotation>
    <complexContent>
        <extension base="cv:CV_AbstractGeometryValuePairType">
            <sequence>
                <element name="geometry" type="gml:TimePositionType"/>
                <element name="value">
                    <annotation>
                        <documentation>Implicitly xs:anyType. Use xsi:type attribute to indicate the datatype at run-
time.</documentation>
                    </annotation>
                </element>
            </sequence>
        </extension>
    </complexContent>
</complexType>
<!-- ........... -->
<element name="CompactTimeValuePair" type="cv:CompactTimeValuePairType"
substitutionGroup="cv:CV_AbstractGeometryValuePair">
```

```xml
    <annotation>
      <documentation>Compact equivalent to CV_TimeInstantValuePair, in which the geometry is encoded
directly.</documentation>
    </annotation>
  </element>
  <!-- ........... -->
  <complexType name="CompactTimeValuePairPropertyType">
    <sequence>
      <element ref="cv:CompactTimeValuePair"/>
    </sequence>
  </complexType>
  <!-- =============== -->
  <!-- =============== -->
  <!-- =============== -->
  <complexType name="CompactDiscreteCoverageType">
    <annotation>
      <documentation>Head of substitution group for compact discrete coverage encodings</documentation>
    </annotation>
    <complexContent>
      <extension base="cv:CV_AbstractDiscreteCoverageType">
        <sequence>
          <element name="element" type="cv:CompactGeometryValuePairPropertyType" maxOccurs="unbounded"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <!-- ........... -->
  <element name="CompactDiscreteCoverage" type="cv:CompactDiscreteCoverageType"
substitutionGroup="cv:CV_AbstractDiscreteCoverage">
    <annotation>
      <documentation>Head of substitution group for compact discrete coverage encodings</documentation>
    </annotation>
  </element>
  <!-- ........... -->
  <complexType name="CompactDiscreteCoveragePropertyType">
    <sequence>
      <element ref="cv:CompactDiscreteCoverage"/>
    </sequence>
  </complexType>
  <!-- =============== -->
  <complexType name="CompactDiscretePointCoverageType">
    <annotation>
      <documentation>Compact equivalent to ISO 19123 CV_DiscretePointCoverage, in which the domain geometry is
encoded directly.</documentation>
    </annotation>
    <complexContent>
      <extension base="cv:CV_AbstractDiscreteCoverageType">
        <sequence>
          <element name="element" type="cv:CompactPointValuePairPropertyType" maxOccurs="unbounded"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <!-- ........... -->
  <element name="CompactDiscretePointCoverage" type="cv:CompactDiscretePointCoverageType"
substitutionGroup="cv:CV_AbstractDiscreteCoverage">
    <annotation>
      <documentation>Compact equivalent to ISO 19123 CV_DiscretePointCoverage, in which the domain geometry is
encoded directly.</documentation>
    </annotation>
  </element>
  <!-- ........... -->
  <complexType name="CompactDiscretePointCoveragePropertyType">
    <sequence>
      <element ref="cv:CompactDiscretePointCoverage"/>
    </sequence>
  </complexType>
  <!-- =============== -->
  <complexType name="CompactDiscreteTimeCoverageType">
    <annotation>
      <documentation>Compact equivalent to CV_DiscreteTimeInstantCoverage, in which the domain geometry is
```

```
encoded directly.</documentation>
      </annotation>
      <complexContent>
        <extension base="cv:CV_AbstractDiscreteCoverageType">
          <sequence>
            <element name="element" type="cv:CompactTimeValuePairPropertyType" maxOccurs="unbounded"/>
          </sequence>
        </extension>
      </complexContent>
  </complexType>
  <!-- ........... -->
  <element name="CompactDiscreteTimeCoverage" type="cv:CompactDiscreteTimeCoverageType"
substitutionGroup="cv:CV_AbstractDiscreteCoverage">
      <annotation>
        <documentation>Compact equivalent to CV_DiscreteTimeInstantCoverage, in which the domain geometry is
encoded directly.</documentation>
      </annotation>
  </element>
  <!-- ........... -->
  <complexType name="CompactDiscreteTimeCoveragePropertyType">
      <sequence>
        <element ref="cv:CompactDiscreteTimeCoverage"/>
      </sequence>
  </complexType>
      <!-- ================================================================== -->
      <!-- ================ -->
</schema>
```

ANNEX A
(informative)

XML implementation - examples

1 Introduction

The details of a GML implementation may be explored using instance examples. The implementation is an explicit mapping from the UML model, using the same names as XML element and attribute names, so inspection of sample data is an effective way to assess the effectiveness of the model in capturing the required information. In this clause we present a series of examples to illustrate the model and encoding.

2 Scalar coverage over a set of features

Listing 3 shows a coverage of a property whose value is measured in micro-volts. The domain elements are represented using links to external resources. The coverage values are encoded using gml:MeasureType, which carries a unit of measure identifier. In this example the unit-of-measure is encoded using the short UCUM syntax described in GML 3.2.

Listing 3.   multiElement1.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<cv:CV_DiscreteCoverage gml:id="dc1"
xmlns:cv="http://www.opengis.net/cv/0.0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:gml="http://www.opengis.net/gml"
xsi:schemaLocation="http://www.opengis.net/cv/0.0 ../cv.xsd">
  <cv:domainExtent>
    <gml:Envelope>
      <gml:lowerCorner>0 0</gml:lowerCorner>
      <gml:upperCorner>2 2</gml:upperCorner>
    </gml:Envelope>
  </cv:domainExtent>
  <cv:rangeType xsi:type="gml:ReferenceType" xlink:href="http://www.flakey.org/properties/potential"/>
  <cv:element>
    <cv:CV_GeometryValuePair>
      <cv:geometry xlink:href="http://www.bogus.org/wfs?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="http://www.bogus.org/wfs?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="http://www.bogus.org/wfs?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="http://www.bogus.org/wfs?pixel4"/>
          <cv:value xsi:type="gml:MeasureType" uom="uV">27.5</cv:value>
        </cv:CV_GeometryValuePair>
      </cv:element>
</cv:CV_DiscreteCoverage>
```

3 Coverage values using the cv:Record encoding

Listing 4 shows a coverage of a two component property whose field values are measured in micro-volts and on an ordinal scale. The representation of the domain objects is similar to Listing 3. The range values are records comprised of two fields, encoded using the simple Record encoding described in ANNEX B.

Listing 4.   multiElement2.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<cv:CV_DiscreteCoverage gml:id="dc2" xmlns:cv="http://www.opengis.net/cv/0.0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:gml="http://www.opengis.net/gml"
                xsi:schemaLocation="http://www.opengis.net/cv/0.0 ../cv.xsd">
  <cv:domainExtent>
    <gml:Envelope>
      <gml:lowerCorner>0 0</gml:lowerCorner>
      <gml:upperCorner>2 2</gml:upperCorner>
    </gml:Envelope>
  </cv:domainExtent>
  <cv:rangeType xsi:type="gml:ReferenceType" xlink:href="http://www.flakey.org/properties/potential"/>
  <cv:element>
    <cv:CV_GeometryValuePair>
      <cv:geometry xlink:href="pixel1"/>
      <cv:value>
        <cv:Record>
          <cv:field>
            <cv:Item xsi:type="gml:MeasureType" uom="uV">10.1</cv:Item>
          </cv:field>
          <cv:field>
            <cv:Item xsi:type="gml:CodeWithAuthorityType"
codeSpace="http://wikipedia.org/species/fruit">banana</cv:Item>
          </cv:field>
        </cv:Record>
      </cv:value>
    </cv:CV_GeometryValuePair>
  </cv:element>
  <cv:element>
    <cv:CV_GeometryValuePair>
      <cv:geometry xlink:href="pixel2"/>
      <cv:value>
        <cv:Record>
          <cv:field>
            <cv:Item xsi:type="gml:MeasureType" uom="uV">15.7</cv:Item>
          </cv:field>
          <cv:field>
            <cv:Item xsi:type="gml:CodeWithAuthorityType"
codeSpace="http://wikipedia.org/species/fruit">cumquat</cv:Item>
          </cv:field>
        </cv:Record>
      </cv:value>
    </cv:CV_GeometryValuePair>
  </cv:element>
  <cv:element>
    <cv:CV_GeometryValuePair>
      <cv:geometry xlink:href="pixel3"/>
      <cv:value>
```

```
            <cv:Record>
              <cv:field>
                <cv:Item xsi:type="gml:MeasureType" uom="uV">20.2</cv:Item>
              </cv:field>
              <cv:field>
                <cv:Item xsi:type="gml:CodeWithAuthorityType"
codeSpace="http://wikipedia.org/species/fruit">mangosteen</cv:Item>
              </cv:field>
            </cv:Record>
          </cv:value>
        </cv:CV_GeometryValuePair>
      </cv:element>
      <cv:element>
        <cv:CV_GeometryValuePair>
          <cv:geometry xlink:href="pixel4"/>
          <cv:value>
            <cv:Record>
              <cv:field>
                <cv:Item xsi:type="gml:MeasureType" uom="uV">27.5</cv:Item>
              </cv:field>
              <cv:field>
                <cv:Item xsi:type="gml:CodeWithAuthorityType"
codeSpace="http://wikipedia.org/species/fruit">guava</cv:Item>
              </cv:field>
            </cv:Record>
          </cv:value>
        </cv:CV_GeometryValuePair>
      </cv:element>
</cv:CV_DiscreteCoverage>
```

4 Time Series

0 shows a time-series, in which the sampling domain is composed of set of time periods, and the range value is a measure.

> **Listing 5.**   timeSeries2.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<cv:CV_DiscreteCoverage gml:id="dc5" xmlns:cv="http://www.opengis.net/cv/0.0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:gml="http://www.opengis.net/gml"
          xsi:schemaLocation="http://www.opengis.net/cv/0.0 ../cv.xsd">
  <cv:domainExtent>
    <gml:TimePeriod>
      <gml:beginPosition>2005-06-17T09:00:00.00+08:00</gml:beginPosition>
      <gml:endPosition>2005-06-22T09:00:00.00+08:00</gml:endPosition>
    </gml:TimePeriod>
  </cv:domainExtent>
  <cv:rangeType xsi:type="gml:ReferenceType" xlink:href="http://www.flakey.org/properties/length"/>
  <cv:element>
    <cv:CV_GeometryValuePair>
      <cv:geometry>
        <cv:CV_DomainObject>
          <cv:temporalElement>
            <gml:TimePeriod gml:id="tp1">
              <gml:beginPosition>2005-06-17T09:00+08:00</gml:beginPosition>
              <gml:endPosition>2005-06-18T09:00+08:00</gml:endPosition>
              <gml:duration>PT24H</gml:duration>
            </gml:TimePeriod>
          </cv:temporalElement>
        </cv:CV_DomainObject>
      </cv:geometry>
      <cv:value xsi:type="gml:MeasureType" uom="mm">10.1</cv:value>
    </cv:CV_GeometryValuePair>
  </cv:element>
  <cv:element>
```

```xml
        <cv:CV_GeometryValuePair>
          <cv:geometry>
            <cv:CV_DomainObject>
              <cv:temporalElement>
                <gml:TimePeriod gml:id="tp2">
                  <gml:beginPosition>2005-06-18T09:00+08:00</gml:beginPosition>
                  <gml:endPosition>2005-06-19T09:00+08:00</gml:endPosition>
                  <gml:duration>PT24H</gml:duration>
                </gml:TimePeriod>
              </cv:temporalElement>
            </cv:CV_DomainObject>
          </cv:geometry>
          <cv:value xsi:type="gml:MeasureType" uom="mm">15.7</cv:value>
        </cv:CV_GeometryValuePair>
      </cv:element>
      <cv:element>
        <cv:CV_GeometryValuePair>
          <cv:geometry>
            <cv:CV_DomainObject>
              <cv:temporalElement>
                <gml:TimePeriod gml:id="tp3">
                  <gml:beginPosition>2005-06-19T09:00+08:00</gml:beginPosition>
                  <gml:endPosition>2005-06-20T09:00+08:00</gml:endPosition>
                  <gml:duration>PT24H</gml:duration>
                </gml:TimePeriod>
              </cv:temporalElement>
            </cv:CV_DomainObject>
          </cv:geometry>
          <cv:value xsi:type="gml:MeasureType" uom="mm">20.2</cv:value>
        </cv:CV_GeometryValuePair>
      </cv:element>
      <cv:element>
        <cv:CV_GeometryValuePair>
          <cv:geometry>
            <cv:CV_DomainObject>
              <cv:temporalElement>
                <gml:TimePeriod gml:id="tp4">
                  <gml:beginPosition>2005-06-20T09:00+08:00</gml:beginPosition>
                  <gml:endPosition>2005-06-21T09:00+08:00</gml:endPosition>
                  <gml:duration>PT24H</gml:duration>
                </gml:TimePeriod>
              </cv:temporalElement>
            </cv:CV_DomainObject>
          </cv:geometry>
          <cv:value xsi:type="gml:MeasureType" uom="mm">27.5</cv:value>
        </cv:CV_GeometryValuePair>
      </cv:element>
      <cv:element>
        <cv:CV_GeometryValuePair>
          <cv:geometry>
            <cv:CV_DomainObject>
              <cv:temporalElement>
                <gml:TimePeriod gml:id="tp5">
                  <gml:beginPosition>2005-06-21T09:00+08:00</gml:beginPosition>
                  <gml:endPosition>2005-06-22T09:00+08:00</gml:endPosition>
                  <gml:duration>PT24H</gml:duration>
                </gml:TimePeriod>
              </cv:temporalElement>
            </cv:CV_DomainObject>
          </cv:geometry>
          <cv:value xsi:type="gml:MeasureType" uom="mm">45.2</cv:value>
        </cv:CV_GeometryValuePair>
      </cv:element>
</cv:CV_DiscreteCoverage>
```

The time series in Listing 6 is sampled at time instants, which are represented using the compact gml:TimePositionType encoding. The range values are measures.

Listing 6.   timeSeries1.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<cv:CompactDiscreteTimeCoverage gml:id="dc4" xmlns:cv="http://www.opengis.net/cv/0.0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:gml="http://www.opengis.net/gml"
                xsi:schemaLocation="http://www.opengis.net/cv/0.0 ../cv.xsd">
  <cv:domainExtent>
    <gml:TimePeriod>
      <gml:beginPosition>2005-06-17T09:00:00.00+08:00</gml:beginPosition>
      <gml:endPosition>2005-06-21T09:00:00.00+08:00</gml:endPosition>
    </gml:TimePeriod>
  </cv:domainExtent>
  <cv:rangeType xsi:type="gml:ReferenceType" xlink:href="http://www.flakey.org/properties/length"/>
  <cv:element>
    <cv:CompactTimeValuePair>
      <cv:geometry>2005-06-17T09:00:00.00+08:00</cv:geometry>
      <cv:value xsi:type="gml:MeasureType" uom="mm">10.1</cv:value>
    </cv:CompactTimeValuePair>
  </cv:element>
  <cv:element>
    <cv:CompactTimeValuePair>
      <cv:geometry>2005-06-18T09:00:00.00+08:00</cv:geometry>
      <cv:value xsi:type="gml:MeasureType" uom="mm">15.7</cv:value>
    </cv:CompactTimeValuePair>
  </cv:element>
  <cv:element>
    <cv:CompactTimeValuePair>
      <cv:geometry>2005-06-19T09:00:00.00+08:00</cv:geometry>
      <cv:value xsi:type="gml:MeasureType" uom="mm">20.2</cv:value>
    </cv:CompactTimeValuePair>
  </cv:element>
  <cv:element>
    <cv:CompactTimeValuePair>
      <cv:geometry>2005-06-20T09:00:00.00+08:00</cv:geometry>
      <cv:value xsi:type="gml:MeasureType" uom="mm">27.5</cv:value>
    </cv:CompactTimeValuePair>
  </cv:element>
  <cv:element>
    <cv:CompactTimeValuePair>
      <cv:geometry>2005-06-21T09:00:00.00+08:00</cv:geometry>
      <cv:value xsi:type="gml:MeasureType" uom="mm">45.2</cv:value>
    </cv:CompactTimeValuePair>
  </cv:element>
</cv:CompactDiscreteTimeCoverage>
```

5 Compound domain and range

Listing 7 describes a coverage in which the domain objects iterate over time and space explicitly, and the range values have seven members represented using the cv:Record encoding.

Listing 7.   spectrumSeries3.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<cv:CV_DiscreteCoverage gml:id="dc3" xmlns:cv="http://www.opengis.net/cv/0.0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:gml="http://www.opengis.net/gml"
                xsi:schemaLocation="http://www.opengis.net/cv/0.0 ../cv.xsd">
  <cv:domainExtent>
    <gml:TimePeriod>
      <gml:beginPosition>2005-06-17T09:00:00.00+08:00</gml:beginPosition>
      <gml:endPosition>2005-06-21T09:00:00.00+08:00</gml:endPosition>
```

```xml
          </gml:TimePeriod>
        </cv:domainExtent>
        <cv:rangeType xsi:type="gml:ReferenceType" xlink:href="urn:x-ogc:def:recordType:NASA:TM7"/>
        <cv:element>
          <cv:CV_GeometryValuePair>
            <cv:geometry>
              <cv:CV_DomainObject>
                <cv:spatialElement xlink:href="./foi.xml#st1"/>
                <cv:temporalElement xlink:href="./toi.xml#ti1"/>
              </cv:CV_DomainObject>
            </cv:geometry>
            <cv:value>
              <cv:Record RS="urn:x-ogc:def:recordType:NASA:TM7" fieldCount="7">
                <cv:field> <cv:Item>9</cv:Item> </cv:field>
                <cv:field> <cv:Item>8</cv:Item> </cv:field>
                <cv:field> <cv:Item>7</cv:Item> </cv:field>
                <cv:field> <cv:Item>6</cv:Item> </cv:field>
                <cv:field> <cv:Item>5</cv:Item> </cv:field>
                <cv:field> <cv:Item>4</cv:Item> </cv:field>
                <cv:field> <cv:Item>3</cv:Item> </cv:field>
              </cv:Record>
            </cv:value>
          </cv:CV_GeometryValuePair>
        </cv:element>
        <cv:element>
          <cv:CV_GeometryValuePair>
            <cv:geometry>
              <cv:CV_DomainObject>
                <cv:spatialElement xlink:href="./foi.xml#st3"/>
                <cv:temporalElement xlink:href="./toi.xml#ti1"/>
              </cv:CV_DomainObject>
            </cv:geometry>
            <cv:value>
              <cv:Record>
                <cv:field> <cv:Item>1</cv:Item> </cv:field>
                <cv:field> <cv:Item>2</cv:Item> </cv:field>
                <cv:field> <cv:Item>3</cv:Item> </cv:field>
                <cv:field> <cv:Item>4</cv:Item> </cv:field>
                <cv:field> <cv:Item>5</cv:Item> </cv:field>
                <cv:field> <cv:Item>6</cv:Item> </cv:field>
                <cv:field> <cv:Item>7</cv:Item> </cv:field>
              </cv:Record>
            </cv:value>
          </cv:CV_GeometryValuePair>
        </cv:element>
        <cv:element>
          <cv:CV_GeometryValuePair>
            <cv:geometry>
              <cv:CV_DomainObject>
                <cv:spatialElement xlink:href="./foi.xml#st2"/>
                <cv:temporalElement xlink:href="./toi.xml#ti1"/>
              </cv:CV_DomainObject>
            </cv:geometry>
            <cv:value>
              <cv:Record>
                <cv:field> <cv:Item>1</cv:Item> </cv:field>
                <cv:field> <cv:Item>9</cv:Item> </cv:field>
                <cv:field> <cv:Item>2</cv:Item> </cv:field>
                <cv:field> <cv:Item>8</cv:Item> </cv:field>
                <cv:field> <cv:Item>3</cv:Item> </cv:field>
                <cv:field> <cv:Item>7</cv:Item> </cv:field>
                <cv:field> <cv:Item>4</cv:Item> </cv:field>
              </cv:Record>
            </cv:value>
          </cv:CV_GeometryValuePair>
        </cv:element>
        <cv:element>
          <cv:CV_GeometryValuePair>
            <cv:geometry>
              <cv:CV_DomainObject>
                <cv:spatialElement xlink:href="./foi.xml#st4"/>
```

```
                    <cv:temporalElement xlink:href="./toi.xml#ti1"/>
                  </cv:CV_DomainObject>
                </cv:geometry>
                <cv:value>
                  <cv:Record>
                    <cv:field> <cv:Item>5</cv:Item> </cv:field>
                    <cv:field> <cv:Item>6</cv:Item> </cv:field>
                    <cv:field> <cv:Item>3</cv:Item> </cv:field>
                    <cv:field> <cv:Item>7</cv:Item> </cv:field>
                    <cv:field> <cv:Item>2</cv:Item> </cv:field>
                    <cv:field> <cv:Item>8</cv:Item> </cv:field>
                    <cv:field> <cv:Item>1</cv:Item> </cv:field>
                  </cv:Record>
                </cv:value>
              </cv:CV_GeometryValuePair>
            </cv:element>
            <cv:element>
              <cv:CV_GeometryValuePair>
                <cv:geometry>
                  <cv:CV_DomainObject>
                    <cv:spatialElement xlink:href="./foi.xml#st1"/>
                    <cv:temporalElement xlink:href="./toi.xml#ti3"/>
                  </cv:CV_DomainObject>
                </cv:geometry>
                <cv:value>
                  <cv:Record>
                    <cv:field> <cv:Item>9</cv:Item> </cv:field>
                    <cv:field> <cv:Item>8</cv:Item> </cv:field>
                    <cv:field> <cv:Item>7</cv:Item> </cv:field>
                    <cv:field> <cv:Item>6</cv:Item> </cv:field>
                    <cv:field> <cv:Item>5</cv:Item> </cv:field>
                    <cv:field> <cv:Item>4</cv:Item> </cv:field>
                    <cv:field> <cv:Item>3</cv:Item> </cv:field>
                  </cv:Record>
                </cv:value>
              </cv:CV_GeometryValuePair>
            </cv:element>
            <cv:element>
              <cv:CV_GeometryValuePair>
                <cv:geometry>
                  <cv:CV_DomainObject>
                    <cv:spatialElement xlink:href="./foi.xml#st3"/>
                    <cv:temporalElement xlink:href="./toi.xml#ti3"/>
                  </cv:CV_DomainObject>
                </cv:geometry>
                <cv:value>
                  <cv:Record>
                    <cv:field> <cv:Item>1</cv:Item> </cv:field>
                    <cv:field> <cv:Item>2</cv:Item> </cv:field>
                    <cv:field> <cv:Item>3</cv:Item> </cv:field>
                    <cv:field> <cv:Item>4</cv:Item> </cv:field>
                    <cv:field> <cv:Item>5</cv:Item> </cv:field>
                    <cv:field> <cv:Item>6</cv:Item> </cv:field>
                    <cv:field> <cv:Item>7</cv:Item> </cv:field>
                  </cv:Record>
                </cv:value>
              </cv:CV_GeometryValuePair>
            </cv:element>
            <cv:element>
              <cv:CV_GeometryValuePair>
                <cv:geometry>
                  <cv:CV_DomainObject>
                    <cv:spatialElement xlink:href="./foi.xml#st2"/>
                    <cv:temporalElement xlink:href="./toi.xml#ti3"/>
                  </cv:CV_DomainObject>
                </cv:geometry>
                <cv:value>
                  <cv:Record>
                    <cv:field> <cv:Item>1</cv:Item> </cv:field>
                    <cv:field> <cv:Item>9</cv:Item> </cv:field>
                    <cv:field> <cv:Item>2</cv:Item> </cv:field>
```

```
            <cv:field> <cv:Item>8</cv:Item> </cv:field>
            <cv:field> <cv:Item>3</cv:Item> </cv:field>
            <cv:field> <cv:Item>7</cv:Item> </cv:field>
            <cv:field> <cv:Item>4</cv:Item> </cv:field>
          </cv:Record>
        </cv:value>
      </cv:CV_GeometryValuePair>
    </cv:element>
    <cv:element>
      <cv:CV_GeometryValuePair>
        <cv:geometry>
          <cv:CV_DomainObject>
            <cv:spatialElement xlink:href="./foi.xml#st4"/>
            <cv:temporalElement xlink:href="./toi.xml#ti3"/>
          </cv:CV_DomainObject>
        </cv:geometry>
        <cv:value>
          <cv:Record>
            <cv:field> <cv:Item>5</cv:Item> </cv:field>
            <cv:field> <cv:Item>6</cv:Item> </cv:field>
            <cv:field> <cv:Item>3</cv:Item> </cv:field>
            <cv:field> <cv:Item>7</cv:Item> </cv:field>
            <cv:field> <cv:Item>2</cv:Item> </cv:field>
            <cv:field> <cv:Item>8</cv:Item> </cv:field>
            <cv:field> <cv:Item>1</cv:Item> </cv:field>
          </cv:Record>
        </cv:value>
      </cv:CV_GeometryValuePair>
    </cv:element>
    <cv:element>
      <cv:CV_GeometryValuePair>
        <cv:geometry>
          <cv:CV_DomainObject>
            <cv:spatialElement xlink:href="./foi.xml#st1"/>
            <cv:temporalElement xlink:href="./toi.xml#ti5"/>
          </cv:CV_DomainObject>
        </cv:geometry>
        <cv:value>
          <cv:Record>
            <cv:field> <cv:Item>9</cv:Item> </cv:field>
            <cv:field> <cv:Item>8</cv:Item> </cv:field>
            <cv:field> <cv:Item>7</cv:Item> </cv:field>
            <cv:field> <cv:Item>6</cv:Item> </cv:field>
            <cv:field> <cv:Item>5</cv:Item> </cv:field>
            <cv:field> <cv:Item>4</cv:Item> </cv:field>
            <cv:field> <cv:Item>3</cv:Item> </cv:field>
          </cv:Record>
        </cv:value>
      </cv:CV_GeometryValuePair>
    </cv:element>
    <cv:element>
      <cv:CV_GeometryValuePair>
        <cv:geometry>
          <cv:CV_DomainObject>
            <cv:spatialElement xlink:href="./foi.xml#st3"/>
            <cv:temporalElement xlink:href="./toi.xml#ti5"/>
          </cv:CV_DomainObject>
        </cv:geometry>
        <cv:value>
          <cv:Record>
            <cv:field> <cv:Item>1</cv:Item> </cv:field>
            <cv:field> <cv:Item>2</cv:Item> </cv:field>
            <cv:field> <cv:Item>3</cv:Item> </cv:field>
            <cv:field> <cv:Item>4</cv:Item> </cv:field>
            <cv:field> <cv:Item>5</cv:Item> </cv:field>
            <cv:field> <cv:Item>6</cv:Item> </cv:field>
            <cv:field> <cv:Item>7</cv:Item> </cv:field>
          </cv:Record>
        </cv:value>
      </cv:CV_GeometryValuePair>
    </cv:element>
```

```xml
<cv:element>
  <cv:CV_GeometryValuePair>
    <cv:geometry>
      <cv:CV_DomainObject>
        <cv:spatialElement xlink:href="./foi.xml#st2"/>
        <cv:temporalElement xlink:href="./toi.xml#ti5"/>
      </cv:CV_DomainObject>
    </cv:geometry>
    <cv:value>
      <cv:Record>
        <cv:field> <cv:Item>1</cv:Item> </cv:field>
        <cv:field> <cv:Item>9</cv:Item> </cv:field>
        <cv:field> <cv:Item>2</cv:Item> </cv:field>
        <cv:field> <cv:Item>8</cv:Item> </cv:field>
        <cv:field> <cv:Item>3</cv:Item> </cv:field>
        <cv:field> <cv:Item>7</cv:Item> </cv:field>
        <cv:field> <cv:Item>4</cv:Item> </cv:field>
      </cv:Record>
    </cv:value>
  </cv:CV_GeometryValuePair>
</cv:element>
<cv:element>
  <cv:CV_GeometryValuePair>
    <cv:geometry>
      <cv:CV_DomainObject>
        <cv:spatialElement xlink:href="./foi.xml#st4"/>
        <cv:temporalElement xlink:href="./toi.xml#ti5"/>
      </cv:CV_DomainObject>
    </cv:geometry>
    <cv:value>
      <cv:Record>
        <cv:field> <cv:Item>5</cv:Item> </cv:field>
        <cv:field> <cv:Item>6</cv:Item> </cv:field>
        <cv:field> <cv:Item>3</cv:Item> </cv:field>
        <cv:field> <cv:Item>7</cv:Item> </cv:field>
        <cv:field> <cv:Item>2</cv:Item> </cv:field>
        <cv:field> <cv:Item>8</cv:Item> </cv:field>
        <cv:field> <cv:Item>1</cv:Item> </cv:field>
      </cv:Record>
    </cv:value>
  </cv:CV_GeometryValuePair>
</cv:element>
</cv:CV_DiscreteCoverage>
```

ANNEX B
(informative)

An XML schema for simple Items, Records and Arrays

Listing 8 shows a schema for explicit XML representation of simple items, records and arrays, based on the terminology of ISO/IEC 11404. The global element names are cv:Item, cv:Record and cv:Array. The most primitive element is cv:Item, whose XML Schema type is xs:anyType.

This schema is primarily intended for use for simple data aggregations corresponding to lists and tables, and should not be expected to replace the rich capabilities of W3C XML Schema in general. If a more suitable domain-specific schema is available then it may be preferred. Its is used in some of the example instances provided in ANNEX A.

Listing 8.   xmlData.xsd

```xml
<?xml version="1.0"?>
<schema xmlns="http://www.w3.org/2001/XMLSchema" xmlns:cv="http://www.opengis.net/cv/0.0"
targetNamespace="http://www.opengis.net/cv/0.0" elementFormDefault="qualified" attributeFormDefault="unqualified"
version="pre-release">
  <annotation>
    <documentation>A basic schema for data aggregates (Records and Arrays), using terminology consistent with ISO
11404.
</documentation>
  </annotation>
  <!-- =============== -->
  <!-- =============== -->
  <element name="Item">
    <annotation>
      <documentation>An Item is an item of data of any type</documentation>
    </annotation>
  </element>
  <!-- ...... ...... -->
  <complexType name="ItemPropertyType">
    <sequence>
      <element ref="cv:Item"/>
    </sequence>
  </complexType>
  <!-- =============== -->
  <!-- =============== -->
  <complexType name="RecordType">
    <annotation>
      <documentation>A record is a list of fields</documentation>
    </annotation>
    <sequence>
      <element name="field" type="cv:ItemPropertyType" maxOccurs="unbounded">
        <annotation>
          <documentation>A Record/field contains an item of data</documentation>
        </annotation>
      </element>
    </sequence>
    <attribute name="RS" type="anyURI" use="optional">
      <annotation>
        <documentation>Optional pointer to record-type schema</documentation>
      </annotation>
    </attribute>
    <attribute name="fieldCount" type="positiveInteger" use="optional">
      <annotation>
```

```xml
            <documentation>Optional count of the number of fields in the record.</documentation>
         </annotation>
      </attribute>
   </complexType>
   <!-- ..... ...... -->
   <element name="Record" type="cv:RecordType">
      <annotation>
         <documentation>A record is a list of fields</documentation>
      </annotation>
   </element>
   <!-- ..... ...... -->
   <complexType name="RecordPropertyType">
      <sequence>
         <element ref="cv:Record"/>
      </sequence>
   </complexType>
   <!-- =============== -->
   <!-- =============== -->
   <complexType name="ArrayType">
      <annotation>
         <documentation>An array is an indexed set of records of homogeneous type</documentation>
      </annotation>
      <sequence>
         <element name="element" type="cv:ElementPropertyType" maxOccurs="unbounded">
            <annotation>
               <documentation>An Array/element contains an Item or a Record or an Array</documentation>
            </annotation>
         </element>
      </sequence>
      <attribute name="RS" type="anyURI" use="optional">
         <annotation>
            <documentation>Optional pointer to the record-type schema. This should be used when the elements of the
array are Records</documentation>
         </annotation>
      </attribute>
      <attribute name="elementCount" type="positiveInteger" use="optional">
         <annotation>
            <documentation>Optional count of the number of elements in the array.</documentation>
         </annotation>
      </attribute>
   </complexType>
   <!-- ..... ...... -->
   <element name="Array" type="cv:ArrayType">
      <annotation>
         <documentation>An array is an indexed set of records of homogeneous type</documentation>
      </annotation>
   </element>
   <!-- ..... ...... -->
   <complexType name="ArrayPropertyType">
      <sequence>
         <element ref="cv:Array"/>
      </sequence>
   </complexType>
   <!-- =============== -->
   <complexType name="ElementPropertyType">
      <annotation>
         <documentation>Choice of Item or Record or Array - used in composing Arrays</documentation>
      </annotation>
      <group ref="cv:XMLaggregate"/>
   </complexType>
   <!-- =============== -->
   <group name="XMLaggregate">
      <annotation>
         <documentation>Convenience group that bundles all the soft-typed XML-encoded aggregates into a choice
group</documentation>
      </annotation>
      <choice>
         <element ref="cv:Item"/>
         <element ref="cv:Record"/>
         <element ref="cv:Array"/>
      </choice>
```

```
    </group>
    <!-- =============== -->
</schema>
```

Listing 9 shows a convenience schema document that collects all the components described in this specification. It is recommended that the schemaLocation value in a data instance be set to point to a copy of this schema.

Listing 9.   cv.xsd

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" targetNamespace="http://www.opengis.net/cv/0.0"
xmlns:cv="http://www.opengis.net/cv/0.0" elementFormDefault="qualified" attributeFormDefault="unqualified">
    <xs:annotation>
        <xs:documentation>Stub schema for cv</xs:documentation>
    </xs:annotation>
    <!--==========================-->
    <xs:include schemaLocation="./discreteCoverage.xsd"/>
    <xs:include schemaLocation="./aggregates.xsd"/>
    <!--==========================-->
    <xs:group name="XMLdata">
        <xs:annotation>
            <xs:documentation>Convenience group that bundles all the soft-typed XML-encoded aggregates and coverages
into a choice group</xs:documentation>
        </xs:annotation>
        <xs:choice>
            <xs:group ref="cv:XMLaggregate"/>
            <xs:element ref="cv:CV_DiscreteCoverage"/>
        </xs:choice>
    </xs:group>
    <!-- =============== -->
</xs:schema>
```

Bibliography